# TEST REPORT

FCC Test for RF2216d-D1A
Class II Permissive Change

**APPLICANT**
SAMSUNG Electronics Co., Ltd.

**REPORT NO.**
HCT-RF-2412-FC043

**DATE OF ISSUE**
December 10, 2024

**Tested by**
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**Technical Manager**
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# TEST REPORT

REPORT NO.
HCT-RF-2412-FC043

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December 10, 2024

| | |
|---|---|
| Applicant | **SAMSUNG Electronics Co., Ltd.**<br>129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea |
| Product Name<br>Model Name | RRU(RF2216d)<br>RF2216d-D1A |
| FCC ID | A3LRF2216D-D1A |
| Date of Test | November 14, 2024 ~ December 06, 2024 |
| Location of Test | ■ Permanent Testing Lab ☐ On Site Testing<br>(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea) |
| Test Standard Used | CFR 47 Part 2, Part 27 |
| Test Results | PASS |

## REVISION HISTORY

The revision history for this test report is shown in table.

| Revision No. | Date of Issue | Description |
|---|---|---|
| 0 | December 10, 2024 | Initial Release |

## Notice

| Content |
|---|

Engineering Statement:
The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.
The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.
Information provided by the applicant is marked **.
Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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# 1. GENERAL INFORMATION

## 1.1. APPLICANT INFORMATION

| | |
|---|---|
| Company Name | Samsung Electronics Co., Ltd. |
| Company Address | 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea |

## 1.2. PRODUCT INFORMATION

<table>
<tr><td>EUT Type</td><td colspan="6">RRU(RF2216d)</td></tr>
<tr><td>EUT Serial Number</td><td colspan="6">SC77900074</td></tr>
<tr><td>Power Supply</td><td colspan="6">DC: -48 V / PoE: 57 V</td></tr>
<tr><td>Frequency Range</td><td colspan="6">2 110 MHz ~ 2 180 MHz</td></tr>
<tr><td>Modulation Type</td><td colspan="6">QPSK, 16QAM, 64QAM, 256QAM</td></tr>
<tr><td>Output Power</td><td colspan="6"><table>
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<tr><td>(2 Port) 5G NR n66</td><td>1</td><td>25 MHz</td><td>0.125 W/path, Total: 0.250 W</td></tr>
<tr><td>(2 Port) 5G NR n66 + 5G NR n66</td><td>2</td><td>25 MHz + 5 MHz</td><td>0.125 W/path, Total: 0.250 W</td></tr>
<tr><td>(2 Port) 5G NR n66 + LTE B66</td><td>2</td><td>25 MHz + 5 MHz</td><td>0.125 W/path, Total: 0.250 W</td></tr>
</table></td></tr>
<tr><td>Emission Designator</td><td colspan="6"><table>
<tr><th rowspan="2">Mode</th><th rowspan="2">Bandwidth</th><th colspan="4">Emission Designator</th></tr>
<tr><th>QPSK (G7D)</th><th>Conducted (W)</th><th>16/64/256 QAM (W7D)</th><th>Conducted (W)</th></tr>
<tr><td>(2 Port) 5G NR n66</td><td>25 MHz</td><td>23M9G7D</td><td>0.26</td><td>23M9W7D</td><td>0.26</td></tr>
<tr><td>(2 Port) 5G NR n66 + 5G NR n66 (Contiguous)</td><td>25 MHz + 5 MHz</td><td>29M1G7D</td><td>0.25</td><td>29M1W7D</td><td>0.25</td></tr>
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<tr><td>(2 Port) 5G NR n66 + 5G NR n66 (Non-Contiguous)</td><td>25 MHz + 5 MHz</td><td>28M3G7D</td><td>0.25</td><td>28M3W7D</td><td>0.25</td></tr>
<tr><td>(2 Port) 5G NR n66 + LTE B66 (Non-Contiguous)</td><td>25 MHz + 5 MHz</td><td>28M3G7D</td><td>0.26</td><td>28M5W7D</td><td>0.26</td></tr>
</table></td></tr>
<tr><td>Antenna Specification</td><td colspan="6">Antenna type: Integrated<br>Gain: Band 66 : 4.0±1dBi<br>Directional gain calculations for in-band measurements according to KDB 662911 D01 v02r01.<br>Transmit signals in two ports are correlated and equal antenna gain in each bands respetively.<table>
<tr><td>Directional gain</td><td>$G_{ANT}$ + 10 log($N_{ANT}$) dBi</td></tr>
<tr><td>Band 66</td><td>5.0 dBi + 10 log(2)= 8.0 dBi</td></tr>
</table></td></tr>
</table>

## 1.3. TEST INFORMATION

| | |
|---|---|
| FCC Rule Parts | CFR 47 Part 2, Part 27 |
| Measurement standards | ANSI C63.26-2015, KDB 971168 D01 v03r01, KDB 662911 D01 v02r01 |
| Test Location | 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea |

# 2. FACILITIES AND ACCREDITATIONS

## 2.1. FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication22.
Detailed description of test facility was submitted to the Commission and accepted dated March 11, 2024 (CAB identifier: KR0032).

## 2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

# 3. TEST SPECIFICATIONS

## 3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 27

| Description | Reference | Results |
|---|---|---|
| Conducted Output Power and PSD | § 2.1046, § 27.50(d)(2) | Compliant |
| PAPR | § 27.50(d)(5) | Compliant |
| Occupied Bandwidth | § 2.1049 | Compliant |
| Out-of-band Unwanted Emissions | § 2.1051, § 27.53(h) | Compliant |
| Spurious Unwanted Emissions | | Compliant |
| Radiated Emissions | | Compliant |
| Frequency Stability | § 2.1055, § 27.54 | Compliant |

## 3.2. ADDITIONAL DESCRIPTIONS ABOUT TEST

- The EUT was operated in a manner representative of the typical usage of the equipment.
- During all testing, system components were manipulated within the confines of typical usage to maximize each emission.
- All modulation types (QPSK, 16QAM, 64QAM, 256QAM) supported by the EUT have been tested.
- All mode of operation, supporting bandwidth and frequencies were investigated. The test plots shown in the following sections represent the worst case emissions.
- All power supplies used during operation were investigated, and the results of the worst-case configuration are reported.
- Among the multi-carrier combination, only worst-case combination has tested in this test report to cover all multi-carrier combination addressed in technical documents.
- The measurement has been performed for each carrier in the mode of full resource block size as worst case to transmit maximum output power condition.
- The dummy loads were connected to the RF output ports for radiated spurious emission testing.
- The device was operating at 100 % duty cycle.
- The tests results in plots are already including the actual value of loss for the attenuator and cable combination. Please check correction factors below table.

ANT0

| Correction factor table | | | |
|---|---|---|---|
| Frequency (MHz) | Factor (dB) | Frequency (MHz) | Factor (dB) |
| 0.009 | 29.315 | 2 500 | 32.595 |
| 20 | 29.360 | 2 600 | 32.693 |
| 40 | 29.400 | 2 700 | 32.744 |
| 60 | 29.540 | 2 800 | 32.846 |
| 80 | 29.572 | 2 900 | 32.982 |
| 100 | 29.636 | 3 000 | 33.046 |
| 200 | 29.995 | 4 000 | 33.722 |
| 300 | 30.251 | 5 000 | 34.253 |
| 400 | 30.357 | 6 000 | 35.158 |
| 500 | 30.563 | 7 000 | 35.732 |
| 600 | 30.676 | 8 000 | 36.576 |
| 700 | 30.798 | 9 000 | 37.389 |
| 800 | 30.977 | 10 000 | 35.100 |
| 900 | 31.080 | 11 000 | 35.186 |
| 1 000 | 31.163 | 12 000 | 36.295 |
| 1 100 | 31.304 | 13 000 | 35.996 |
| 1 200 | 31.462 | 14 000 | 36.614 |
| 1 300 | 31.519 | 15 000 | 37.713 |
| 1 400 | 31.572 | 16 000 | 37.458 |
| 1 500 | 31.678 | 17 000 | 37.164 |
| 1 600 | 31.744 | 18 000 | 37.641 |
| 1 700 | 31.840 | 19 000 | 37.785 |
| 1 800 | 31.970 | 20 000 | 38.230 |
| 1 900 | 32.125 | 21 000 | 38.890 |
| 2 000 | 32.179 | 22 000 | 40.929 |
| 2 100 | 32.286 | 23 000 | 39.121 |
| 2 200 | 32.388 | 24 000 | 38.721 |
| 2 300 | 32.477 | 25 000 | 40.713 |
| 2 400 | 32.610 | 26 000 | 39.995 |

ANT1

| Correction factor table | | | |
|---|---|---|---|
| Frequency (MHz) | Factor (dB) | Frequency (MHz) | Factor (dB) |
| 0.009 | 29.271 | 2 500 | 32.882 |
| 20 | 29.230 | 2 600 | 32.993 |
| 40 | 29.327 | 2 700 | 33.047 |
| 60 | 29.484 | 2 800 | 33.137 |
| 80 | 29.525 | 2 900 | 33.301 |
| 100 | 29.598 | 3 000 | 33.365 |
| 200 | 30.020 | 4 000 | 34.034 |
| 300 | 30.319 | 5 000 | 34.594 |
| 400 | 30.459 | 6 000 | 35.473 |
| 500 | 30.671 | 7 000 | 36.073 |
| 600 | 30.804 | 8 000 | 36.916 |
| 700 | 30.941 | 9 000 | 37.722 |
| 800 | 31.147 | 10 000 | 35.507 |
| 900 | 31.239 | 11 000 | 35.621 |
| 1 000 | 31.358 | 12 000 | 36.343 |
| 1 100 | 31.501 | 13 000 | 36.327 |
| 1 200 | 31.639 | 14 000 | 36.573 |
| 1 300 | 31.699 | 15 000 | 37.819 |
| 1 400 | 31.799 | 16 000 | 37.725 |
| 1 500 | 31.911 | 17 000 | 37.560 |
| 1 600 | 31.981 | 18 000 | 37.930 |
| 1 700 | 32.073 | 19 000 | 37.942 |
| 1 800 | 32.199 | 20 000 | 38.264 |
| 1 900 | 32.372 | 21 000 | 38.521 |
| 2 000 | 32.436 | 22 000 | 40.898 |
| 2 100 | 32.560 | 23 000 | 39.210 |
| 2 200 | 32.643 | 24 000 | 39.061 |
| 2 300 | 32.716 | 25 000 | 40.836 |
| 2 400 | 32.867 | 26 000 | 40.283 |

### 3.3. MAXIMUM MEASUREMENTUNCERTAINTY

| Description | Condition | Uncertainty |
|---|---|---|
| Radiated Disturbance | 9 kHz ~ 30 MHz | 4.36 dB |
| | 30 MHz ~ 1 GHz | 5.70 dB |
| | 1 GHz ~ 18 GHz | 5.52 dB |
| | 18 GHz ~ 40 GHz | 5.66 dB |

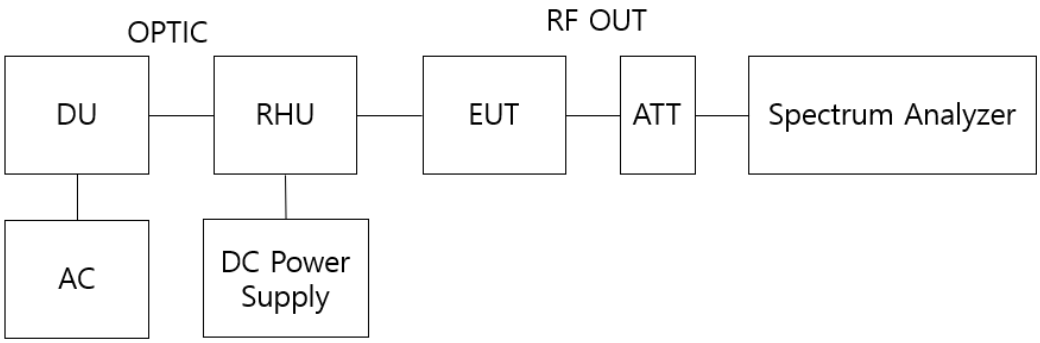
Coverage factor $k$ = 2, Confidence levels of 95 %

### 3.4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

| | |
|---|---|
| **Temperature:** | +15 °C to +35 °C |
| **Relative humidity:** | 30 % to 60 % |
| **Air pressure:** | 860 mbar to 1 060 mbar |

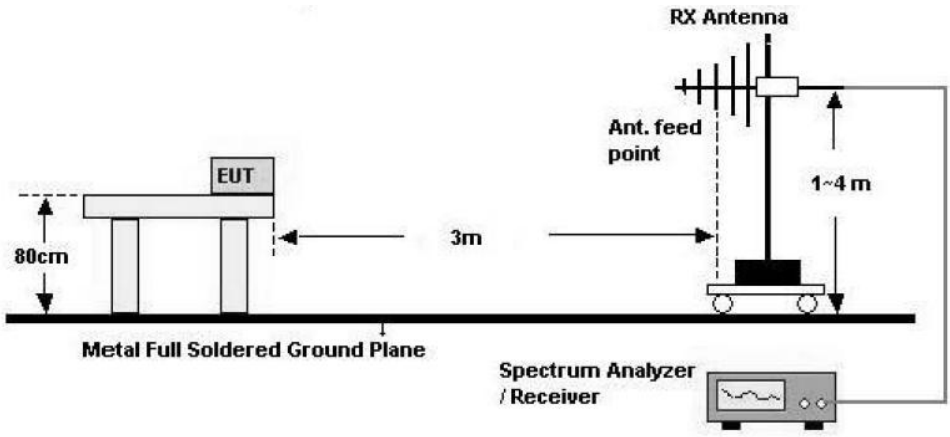
### 3.5. TEST DIAGRAMS

Conducted Test

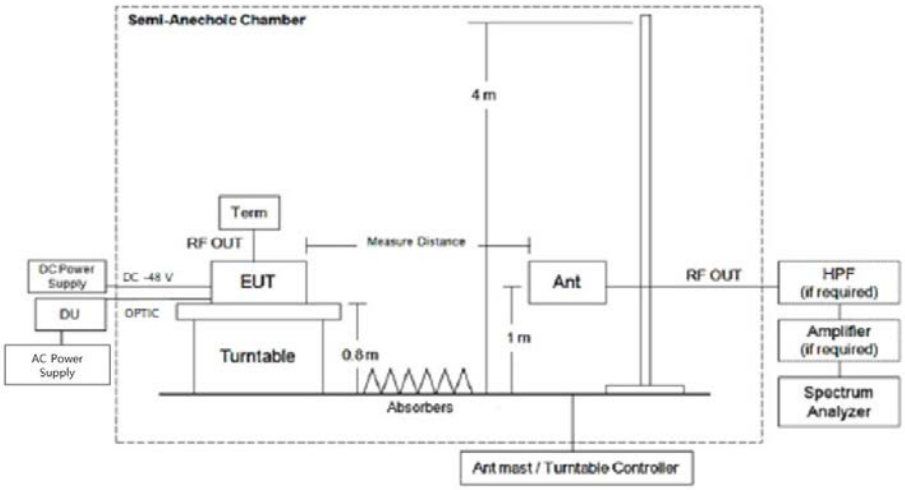



Radiated Test

30 MHz ~ 1 GHz

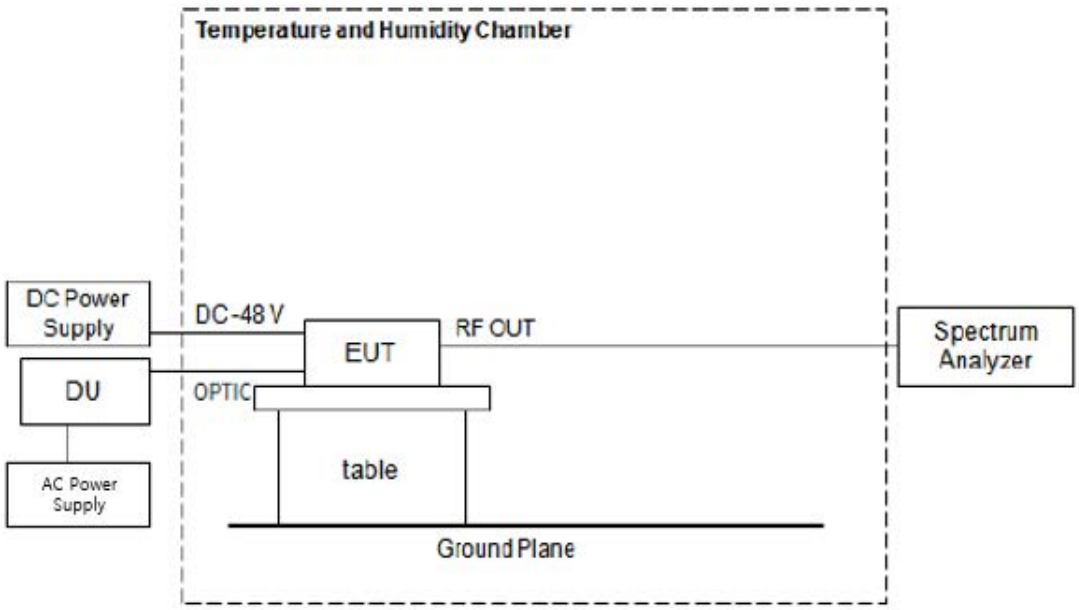



Above 1 GHz




※ Measure distance for Above 1 GHz is 3 m

Frequency Stability




**Note:** All modulations(QPSK, 16QAM, 64QAM, 256QAM) were investigated and the worst case configuration channel results are reported.

## 4. TEST EQUIPMENTS

| Equipment | Model | Manufacturer | Serial No. | Due to Calibration | Calibration Interval |
|---|---|---|---|---|---|
| PXA Signal Analyzer | N9030A | Keysight | MY49431434 | 07/19/2025 | Annual |
| MXA Signal Analyzer | N9020A | Agilent | MY46471250 | 07/12/2025 | Annual |
| PXA Signal Analyzer | N9030B | Keysight | MY60070602 | 04/26/2025 | Annual |
| RF Switch System | TMX0108 | TNM System | TM21100001 | N/A | N/A |
| #30 dB Attenuator | TWAN-300-18G | Teleworld | N/A | 08/12/2025 | Annual |
| #30 dB Attenuator | WA93-30-33 | Weinschel Associates | 0190 | 03/19/2025 | Annual |
| #50Ω Termination | 908A | H.P. | N/A | N/A | N/A |
| DC Power Supply | PWR800L | KIKUSUI | LJ003448 | 05/22/2025 | Annual |
| AC Power Supply | PCR2000MA | KIKUSUI | ZL002530 | 12/29/2024 | Annual |
| Temperature and Humidity Chamber | NY-THR18750 | NANGYEAL | NY-200912201A | 01/04/2025 | Annual |
| Amp & Filter Bank Switch Controller | FBSM-01B | TNM system | TM20090002 | N/A | N/A |
| Controller(Antenna Mast & Turn Table) | CO3000 | Innco system | CO3000/1251/48920320/P | N/A | N/A |
| Antenna Mast | MA4640 | Innco system | S4AM | 08/07/2025 | Annual |
| Turn Table | DS2000-S | Innco system | N/A | N/A | N/A |
| Turn Table | N/A | Ets | N/A | N/A | N/A |
| Loop Antenna | FMZB 1513 | Rohde & Schwarz | 1513-333 | 03/07/2026 | Biennial |
| BILOG Antenna | VULB 9160-31 | Schwarzbeck | 3150 | 03/09/2025 | Biennial |
| Horn Antenna | BBHA 9120D | Schwarzbeck | 9120D-937 | 02/13/2025 | Biennial |
| Horn Antenna | BBHA9170 | Schwarzbeck | BBHA9170342 | 09/20/2026 | Biennial |
| RF Switching System | FBSR-04C (3 GHz HPF + LNA) | TNM system | S4L1 | 04/11/2025 | Annual |
| RF Switching System | FBSR-04C (10 dB ATT + LNA) | TNM system | S4L2 | 04/11/2025 | Annual |
| RF Switching System | FBSR-04C (3 dB ATT + LNA) | TNM system | S4L3 | 04/11/2025 | Annual |
| RF Switching System | FBSR-04C (LNA) | TNM system | S4L4 | 04/11/2025 | Annual |
| RF Switching System | FBSR-04C (Thru) | TNM system | S4L6 | 04/11/2025 | Annual |
| LOW NOISE AMPLIFIER | TK-PA1840H | TESTEK | 170011-L | 10/11/2025 | Annual |

#This equipment has been used to each port, but we only listed one equipment for simplicity.

**Note:**

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date, or will be tested after the calibration is completed.

# 5. TEST RESULT

## 5.1. RF OUTPUT POWER and PSD

**Test Requirements:**

**§ 2.1046 Measurements required: RF power output.**

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

**§ 27.50 Power limits and duty cycle.**

(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

(2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:

(ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

**Test Procedures:**

The measurement is performed in accordance with Section 5.2.4.4.2 of ANSI C63.26.

When the fundamental condition for average power measurements cannot be realized (i.e., the EUT cannot be configured to transmit at full-power on a continuous basis (i.e., duty cycle < 98%) and the instrumentation cannot be configured to measure only during active full-power transmissions), then the following procedure can be used if the EUT duty cycle is constant (i.e., duty cycle variations are less than or equal to ±2%). See 5.2.4.3.4 for guidance on measurement of duty cycle.

a) Set span to 2 × to 3 × the OBW.

b) Set RBW = 1 % to 5 % of the OBW.

c) Set VBW ≥ 3 × RBW.

d) Set number of measurement points in sweep ≥ 2 × span / RBW.

e) Sweep time:

   1) Set = auto-couple, or

   2) Set ≥ [10 × (number of points in sweep) × (transmission symbol period)] for single sweep (automation-compatible) measurement.

f) Detector = power averaging (rms).

g) Set sweep trigger to “free run.”

h) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band or channel power measurement function with band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

j) Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25%.

The PSD measurement is performed in accordance with Section 5.2.4.5 of ANSI C63.26.
Some regulatory requirements specify the RF output power limits in terms of maximum or average PSD, (i.e., the output power or unwanted emissions power limits are defined within a specified reference bandwidth).
When average PSD limits are specified, the same fundamental measurement condition applies as previously discussed (i.e., averaging is to be performed only over durations of active transmissions at maximum output power level). Thus, when performing this measurement, the EUT must either be configured to transmit continuously at full power while the compliance measurement is performed, or else the measurement instrumentation must be configured to acquire data only over durations when the EUT is actively transmitting at full power. In circumstances where neither of these conditions can be realized, then alternative procedures are provided for both constant duty cycle and non-constant duty cycle transmissions.
The PSD is measured following the same procedures described in 5.2.4.4 for measuring the total average power, but with the RBW set to the reference bandwidth specified by the applicable regulatory requirement, and by using the marker function to identify the maximum PSD instead of summing the power across the OBW. If the fundamental measurement condition cannot be realized, then one of the alternative procedures in 5.2.4.4.2 or 5.2.4.4.3 should be selected, based on whether the transmitter duty cycle is constant (variations $\leq \pm 2\%$) or non-constant (variations $> \pm 2\%$), respectively.

**Note:** The results of the Conducted output power and PSD test shown above the frequency measured values are very small and similar trend for each port, so we are attached only the worst case plot.

**Test Results:**

**Tabular Data of RF Output Power**

(2 Port) 5G NR n66 25 MHz 1 Carrier

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) | Calculated (W) |
|---|---|---|---|---|---|
| 0 | QPSK | Low | 2 122.50 | 20.87 | 0.12 |
| | | Middle | 2 145.00 | 21.09 | 0.13 |
| | | High | 2 167.50 | 20.71 | 0.12 |
| | 16QAM | Low | 2 122.50 | 20.87 | 0.12 |
| | | Middle | 2 145.00 | 21.01 | 0.13 |
| | | High | 2 167.50 | 20.73 | 0.12 |
| | 64QAM | Low | 2 122.50 | 20.87 | 0.12 |
| | | Middle | 2 145.00 | 21.04 | 0.13 |
| | | High | 2 167.50 | 20.69 | 0.12 |
| | 256QAM | Low | 2 122.50 | 20.91 | 0.12 |
| | | Middle | 2 145.00 | 21.06 | 0.13 |
| | | High | 2 167.50 | 20.74 | 0.12 |
| 1 | QPSK | Low | 2 122.50 | 21.12 | 0.13 |
| | | Middle | 2 145.00 | 21.27 | 0.13 |
| | | High | 2 167.50 | 21.00 | 0.13 |
| | 16QAM | Low | 2 122.50 | 21.14 | 0.13 |
| | | Middle | 2 145.00 | 21.18 | 0.13 |
| | | High | 2 167.50 | 20.97 | 0.13 |
| | 64QAM | Low | 2 122.50 | 21.09 | 0.13 |
| | | Middle | 2 145.00 | 21.22 | 0.13 |
| | | High | 2 167.50 | 20.95 | 0.12 |
| | 256QAM | Low | 2 122.50 | 21.17 | 0.13 |
| | | Middle | 2 145.00 | 21.28 | 0.13 |
| | | High | 2 167.50 | 20.96 | 0.12 |

Sum Data of Port 0 and Port 1

| Frequency (MHz) | Output Power (Conducted) | | | |
|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM |
| | W | | | |
| 2 122.50 | 0.25 | 0.25 | 0.25 | 0.25 |
| 2 145.00 | 0.26 | 0.26 | 0.26 | 0.26 |
| 2 167.50 | 0.24 | 0.24 | 0.24 | 0.24 |

**Tabular Data of RF Contiguous Output Power**

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) | Calculated (W) |
|---|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 20.99 | 0.13 |
| | | Middle | 2 145.00 | 21.11 | 0.13 |
| | | High | 2 165.00 | 20.88 | 0.12 |
| | 16QAM | Low | 2 125.00 | 20.97 | 0.12 |
| | | Middle | 2 145.00 | 21.14 | 0.13 |
| | | High | 2 165.00 | 20.73 | 0.12 |
| | 64QAM | Low | 2 125.00 | 20.96 | 0.12 |
| | | Middle | 2 145.00 | 21.09 | 0.13 |
| | | High | 2 165.00 | 20.71 | 0.12 |
| | 256QAM | Low | 2 125.00 | 20.98 | 0.13 |
| | | Middle | 2 145.00 | 21.12 | 0.13 |
| | | High | 2 165.00 | 20.79 | 0.12 |
| 1 | QPSK | Low | 2 125.00 | 21.23 | 0.13 |
| | | Middle | 2 145.00 | 21.11 | 0.13 |
| | | High | 2 165.00 | 20.86 | 0.12 |
| | 16QAM | Low | 2 125.00 | 21.24 | 0.13 |
| | | Middle | 2 145.00 | 21.26 | 0.13 |
| | | High | 2 165.00 | 20.76 | 0.12 |
| | 64QAM | Low | 2 125.00 | 21.22 | 0.13 |
| | | Middle | 2 145.00 | 21.25 | 0.13 |
| | | High | 2 165.00 | 20.73 | 0.12 |
| | 256QAM | Low | 2 125.00 | 21.23 | 0.13 |
| | | Middle | 2 145.00 | 21.35 | 0.14 |
| | | High | 2 165.00 | 20.85 | 0.12 |

Sum Data of Port 0 and Port 1

| Frequency (MHz) | Output Power (Conducted) | | | |
|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM |
| | W | | | |
| 2 125.00 | 0.26 | 0.26 | 0.26 | 0.26 |
| 2 145.00 | 0.26 | 0.26 | 0.26 | 0.27 |
| 2 165.00 | 0.24 | 0.24 | 0.24 | 0.24 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) | Calculated (W) |
|---|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 20.77 | 0.12 |
| | | Middle | 2 145.00 | 20.88 | 0.12 |
| | | High | 2 165.00 | 20.64 | 0.12 |
| | 16QAM | Low | 2 125.00 | 20.76 | 0.12 |
| | | Middle | 2 145.00 | 20.86 | 0.12 |
| | | High | 2 165.00 | 20.68 | 0.12 |
| | 64QAM | Low | 2 125.00 | 20.67 | 0.12 |
| | | Middle | 2 145.00 | 20.85 | 0.12 |
| | | High | 2 165.00 | 20.59 | 0.11 |
| | 256QAM | Low | 2 125.00 | 20.65 | 0.12 |
| | | Middle | 2 145.00 | 20.88 | 0.12 |
| | | High | 2 165.00 | 20.65 | 0.12 |
| 1 | QPSK | Low | 2 125.00 | 21.03 | 0.13 |
| | | Middle | 2 145.00 | 20.97 | 0.13 |
| | | High | 2 165.00 | 20.83 | 0.12 |
| | 16QAM | Low | 2 125.00 | 21.03 | 0.13 |
| | | Middle | 2 145.00 | 20.98 | 0.13 |
| | | High | 2 165.00 | 20.82 | 0.12 |
| | 64QAM | Low | 2 125.00 | 20.96 | 0.12 |
| | | Middle | 2 145.00 | 20.96 | 0.12 |
| | | High | 2 165.00 | 20.69 | 0.12 |
| | 256QAM | Low | 2 125.00 | 20.99 | 0.13 |
| | | Middle | 2 145.00 | 20.98 | 0.13 |
| | | High | 2 165.00 | 20.81 | 0.12 |

Sum Data of Port 0 and Port 1

| Frequency (MHz) | Output Power (Conducted) | | | |
|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM |
| | W | | | |
| 2 125.00 | 0.25 | 0.25 | 0.24 | 0.24 |
| 2 145.00 | 0.25 | 0.25 | 0.25 | 0.25 |
| 2 165.00 | 0.24 | 0.24 | 0.23 | 0.24 |

**Tabular Data of RF Non-Contiguous Output Power**

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | 5G NR n66 25 MHz 1 Carrier | | LTE B66 5 MHz 1 Carrier | | Summation Value (dBm) | Calculated (W) |
|---|---|---|---|---|---|---|---|
| | | Frequency (MHz) | Measured Value (dBm) | Frequency (MHz) | Measured Value (dBm) | | |
| 0 | QPSK | 2 122.50 | 20.20 | 2 177.50 | 13.05 | 20.97 | 0.12 |
| | 16QAM | 2 122.50 | 20.20 | 2 177.50 | 13.06 | 20.97 | 0.12 |
| | 64QAM | 2 122.50 | 20.02 | 2 177.50 | 13.05 | 20.82 | 0.12 |
| | 256QAM | 2 122.50 | 20.21 | 2 177.50 | 13.02 | 20.97 | 0.13 |
| 1 | QPSK | 2 122.50 | 20.65 | 2 177.50 | 13.33 | 21.39 | 0.14 |
| | 16QAM | 2 122.50 | 20.64 | 2 177.50 | 13.31 | 21.38 | 0.14 |
| | 64QAM | 2 122.50 | 20.62 | 2 177.50 | 13.33 | 21.37 | 0.14 |
| | 256QAM | 2 122.50 | 20.66 | 2 177.50 | 13.33 | 21.39 | 0.14 |

Sum Data of Port 0 and Port 1

| Frequency (MHz) | Output Power (Conducted) | | | |
|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM |
| | W | | | |
| 2 122.50 + 2 177.50 | 0.26 | 0.26 | 0.26 | 0.26 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

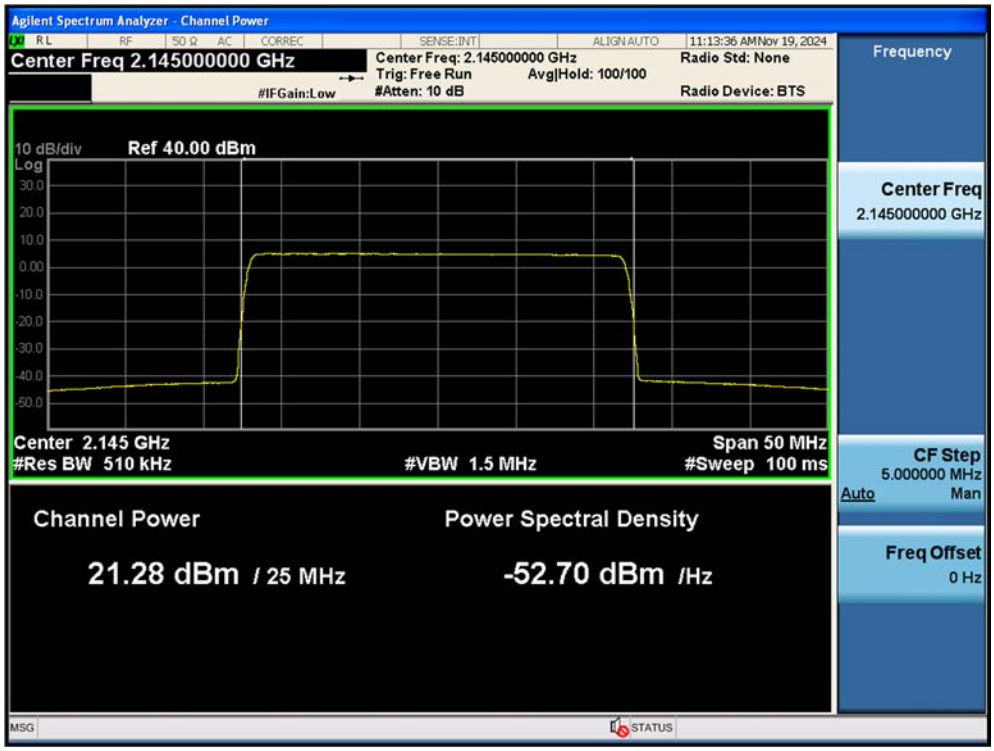
| Antenna | Modulation | 5G NR n66 25 MHz 1 Carrier | | 5G NR n66 5 MHz 1 Carrier | | Summation Value (dBm) | Calculated (W) |
|---|---|---|---|---|---|---|---|
| | | Frequency (MHz) | Measured Value (dBm) | Frequency (MHz) | Measured Value (dBm) | | |
| 0 | QPSK | 2 122.50 | 20.15 | 2 177.50 | 12.90 | 20.90 | 0.12 |
| | 16QAM | 2 122.50 | 20.07 | 2 177.50 | 12.83 | 20.82 | 0.12 |
| | 64QAM | 2 122.50 | 20.02 | 2 177.50 | 12.76 | 20.77 | 0.12 |
| | 256QAM | 2 122.50 | 20.08 | 2 177.50 | 12.78 | 20.82 | 0.12 |
| 1 | QPSK | 2 122.50 | 20.28 | 2 177.50 | 12.92 | 21.01 | 0.13 |
| | 16QAM | 2 122.50 | 20.30 | 2 177.50 | 12.98 | 21.04 | 0.13 |
| | 64QAM | 2 122.50 | 20.27 | 2 177.50 | 12.85 | 20.99 | 0.13 |
| | 256QAM | 2 122.50 | 20.35 | 2 177.50 | 12.89 | 21.06 | 0.13 |

Sum Data of Port 0 and Port 1

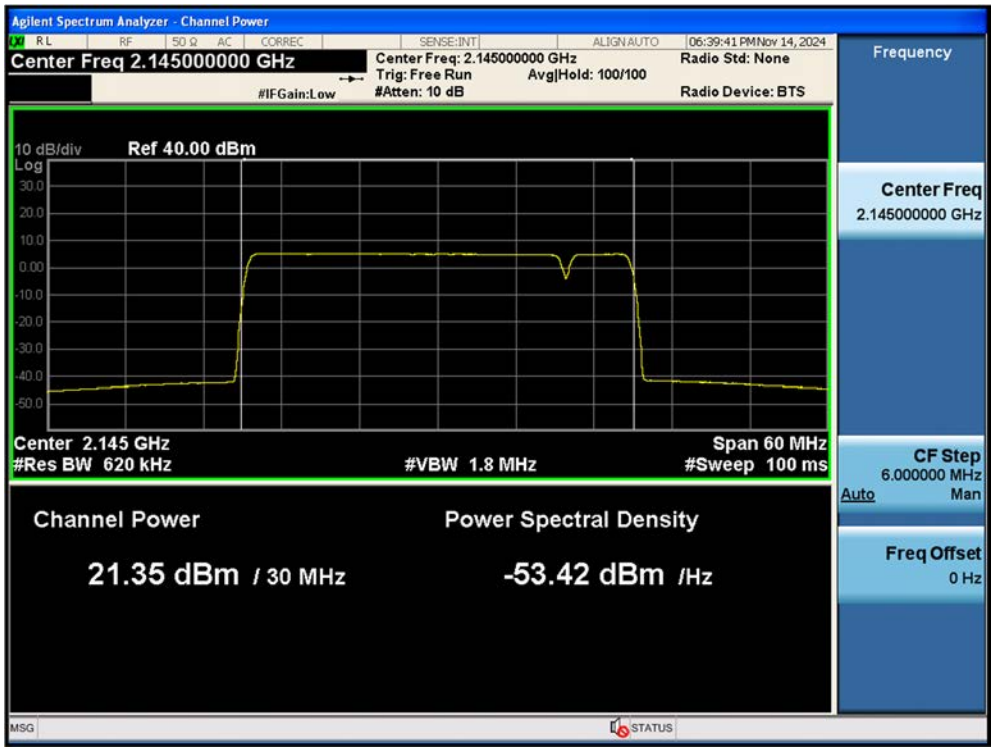
| Frequency (MHz) | Output Power (Conducted) | | | |
|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM |
| | W | | | |
| 2 122.50 + 2 177.50 | 0.25 | 0.25 | 0.25 | 0.25 |

**Plot Data of RF Output Power**

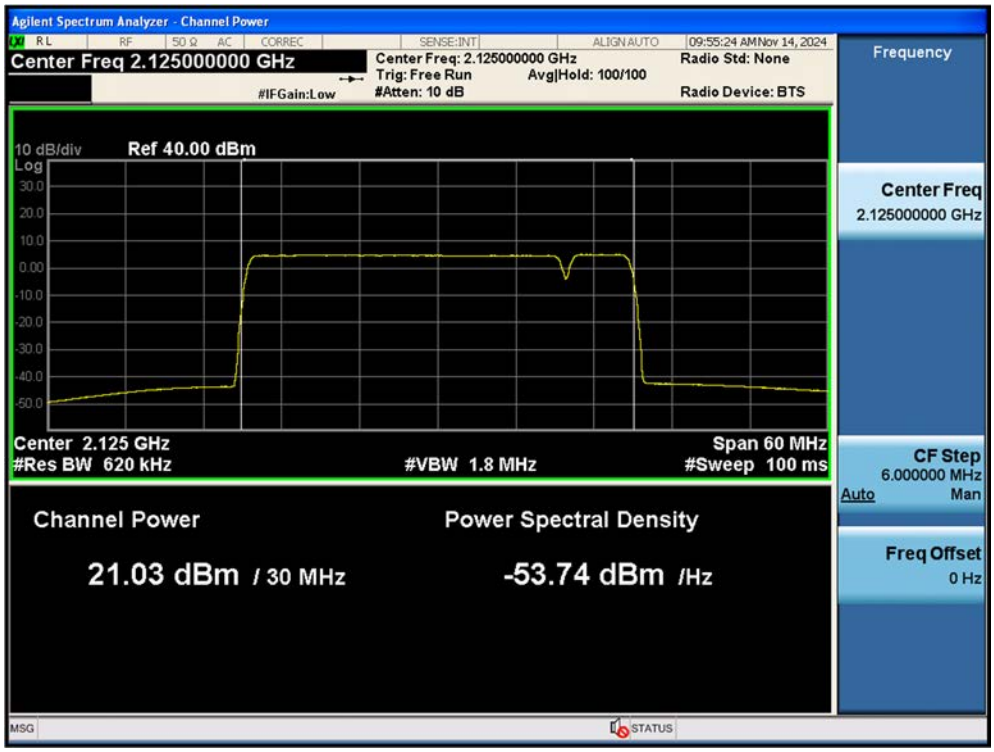
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 256QAM / Middle



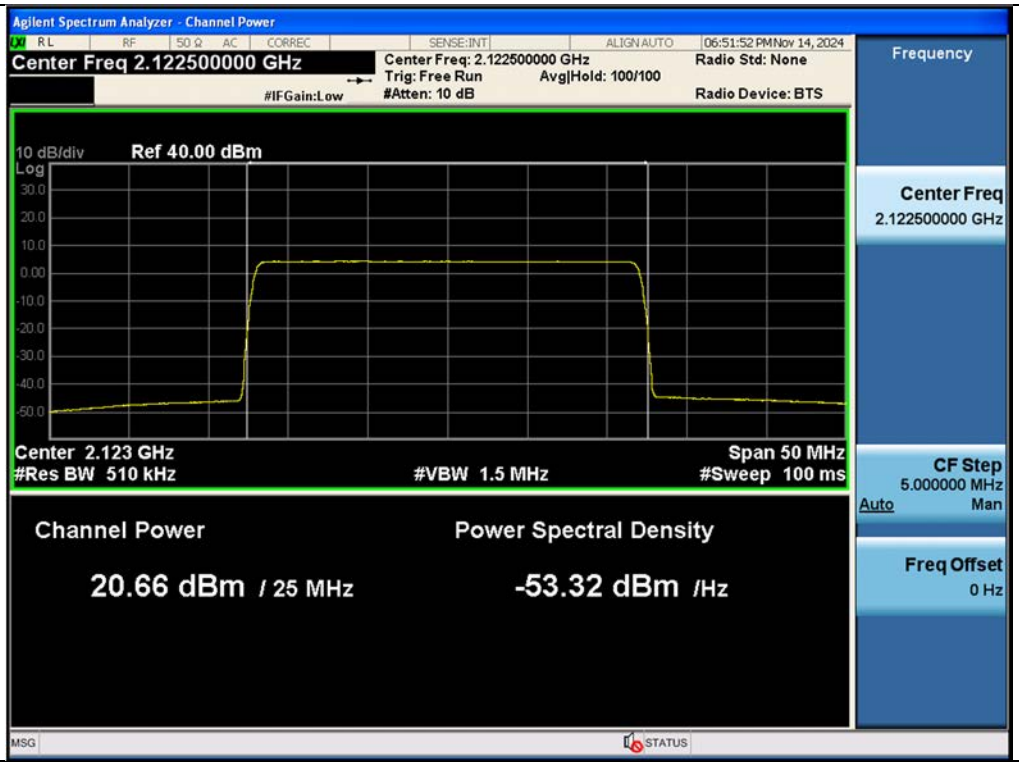
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 256QAM / Middle / Contiguous



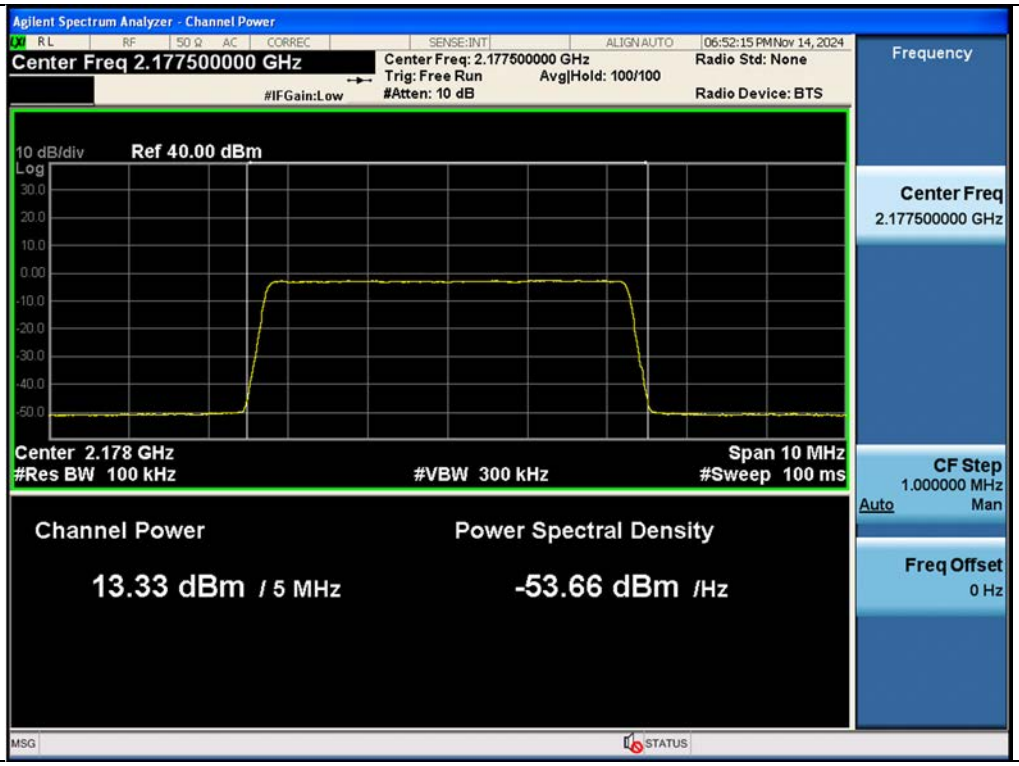

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / QPSK / Low / Contiguous



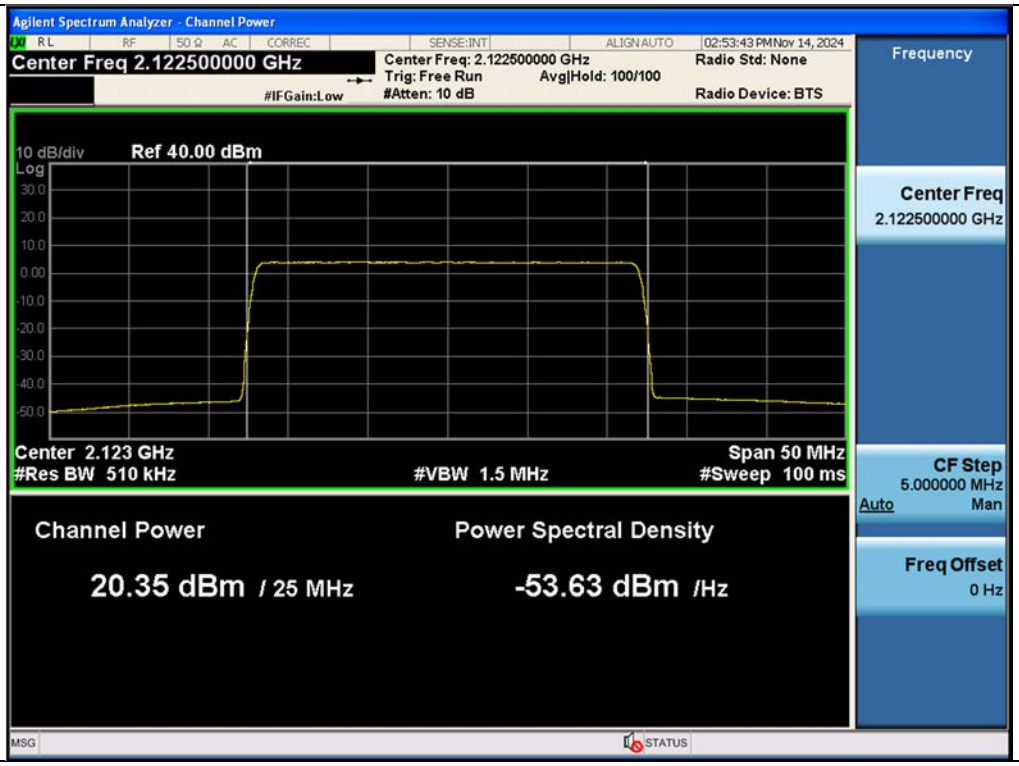
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 256QAM / Low / Non-Contiguous



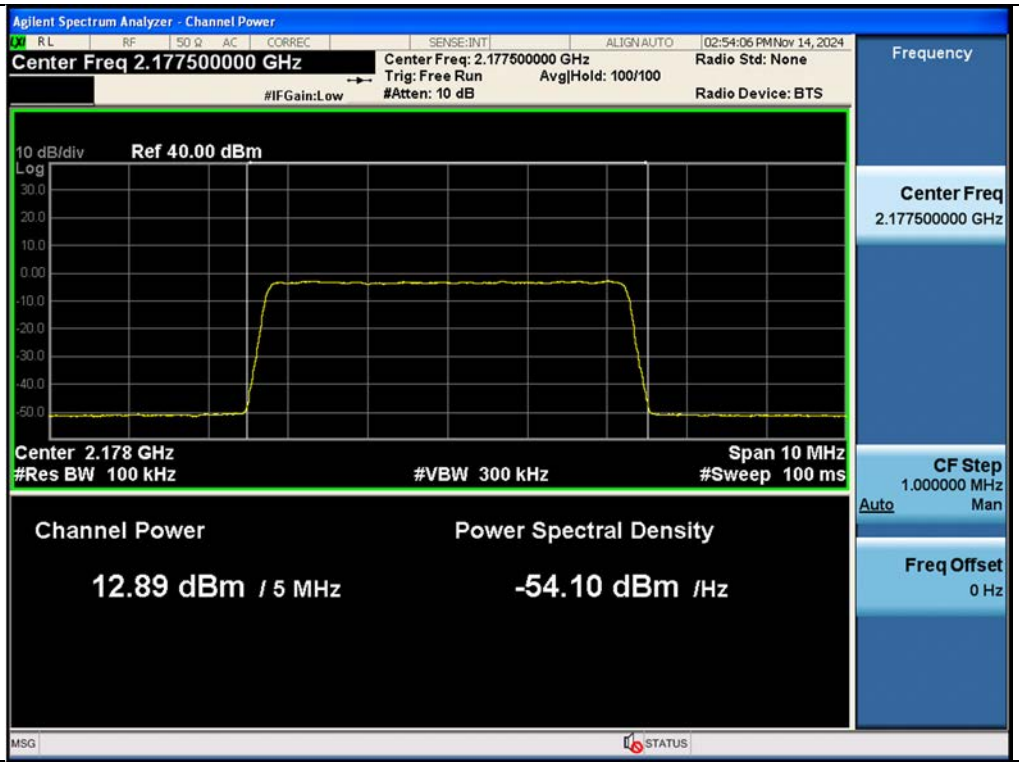

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 256QAM / High / Non-Contiguous



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 256QAM / Low / Non-Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 256QAM / High / Non-Contiguous



**Test Results:**

**Tabular Data of RF PSD**

(2 Port) 5G NR n66 25 MHz 1 Carrier

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm/MHz) | Ant.Gain (dBi) | E.I.R.P. (dBm/MHz) | Calculated (W/MHz) | Limit (W/MHz) |
|---|---|---|---|---|---|---|---|---|
| 0 | QPSK | Low | 2 122.50 | 7.49 | 8.00 | 15.49 | 0.04 | 1640 |
| | | Middle | 2 145.00 | 7.72 | 8.00 | 15.72 | 0.04 | |
| | | High | 2 167.50 | 7.48 | 8.00 | 15.48 | 0.04 | |
| | 16QAM | Low | 2 122.50 | 8.86 | 8.00 | 16.86 | 0.05 | |
| | | Middle | 2 145.00 | 9.06 | 8.00 | 17.06 | 0.05 | |
| | | High | 2 167.50 | 8.75 | 8.00 | 16.75 | 0.05 | |
| | 64QAM | Low | 2 122.50 | 7.57 | 8.00 | 15.57 | 0.04 | |
| | | Middle | 2 145.00 | 7.68 | 8.00 | 15.68 | 0.04 | |
| | | High | 2 167.50 | 7.48 | 8.00 | 15.48 | 0.04 | |
| | 256QAM | Low | 2 122.50 | 7.56 | 8.00 | 15.56 | 0.04 | |
| | | Middle | 2 145.00 | 7.70 | 8.00 | 15.70 | 0.04 | |
| | | High | 2 167.50 | 7.52 | 8.00 | 15.52 | 0.04 | |
| 1 | QPSK | Low | 2 122.50 | 7.74 | 8.00 | 15.74 | 0.04 | |
| | | Middle | 2 145.00 | 7.94 | 8.00 | 15.94 | 0.04 | |
| | | High | 2 167.50 | 7.68 | 8.00 | 15.68 | 0.04 | |
| | 16QAM | Low | 2 122.50 | 9.13 | 8.00 | 17.13 | 0.05 | |
| | | Middle | 2 145.00 | 9.35 | 8.00 | 17.35 | 0.05 | |
| | | High | 2 167.50 | 9.06 | 8.00 | 17.06 | 0.05 | |
| | 64QAM | Low | 2 122.50 | 7.72 | 8.00 | 15.72 | 0.04 | |
| | | Middle | 2 145.00 | 7.98 | 8.00 | 15.98 | 0.04 | |
| | | High | 2 167.50 | 7.70 | 8.00 | 15.70 | 0.04 | |
| | 256QAM | Low | 2 122.50 | 7.80 | 8.00 | 15.80 | 0.04 | |
| | | Middle | 2 145.00 | 7.99 | 8.00 | 15.99 | 0.04 | |
| | | High | 2 167.50 | 7.64 | 8.00 | 15.64 | 0.04 | |

Sum Data of Port 0, Port 1

| Frequency (MHz) | PSD | | | | Limit |
|---|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM | |
| | W/MHz | | | | |
| 2 122.50 | 0.07 | 0.10 | 0.07 | 0.07 | 1640 |
| 2 145.00 | 0.08 | 0.11 | 0.08 | 0.08 | |
| 2 167.50 | 0.07 | 0.10 | 0.07 | 0.07 | |

## Tabular Data of RF Contiguous PSD

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm/MHz) | Ant.Gain (dBi) | E.I.R.P. (dBm/MHz) | Calculated (W/MHz) | Limit (W/MHz) |
|---|---|---|---|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 7.23 | 8.00 | 15.23 | 0.03 | 1640 |
| | | Middle | 2 145.00 | 7.01 | 8.00 | 15.01 | 0.03 | |
| | | High | 2 165.00 | 6.94 | 8.00 | 14.94 | 0.03 | |
| | 16QAM | Low | 2 125.00 | 8.16 | 8.00 | 16.16 | 0.04 | |
| | | Middle | 2 145.00 | 8.42 | 8.00 | 16.42 | 0.04 | |
| | | High | 2 165.00 | 8.20 | 8.00 | 16.20 | 0.04 | |
| | 64QAM | Low | 2 125.00 | 7.24 | 8.00 | 15.24 | 0.03 | |
| | | Middle | 2 145.00 | 7.02 | 8.00 | 15.02 | 0.03 | |
| | | High | 2 165.00 | 6.76 | 8.00 | 14.76 | 0.03 | |
| | 256QAM | Low | 2 125.00 | 7.19 | 8.00 | 15.19 | 0.03 | |
| | | Middle | 2 145.00 | 7.03 | 8.00 | 15.03 | 0.03 | |
| | | High | 2 165.00 | 6.84 | 8.00 | 14.84 | 0.03 | |
| 1 | QPSK | Low | 2 125.00 | 7.32 | 8.00 | 15.32 | 0.03 | |
| | | Middle | 2 145.00 | 7.01 | 8.00 | 15.01 | 0.03 | |
| | | High | 2 165.00 | 6.94 | 8.00 | 14.94 | 0.03 | |
| | 16QAM | Low | 2 125.00 | 8.47 | 8.00 | 16.47 | 0.04 | |
| | | Middle | 2 145.00 | 8.60 | 8.00 | 16.60 | 0.05 | |
| | | High | 2 165.00 | 8.09 | 8.00 | 16.09 | 0.04 | |
| | 64QAM | Low | 2 125.00 | 7.38 | 8.00 | 15.38 | 0.03 | |
| | | Middle | 2 145.00 | 7.20 | 8.00 | 15.20 | 0.03 | |
| | | High | 2 165.00 | 6.85 | 8.00 | 14.85 | 0.03 | |
| | 256QAM | Low | 2 125.00 | 7.33 | 8.00 | 15.33 | 0.03 | |
| | | Middle | 2 145.00 | 7.31 | 8.00 | 15.31 | 0.03 | |
| | | High | 2 165.00 | 6.98 | 8.00 | 14.98 | 0.03 | |

Sum Data of Port 0, Port 1

| Frequency (MHz) | PSD | | | | Limit |
|---|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM | |
| | W/MHz | | | | |
| 2 125.00 | 0.07 | 0.09 | 0.07 | 0.07 | 1640 |
| 2 145.00 | 0.06 | 0.09 | 0.06 | 0.07 | |
| 2 165.00 | 0.06 | 0.08 | 0.06 | 0.06 | |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm/MHz) | Ant.Gain (dBi) | E.I.R.P. (dBm/MHz) | Calculated (W/MHz) | Limit (W/MHz) |
|---|---|---|---|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 6.96 | 8.00 | 14.96 | 0.03 | 1640 |
| | | Middle | 2 145.00 | 6.74 | 8.00 | 14.74 | 0.03 | |
| | | High | 2 165.00 | 6.69 | 8.00 | 14.69 | 0.03 | |
| | 16QAM | Low | 2 125.00 | 7.92 | 8.00 | 15.92 | 0.04 | |
| | | Middle | 2 145.00 | 8.17 | 8.00 | 16.17 | 0.04 | |
| | | High | 2 165.00 | 8.15 | 8.00 | 16.15 | 0.04 | |
| | 64QAM | Low | 2 125.00 | 6.90 | 8.00 | 14.90 | 0.03 | |
| | | Middle | 2 145.00 | 6.75 | 8.00 | 14.75 | 0.03 | |
| | | High | 2 165.00 | 6.66 | 8.00 | 14.66 | 0.03 | |
| | 256QAM | Low | 2 125.00 | 6.76 | 8.00 | 14.76 | 0.03 | |
| | | Middle | 2 145.00 | 6.75 | 8.00 | 14.75 | 0.03 | |
| | | High | 2 165.00 | 6.75 | 8.00 | 14.75 | 0.03 | |
| 1 | QPSK | Low | 2 125.00 | 7.08 | 8.00 | 15.08 | 0.03 | |
| | | Middle | 2 145.00 | 6.90 | 8.00 | 14.90 | 0.03 | |
| | | High | 2 165.00 | 6.94 | 8.00 | 14.94 | 0.03 | |
| | 16QAM | Low | 2 125.00 | 8.25 | 8.00 | 16.25 | 0.04 | |
| | | Middle | 2 145.00 | 8.34 | 8.00 | 16.34 | 0.04 | |
| | | High | 2 165.00 | 8.26 | 8.00 | 16.26 | 0.04 | |
| | 64QAM | Low | 2 125.00 | 7.08 | 8.00 | 15.08 | 0.03 | |
| | | Middle | 2 145.00 | 6.93 | 8.00 | 14.93 | 0.03 | |
| | | High | 2 165.00 | 6.85 | 8.00 | 14.85 | 0.03 | |
| | 256QAM | Low | 2 125.00 | 6.97 | 8.00 | 14.97 | 0.03 | |
| | | Middle | 2 145.00 | 6.98 | 8.00 | 14.98 | 0.03 | |
| | | High | 2 165.00 | 6.96 | 8.00 | 14.96 | 0.03 | |

Sum Data of Port 0, Port 1

| Frequency (MHz) | PSD | | | | Limit |
|---|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM | |
| | W/MHz | | | | |
| 2 125.00 | 0.06 | 0.08 | 0.06 | 0.06 | 1640 |
| 2 145.00 | 0.06 | 0.08 | 0.06 | 0.06 | |
| 2 165.00 | 0.06 | 0.08 | 0.06 | 0.06 | |

**Tabular Data of RF Non-Contiguous PSD**

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Frequency (MHz) | Measured Value (dBm/MHz) | Ant. Gain (dBi) | E.I.R.P. (dBm/MHz) | Calculated (W/MHz) | Limit (W/MHz) |
|---|---|---|---|---|---|---|---|
| 0 | QPSK | 2 122.50 + 2 177.50 | 6.88 | 8.00 | 14.88 | 0.03 | 1640 |
| | 16QAM | 2 122.50 + 2 177.50 | 8.25 | 8.00 | 16.25 | 0.04 | |
| | 64QAM | 2 122.50 + 2 177.50 | 6.90 | 8.00 | 14.90 | 0.03 | |
| | 256QAM | 2 122.50 + 2 177.50 | 6.89 | 8.00 | 14.89 | 0.03 | |
| 1 | QPSK | 2 122.50 + 2 177.50 | 7.25 | 8.00 | 15.25 | 0.03 | |
| | 16QAM | 2 122.50 + 2 177.50 | 8.66 | 8.00 | 16.66 | 0.05 | |
| | 64QAM | 2 122.50 + 2 177.50 | 7.25 | 8.00 | 15.25 | 0.03 | |
| | 256QAM | 2 122.50 + 2 177.50 | 7.34 | 8.00 | 15.34 | 0.03 | |

Sum Data of Port 0, Port 1

| Freq. (MHz) | PSD | | | | Limit |
|---|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM | |
| | W/MHz | | | | |
| 2 122.50 + 2 177.50 | 0.06 | 0.09 | 0.06 | 0.06 | 1640 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

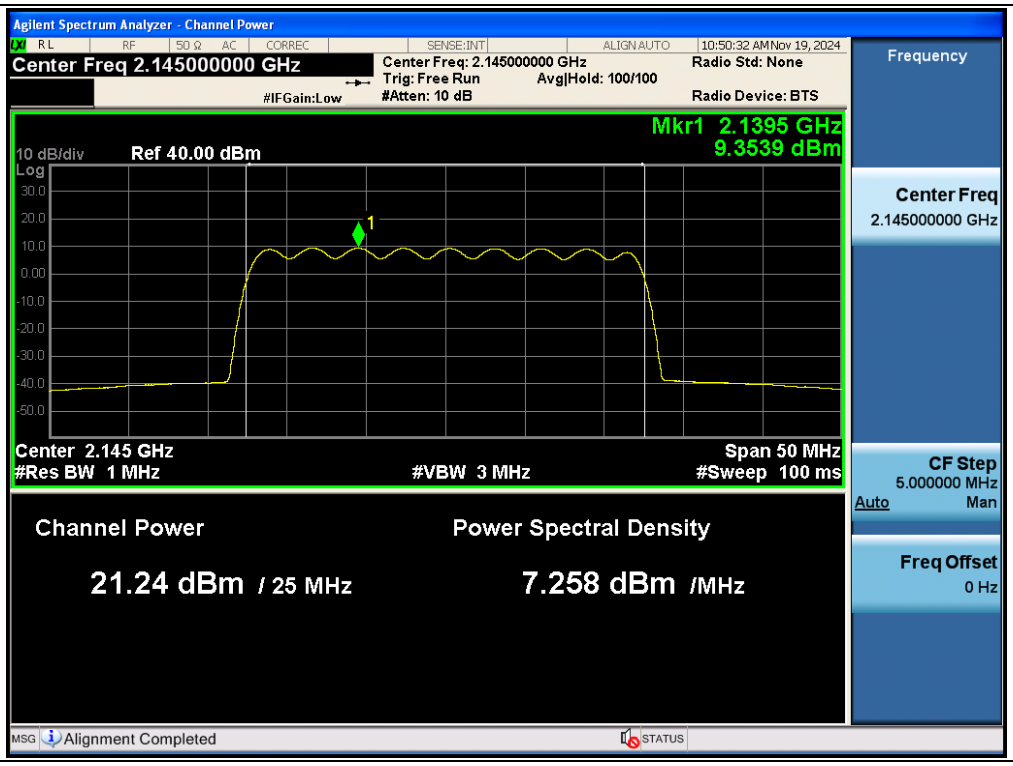
| Antenna | Modulation | Frequency (MHz) | Measured Value (dBm/MHz) | Ant. Gain (dBi) | E.I.R.P. (dBm/MHz) | Calculated (W/MHz) | Limit (W/MHz) |
|---|---|---|---|---|---|---|---|
| 0 | QPSK | 2 122.50 + 2 177.50 | 6.77 | 8.00 | 14.77 | 0.03 | 1640 |
| | 16QAM | 2 122.50 + 2 177.50 | 8.13 | 8.00 | 16.13 | 0.04 | |
| | 64QAM | 2 122.50 + 2 177.50 | 6.69 | 8.00 | 14.69 | 0.03 | |
| | 256QAM | 2 122.50 + 2 177.50 | 6.75 | 8.00 | 14.75 | 0.03 | |
| 1 | QPSK | 2 122.50 + 2 177.50 | 6.88 | 8.00 | 14.88 | 0.03 | |
| | 16QAM | 2 122.50 + 2 177.50 | 8.33 | 8.00 | 16.33 | 0.04 | |
| | 64QAM | 2 122.50 + 2 177.50 | 6.94 | 8.00 | 14.94 | 0.03 | |
| | 256QAM | 2 122.50 + 2 177.50 | 6.98 | 8.00 | 14.98 | 0.03 | |

Sum Data of Port 0, Port 1

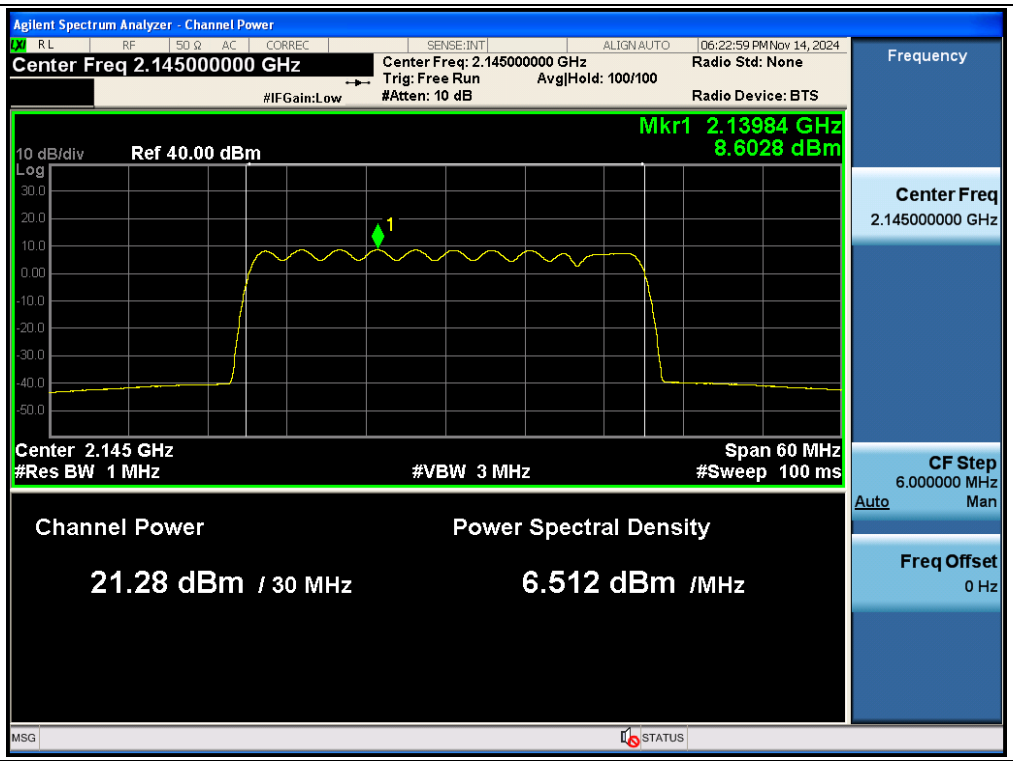
| Freq. (MHz) | PSD | | | | Limit |
|---|---|---|---|---|---|
| | QPSK | 16QAM | 64QAM | 256QAM | |
| | W/MHz | | | | |
| 2 122.50 + 2 177.50 | 0.06 | 0.08 | 0.06 | 0.06 | 1640 |

## Plot Data of PSD

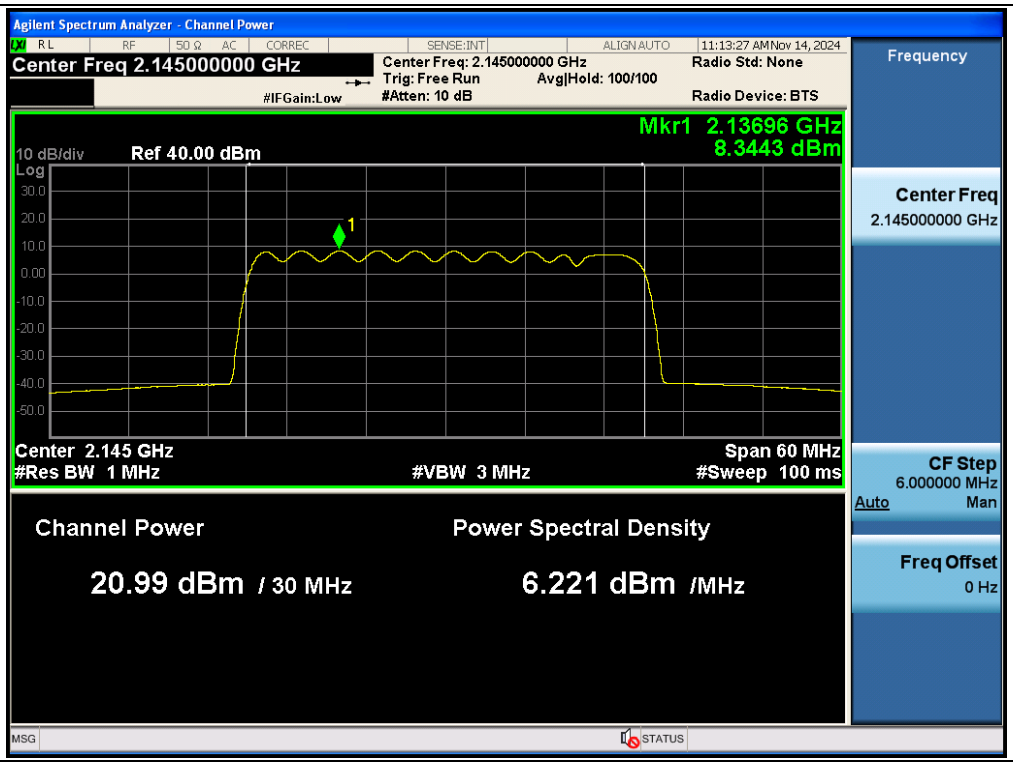
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 16QAM / Middle



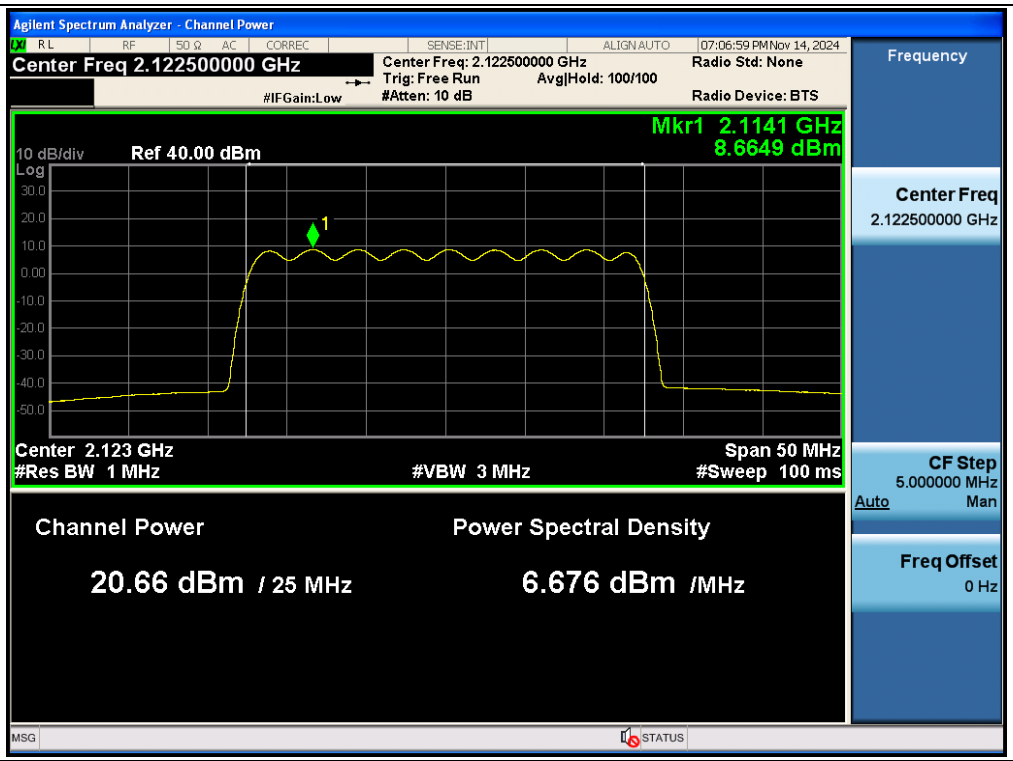
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Middle / Contiguous



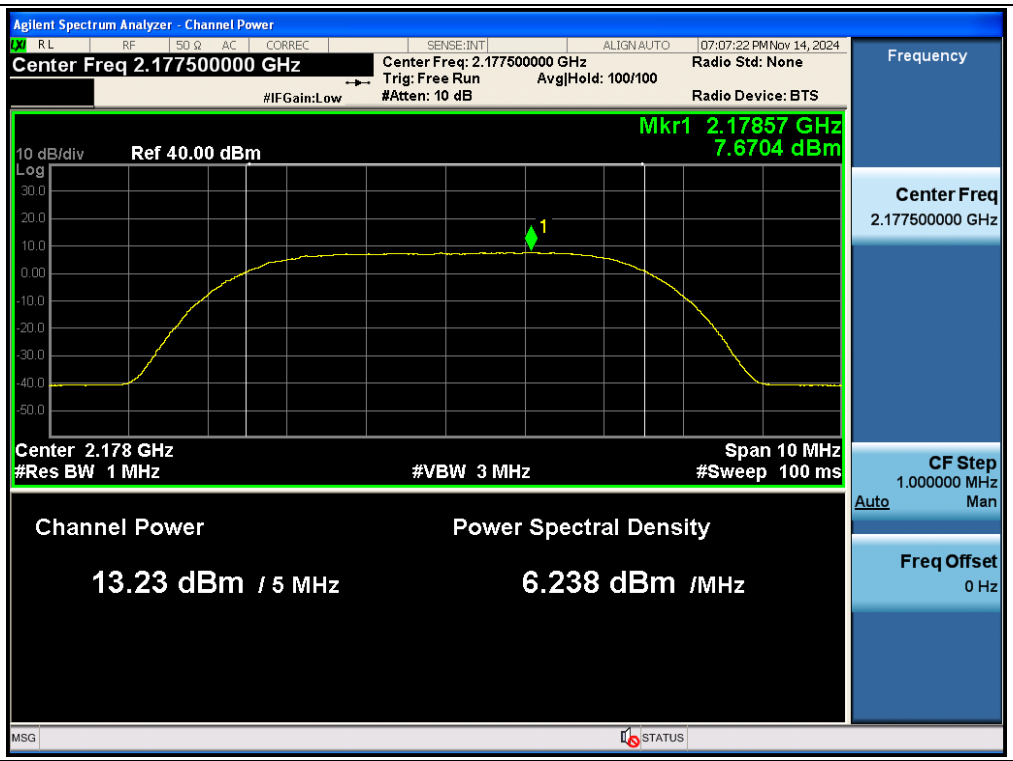

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Middle / Contiguous



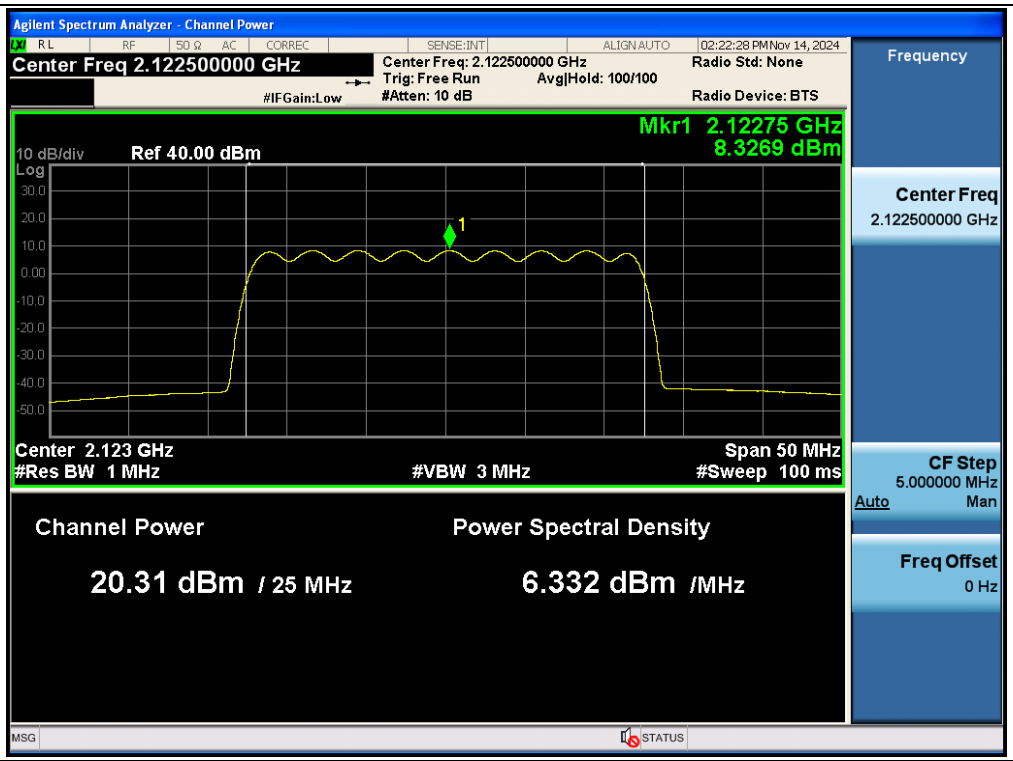
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Low / Non-Contiguous



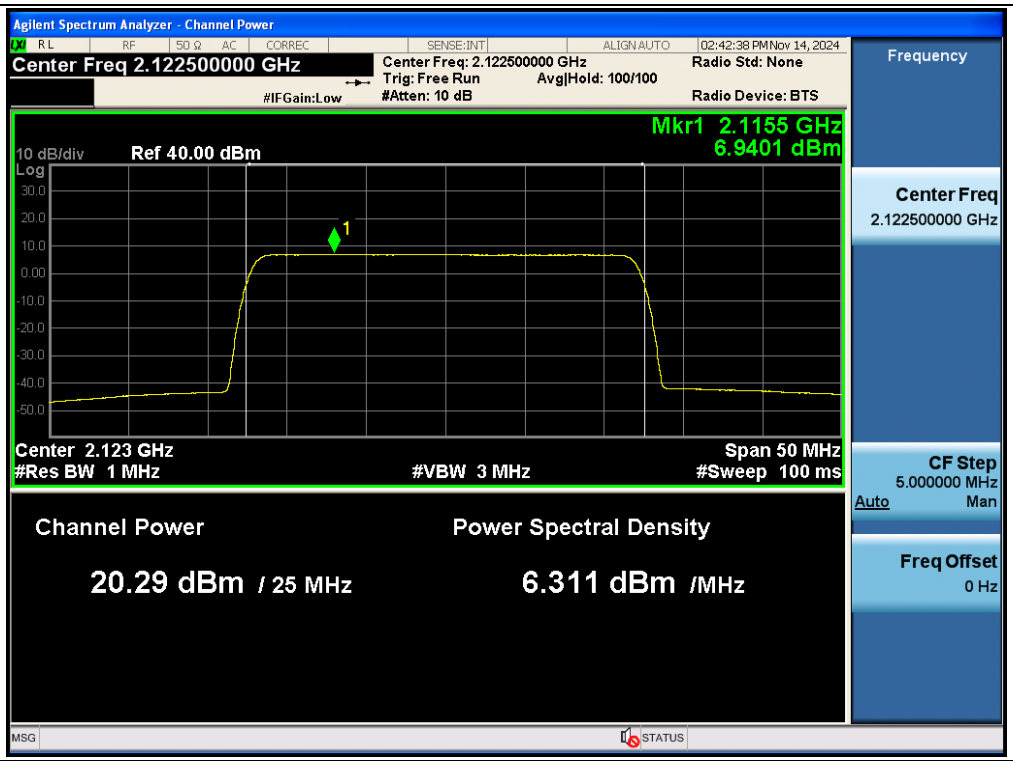

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / High / Non-Contiguous



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Low / Non-Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 16QAM / High / Non-Contiguous



## 5.2. PAPR

**Test Requirements:**

**§ 27.50 Power limits and duty cycle.**

(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

(5) Equipment employed must be authorized in accordance with the provisions of § 24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. 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.

**Test Procedures:**

The measurement is performed in accordance with Section 5.2.3.4 of ANSI C63.26.

The following guidelines are offered for performing a CCDF measurement.

a) Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth.

b) Set the number of counts to a value that stabilizes the measured CCDF curve.

c) Set the measurement interval as follows:

1) For continuous transmissions, set to the greater of [10 × (number of points in sweep) × (transmission symbol period)] or 1 ms.

2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.

3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.

d) Record the maximum PAPR level associated with a probability of 0.1%.

e) The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.

**Note:** The results of the PAPR test shown above the frequency measured values are very small and similar trend for each port, so we are attached only the worst case plot.

**Test Results:**
**Tabular data of RF PAPR**

(2 Port) 5G NR n66 25 MHz 1 Carrier

| Antenna | Modulation | Channel | Frequency (MHz) | 0.1 % PAPR (dB) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 122.50 | 8.44 |
| | | Middle | 2 145.00 | 8.39 |
| | | High | 2 167.50 | 8.38 |
| | 16QAM | Low | 2 122.50 | 8.50 |
| | | Middle | 2 145.00 | 8.48 |
| | | High | 2 167.50 | 8.46 |
| | 64QAM | Low | 2 122.50 | 8.49 |
| | | Middle | 2 145.00 | 8.47 |
| | | High | 2 167.50 | 8.45 |
| | 256QAM | Low | 2 122.50 | 8.49 |
| | | Middle | 2 145.00 | 8.48 |
| | | High | 2 167.50 | 8.46 |
| 1 | QPSK | Low | 2 122.50 | 8.41 |
| | | Middle | 2 145.00 | 8.38 |
| | | High | 2 167.50 | 8.35 |
| | 16QAM | Low | 2 122.50 | 8.47 |
| | | Middle | 2 145.00 | 8.46 |
| | | High | 2 167.50 | 8.43 |
| | 64QAM | Low | 2 122.50 | 8.47 |
| | | Middle | 2 145.00 | 8.45 |
| | | High | 2 167.50 | 8.41 |
| | 256QAM | Low | 2 122.50 | 8.46 |
| | | Middle | 2 145.00 | 8.44 |
| | | High | 2 167.50 | 8.44 |

## Tabular Data of RF Contiguous PAPR

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | 0.1 % PAPR (dB) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 8.49 |
| | | Middle | 2 145.00 | 8.44 |
| | | High | 2 165.00 | 8.42 |
| | 16QAM | Low | 2 125.00 | 8.45 |
| | | Middle | 2 145.00 | 8.47 |
| | | High | 2 165.00 | 8.44 |
| | 64QAM | Low | 2 125.00 | 8.48 |
| | | Middle | 2 145.00 | 8.49 |
| | | High | 2 165.00 | 8.46 |
| | 256QAM | Low | 2 125.00 | 8.50 |
| | | Middle | 2 145.00 | 8.48 |
| | | High | 2 165.00 | 8.47 |
| 1 | QPSK | Low | 2 125.00 | 8.47 |
| | | Middle | 2 145.00 | 8.39 |
| | | High | 2 165.00 | 8.36 |
| | 16QAM | Low | 2 125.00 | 8.48 |
| | | Middle | 2 145.00 | 8.44 |
| | | High | 2 165.00 | 8.41 |
| | 64QAM | Low | 2 125.00 | 8.47 |
| | | Middle | 2 145.00 | 8.44 |
| | | High | 2 165.00 | 6.67 |
| | 256QAM | Low | 2 125.00 | 8.47 |
| | | Middle | 2 145.00 | 8.45 |
| | | High | 2 165.00 | 8.43 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | 0.1 % PAPR (dB) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 8.52 |
| | | Middle | 2 145.00 | 8.45 |
| | | High | 2 165.00 | 8.41 |
| | 16QAM | Low | 2 125.00 | 8.47 |
| | | Middle | 2 145.00 | 8.48 |
| | | High | 2 165.00 | 8.48 |
| | 64QAM | Low | 2 125.00 | 8.50 |
| | | Middle | 2 145.00 | 8.51 |
| | | High | 2 165.00 | 8.49 |
| | 256QAM | Low | 2 125.00 | 8.49 |
| | | Middle | 2 145.00 | 8.44 |
| | | High | 2 165.00 | 8.44 |
| 1 | QPSK | Low | 2 125.00 | 8.42 |
| | | Middle | 2 145.00 | 8.44 |
| | | High | 2 165.00 | 8.41 |
| | 16QAM | Low | 2 125.00 | 8.46 |
| | | Middle | 2 145.00 | 8.46 |
| | | High | 2 165.00 | 8.44 |
| | 64QAM | Low | 2 125.00 | 8.50 |
| | | Middle | 2 145.00 | 8.48 |
| | | High | 2 165.00 | 8.44 |
| | 256QAM | Low | 2 125.00 | 8.47 |
| | | Middle | 2 145.00 | 8.45 |
| | | High | 2 165.00 | 8.44 |

## Tabular Data of RF Non-Contiguous PAPR

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | 5G NR n66 25 MHz 1 Carrier | | LTE B66 5 MHz 1 Carrier | |
|---|---|---|---|---|---|
| | | Frequency (MHz) | 0.1 % PAPR (dB) | Frequency (MHz) | 0.1 % PAPR (dB) |
| 0 | QPSK | 2 122.50 | 8.42 | 2 177.50 | 8.40 |
| | 16QAM | 2 122.50 | 8.48 | 2 177.50 | 8.45 |
| | 64QAM | 2 122.50 | 8.48 | 2 177.50 | 8.49 |
| | 256QAM | 2 122.50 | 8.50 | 2 177.50 | 8.38 |
| 1 | QPSK | 2 122.50 | 8.39 | 2 177.50 | 8.41 |
| | 16QAM | 2 122.50 | 8.45 | 2 177.50 | 8.46 |
| | 64QAM | 2 122.50 | 8.45 | 2 177.50 | 8.49 |
| | 256QAM | 2 122.50 | 8.47 | 2 177.50 | 8.39 |
| 2 | QPSK | 2 122.50 | 8.42 | 2 177.50 | 8.40 |
| | 16QAM | 2 122.50 | 8.48 | 2 177.50 | 8.45 |
| | 64QAM | 2 122.50 | 8.48 | 2 177.50 | 8.49 |
| | 256QAM | 2 122.50 | 8.50 | 2 177.50 | 8.38 |

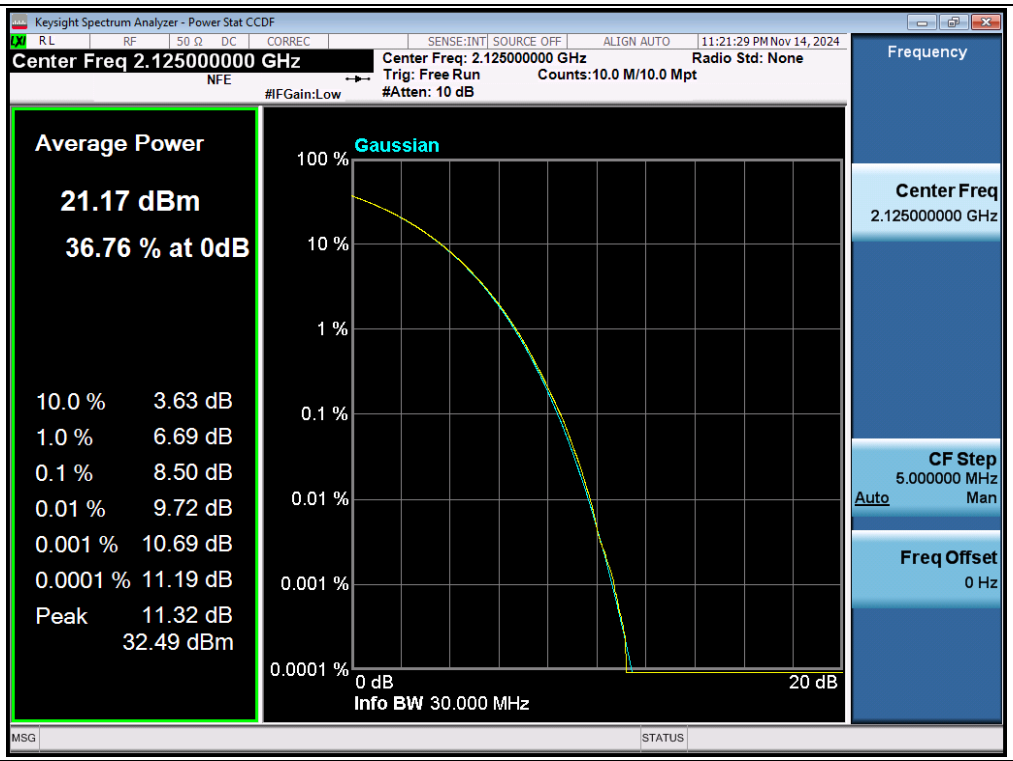
(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | 5G NR n66 25 MHz 1 Carrier | | 5G NR n66 5 MHz 1 Carrier | |
|---|---|---|---|---|---|
| | | Frequency (MHz) | 0.1 % PAPR (dB) | Frequency (MHz) | 0.1 % PAPR (dB) |
| 0 | QPSK | 2 122.50 | 8.42 | 2 177.50 | 8.37 |
| | 16QAM | 2 122.50 | 8.47 | 2 177.50 | 8.38 |
| | 64QAM | 2 122.50 | 8.49 | 2 177.50 | 8.26 |
| | 256QAM | 2 122.50 | 8.48 | 2 177.50 | 8.62 |
| 1 | QPSK | 2 122.50 | 8.41 | 2 177.50 | 8.38 |
| | 16QAM | 2 122.50 | 8.45 | 2 177.50 | 8.38 |
| | 64QAM | 2 122.50 | 8.47 | 2 177.50 | 8.24 |
| | 256QAM | 2 122.50 | 8.46 | 2 177.50 | 8.61 |
| 2 | QPSK | 2 122.50 | 8.42 | 2 177.50 | 8.37 |
| | 16QAM | 2 122.50 | 8.47 | 2 177.50 | 8.38 |
| | 64QAM | 2 122.50 | 8.49 | 2 177.50 | 8.26 |
| | 256QAM | 2 122.50 | 8.48 | 2 177.50 | 8.62 |

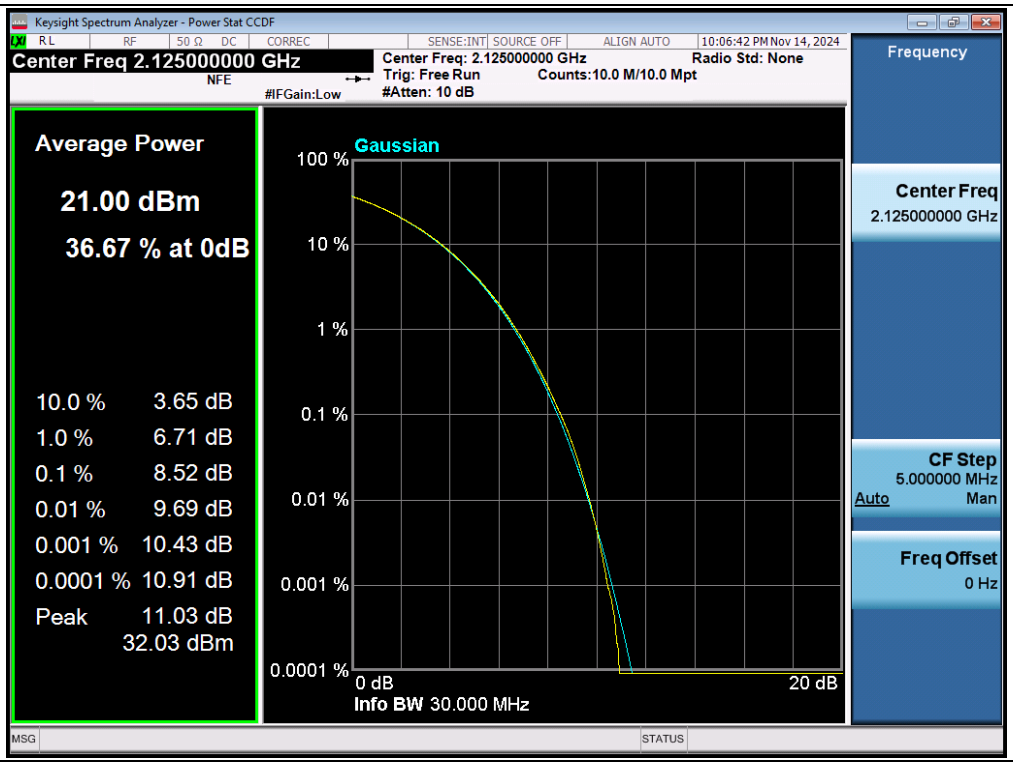
**Plot Data of RF PAPR**

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 16QAM / Low

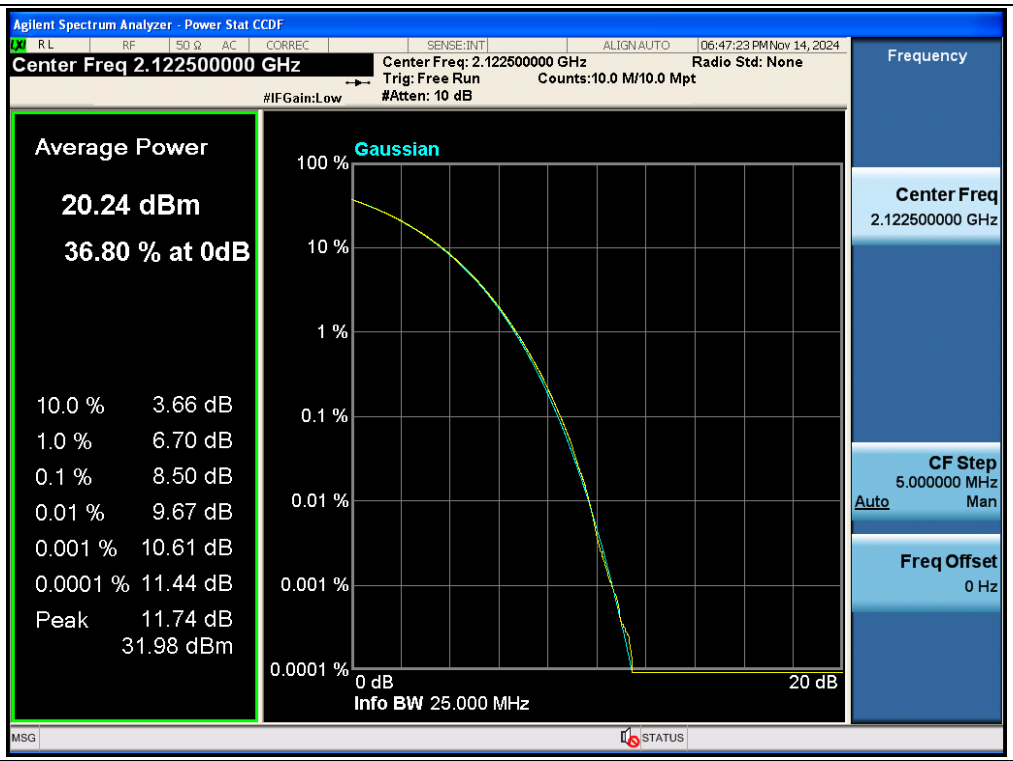
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 256QAM / Low / Contiguous



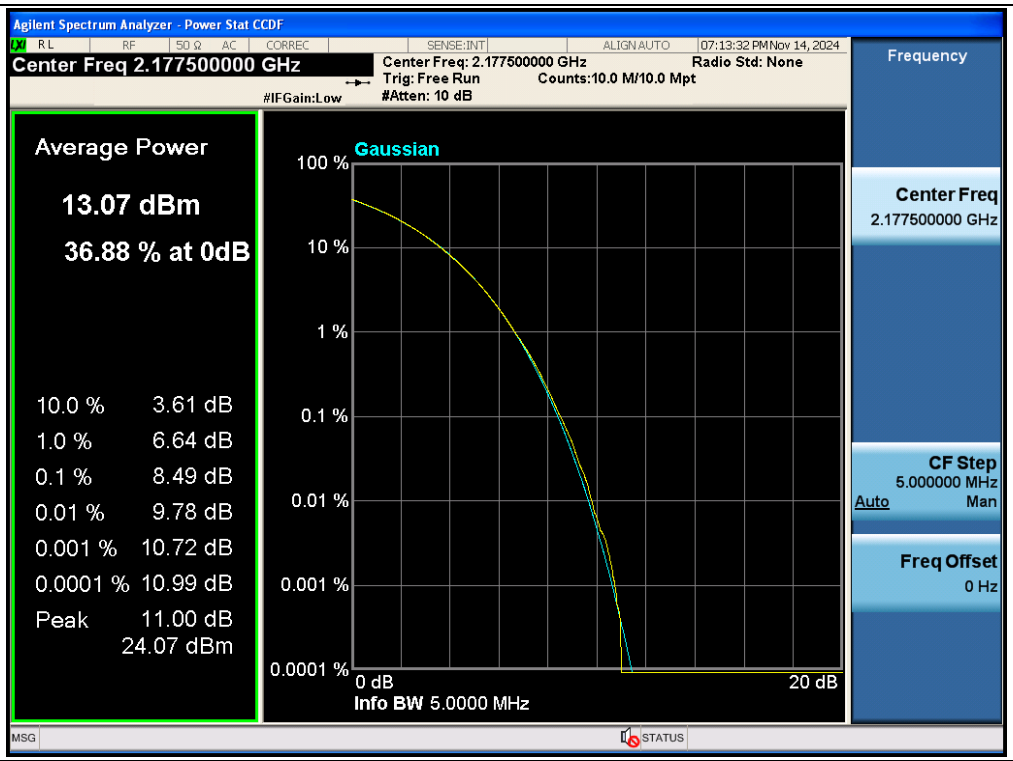

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / QPSK / Low / Contiguous



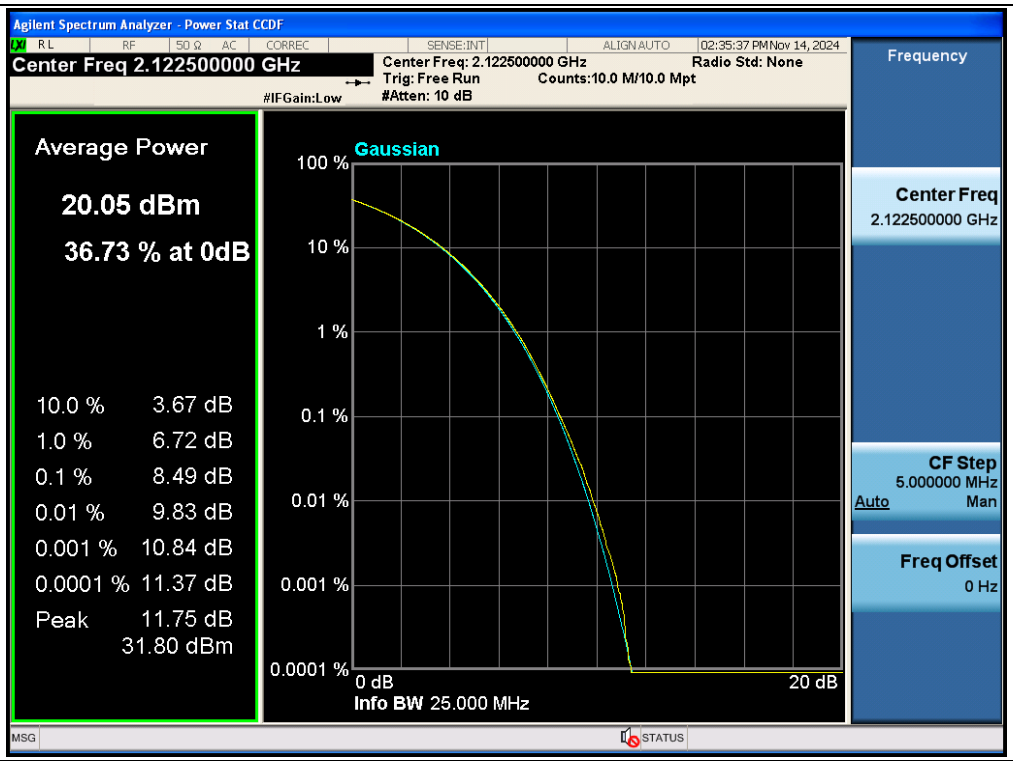
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 256QAM / Low / Non-Contiguous



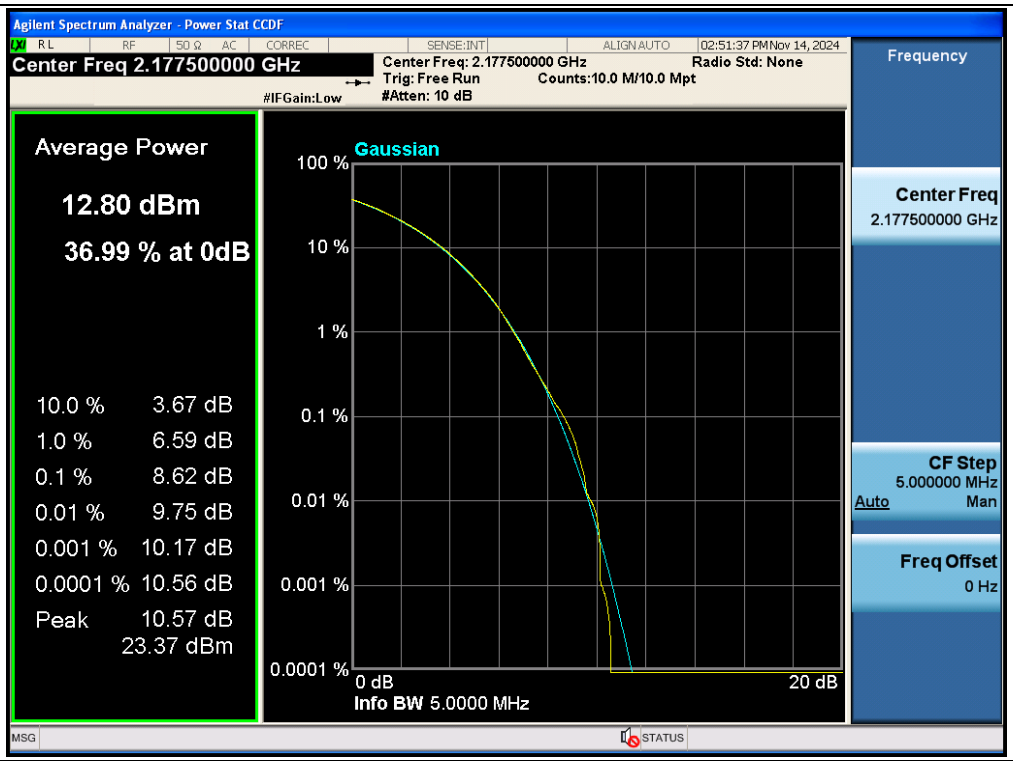

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 64QAM / High / Non-Contiguous



Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 64QAM / Low / Non-Contiguous




Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 256QAM / High / Non-Contiguous



## 5.3. OCCUPIED BANDWIDTH

**Test Requirements:**

**§ 2.1049 Measurements required: Occupied bandwidth.**

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

**Test Procedures:**

The measurement is performed in accordance with Section 5.4.3 and 5.4.4 of ANSI C63.26.

**5.4.3 Occupied bandwidth—Relative measurement procedure**

The OBW is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). The typical ratio for transmitters is −26 dB, corresponding to the 26 dB BW; however, other ratios can be specified. In this subclause, the ratio is designated by "−X dB."

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.

b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target "−X dB" requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.

e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

f) Determine the reference value by either of the following:
   1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the Highest level of the displayed trace (this is the reference value).
   2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.

g) 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.

h) If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).

i) Place two markers, one at the lowest and the other at the Highest frequency of the envelope of the spectral

display such that each marker is at or slightly below the "−X dB amplitude" determined in step f). If a marker is below this "−X dB amplitude" value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers. The spectral envelope can cross the "−X dB amplitude" at multiple points. The lowest or Highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the "−X dB amplitude."

j) 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).

### 5.4.4 Occupied bandwidth—Power bandwidth (99%) measurement procedure

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

The following procedure shall be used for measuring (99%) power bandwidth:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).

b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d) Set the detection mode to peak, and the trace mode to max-hold.

e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.

f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

**Note:** The results of the Occupied Bandwidth test shown above the frequency measured values are very small and similar trend for each port, so we are attached only the worst case plot.

**Test Results:**

**Tabular Data of Occupied Bandwidth**

(2 Port) 5G NR n66 25 MHz 1 Carrier

| Antenna | Modulation | Channel | Frequency (MHz) | Occupied Bandwidth (MHz) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 122.50 | 23.777 |
| | | Middle | 2 145.00 | 23.806 |
| | | High | 2 167.50 | 23.858 |
| | 16QAM | Low | 2 122.50 | 23.830 |
| | | Middle | 2 145.00 | 23.857 |
| | | High | 2 167.50 | 23.865 |
| | 64QAM | Low | 2 122.50 | 23.804 |
| | | Middle | 2 145.00 | 23.791 |
| | | High | 2 167.50 | 23.796 |
| | 256QAM | Low | 2 122.50 | 23.783 |
| | | Middle | 2 145.00 | 23.802 |
| | | High | 2 167.50 | 23.807 |
| 1 | QPSK | Low | 2 122.50 | 23.772 |
| | | Middle | 2 145.00 | 23.777 |
| | | High | 2 167.50 | 23.823 |
| | 16QAM | Low | 2 122.50 | 23.860 |
| | | Middle | 2 145.00 | 23.840 |
| | | High | 2 167.50 | 23.889 |
| | 64QAM | Low | 2 122.50 | 23.787 |
| | | Middle | 2 145.00 | 23.751 |
| | | High | 2 167.50 | 23.789 |
| | 256QAM | Low | 2 122.50 | 23.787 |
| | | Middle | 2 145.00 | 23.780 |
| | | High | 2 167.50 | 23.854 |

**Tabular Data of RF Contiguous Occupied Bandwidth**

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Occupied Bandwidth (MHz) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 29.085 |
| | | Middle | 2 145.00 | 29.092 |
| | | High | 2 165.00 | 29.066 |
| | 16QAM | Low | 2 125.00 | 29.020 |
| | | Middle | 2 145.00 | 28.994 |
| | | High | 2 165.00 | 29.087 |
| | 64QAM | Low | 2 125.00 | 29.144 |
| | | Middle | 2 145.00 | 29.079 |
| | | High | 2 165.00 | 29.069 |
| | 256QAM | Low | 2 125.00 | 29.074 |
| | | Middle | 2 145.00 | 29.093 |
| | | High | 2 165.00 | 29.125 |
| 1 | QPSK | Low | 2 125.00 | 29.112 |
| | | Middle | 2 145.00 | 29.087 |
| | | High | 2 165.00 | 29.082 |
| | 16QAM | Low | 2 125.00 | 29.101 |
| | | Middle | 2 145.00 | 29.047 |
| | | High | 2 165.00 | 29.080 |
| | 64QAM | Low | 2 125.00 | 29.085 |
| | | Middle | 2 145.00 | 29.054 |
| | | High | 2 165.00 | 29.097 |
| | 256QAM | Low | 2 125.00 | 29.106 |
| | | Middle | 2 145.00 | 29.056 |
| | | High | 2 165.00 | 29.157 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Occupied Bandwidth (MHz) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 125.00 | 29.077 |
| | | Middle | 2 145.00 | 29.082 |
| | | High | 2 165.00 | 29.134 |
| | 16QAM | Low | 2 125.00 | 29.105 |
| | | Middle | 2 145.00 | 29.068 |
| | | High | 2 165.00 | 29.072 |
| | 64QAM | Low | 2 125.00 | 29.073 |
| | | Middle | 2 145.00 | 29.056 |
| | | High | 2 165.00 | 29.097 |
| | 256QAM | Low | 2 125.00 | 29.092 |
| | | Middle | 2 145.00 | 29.075 |
| | | High | 2 165.00 | 29.116 |
| 1 | QPSK | Low | 2 125.00 | 29.041 |
| | | Middle | 2 145.00 | 29.098 |
| | | High | 2 165.00 | 29.024 |
| | 16QAM | Low | 2 125.00 | 29.080 |
| | | Middle | 2 145.00 | 29.074 |
| | | High | 2 165.00 | 29.121 |
| | 64QAM | Low | 2 125.00 | 29.060 |
| | | Middle | 2 145.00 | 29.049 |
| | | High | 2 165.00 | 29.129 |
| | 256QAM | Low | 2 125.00 | 29.086 |
| | | Middle | 2 145.00 | 29.119 |
| | | High | 2 165.00 | 29.050 |

## Tabular Data of RF Non-Contiguous Occupied Bandwidth

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

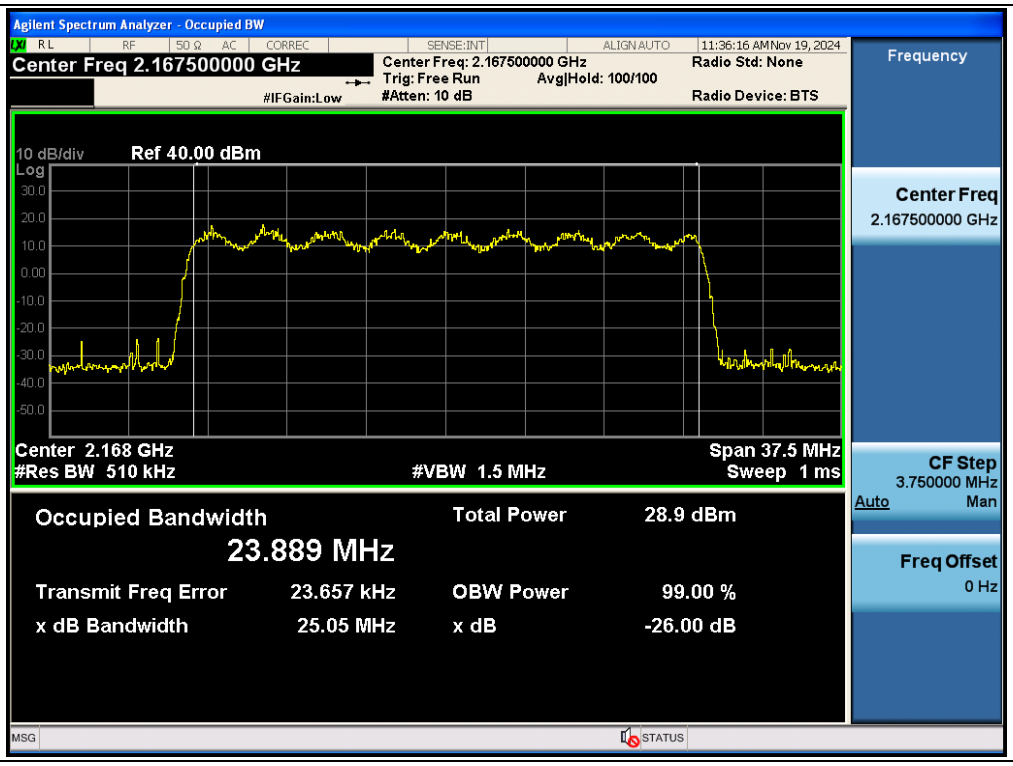
| Antenna | Modulation | 5G NR n66 25 MHz 1 Carrier | | LTE B66 5 MHz 1 Carrier | | Total OBW (MHz) |
|---|---|---|---|---|---|---|
| | | Frequency (MHz) | Measured Value (MHz) | Frequency (MHz) | Measured Value (MHz) | |
| 0 | QPSK | 2 122.50 | 23.807 | 2 177.50 | 4.5068 | 28.314 |
| | 16QAM | 2 122.50 | 23.940 | 2 177.50 | 4.5114 | 28.451 |
| | 64QAM | 2 122.50 | 23.853 | 2 177.50 | 4.5238 | 28.377 |
| | 256QAM | 2 122.50 | 23.824 | 2 177.50 | 4.5082 | 28.333 |
| 1 | QPSK | 2 122.50 | 23.794 | 2 177.50 | 4.5128 | 28.306 |
| | 16QAM | 2 122.50 | 23.865 | 2 177.50 | 4.4759 | 28.341 |
| | 64QAM | 2 122.50 | 23.761 | 2 177.50 | 4.5197 | 28.281 |
| | 256QAM | 2 122.50 | 23.847 | 2 177.50 | 4.4970 | 28.344 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

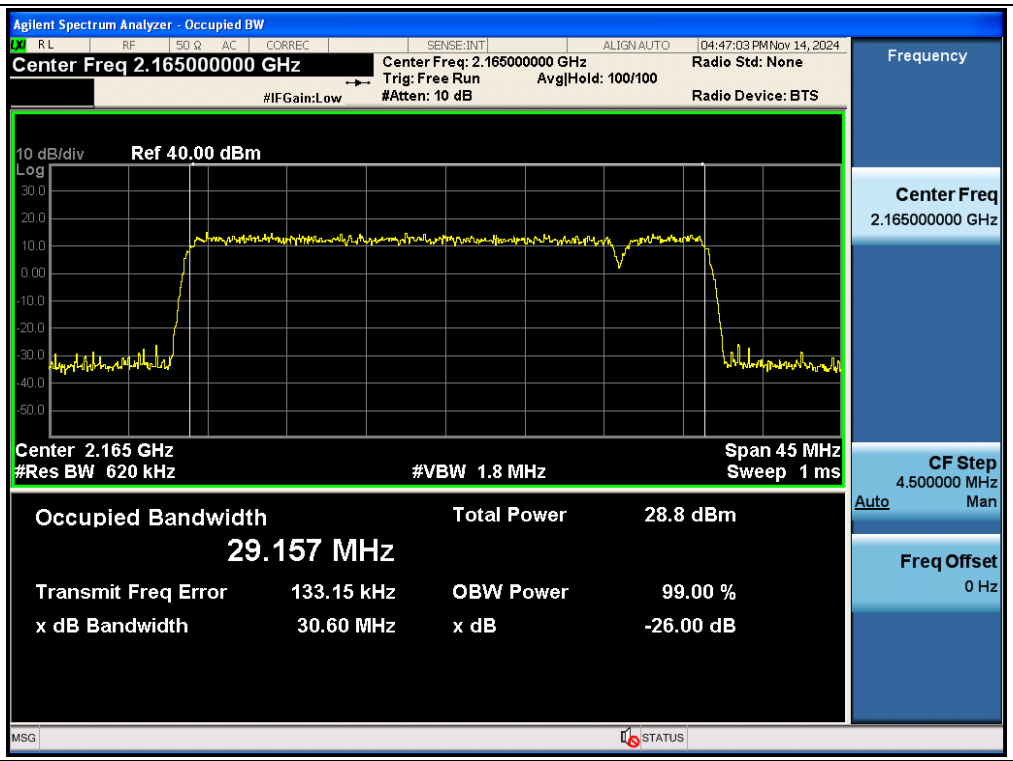
| Antenna | Modulation | 5G NR n66 25 MHz 1 Carrier | | 5G NR n66 5 MHz 1 Carrier | | Total OBW (MHz) |
|---|---|---|---|---|---|---|
| | | Frequency (MHz) | Measured Value (MHz) | Frequency (MHz) | Measured Value (MHz) | |
| 0 | QPSK | 2 122.50 | 23.791 | 2 177.50 | 4.4762 | 28.267 |
| | 16QAM | 2 122.50 | 23.844 | 2 177.50 | 4.4938 | 28.337 |
| | 64QAM | 2 122.50 | 23.764 | 2 177.50 | 4.4898 | 28.254 |
| | 256QAM | 2 122.50 | 23.810 | 2 177.50 | 4.4809 | 28.290 |
| 1 | QPSK | 2 122.50 | 23.755 | 2 177.50 | 4.4787 | 28.234 |
| | 16QAM | 2 122.50 | 23.852 | 2 177.50 | 4.4905 | 28.342 |
| | 64QAM | 2 122.50 | 23.770 | 2 177.50 | 4.5059 | 28.276 |
| | 256QAM | 2 122.50 | 23.799 | 2 177.50 | 4.4871 | 28.286 |

## Plot Data of Occupied Bandwidth

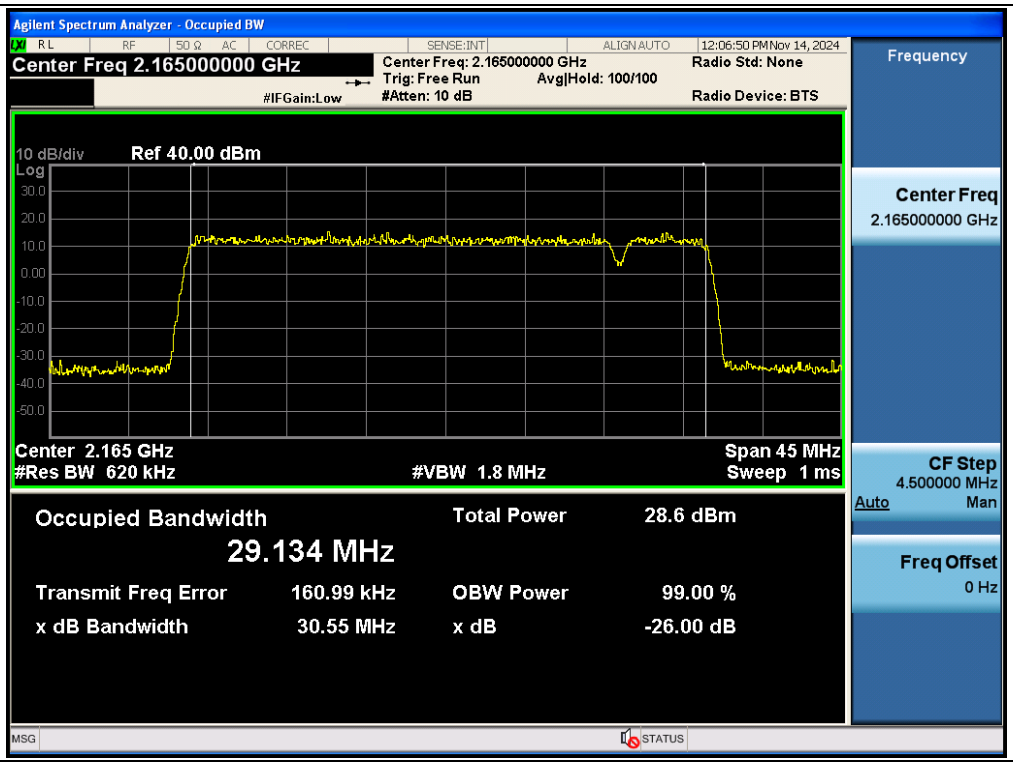
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 16QAM / High



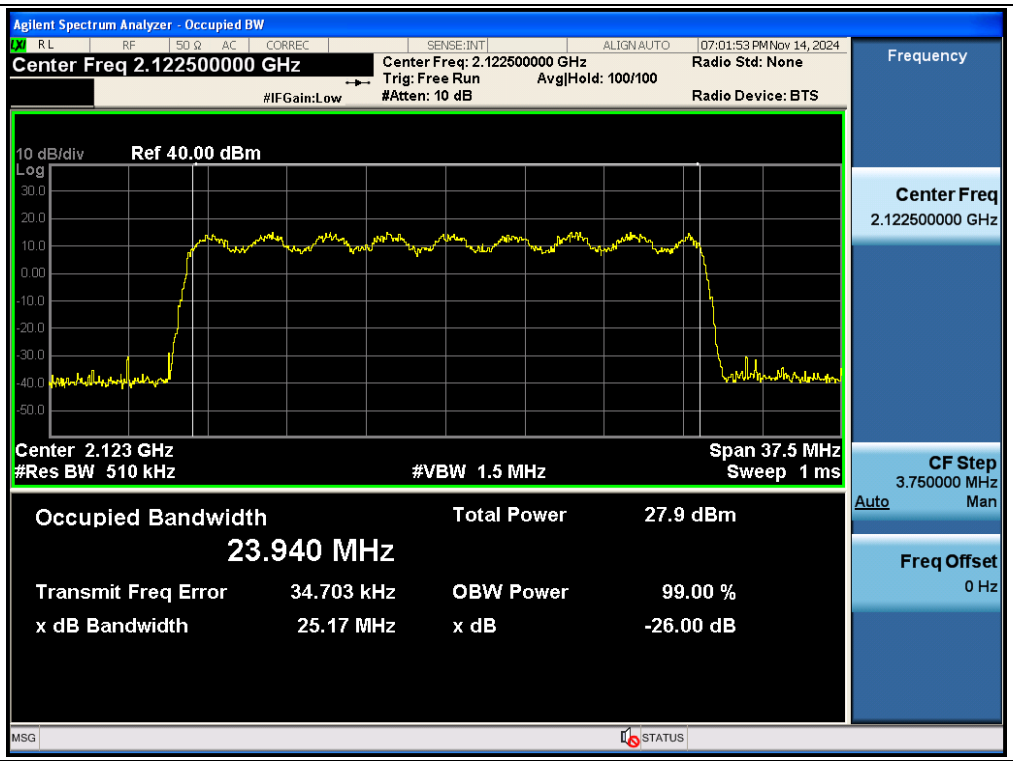
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 256QAM / High / Contiguous



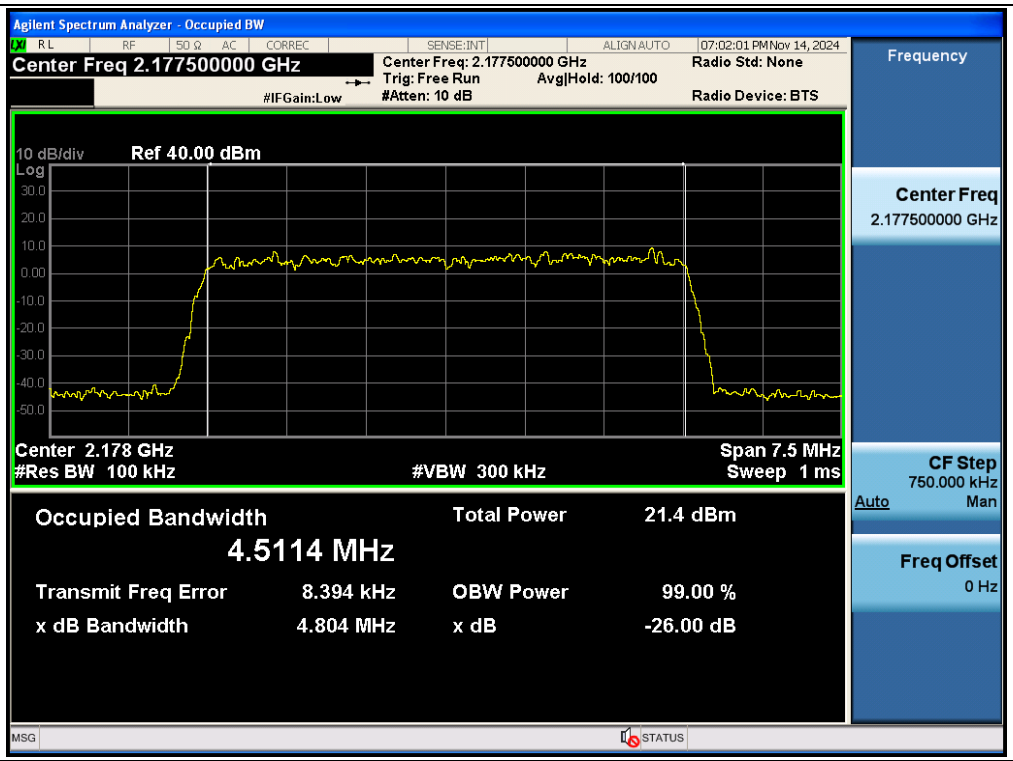

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / QPSK / High / Contiguous



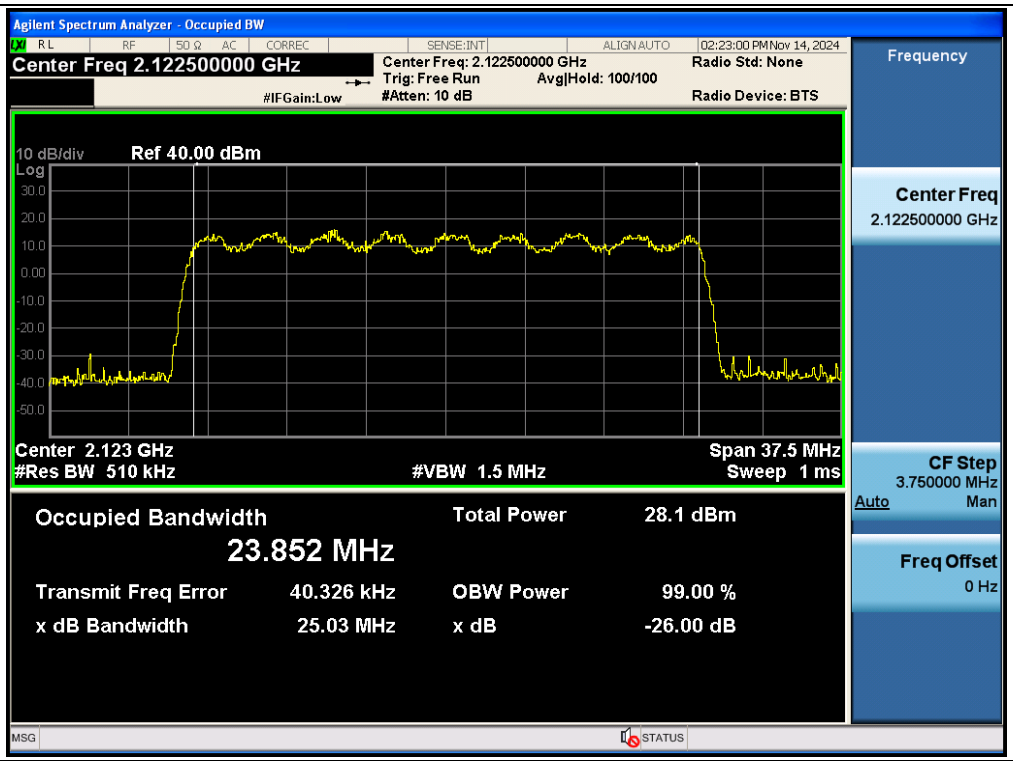
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Low / Non-Contiguous



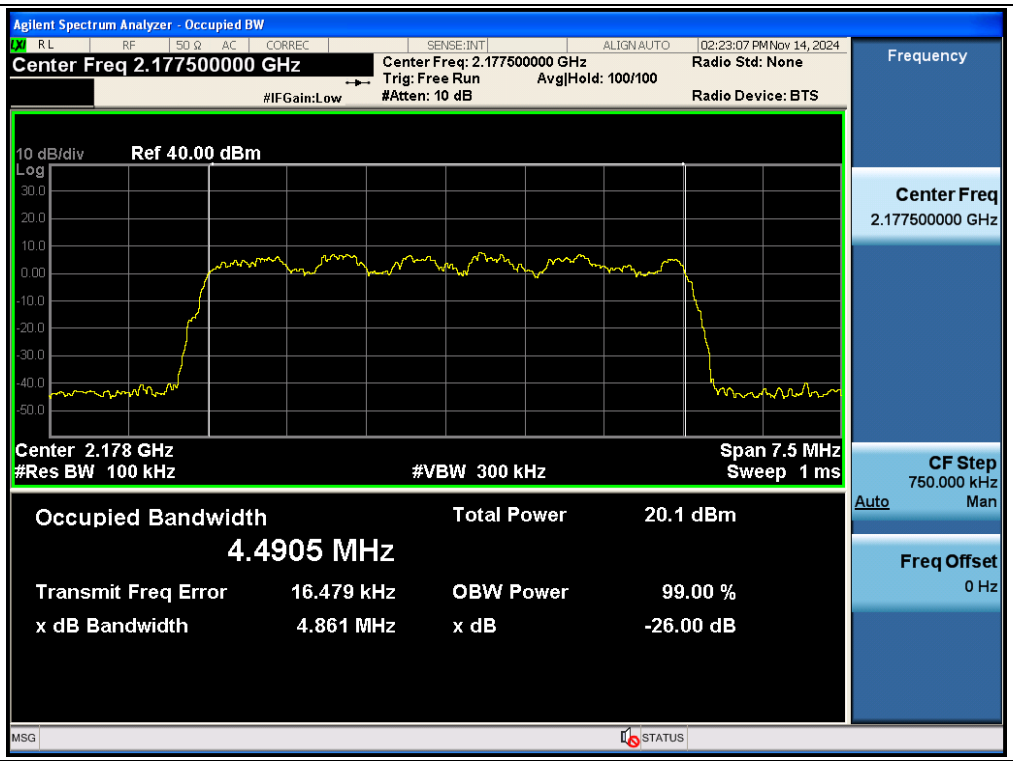

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / High / Non-Contiguous



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Low / Non-Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 16QAM / High / Non-Contiguous



## 5.4. OUT-OF-BAND UNWANTED EMISSIONS

**Test Requirements:**

**§ 2.1051 Measurements required: Spurious emissions at antenna terminals.**

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

**§ 27.53 Emission limits.**

(h) AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 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 log10 (P) dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. 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. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

**Test Procedures:**

The measurement is performed in accordance with Section 5.7.3 of ANSI C63.26.

**5.7.3 Out-of-band unwanted emissions measurements**

a) Set the spectrum analyzer center frequency to the block, band, or channel edge frequency.

b) Set the span wide enough to capture the fundamental emission closest to the authorized block or band edge, and to include all modulation products that spill into the immediately adjacent frequency band. In some cases, it may be possible to set the center frequency and span so as to encompass the fundamental emission and the unwanted out-of-band (band-edge) emissions on either side of the authorized block, band, or channel. This can be accomplished with a single (slow) sweep, if adequate overload protection and sufficient

dynamic range can be maintained.

c) Set the number of points in sweep ≥ 2 × span / RBW.

d) Sweep time should be auto for peak detection. For rms detection the sweep time should be set as follows:

1) If the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) × (symbol period) (e.g., by a factor of 10 × symbol period × number of points). Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols

2) If the device cannot be configured to transmit continuously (duty cycle < 98%) and a freerunning sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).

3) If the device cannot be configured to transmit continuously (duty cycle < 98%) and a freerunning sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).

4) If the device cannot be configured to transmit continuously and a free-running sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations > ±2%), set the sweep time so that the averaging is performed over the on-period by setting the sweep time > (symbol period) × (number of points), while also maintaining the sweep time < (transmitter on-time). The trace mode shall be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold are necessary to ensure that the maximum power is measured.

e) The test report shall include the plots of the measuring instrument display and the measured data.

f) See Annex I for example emission mask plots.

**Note:**

1. Due to MIMO operations, a correction has been added to the limit according to KDB 662911 D01 v02r01.
   - 2Tx MIMO correction: 10 log(NANT) = 10 log(2) = 3.01 dB // -13 dBm – 10*log (2) = -16.01 dBm
2. The results of the Out-of-band Unwanted Emissions test shown above the frequency measured values are very small and similar trend for each port, so we are attached only the worst case plot.

Test Results:
Tabular Data of Out-of-band Unwanted Emissions

(2 Port) 5G NR n66 25 MHz 1 Carrier

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 109.88 | -40.70 |
| | | High | 2 180.13 | -40.59 |
| | 16QAM | Low | 2 109.88 | -39.20 |
| | | High | 2 180.13 | -36.76 |
| | 64QAM | Low | 2 109.88 | -38.28 |
| | | High | 2 180.13 | -36.10 |
| | 256QAM | Low | 2 109.88 | -39.68 |
| | | High | 2 180.13 | -38.93 |
| 1 | QPSK | Low | 2 109.88 | -39.93 |
| | | High | 2 180.13 | -39.20 |
| | 16QAM | Low | 2 109.88 | -41.04 |
| | | High | 2 180.13 | -36.41 |
| | 64QAM | Low | 2 109.88 | -38.46 |
| | | High | 2 180.13 | -38.86 |
| | 256QAM | Low | 2 109.88 | -40.65 |
| | | High | 2 180.13 | -38.77 |

Tabular Data of Contiguous Out-of-band Unwanted Emissions

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 109.88 | -42.59 |
| | | High | 2 180.03 | -48.53 |
| | 16QAM | Low | 2 109.88 | -39.12 |
| | | High | 2 180.03 | -48.11 |
| | 64QAM | Low | 2 109.88 | -40.15 |
| | | High | 2 180.15 | -48.27 |
| | 256QAM | Low | 2 109.88 | -39.47 |
| | | High | 2 180.03 | -47.97 |
| 1 | QPSK | Low | 2 109.88 | -40.56 |
| | | High | 2 180.53 | -47.75 |
| | 16QAM | Low | 2 109.88 | -40.75 |
| | | High | 2 180.03 | -47.67 |
| | 64QAM | Low | 2 109.88 | -40.31 |
| | | High | 2 180.68 | -47.34 |
| | 256QAM | Low | 2 109.88 | -39.87 |
| | | High | 2 180.03 | -47.70 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 109.88 | -38.57 |
| | | High | 2 180.12 | -48.11 |
| | 16QAM | Low | 2 109.88 | -40.83 |
| | | High | 2 180.03 | -47.95 |
| | 64QAM | Low | 2 109.88 | -40.02 |
| | | High | 2 180.06 | -48.51 |
| | 256QAM | Low | 2 109.88 | -40.80 |
| | | High | 2 180.11 | -48.28 |
| 1 | QPSK | Low | 2 109.88 | -39.43 |
| | | High | 2 180.39 | -48.07 |
| | 16QAM | Low | 2 109.88 | -41.04 |
| | | High | 2 180.03 | -47.86 |
| | 64QAM | Low | 2 109.88 | -40.92 |
| | | High | 2 180.62 | -47.72 |
| | 256QAM | Low | 2 109.88 | -39.01 |
| | | High | 2 180.95 | -47.76 |

Tabular Data of Non-Contiguous Out-of-band Unwanted Emissions

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

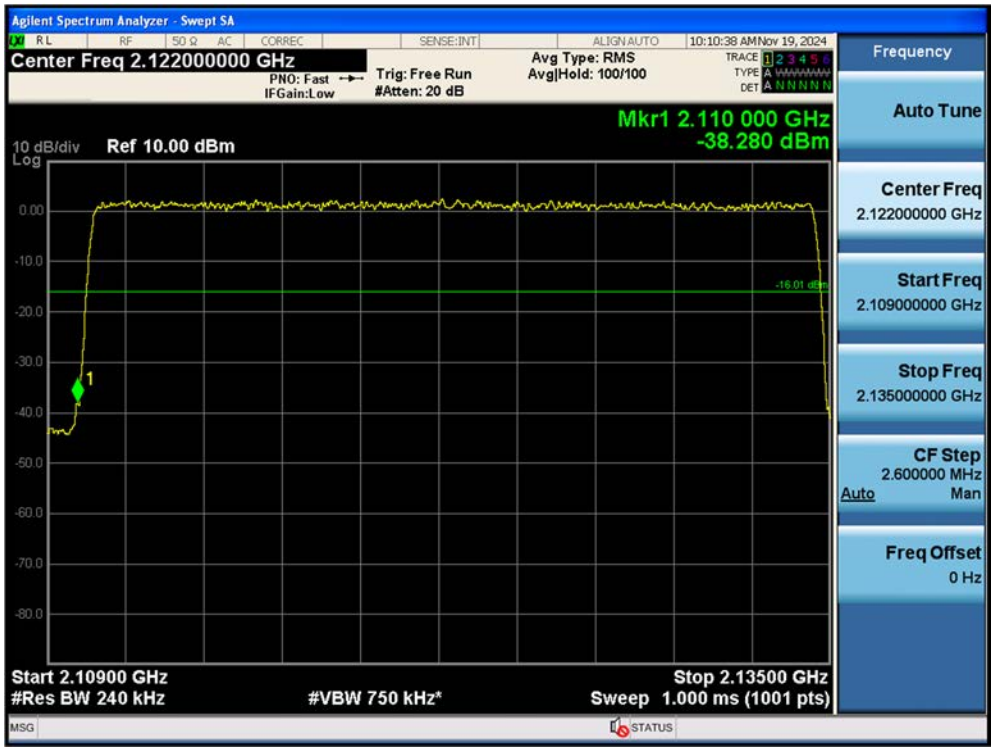
| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 110.00 | -39.88 |
| | | High | 2 180.36 | -49.38 |
| | 16QAM | Low | 2 110.00 | -39.48 |
| | | High | 2 180.71 | -48.81 |
| | 64QAM | Low | 2 110.00 | -39.91 |
| | | High | 2 180.20 | -49.04 |
| | 256QAM | Low | 2 110.00 | -41.65 |
| | | High | 2 180.00 | -48.31 |
| 1 | QPSK | Low | 2 110.00 | -41.13 |
| | | High | 2 180.11 | -48.50 |
| | 16QAM | Low | 2 110.00 | -40.87 |
| | | High | 2 180.00 | -48.05 |
| | 64QAM | Low | 2 110.00 | -40.61 |
| | | High | 2 180.50 | -48.44 |
| | 256QAM | Low | 2 110.00 | -40.81 |
| | | High | 2 180.81 | -48.80 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

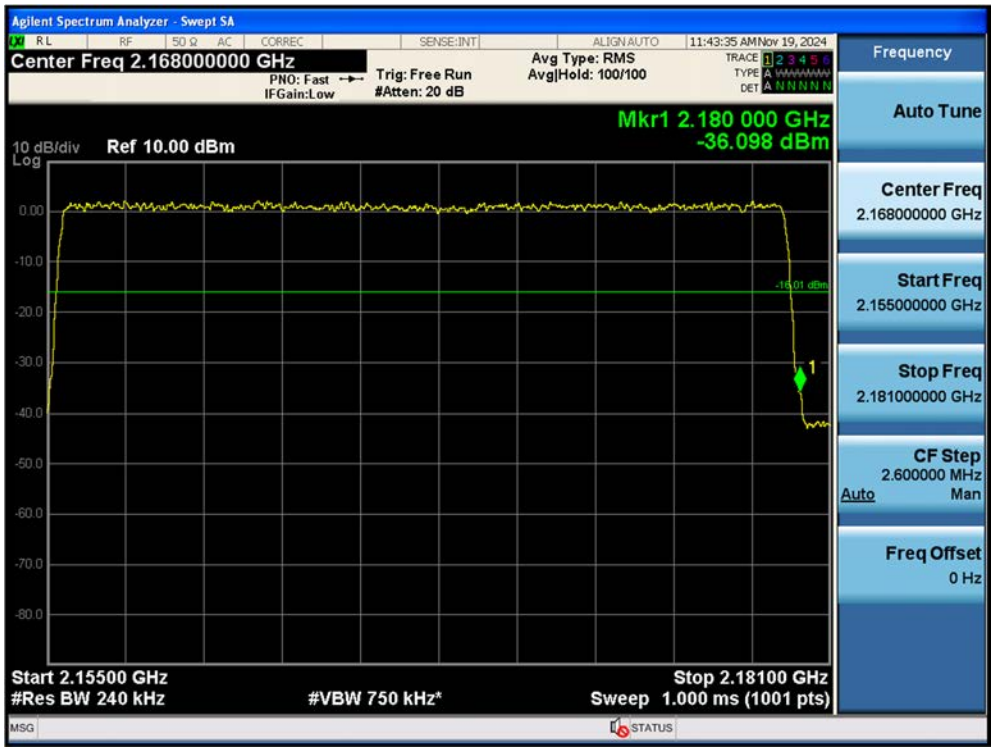
| Antenna | Modulation | Channel | Frequency (MHz) | Measured Value (dBm) |
|---|---|---|---|---|
| 0 | QPSK | Low | 2 110.00 | -39.60 |
| | | High | 2 180.49 | -49.25 |
| | 16QAM | Low | 2 110.00 | -41.23 |
| | | High | 2 180.00 | -48.71 |
| | 64QAM | Low | 2 110.00 | -42.37 |
| | | High | 2 180.00 | -48.67 |
| | 256QAM | Low | 2 110.00 | -39.64 |
| | | High | 2 180.00 | -48.55 |
| 1 | QPSK | Low | 2 110.00 | -40.22 |
| | | High | 2 180.23 | -48.85 |
| | 16QAM | Low | 2 110.00 | -39.73 |
| | | High | 2 180.00 | -48.71 |
| | 64QAM | Low | 2 110.00 | -40.14 |
| | | High | 2 180.00 | -48.79 |
| | 256QAM | Low | 2 110.00 | -41.90 |
| | | High | 2 180.03 | -48.47 |

Plot Data of Out-of-band Unwanted Emissions

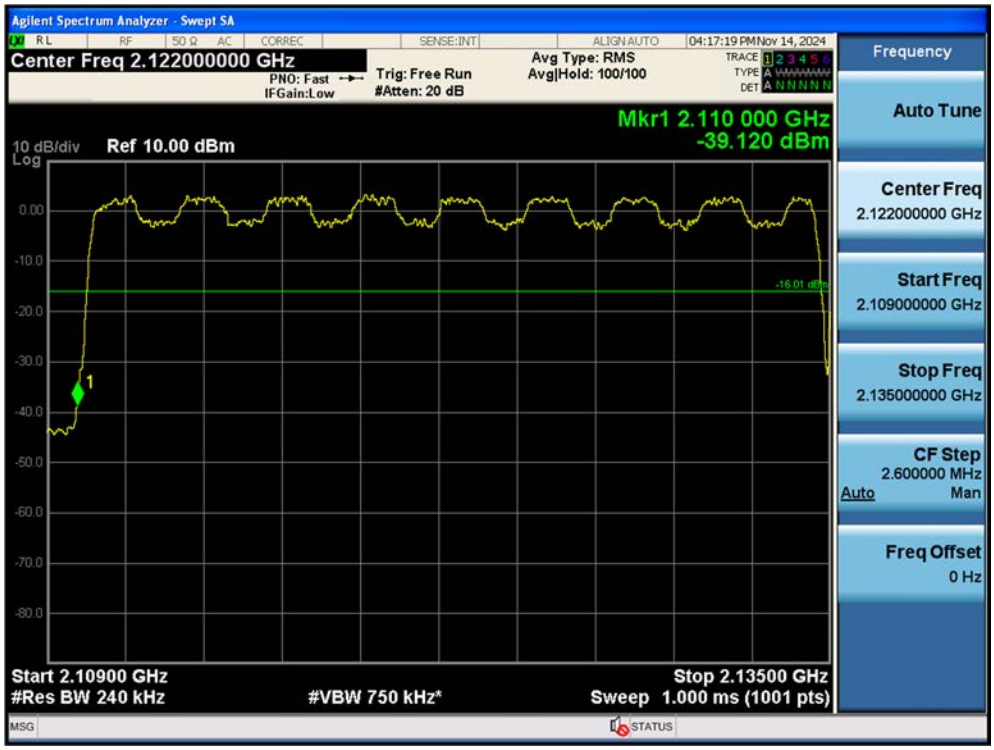
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 64QAM / Low



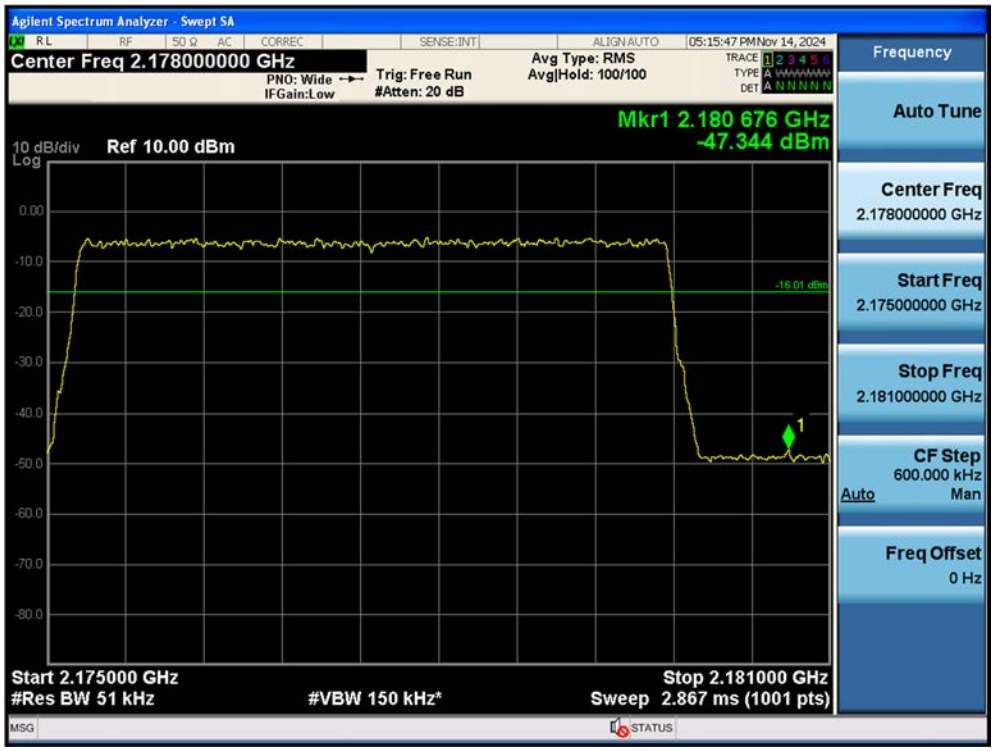

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 64QAM / High



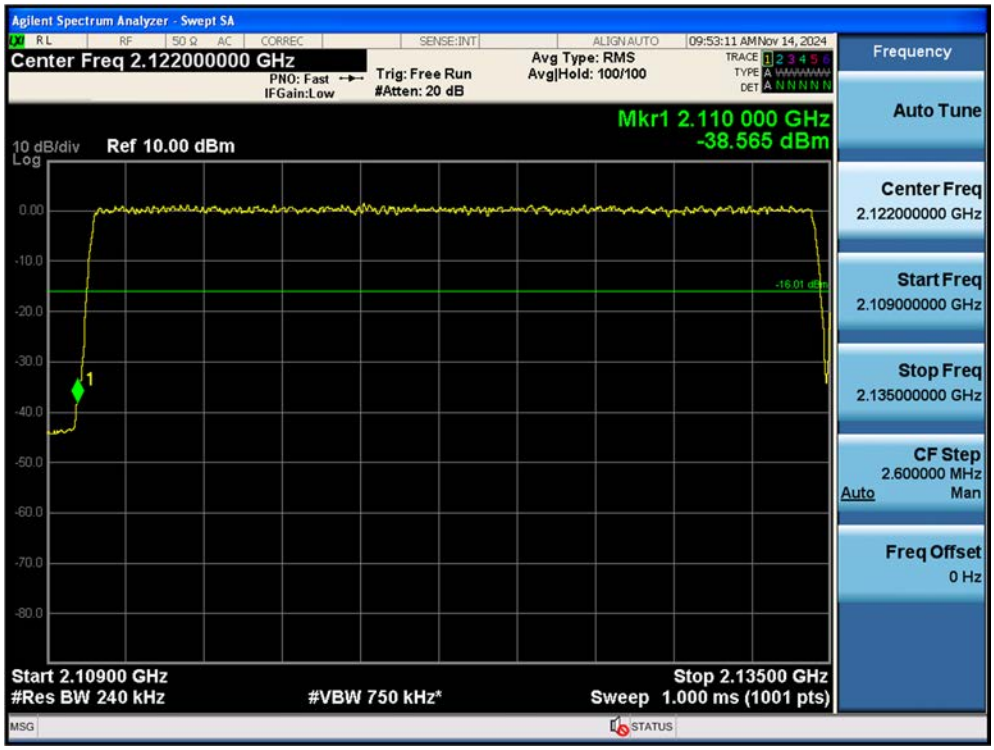
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Low / Contiguous



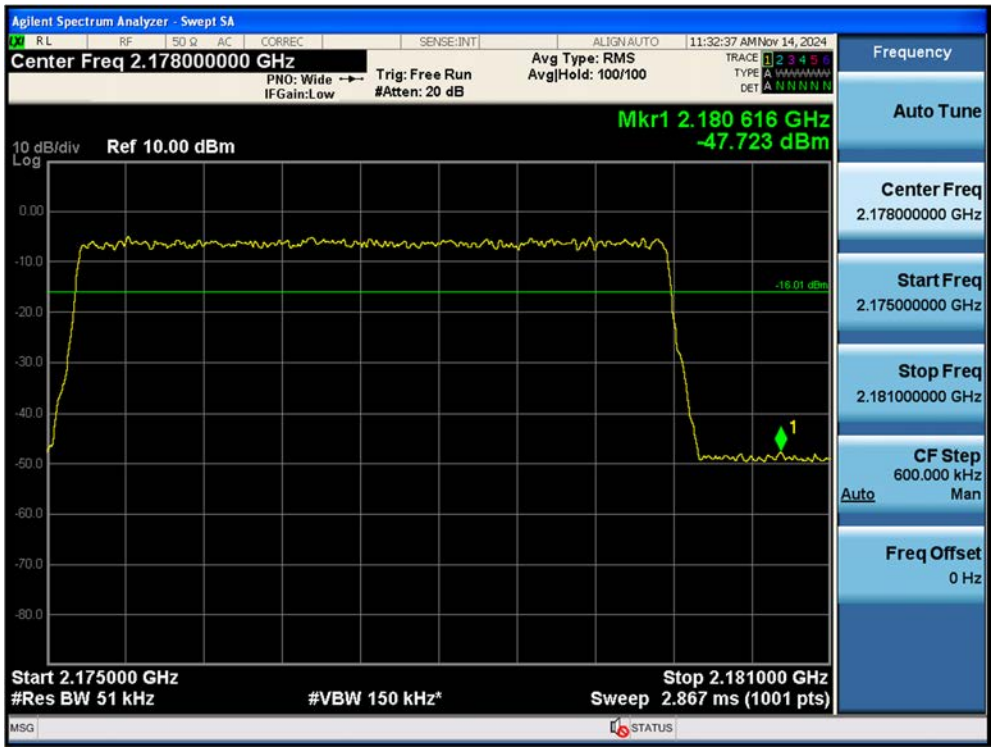

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 64QAM / High / Contiguous



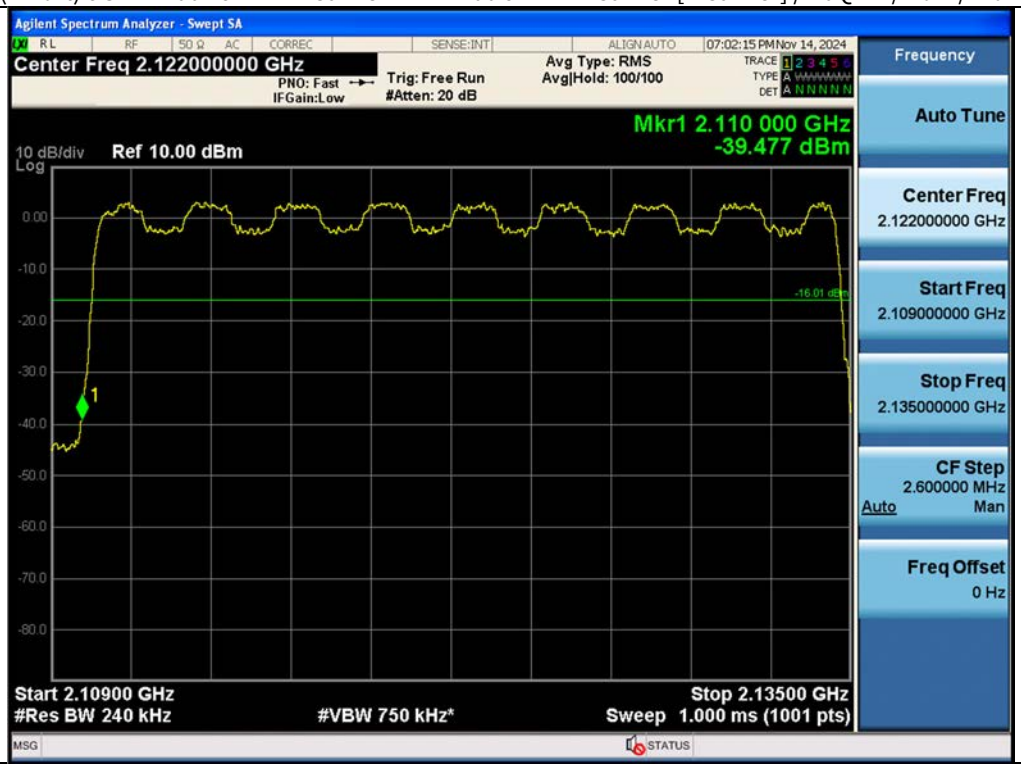
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / QPSK / Low / Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 64QAM / High / Contiguous

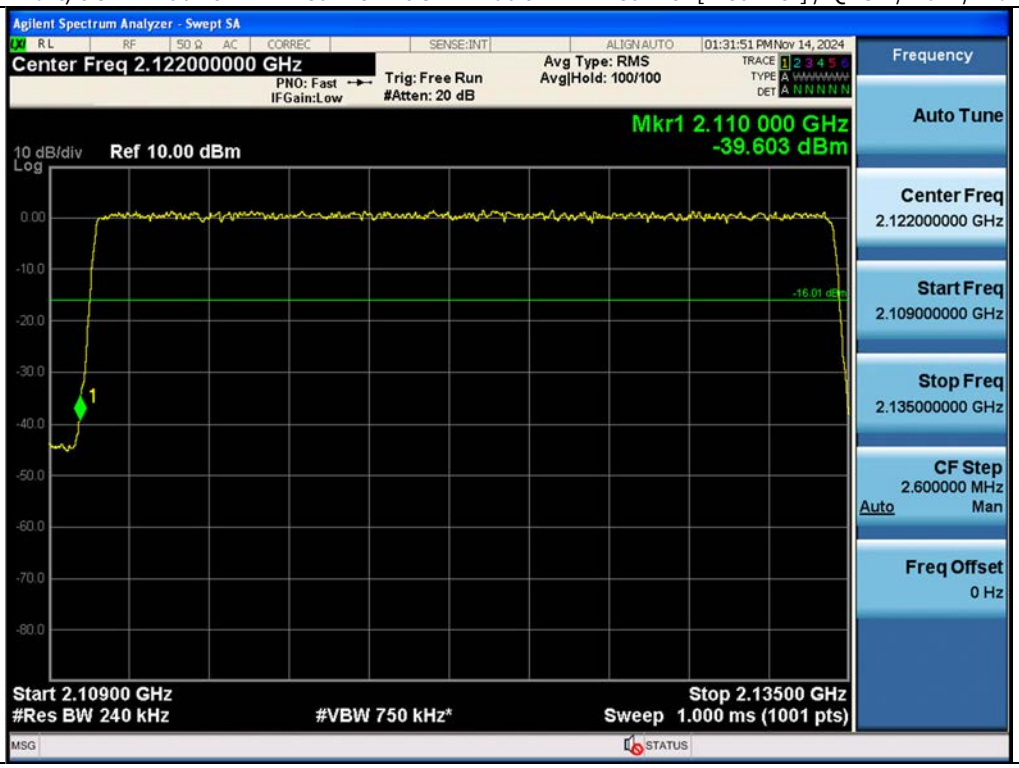


Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / Low / Non-Contiguous

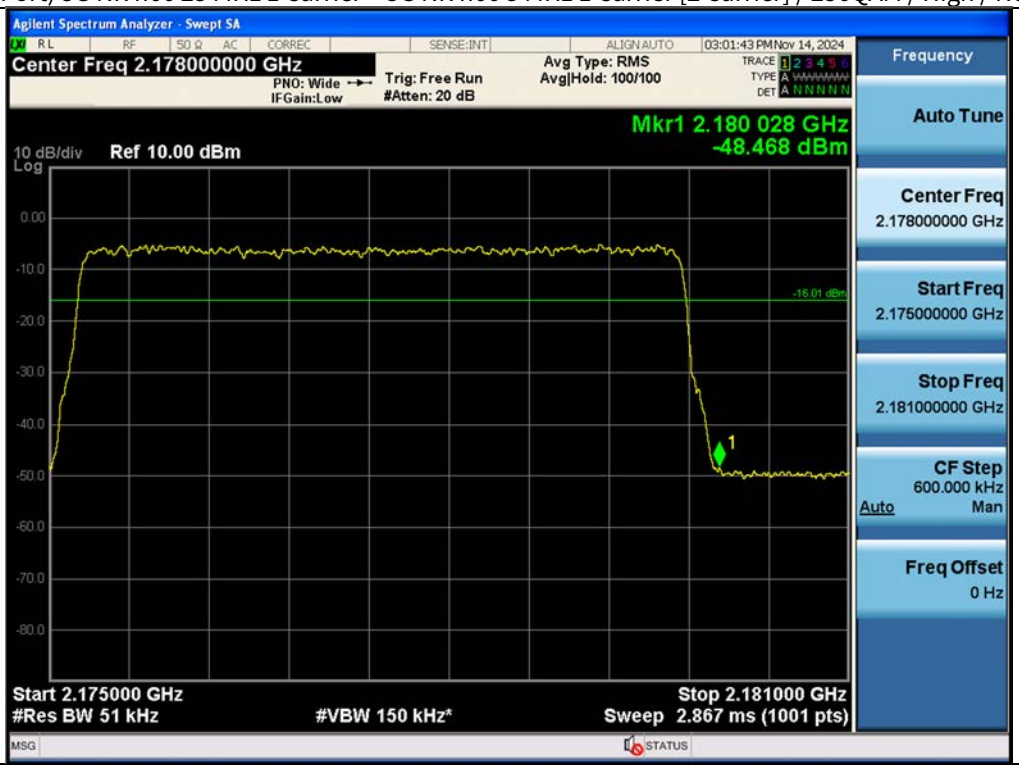



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 16QAM / High / Non-Contiguous

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / QPSK / Low / Non-Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 256QAM / High / Non-Contiguous



## 5.5. SPURIOUS UNWANTED EMISSIONS

**Test Requirements:**

**§ 2.1051 Measurements required: Spurious emissions at antenna terminals.**

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

**§ 27.53 Emission limits.**

(h) AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 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 log10 (P) dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. 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. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

**Test Procedures:**

The measurement is performed in accordance with Section 5.7.4 of ANSI C63.26.

**5.7.4 Spurious unwanted emission measurements**

a) Set the spectrum analyzer start frequency to the lowest frequency generated by the EUT, without going below 9 kHz, and the stop frequency to the lower frequency covered by the measurements previously performed in 5.7.3. As an alternative, the stop frequency can be set to the value specified in 5.1.1, depending on the EUT operating range, if the resulting plot can clearly demonstrate compliance for all frequencies not addressed by the out-of-band emissions measurements performed as per 5.7.3.

b) When using an average power (rms) detector, ensure that the number of points in the sweep ≥ 2 × (span /

RBW). This may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the spectrum analyzer capabilities. This requirement does not apply to peak-detected power measurements. When average power is specified by the applicable regulation, a peak-detector can be utilized for preliminary measurements to accommodate wider frequency spans. Any emissions found in the preliminary measurement to exceed the applicable limit(s) shall be further examined using a power averaging (rms) detector with the minimum number of measurement points as defined above.

c) The sweep time should be set to auto-couple for performing peak-detector measurements. For measurements that use a power averaging (rms) detector, the sweep time shall be set as described for out-of-band emissions measurements in item d) of 5.7.3.

d) Identify and measure the Highest spurious emission levels in each frequency range. It is not necessary to re-measure the out-of-band emissions as a part of this test. Record the frequencies and amplitudes corresponding to the measured emissions and capture the data plots.

e) Repeat step b) through step d) for the upper spurious emission frequency range if not already captured by a wide span measurement performed as per the alternative provided in step a). The upper frequency for this measurement is defined in 5.1.1 as a function of the EUT operating range.

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

g) The test report shall include the data plots of the measuring instrument display and the measured data.

**Note:**

1. Due to MIMO operations, a correction has been added to the limit according to KDB 662911 D01 v02r01.
   - 2Tx MIMO correction: 10 log(NANT) = 10 log(2) = 3.01 dB // -13 dBm – 10*log (2) = -16.01 dBm
2. In some frequency ranges, the RBW was reduced to 0.1%, 1%, and 10% of the reference bandwidth for measuring out-of-band and unwanted spurious emissions levels. Therefore, the limit lines were compensated according to section 5.7.2 of ANSI C63.26-2015.

| Reduced RBW | 0.1 % | 1 % | 10 % |
|---|---|---|---|
| Limit line compensation | -30 dB | -20 dB | -10 dB |

3. The results of the Spurious Unwanted Emissions shown above the frequency measured values are very small and similar trend for each port, so we are attached only the worst case plot.

Test Results:

Tabular Data of RF Spurious Unwanted Emissions

(2 Port) 5G NR n66 25 MHz 1 Carrier

Test Result for Output Port 0

| Modulation | Channel | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| QPSK | Low | -21.177 | -28.047 | -33.712 | -31.826 | -37.069 | -33.944 | -23.747 |
| | Middle | -20.776 | -27.498 | -34.038 | -31.626 | -36.772 | -33.683 | -24.124 |
| | High | -21.034 | -27.646 | -34.280 | -31.844 | -34.807 | -33.767 | -23.729 |
| 16QAM | Low | -22.894 | -27.818 | -33.845 | -31.762 | -37.079 | -33.954 | -24.213 |
| | Middle | -21.491 | -27.851 | -33.476 | -31.938 | -37.074 | -33.762 | -23.961 |
| | High | -19.697 | -27.939 | -34.257 | -31.730 | -34.946 | -33.610 | -23.826 |
| 64QAM | Low | -21.204 | -27.439 | -33.272 | -31.705 | -36.893 | -34.012 | -24.070 |
| | Middle | -21.739 | -27.379 | -33.812 | -31.791 | -36.775 | -33.905 | -23.920 |
| | High | -22.565 | -28.230 | -33.891 | -31.907 | -35.067 | -33.754 | -23.856 |
| 256QAM | Low | -22.129 | -27.217 | -33.928 | -31.781 | -36.858 | -33.692 | -24.014 |
| | Middle | -22.025 | -28.204 | -34.049 | -31.769 | -36.928 | -33.706 | -24.074 |
| | High | -20.315 | -27.630 | -34.233 | -31.821 | -35.344 | -33.720 | -24.050 |

Test Result for Output Port 1

| Modulation | Channel | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| QPSK | Low | -20.950 | -26.563 | -34.103 | -31.533 | -36.754 | -33.582 | -24.315 |
| | Middle | -18.374 | -26.727 | -33.383 | -31.568 | -36.540 | -33.286 | -24.223 |
| | High | -22.206 | -26.814 | -33.729 | -31.460 | -34.554 | -33.714 | -24.322 |
| 16QAM | Low | -18.069 | -27.539 | -33.936 | -31.394 | -36.658 | -33.806 | -24.172 |
| | Middle | -21.123 | -27.295 | -33.892 | -31.480 | -36.369 | -33.663 | -23.982 |
| | High | -19.203 | -27.666 | -33.744 | -31.649 | -34.220 | -33.649 | -23.927 |
| 64QAM | Low | -18.619 | -25.703 | -33.908 | -31.354 | -36.644 | -33.573 | -24.254 |
| | Middle | -21.320 | -26.142 | -33.666 | -31.462 | -36.622 | -33.648 | -24.164 |
| | High | -21.601 | -26.788 | -33.677 | -31.560 | -34.488 | -33.600 | -24.268 |
| 256QAM | Low | -18.248 | -27.152 | -33.177 | -31.246 | -36.400 | -33.527 | -24.190 |
| | Middle | -21.723 | -27.679 | -33.513 | -31.521 | -36.612 | -33.806 | -24.172 |
| | High | -20.271 | -24.991 | -34.012 | -31.415 | -34.794 | -33.275 | -23.902 |

Tabular Data of RF Contiguous Spurious Unwanted Emissions

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

Test Result for Output Port 0

| Modulation | Channel | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| QPSK | Low | -21.445 | -26.953 | -33.916 | -31.630 | -36.634 | -33.828 | -24.048 |
| | Middle | -21.193 | -29.228 | -34.253 | -31.791 | -36.921 | -33.665 | -24.217 |
| | High | -19.916 | -28.264 | -34.303 | -31.915 | -35.541 | -33.883 | -23.968 |
| 16QAM | Low | -20.169 | -27.463 | -34.043 | -31.614 | -36.979 | -33.863 | -24.079 |
| | Middle | -20.553 | -27.678 | -33.828 | -31.802 | -36.664 | -33.869 | -23.970 |
| | High | -20.450 | -26.605 | -32.611 | -31.878 | -35.104 | -34.007 | -23.948 |
| 64QAM | Low | -20.577 | -27.810 | -33.742 | -31.502 | -36.885 | -33.815 | -24.178 |
| | Middle | -20.833 | -26.708 | -33.397 | -31.712 | -36.662 | -33.655 | -24.151 |
| | High | -20.357 | -27.856 | -34.186 | -31.732 | -35.603 | -34.055 | -24.064 |
| 256QAM | Low | -20.609 | -27.481 | -33.987 | -31.755 | -37.036 | -33.871 | -23.788 |
| | Middle | -20.896 | -27.613 | -33.853 | -31.812 | -36.707 | -33.846 | -23.784 |
| | High | -22.449 | -27.844 | -32.596 | -31.886 | -35.590 | -33.764 | -23.980 |

Test Result for Output Port 1

| Modulation | Channel | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| QPSK | Low | -19.527 | -27.345 | -33.517 | -31.367 | -36.538 | -33.937 | -24.292 |
| | Middle | -20.720 | -25.961 | -33.541 | -31.580 | -36.696 | -33.530 | -24.159 |
| | High | -21.386 | -27.655 | -33.843 | -31.519 | -35.019 | -33.584 | -24.151 |
| 16QAM | Low | -20.655 | -27.460 | -34.104 | -31.382 | -36.253 | -33.580 | -24.286 |
| | Middle | -20.326 | -27.232 | -33.378 | -31.286 | -36.457 | -33.417 | -24.411 |
| | High | -20.795 | -26.602 | -34.043 | -31.692 | -34.926 | -33.716 | -24.284 |
| 64QAM | Low | -19.543 | -26.068 | -32.928 | -31.239 | -36.495 | -33.677 | -24.282 |
| | Middle | -19.052 | -27.356 | -34.140 | -31.495 | -36.517 | -33.572 | -24.145 |
| | High | -18.210 | -28.843 | -33.691 | -31.604 | -34.898 | -33.413 | -24.238 |
| 256QAM | Low | -19.397 | -25.975 | -33.852 | -31.396 | -36.114 | -33.604 | -24.356 |
| | Middle | -19.250 | -25.460 | -34.221 | -31.402 | -36.506 | -33.615 | -24.491 |
| | High | -20.854 | -29.196 | -34.184 | -31.618 | -34.850 | -33.654 | -24.558 |

(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

Test Result for Output Port 0

| Modulation | Channel | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| QPSK | Low | -20.875 | -28.369 | -34.075 | -31.463 | -36.951 | -33.986 | -23.933 |
| | Middle | -20.174 | -26.613 | -33.569 | -31.958 | -37.027 | -34.048 | -24.203 |
| | High | -22.033 | -28.852 | -33.451 | -31.817 | -35.148 | -33.738 | -23.994 |
| 16QAM | Low | -19.818 | -25.314 | -34.774 | -31.656 | -36.761 | -33.959 | -24.319 |
| | Middle | -22.368 | -27.205 | -34.323 | -31.895 | -36.593 | -33.789 | -24.323 |
| | High | -21.705 | -26.415 | -34.511 | -31.889 | -35.122 | -33.911 | -23.851 |
| 64QAM | Low | -21.850 | -28.257 | -33.725 | -31.688 | -36.842 | -33.924 | -24.194 |
| | Middle | -22.199 | -27.753 | -34.085 | -31.860 | -36.824 | -33.800 | -24.147 |
| | High | -21.260 | -28.390 | -33.539 | -31.900 | -35.049 | -33.880 | -24.173 |
| 256QAM | Low | -21.375 | -28.670 | -33.287 | -31.760 | -37.056 | -34.113 | -24.235 |
| | Middle | -19.296 | -27.763 | -33.140 | -31.867 | -37.017 | -33.843 | -24.046 |
| | High | -20.836 | -29.087 | -34.244 | -31.706 | -35.685 | -33.893 | -24.298 |

Test Result for Output Port 1

| Modulation | Channel | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| QPSK | Low | -18.936 | -26.616 | -33.688 | -31.320 | -36.645 | -33.652 | -24.171 |
| | Middle | -19.602 | -26.905 | -33.854 | -31.678 | -36.683 | -33.338 | -24.241 |
| | High | -18.561 | -27.896 | -33.249 | -31.533 | -34.670 | -33.792 | -24.449 |
| 16QAM | Low | -18.638 | -27.362 | -34.289 | -31.337 | -36.711 | -33.630 | -24.334 |
| | Middle | -19.969 | -28.209 | -33.140 | -31.695 | -36.755 | -33.373 | -24.258 |
| | High | -19.488 | -26.995 | -33.263 | -31.451 | -34.929 | -33.514 | -24.189 |
| 64QAM | Low | -17.719 | -26.029 | -33.759 | -31.359 | -36.491 | -33.584 | -24.418 |
| | Middle | -21.252 | -29.163 | -33.457 | -31.696 | -36.631 | -33.598 | -24.346 |
| | High | -20.181 | -24.838 | -33.485 | -31.638 | -34.774 | -33.698 | -24.334 |
| 256QAM | Low | -18.415 | -26.741 | -33.542 | -31.533 | -36.730 | -33.647 | -24.410 |
| | Middle | -20.125 | -27.053 | -34.324 | -31.474 | -36.466 | -33.645 | -24.487 |
| | High | -21.046 | -26.663 | -34.138 | -31.538 | -34.928 | -33.535 | -24.064 |

Tabular Data of RF Non-Contiguous Spurious Unwanted Emissions

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]

| Port | Modulation | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| 0 | QPSK | -20.569 | -28.185 | -33.503 | -31.769 | -36.213 | -33.650 | -24.107 |
| | 16QAM | -22.321 | -25.925 | -34.312 | -31.591 | -36.592 | -33.614 | -23.927 |
| | 64QAM | -21.746 | -25.529 | -34.046 | -31.739 | -36.587 | -33.984 | -24.022 |
| | 256QAM | -20.520 | -27.438 | -33.992 | -31.672 | -36.374 | -33.839 | -23.941 |
| 1 | QPSK | -19.622 | -28.113 | -33.253 | -31.365 | -35.935 | -33.577 | -24.385 |
| | 16QAM | -20.080 | -25.973 | -33.760 | -31.290 | -36.001 | -33.739 | -24.333 |
| | 64QAM | -20.215 | -24.177 | -32.894 | -31.642 | -35.965 | -33.424 | -24.154 |
| | 256QAM | -18.839 | -28.241 | -34.002 | -31.450 | -36.094 | -33.701 | -24.101 |

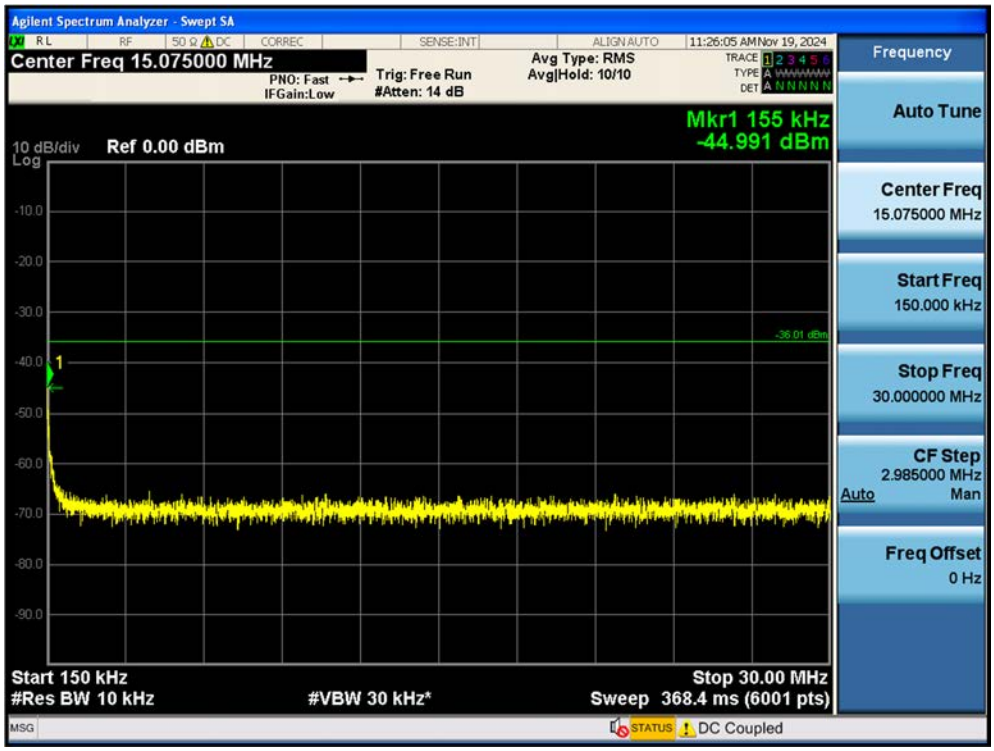
(2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier]

| Port | Modulation | Measured Level (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9 kHz ~ 150 kHz | 150 kHz ~ 30 MHz | 30 MHz ~ Low Edge - 100 MHz | Low Edge - 100 MHz ~ Low Edge | High Edge ~ High Edge + 100 MHz | High Edge + 100 MHz ~ 10 GHz | 10 GHz ~ 26.5 GHz |
| 0 | QPSK | -20.310 | -28.674 | -34.097 | -31.830 | -36.532 | -33.862 | -24.033 |
| | 16QAM | -21.917 | -26.571 | -34.073 | -31.524 | -36.803 | -33.821 | -23.910 |
| | 64QAM | -22.607 | -29.493 | -33.970 | -31.730 | -36.369 | -33.651 | -23.894 |
| | 256QAM | -22.786 | -28.994 | -33.792 | -31.809 | -36.692 | -33.917 | -23.933 |
| 1 | QPSK | -18.341 | -27.759 | -33.901 | -31.367 | -36.442 | -33.672 | -24.295 |
| | 16QAM | -21.468 | -25.182 | -33.358 | -31.301 | -36.204 | -33.650 | -24.343 |
| | 64QAM | -19.652 | -25.939 | -33.738 | -31.568 | -35.983 | -33.527 | -24.122 |
| | 256QAM | -19.208 | -25.151 | -33.905 | -31.363 | -36.249 | -33.519 | -24.316 |

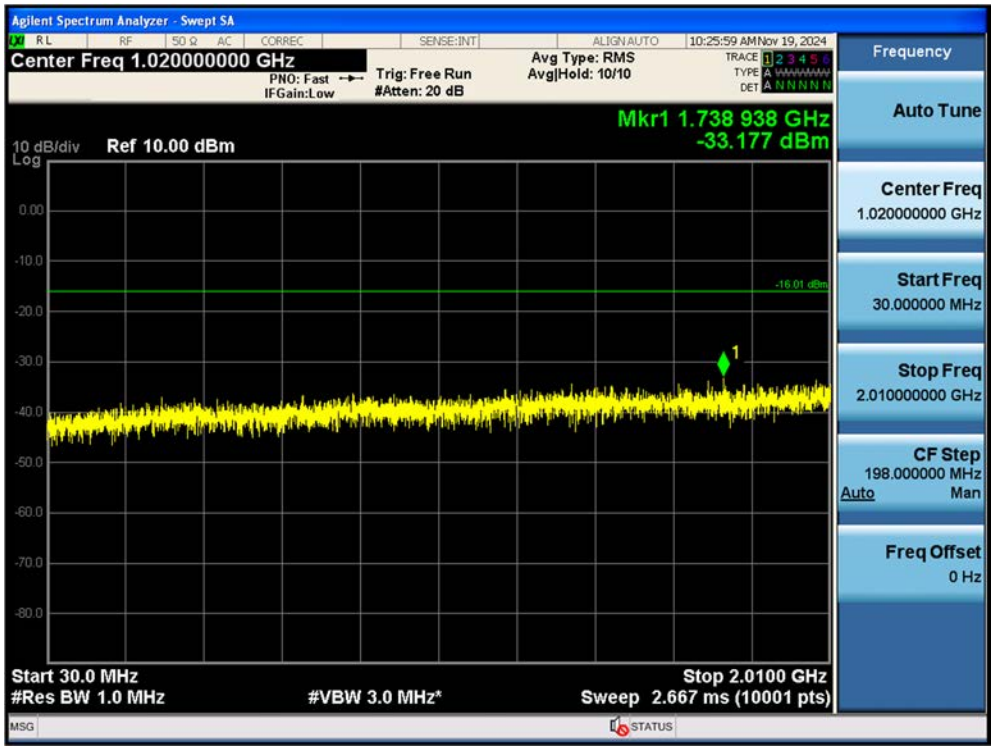
Plot Data of Spurious Unwanted Emissions

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 9 kHz ~ 150 kHz / 16QAM / Low

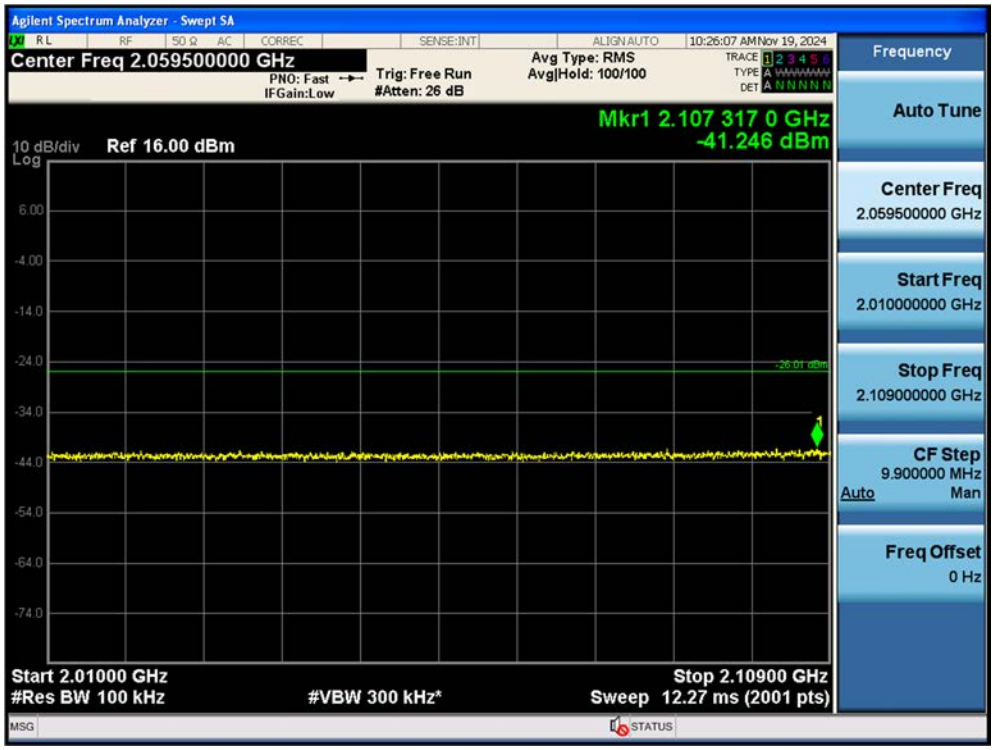

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 150 kHz ~ 30 MHz / 256QAM / High



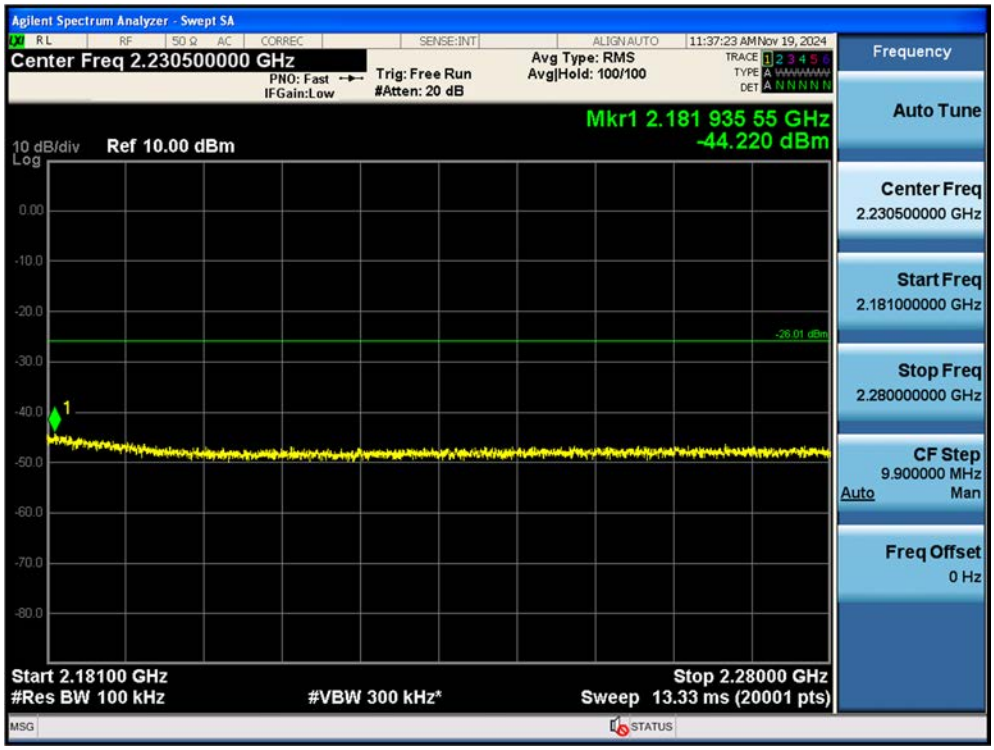
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 30 MHz ~ Low Edge - 100 MHz / 256QAM / Low




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / Low Edge - 100 MHz ~ Low Edge / 256QAM / Low



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / High Edge ~ High Edge + 100 MHz / 16QAM / High

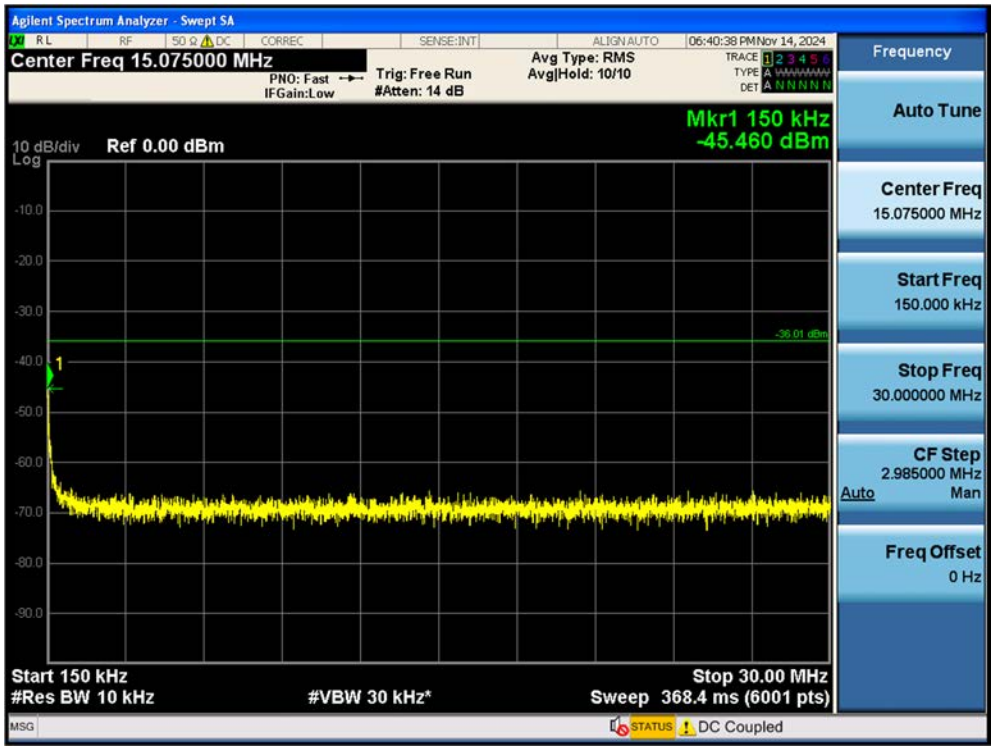



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier / High Edge + 100 MHz ~ 10 GHz / 256QAM / High

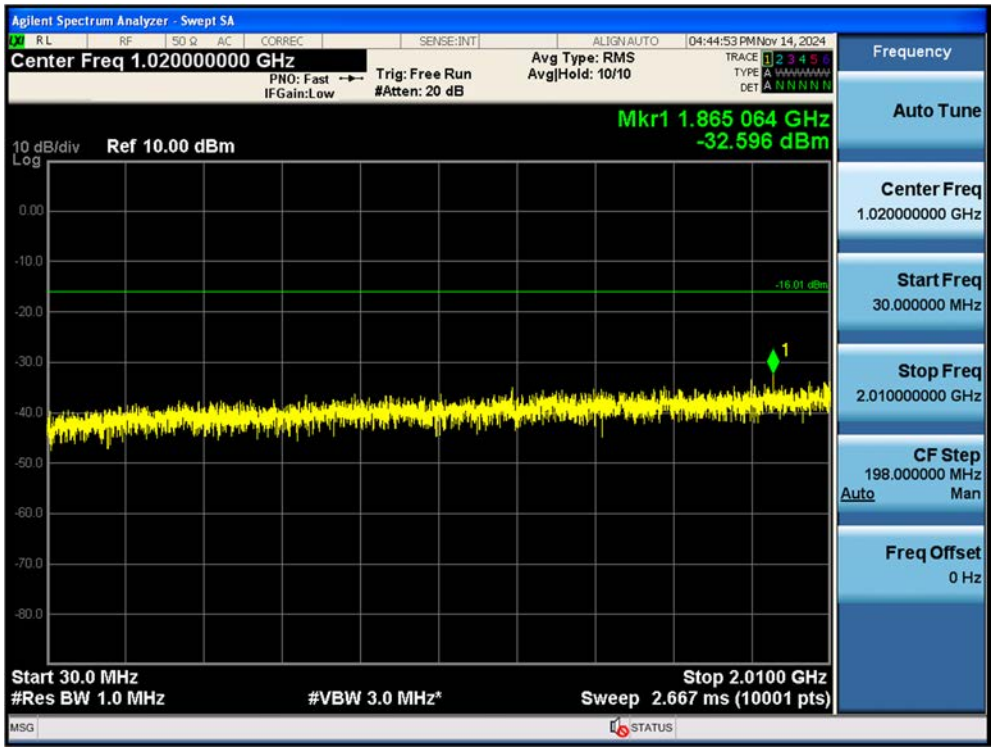
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier / 10 GHz ~ 26.5 GHz / QPSK / High

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 9 kHz ~ 150 kHz / 64QAM / High / Contiguous

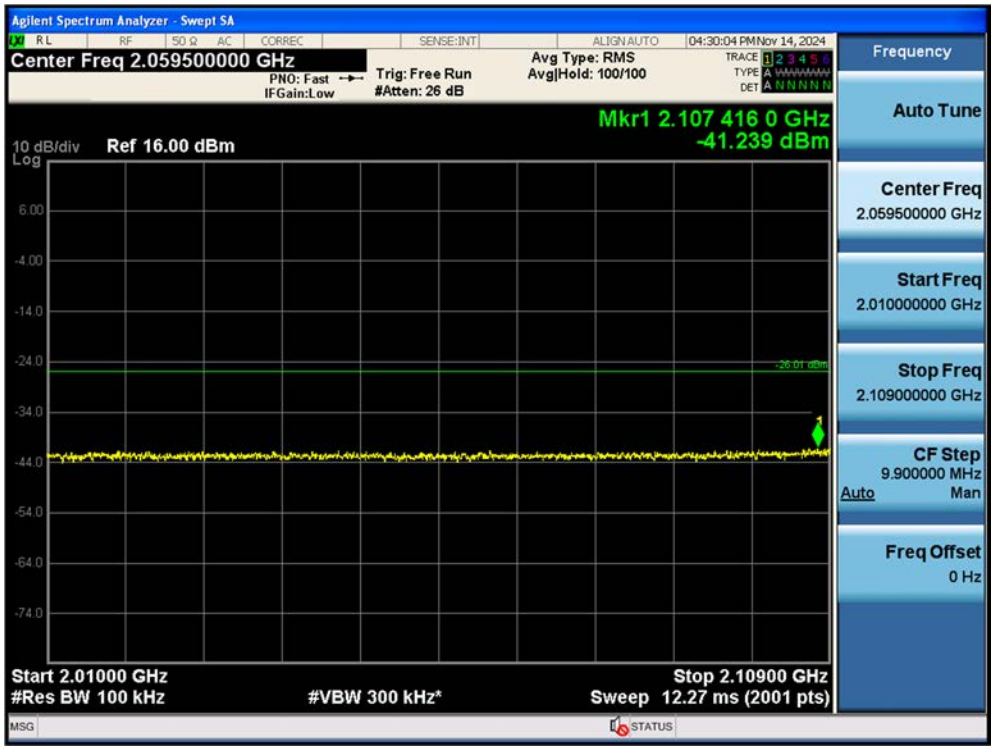

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 150 kHz ~ 30 MHz / 256QAM / Middle / Contiguous



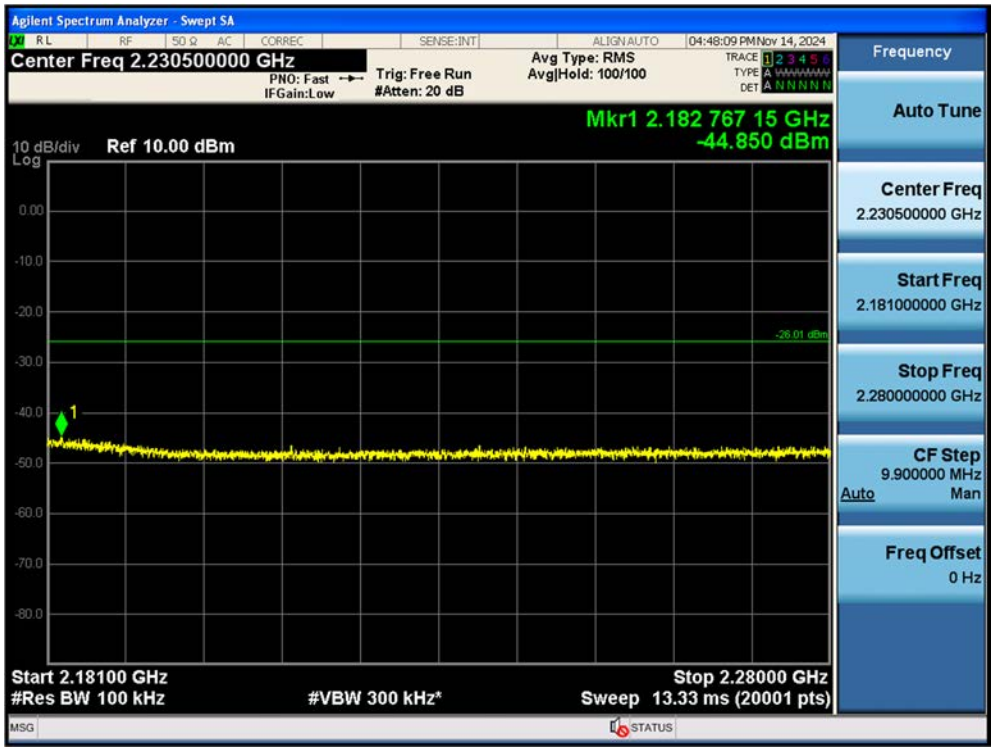
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 30 MHz ~ Low Edge-100 / 256QAM / High / Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / Low Edge-100 ~ Low Edge / 64QAM / Low / Contiguous



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / High Edge ~ High Edge+100 / 256QAM / High / Contiguous

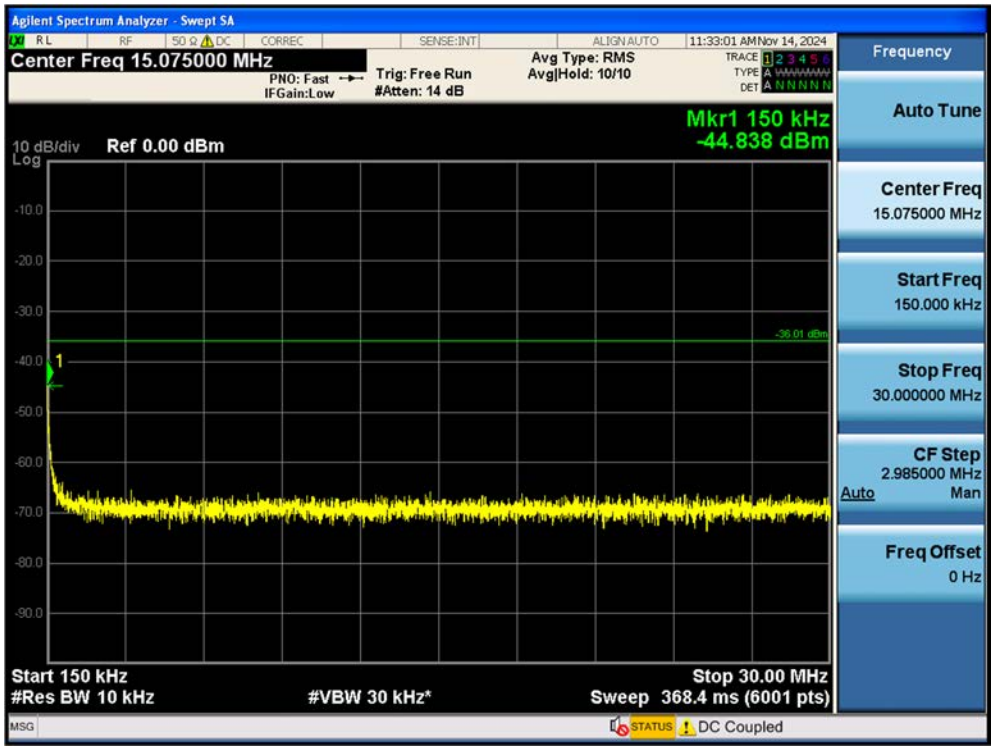



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / High Edge+100 ~ 10 GHz / 64QAM / High / Contiguous

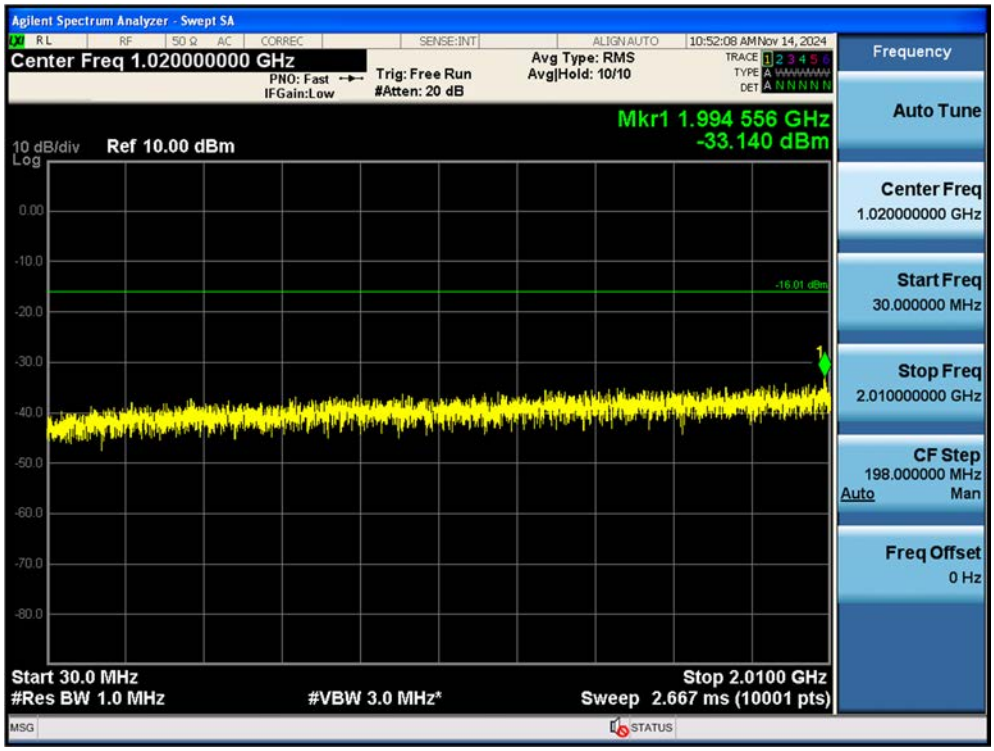
| Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 10 GHz ~ 26.5 GHz / 256QAM / Middle / Contiguous |
|---|
|  |

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 9 kHz ~ 150 kHz / 64QAM / Low / Contiguous

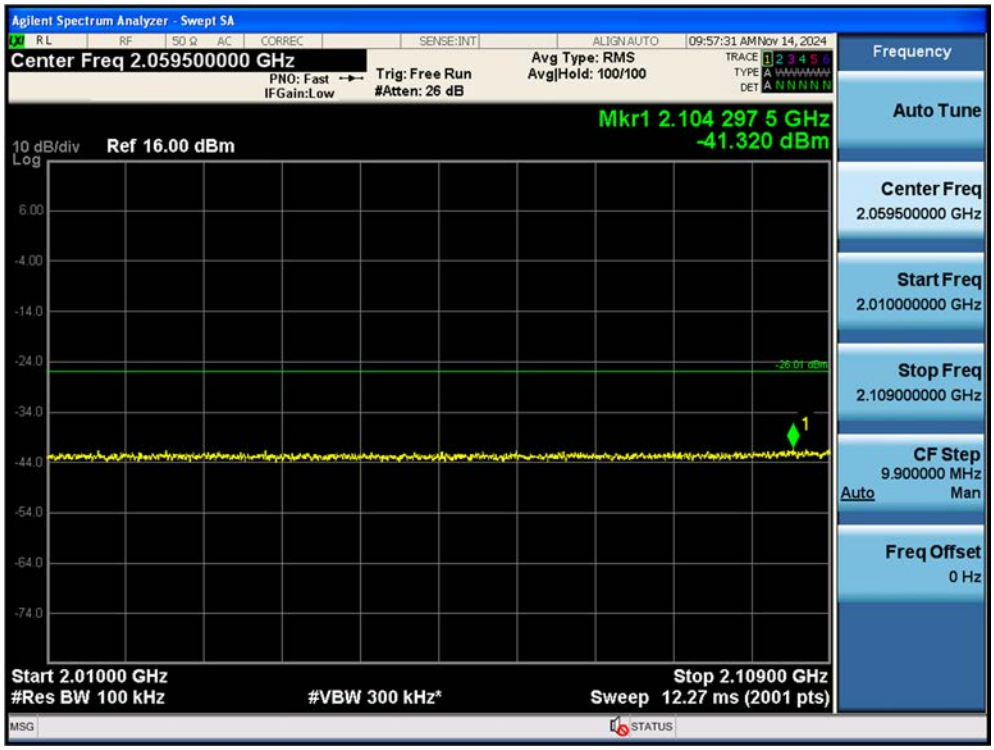

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 150 kHz ~ 30 MHz / 64QAM / High / Contiguous



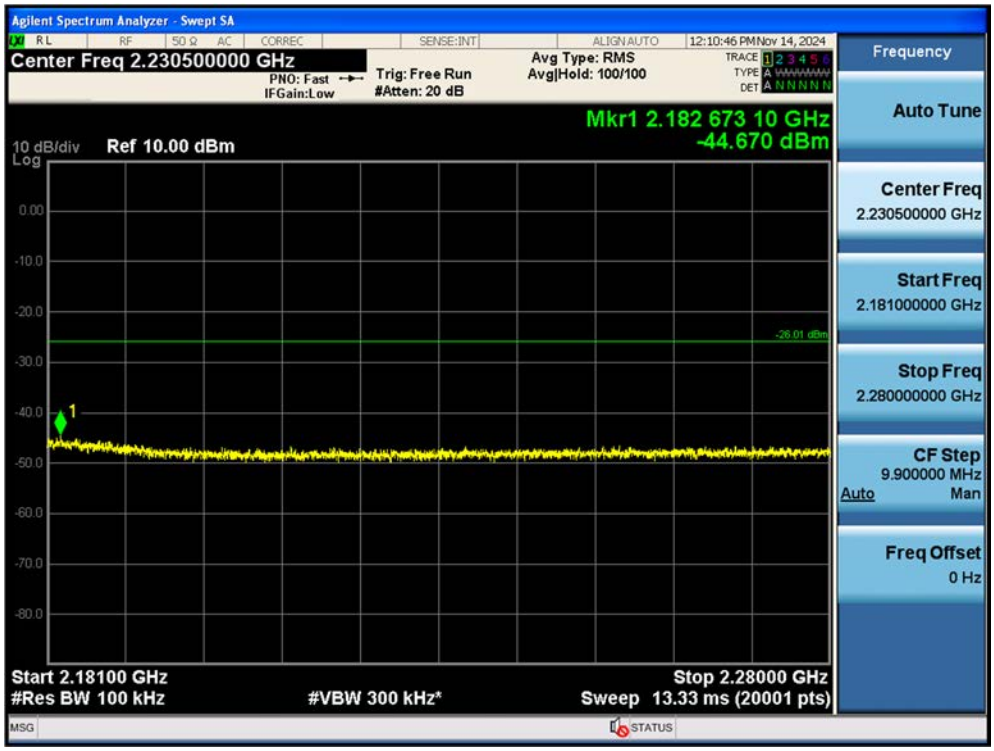
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 30 MHz ~ Low Edge-100 / 256QAM / Middle / Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / Low Edge-100 ~ Low Edge / QPSK / Low / Contiguous



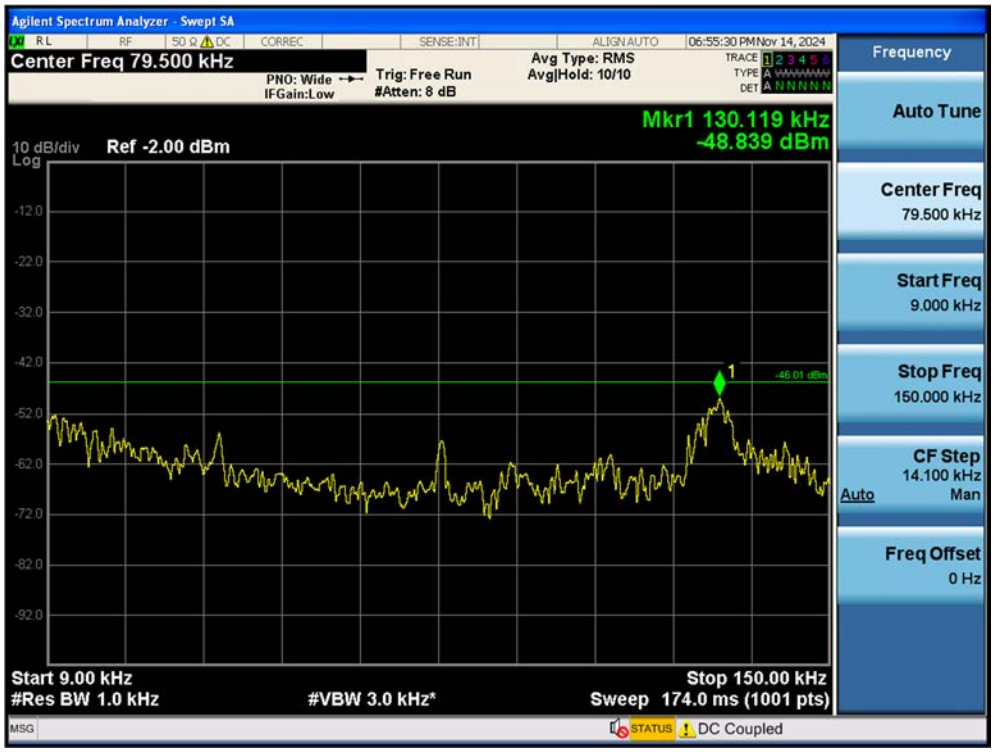
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / High Edge ~ High Edge+100 / QPSK / High / Contiguous



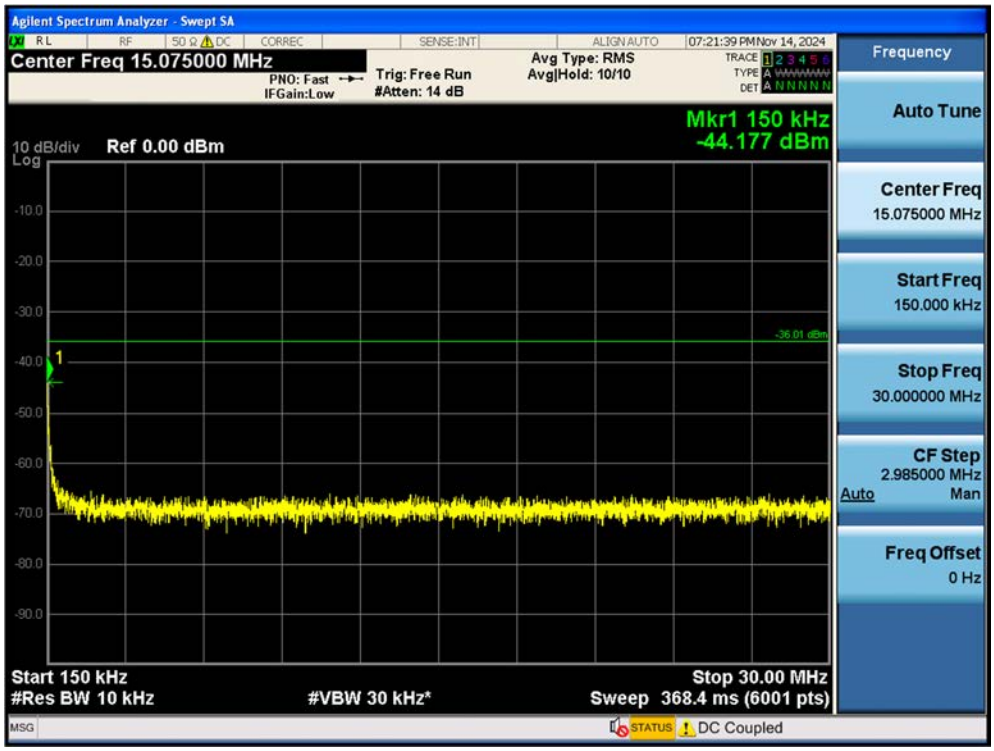

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / High Edge+100 ~ 10 GHz / QPSK / Middle / Contiguous

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 10 GHz ~ 26.5 GHz / 16QAM / High / Contiguous

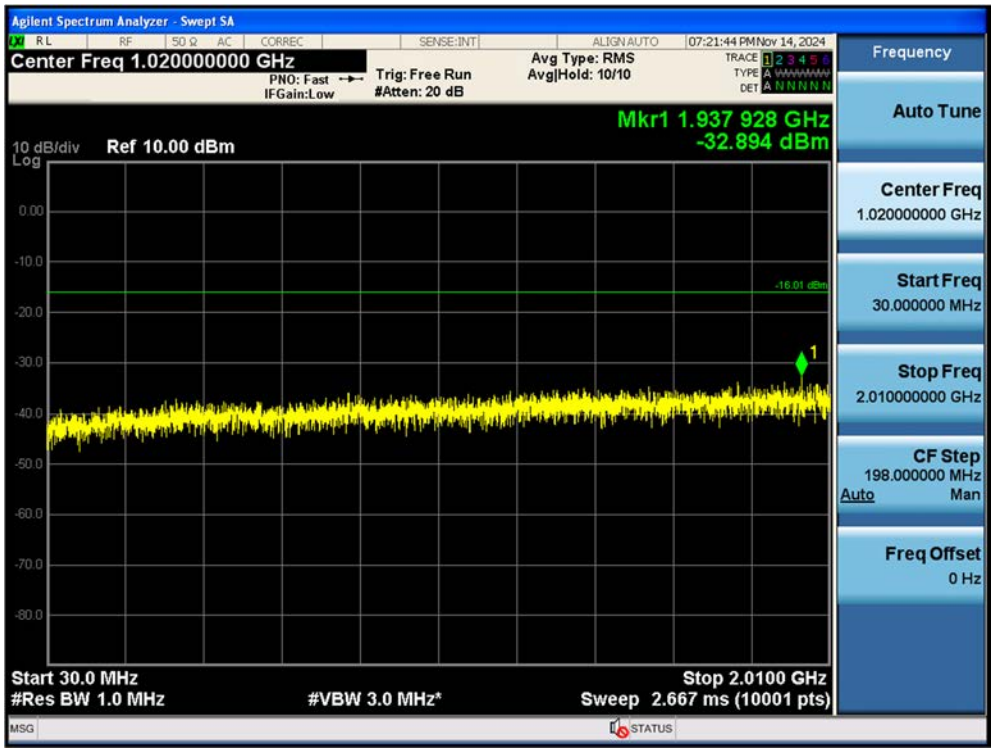
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 9 kHz ~ 150 kHz / 256QAM / Non-Contiguous



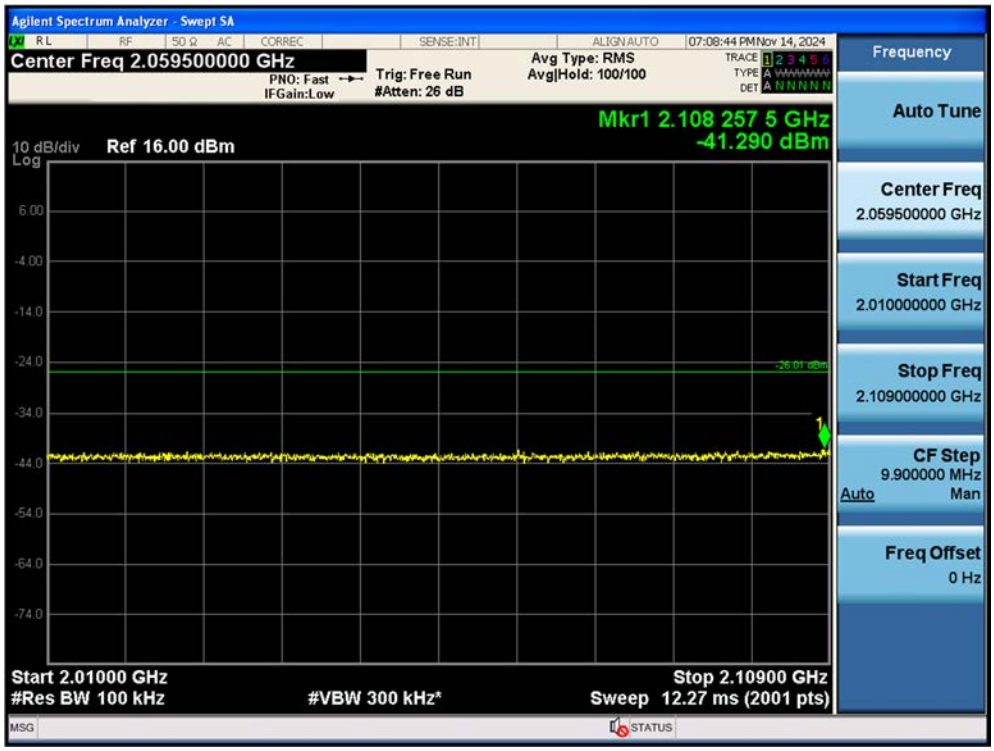

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 150 kHz ~ 30 MHz / 64QAM / Non-Contiguous



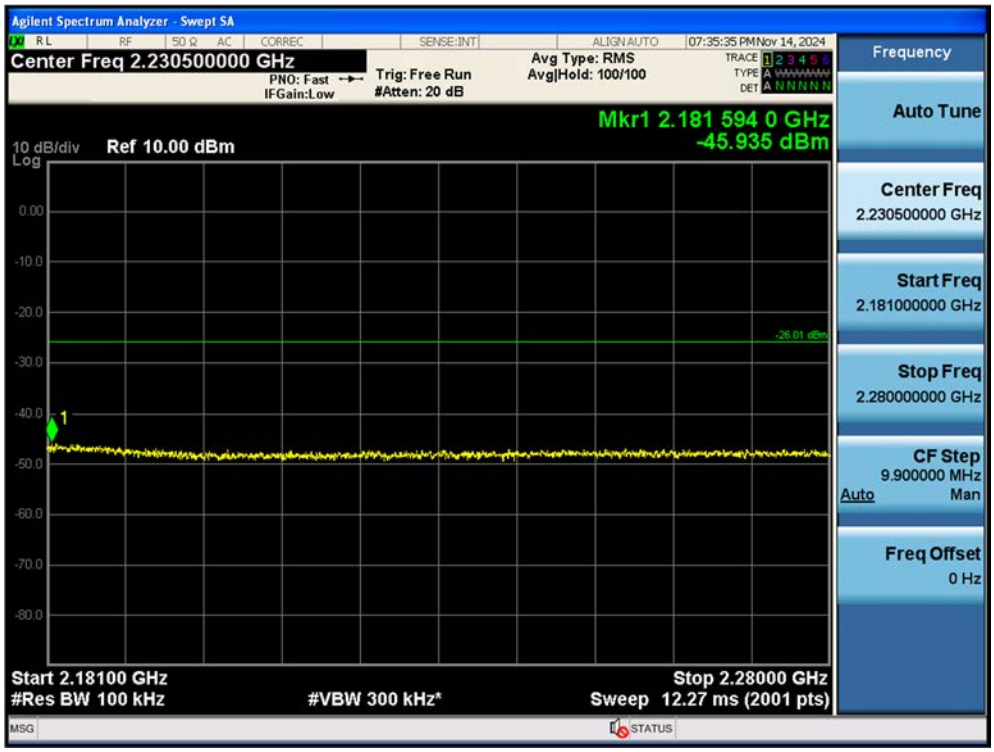
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 30 MHz ~ Low Edge-100 / 64QAM / Non-Contiguous



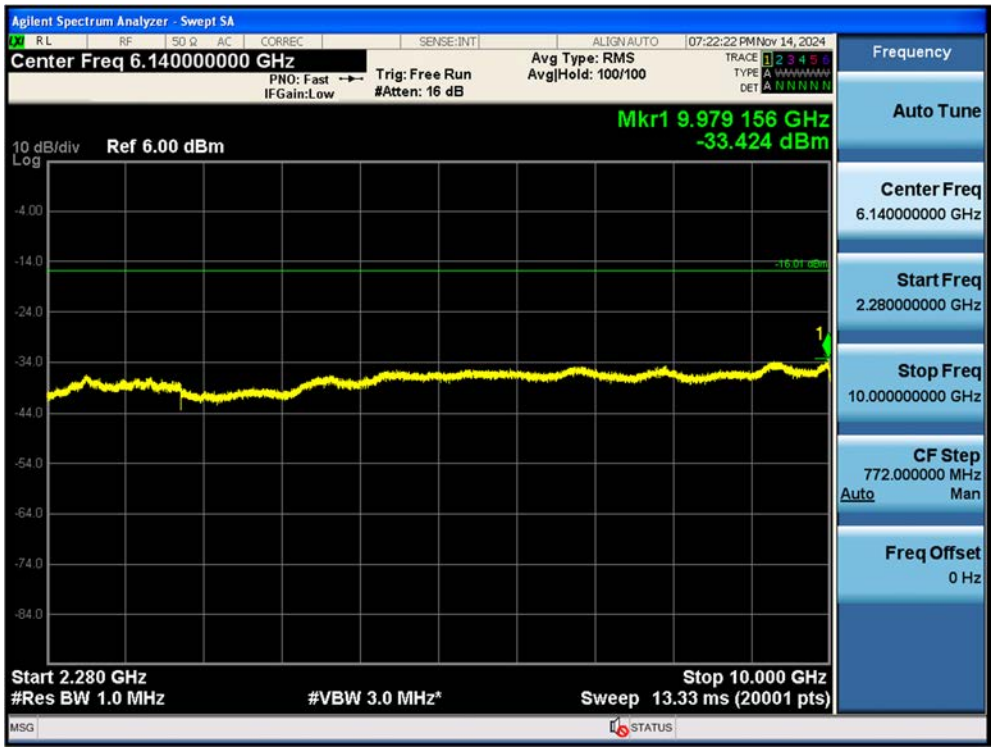

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / Low Edge-100 ~ Low Edge / 16QAM / Non-Contiguous



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / High Edge ~ High Edge+100 / QPSK / Non-Contiguous



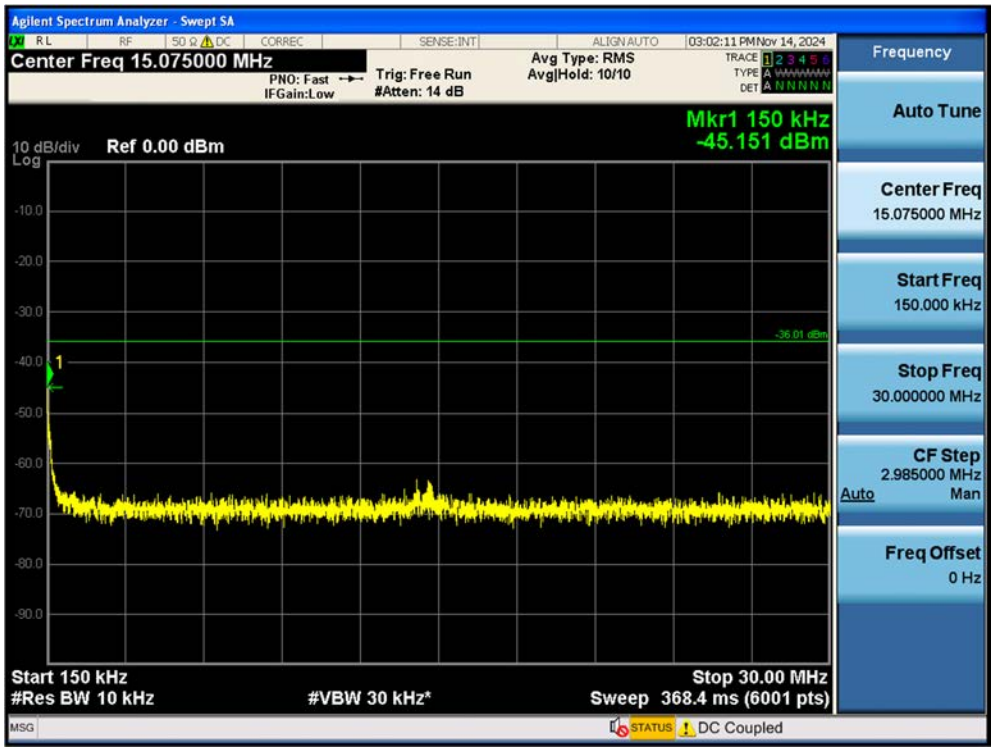

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / High Edge+100 ~ 10 GHz / 64QAM / Non-Contiguous



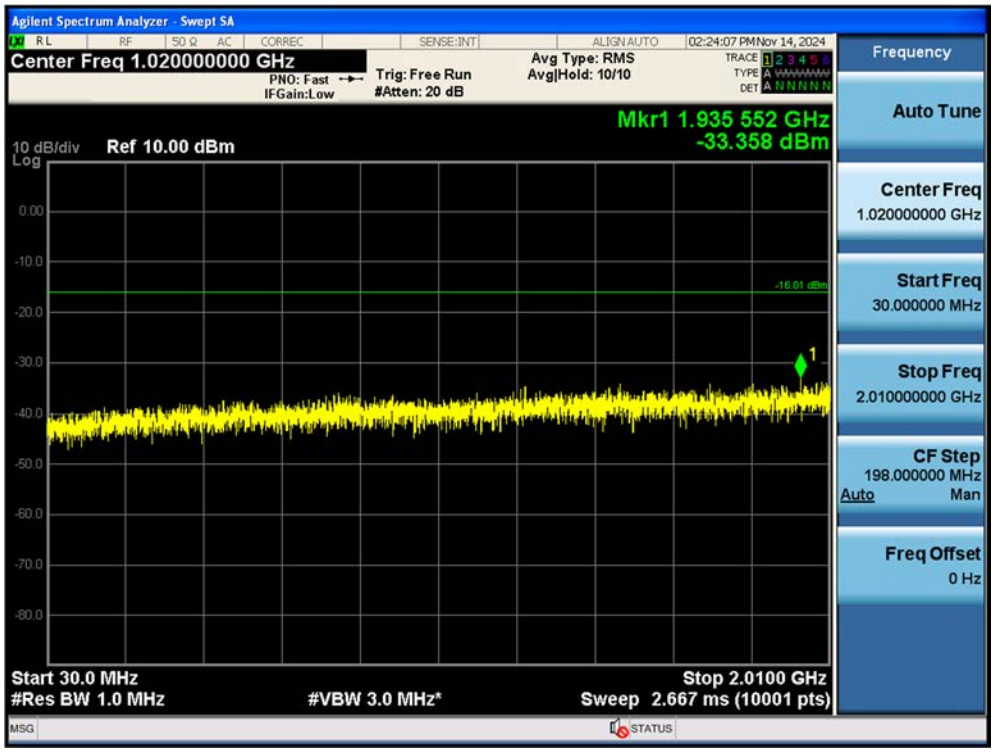
Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier] / 10 GHz ~ 26.5 GHz / 16QAM / Non-Contiguous

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 9 kHz ~ 150 kHz / QPSK / Non-Contiguous

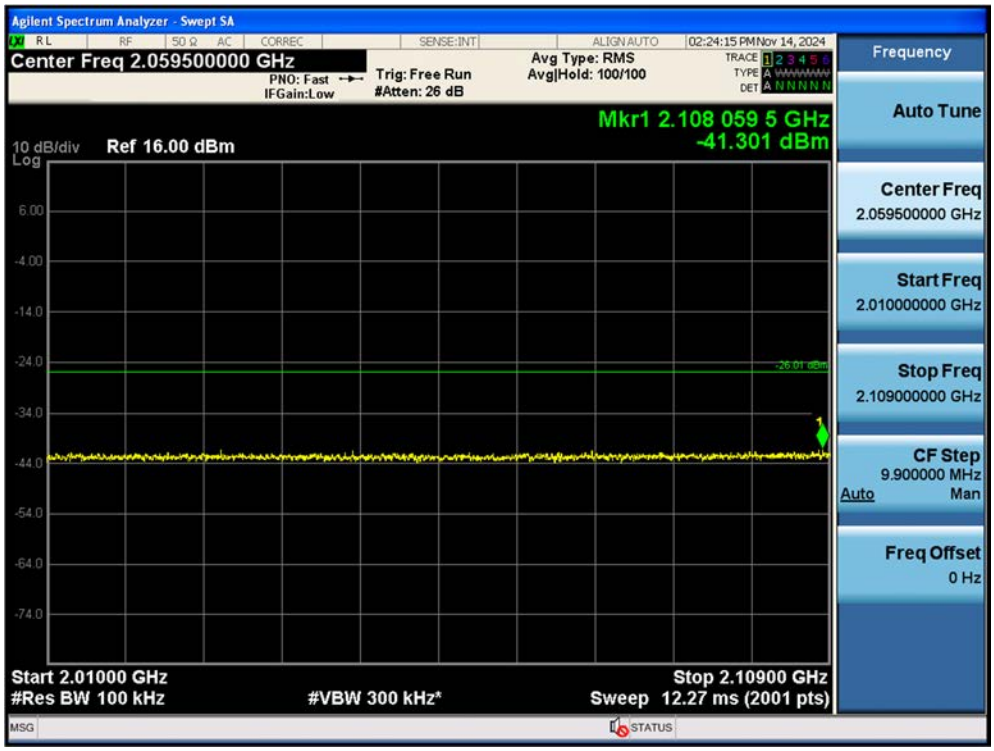

Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 150 kHz ~ 30 MHz / 256QAM / Non-Contiguous



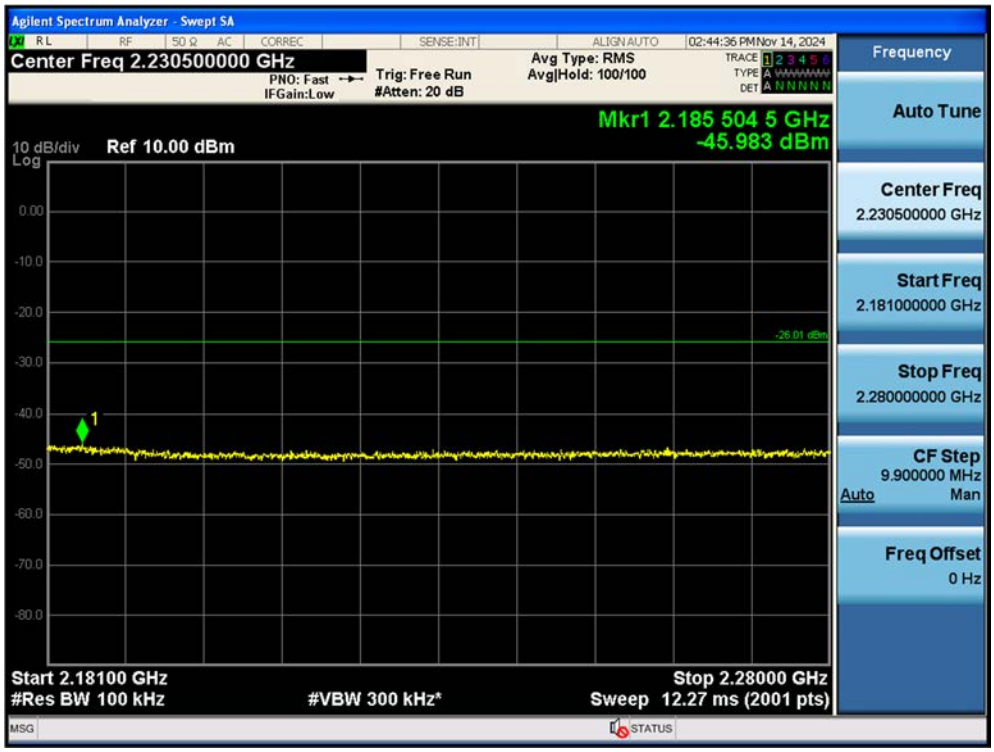
Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 30 MHz ~ Low Edge-100 / 16QAM / Non-Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / Low Edge-100 ~ Low Edge / 16QAM / Non-Contiguous



Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / High Edge ~ High Edge+100 / 64QAM / Non-Contiguous




Antenna 1 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / High Edge+100 ~ 10 GHz / 256QAM / Non-Contiguous

Antenna 0 / (2 Port) 5G NR n66 25 MHz 1 Carrier + 5G NR n66 5 MHz 1 Carrier [2 Carrier] / 10 GHz ~ 26.5 GHz / 64QAM / Non-Contiguous

## 5.6. RADIATED EMISSIONS

**Test Requirements:**

**§ 2.1053 Measurements required: Field strength of spurious radiation.**

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

**§ 27.53 Emission limits.**

(h) AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 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 log10 (P) dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. 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. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

**Test Procedures:**

The measurement is performed in accordance with Section 5.5.3.2 of ANSI C63.26.

a) Place the EUT in the center of the turntable. The EUT shall be configured to transmit into the standard non-radiating load (for measuring radiated spurious emissions), connected with cables of minimal length unless specified otherwise. If the EUT uses an adjustable antenna, the antenna shall be positioned to the length that produces the worst case emission at the fundamental operating frequency.

b) Each emission under consideration shall be evaluated:
   1) Raise and lower the measurement antenna in accordance 5.5.2, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.
   2) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.
   3) Return the turntable to the azimuth where the highest emission amplitude level was observed.
   4) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.
   5) Record the measured emission amplitude level and frequency using the appropriate RBW.

c) Repeat step b) for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.

d) ~ j) Omitted

k) Provide the complete measurement results as a part of the test report.

**Note:**

1. The results of the Radiated Emissions test shown above are measured at maximum power, and data values are attached only in the worst case.
2. We have done horizontal and vertical polarization in detecting antenna.
3. The amplitude of the spurious domain emission attenuated by more than 20 dB over the permissible value was not recorded according to ANSI C63.26, clause 5.1.1., c).
4. Measure distance = 3 m

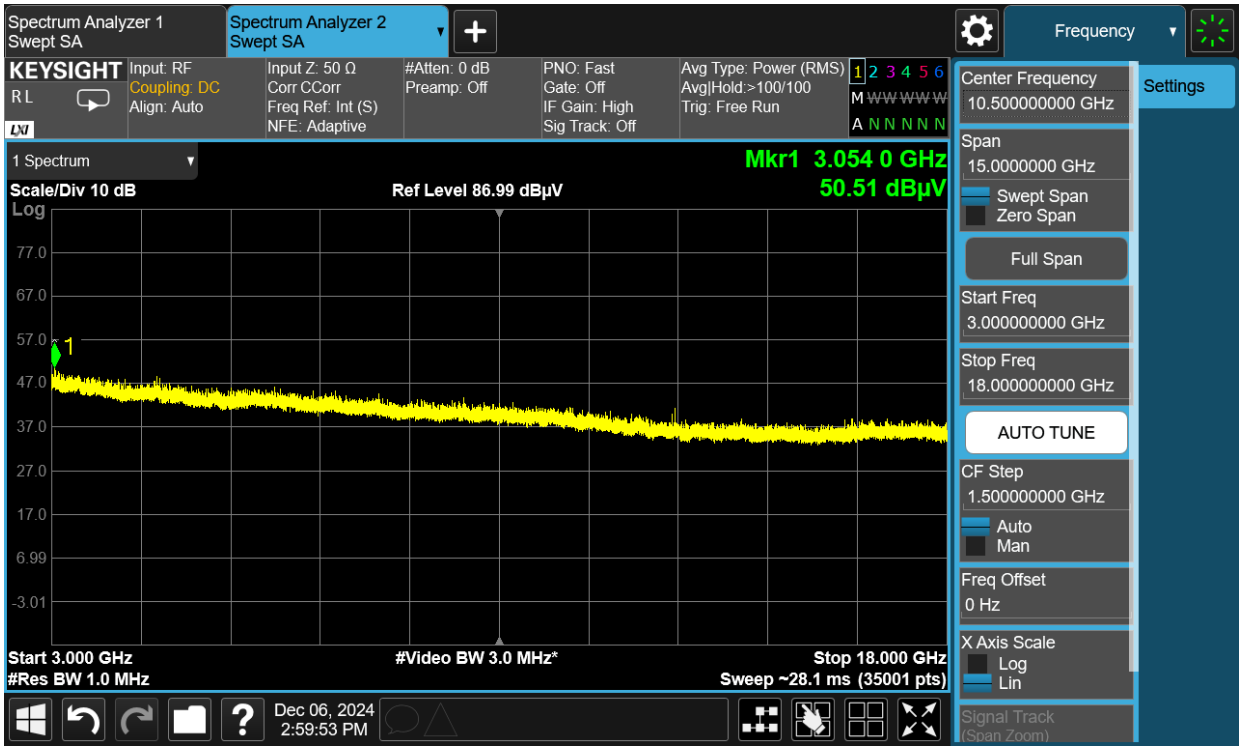
**Test Results:**

| Freq.(MHz) | Measured Level | Ant. Factor | A.G.+C.L.+H.P.F. | Pol. | Measured Power | Result |
|---|---|---|---|---|---|---|
| | [dBµV] | [dB/m] | [dB] | | [dBm] | [dBm/m] |
| No Critical Peaks Found. | | | | | | |

C.L.: Cable Loss / A.G.: Amp Gain / H.P.F.: High Pass Filter

**Plot data of Radiated Emissions**

(2 Port) 5G NR n66 25 MHz 1 Carrier + LTE B66 5 MHz 1 Carrier [2 Carrier]




**Note:** Only the worst case plots for Radiated Spurious Emissions.

## 5.7. FREQUENCY STABILITY

**Test Requirements:**

**§ 2.1055 Measurements required: Frequency stability.**

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From －30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

**§ 27.54 Frequency stability.**

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

**Test Procedures:**

The measurement is performed in accordance with Section 5.6.3, 5.6.4 and 5.6.5 of ANSI C63.26.

**5.6.3 Procedure for frequency stability testing**

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between －30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the －15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

### 5.6.4 Frequency stability over variations in temperature

a) Supply the EUT with a nominal 60 Hz ac voltage, dc voltage, or install a new or fully charged battery in the EUT.

b) If possible a dummy load should be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, the EUT should be placed in the center of the chamber with the antenna adjusted to the shortest length possible.

c) Turn on the EUT, and tune it to the center frequency of the operating band.

d) Couple the transmitter output to the measuring instrument through a suitable attenuator and coaxial cable. If connection to the EUT output is not possible, make the measurement by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away).
NOTE—An instrument that has an adequate level of accuracy as specified by the procuring or regulatory authority is the recommended measuring instrument.

e) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Adjust the detector bandwidth and span settings to achieve a resolution capable of accurate frequency measurements over the applicable frequency stability limits.

f) Turn the EUT off, and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

g) Set the temperature control on the chamber to the Highest temperature specified in the regulatory requirements for the type of device, and allow the oscillator heater and the chamber temperature to stabilize. Unless otherwise instructed by the regulatory authority, this temperature should be 50 °C.

h) While maintaining a constant temperature inside the environmental chamber, turn on the EUT and allow sufficient time for the EUT temperature to stabilize.

i) Measure the frequency.

j) Switch off the EUT, but do not switch off the oscillator heater.

k) Lower the chamber temperature to the next level that is required by the standard and allow the temperature inside the chamber to stabilize. Unless otherwise instructed by the regulators, this temperature step should be 10 °C.

l) Repeat step h) through step k) down to the lowest specified temperature. Unless otherwise instructed by the regulators, this temperature should be −30 °C. When the frequency stability limit is stated as being sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point shall be established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and Highest channel of operation shall be identified as $f_L$ and $f_H$ respectively. The worst-case frequency offset determined in the above methods shall be added or subtracted from the values of $f_L$ and $f_H$ and the resulting frequencies must remain within the band.

m) Omitted

### 5.6.5 Frequency stability when varying supply voltage

a) Couple the transmitter output to the measuring instrument through a suitable attenuator and coaxial cable. If connection to the EUT output is not possible make the measurement by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away)

b) Supply the EUT with nominal ac or dc voltage. The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

c) Turn on the EUT, and couple its output to a frequency counter or other frequency-measuring instrument.

d) Tune the EUT to the center frequency of the operating band. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Adjust the detector bandwidth and span settings to achieve a resolution capable of accurate frequency measurements over the applicable frequency stability limits.

   NOTE—An instrument that has an adequate level of accuracy as specified by the procuring or regulatory authority is the recommended measuring instrument.

e) Measure the frequency.

f) Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.

g) For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

h) Repeat the frequency measurement.

   NOTE—For band-edge compliance, it can be required to make these measurements at the low and High channel of the operating band.

**Note:** The results of the frequency stability test shown above the frequency deviation measured values are very small and similar trend for each port, so we are attached only the worst case data.

**Test Results:**

**Reference: -** 48 Vdc at 20°C **Freq.** = 2,145,000,000 Hz

| Voltage (%) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (Hz) | ppm |
|---|---|---|---|---|---|
| 100 % | +20(Ref) | 2 145 000 001 | 1.134 | 0.000 | 0.00000 |
| | -30 | 2 145 000 008 | 6.846 | 5.712 | 0.00266 |
| | -20 | 2 145 000 003 | 1.603 | 0.470 | 0.00022 |
| | -10 | 2 145 000 003 | 2.346 | 1.213 | 0.00057 |
| | 0 | 2 145 000 002 | 1.088 | -0.046 | -0.00002 |
| | +10 | 2 145 000 007 | 5.585 | 4.452 | 0.00208 |
| | +30 | 2 145 000 009 | 8.201 | 7.067 | 0.00329 |
| | +40 | 2 145 000 007 | 6.159 | 5.026 | 0.00234 |
| | +50 | 2 145 000 008 | 7.202 | 6.068 | 0.00283 |
| 115 % | +20 | 2 145 000 010 | 9.205 | 8.072 | 0.00376 |
| 85 % | +20 | 2 145 000 010 | 8.563 | 7.429 | 0.00346 |

**Note:** The results of the frequency stability test shown above the frequency deviation measured values are very small and similer trend for each port, so attached datas were only the port 0.

## 6. Annex B_EUT AND TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

| No. | Description |
|---|---|
| 1 | HCT-RF-2412-FC043-P |