Element Suwon
13, Heungdeok 1-ro, Giheung-gu, Yongin-si,
Gyeonggi-do, 16954 South Korea
Tel. 031.660.7319 / Fax 031.660.7318
http://www.element.com

# PART 22 & 90 MEASUREMENT REPORT

**Applicant Name:**
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

**Date of Testing:**
9/8/2022 – 11/6/2022
**Test Report Issue Date:**
11/16/2022
**Test Site/Location:**
Element Lab. Yongin-Si, Gyeonggi-do, South Korea
**Test Report Serial No.:**
1M2209010098-11.A3L

| | |
|---|---|
| **FCC ID:** | **A3LSMS918U** |
| **APPLICANT:** | **Samsung Electronics Co., Ltd.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model:** | SM-S918U |
| **Additional Model(s):** | SM-S918U1 |
| **EUT Type:** | Portable Handset |
| **FCC Classification:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FCC Rule Part:** | §22(H), §90(S), §90(R) |
| **Test Procedure(s):** | ANSI C63.26-2015, KDB 648474 D03 v01r04 |

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Prepared by

Reviewed by

# TABLE OF CONTENTS

# MEASUREMENT REPORT
## FCC Part 22 & 90

| Mode | Bandwidth | Modulation | Tx Frequency Range [MHz] | Measurement | Max. Power [W] | Max. Power [dBm] | Emission Designator |
|---|---|---|---|---|---|---|---|
| LTE Band 14 | 10 MHz | QPSK | 793.0 | ERP | 0.103 | 20.15 | 9M02G7D |
| | | 16QAM | 793.0 | ERP | 0.087 | 19.42 | 9M05W7D |
| | 5 MHz | QPSK | 790.5 - 795.5 | ERP | 0.105 | 20.21 | 4M55G7D |
| | | 16QAM | 790.5 - 795.5 | ERP | 0.092 | 19.64 | 4M54W7D |
| LTE Band 26 | 15 MHz | QPSK | 821.5 | ERP | 0.141 | 21.49 | 13M5G7D |
| | | 16QAM | 821.5 | ERP | 0.118 | 20.73 | 13M5W7D |
| | 15 MHz | QPSK | 821.5 | Conducted | 0.287 | 24.57 | 13M5G7D |
| | | 16QAM | 821.5 | Conducted | 0.226 | 23.55 | 13M5W7D |
| | 10 MHz | QPSK | 819.0 | Conducted | 0.301 | 24.78 | 9M02G7D |
| | | 16QAM | 819.0 | Conducted | 0.246 | 23.91 | 9M03W7D |
| | 5 MHz | QPSK | 816.5 - 821.5 | Conducted | 0.316 | 25.00 | 4M57G7D |
| | | 16QAM | 816.5 - 821.5 | Conducted | 0.252 | 24.02 | 4M54W7D |
| | 3 MHz | QPSK | 815.5 - 822.5 | Conducted | 0.303 | 24.81 | 2M73G7D |
| | | 16QAM | 815.5 - 822.5 | Conducted | 0.248 | 23.94 | 2M73W7D |
| | 1.4 MHz | QPSK | 814.7 - 823.3 | Conducted | 0.294 | 24.69 | 1M11G7D |
| | | 16QAM | 814.7 - 823.3 | Conducted | 0.247 | 23.92 | 1M12W7D |
| NR Band n26 | 20 MHz | π/2 BPSK | 824 | ERP | 0.103 | 20.12 | 17M9G7D |
| | | QPSK | 824 | ERP | 0.099 | 19.97 | 19M0G7D |
| | | 16QAM | 824 | ERP | 0.081 | 19.07 | 19M0W7D |
| | 15 MHz | π/2 BPSK | 821.5 | ERP | 0.105 | 20.20 | 13M5G7D |
| | | QPSK | 821.5 | ERP | 0.102 | 20.07 | 14M1G7D |
| | | 16QAM | 821.5 | ERP | 0.074 | 18.71 | 14M2W7D |
| | 20 MHz | π/2 BPSK | 824 | Conducted | 0.254 | 24.05 | 17M9G7D |
| | | QPSK | 824 | Conducted | 0.249 | 23.96 | 19M0G7D |
| | | 16QAM | 824 | Conducted | 0.218 | 23.39 | 19M0W7D |
| | 15 MHz | π/2 BPSK | 821.5 | Conducted | 0.259 | 24.13 | 13M5G7D |
| | | QPSK | 821.5 | Conducted | 0.255 | 24.06 | 14M1G7D |
| | | 16QAM | 821.5 | Conducted | 0.201 | 23.03 | 14M2W7D |
| | 10 MHz | π/2 BPSK | 819 | Conducted | 0.251 | 24.00 | 9M01G7D |
| | | QPSK | 819 | Conducted | 0.257 | 24.10 | 9M33G7D |
| | | 16QAM | 819 | Conducted | 0.204 | 23.10 | 9M35W7D |
| | 5 MHz | π/2 BPSK | 816.5 - 821.5 | Conducted | 0.255 | 24.06 | 4M52G7D |
| | | QPSK | 816.5 - 821.5 | Conducted | 0.249 | 23.97 | 4M50G7D |
| | | 16QAM | 816.5 - 821.5 | Conducted | 0.222 | 23.46 | 4M52W7D |

**EUT Overview**

# 1.0 INTRODUCTION

## 1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

## 1.2 Element Test Location

These measurement tests were conducted at the Element Suwon Laboratory located at 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do, 16954, South Korea. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

## 1.3 Test Facility / Accreditations

**Measurements were performed at Element Materials Technology Suwon, Ltd. located in Yongin-si, Gyeonggi-do, 16954, South Korea.**

- Element Materials Technology Suwon, Ltd. is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation(A2LA) with Certificate number 2041.04 for Specific Absorption Rate (SAR), and Electromagnetic Compatibility (EMC) & Telecommunications testing for FCC and Innovation, Science, and Economic Development Canada rules.

- Element Materials Technology Suwon, Ltd. facility is accredited, designated, and recognized in accordance with the provision of Radio Wave Act and International Standard ISO/IEC 17025:2017 under the National Radio Research Agency.

  - Designation Number / CABID: KR0169
  - Test Firm Registration Number of FCC: 417945
  - Test Firm Registration Number of ISED: 26168

# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMS918U**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 90 and 22H.

**Test Device Serial No.:** 0130M, 0187M, 0131M , 0167M, 1616M, 0430M

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1 and FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, UWB, Wireless Power Transfer

## 2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

## 2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version S918USQU0AVJH installed on the EUT.

## 2.5 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

# 3.0 DESCRIPTION OF TESTS

## 3.1 Evaluation Procedure

The measurement procedures described in the "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services" (ANSI C63.26-2015) were used in the measurement of the EUT.

**Deviation from Measurement Procedure……..None**

## 3.2 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated power measurements, substitution method is used per the guidance of ANSI C63.26-2015. For emissions below 1GHz, a half-wave dipole is substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\,[dBm]} = P_{g\,[dBm]} - \text{cable loss}_{\,[dB]} + \text{antenna gain}_{\,[dBd/dBi]};$$

where $P_d$ is the dipole equivalent power, $P_g$ is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_{g\,[dBm]}$ – cable loss $_{[dB]}$.

For radiated spurious emissions measurements, the field strength conversion method is used per the formulas in Section 5.2.7 of ANSI C63.26-2015. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And

$$EIRP_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;$$ where D is the measurement distance in meters.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01 v01r01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015.

# 4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the $U_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Contribution | Expanded Uncertainty (±dB) |
|---|---|
| Conducted Bench Top Measurements | 1.13 |
| Radiated Disturbance (<1GHz) | 4.98 |
| Radiated Disturbance (>1GHz) | 5.07 |
| Radiated Disturbance (>18GHz) | 5.09 |

# 5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|---|---|---|---|---|---|---|
| AAMCS | UDC | Directional Coupler | 2022-07-05 | Annual | 2023-07-04 | N/A |
| Agilent | N9030A | PXA Signal Analyzer | 2022-07-04 | Annual | 2023-07-03 | MY49432391 |
| Anritsu | S820E | Cable and Antenna Analyzer | 2022-07-06 | Annual | 2023-07-05 | 1839097 |
| Anritsu | MA24106A | USB Power Sensor | 2022-07-06 | Annual | 2023-07-05 | 1244512 |
| Com-Power | AL-130 | 9kHz - 30MHz Loop Antenna | 2022-10-21 | Biennial | 2024-10-20 | 10160045 |
| Com-Power | PAM-118A | Preamplifier | 2022-07-06 | Annual | 2023-07-05 | 551042 |
| Espec | SH-242 | Environmental Chamber | 2022-08-26 | Annual | 2023-08-25 | 93011064 |
| Fairview Microwave | FM2CP1122-10 | Coupler | 2022-07-06 | Annual | 2023-07-05 | 1946 |
| Keysight Technologies | N9030B | MXA Signal Analyzer | 2022-05-10 | Annual | 2023-05-19 | MY57142018 |
| AAMCS | UDC | Directional Coupler | 2022-07-05 | Annual | 2022-07-04 | N/A |
| Mini-Circuits | BW-N10W5+ | Attenuator | 2022-05-09 | Annual | 2023-05-08 | 1607 |
| Mini-Circuits | BW-N10W5+ | Attenuator | 2022-05-09 | Annual | 2023-05-08 | 1607 |
| Rohde & Schwarz | TS-PR18 | Preamplifier | 2022-07-06 | Annual | 2023-07-05 | 102141 |
| Rohde & Schwarz | SMB100A03 | Signal Generator | 2022-01-18 | Annual | 2023-01-17 | 182487 |
| Rohde & Schwarz | CMW500 | Wideband Radio Communication Tester | 2022-02-18 | Annual | 2023-02-17 | 131453 |
| Rohde & Schwarz | ESW | EMI Test Receiver | 2022-07-04 | Annual | 2023-07-03 | 101761 |
| Rohde & Schwarz | FSW43 | Signal & Spectrum Analyzer | 2022-01-18 | Annual | 2023-01-17 | 101250 |
| Rohde & Schwarz | SFUNIT-Rx | Shielded Filter Unit | 2022-02-18 | Annual | 2023-02-17 | 102131 |
| Rohde & Schwarz | SFUNIT-Rx | Shielded Filter Unit | 2022-03-28 | Annual | 2023-03-27 | 102151 |
| Schwarzbeck | VULB9162 | Broadband TRILOG Antenna | 2021-07-13 | Biennial | 2023-07-12 | 9162-217 |
| Schwarzbeck | UHA9105 | Dipole Antenna | 2022-07-19 | Biennial | 2024-07-18 | 91052522 |
| Sunol | DRH-118 | Horn Antenna | 2021-07-14 | Biennial | 2023-07-13 | A102416-1 |
| Sunol | DRH-118 | Horn Antenna | 2021-01-12 | Biennial | 2023-01-11 | A060215 |

**Table 5-1. Test Equipment**

**Notes:**

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

2. Equipment with a calibration date of “N/A” shown in this list was not used to make direct calibrated measurements.

# 6.0 SAMPLE CALCULATIONS

## Emission Designator

### QPSK Modulation

**Emission Designator = 8M62G7D**

LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

### QAM Modulation

**Emission Designator = 8M45W7D**

LTE BW = 8.45 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

## Spurious Radiated Emission – LTE Band

**Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)**

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc.

# 7.0 TEST RESULTS

## 7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMS918U

FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)

Mode(s): LTE/NR

| Test Condition | Test Description | FCC Part Section(s) | Test Limit | Test Result | Reference |
|---|---|---|---|---|---|
| CONDUCTED | Transmitter Conducted Output Power* | 2.1046(a), 90.635(b) | < 100 Watts | PASS | Section 7.2 |
| | Occupied Bandwidth | 2.1049(h) | N/A | PASS | Section 7.3 |
| | Conducted Band Edge / Spurious Emissions (LTE Band 14) | 2.1051, 90.543(c)(e) | On all frequencies between 769-775 MHz and 799-805 MHz, attenuation by a factor not less than 65 + 10 log(P) dB in a 6.25 kHz band segment, for mobile and portable stations.<br>On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, attenuation by at least 43 + 10 log(P) dB<br>> 43 + 10log10(P[Watts]) for all out-of-band emissions outside of those specified in 90.543(e) | PASS | Sections 7.4, 7.5 |
| | Conducted Band Edge / Spurious Emissions (LTE Band 26; NR Band n26) | 2.1051, 90.691(a) | > 43 + 10 log10(P[Watts]) for all out-of-band emissions except emissions beyond 37.5kHz from the block edge<br>> 50 + 10 log10(P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge | PASS | Sections 7.4, 7.5 |
| | Frequency Stability | 2.1055, 90.213 | < 2.5 ppm<br>**Fundamental emissions stay within authorized frequency block | PASS | Section 7.8 |
| RADIATED | Effective Radiated Power (LTE Band 14) | 90.542(a)(7) | < 3 Watts max. ERP | PASS | Section 7.6 |
| | Effective Radiated Power (LTE Band 26; NR Band n26) | 22.913(a)(2) | < 7 Watts max. ERP | PASS | Section 7.6 |
| | Radiated Spurious Emissions (LTE Band 14) | 2.1053, 90.543(e)(f) | > 43 + 10 log10 (P[Watts]) for all out-of-band emissions except emissions in the 1559 - 1610MHz band are subject to a limit of -40dBm/MHz for wideband signals | PASS | Section 7.7 |
| | Radiated Spurious Emissions (LTE Band 26; NR Band n26) | 2.1053, 90.691(a) | > 43 + 10 log10(P[Watts]) for all out-of-band emissions except emissions beyond 37.5kHz from the block edge<br>> 50 + 10 log10(P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge | PASS | Section 7.7 |

* The only transmitter output conducted powers included in this report are those where the Pmax value, per the tune-up document, is higher than any of the DSI power levels. For the remaining conducted power measurements, see the **RF Exposure Report**.

**Table 7-1. Summary of Test Results**

**Notes:**

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is EMC Software Tool V1.0.

## 7.2 Conducted Output Power Data

**Test Overview**

All emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

**Test Procedure Used**

ANSI C63.26-2015 – Section 5.2

**Test Settings**

1. Span = 2 x OBW to 3 x OBW
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

**Test Setup**

The EUT and measurement equipment were set up as shown in the diagram below.

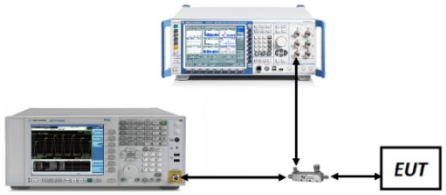



**Figure 7-1. Test Instrument & Measurement Setup**

**Test Notes**

1. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.

2. This unit was tested with its standard battery.

3. Conducted power measurements were evaluated using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device.

4. All other conducted power measurements are contained in the RF exposure report for this filing.

| Bandwidth | Modulation | Channel | Frequency [MHz] | RB Size/Offset | Conducted Power [dBm] | Conducted Power [Watts] | Conducted Power Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| 15 MHz | QPSK | 26765 | 821.5 | 1 / 37 | 24.57 | 0.287 | 50.00 | -25.43 |
| | 16-QAM | 26765 | 821.5 | 1 / 37 | 23.55 | 0.226 | 50.00 | -26.45 |
| 10 MHz | QPSK | 26740 | 819.0 | 1 / 25 | 24.78 | 0.301 | 50.00 | -25.22 |
| | 16-QAM | 26740 | 819.0 | 1 / 25 | 23.91 | 0.246 | 50.00 | -26.09 |
| 5 MHz | QPSK | 26715 | 816.5 | 1 / 12 | 24.69 | 0.294 | 50.00 | -25.31 |
| | | 26765 | 821.5 | 1 / 12 | 25.00 | 0.316 | 50.00 | -25.00 |
| | 16-QAM | 26715 | 816.5 | 1 / 12 | 23.91 | 0.246 | 50.00 | -26.09 |
| | | 26765 | 821.5 | 1 / 12 | 24.02 | 0.252 | 50.00 | -25.98 |
| 3 MHz | QPSK | 26705 | 815.5 | 1 / 0 | 24.81 | 0.303 | 50.00 | -25.19 |
| | | 26775 | 822.5 | 1 / 7 | 24.70 | 0.295 | 50.00 | -25.30 |
| | 16-QAM | 26705 | 815.5 | 1 / 0 | 23.88 | 0.245 | 50.00 | -26.12 |
| | | 26775 | 822.5 | 1 / 7 | 23.94 | 0.248 | 50.00 | -26.06 |
| 1.4 MHz | QPSK | 26697 | 814.7 | 1 / 3 | 24.69 | 0.294 | 50.00 | -25.31 |
| | | 26783 | 823.3 | 1 / 3 | 24.57 | 0.287 | 50.00 | -25.43 |
| | 16-QAM | 26697 | 814.7 | 1 / 3 | 23.92 | 0.247 | 50.00 | -26.08 |
| | | 26783 | 823.3 | 1 / 3 | 23.83 | 0.242 | 50.00 | -26.17 |

**Table 7-2. Conducted Power Output Data (LTE Band 26)**

| Bandwidth | Modulation | Channel | Frequency [MHz] | RB Size/Offset | Conducted Power [dBm] | Conducted Power [Watts] | Conducted Power Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| 20 MHz | π/2 BPSK | 167300 | 836.5 | 1 / 53 | 24.05 | 0.254 | 50.00 | -25.95 |
| | QPSK | 167300 | 836.5 | 1 / 26 | 23.96 | 0.249 | 50.00 | -26.04 |
| | 16-QAM | 167300 | 836.5 | 1 / 53 | 23.39 | 0.218 | 50.00 | -26.61 |
| 15 MHz | π/2 BPSK | 167300 | 836.5 | 1 / 20 | 24.13 | 0.259 | 50.00 | -25.87 |
| | QPSK | 167300 | 836.5 | 1 / 20 | 24.06 | 0.255 | 50.00 | -25.94 |
| | 16-QAM | 167300 | 836.5 | 1 / 20 | 23.03 | 0.201 | 50.00 | -26.97 |
| 10 MHz | π/2 BPSK | 167300 | 836.5 | 1 / 26 | 24.00 | 0.251 | 50.00 | -26.00 |
| | QPSK | 167300 | 836.5 | 1 / 38 | 24.10 | 0.257 | 50.00 | -25.90 |
| | 16-QAM | 167300 | 836.5 | 1 / 13 | 23.10 | 0.204 | 50.00 | -26.90 |
| 5 MHz | π/2 BPSK | 165300 | 826.5 | 1 / 6 | 24.04 | 0.254 | 50.00 | -25.96 |
| | | 169300 | 846.5 | 1 / 18 | 24.06 | 0.255 | 50.00 | -25.94 |
| | QPSK | 165300 | 826.5 | 1 / 12 | 23.92 | 0.247 | 50.00 | -26.08 |
| | | 169300 | 846.5 | 1 / 18 | 23.97 | 0.249 | 50.00 | -26.03 |
| | 16-QAM | 165300 | 826.5 | 1 / 18 | 23.46 | 0.222 | 50.00 | -26.54 |
| | | 169300 | 846.5 | 1 / 6 | 22.95 | 0.197 | 50.00 | -27.05 |

**Table 7-3. Conducted Power Output Data (NR Band n26)**

## 7.3 Occupied Bandwidth

**Test Overview**

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. All modes of operation were investigated and the worst case configuration results are reported in this section.

**Test Procedure Used**

ANSI C63.26-2015 – Section 5.4.4

**Test Settings**

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

**Test Setup**

The EUT and measurement equipment were set up as shown in the diagram below.

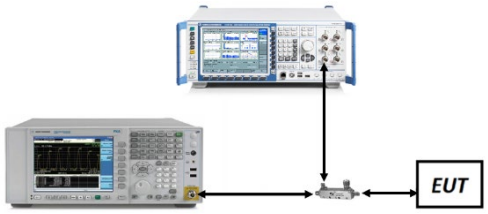


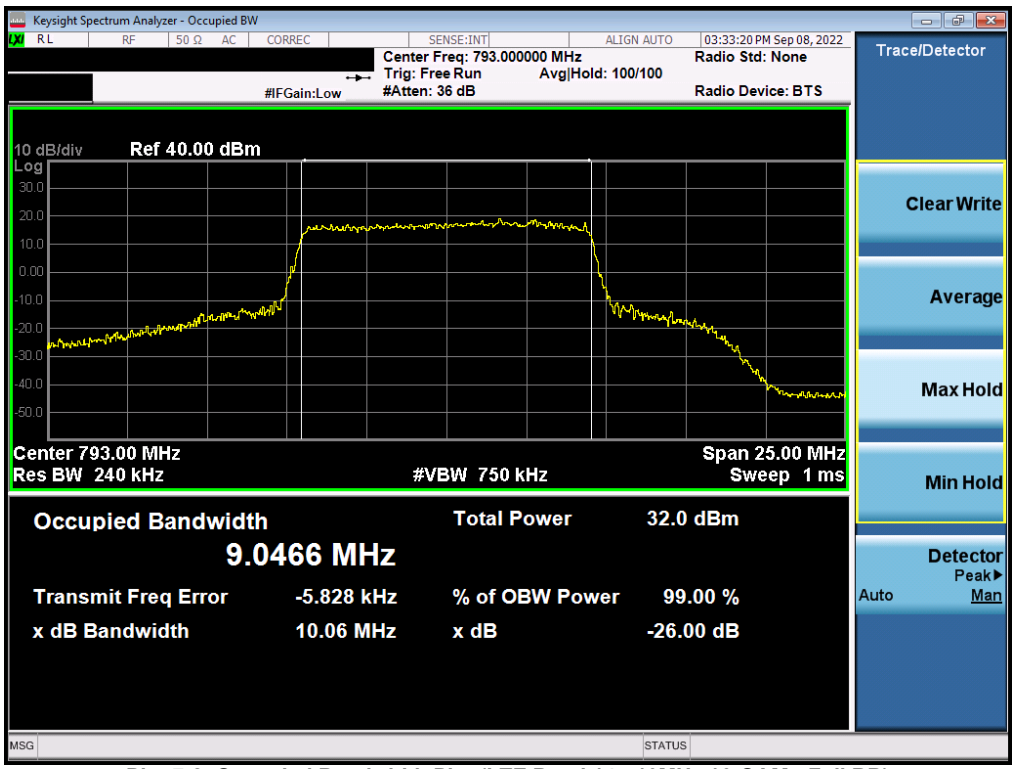

**Figure 7-2. Test Instrument & Measurement Setup**

**Test Notes**

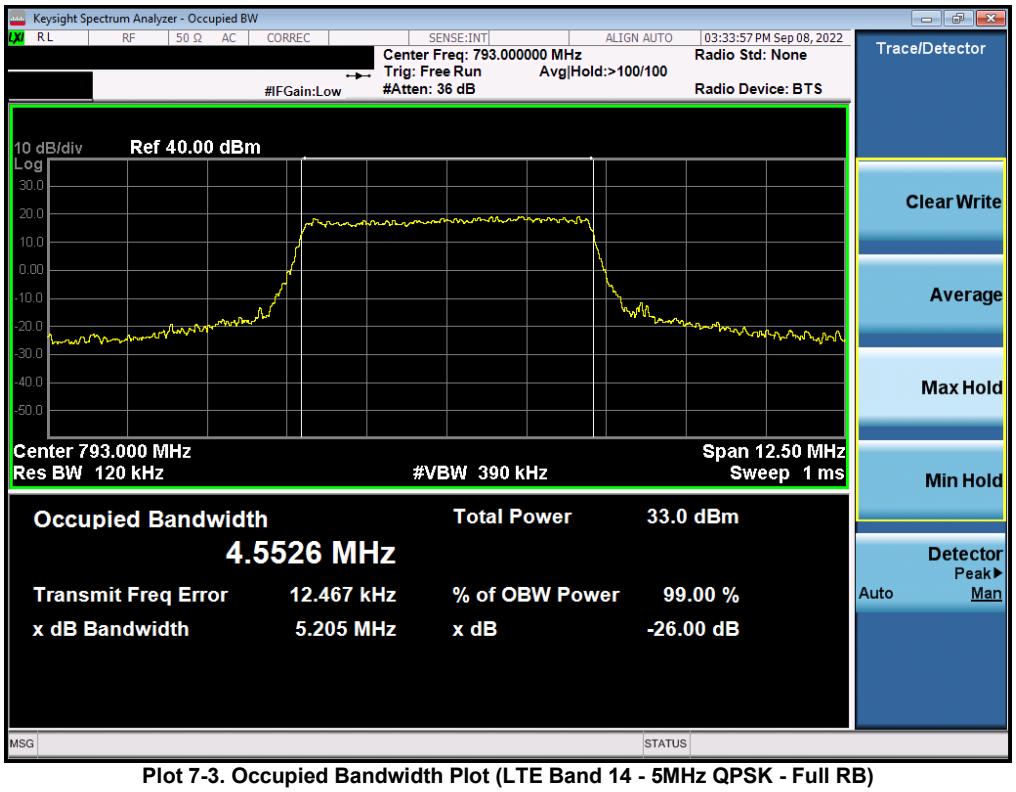
None

## LTE Band 14

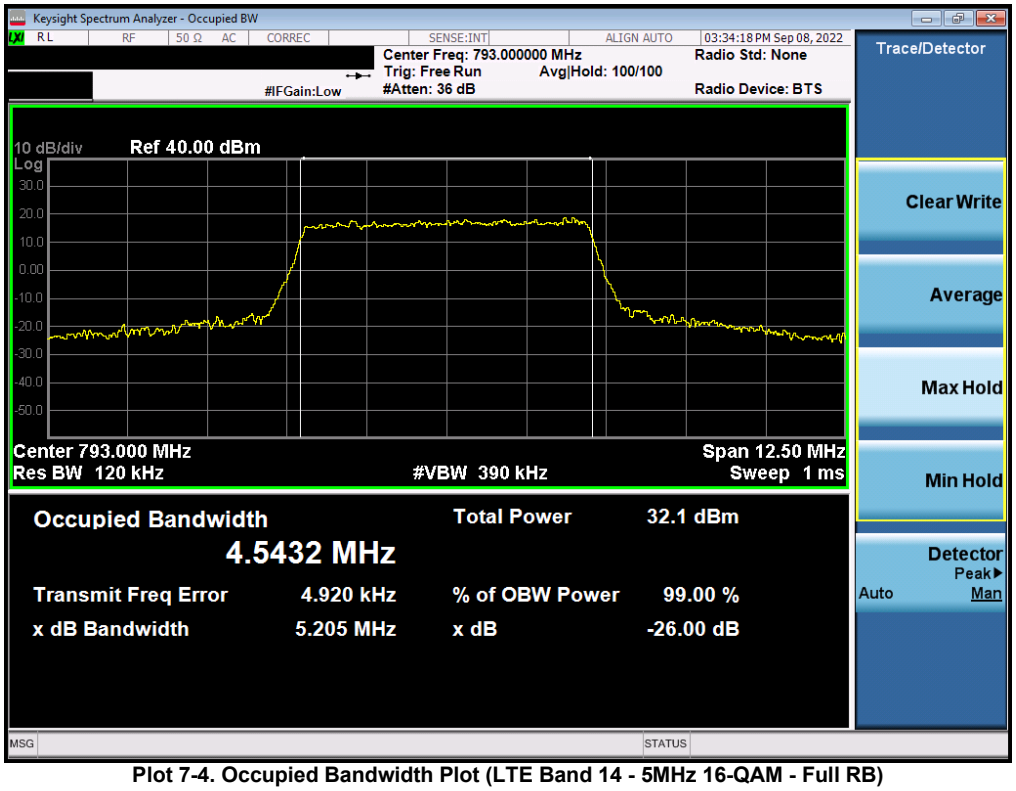

**Plot 7-1. Occupied Bandwidth Plot (LTE Band 14 - 10MHz QPSK - Full RB)**




**Plot 7-2. Occupied Bandwidth Plot (LTE Band 14 - 10MHz 16-QAM - Full RB)**

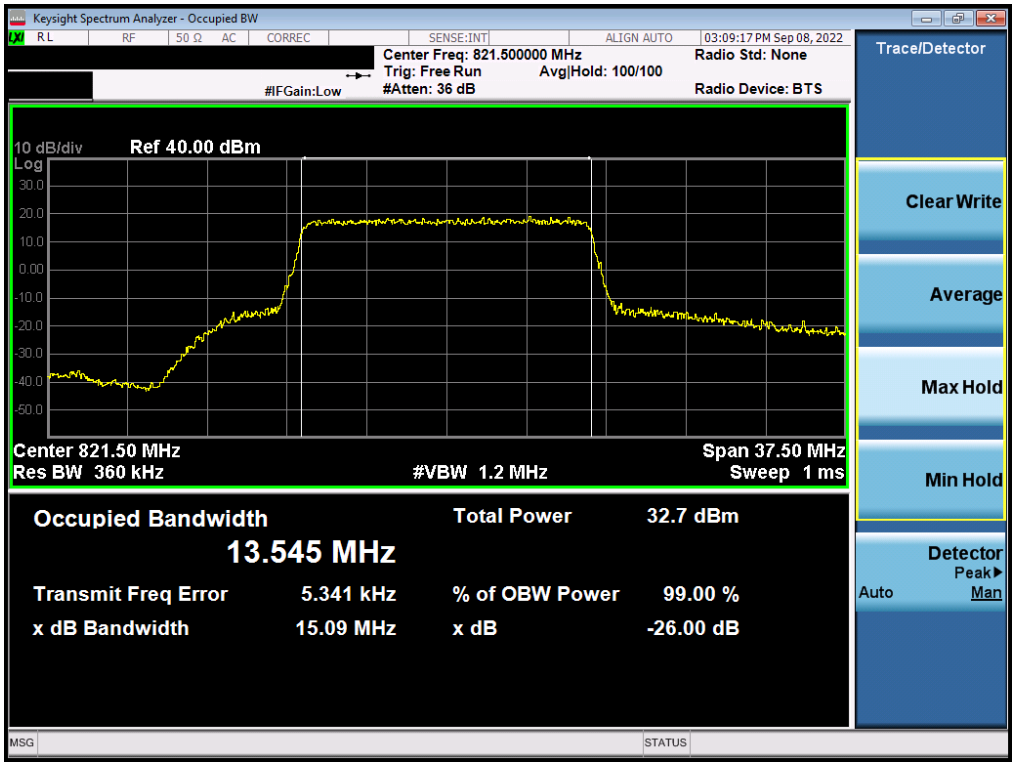



**Plot 7-3. Occupied Bandwidth Plot (LTE Band 14 - 5MHz QPSK - Full RB)**

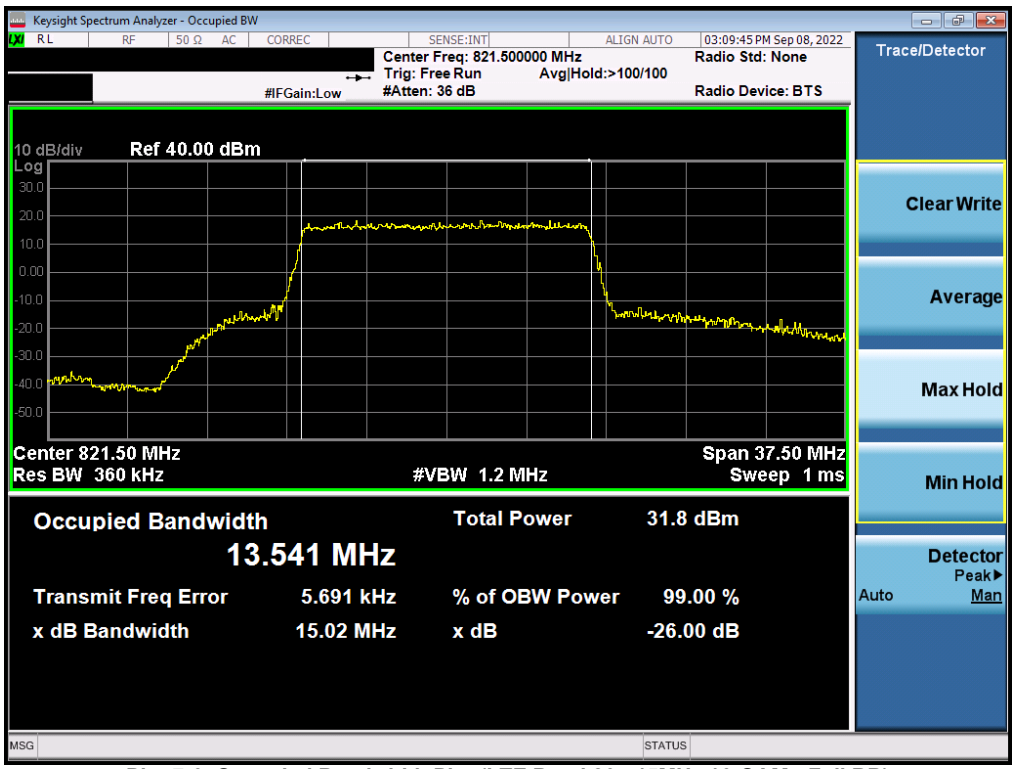



**Plot 7-4. Occupied Bandwidth Plot (LTE Band 14 - 5MHz 16-QAM - Full RB)**

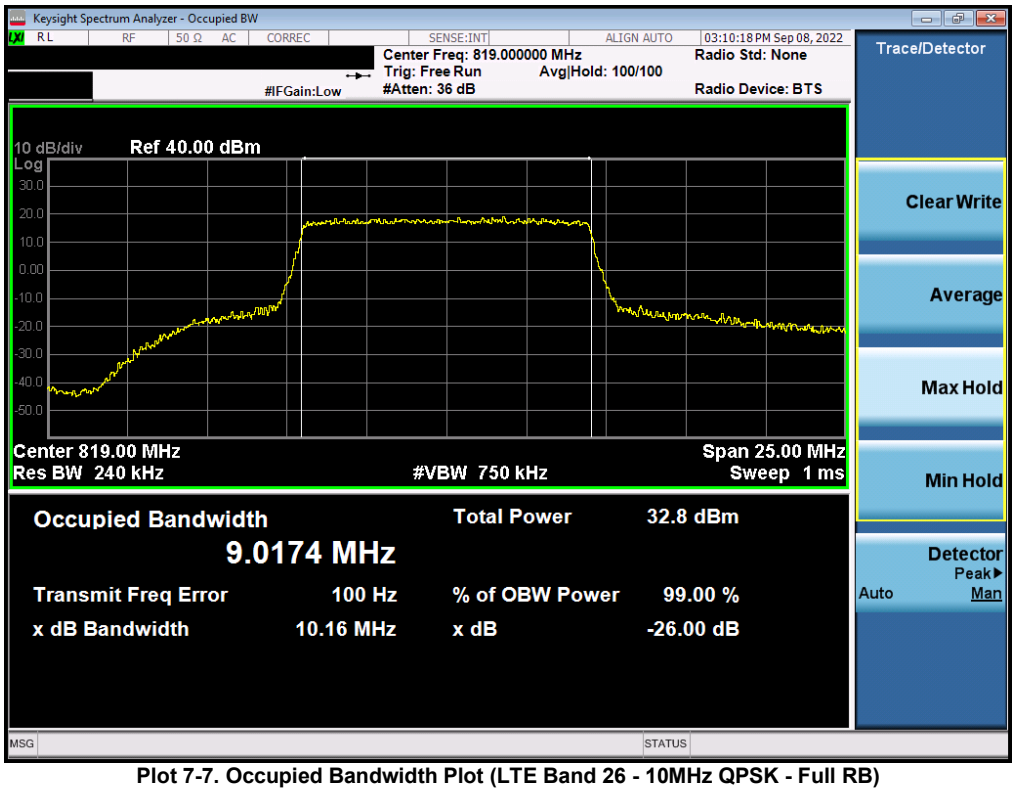
## LTE Band 26



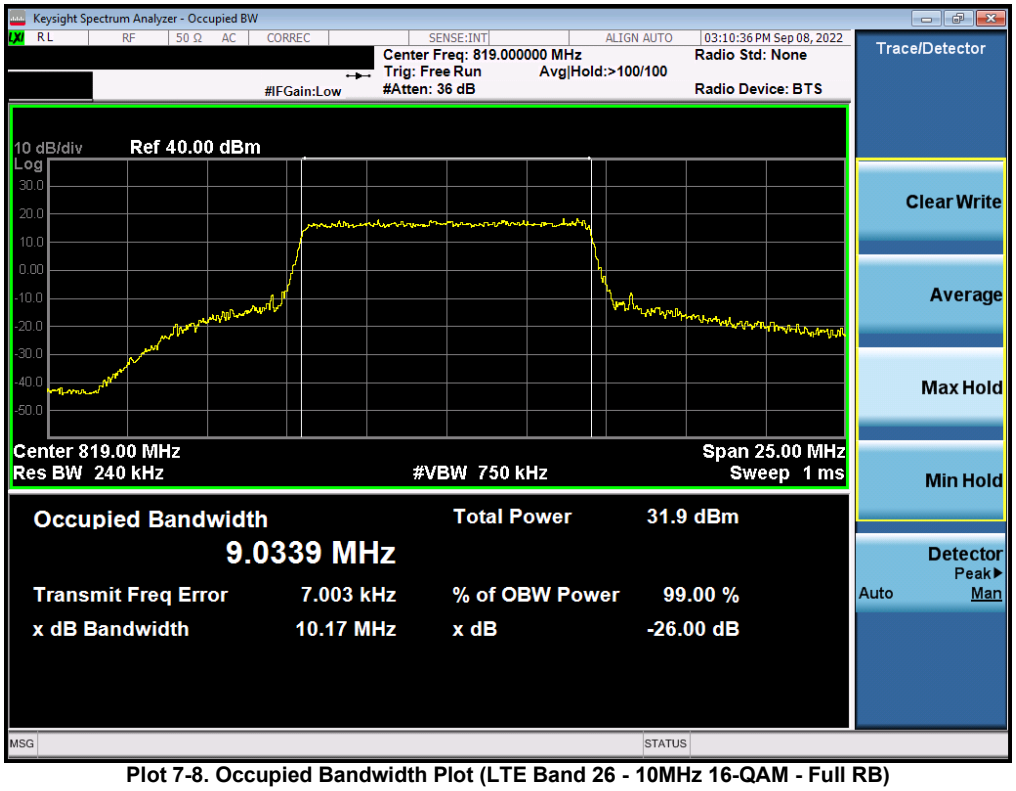

**Plot 7-5. Occupied Bandwidth Plot (LTE Band 26 - 15MHz QPSK - Full RB)**



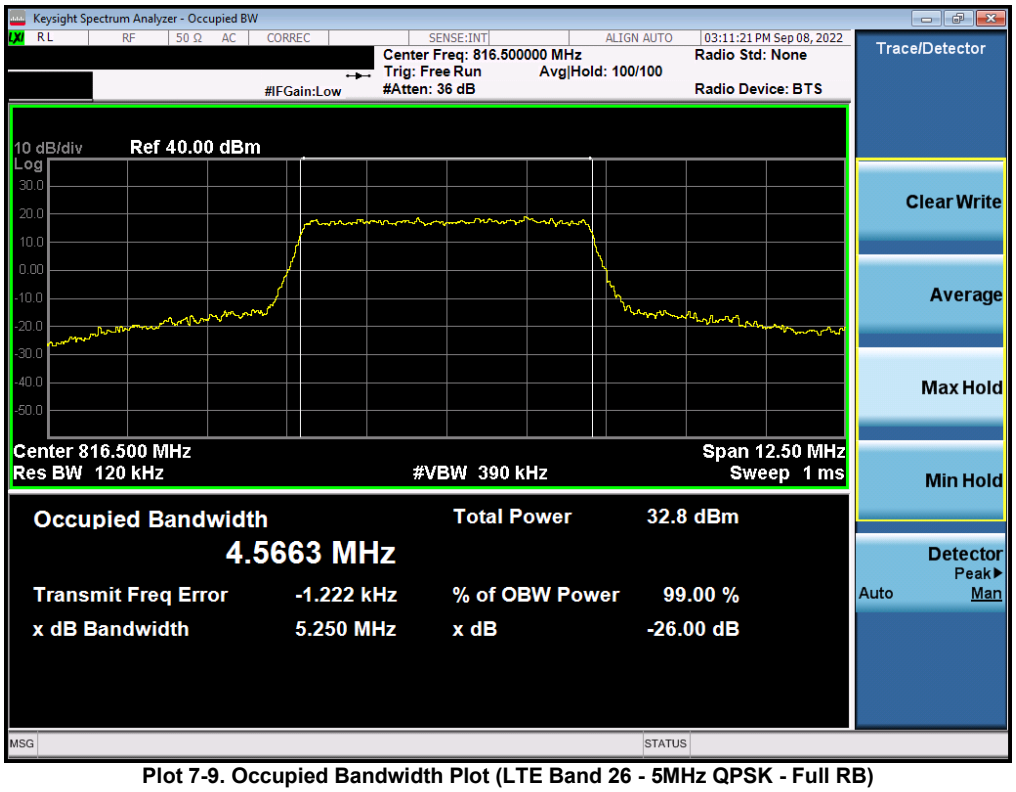

**Plot 7-6. Occupied Bandwidth Plot (LTE Band 26 - 15MHz 16-QAM - Full RB)**



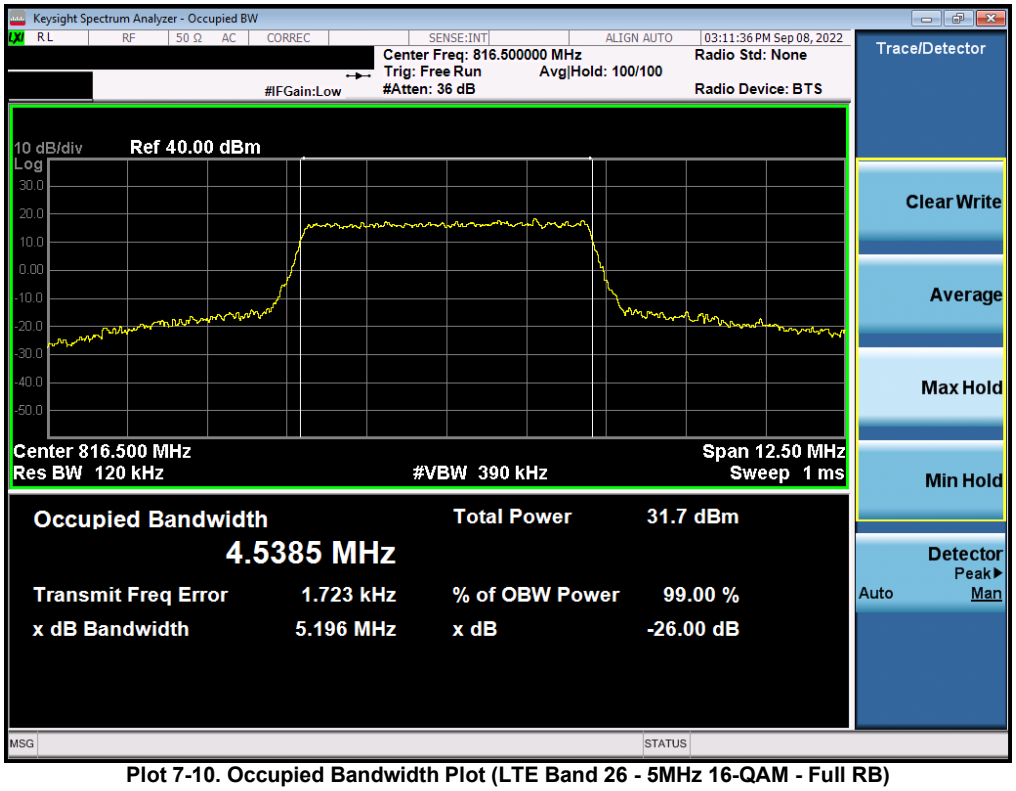

**Plot 7-7. Occupied Bandwidth Plot (LTE Band 26 - 10MHz QPSK - Full RB)**



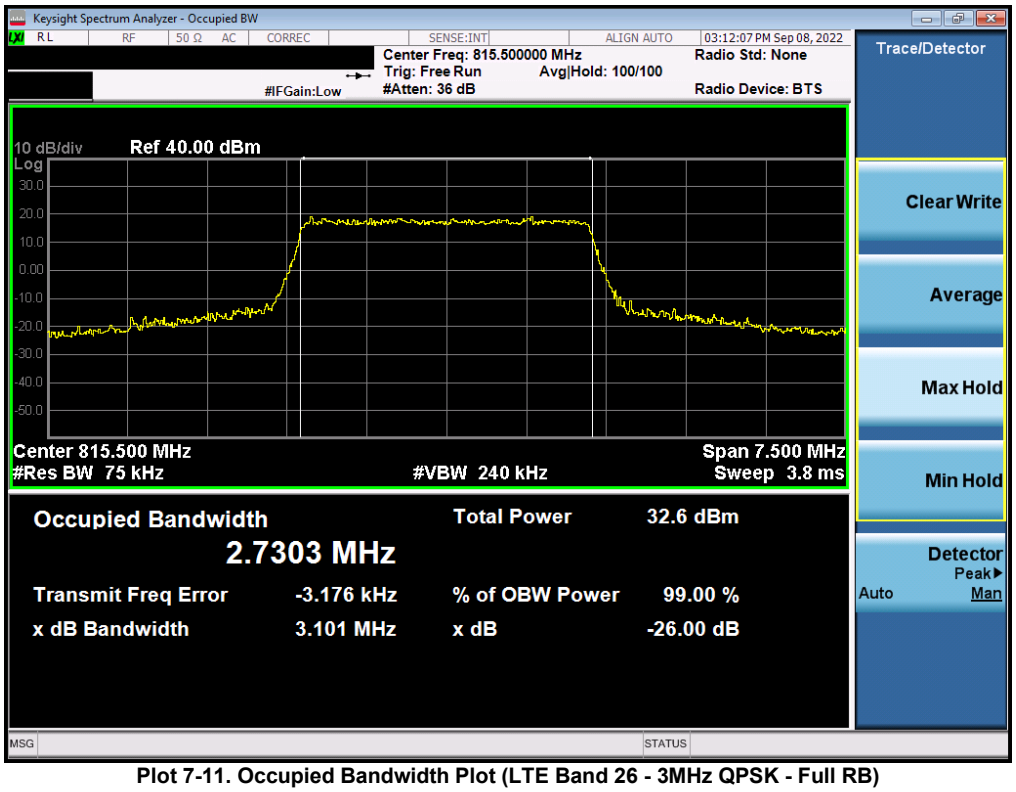

**Plot 7-8. Occupied Bandwidth Plot (LTE Band 26 - 10MHz 16-QAM - Full RB)**



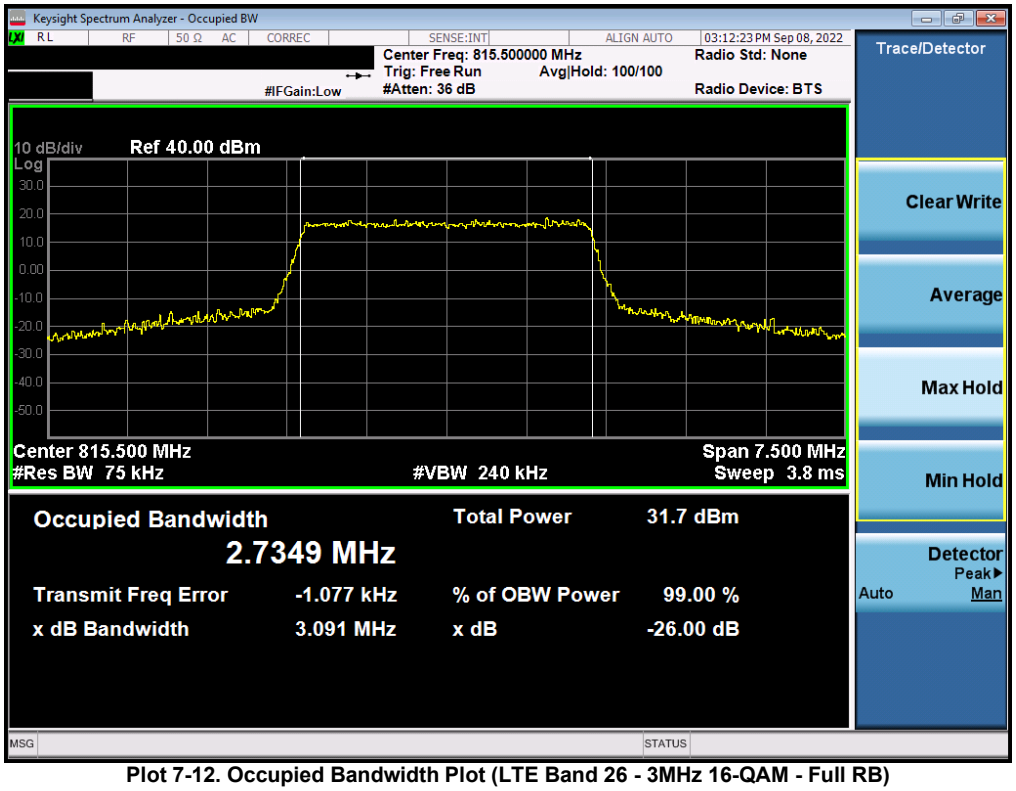

**Plot 7-9. Occupied Bandwidth Plot (LTE Band 26 - 5MHz QPSK - Full RB)**



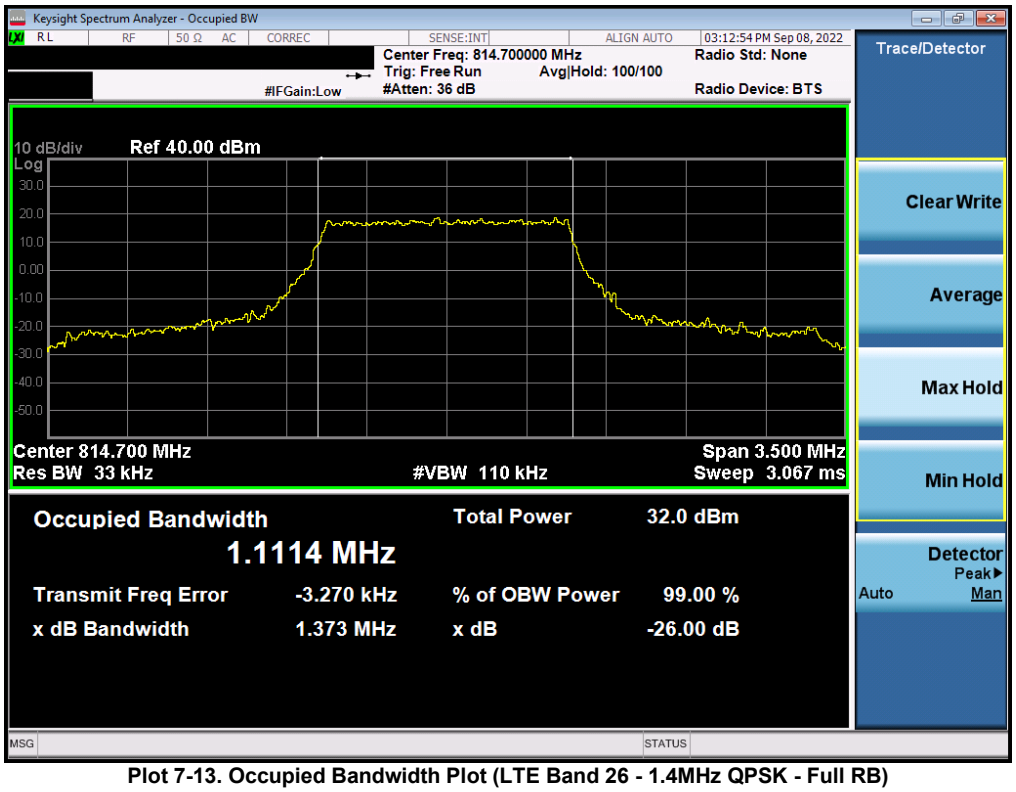

**Plot 7-10. Occupied Bandwidth Plot (LTE Band 26 - 5MHz 16-QAM - Full RB)**



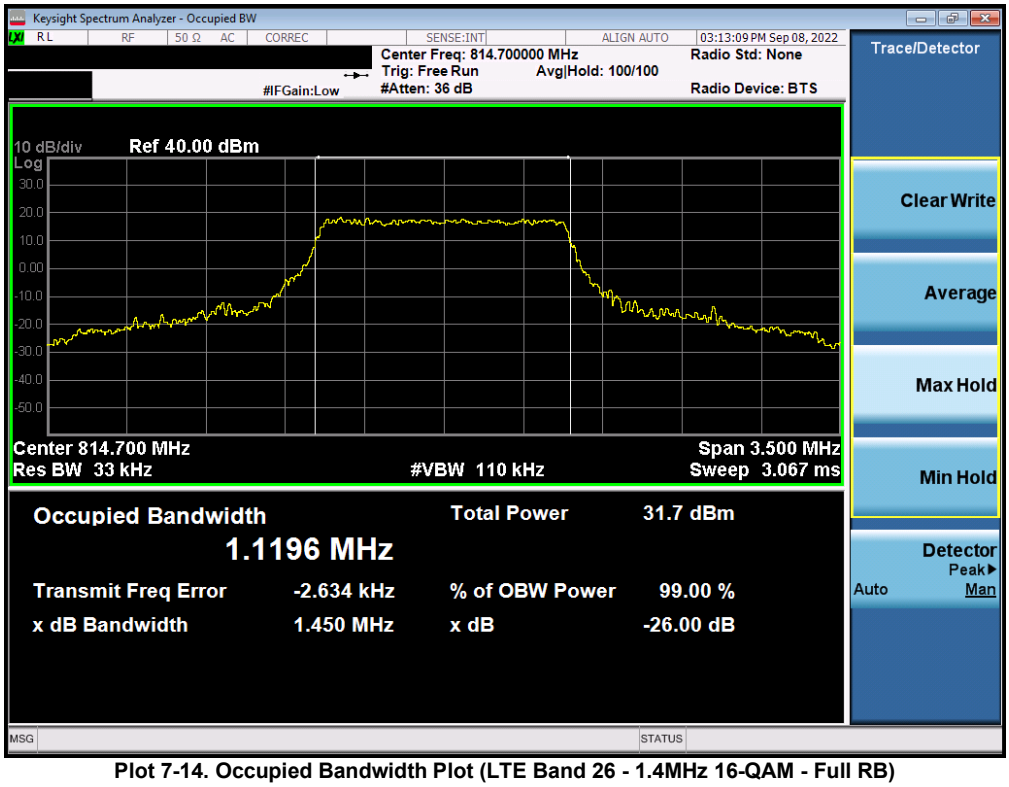

**Plot 7-11. Occupied Bandwidth Plot (LTE Band 26 - 3MHz QPSK - Full RB)**




**Plot 7-12. Occupied Bandwidth Plot (LTE Band 26 - 3MHz 16-QAM - Full RB)**

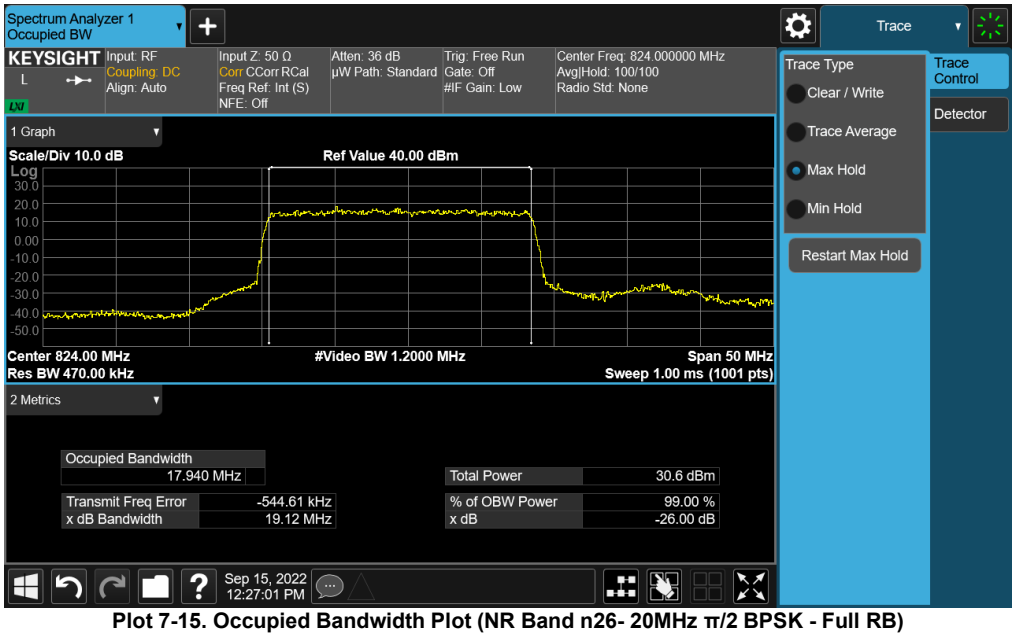



**Plot 7-13. Occupied Bandwidth Plot (LTE Band 26 - 1.4MHz QPSK - Full RB)**

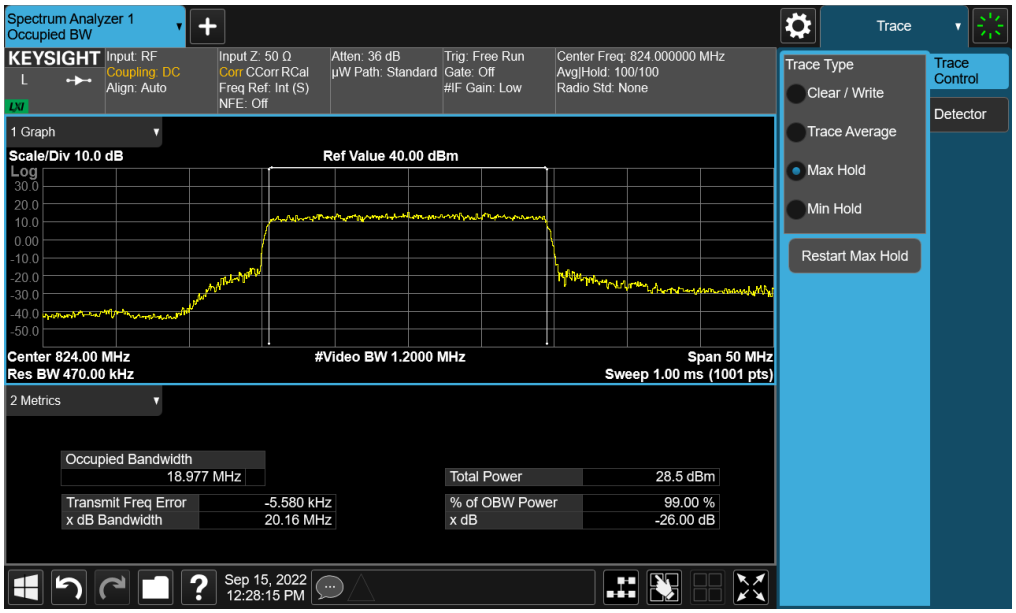



**Plot 7-14. Occupied Bandwidth Plot (LTE Band 26 - 1.4MHz 16-QAM - Full RB)**

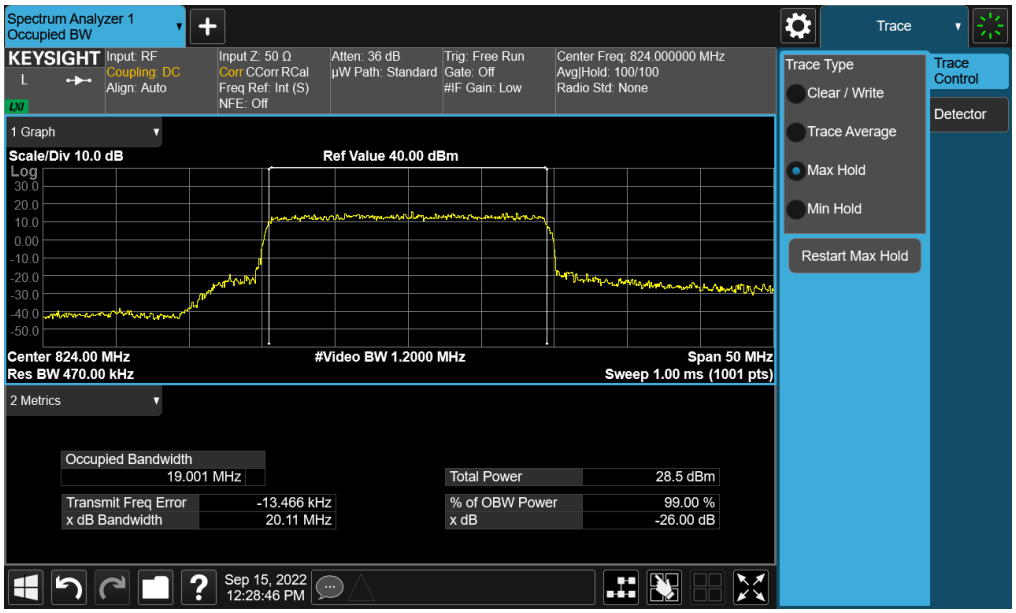
## NR Band n26



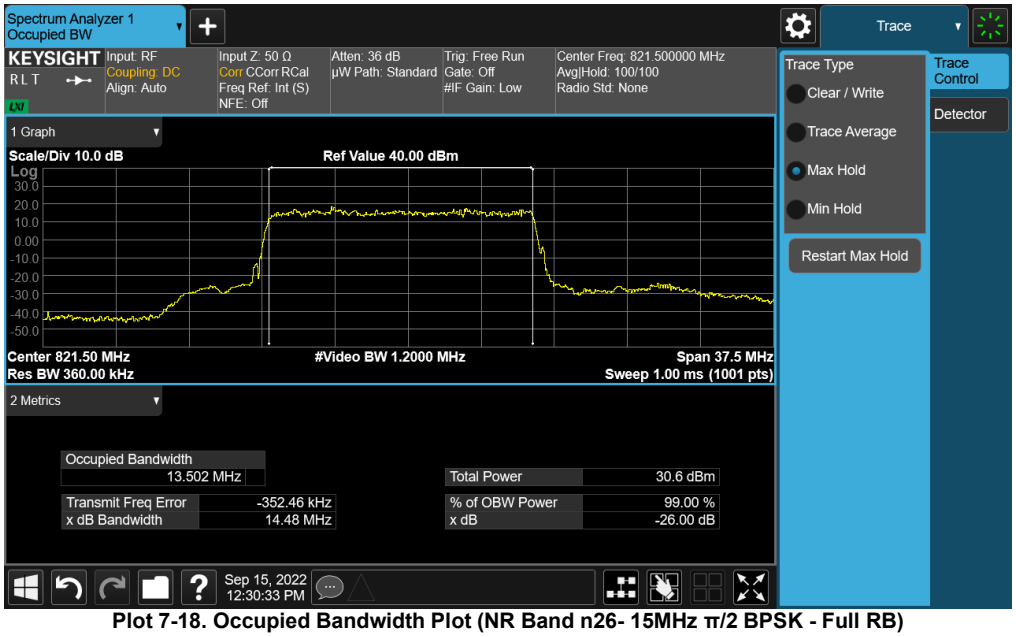

**Plot 7-15. Occupied Bandwidth Plot (NR Band n26- 20MHz π/2 BPSK - Full RB)**



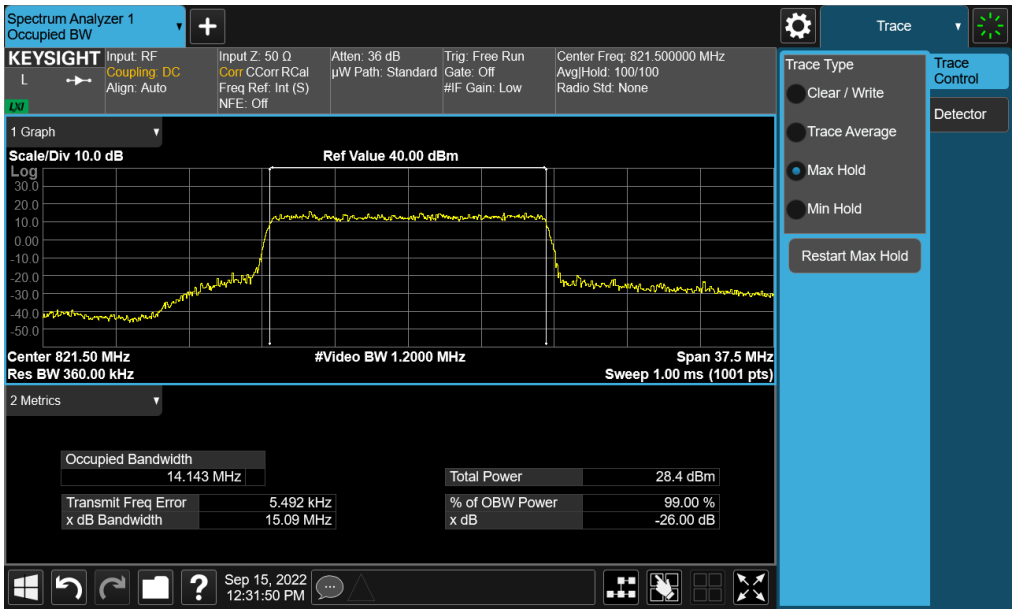

**Plot 7-16. Occupied Bandwidth Plot (NR Band n26- 20MHz QPSK - Full RB)**



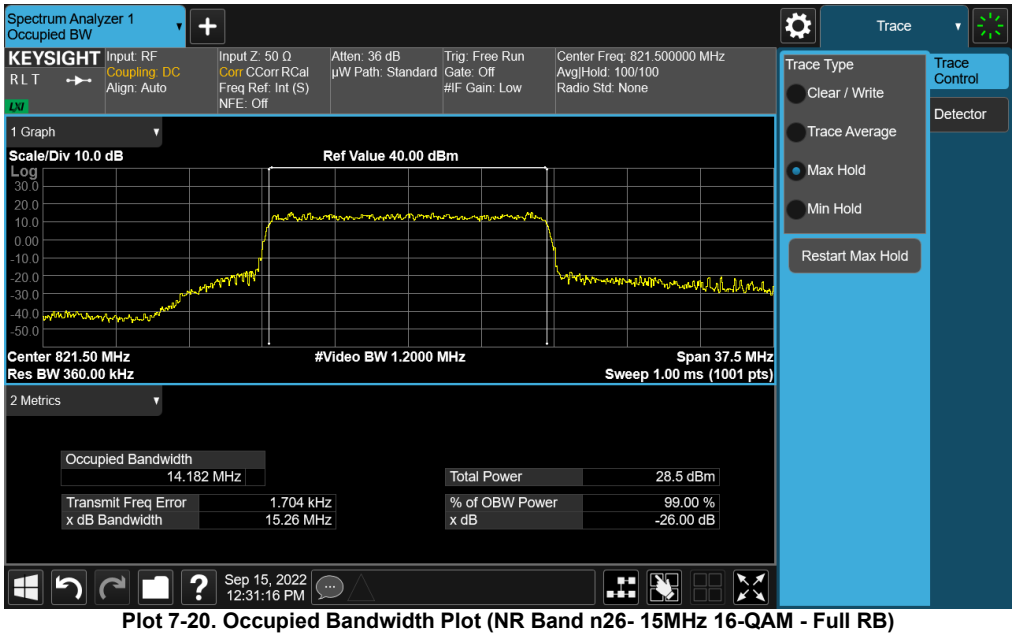

**Plot 7-17. Occupied Bandwidth Plot (NR Band n26- 20MHz 16-QAM - Full RB)**




**Plot 7-18. Occupied Bandwidth Plot (NR Band n26- 15MHz π/2 BPSK - Full RB)**

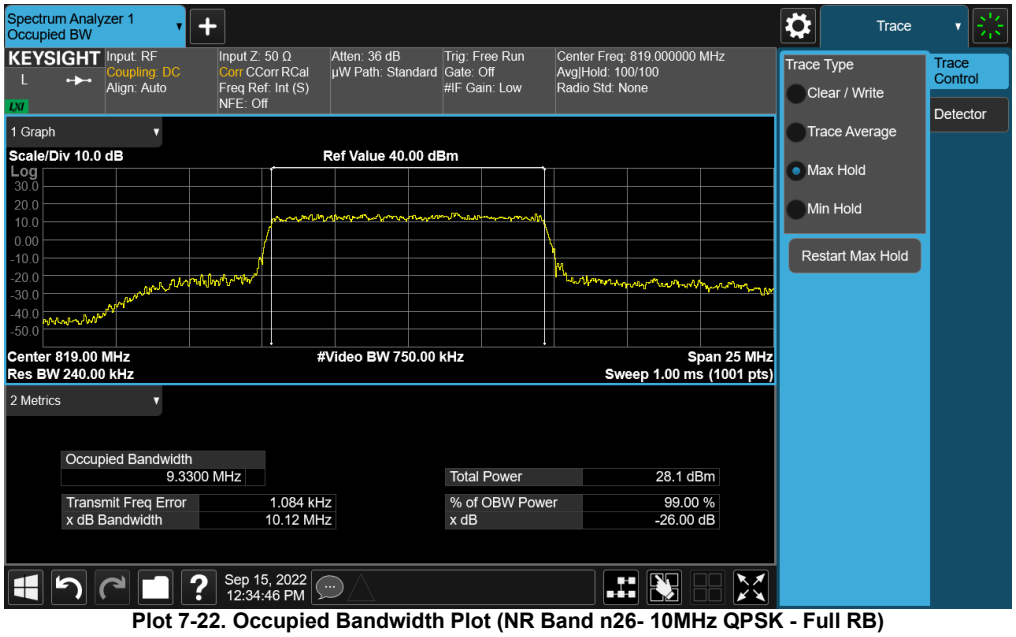



**Plot 7-19. Occupied Bandwidth Plot (NR Band n26- 15MHz QPSK - Full RB)**

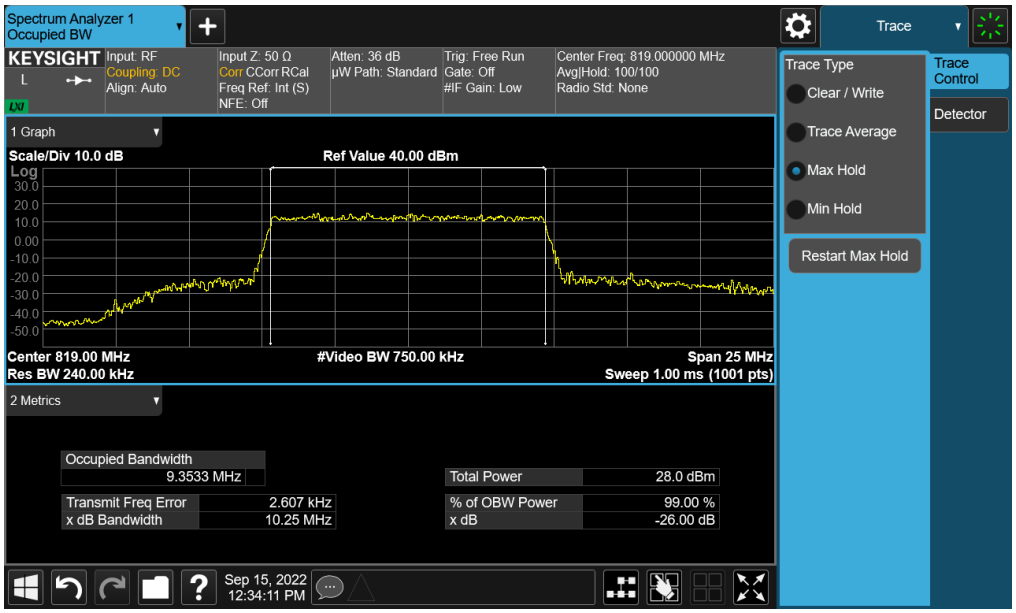



**Plot 7-20. Occupied Bandwidth Plot (NR Band n26- 15MHz 16-QAM - Full RB)**


**Plot 7-21. Occupied Bandwidth Plot (NR Band n26- 10MHz π/2 BPSK - Full RB)**

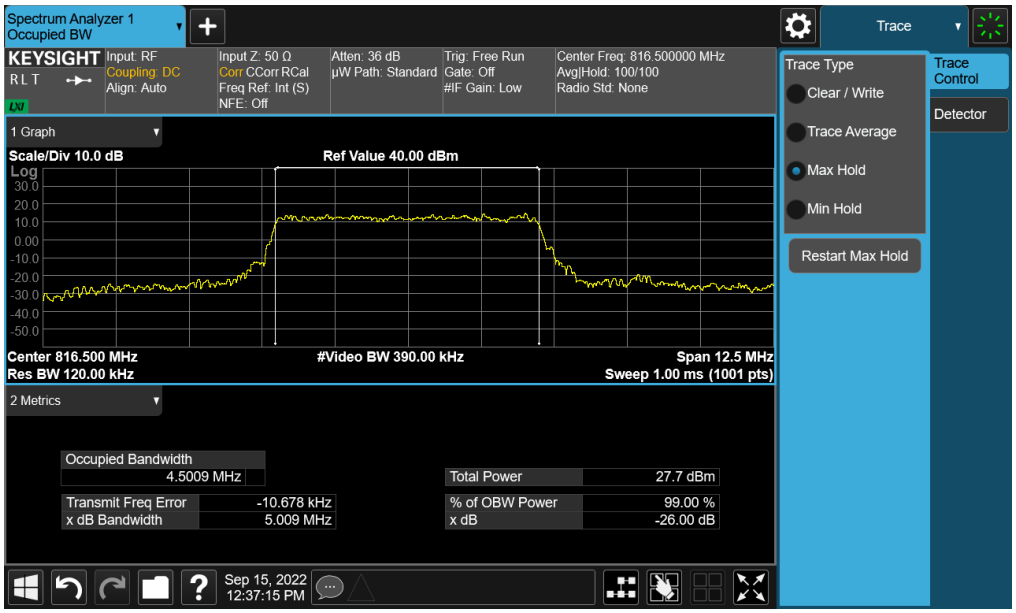



**Plot 7-22. Occupied Bandwidth Plot (NR Band n26- 10MHz QPSK - Full RB)**

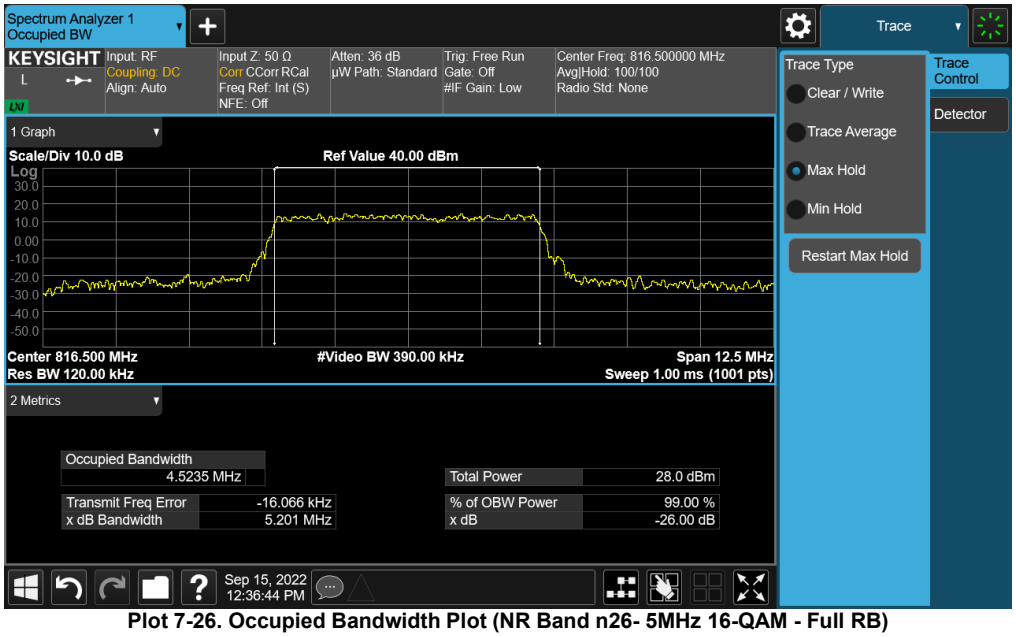



**Plot 7-23. Occupied Bandwidth Plot (NR Band n26- 10MHz 16-QAM - Full RB)**


**Plot 7-24. Occupied Bandwidth Plot (NR Band n26- 5MHz π/2 BPSK - Full RB)**




**Plot 7-25. Occupied Bandwidth Plot (NR Band n26- 5MHz QPSK - Full RB)**




**Plot 7-26. Occupied Bandwidth Plot (NR Band n26- 5MHz 16-QAM - Full RB)**

## 7.4 Spurious and Harmonic Emissions at Antenna Terminal

**Test Overview**

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

***The minimum permissible attenuation level of any spurious emission is 43 + 10 $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.***

**Test Procedure Used**

ANSI C63.26-2015 – Section 5.7.4

**Test Settings**

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. RBW ≥ 100kHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

**Test Setup**

The EUT and measurement equipment were set up as shown in the diagram below.

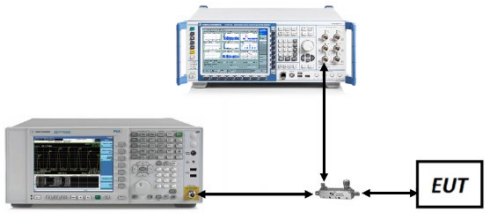


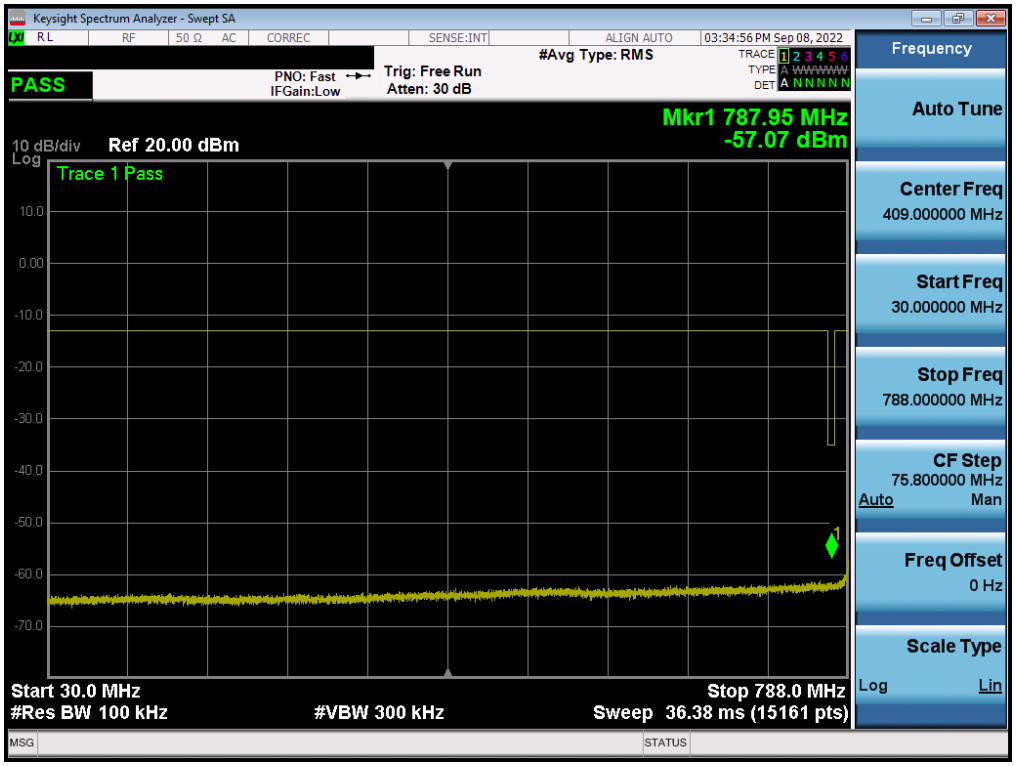

**Figure 7-3. Test Instrument & Measurement Setup**

**Test Notes**

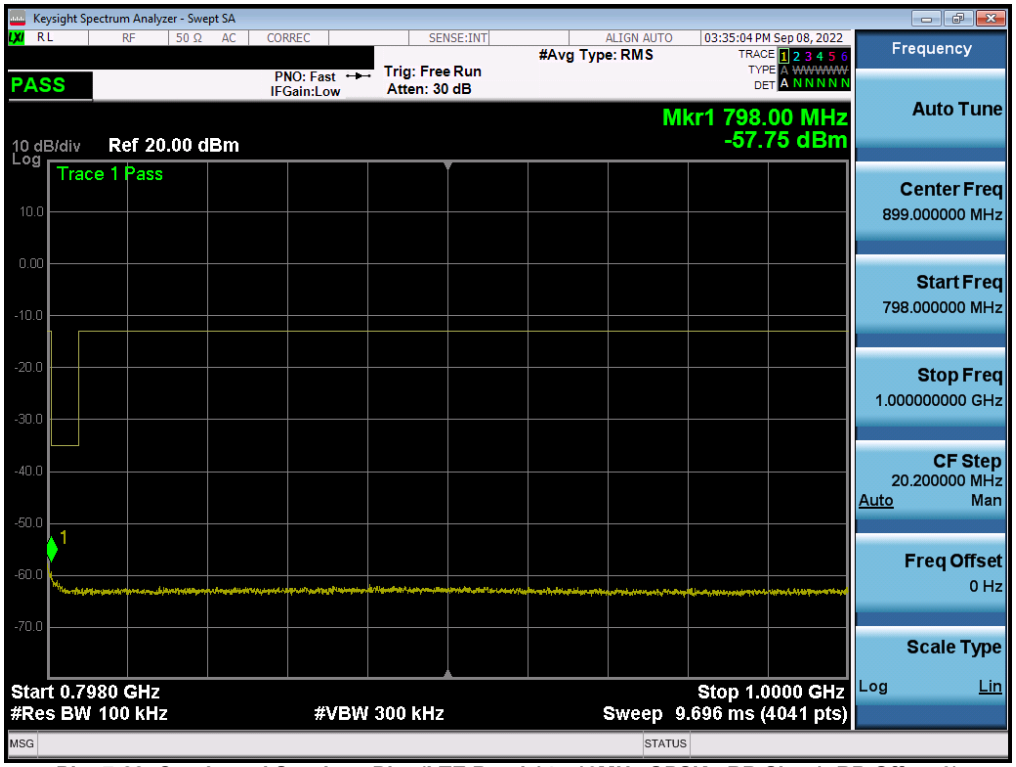
1. Per Part 22H and 90, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

## LTE Band 14



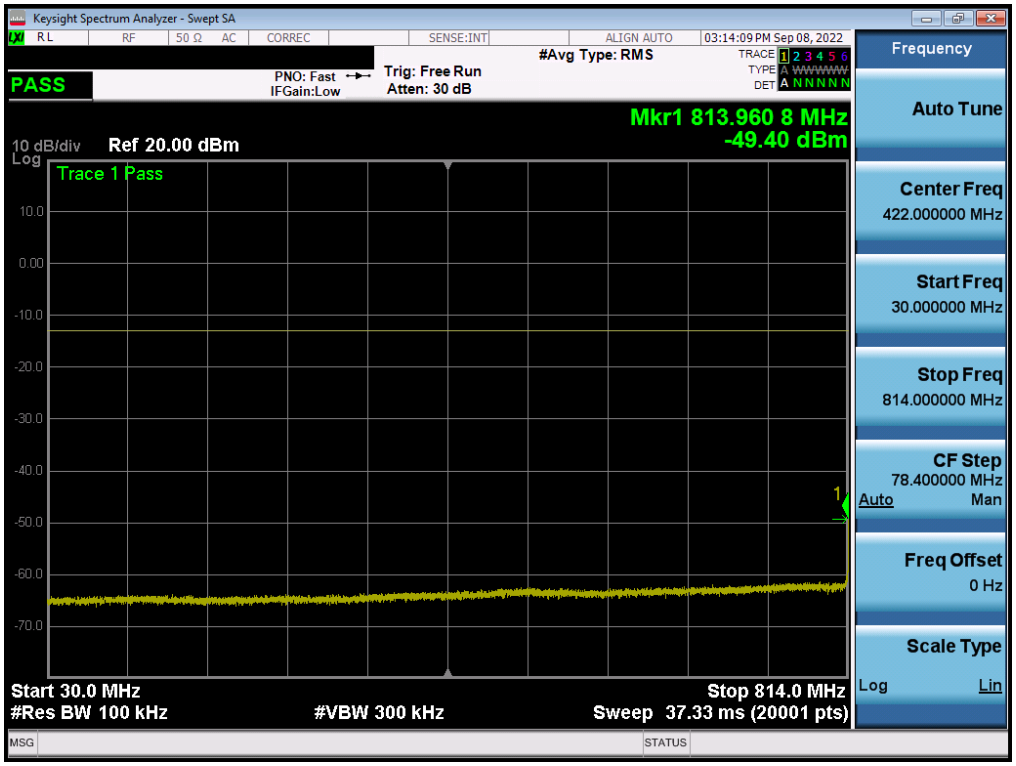

**Plot 7-27. Conducted Spurious Plot (LTE Band 14 - 10MHz QPSK - RB Size 1, RB Offset 0)**



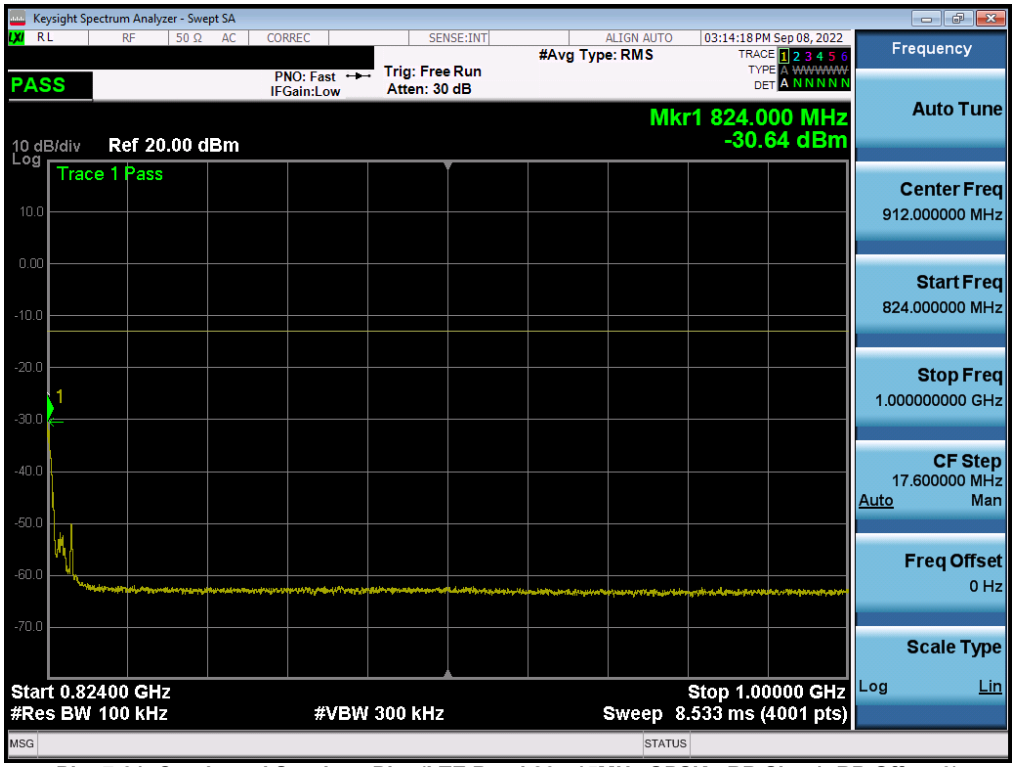

**Plot 7-28. Conducted Spurious Plot (LTE Band 14 - 10MHz QPSK - RB Size 1, RB Offset 0)**


**Plot 7-29. Conducted Spurious Plot (LTE Band 14 - 10MHz QPSK - RB Size 1, RB Offset 0)**

## LTE Band 26



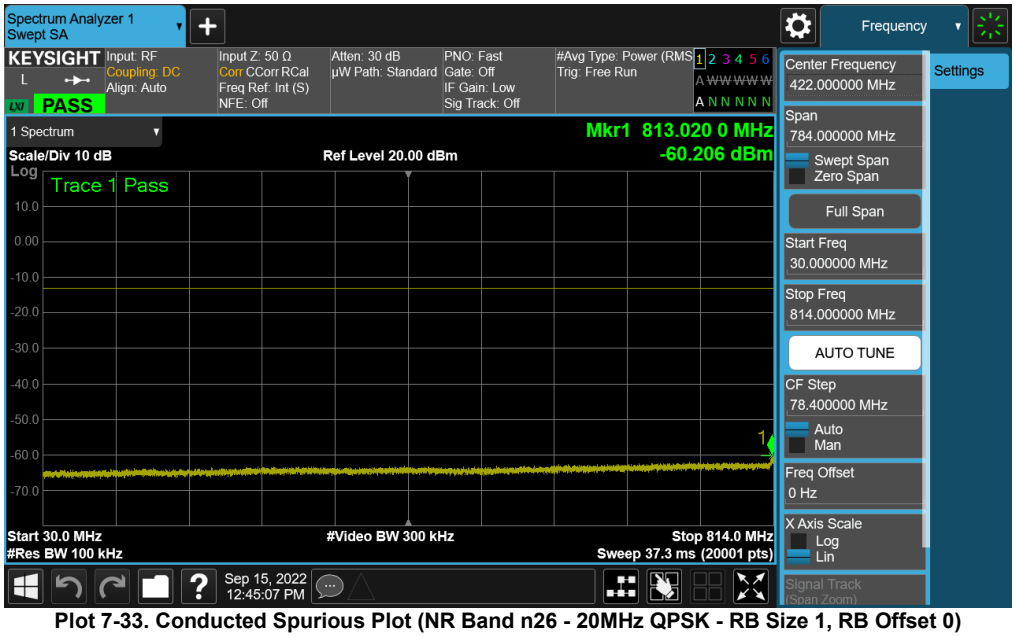

**Plot 7-30. Conducted Spurious Plot (LTE Band 26 - 15MHz QPSK - RB Size 1, RB Offset 0)**



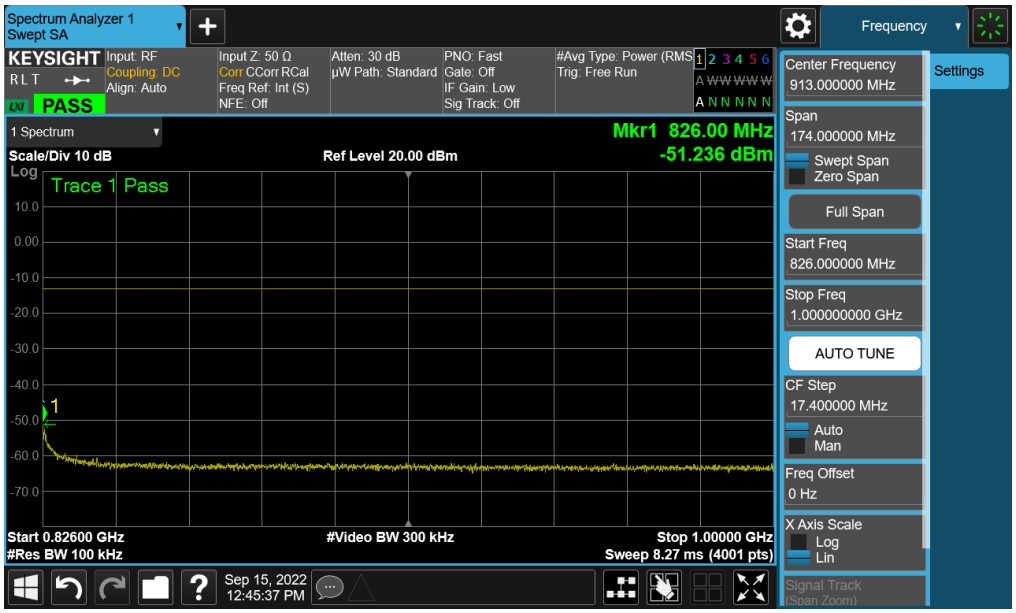

**Plot 7-31. Conducted Spurious Plot (LTE Band 26 - 15MHz QPSK - RB Size 1, RB Offset 0)**


**Plot 7-32. Conducted Spurious Plot (LTE Band 26 - 15MHz QPSK - RB Size 1, RB Offset 0)**

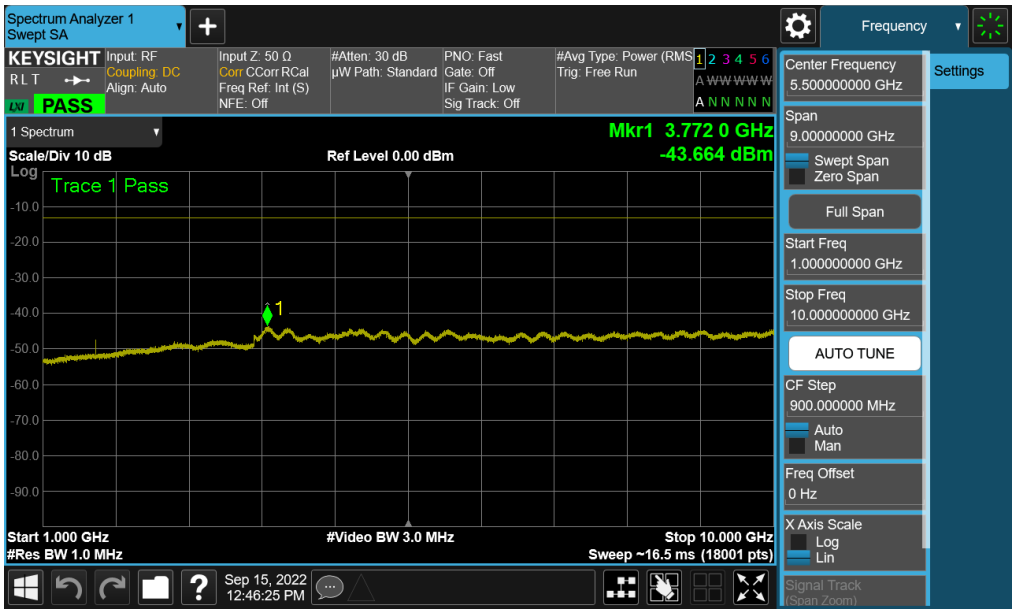
## NR Band n26




**Plot 7-33. Conducted Spurious Plot (NR Band n26 - 20MHz QPSK - RB Size 1, RB Offset 0)**




**Plot 7-34. Conducted Spurious Plot (NR Band n26 - 20MHz QPSK - RB Size 1, RB Offset 0)**




**Plot 7-35. Conducted Spurious Plot (NR Band n26 - 20MHz QPSK - RB Size 1, RB Offset 0)**

## 7.5 Band Edge Emissions at Antenna Terminal

**Test Overview**

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

***For LTE B26 operation under Part 90.691, the minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by greater than 37.5 kHz is 43 + 10log$_{10}$(P$_{[Watts]}$), where P is the transmitter power in Watts. The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is 50 + 10log$_{10}$(P$_{[Watts]}$), where P is the transmitter power in Watts.***

***For LTE Band 14 operation under Part 90.543, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.***

***Additionally, for LTE Band 14 operation, on all frequencies between 769-775 MHz and 799-805 MHz, the power of any emission shall be attenuated by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.***

**Test Procedure Used**

ANSI C63.26-2015 – Section 5.7.3

**Test Settings**

1. Span was set large enough so as to capture all out of band emissions near the band edge
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = RMS
5. Trace mode = trace average
6. Sweep time = auto couple
7. The trace was allowed to stabilize

**Test Setup**

The EUT and measurement equipment were set up as shown in the diagram below.

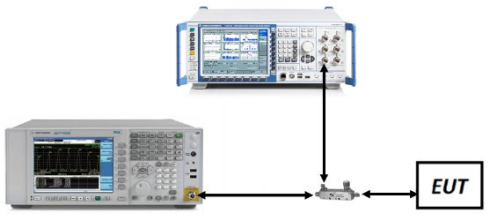



**Figure 7-4. Test Instrument & Measurement Setup**

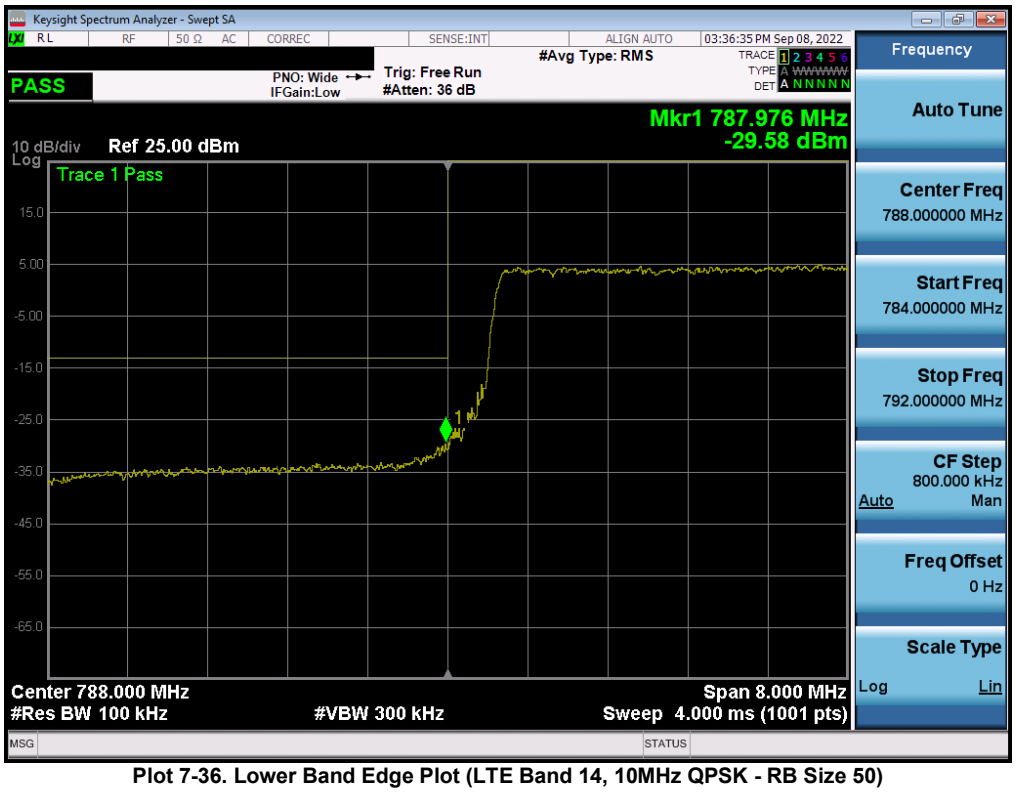
## Test Notes

1. For channel edge emission, the signal analyzer's "ACP" measurement capability is used.

2. Per 22.917(b) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. 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 emission are attenuated at least 26 dB below the transmitter power.

3. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

## LTE Band 14




**Plot 7-36. Lower Band Edge Plot (LTE Band 14, 10MHz QPSK - RB Size 50)**


**Plot 7-37. Lower Emission Mask Plot (LTE Band 14, 10MHz QPSK - RB Size 50)**


**Plot 7-38. Upper Band Edge Plot (LTE Band 14, 10MHz QPSK - RB Size 50)**


**Plot 7-39. Upper Emission Mask Plot (LTE Band 14, 10MHz QPSK - RB Size 50)**

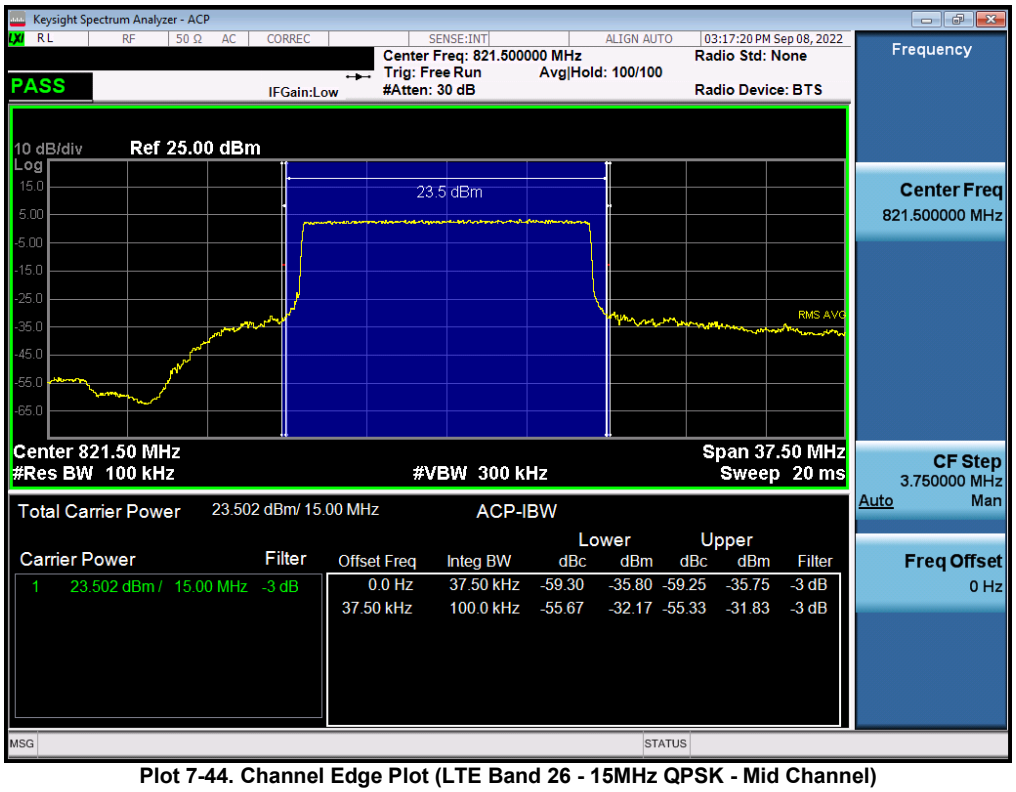

**Plot 7-40. Lower Band Edge Plot (LTE Band 14, 5MHz QPSK - RB Size 25)**


**Plot 7-41. Lower Emission Mask Plot (LTE Band 14, 5MHz QPSK - RB Size 25)**

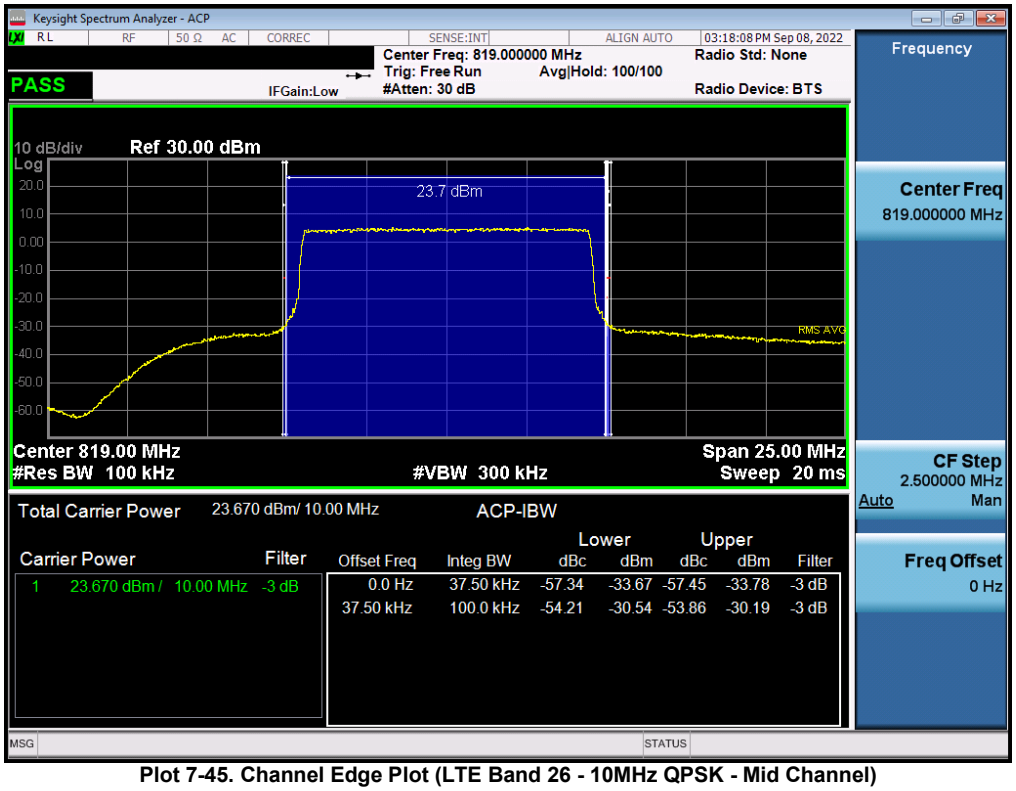

**Plot 7-42. Upper Band Edge Plot (LTE Band 14, 5MHz QPSK - RB Size 25)**


**Plot 7-43. Upper Emission Mask Plot (LTE Band 14, 5MHz QPSK - RB Size 25)**

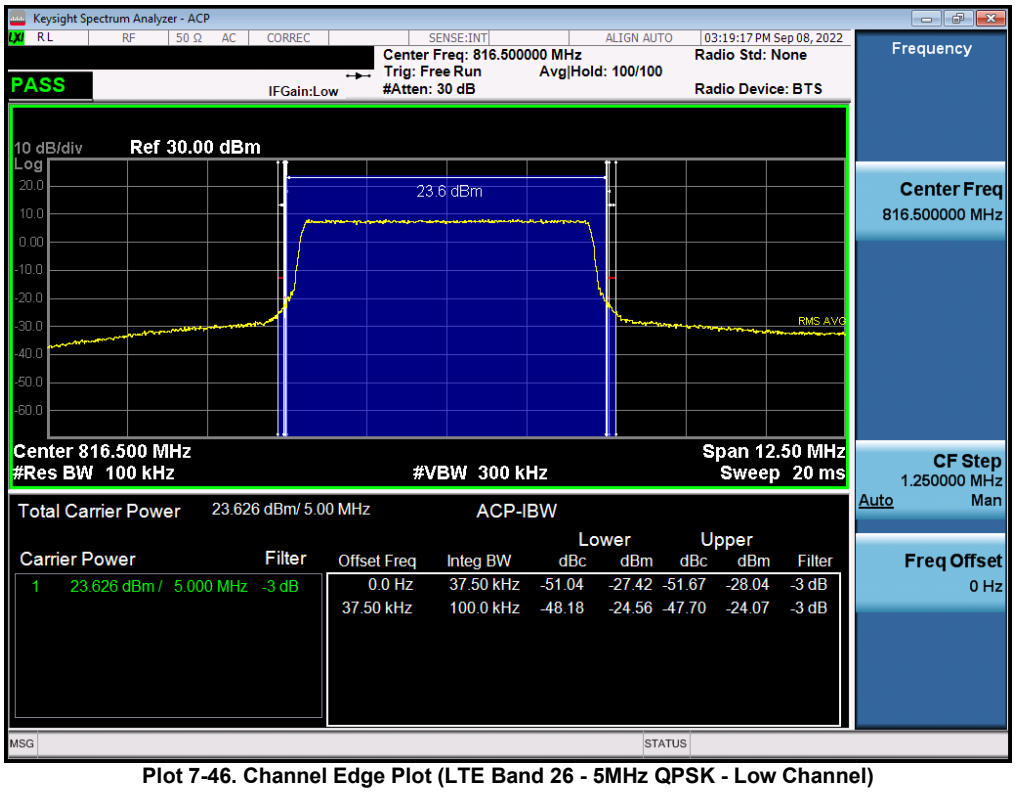
## LTE Band 26



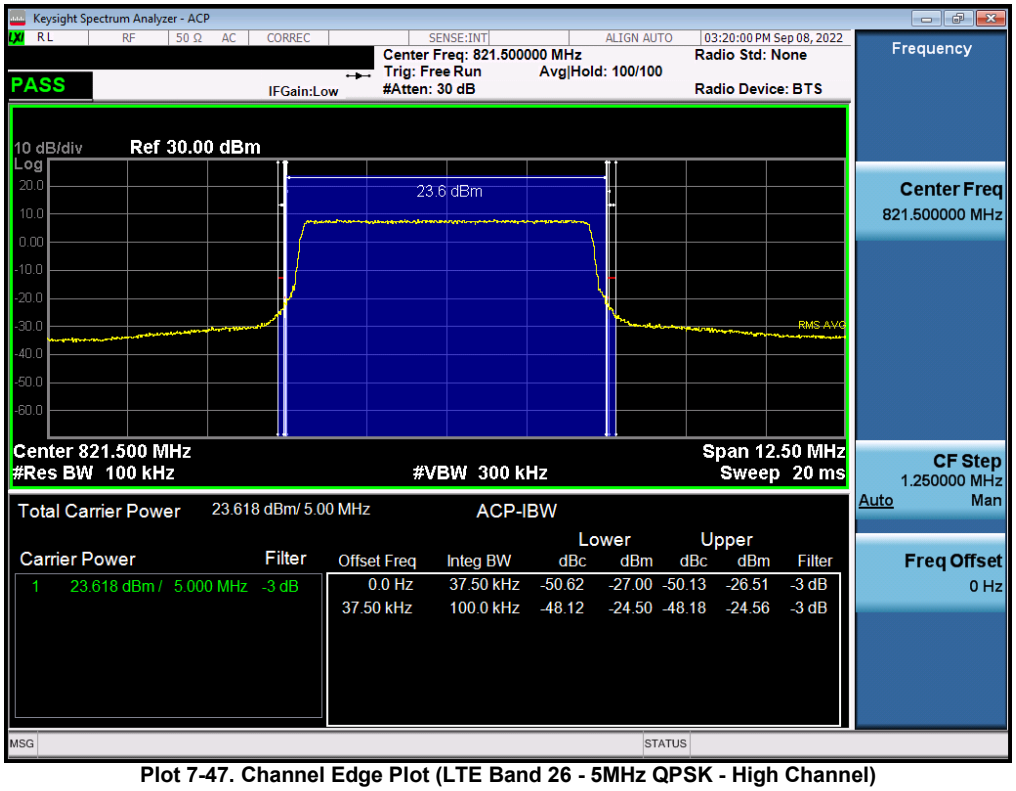

**Plot 7-44. Channel Edge Plot (LTE Band 26 - 15MHz QPSK - Mid Channel)**



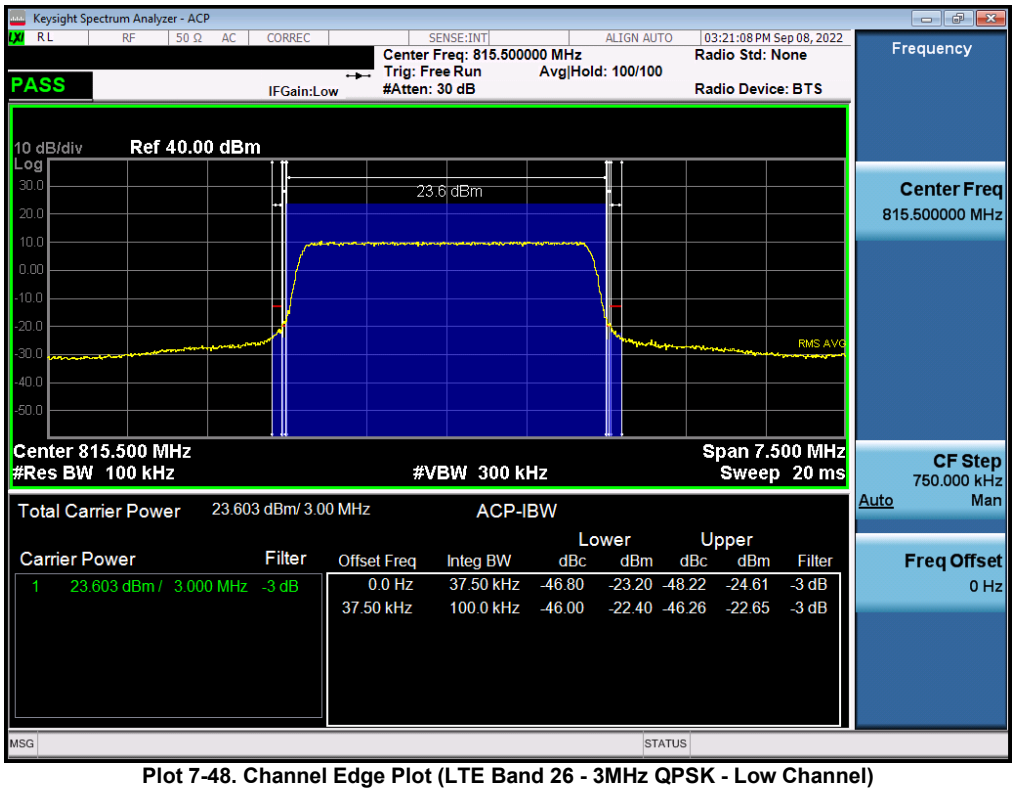

**Plot 7-45. Channel Edge Plot (LTE Band 26 - 10MHz QPSK - Mid Channel)**



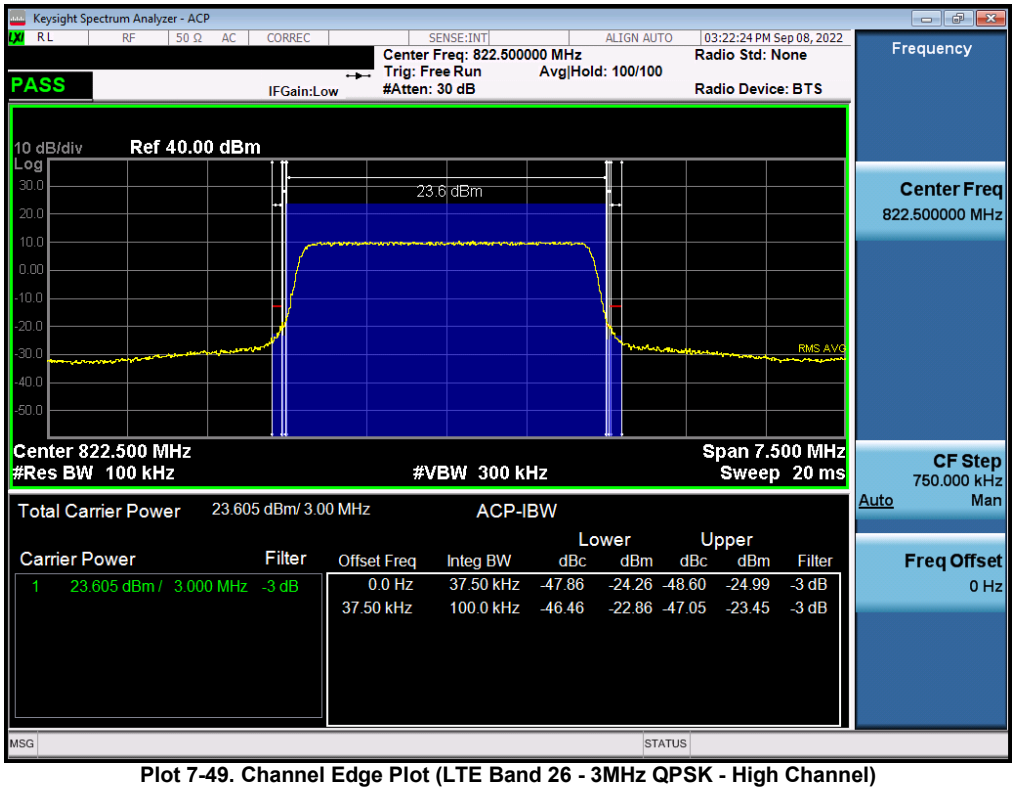

**Plot 7-46. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - Low Channel)**



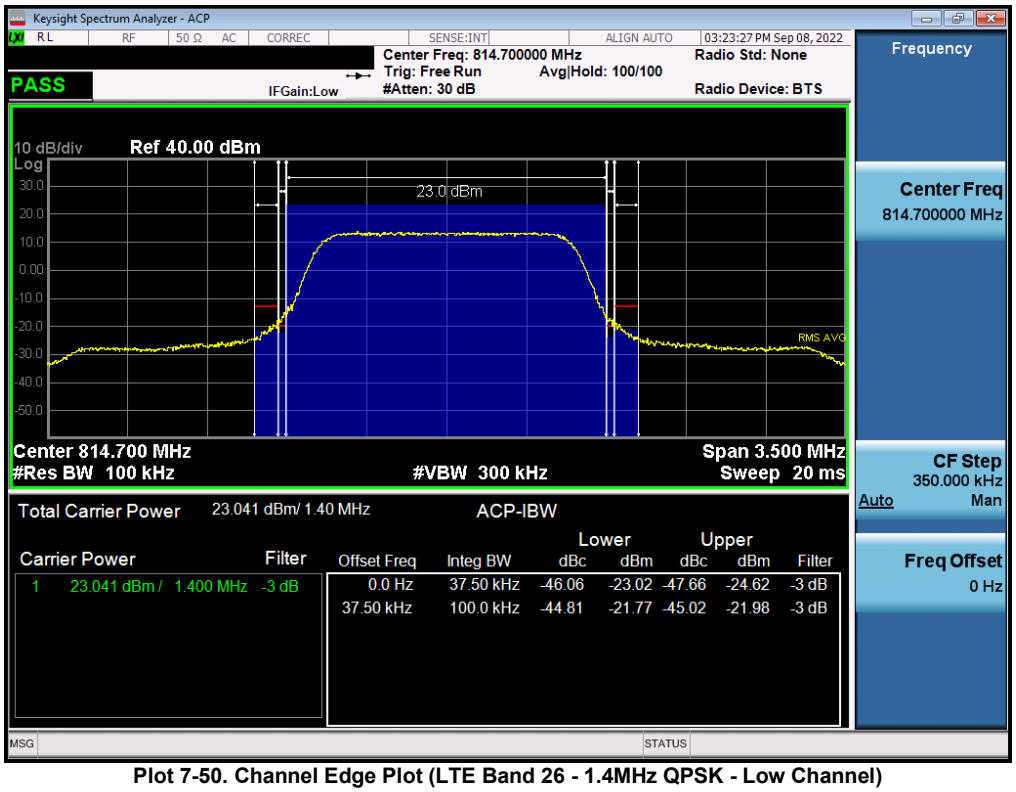

**Plot 7-47. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - High Channel)**



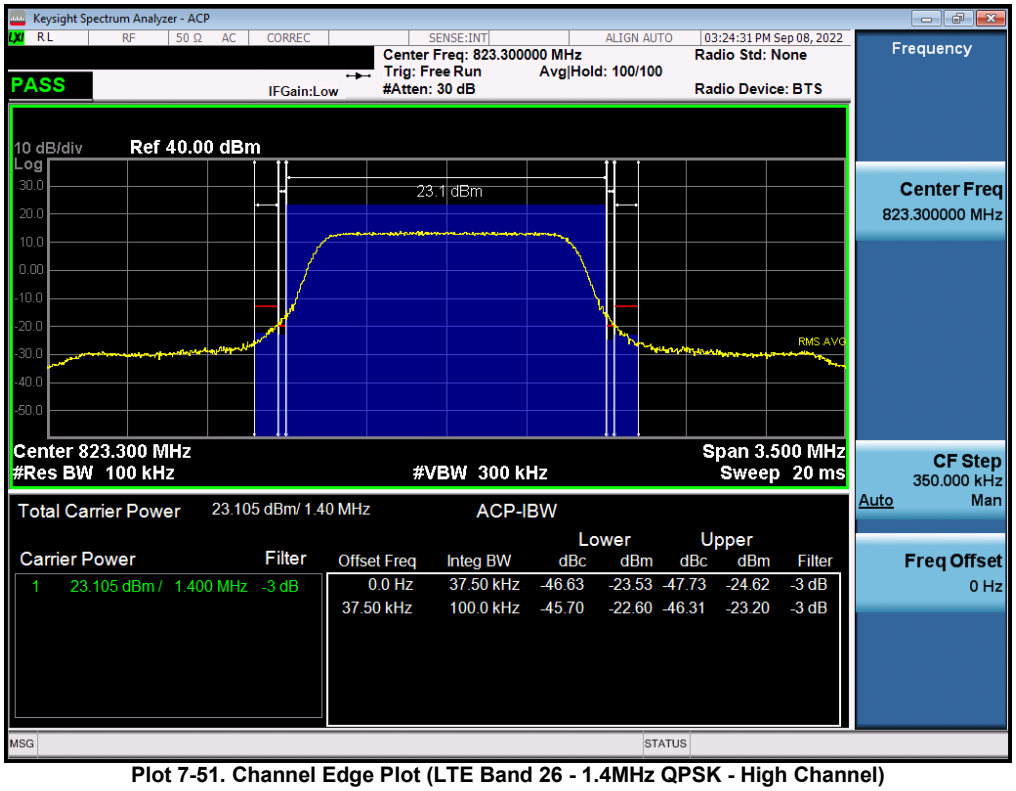

**Plot 7-48. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - Low Channel)**




**Plot 7-49. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - High Channel)**

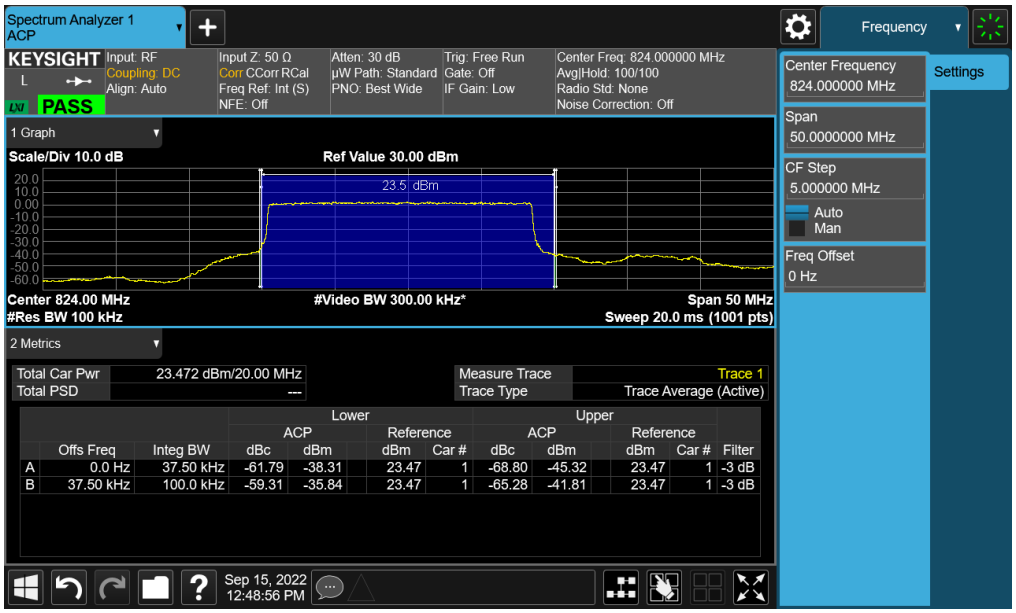



**Plot 7-50. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - Low Channel)**

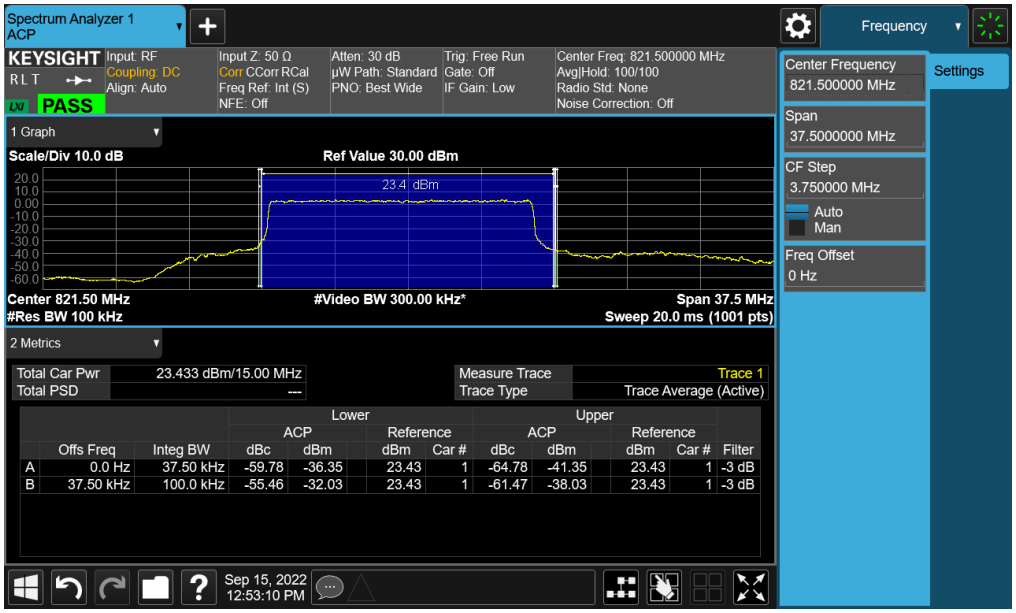



**Plot 7-51. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - High Channel)**

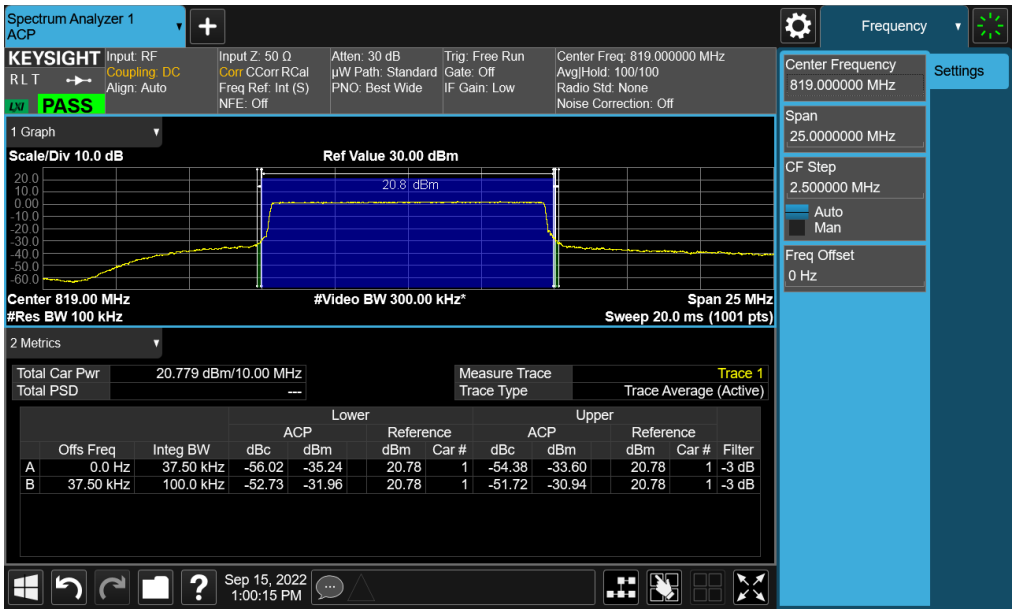
## NR Band n26



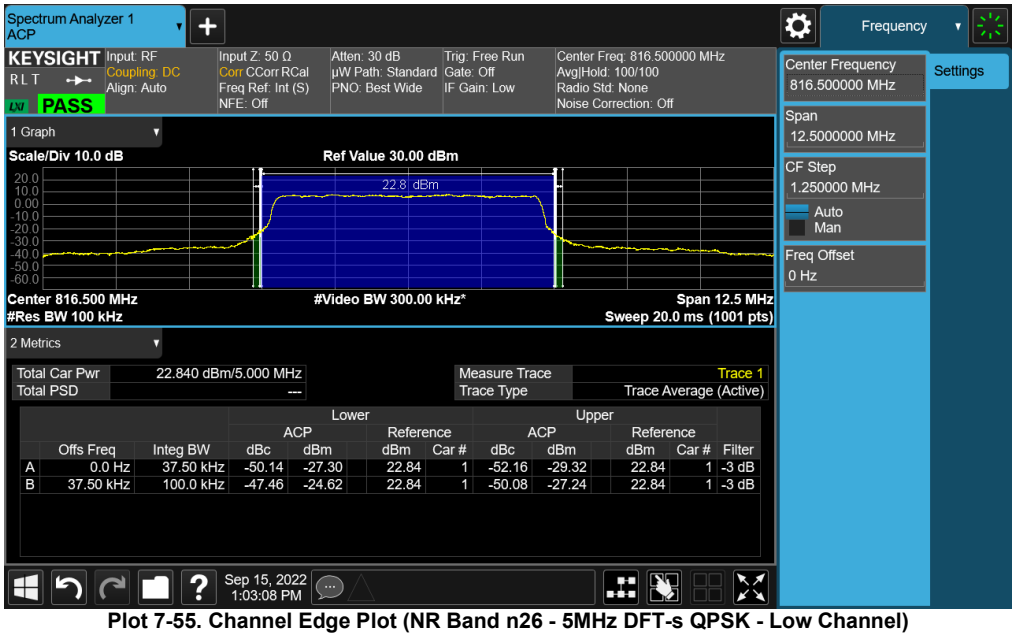

**Plot 7-52. Channel Edge Plot (NR Band n26 - 20MHz DFT-s π/2 BPSK - Mid Channel)**



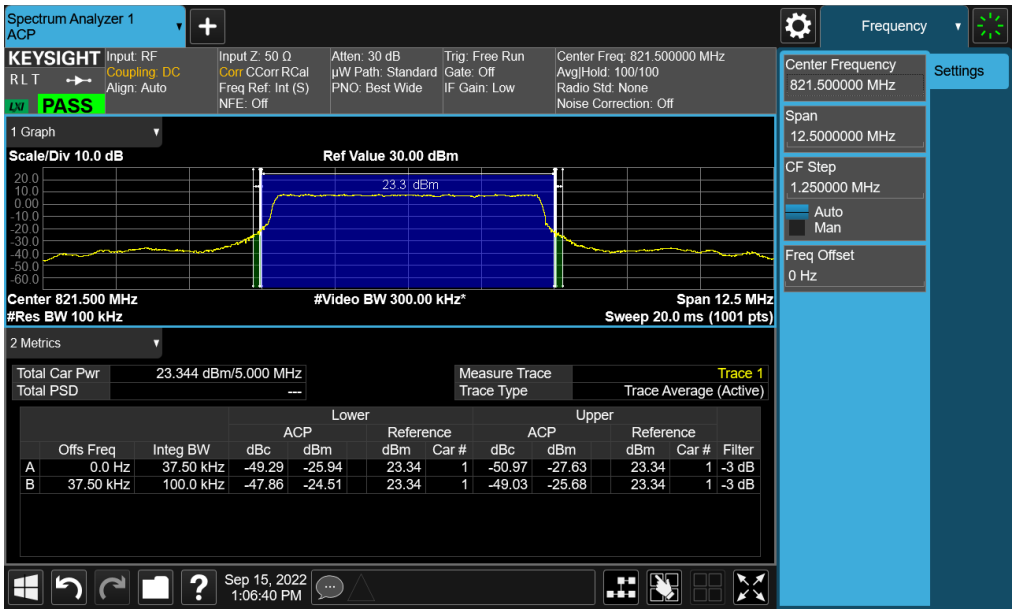

**Plot 7-53. Channel Edge Plot (NR Band n26 - 15MHz DFT-s π/2 BPSK - Mid Channel)**




**Plot 7-54. Channel Edge Plot (NR Band n26 - 10MHz CP QPSK - Mid Channel)**




**Plot 7-55. Channel Edge Plot (NR Band n26 - 5MHz DFT-s QPSK - Low Channel)**




**Plot 7-56. Channel Edge Plot (NR Band n26 - 5MHz DFT-s π/2 BPSK - High Channel)**

## 7.6 Radiated Power (ERP)

**Test Overview**

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI C63.26-2015 with the EUT transmitting into an integral antenna. Measurements are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

**Test Procedures Used**

ANSI C63.26-2015 – Section 5.2.4.4

**Test Settings**

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize.

## Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

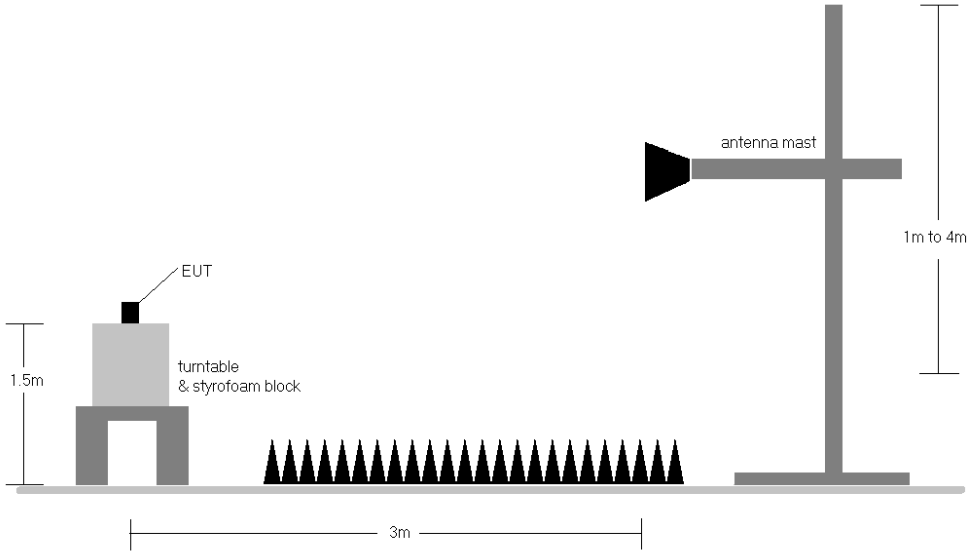



**Figure 7-5. Radiated Test Setup <1GHz**

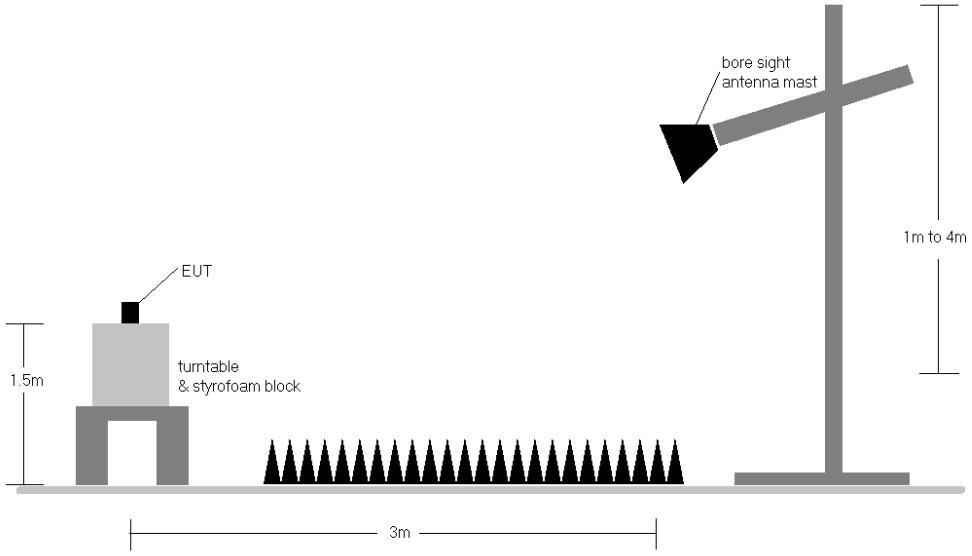



**Figure 7-6. Radiated Test Setup > 1GHz**

## Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

3) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.