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 27 MEASUREMENT REPORT

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

**Date of Testing:**
6/15/2023 - 7/13/2023
**Test Report Issue Date:**
7/17/2023
**Test Site/Location:**
Element lab. Yongin-Si, Gyeonggi-do, South Korea
**Test Report Serial No.:**
1M2304260059-06.A3L

| | |
|---|---|
| **FCC ID:** | **A3LSMF731JPN** |
| **Applicant Name:** | **Samsung Electronics Co., Ltd.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model:** | SC-54D |
| **Additional Model(s):** | SCG23 |
| **EUT Type:** | Portable Handset |
| **FCC Classification:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FCC Rule Part:** | 27 |
| **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

# PART 27 MEASUREMENT REPORT

| Antenna-B | | | | | | |
|---|---|---|---|---|---|---|
| Mode | Bandwidth | Modulation | Tx Frequency Range [MHz] | EIRP | | Emission Designator |
| | | | | Max. Power [W] | Max. Power [dBm] | |
| LTE Band 41(PC3) | 20 MHz | QPSK | 2506.0 - 2680.0 | 0.078 | 18.94 | 18M0G7D |
| | | 16QAM | 2506.0 - 2680.0 | 0.066 | 18.18 | 18M1W7D |
| | 15 MHz | QPSK | 2503.5 - 2682.5 | 0.080 | 19.03 | 13M5G7D |
| | | 16QAM | 2503.5 - 2682.5 | 0.069 | 18.40 | 13M5W7D |
| | 10 MHz | QPSK | 2501.0 - 2685.0 | 0.084 | 19.22 | 9M02G7D |
| | | 16QAM | 2501.0 - 2685.0 | 0.075 | 18.73 | 9M01W7D |
| | 5 MHz | QPSK | 2498.5 - 2687.5 | 0.083 | 19.17 | 4M52G7D |
| | | 16QAM | 2498.5 - 2687.5 | 0.067 | 18.23 | 4M51W7D |

| Antenna-I | | | | | | |
|---|---|---|---|---|---|---|
| Mode | Bandwidth | Modulation | Tx Frequency Range [MHz] | EIRP | | Emission Designator |
| | | | | Max. Power [W] | Max. Power [dBm] | |
| LTE Band 41(PC3) | 20 MHz | QPSK | 2506.0 - 2680.0 | 0.347 | 25.40 | 18M0G7D |
| | | 16QAM | 2506.0 - 2680.0 | 0.261 | 24.16 | 18M0W7D |
| | 15 MHz | QPSK | 2503.5 - 2682.5 | 0.367 | 25.65 | 13M5G7D |
| | | 16QAM | 2503.5 - 2682.5 | 0.274 | 24.37 | 13M5W7D |
| | 10 MHz | QPSK | 2501.0 - 2685.0 | 0.389 | 25.90 | 9M04G7D |
| | | 16QAM | 2501.0 - 2685.0 | 0.267 | 24.27 | 9M02W7D |
| | 5 MHz | QPSK | 2498.5 - 2687.5 | 0.354 | 25.49 | 4M52G7D |
| | | 16QAM | 2498.5 - 2687.5 | 0.269 | 24.30 | 4M51W7D |
| NR Band n41 | 100 MHz | π/2 BPSK | 2546.0 - 2640.0 | 0.420 | 26.23 | 97M3G7D |
| | | QPSK | 2546.0 - 2640.0 | 0.417 | 26.20 | 98M3G7D |
| | | 16QAM | 2546.0 - 2640.0 | 0.321 | 25.06 | 98M1W7D |
| | 90 MHz | π/2 BPSK | 2541.0 - 2645.0 | 0.420 | 26.23 | 87M3G7D |
| | | QPSK | 2541.0 - 2645.0 | 0.420 | 26.23 | 87M9G7D |
| | | 16QAM | 2541.0 - 2645.0 | 0.358 | 25.54 | 88M1W7D |
| | 80 MHz | π/2 BPSK | 2536.0 - 2650.0 | 0.432 | 26.35 | 77M5G7D |
| | | QPSK | 2536.0 - 2650.0 | 0.423 | 26.26 | 78M0G7D |
| | | 16QAM | 2536.0 - 2650.0 | 0.361 | 25.58 | 78M0W7D |
| | 70 MHz | π/2 BPSK | 2536.0 - 2650.0 | 0.432 | 26.35 | 64M7G7D |
| | | QPSK | 2536.0 - 2650.0 | 0.423 | 26.26 | 68M0G7D |
| | | 16QAM | 2536.0 - 2650.0 | 0.361 | 25.58 | 68M0W7D |
| | 60 MHz | π/2 BPSK | 2526.0 - 2660.0 | 0.424 | 26.27 | 58M2G7D |
| | | QPSK | 2526.0 - 2660.0 | 0.420 | 26.23 | 58M3G7D |
| | | 16QAM | 2526.0 - 2660.0 | 0.380 | 25.80 | 58M1W7D |
| | 50 MHz | π/2 BPSK | 2521.0 - 2665.0 | 0.427 | 26.30 | 46M1G7D |
| | | QPSK | 2521.0 - 2665.0 | 0.411 | 26.14 | 47M8G7D |
| | | 16QAM | 2521.0 - 2665.0 | 0.360 | 25.56 | 47M7W7D |
| | 40 MHz | π/2 BPSK | 2516.0 - 2670.0 | 0.416 | 26.19 | 35M8G7D |
| | | QPSK | 2516.0 - 2670.0 | 0.521 | 27.17 | 38M1G7D |
| | | 16QAM | 2516.0 - 2670.0 | 0.384 | 25.85 | 38M0W7D |
| | 30 MHz | π/2 BPSK | 2511.0 - 2675.0 | 0.423 | 26.26 | 27M0G7D |
| | | QPSK | 2511.0 - 2675.0 | 0.420 | 26.23 | 28M0G7D |
| | | 16QAM | 2511.0 - 2675.0 | 0.359 | 25.55 | 28M1W7D |
| | 20 MHz | π/2 BPSK | 2506.0 - 2680.0 | 0.416 | 26.19 | 18M0G7D |
| | | QPSK | 2506.0 - 2680.0 | 0.521 | 27.17 | 18M4G7D |
| | | 16QAM | 2506.0 - 2680.0 | 0.384 | 25.85 | 18M4W7D |
| | 15 MHz | π/2 BPSK | 2503.5 - 2682.5 | 0.414 | 26.17 | 13M0G7D |
| | | QPSK | 2503.5 - 2682.5 | 0.402 | 26.04 | 13M7G7D |
| | | 16QAM | 2503.5 - 2682.5 | 0.361 | 25.58 | 13M7W7D |
| | 10 MHz | π/2 BPSK | 2501.0 - 2685.0 | 0.412 | 26.15 | 8M68G7D |
| | | QPSK | 2501.0 - 2685.0 | 0.401 | 26.03 | 8M67G7D |
| | | 16QAM | 2501.0 - 2685.0 | 0.360 | 25.57 | 8M78W7D |

## 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: A3LSMF731JPN**. 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 27.

**Test Device Serial No.:** 0134M, 0165M,0180M, 0214M, 0264M

## 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, Wireless Power Transfer

This device uses a tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance for certain bands and modes of operation. The tuner for this device was set to simulate a "free space" condition where the transmit antenna is matched to the medium into which it is transmitting and, thus, the power is at its maximum level.

This device supports three configurations: one is with screen open, one is where the screen is half open (90 degrees), and one is with screen closed. All configurations are tested, and the worst case radiated emissions data is shown in this report.

## 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 SC54DOMU0AWEQ 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 | 1.95 |
| Radiated Disturbance (<1GHz) | 4.10 |
| Radiated Disturbance (>1GHz) | 4.82 |
| Radiated Disturbance (>18GHz) | 4.96 |

# 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 |
|---|---|---|---|---|---|---|
| Agilent | N9030A | PXA Signal Analyzer | 2023-07-04 | Annual | 2024-07-03 | MY49432391 |
| Anritsu | S820E | Cable and Antenna Analyzer | 2023-07-05 | Annual | 2024-07-04 | 1839097 |
| Anritsu | MA24106A | USB Power Sensor | 2023-07-05 | Annual | 2024-07-04 | 1244512 |
| Com-Power | AL-130 | 9kHz - 30MHz Loop Antenna | 2022-10-21 | Biennial | 2024-10-20 | 10160045 |
| Com-Power | PAM-118A | Preamplifier | 2023-07-05 | Annual | 2024-07-04 | 551042 |
| Espec | SH-242 | Environmental Chamber | 2022-08-26 | Annual | 2023-08-25 | 93011064 |
| Fairview Microwave | FM2CP1122-10 | 2.92mm Directional Coupler | 2023-07-04 | Annual | 2024-07-03 | 1946 |
| Keysight Technologies | N9030B | MXA Signal Analyzer | 2023-07-04 | Annual | 2024-07-03 | MY57143276 |
| Mini-Circuits | BW-N10W5+ | Attenuator | 2023-07-04 | Annual | 2024-07-03 | 1607 |
| Mini-Circuits | BW-N10W5+ | Attenuator | 2023-07-04 | Annual | 2024-07-03 | 1607 |
| Rohde & Schwarz | TS-PR18 | Preamplifier | 2023-07-05 | Annual | 2024-07-04 | 102141 |
| Rohde & Schwarz | SMB100A03 | Signal Generator | 2023-01-17 | Annual | 2024-01-16 | 182487 |
| Rohde & Schwarz | CMW500 | Wideband Radio Communication Tester | 2023-02-17 | Annual | 2024-02-16 | 131453 |
| Rohde & Schwarz | FSW43 | Signal and Spectrum Analyzer | 2023-01-13 | Annual | 2024-01-12 | 101955 |
| Rohde & Schwarz | SFUNIT-Rx | Shielded Filter Unit | 2023-02-17 | Annual | 2024-02-16 | 102131 |
| Rohde & Schwarz | TC-TA18 | VIVALDI-ANT | 2021-10-22 | Biennial | 2023-10-21 | 101097 |
| Rohde & Schwarz | TC-TA18 | VIVALDI-ANT | 2021-10-22 | Biennial | 2023-10-21 | 101098 |
| Schwarzbeck | VULB9162 | Broadband TRILOG Antenna | 2023-06-01 | Biennial | 2025-05-31 | 9162-217 |
| Schwarzbeck | UHA9105 | Dipole Antenna | 2022-07-19 | Biennial | 2024-07-18 | 91052522 |
| Sunol | DRH-118 | Horn Antenna | 2023-01-26 | Biennial | 2025-01-25 | A060215 |

**Table 5-1. Test Equipment**

**Notes:**

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.

# 6.0 SAMPLE CALCULATIONS

## 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

**Example: Spurious emission at 3700.40 MHz**

The receive 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 analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm – (-24.80) = 50.3 dBc.

# 7.0 TEST RESULTS

## 7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMF731JPN

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

Mode(s): LTE/NR/ULCA

| Test Condition | Test Description | FCC Part Section(s) | Test Limit | Test Result | Reference |
|---|---|---|---|---|---|
| CONDUCTED | Transmitter Conducted Output Power* | 2.1046(a), 2.1046(c) | N/A | PASS | Section 7.2 |
| | Occupied Bandwidth | 2.1049(h) | N/A | PASS | Section 7.3 |
| | Conducted Band Edge / Spurious Emissions (LTE Band 41; NR Band n41) | 2.1051, 27.53(m)(4) | Undesirable emissions must meet the limits detailed in 27.53(m)(4) | PASS | Sections 7.4, 7.5 |
| | Frequency Stability | 2.1055, 27.54 | Fundamental emissions stay within authorized frequency block | PASS | Section 7.8 |
| RADIATED | Equivalent Isotropic Radiated Power (LTE Band 41; NR n41) | 27.50(h)(2) | ≤ 2 Watts max. EIRP | PASS | Section 7.6 |
| | Radiated Spurious Emissions (LTE Band 41; NR Band n41) | 2.1053, 27.53(m) | Undesirable emissions must meet the limits detailed in 27.53(m) | 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 were all 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) All conducted emissions measurements are performed with automated test software to 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.

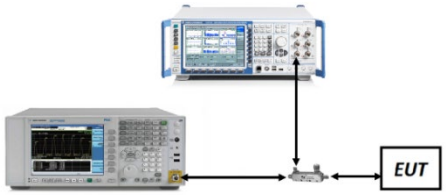



**Figure 7-1. Test Instrument & Measurement Setup**

**Test Notes**

1. Uplink carrier aggregation is only supported in this EUT while operating in Power Class 3.

2. 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.

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

| Power State | Band | Bandwidth (PCC + SCC) | PCC | | | | | SCC | | | | | ULCA Tx. Power [dBm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Modulation | UL Channel | UL Frequency | UL # RB | UL RB Offset | Modulation | UL Channel | UL Frequency | UL # RB | UL RB Offset | |
| Max | LTE B41 (PC3) | 20MHz + 20MHz | QPSK | 39750 | 2506.0 | 1 | 99 | QPSK | 39948 | 2525.8 | 1 | 0 | 24.28 |
| | | | | 40620 | 2593.0 | 1 | 99 | | 40818 | 2612.8 | 1 | 0 | 23.92 |
| | | | | 41490 | 2680.0 | 1 | 0 | | 41292 | 2660.2 | 1 | 99 | 23.83 |
| | | | QPSK | 39750 | 2506 | 100 | 0 | QPSK | 39948 | 2525.8 | 100 | 0 | 22.03 |
| | | | 16-QAM | 39750 | 2506 | 100 | 0 | 16-QAM | 39948 | 2525.8 | 100 | 0 | 20.99 |
| | | | 64-QAM | 39750 | 2506 | 100 | 0 | 64-QAM | 39948 | 2525.8 | 100 | 0 | 20.90 |

**Table 7-2. Conducted Powers (ULCA LTE Band 41 PC3 – Ant B)**

| Power State | Band | Bandwidth (PCC + SCC) | PCC | | | | | SCC | | | | | ULCA Tx. Power [dBm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Modulation | UL Channel | UL Frequency | UL # RB | UL RB Offset | Modulation | UL Channel | UL Frequency | UL # RB | UL RB Offset | |
| Max | LTE B41 (PC3) | 20MHz + 20MHz | QPSK | 39750 | 2506.0 | 1 | 99 | QPSK | 39948 | 2525.8 | 1 | 0 | 23.60 |
| | | | | 40620 | 2593.0 | 1 | 99 | | 40818 | 2612.8 | 1 | 0 | 24.46 |
| | | | | 41490 | 2680.0 | 1 | 0 | | 41292 | 2660.2 | 1 | 99 | 24.88 |
| | | | QPSK | 41490 | 2680 | 100 | 0 | QPSK | 41292 | 2660.2 | 100 | 0 | 22.47 |
| | | | 16-QAM | 41490 | 2680 | 100 | 0 | 16-QAM | 41292 | 2660.2 | 100 | 0 | 21.45 |
| | | | 64-QAM | 41490 | 2680 | 100 | 0 | 64-QAM | 41292 | 2660.2 | 100 | 0 | 21.34 |

**Table 7-3. Conducted Powers (ULCA LTE Band 41 PC3 – Ant I)**

| Bandwidth | Modulation | Channel | Frequency [MHz] | RB Size/Offset | Conducted Power [dBm] |
|---|---|---|---|---|---|
| 20 MHz | QPSK | 39790 | 2510.0 | 1 / 0 | 24.06 |
| | | 40620 | 2593.0 | 1 / 0 | 24.55 |
| | | 41490 | 2680.0 | 1 / 0 | 24.42 |
| | 16-QAM | 41490 | 2680.0 | 1 / 0 | 23.70 |
| 15 MHz | QPSK | 39765 | 2507.5 | 1 / 0 | 24.23 |
| | | 40620 | 2593.0 | 1 / 37 | 24.69 |
| | | 41515 | 2682.5 | 1 / 0 | 24.67 |
| | 16-QAM | 41515 | 2682.5 | 1 / 0 | 23.91 |
| 10 MHz | QPSK | 39740 | 2505.0 | 1 / 25 | 24.37 |
| | | 40620 | 2593.0 | 1 / 49 | 24.74 |
| | | 41540 | 2685.0 | 1 / 49 | 24.91 |
| | 16-QAM | 41540 | 2685.0 | 1 / 25 | 23.81 |
| 5 MHz | QPSK | 39715 | 2502.5 | 1 / 12 | 24.39 |
| | | 40620 | 2593.0 | 1 / 0 | 24.74 |
| | | 41565 | 2687.5 | 1 / 24 | 24.25 |
| | 16-QAM | 40620 | 2593.0 | 1 / 12 | 23.47 |

**Table 7-4. Conducted Powers (LTE Band 41 PC3 – Ant I – Max Power)**

| Bandwidth | Modulation | Channel | Frequency [MHz] | RB Size/Offset | Conducted Power [dBm] |
|---|---|---|---|---|---|
| 100 MHz | π/2 BPSK | 509202 | 2546.0 | 1 / 271 | 24.56 |
| | | 518598 | 2593.0 | 1 / 271 | 24.94 |
| | | 528000 | 2640.0 | 1 / 135 | 24.85 |
| | QPSK | 509202 | 2546.0 | 1 / 135 | 24.68 |
| | | 518598 | 2593.0 | 1 / 135 | 24.96 |
| | | 528000 | 2640.0 | 1 / 135 | 24.86 |
| | 16-QAM | 518598 | 2593.0 | 1 / 135 | 23.72 |
| 90 MHz | π/2 BPSK | 508200 | 2541.0 | 1 / 243 | 24.68 |
| | | 518592 | 2593.0 | 1 / 243 | 24.96 |
| | | 529002 | 2645.0 | 1 / 1 | 24.85 |
| | QPSK | 508200 | 2541.0 | 1 / 121 | 24.71 |
| | | 518592 | 2593.0 | 1 / 243 | 24.95 |
| | | 529002 | 2645.0 | 1 / 1 | 24.89 |
| | 16-QAM | 518592 | 2593.0 | 1 / 243 | 24.20 |
| 80 MHz | π/2 BPSK | 507204 | 2536.0 | 1 / 215 | 24.56 |
| | | 518598 | 2593.0 | 1 / 215 | 24.96 |
| | | 529998 | 2650.0 | 1 / 1 | 24.97 |
| | QPSK | 507204 | 2536.0 | 1 / 108 | 24.58 |
| | | 518598 | 2593.0 | 1 / 215 | 24.95 |
| | | 529998 | 2650.0 | 1 / 1 | 24.92 |
| | 16-QAM | 518598 | 2593.0 | 1 / 215 | 24.24 |
| 70 MHz | π/2 BPSK | 506202 | 2531.0 | 1 / 180 | 24.48 |
| | | 518598 | 2593.0 | 1 / 180 | 24.92 |
| | | 531000 | 2655.0 | 1 / 1 | 24.97 |
| | QPSK | 506202 | 2531.0 | 1 / 90 | 24.50 |
| | | 518598 | 2593.0 | 1 / 180 | 24.96 |
| | | 531000 | 2655.0 | 1 / 1 | 24.92 |
| | 16-QAM | 518598 | 2593.0 | 1 / 180 | 24.24 |
| 60 MHz | π/2 BPSK | 505200 | 2526.0 | 1 / 160 | 24.74 |
| | | 518598 | 2593.0 | 1 / 160 | 24.98 |
| | | 531996 | 2660.0 | 1 / 1 | 24.89 |
| | QPSK | 505200 | 2526.0 | 1 / 160 | 24.89 |
| | | 518598 | 2593.0 | 1 / 160 | 24.97 |
| | | 531996 | 2660.0 | 1 / 1 | 24.89 |
| | 16-QAM | 518598 | 2593.0 | 1 / 160 | 24.46 |
| 50 MHz | π/2 BPSK | 504204 | 2521.0 | 1 / 131 | 24.78 |
| | | 518598 | 2593.0 | 1 / 131 | 24.94 |
| | | 532998 | 2665.0 | 1 / 1 | 24.92 |
| | QPSK | 504204 | 2521.0 | 1 / 131 | 24.80 |
| | | 518598 | 2593.0 | 1 / 131 | 24.92 |
| | | 532998 | 2665.0 | 1 / 1 | 24.80 |
| | 16-QAM | 518598 | 2593.0 | 1 / 131 | 24.22 |
| 40 MHz | π/2 BPSK | 503202 | 2516.0 | 1 / 1 | 24.85 |
| | | 518598 | 2593.0 | 1 / 104 | 24.91 |
| | | 534000 | 2670.0 | 1 / 104 | 24.81 |
| | QPSK | 503202 | 2516.0 | 1 / 1 | 24.83 |
| | | 518598 | 2593.0 | 1 / 104 | 24.98 |
| | | 534000 | 2670.0 | 1 / 104 | 25.83 |
| | 16-QAM | 518598 | 2593.0 | 1 / 104 | 24.51 |
| 30 MHz | π/2 BPSK | 502203 | 2511.0 | 1 / 1 | 24.74 |
| | | 518598 | 2593.0 | 1 / 76 | 24.95 |
| | | 534999 | 2675.0 | 1 / 1 | 24.88 |
| | QPSK | 502203 | 2511.0 | 1 / 1 | 24.73 |
| | | 518598 | 2593.0 | 1 / 76 | 24.94 |
| | | 534999 | 2675.0 | 1 / 1 | 24.89 |
| | 16-QAM | 518598 | 2593.0 | 1 / 76 | 24.21 |
| 20 MHz | π/2 BPSK | 501204 | 2506.0 | 1 / 1 | 24.85 |
| | | 518598 | 2593.0 | 1 / 50 | 24.91 |
| | | 535998 | 2680.0 | 1 / 50 | 24.81 |
| | QPSK | 501204 | 2506.0 | 1 / 1 | 24.83 |
| | | 518598 | 2593.0 | 1 / 50 | 24.98 |
| | | 535998 | 2680.0 | 1 / 50 | 25.83 |
| | 16-QAM | 518598 | 2593.0 | 1 / 50 | 24.51 |
| 15 MHz | π/2 BPSK | 500700 | 2503.5 | 1 / 1 | 24.78 |
| | | 518598 | 2593.0 | 1 / 36 | 24.87 |
| | | 536500 | 2682.5 | 1 / 1 | 24.79 |
| | QPSK | 500700 | 2503.5 | 1 / 1 | 24.78 |
| | | 518598 | 2593.0 | 1 / 36 | 24.89 |
| | | 536500 | 2682.5 | 1 / 1 | 24.67 |
| | 16-QAM | 518598 | 2593.0 | 1 / 36 | 24.24 |
| 10 MHz | π/2 BPSK | 500200 | 2501.0 | 1 / 1 | 24.68 |
| | | 518598 | 2593.0 | 1 / 22 | 24.81 |
| | | 537000 | 2685.0 | 1 / 1 | 24.77 |
| | QPSK | 500200 | 2501.0 | 1 / 1 | 24.77 |
| | | 518598 | 2593.0 | 1 / 22 | 24.88 |
| | | 537000 | 2685.0 | 1 / 1 | 24.65 |
| | 16-QAM | 518598 | 2593.0 | 1 / 22 | 24.23 |

**Table 7-5. Conducted Powers (LTE Band 41 PC3 – Ant I – Max Power)**

## 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.

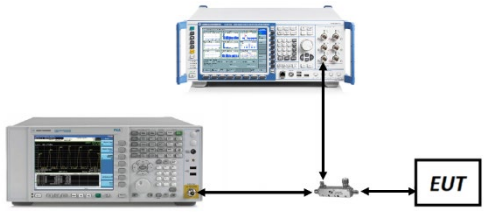



**Figure 7-2. Test Instrument & Measurement Setup**

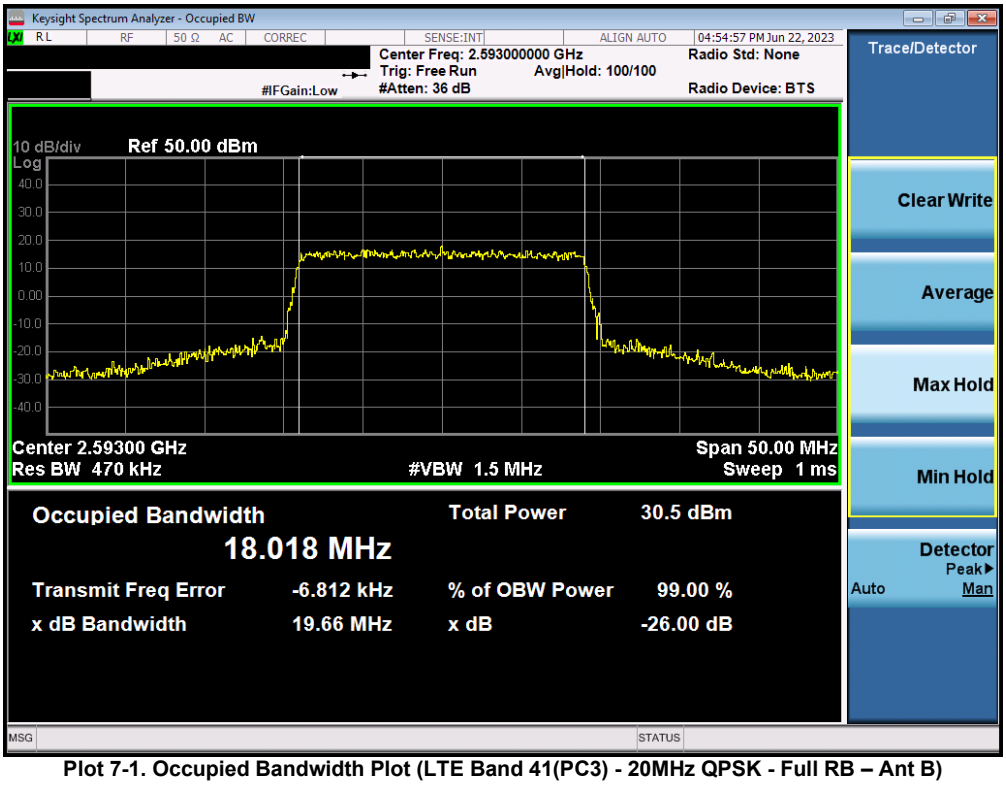
**Test Notes**

None.

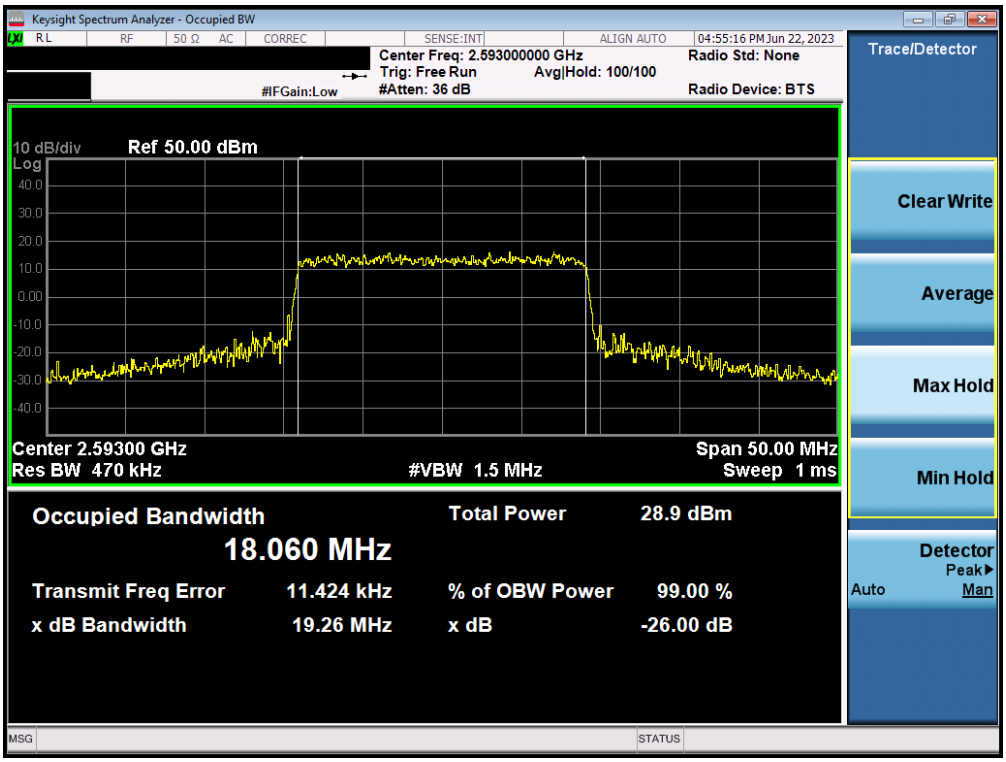
| Mode | Bandwidth | Modulation | OBW [MHz] |
|---|---|---|---|
| LTE Band 41(PC3) | 20 MHz | QPSK | 18.02 |
| | | 16QAM | 18.06 |
| | 15 MHz | QPSK | 13.49 |
| | | 16QAM | 13.50 |
| | 10 MHz | QPSK | 9.02 |
| | | 16QAM | 9.01 |
| | 5 MHz | QPSK | 4.52 |
| | | 16QAM | 4.51 |

**Table 7-6. Occupied Bandwidth Test Results – Ant B**

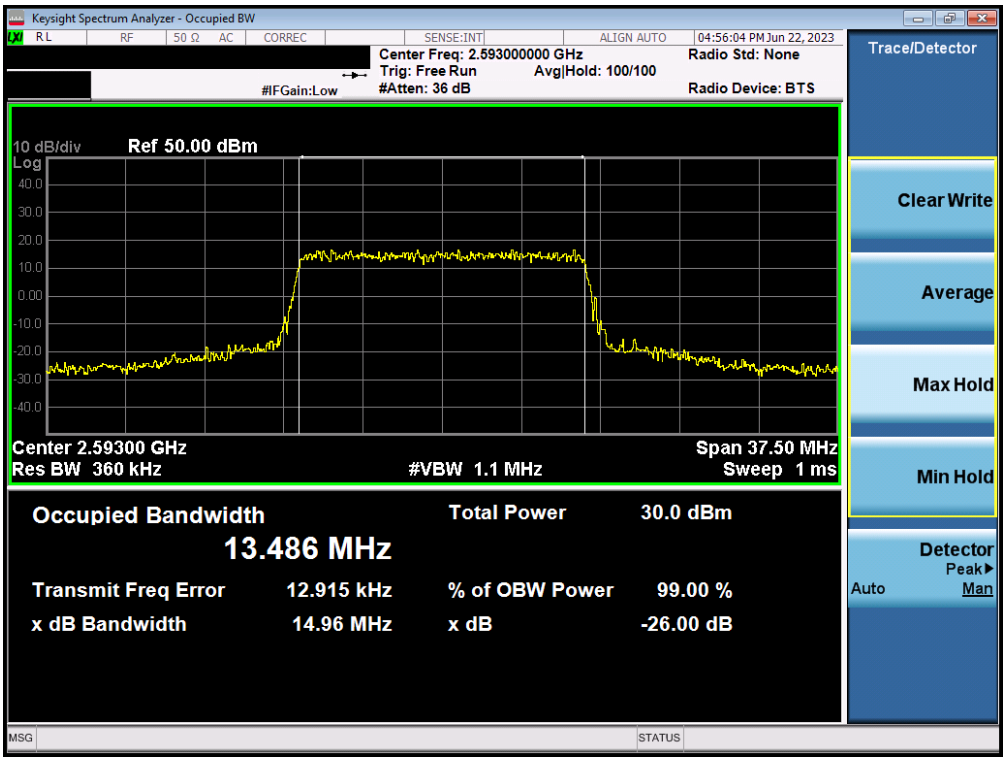
## LTE Band 41(PC3) – Ant B



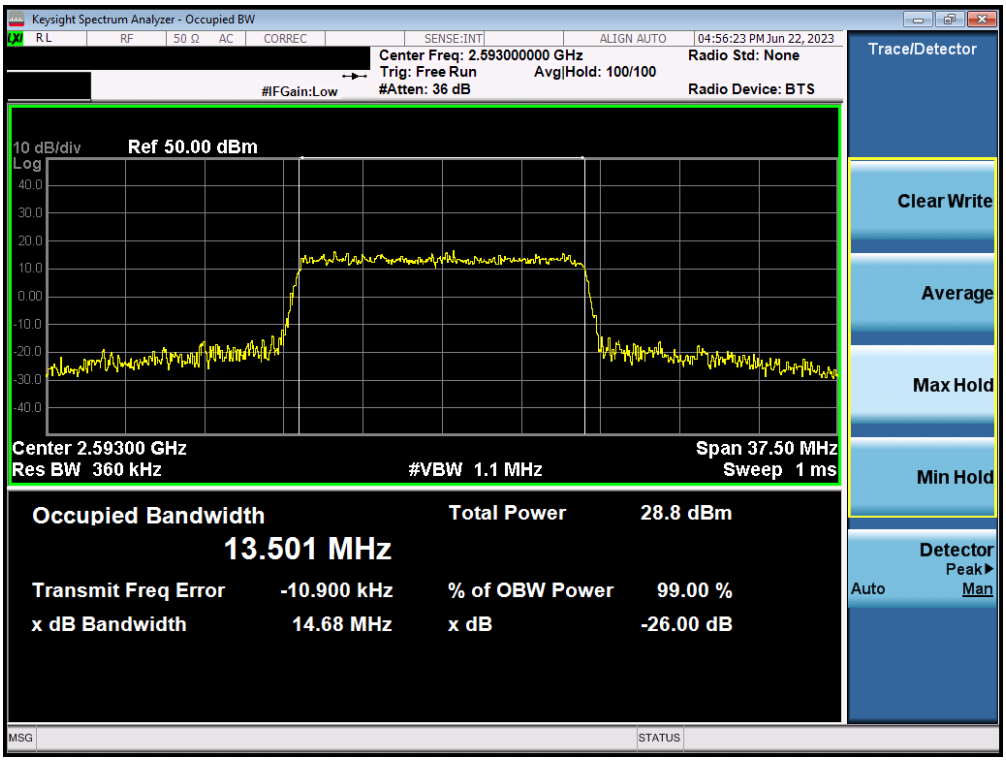

**Plot 7-1. Occupied Bandwidth Plot (LTE Band 41(PC3) - 20MHz QPSK - Full RB – Ant B)**



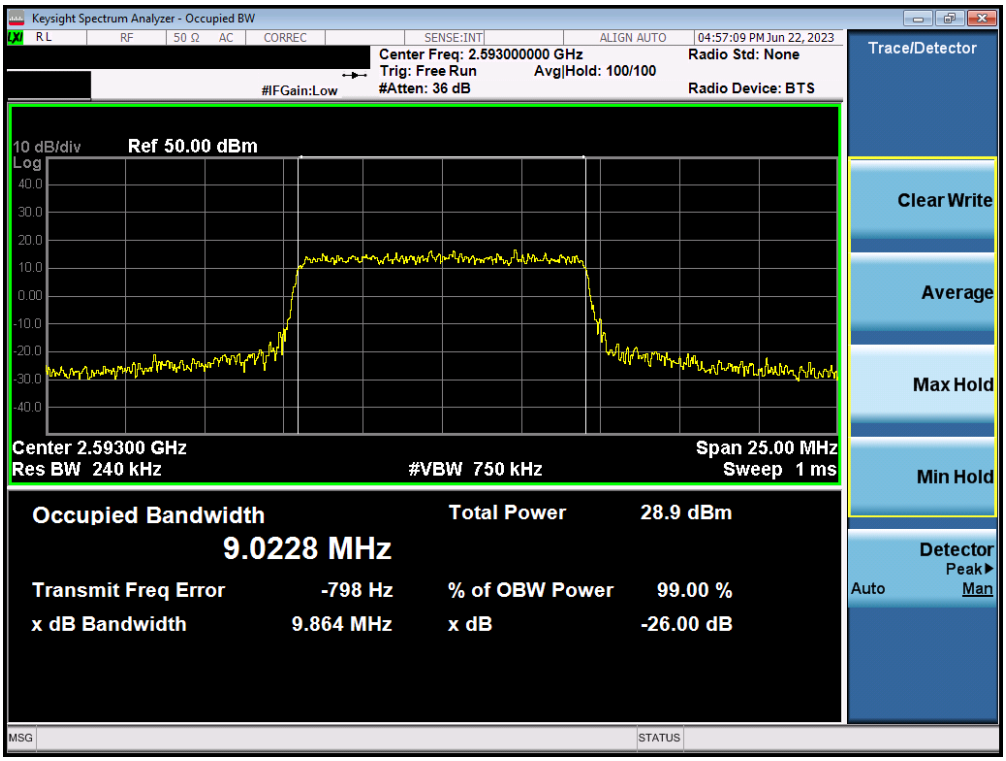

**Plot 7-2. Occupied Bandwidth Plot (LTE Band 41(PC3) - 20MHz 16-QAM - Full RB – Ant B)**



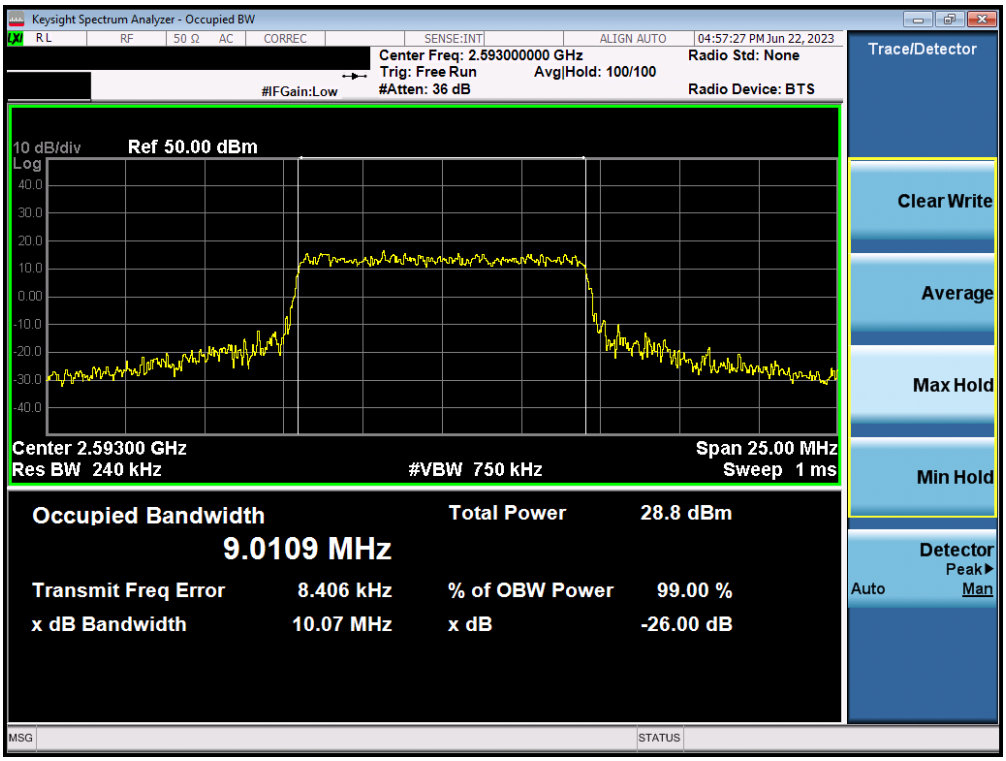

**Plot 7-3. Occupied Bandwidth Plot (LTE Band 41(PC3) - 15MHz QPSK - Full RB – Ant B)**



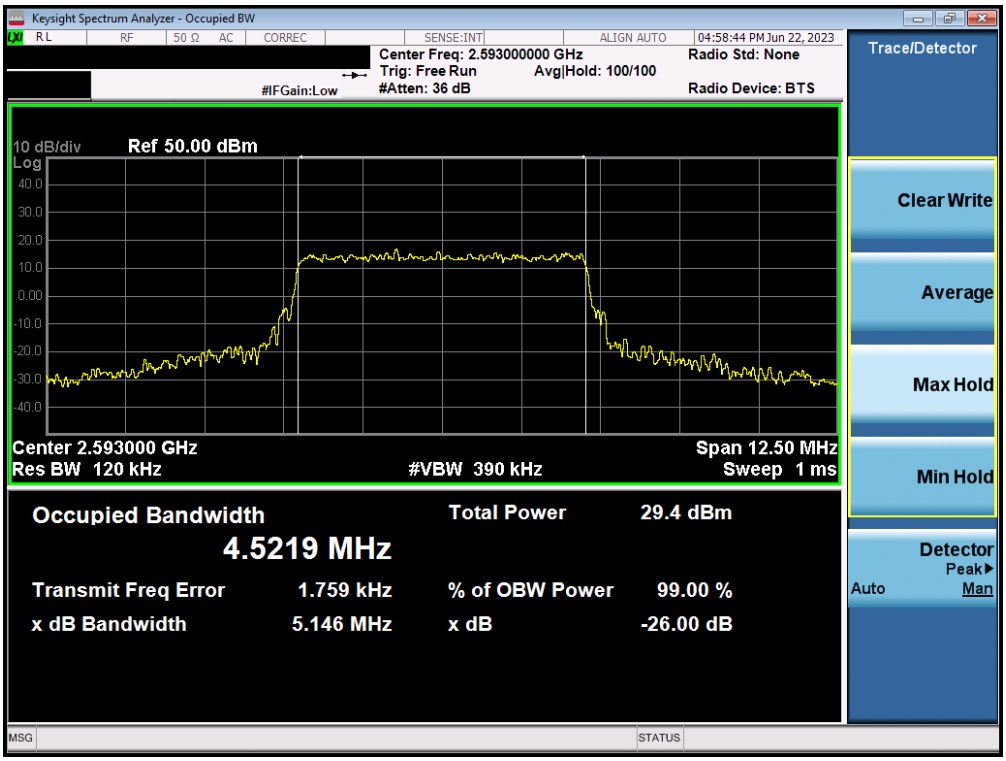

**Plot 7-4. Occupied Bandwidth Plot (LTE Band 41(PC3) - 15MHz 16-QAM - Full RB – Ant B)**



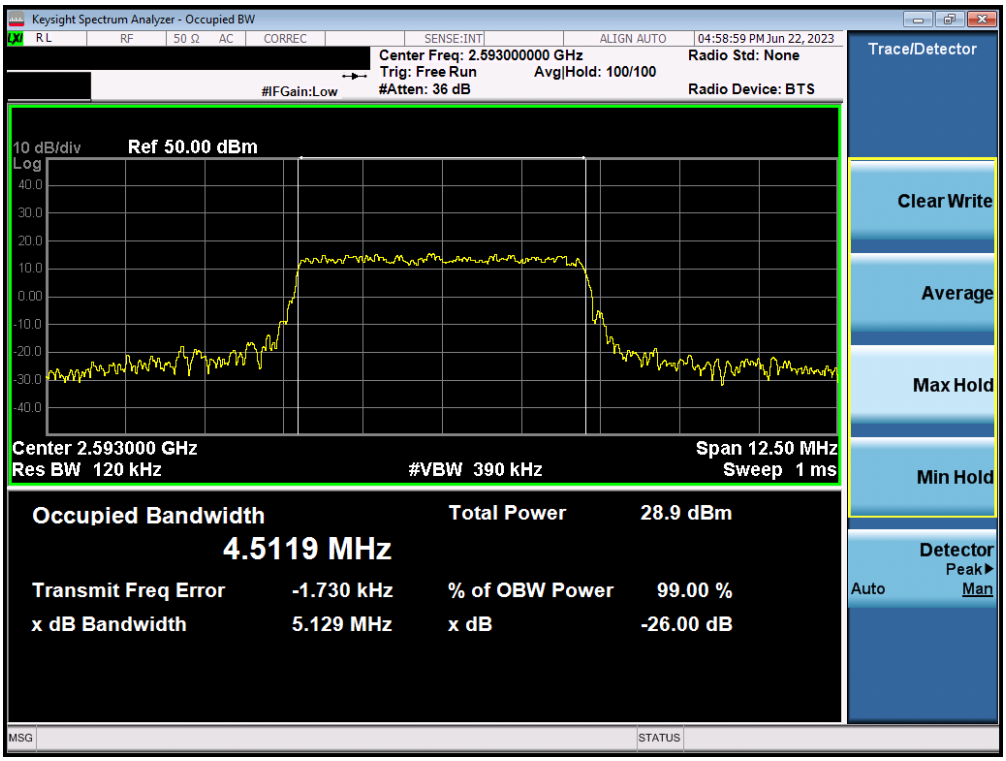

**Plot 7-5. Occupied Bandwidth Plot (LTE Band 41(PC3) - 10MHz QPSK - Full RB – Ant B)**




**Plot 7-6. Occupied Bandwidth Plot (LTE Band 41(PC3) - 10MHz 16-QAM - Full RB – Ant B)**




**Plot 7-7. Occupied Bandwidth Plot (LTE Band 41(PC3) - 5MHz QPSK - Full RB – Ant B)**

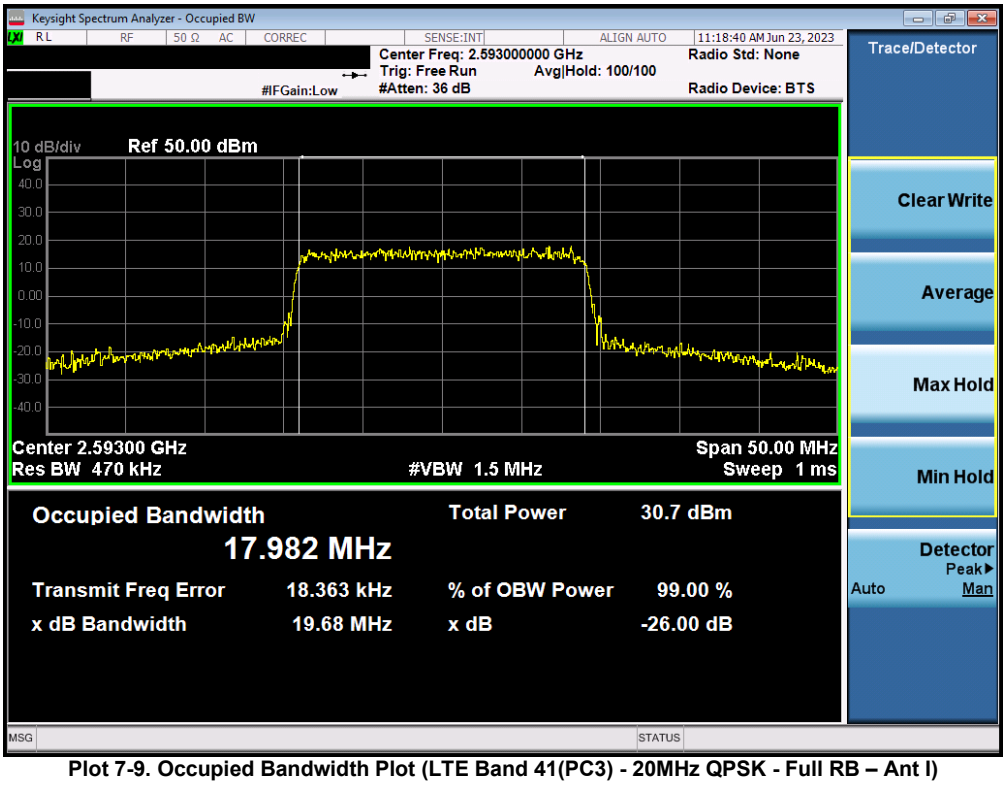



**Plot 7-8. Occupied Bandwidth Plot (LTE Band 41(PC3) - 5MHz 16-QAM - Full RB – Ant B)**

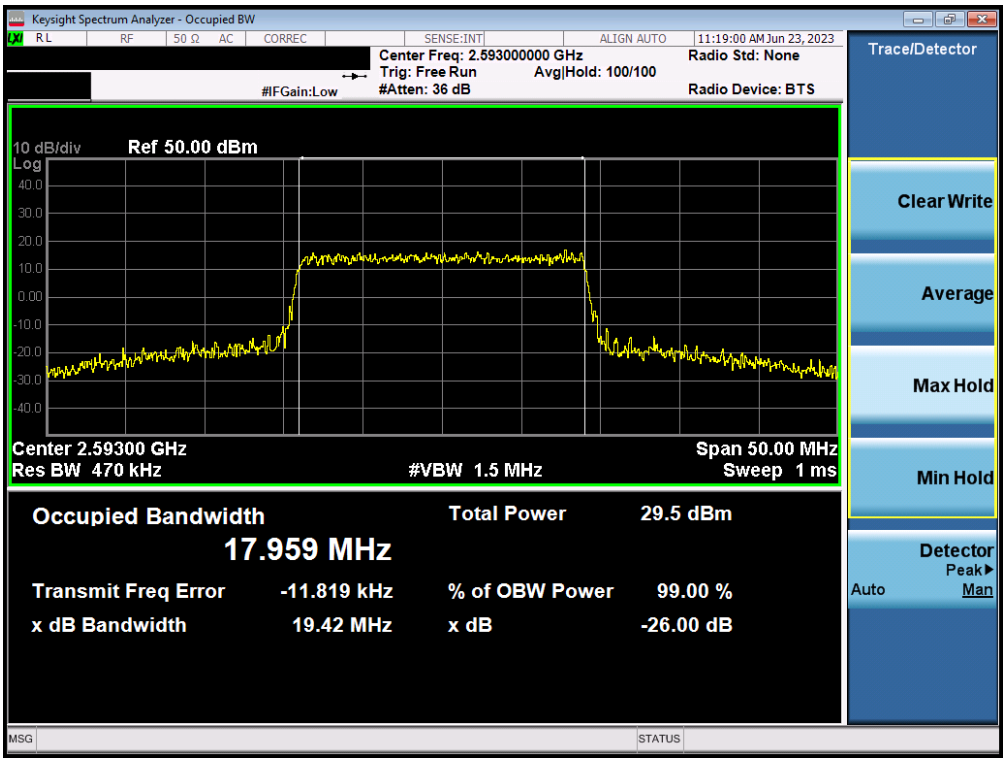
| Mode | Bandwidth | Modulation | OBW [MHz] |
|---|---|---|---|
| LTE Band 41(PC3) | 20 MHz | QPSK | 17.98 |
| | | 16QAM | 17.96 |
| | 15 MHz | QPSK | 13.52 |
| | | 16QAM | 13.50 |
| | 10 MHz | QPSK | 9.04 |
| | | 16QAM | 9.02 |
| | 5 MHz | QPSK | 4.52 |
| | | 16QAM | 4.51 |
| NR Band n41(PC3) | 100 MHz | π/2 BPSK | 97.31 |
| | | QPSK | 98.26 |
| | | 16QAM | 98.09 |
| | 90 MHz | π/2 BPSK | 87.27 |
| | | QPSK | 87.90 |
| | | 16QAM | 88.14 |
| | 80 MHz | π/2 BPSK | 77.53 |
| | | QPSK | 77.99 |
| | | 16QAM | 77.96 |
| | 70 MHz | π/2 BPSK | 64.72 |
| | | QPSK | 68.03 |
| | | 16QAM | 67.97 |
| | 60 MHz | π/2 BPSK | 58.16 |
| | | QPSK | 58.26 |
| | | 16QAM | 58.14 |
| | 50 MHz | π/2 BPSK | 46.09 |
| | | QPSK | 47.77 |
| | | 16QAM | 47.73 |
| | 40 MHz | π/2 BPSK | 35.81 |
| | | QPSK | 38.07 |
| | | 16QAM | 38.05 |
| | 30MHz | π/2 BPSK | 26.98 |
| | | QPSK | 28.02 |
| | | 16QAM | 28.06 |
| | 20 MHz | π/2 BPSK | 18.01 |
| | | QPSK | 18.36 |
| | | 16QAM | 18.36 |
| | 10 MHz | π/2 BPSK | 8.68 |
| | | QPSK | 8.67 |
| | | 16QAM | 8.78 |

**Table 7-7. Occupied Bandwidth Test Results – Ant I**

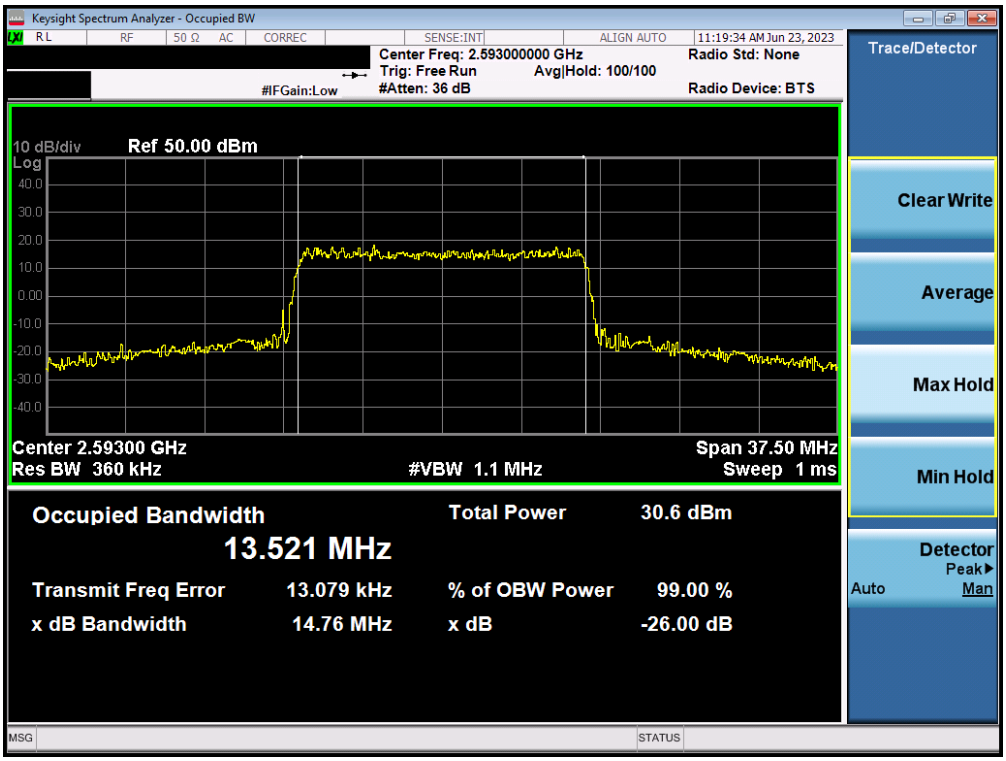
## LTE Band 41(PC3) – Ant I



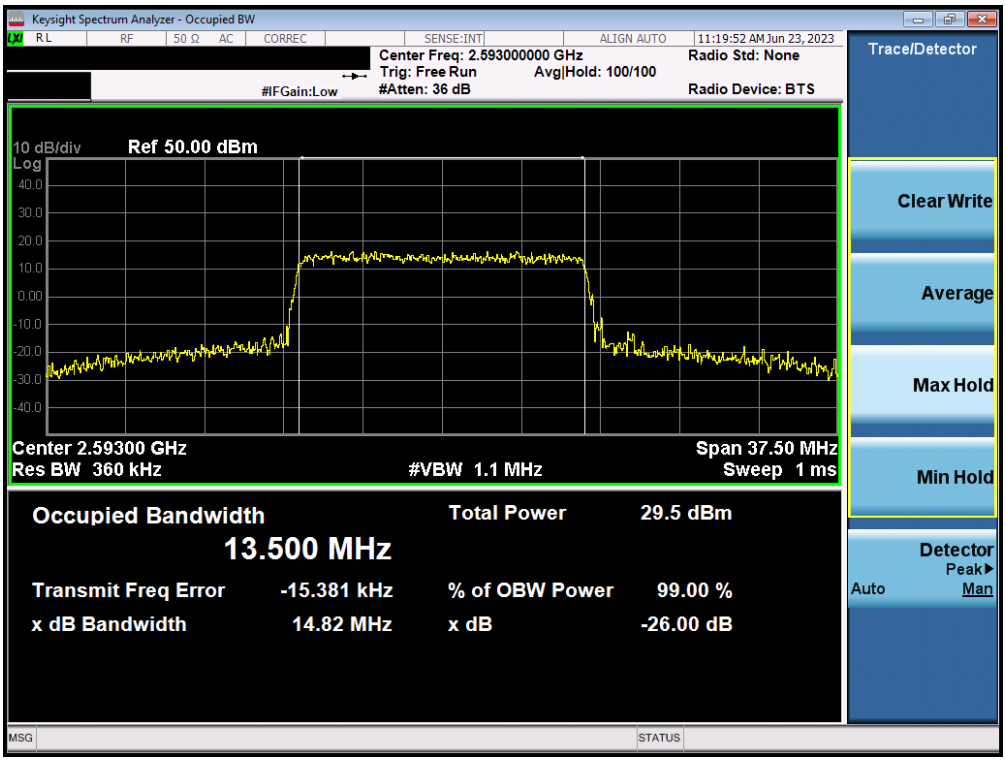

**Plot 7-9. Occupied Bandwidth Plot (LTE Band 41(PC3) - 20MHz QPSK - Full RB – Ant I)**



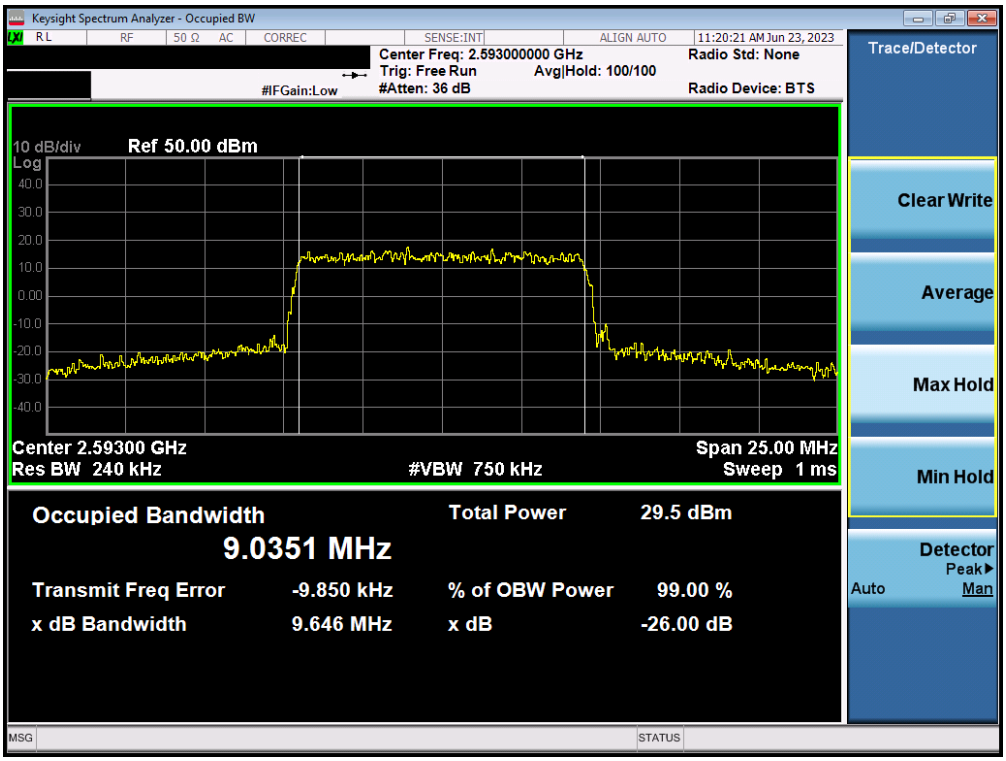

**Plot 7-10. Occupied Bandwidth Plot (LTE Band 41(PC3) - 20MHz 16-QAM - Full RB – Ant I)**



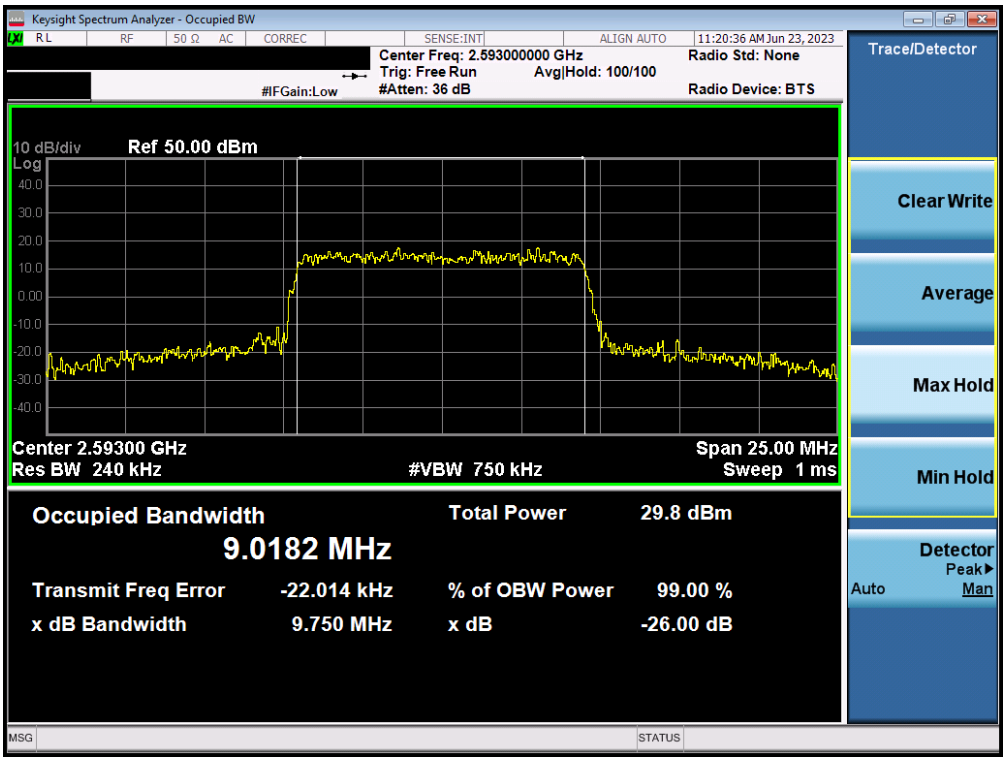

**Plot 7-11. Occupied Bandwidth Plot (LTE Band 41(PC3) - 15MHz QPSK - Full RB – Ant I)**



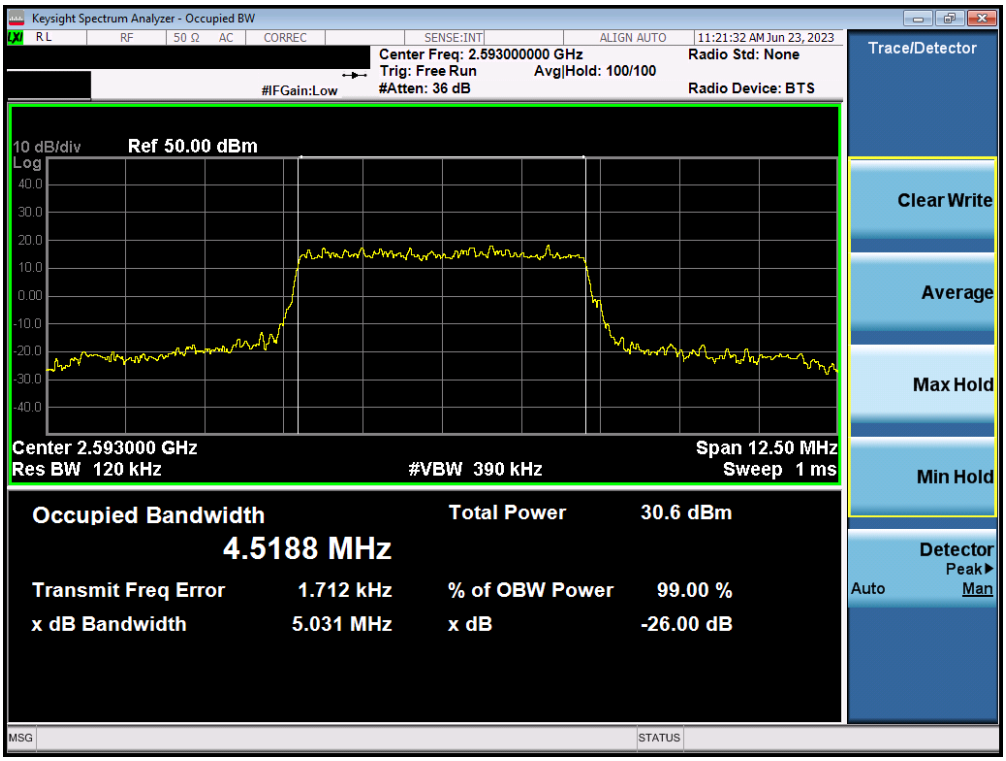

**Plot 7-12. Occupied Bandwidth Plot (LTE Band 41(PC3) - 15MHz 16-QAM - Full RB – Ant I)**



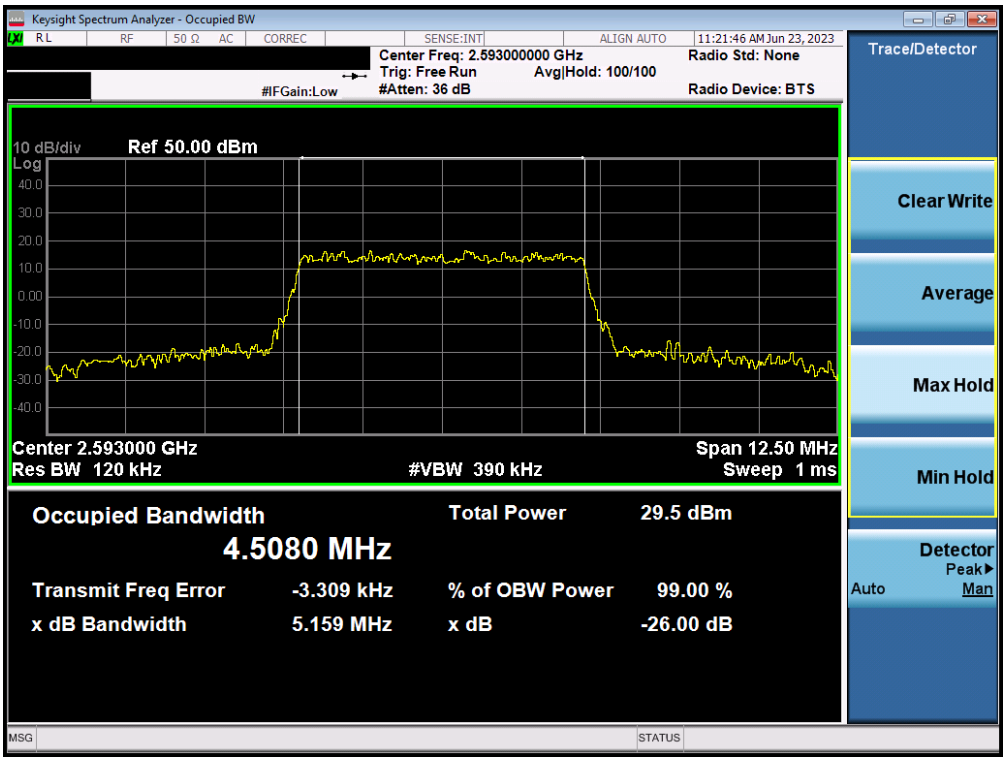

**Plot 7-13. Occupied Bandwidth Plot (LTE Band 41(PC3) - 10MHz QPSK - Full RB – Ant I)**




**Plot 7-14. Occupied Bandwidth Plot (LTE Band 41(PC3) - 10MHz 16-QAM - Full RB – Ant I)**

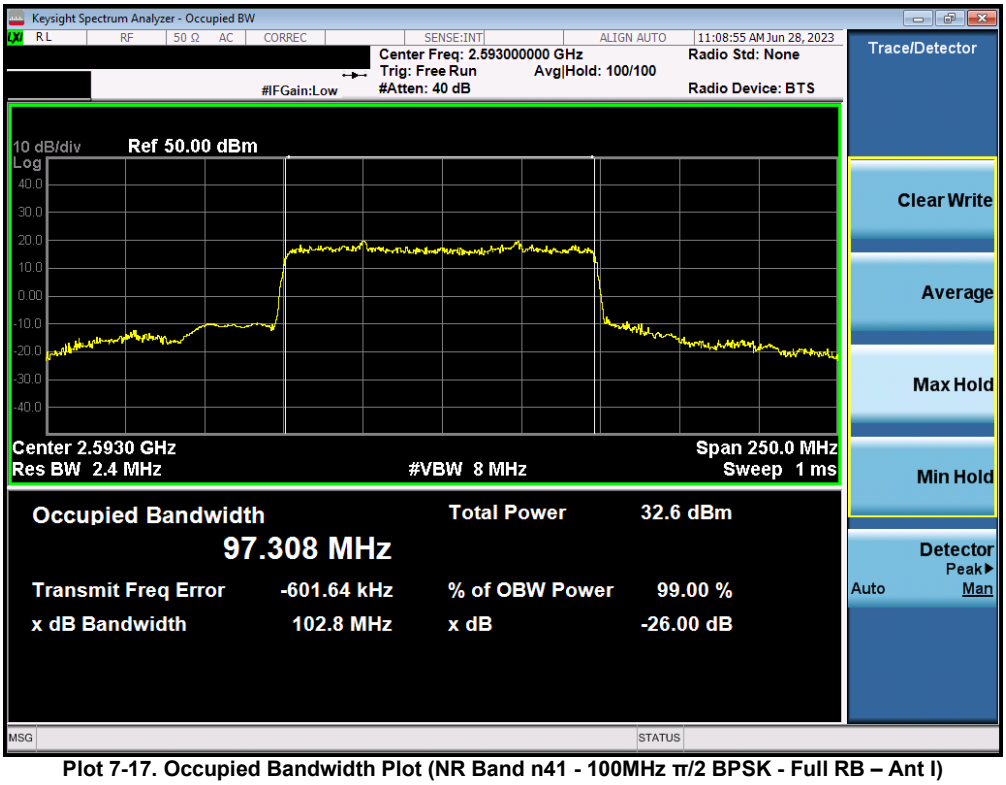



**Plot 7-15. Occupied Bandwidth Plot (LTE Band 41(PC3) - 5MHz QPSK - Full RB – Ant I)**

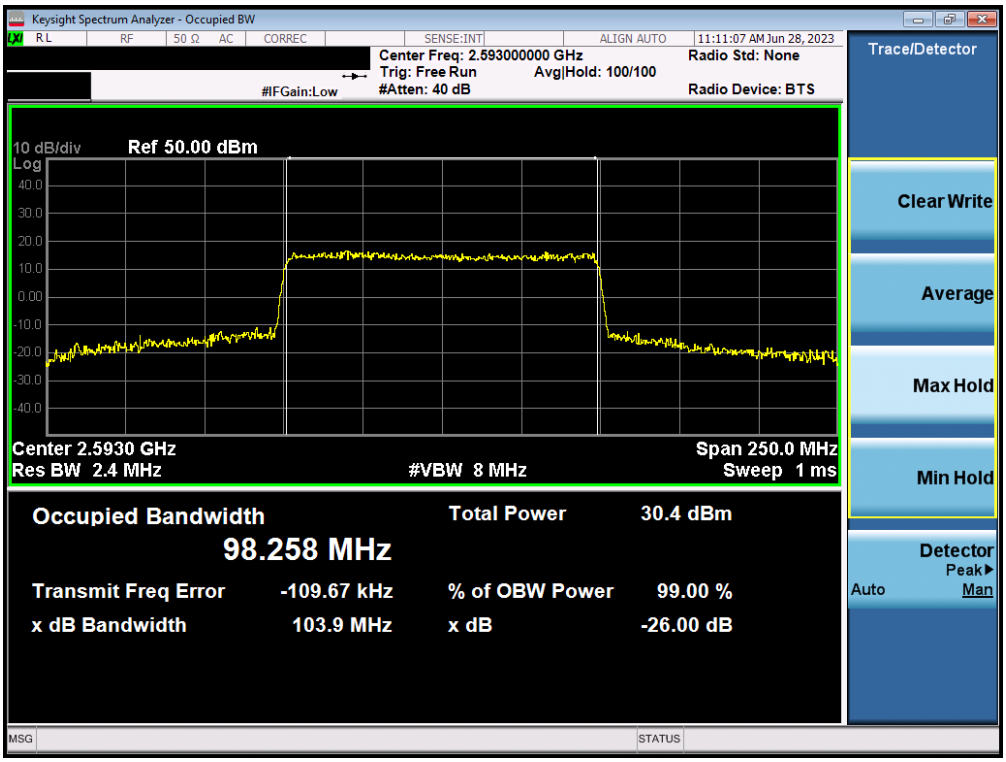



**Plot 7-16. Occupied Bandwidth Plot (LTE Band 41(PC3) - 5MHz 16-QAM - Full RB – Ant I)**

## NR Band n41 – Ant I

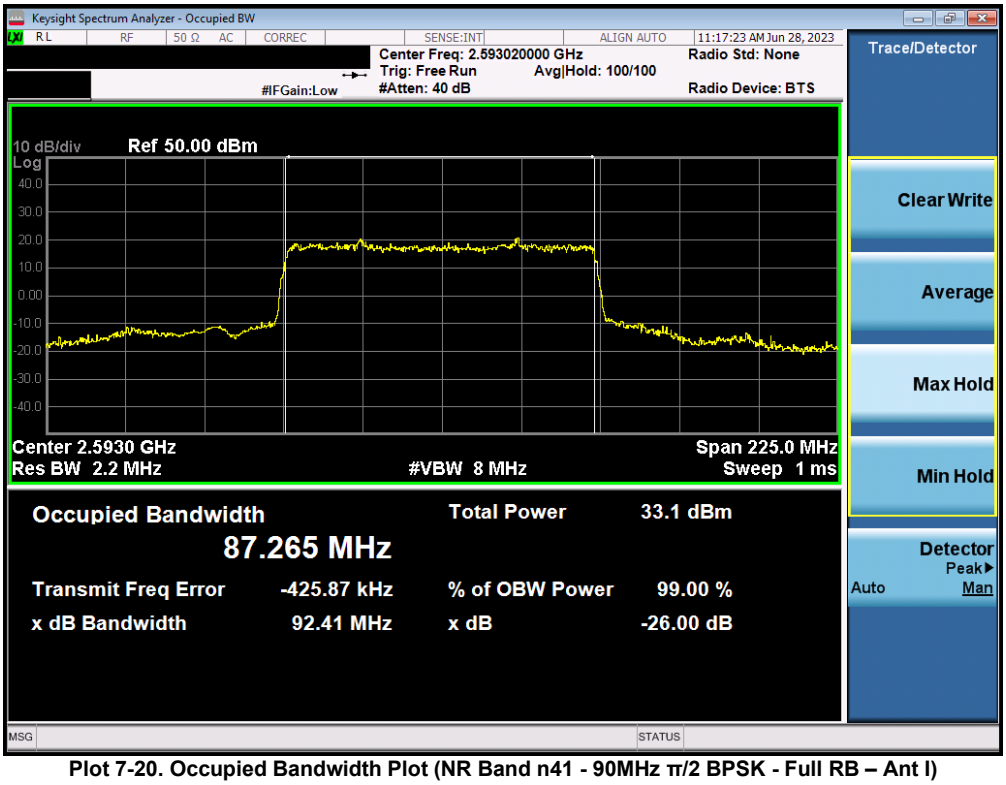



**Plot 7-17. Occupied Bandwidth Plot (NR Band n41 - 100MHz π/2 BPSK - Full RB – Ant I)**

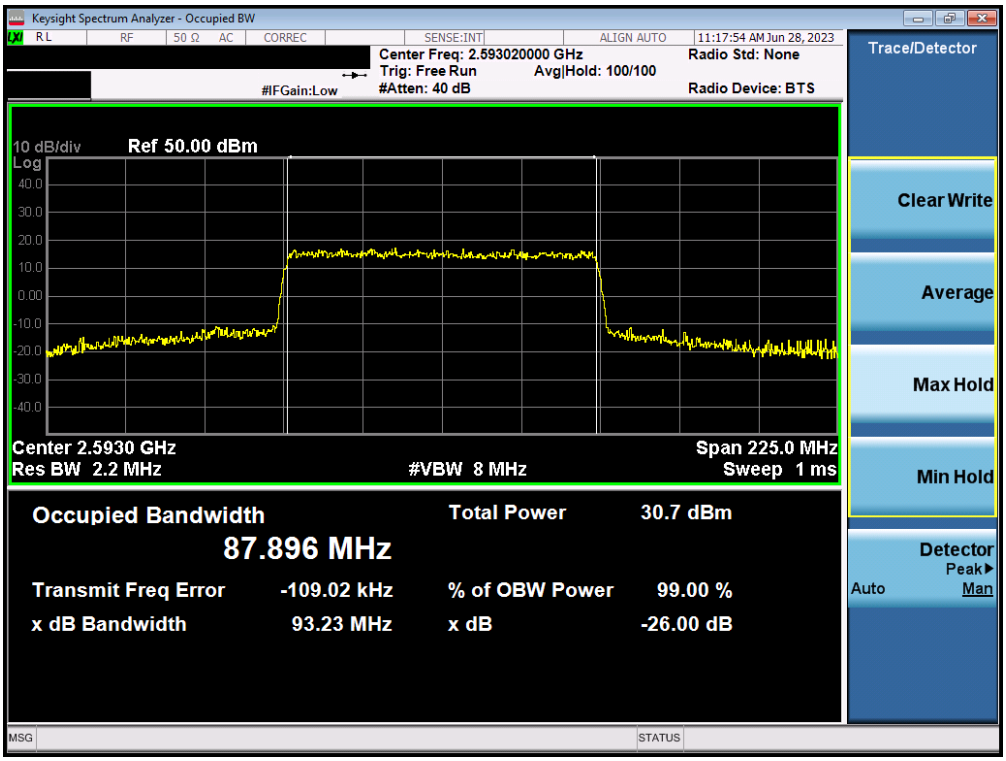



**Plot 7-18. Occupied Bandwidth Plot (NR Band n41 - 100MHz QPSK - Full RB – Ant I)**

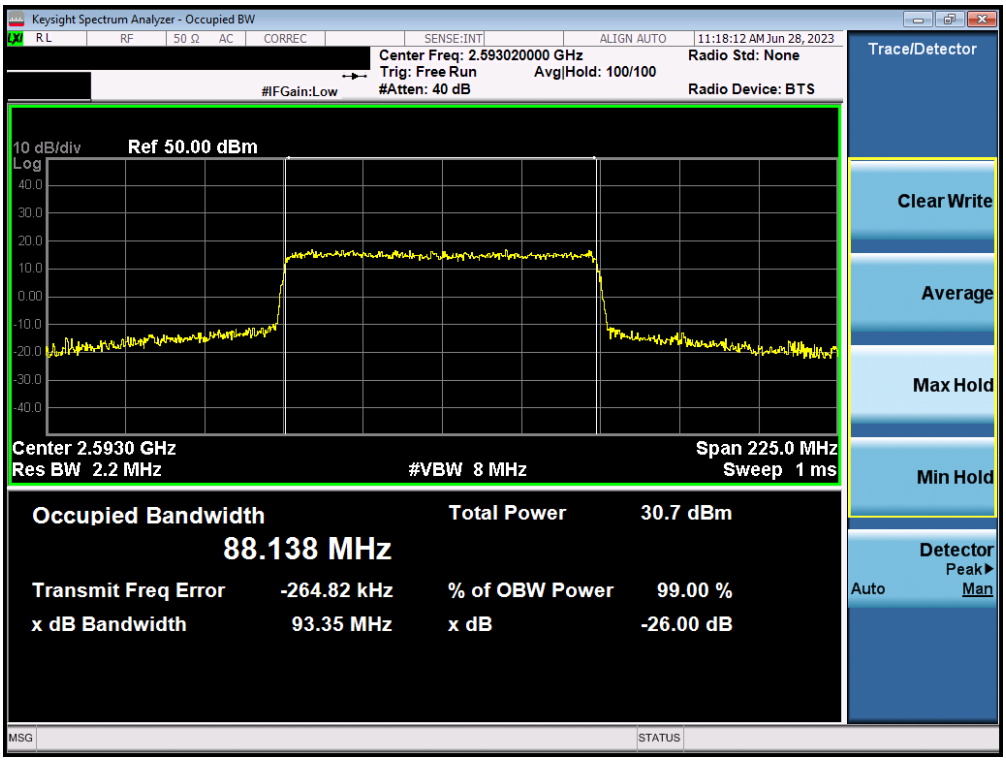

**Plot 7-19. Occupied Bandwidth Plot (NR Band n41 - 100MHz 16-QAM - Full RB – Ant I)**



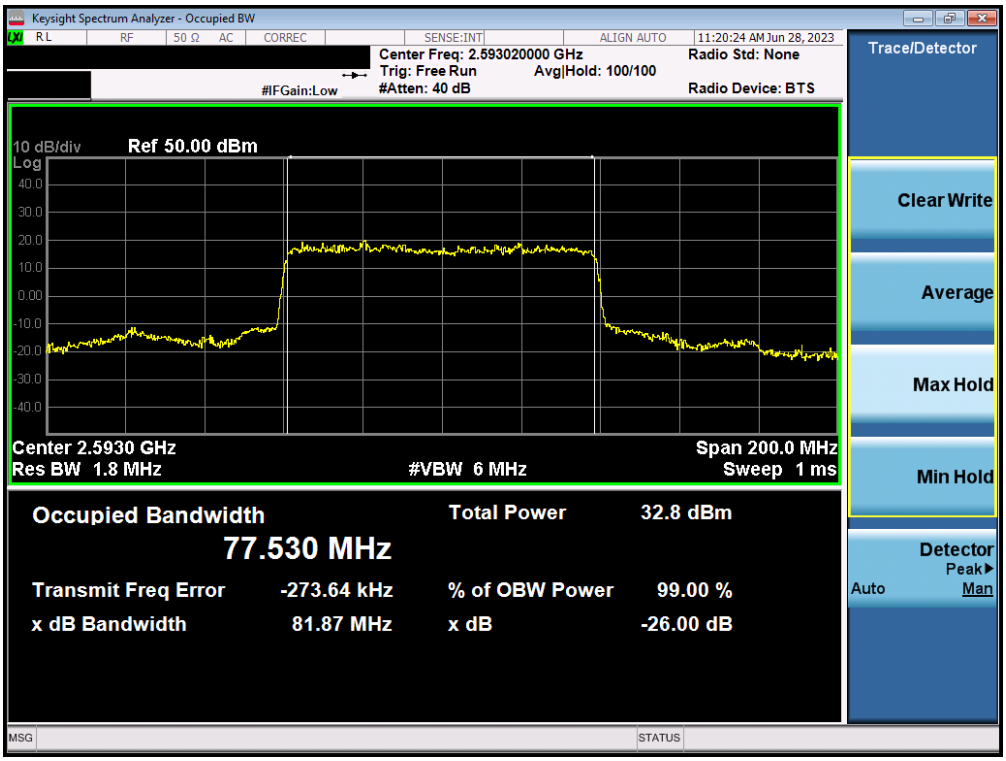

**Plot 7-20. Occupied Bandwidth Plot (NR Band n41 - 90MHz π/2 BPSK - Full RB – Ant I)**



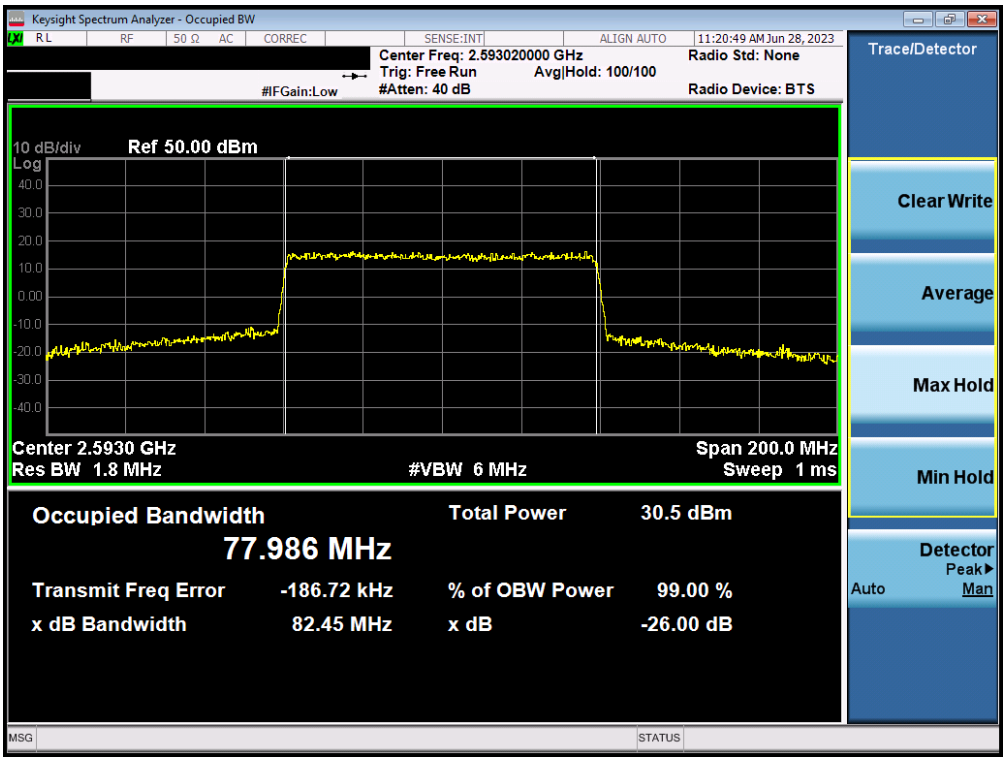

**Plot 7-21. Occupied Bandwidth Plot (NR Band n41 - 90MHz QPSK - Full RB – Ant I)**



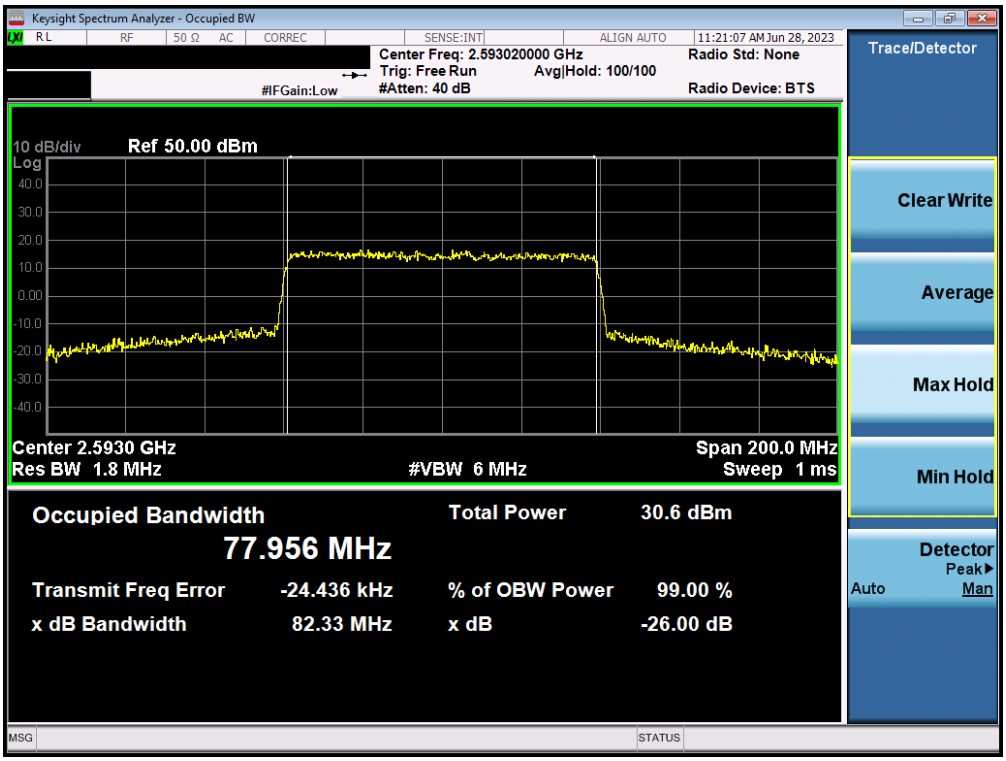

**Plot 7-22. Occupied Bandwidth Plot (NR Band n41 - 90MHz 16-QAM - Full RB – Ant I)**




**Plot 7-23. Occupied Bandwidth Plot (NR Band n41 - 80MHz π/2 BPSK - Full RB – Ant I)**



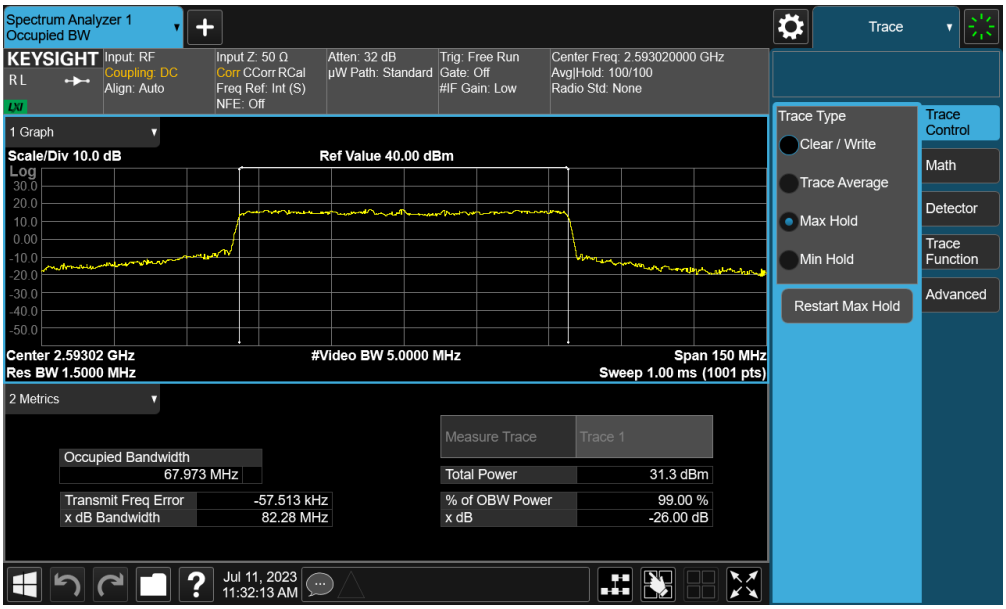

**Plot 7-24. Occupied Bandwidth Plot (NR Band n41 - 80MHz QPSK - Full RB – Ant I)**



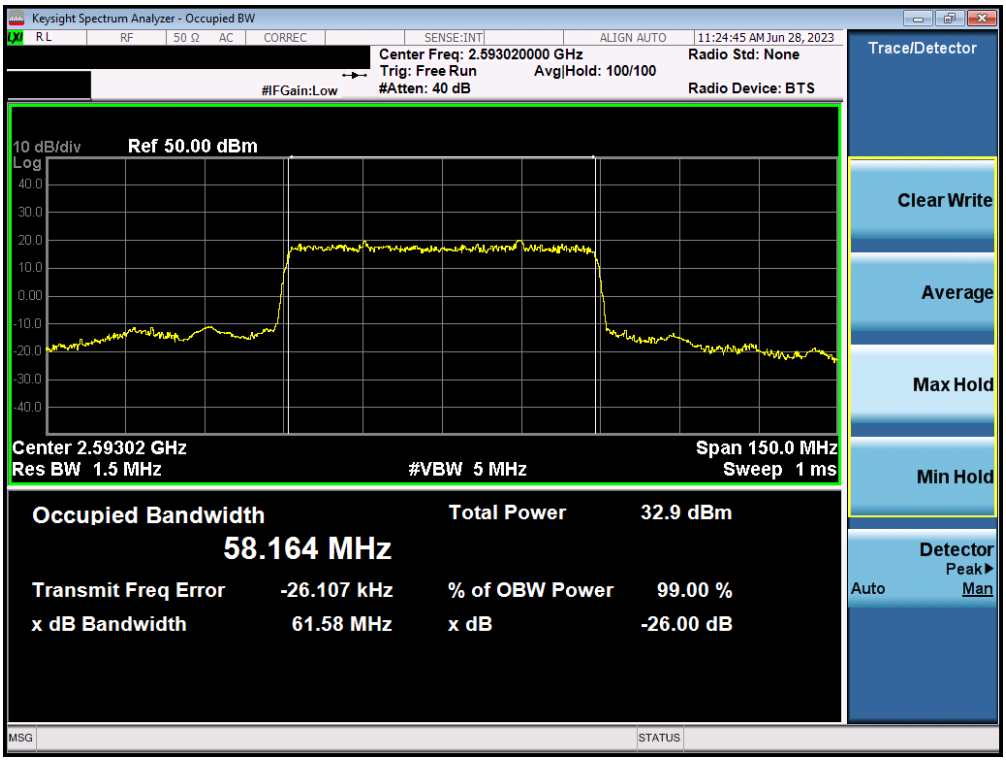

**Plot 7-25. Occupied Bandwidth Plot (NR Band n41 - 80MHz 16-QAM - Full RB – Ant I)**


**Plot 7-26. Occupied Bandwidth Plot (NR Band n41 - 70MHz π/2 BPSK - Full RB – Ant I)**

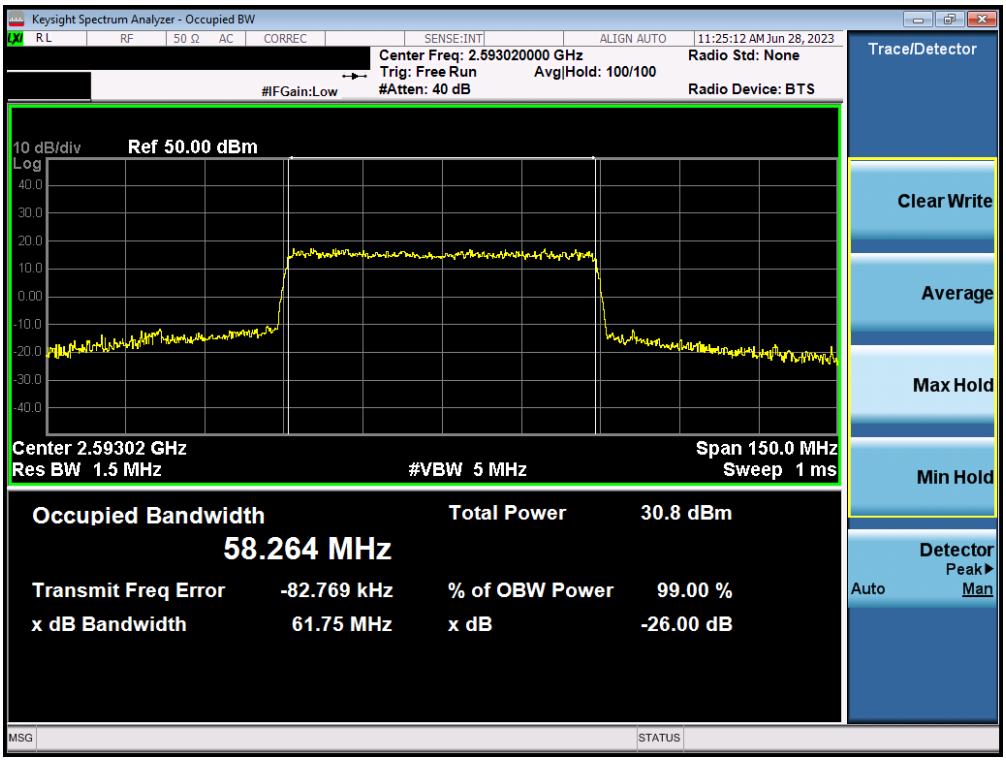

**Plot 7-27. Occupied Bandwidth Plot (NR Band n41 - 70MHz QPSK - Full RB – Ant I)**



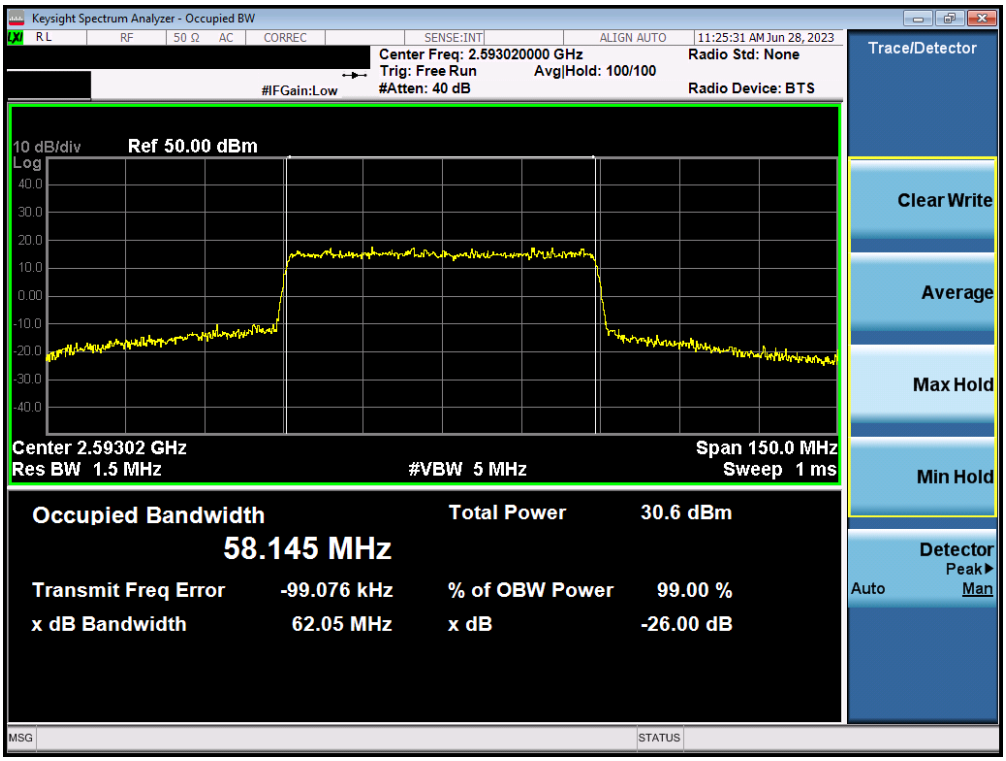

**Plot 7-28. Occupied Bandwidth Plot (NR Band n41 - 70MHz 16-QAM - Full RB – Ant I)**



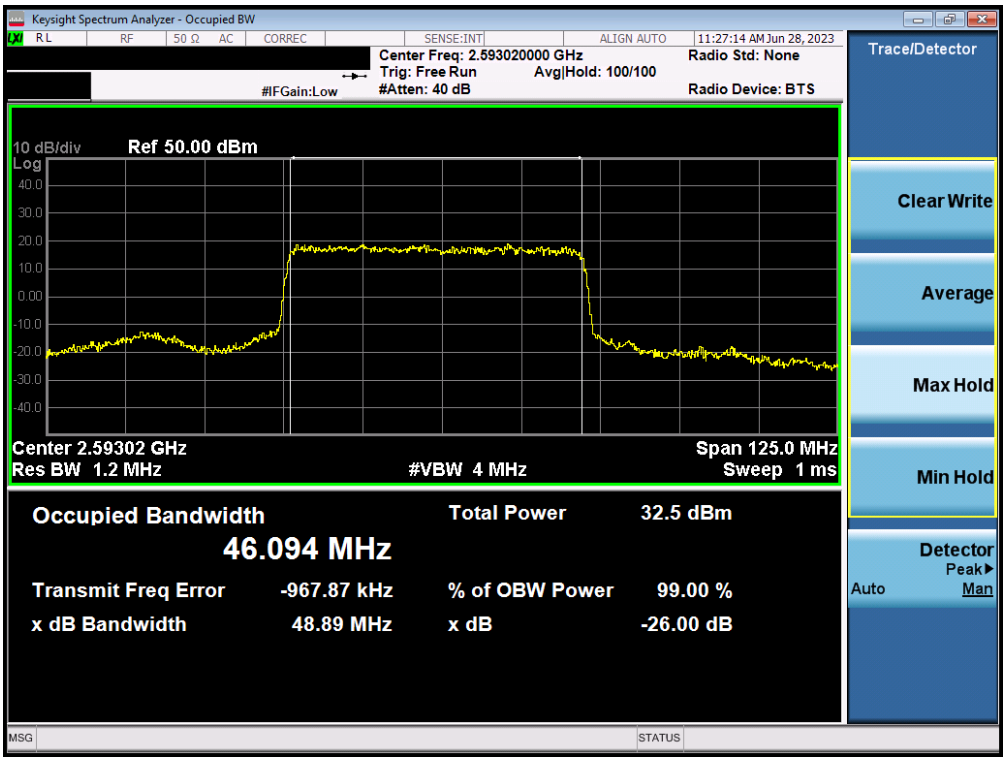

**Plot 7-29. Occupied Bandwidth Plot (NR Band n41 - 60MHz π/2 BPSK - Full RB – Ant I)**



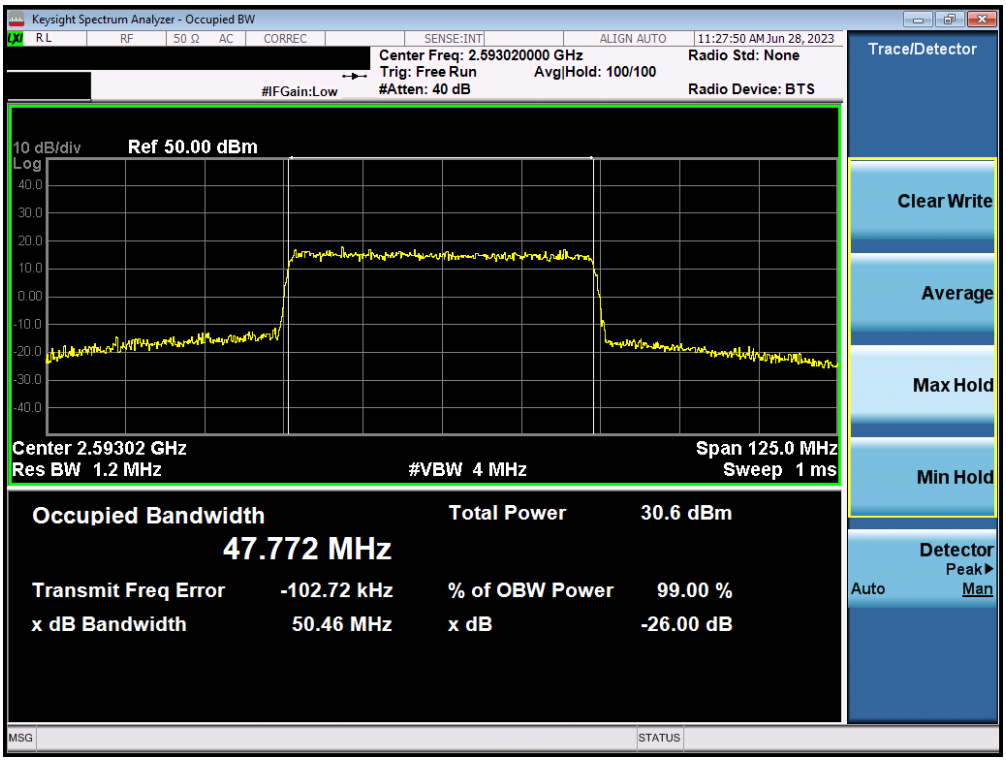

**Plot 7-30. Occupied Bandwidth Plot (NR Band n41 - 60MHz QPSK - Full RB – Ant I)**



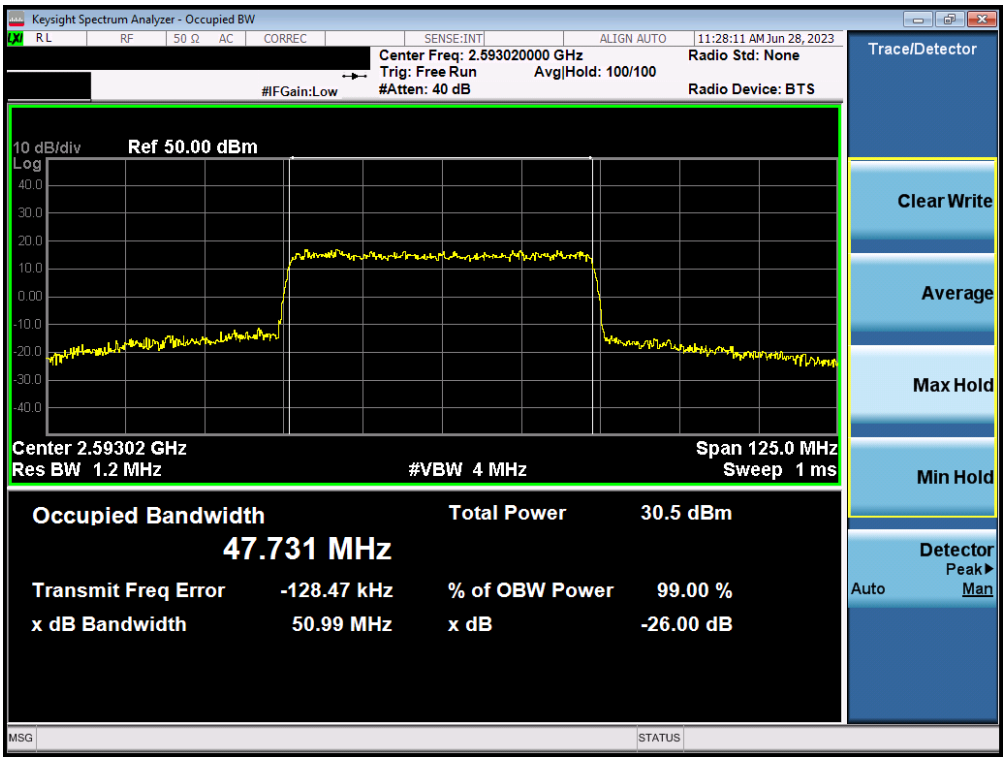

**Plot 7-31. Occupied Bandwidth Plot (NR Band n41 - 60MHz 16-QAM - Full RB – Ant I)**



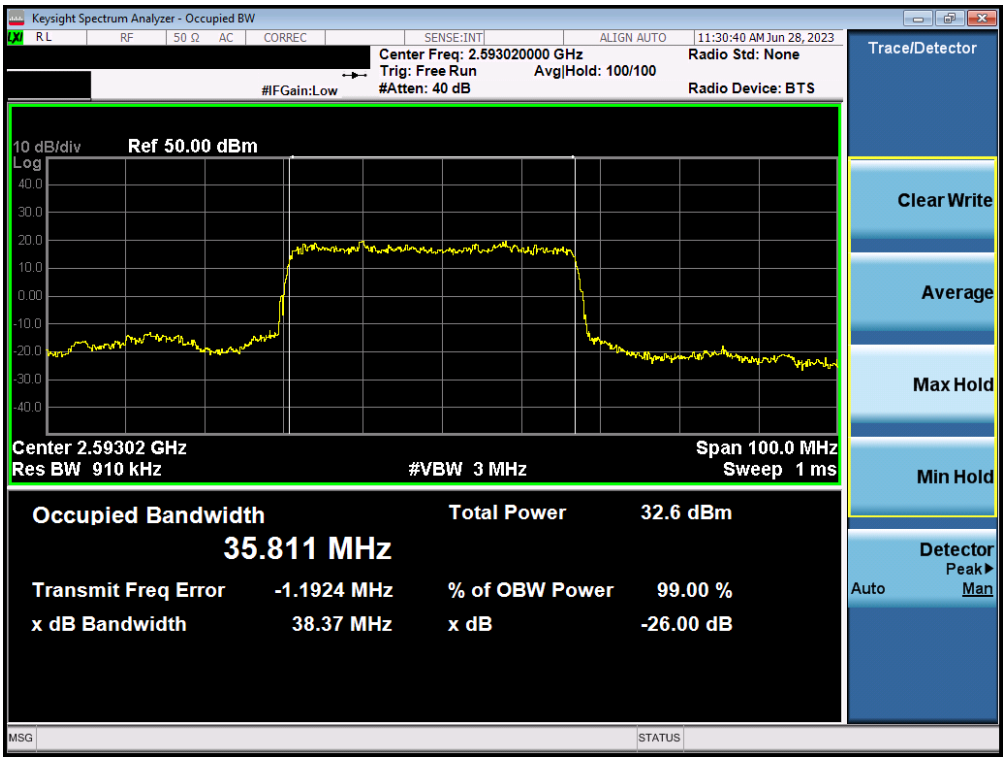

**Plot 7-32. Occupied Bandwidth Plot (NR Band n41 - 50MHz π/2 BPSK - Full RB – Ant I)**



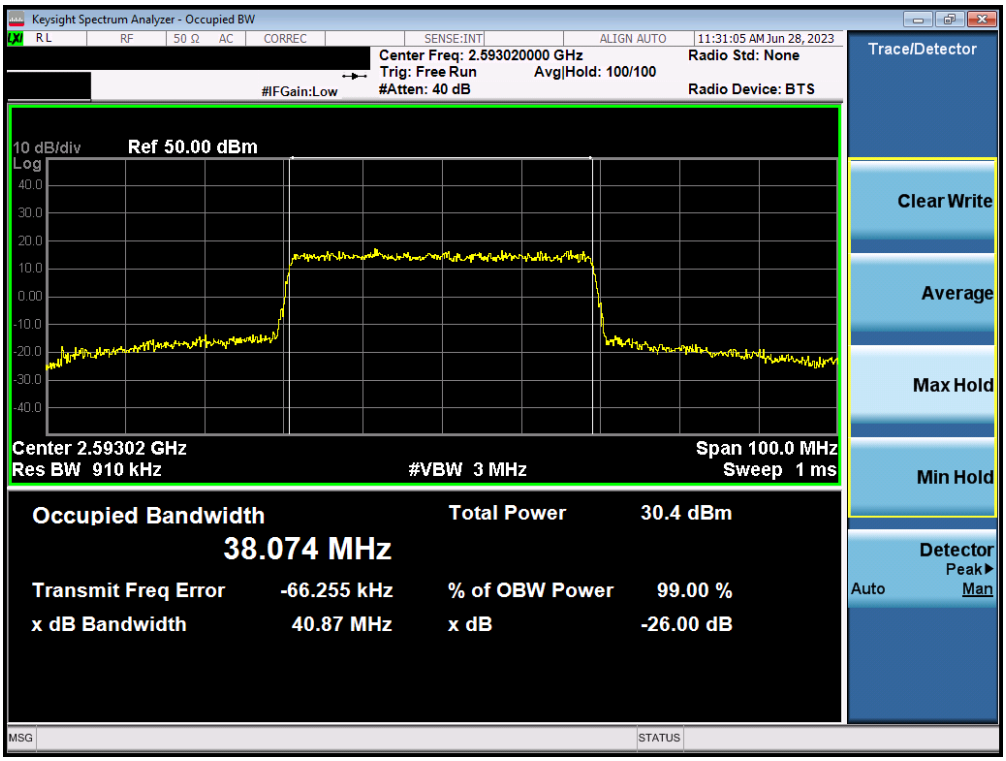

**Plot 7-33. Occupied Bandwidth Plot (NR Band n41 - 50MHz QPSK - Full RB – Ant I)**



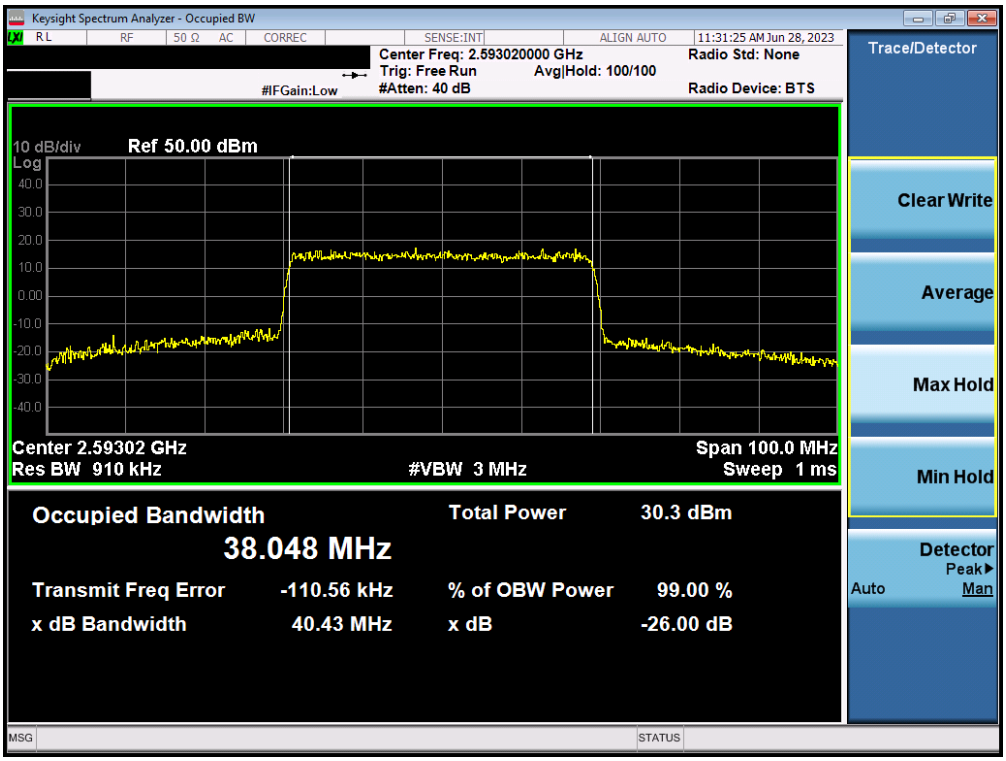

**Plot 7-34. Occupied Bandwidth Plot (NR Band n41 - 50MHz 16-QAM - Full RB – Ant I)**



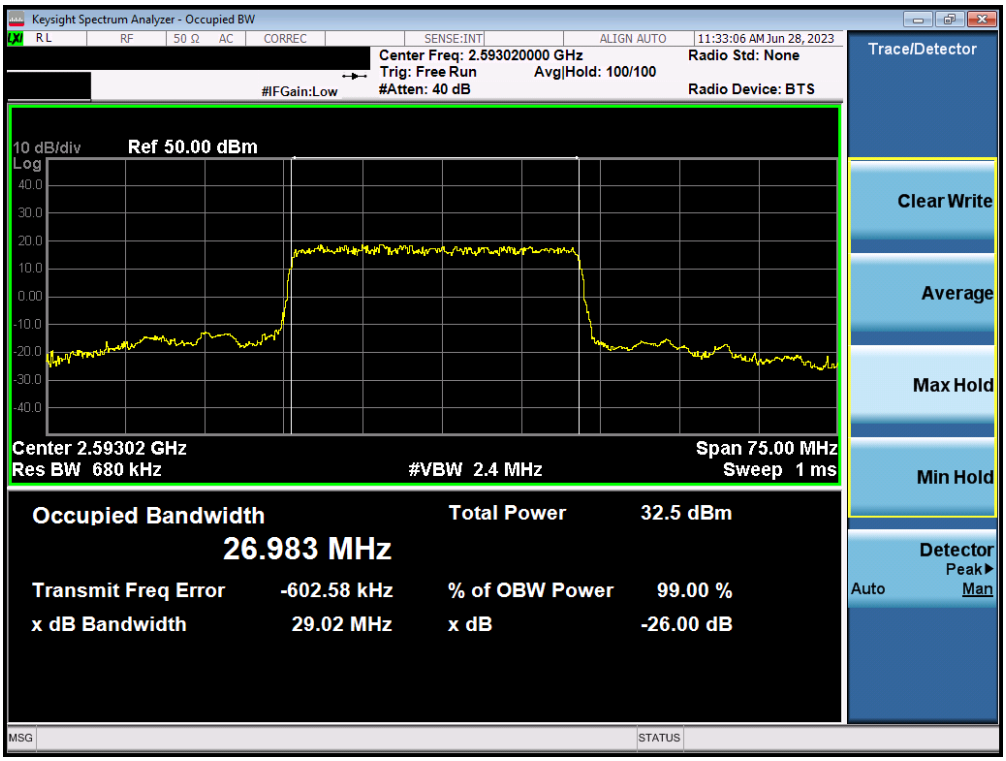

**Plot 7-35. Occupied Bandwidth Plot (NR Band n41 - 40MHz π/2 BPSK - Full RB – Ant I)**



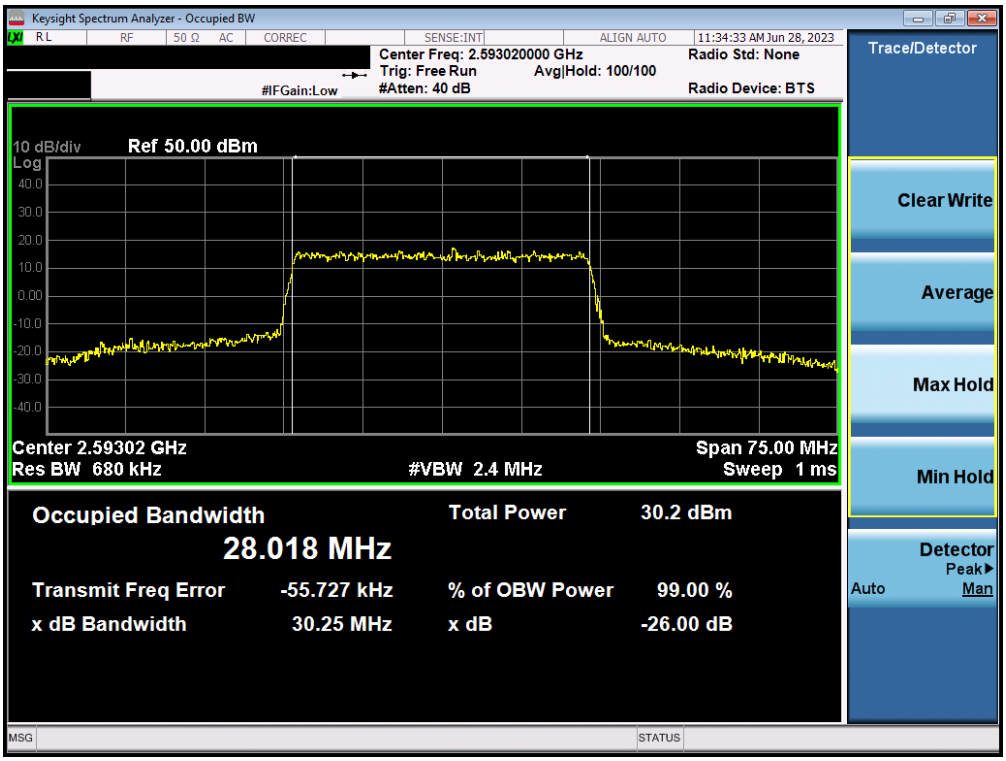

**Plot 7-36. Occupied Bandwidth Plot (NR Band n41 - 40MHz QPSK - Full RB – Ant I)**



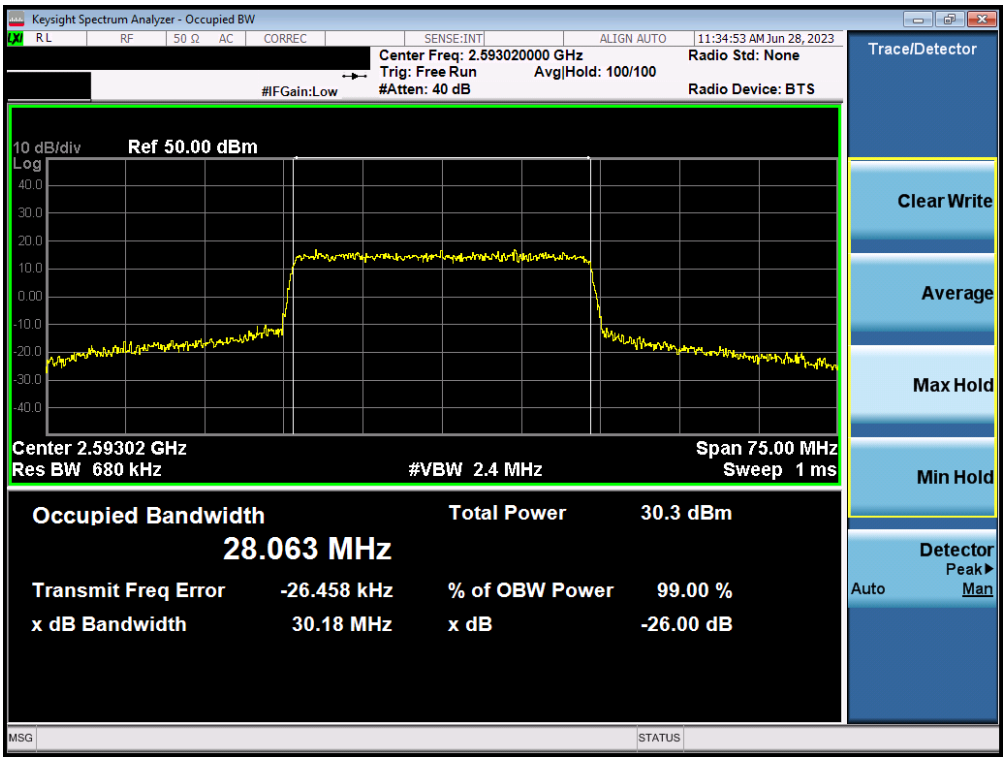

**Plot 7-37. Occupied Bandwidth Plot (NR Band n41 - 40MHz 16-QAM - Full RB – Ant I)**



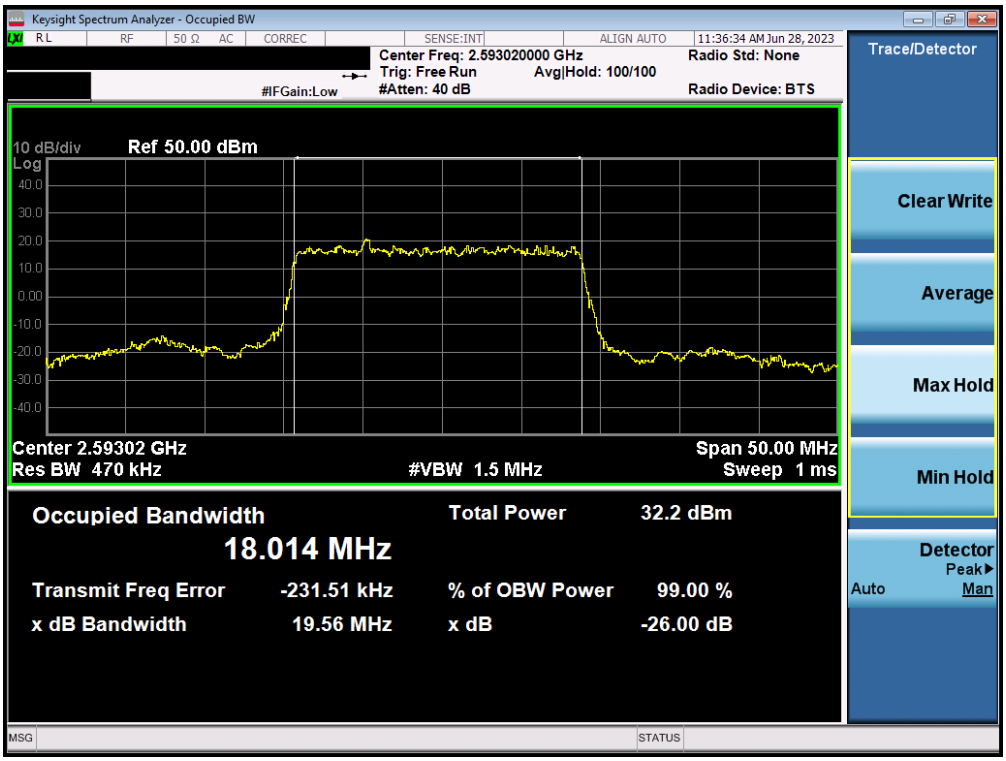

**Plot 7-38. Occupied Bandwidth Plot (NR Band n41 - 30MHz π/2 BPSK - Full RB – Ant I)**



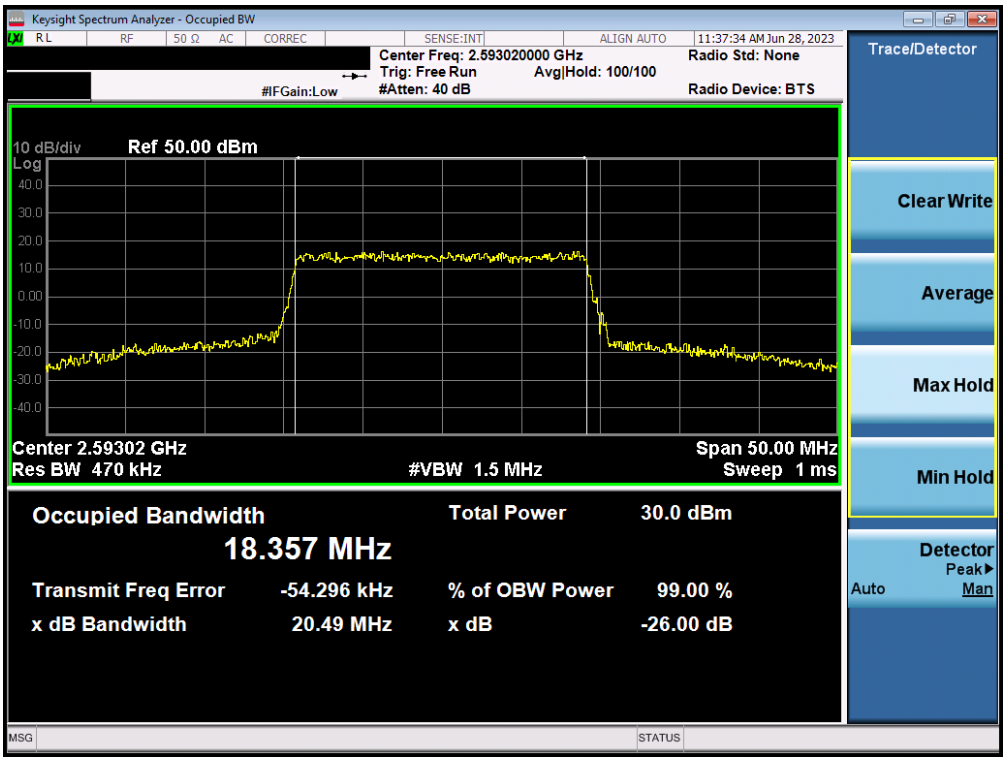

**Plot 7-39. Occupied Bandwidth Plot (NR Band n41 - 30MHz QPSK - Full RB – Ant I)**



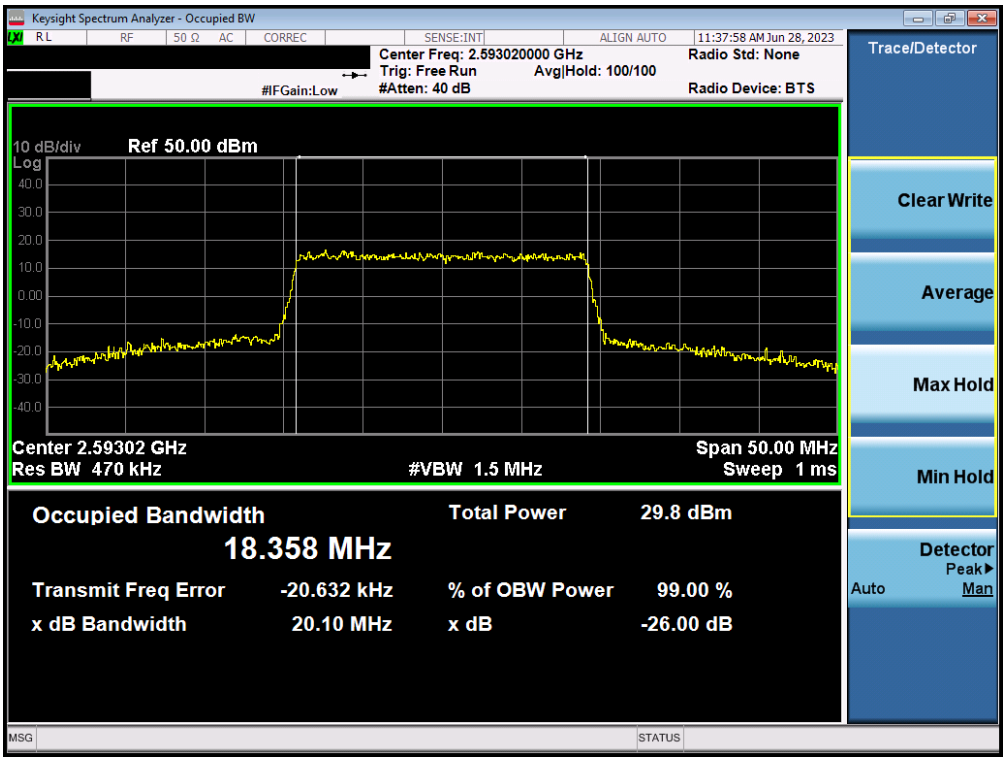

**Plot 7-40. Occupied Bandwidth Plot (NR Band n41 - 30MHz 16-QAM - Full RB – Ant I)**



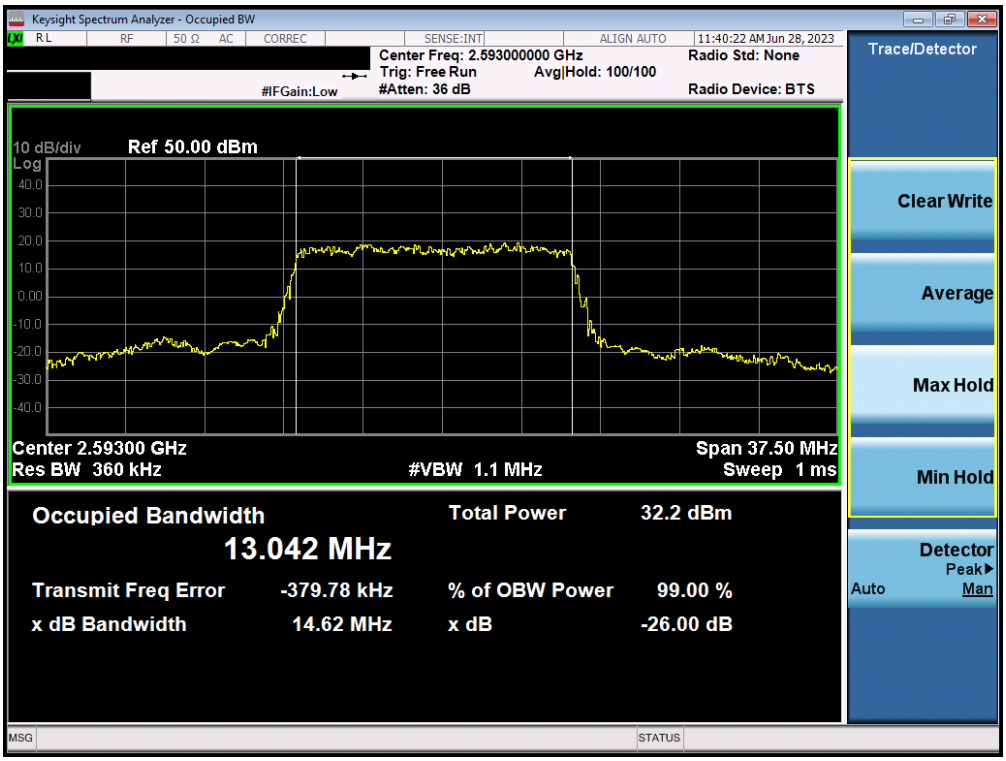

**Plot 7-41. Occupied Bandwidth Plot (NR Band n41 - 20MHz π/2 BPSK - Full RB – Ant I)**



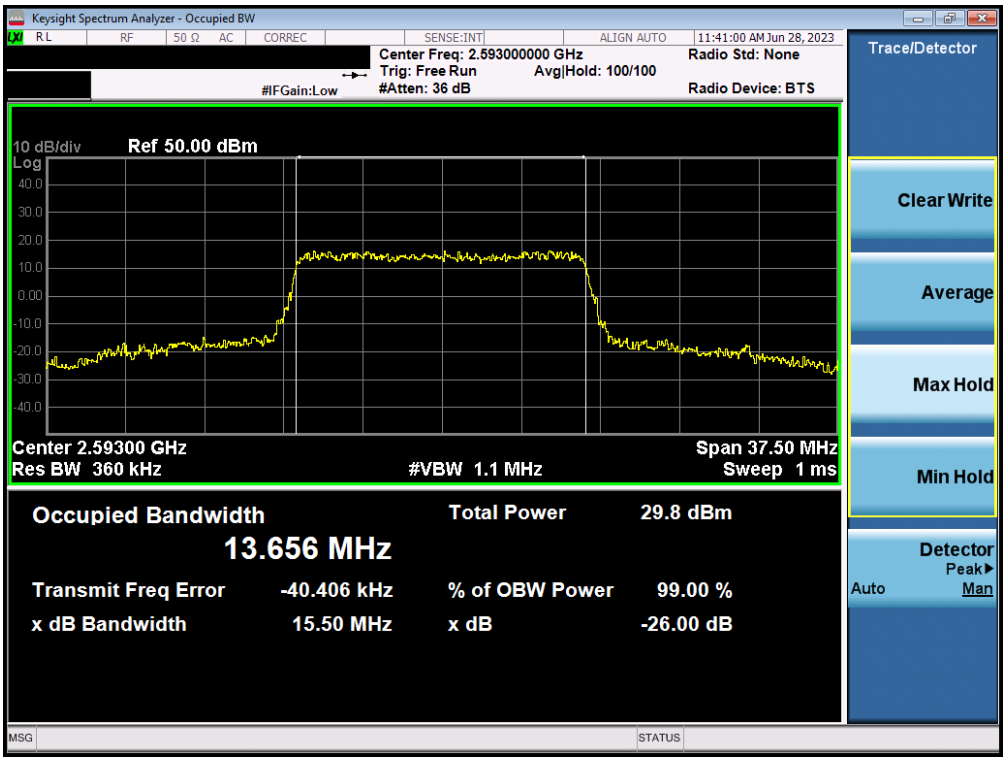

**Plot 7-42. Occupied Bandwidth Plot (NR Band n41 - 20MHz QPSK - Full RB – Ant I)**



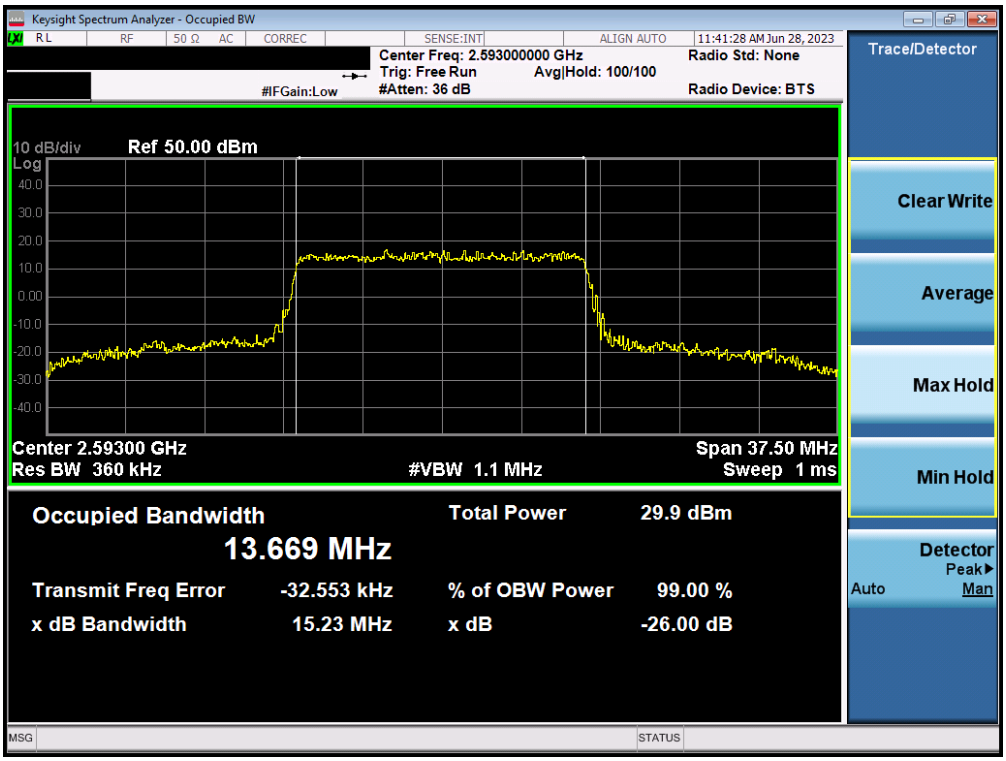

**Plot 7-43. Occupied Bandwidth Plot (NR Band n41 - 20MHz 16-QAM - Full RB – Ant I)**



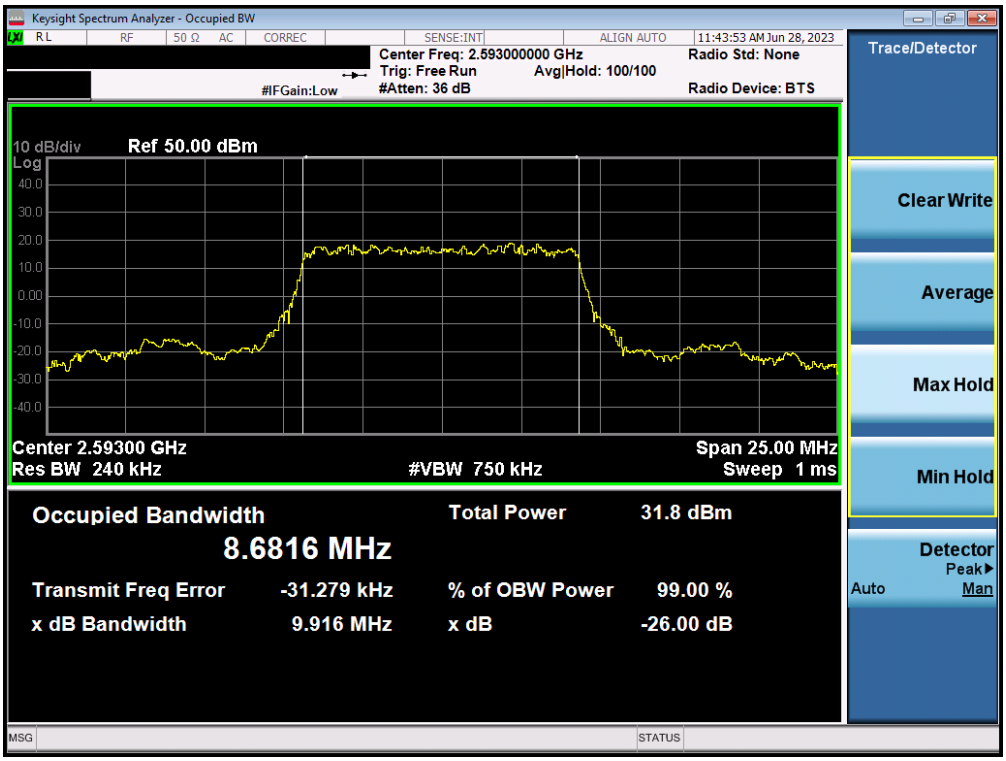

**Plot 7-44. Occupied Bandwidth Plot (NR Band n41 - 15MHz π/2 BPSK - Full RB – Ant I)**



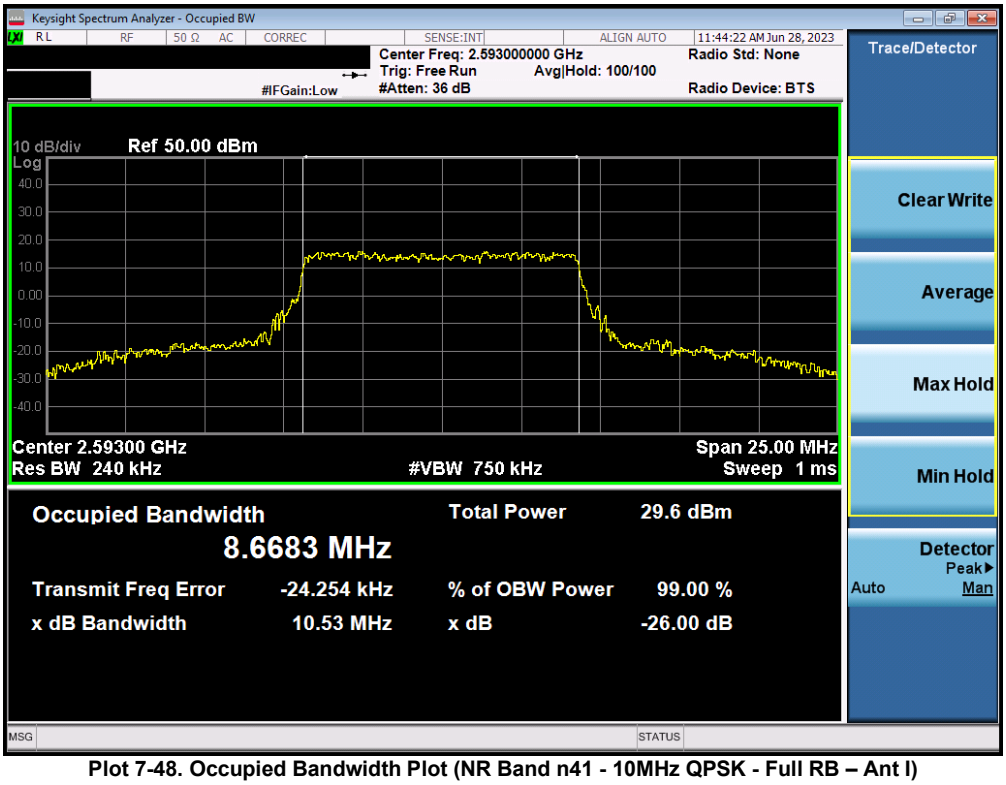

**Plot 7-45. Occupied Bandwidth Plot (NR Band n41 - 15MHz QPSK - Full RB – Ant I)**



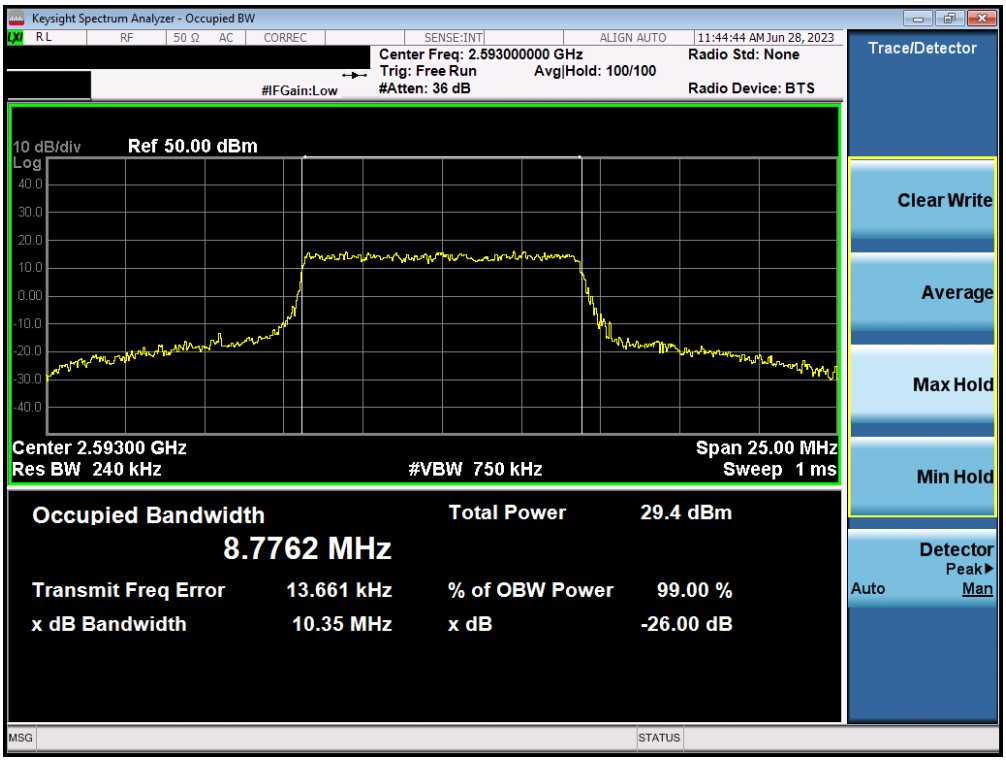

**Plot 7-46. Occupied Bandwidth Plot (NR Band n41 - 15MHz 16-QAM - Full RB – Ant I)**




**Plot 7-47. Occupied Bandwidth Plot (NR Band n41 - 10MHz π/2 BPSK - Full RB – Ant I)**




**Plot 7-48. Occupied Bandwidth Plot (NR Band n41 - 10MHz QPSK - Full RB – Ant I)**




**Plot 7-49. Occupied Bandwidth Plot (NR Band n41 - 10MHz 16-QAM - Full RB – Ant I)**

## 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. 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.

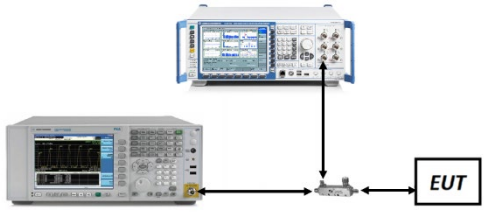



**Figure 7-3. Test Instrument & Measurement Setup**

### Test Notes

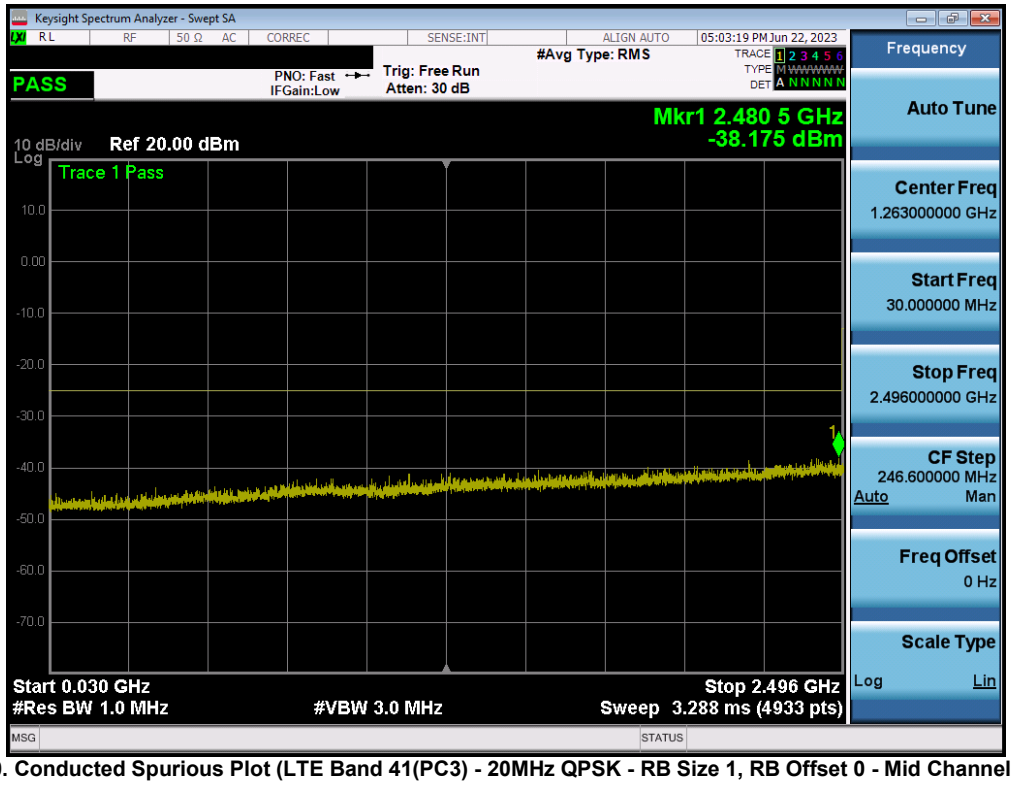
1. Per Part 27, RSS-195 and RSS-199, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz.

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.

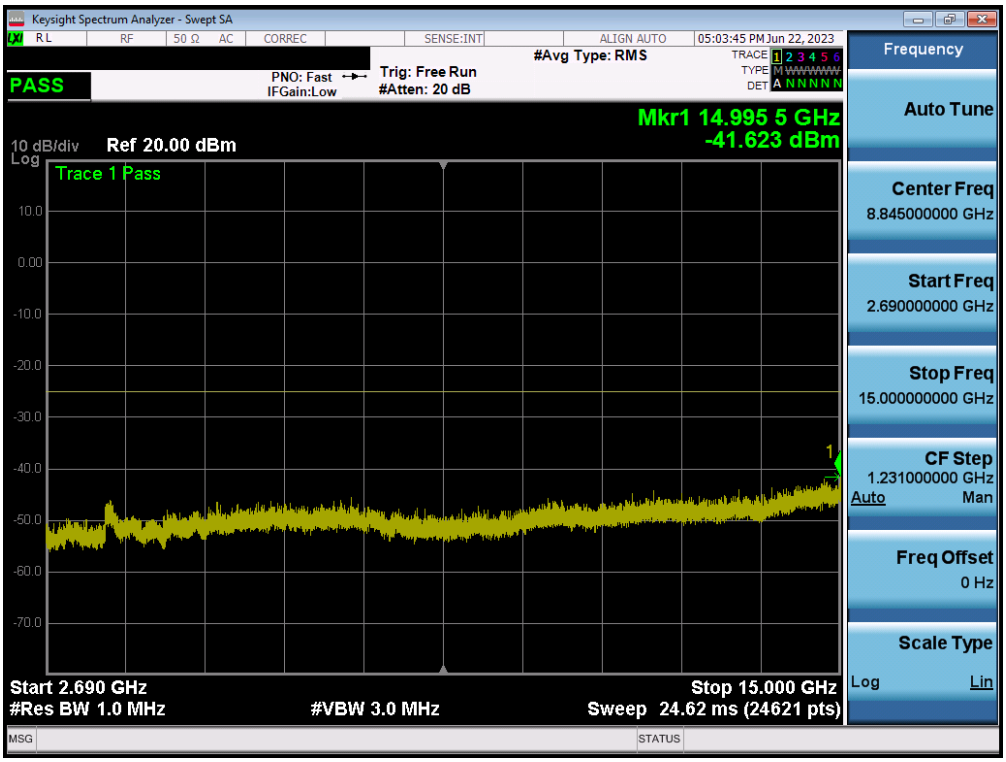
| Mode | Bandwidth | Channel | Range [MHz] | Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| LTE-B41 PC3 | 20MHz | Low | 30.0 - 2475.0 | -39.32 | -25 | -14.32 |
| | | Low | 2690.0 - 15000.0 | -40.89 | -25 | -15.89 |
| | | Low | 15000.0 - 27000.0 | -41.10 | -25 | -16.10 |
| | | Mid | 30.0 - 2496.0 | -38.18 | -25 | -13.17 |
| | | Mid | 2690.0 - 15000.0 | -41.62 | -25 | -16.62 |
| | | Mid | 15000.0 - 27000.0 | -40.53 | -25 | -15.53 |
| | | High | 30.0 - 2496.0 | -38.87 | -25 | -13.87 |
| | | High | 2715.0 - 15000.0 | -40.62 | -25 | -15.62 |
| | | High | 15000.0 - 27000.0 | -41.21 | -25 | -16.21 |
| ULCA LTE-B41 PC3 | 20MHz + 20MHz | Low | 30.0 - 2475.0 | -37.87 | -25 | -12.87 |
| | | Low | 2690.0 - 15000.0 | -31.87 | -25 | -6.87 |
| | | Low | 15000.0 - 27000.0 | -39.08 | -25 | -14.08 |
| | | Mid | 30.0 - 2496.0 | -38.03 | -25 | -13.03 |
| | | Mid | 2690.0 - 15000.0 | -31.47 | -25 | -6.47 |
| | | Mid | 15000.0 - 27000.0 | -39.07 | -25 | -14.07 |
| | | High | 30.0 - 2496.0 | -36.76 | -25 | -11.76 |
| | | High | 2715.0 - 15000.0 | -31.77 | -25 | -6.77 |
| | | High | 1500.0 - 27000.0 | -38.48 | -25 | -13.48 |

**Table 7-8. Conducted Spurious Emission Results – Ant B**

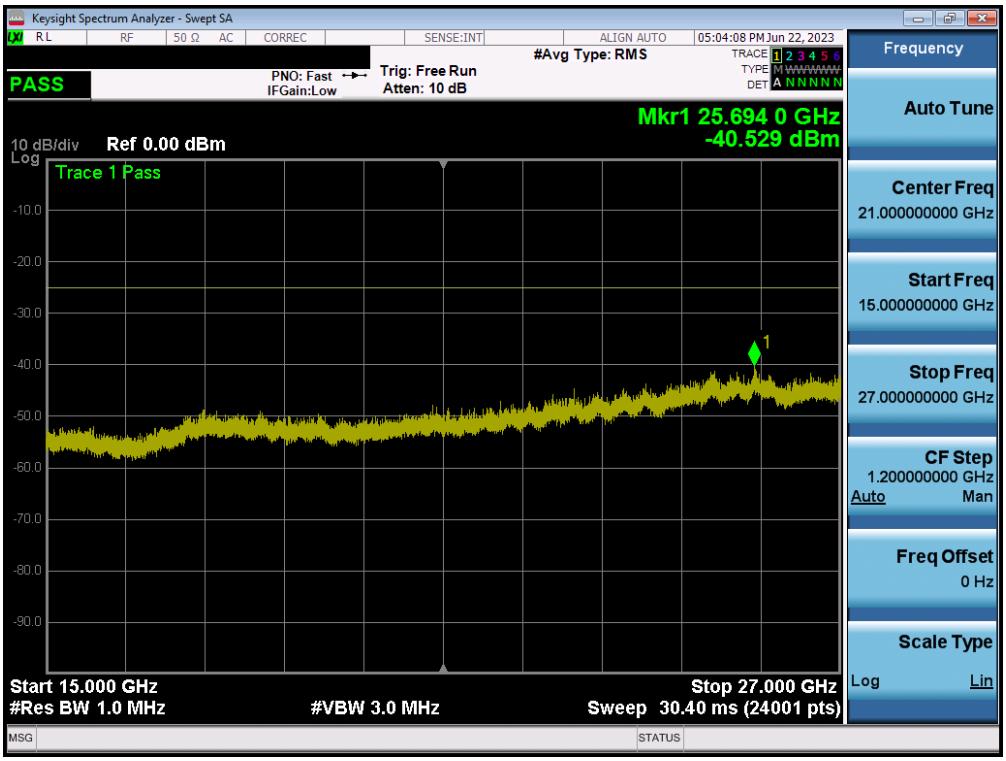
## LTE Band 41(PC3) – Ant B




**Plot 7-50. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant B)**

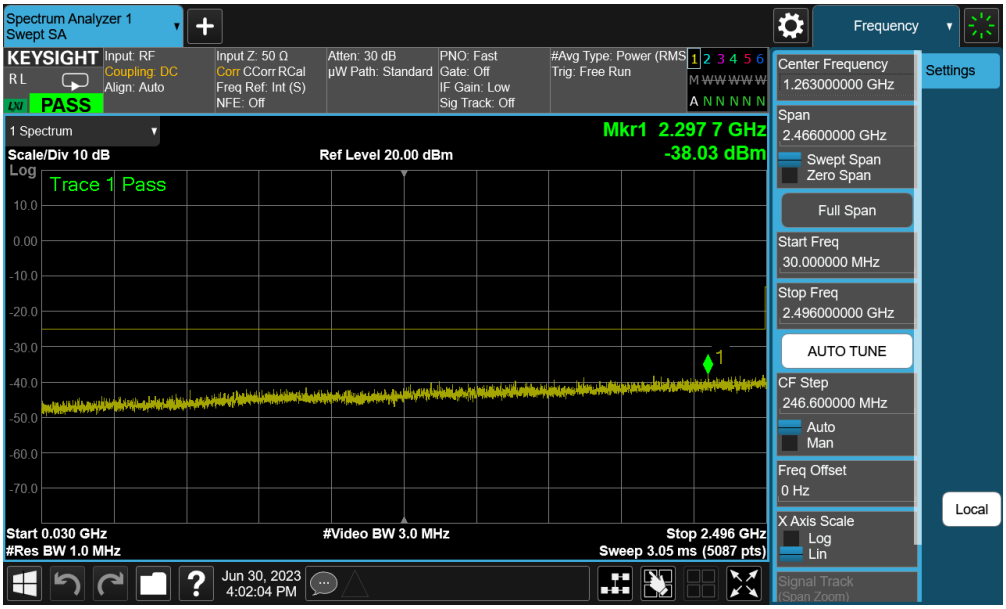



**Plot 7-51. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant B)**

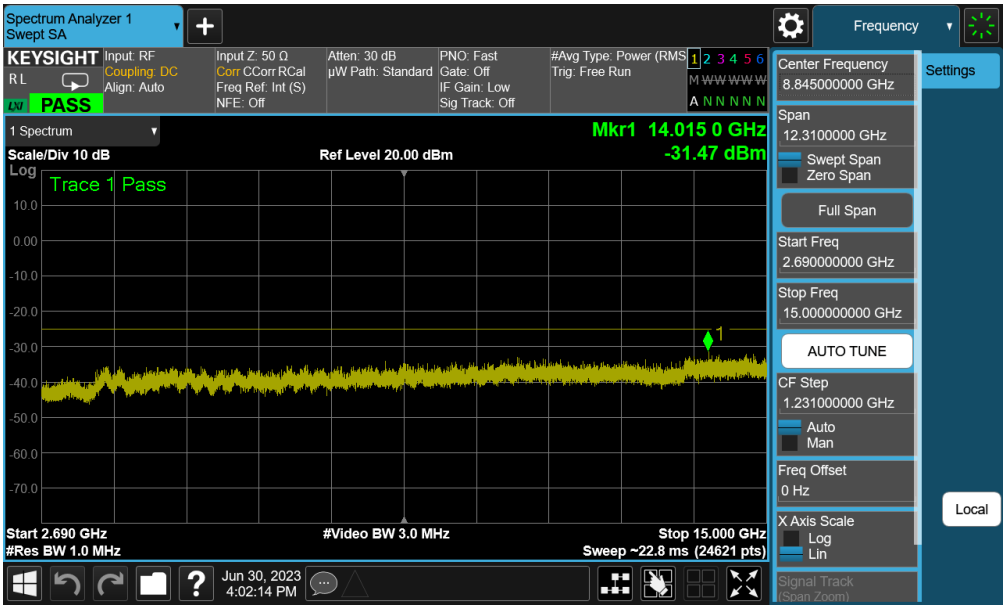



**Plot 7-52. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant B)**

## ULCA - LTE B41(PC3) – Ant B




**Plot 7-53. Conducted Spurious Plot (ULCA LTE B41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant B)**




**Plot 7-54. Conducted Spurious Plot (ULCA LTE B41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant B)**