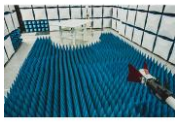
PCTEST
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



# PART 27 MEASUREMENT REPORT

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

**Date of Testing:**
4/21/2021 - 6/25/2021
**Test Site/Location:**
PCTEST Lab. Columbia, MD, USA
**Test Report Serial No.:**
1M2104130035-05.A3L

| | |
|---|---|
| **FCC ID:** | **A3LSMF711B** |
| **Applicant Name:** | **Samsung Electronics Co., Ltd.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model:** | SM-F711B |
| **EUT Type:** | Portable Handset |
| **FCC Classification:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FCC Rule Part:** | 27 |
| **Test Procedure(s):** | ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01, KDB 648474 D03 v01r04 |

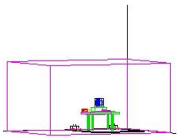
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

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.

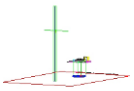
Randy Ortanez
President

ACCREDITED
CERT #2041.01

# TABLE OF CONTENTS



# PART 27 MEASUREMENT REPORT



| Mode | Bandwidth | Modulation | Tx Frequency Range [MHz] | EIRP | | Emission Designator |
|---|---|---|---|---|---|---|
| | | | | Max. Power [W] | Max. Power [dBm] | |
| LTE Band 41(PC2) | 20 MHz | QPSK | 2506.0 - 2680.0 | 0.348 | 25.41 | 18M0G7D |
| | | 16QAM | 2506.0 - 2680.0 | 0.286 | 24.56 | 18M0W7D |
| | 15 MHz | QPSK | 2503.5 - 2682.5 | 0.401 | 26.03 | 13M5G7D |
| | | 16QAM | 2503.5 - 2682.5 | 0.327 | 25.15 | 13M5W7D |
| | 10 MHz | QPSK | 2501.0 - 2685.0 | 0.396 | 25.97 | 9M00G7D |
| | | 16QAM | 2501.0 - 2685.0 | 0.311 | 24.93 | 8M99W7D |
| | 5 MHz | QPSK | 2498.5 - 2687.5 | 0.395 | 25.97 | 4M52G7D |
| | | 16QAM | 2498.5 - 2687.5 | 0.344 | 25.37 | 4M51W7D |
| LTE Band 41(PC3) | 20 MHz | QPSK | 2506.0 - 2680.0 | 0.191 | 22.82 | 18M0G7D |
| | | 16QAM | 2506.0 - 2680.0 | 0.148 | 21.71 | 18M0W7D |
| | 15 MHz | QPSK | 2503.5 - 2682.5 | 0.186 | 22.70 | 13M6G7D |
| | | 16QAM | 2503.5 - 2682.5 | 0.163 | 22.13 | 13M5W7D |
| | 10 MHz | QPSK | 2501.0 - 2685.0 | 0.176 | 22.46 | 9M03G7D |
| | | 16QAM | 2501.0 - 2685.0 | 0.142 | 21.52 | 8M99W7D |
| | 5 MHz | QPSK | 2498.5 - 2687.5 | 0.191 | 22.82 | 4M51G7D |
| | | 16QAM | 2498.5 - 2687.5 | 0.150 | 21.77 | 4M51W7D |

## 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 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. 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 PCTEST located in Columbia, MD 21046, U.S.A.**

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMF711B**. 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.

The Equipment Under Test (EUT) can operate in one of three physical configurations – "Open", "Half open" and "Closed". All emissions are investigated in three modes for compliance.

**Test Device Serial No.:** 0044M, 0050M, 0065M, 0069M, 0086M, 0089M, 0100M

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (n5, n66), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer

## 2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 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 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 "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Measurement Guidance for Certification of Licensed Digital Transmitters" (KDB 971168 D01 v03r01) 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/TIA-603-E-2016. 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 and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. 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 474788 D01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI/TIA-603-E-2016.

# 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). Measurement antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

**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

## 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: A3LSMF711B

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

Mode(s): LTE

| Test Condition | Test Description | FCC Part Section(s) | RSS Section(s) | Test Limit | Test Result | Reference |
|---|---|---|---|---|---|---|
| CONDUCTED | Occupied Bandwidth | 2.1049 | RSS-Gen(6.7) | N/A | PASS | Section 7.2 |
| | Conducted Band Edge / Spurious Emissions (LTE Band 41) | 2.1051, 27.53(m) | RSS-199(4.5) | Undesirable emissions must meet the limits detailed in 27.53(m) | PASS | Sections 7.3, 7.4 |
| | Conducted Band Edge / Spurious Emissions (LTE Band 38) | | | | PASS | Sections 7.3, 7.4 |
| | Transmitter Conducted Output Power | 2.1046 | RSS-199(4.4) | N/A | PASS | See RF Exposure Report |
| | Frequency Stability | 2.1055, 27.54 | RSS-199(4.3) | Fundamental emissions stay within authorized frequency block | PASS | Section 7.8 |
| RADIATED | Effective Radiated Power / Equivalent Isotropic Radiated Power (LTE Band 41) | 27.50(h)(2) | RSS-199(4.4) | < 2 Watts max. EIRP | PASS | Section 7.6 |
| | Effective Radiated Power / Equivalent Isotropic Radiated Power (LTE Band 38) | | | | PASS | Section 7.6 |
| | Radiated Spurious Emissions (LTE Band 41) | 2.1053, 27.53(m) | RSS-199(4.5) | Undesirable emissions must meet the limits detailed in 27.53(m) | PASS | Section 7.7 |
| | Radiated Spurious Emissions (LTE Band 38) | | | | PASS | Section 7.7 |

**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 PCTEST EMC Software Tool Beta 8.

## 7.2 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**

KDB 971168 D01 v03r01 – Section 4.2

**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.

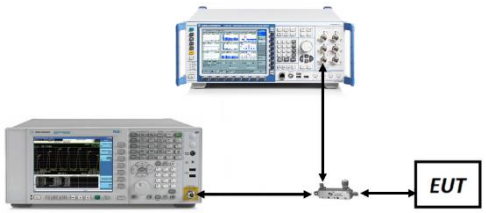
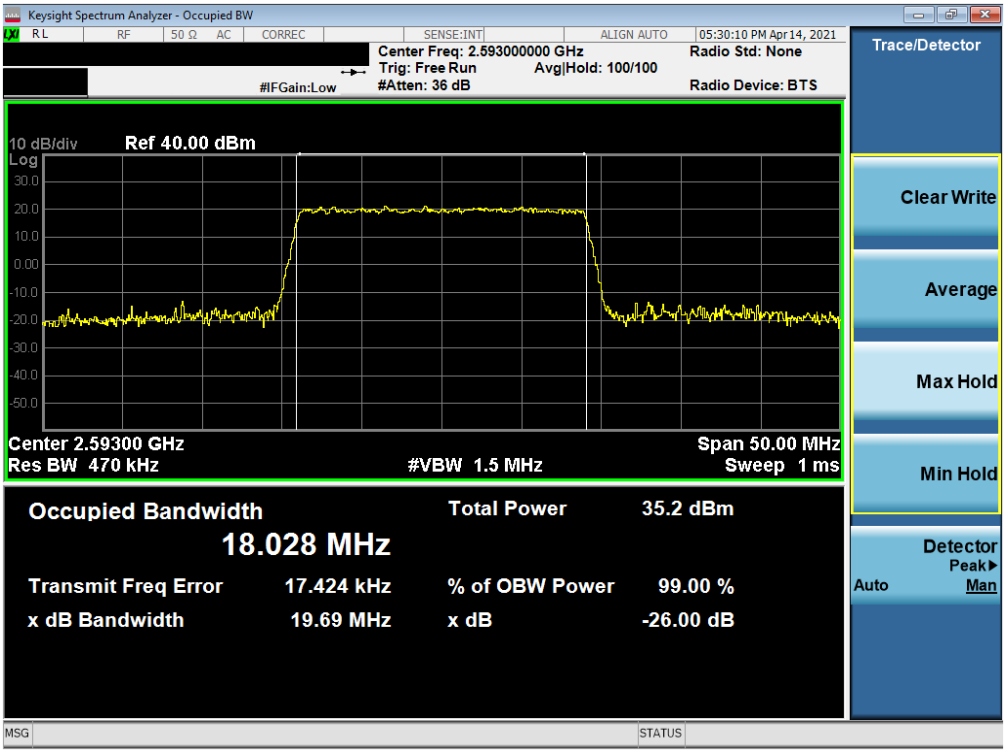



**Figure 7-1. Test Instrument & Measurement Setup**

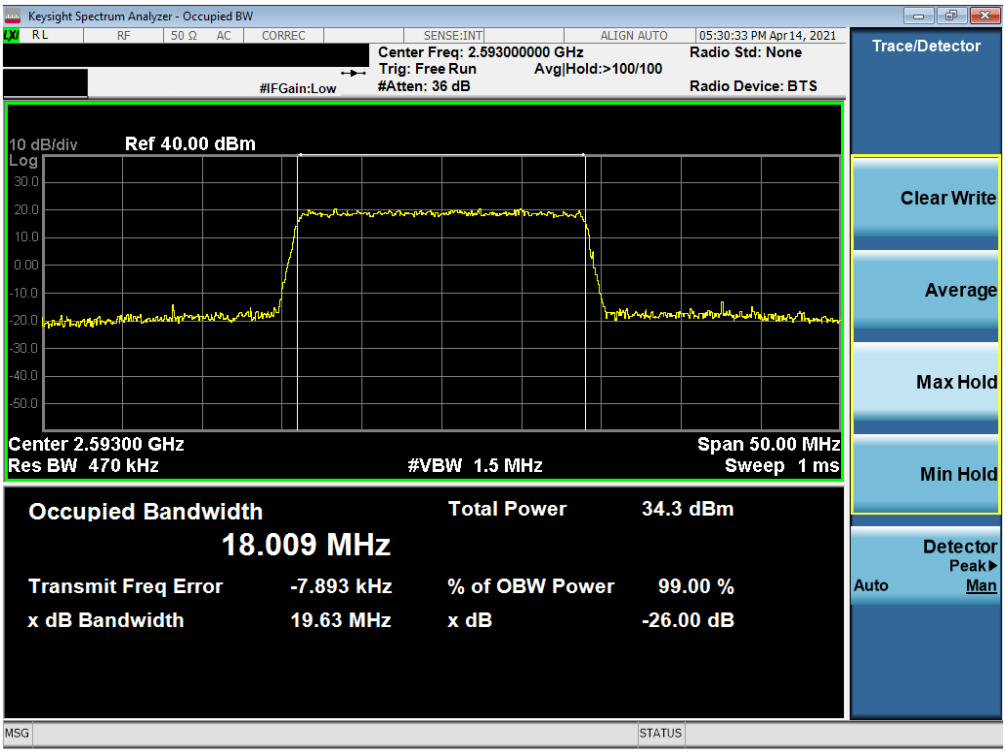
**Test Notes**

None.

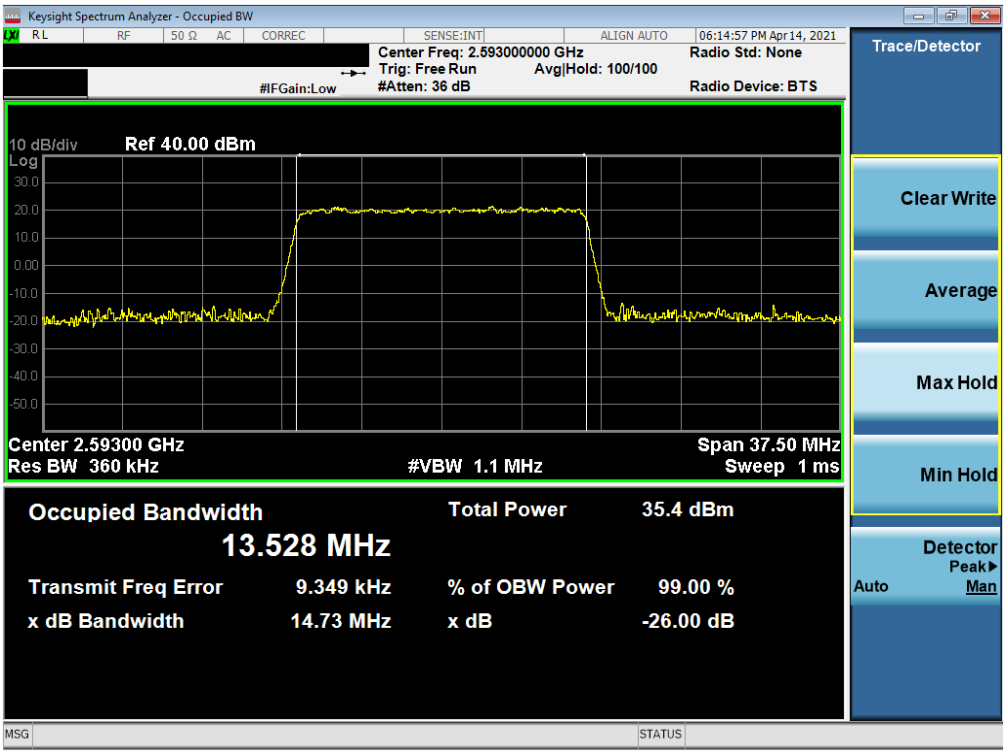
## LTE Band 41(PC2)



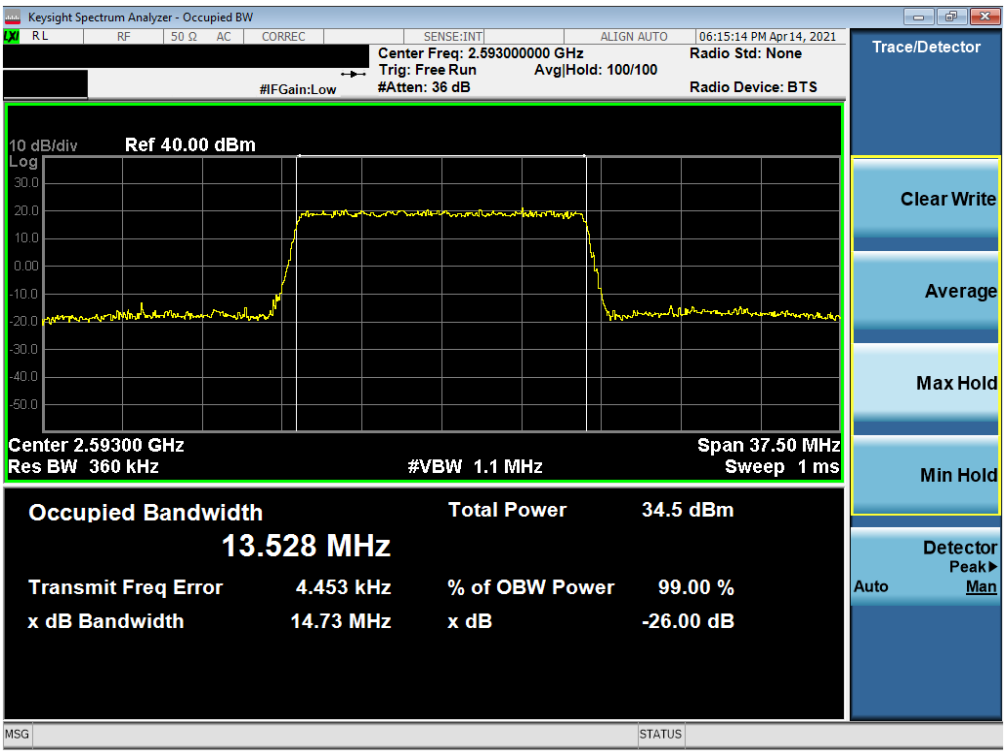

**Plot 7-1. Occupied Bandwidth Plot (LTE Band 41(PC2) - 20MHz QPSK - Full RB)**



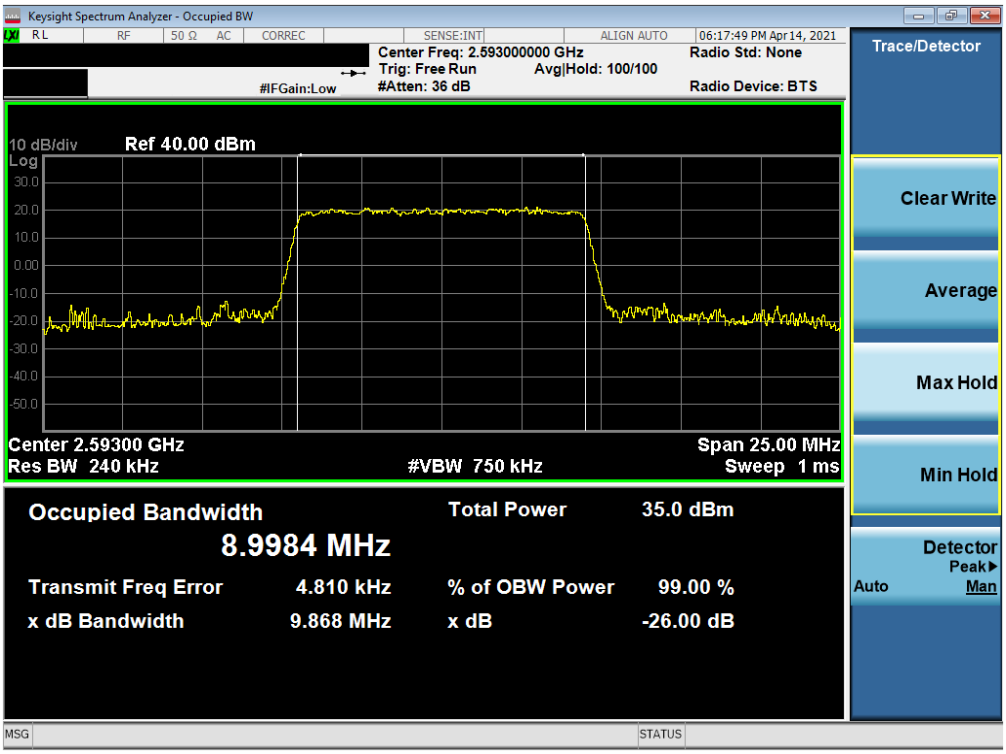

**Plot 7-2. Occupied Bandwidth Plot (LTE Band 41(PC2) - 20MHz 16-QAM - Full RB)**



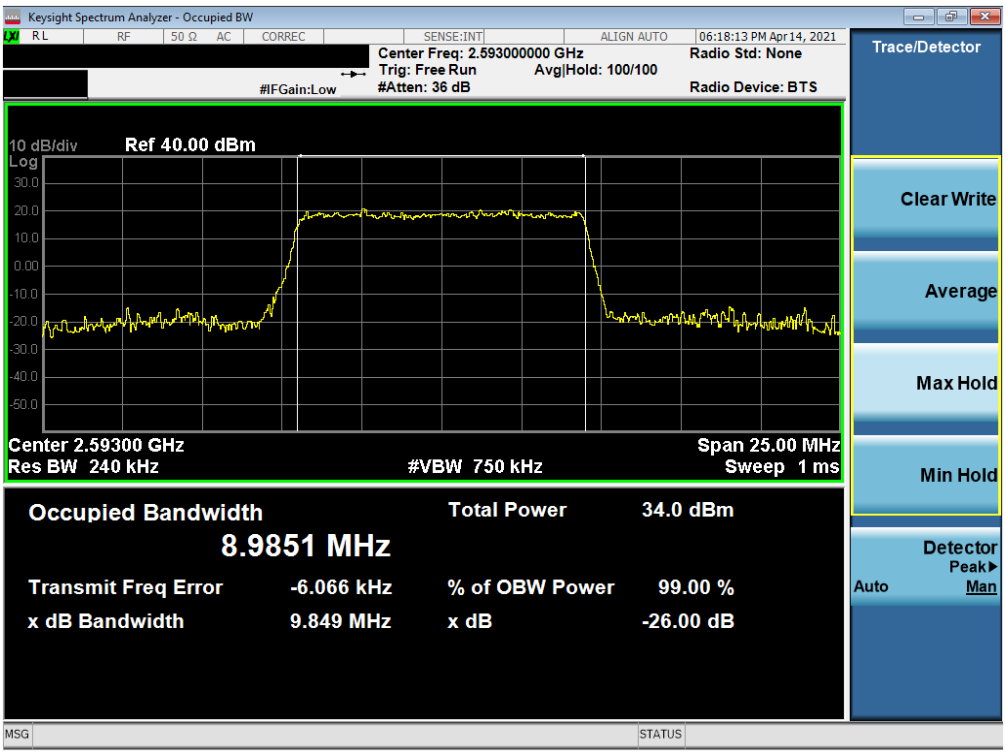

**Plot 7-3. Occupied Bandwidth Plot (LTE Band 41(PC2) - 15MHz QPSK - Full RB)**



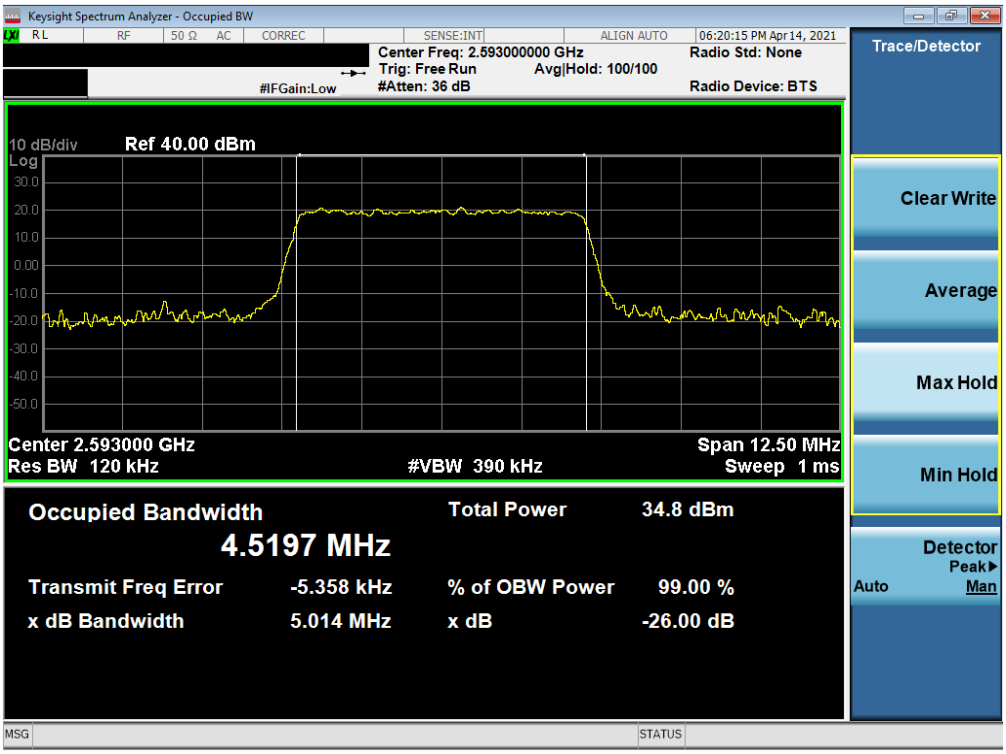

**Plot 7-4. Occupied Bandwidth Plot (LTE Band 41(PC2) - 15MHz 16-QAM - Full RB)**



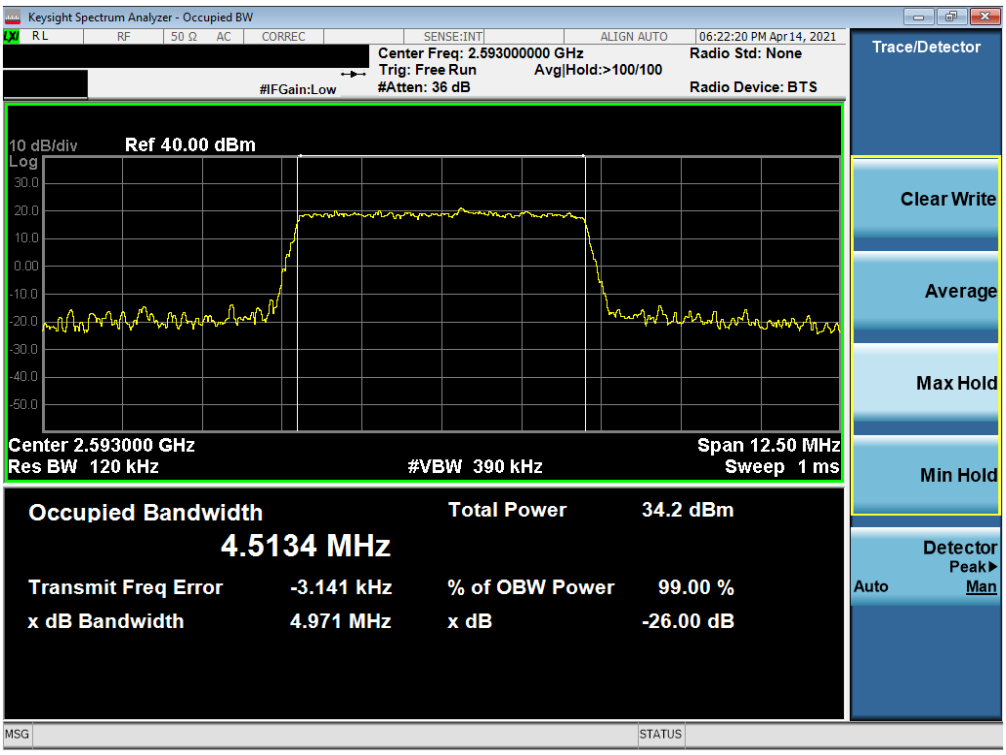

**Plot 7-5. Occupied Bandwidth Plot (LTE Band 41(PC2) - 10MHz QPSK - Full RB)**




**Plot 7-6. Occupied Bandwidth Plot (LTE Band 41(PC2) - 10MHz 16-QAM - Full RB)**

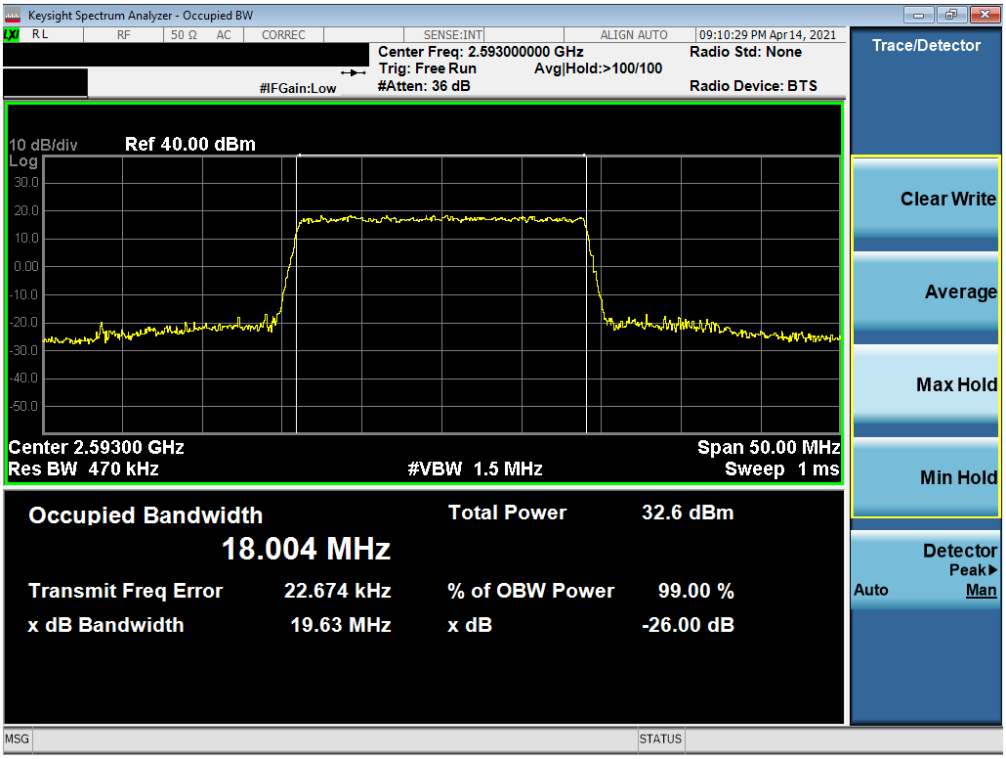



**Plot 7-7. Occupied Bandwidth Plot (LTE Band 41(PC2) - 5MHz QPSK - Full RB)**

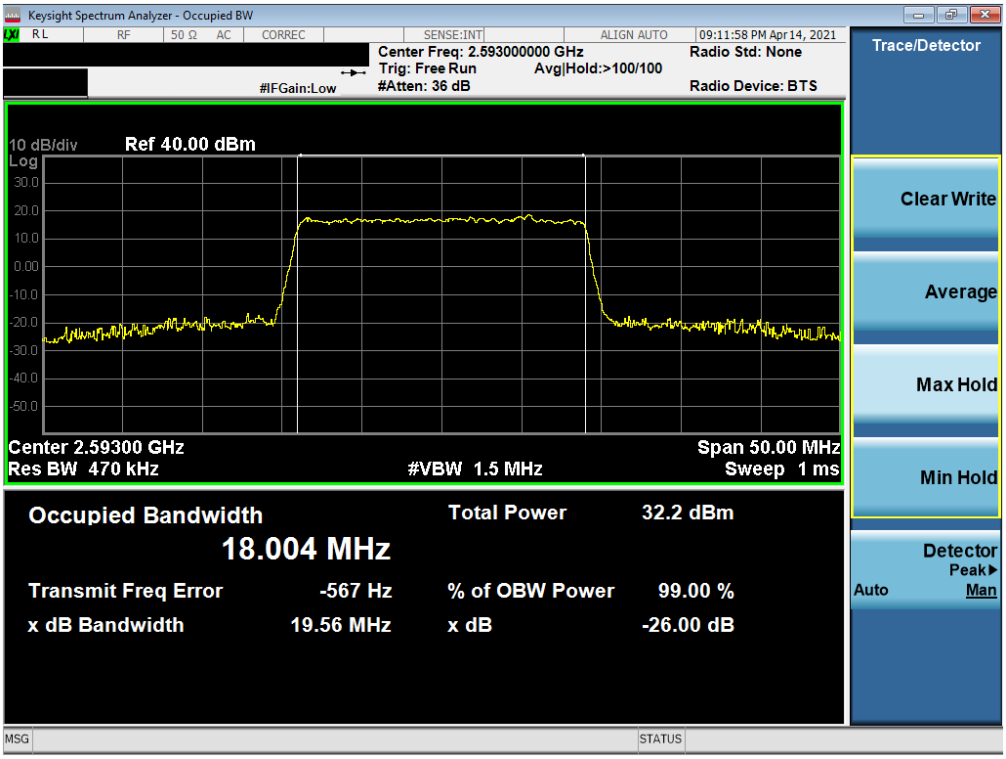



**Plot 7-8. Occupied Bandwidth Plot (LTE Band 41(PC2) - 5MHz 16-QAM - Full RB)**

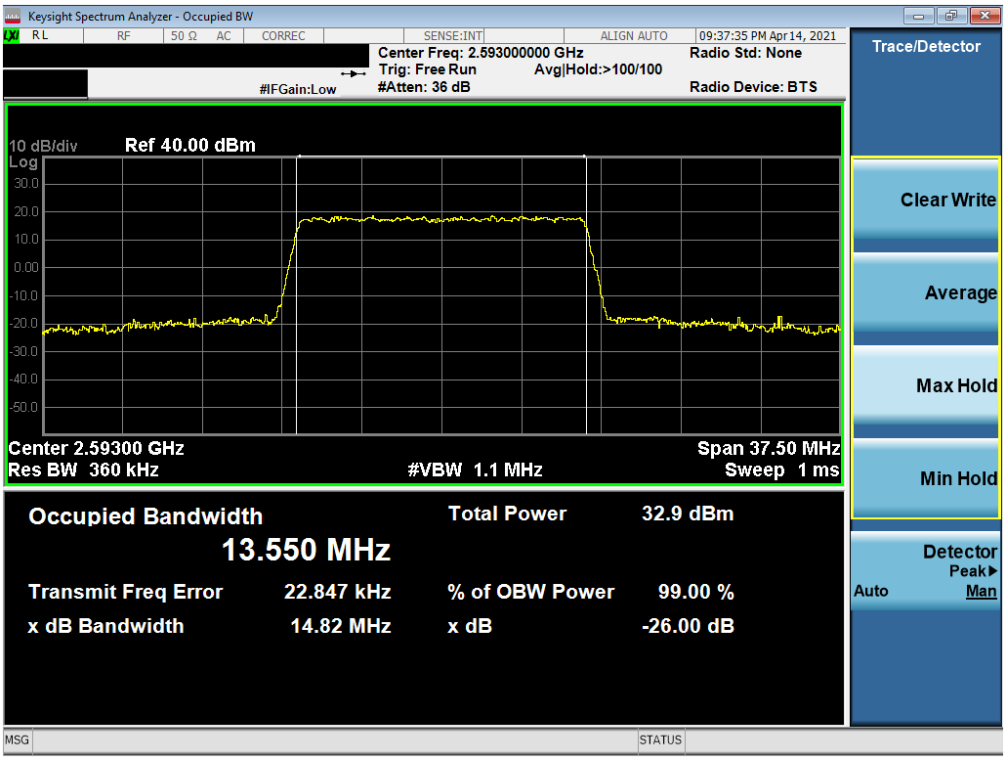
## LTE Band 41(PC3)



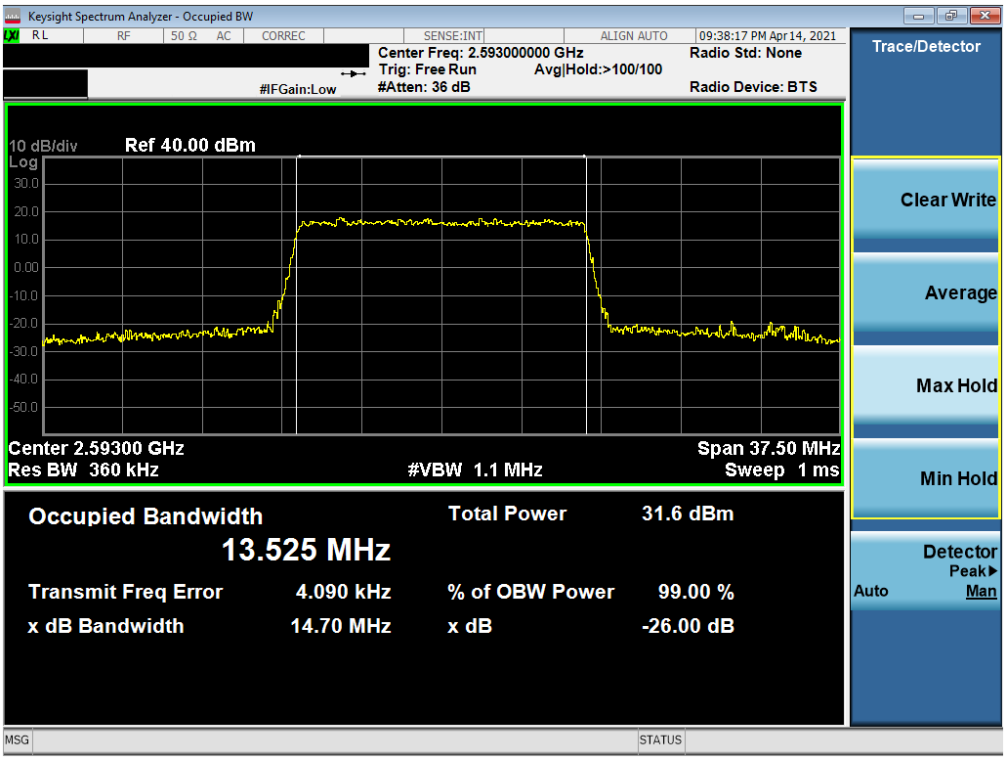

**Plot 7-9. Occupied Bandwidth Plot (LTE Band 41(PC3) - 20MHz QPSK - Full RB)**



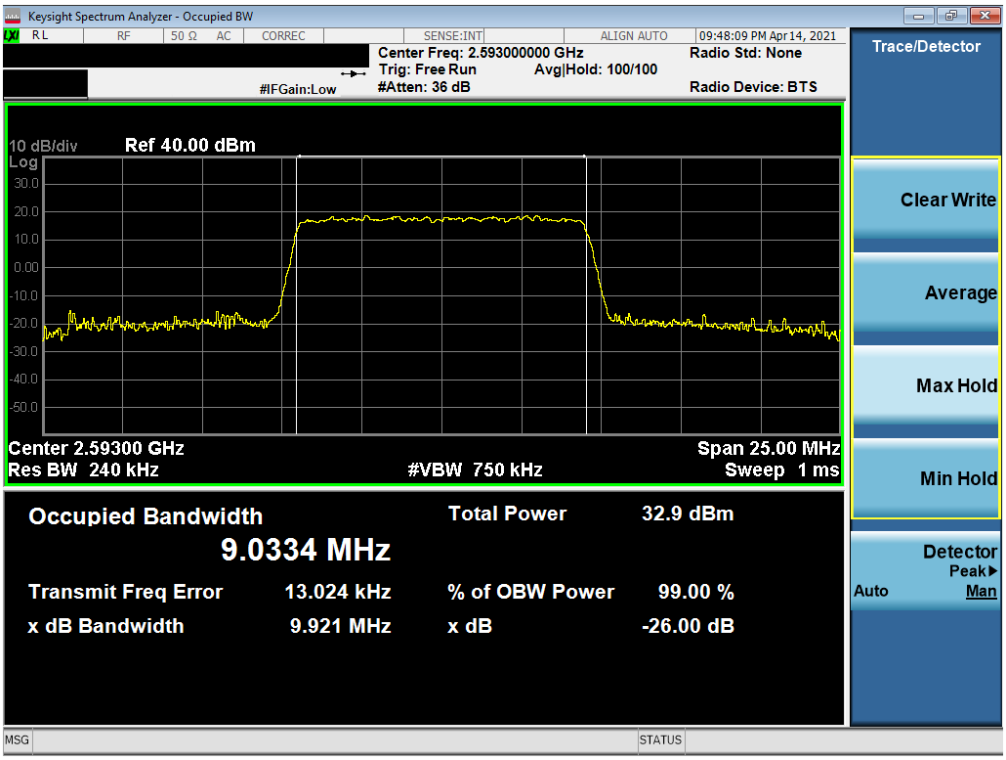

**Plot 7-10. Occupied Bandwidth Plot (LTE Band 41(PC3) - 20MHz 16-QAM - Full RB)**



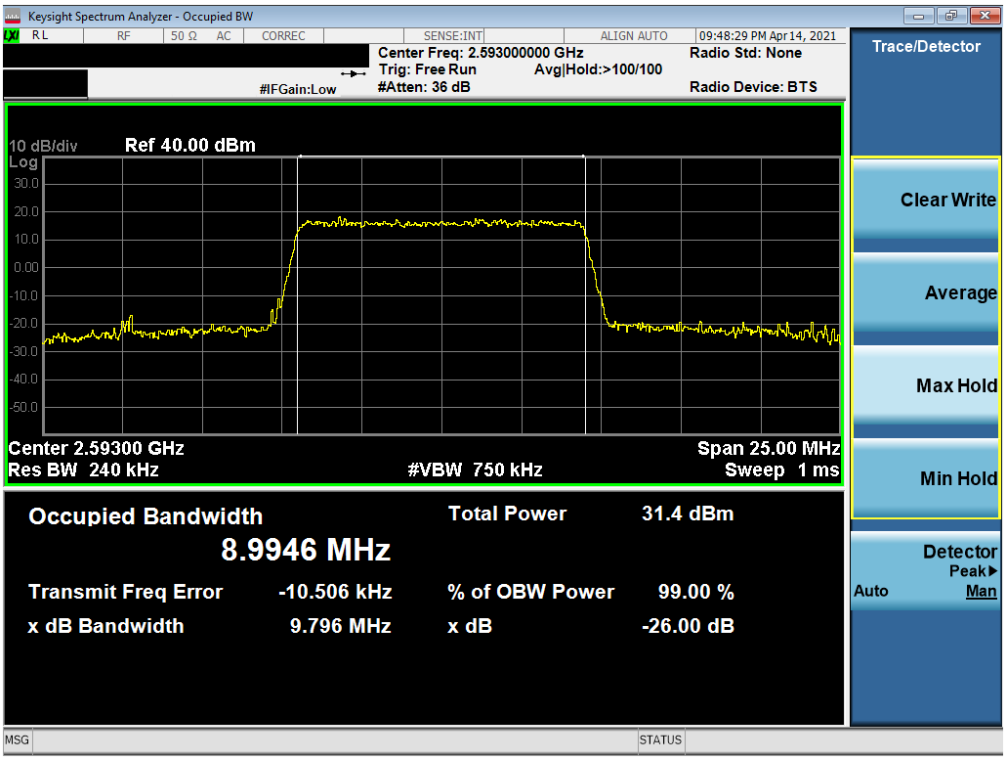

**Plot 7-11. Occupied Bandwidth Plot (LTE Band 41(PC3) - 15MHz QPSK - Full RB)**



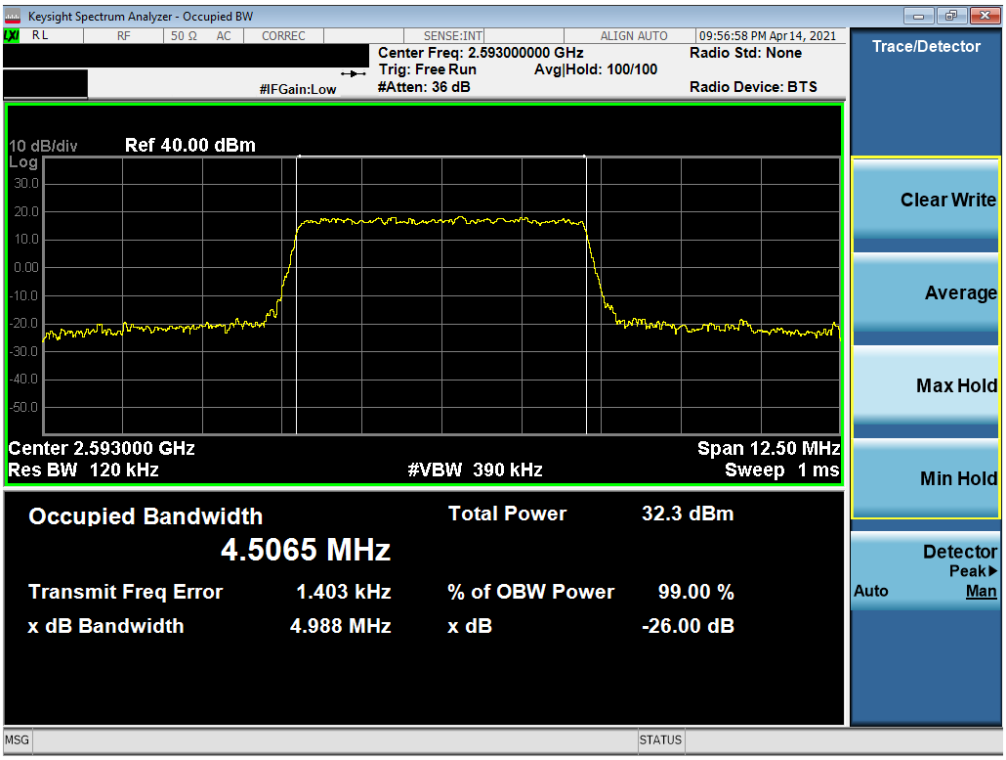

**Plot 7-12. Occupied Bandwidth Plot (LTE Band 41(PC3) - 15MHz 16-QAM - Full RB)**



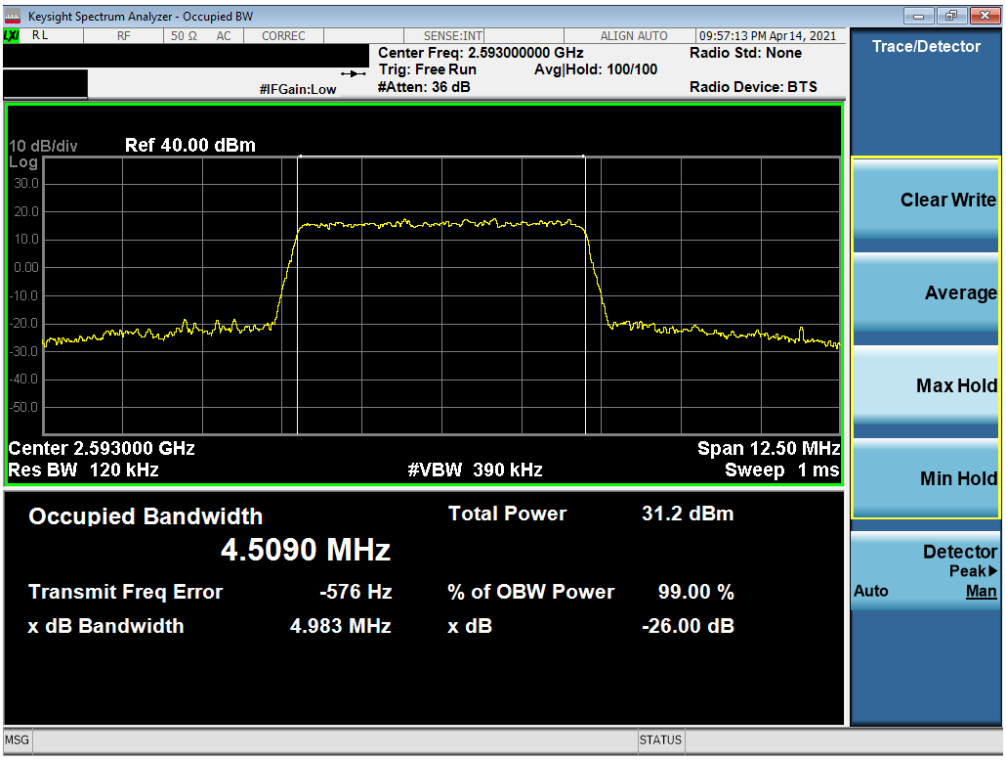

**Plot 7-13. Occupied Bandwidth Plot (LTE Band 41(PC3) - 10MHz QPSK - Full RB)**




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




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




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

## 7.3 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.

***For Band 41, the minimum permissible attenuation level of any spurious emission is 55 + 10log$_{10}$(P$_{[Watts]}$).***

**Test Procedure Used**

KDB 971168 D01 v03r01 – Section 6.0

**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.

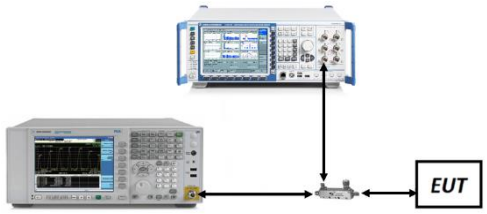
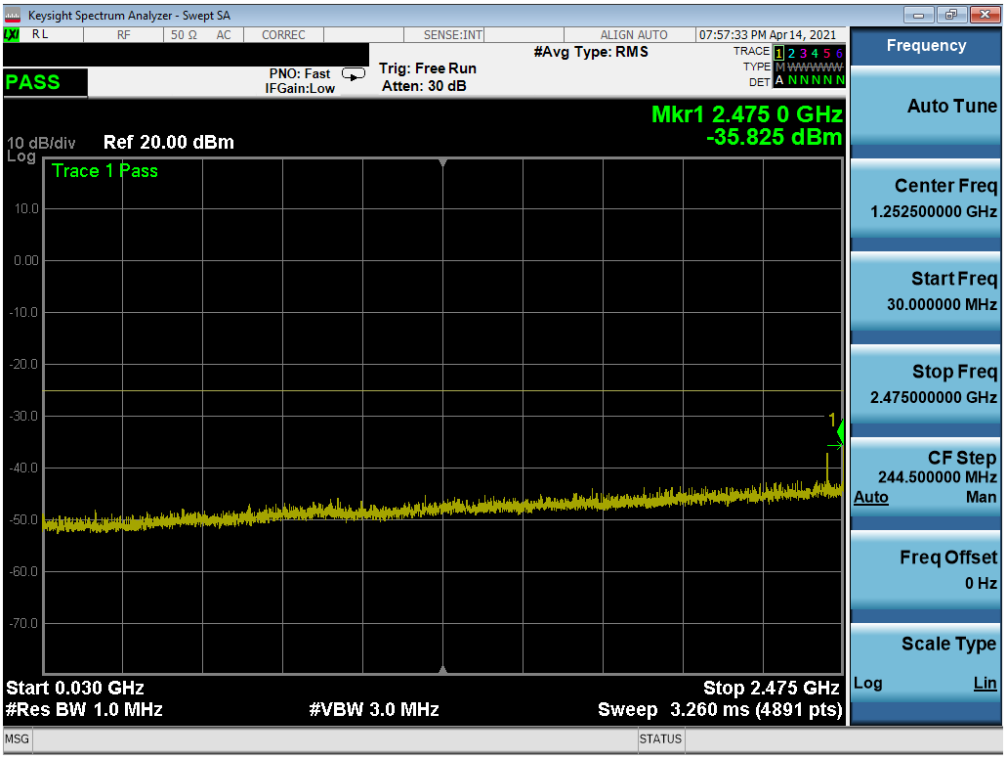



**Figure 7-2. Test Instrument & Measurement Setup**

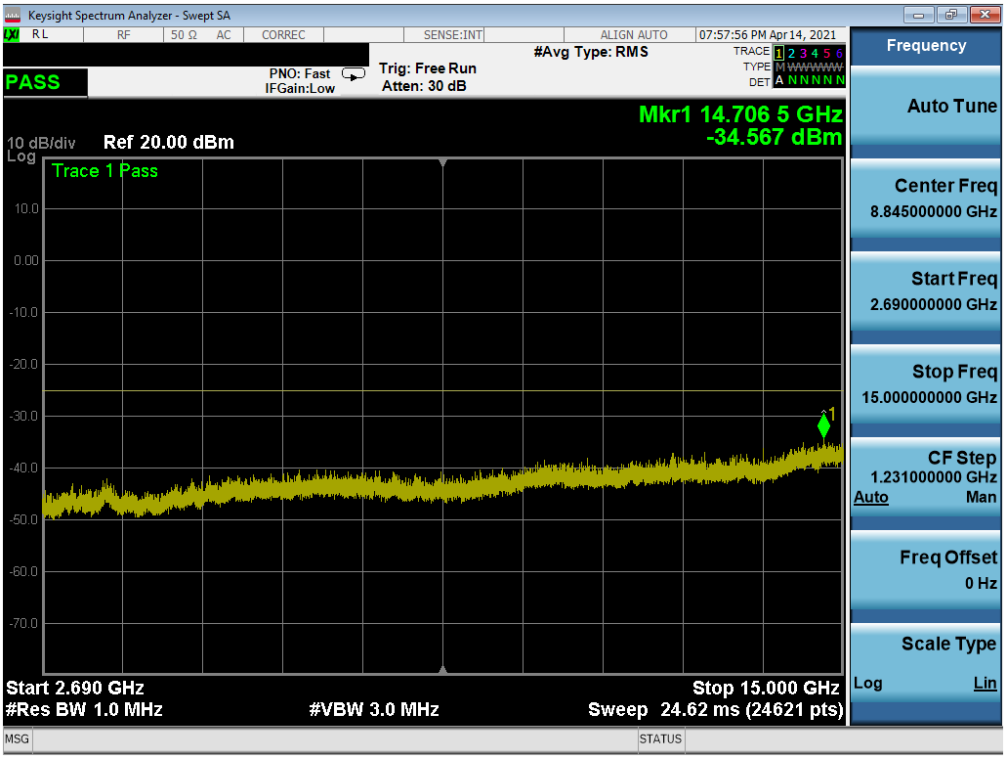
**Test Notes**

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 100 kHz or greater for measurements below 1GHz. However, 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. 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.

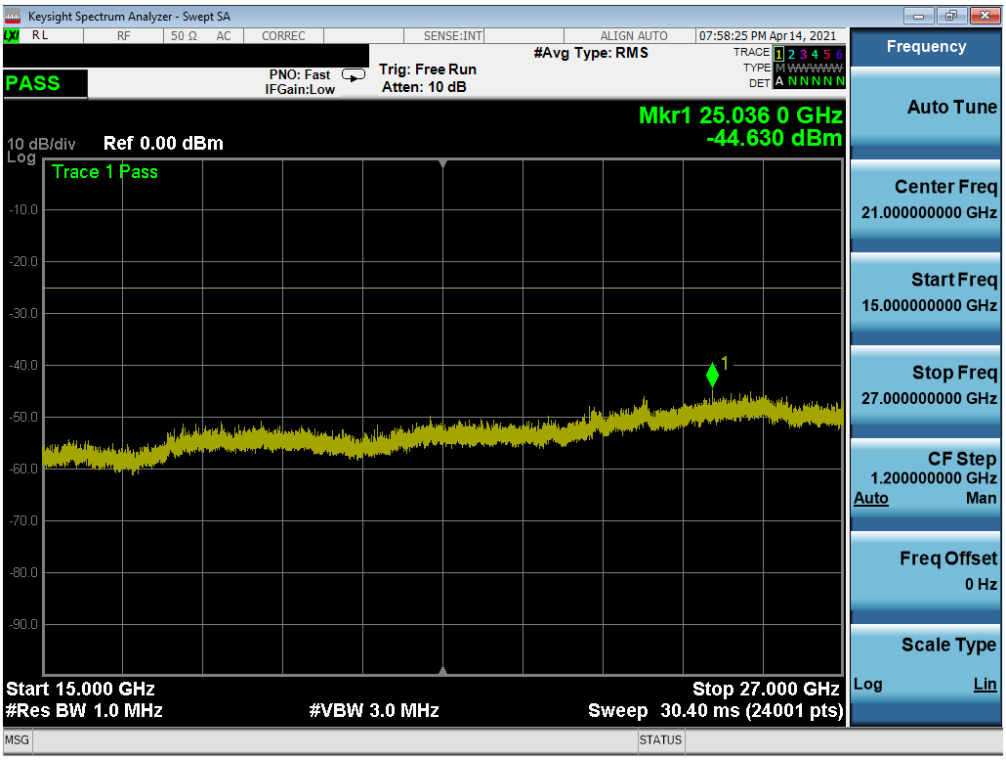
## LTE Band 41(PC2)



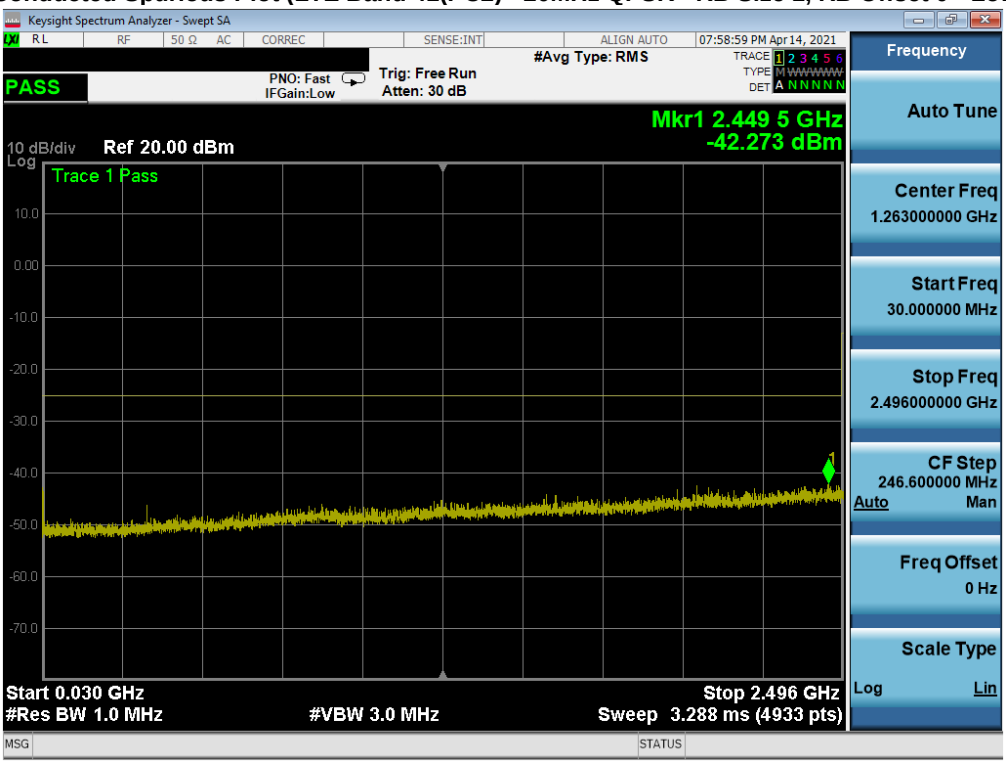

**Plot 7-17. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



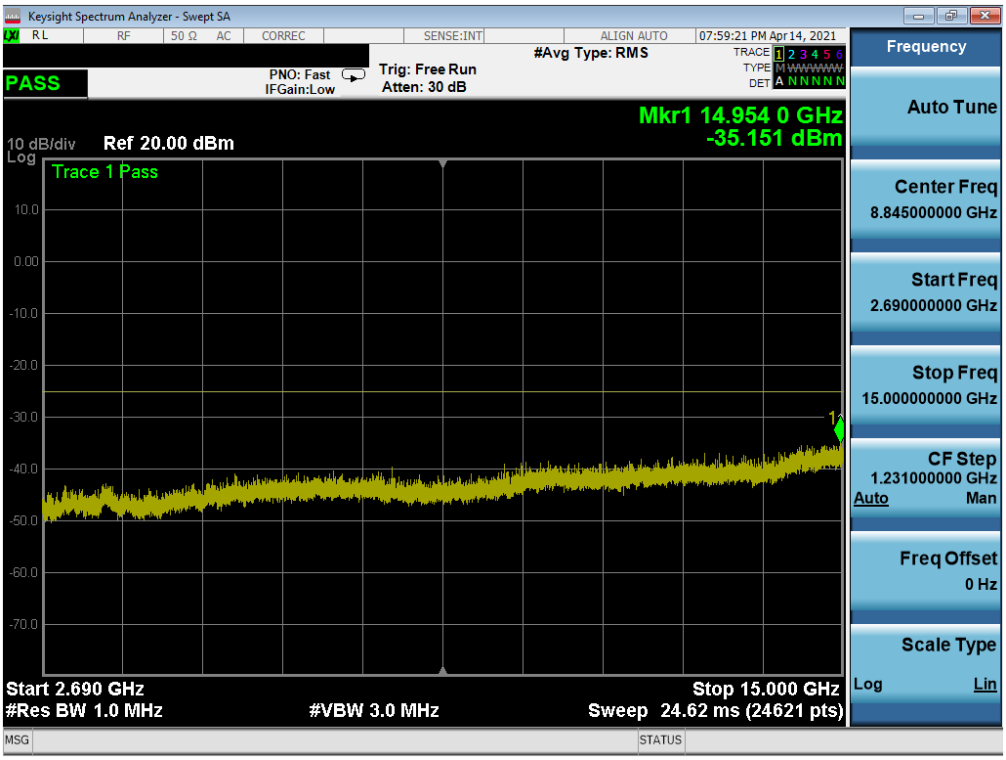

**Plot 7-18. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



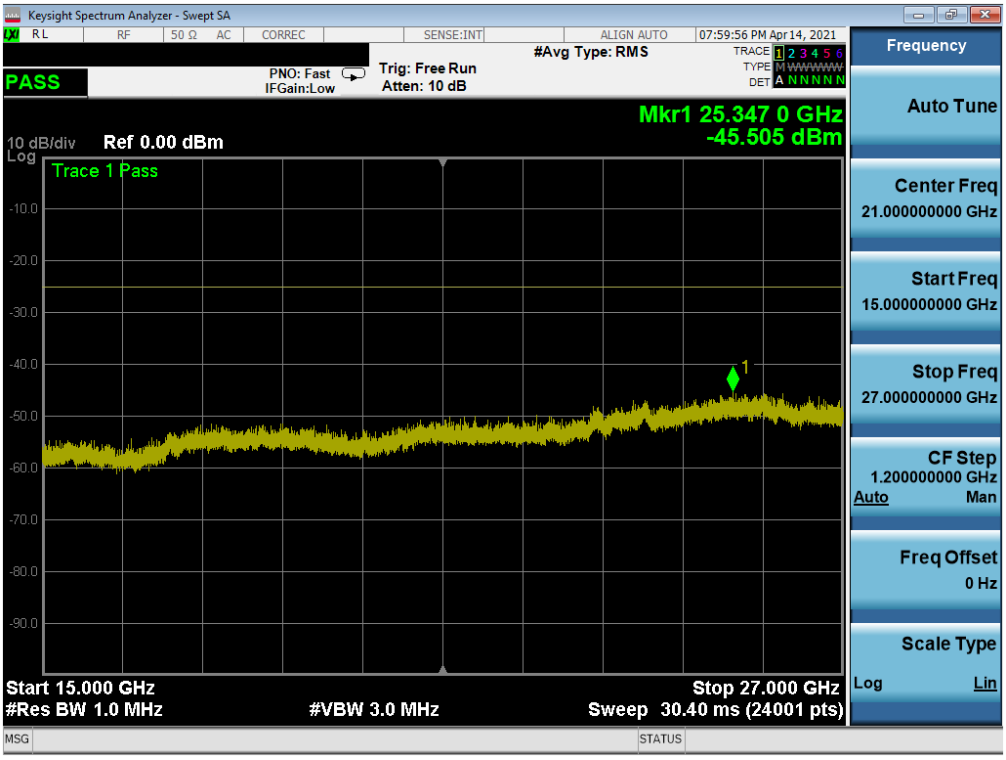

**Plot 7-19. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



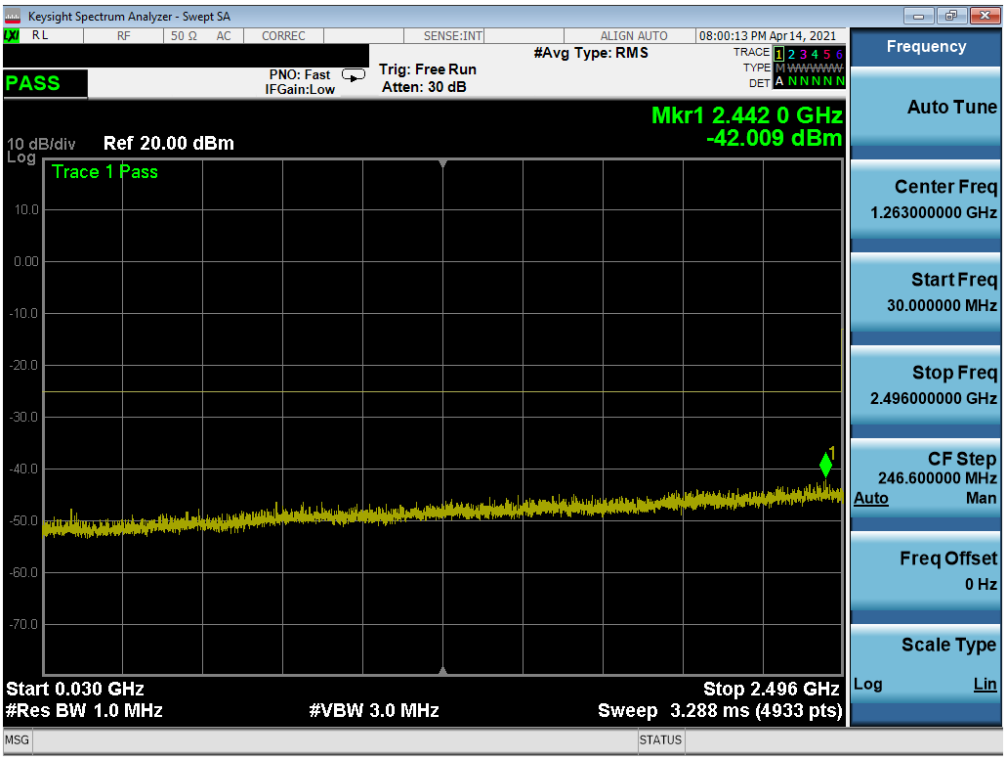

**Plot 7-20. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



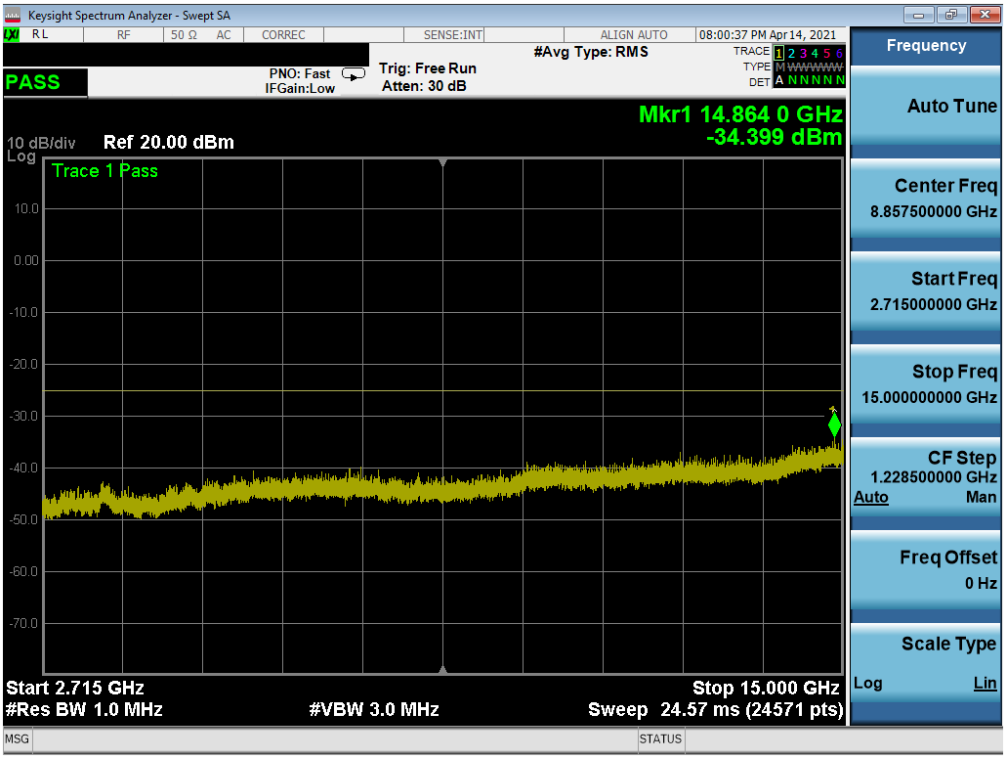

**Plot 7-21. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



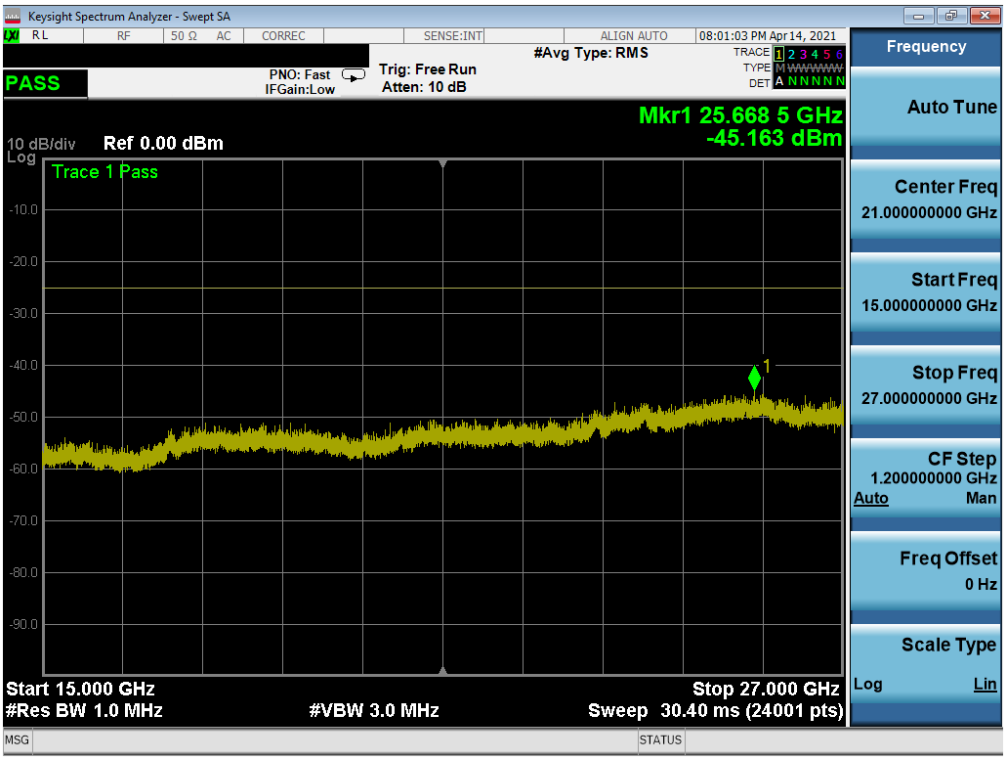

**Plot 7-22. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-23. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

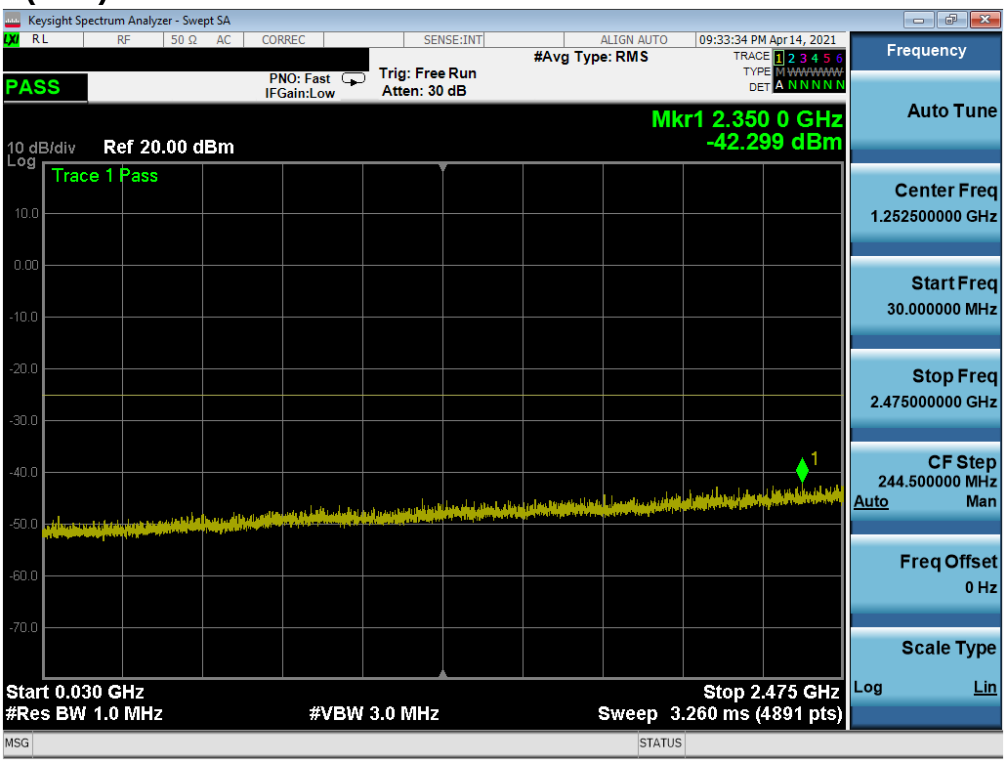



**Plot 7-24. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

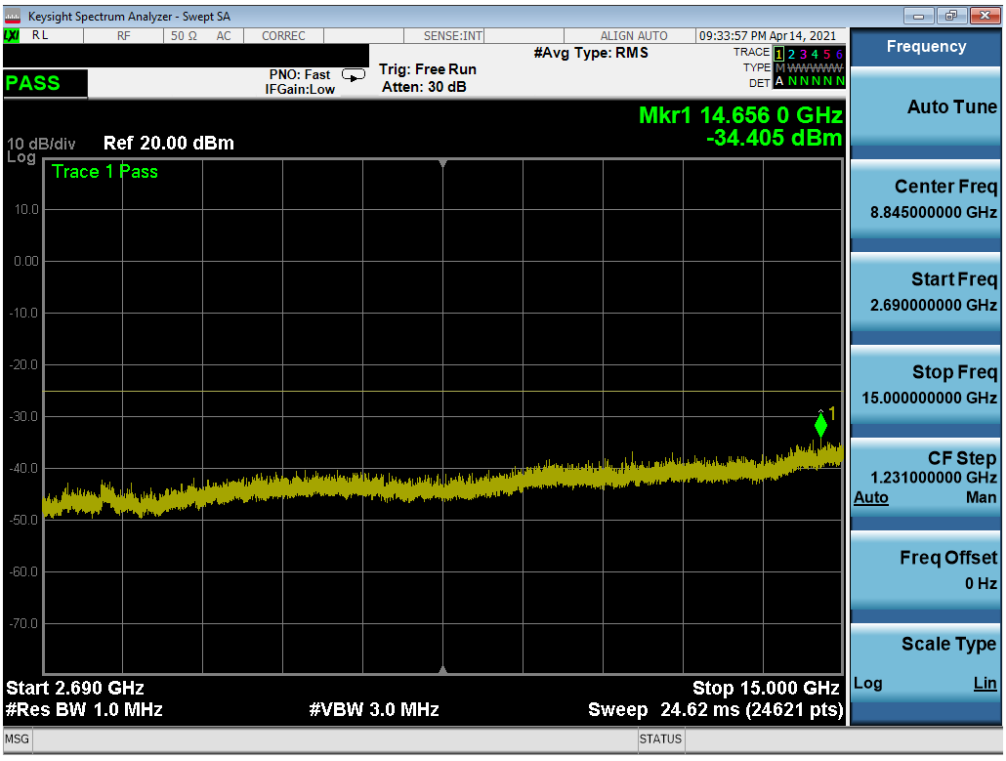



**Plot 7-25. Conducted Spurious Plot (LTE Band 41(PC2) - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

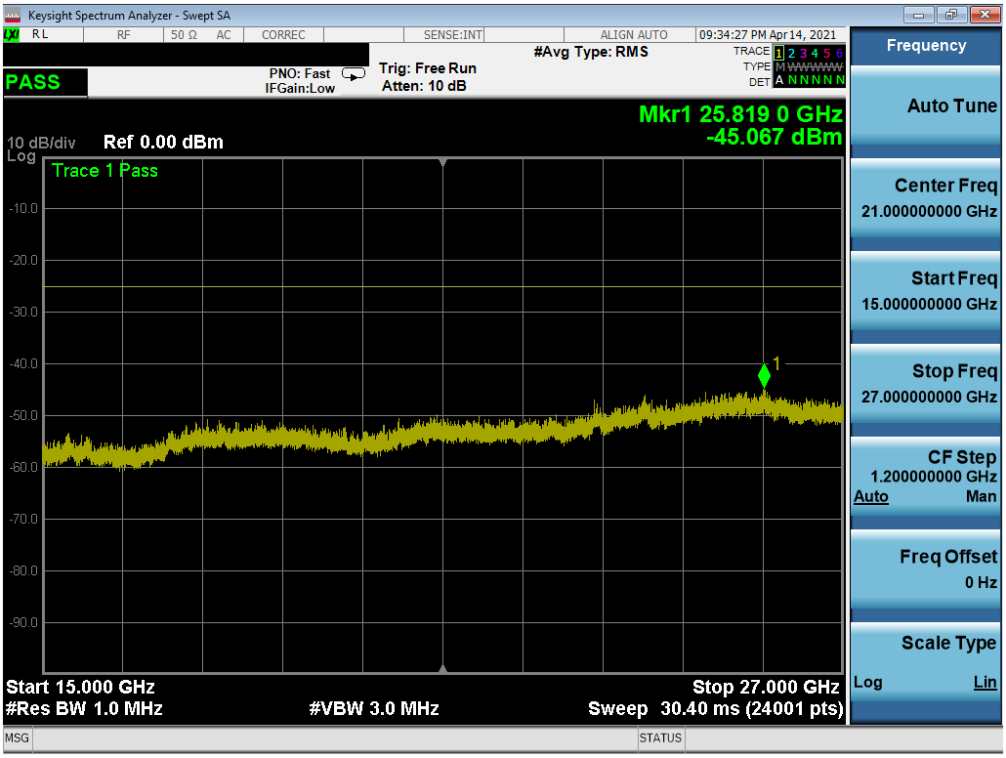
## LTE Band 41(PC3)



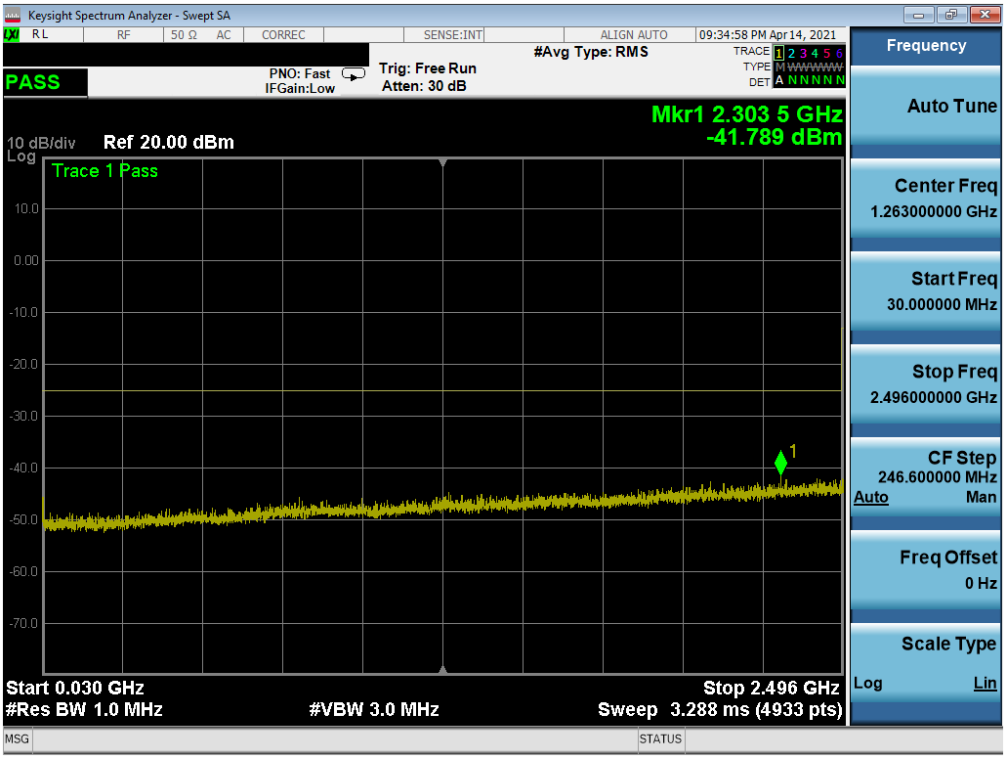

**Plot 7-26. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



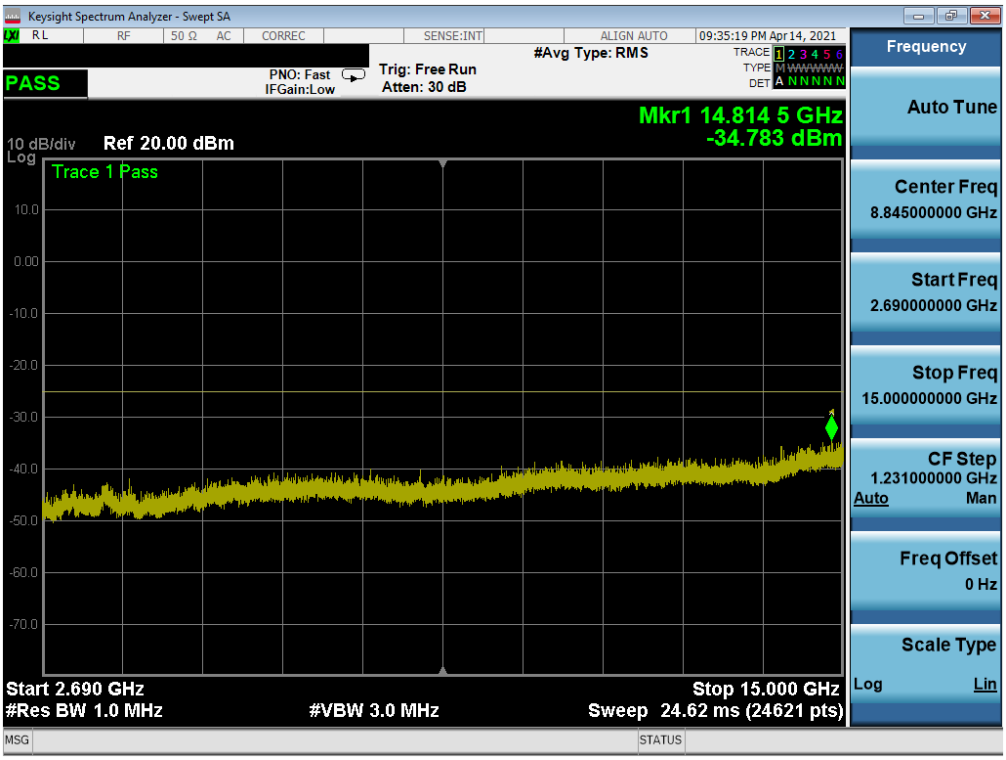

**Plot 7-27. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



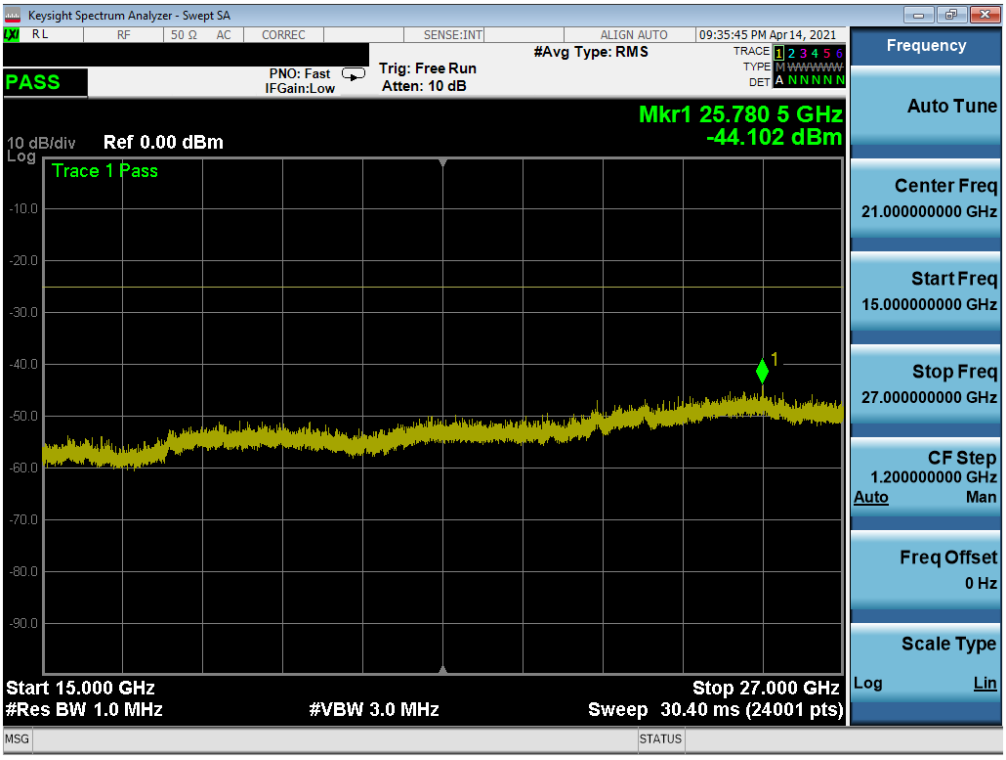

**Plot 7-28. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



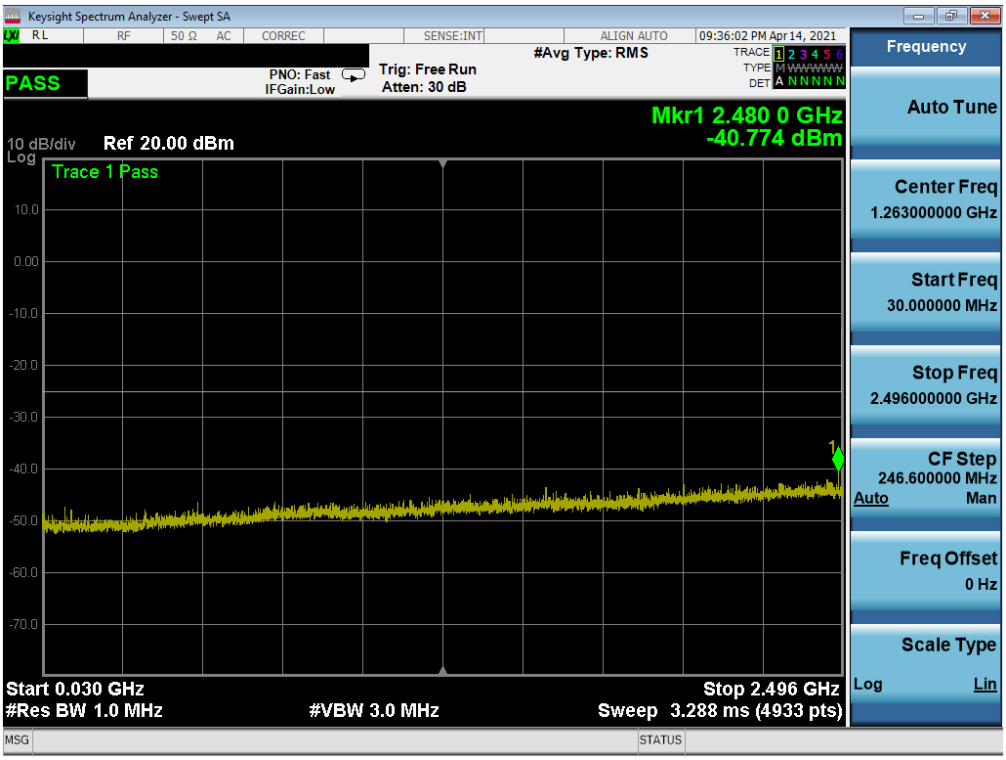

**Plot 7-29. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



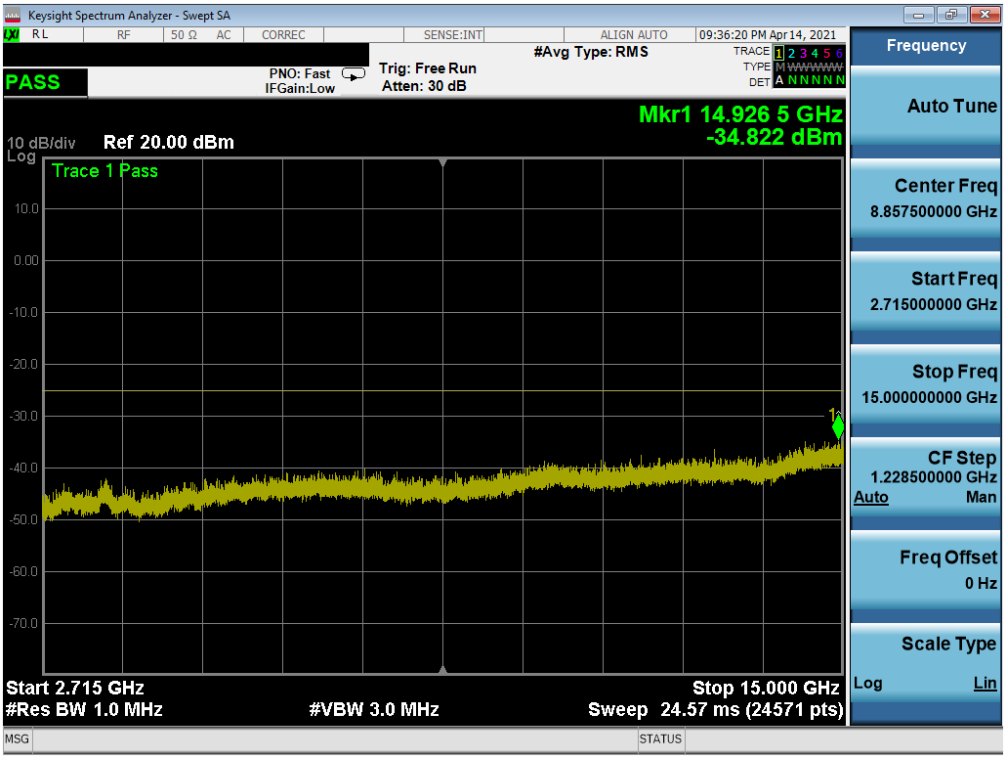

**Plot 7-30. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



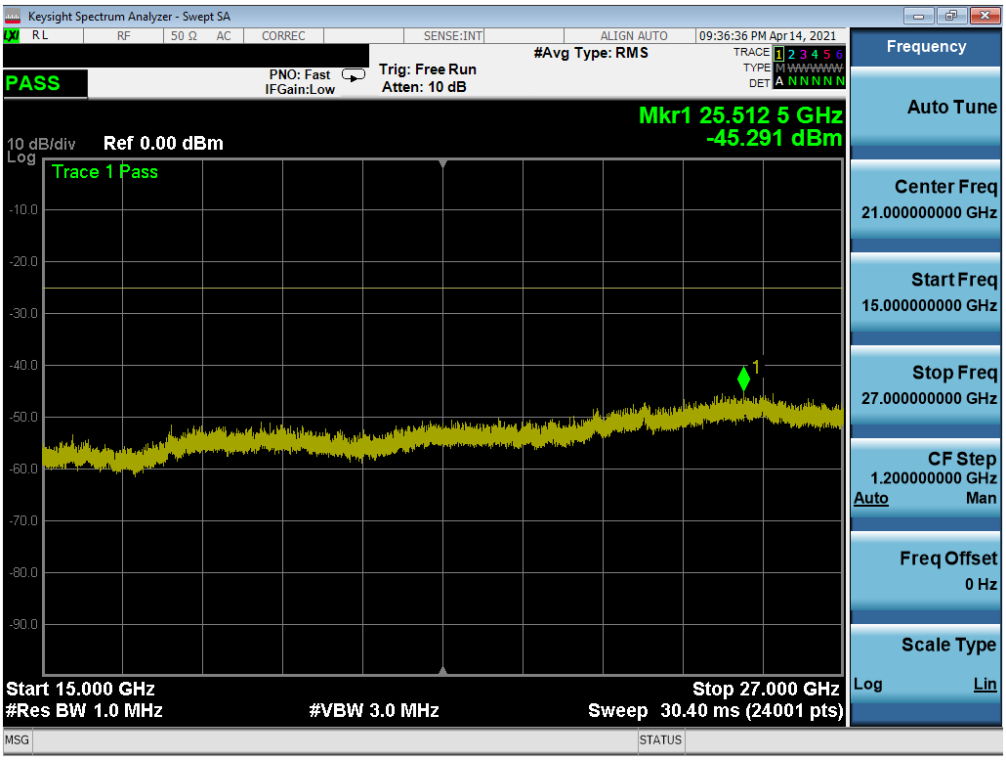

**Plot 7-31. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-32. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**




**Plot 7-33. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**




**Plot 7-34. Conducted Spurious Plot (LTE Band 41(PC3) - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

## 7.4 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.

***The minimum permissible attenuation level for Band 41 is as noted in the Test Notes on the following page.***

**Test Procedure Used**

KDB 971168 D01 v03r01 – Section 6.0

**Test Settings**

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

**Test Setup**

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

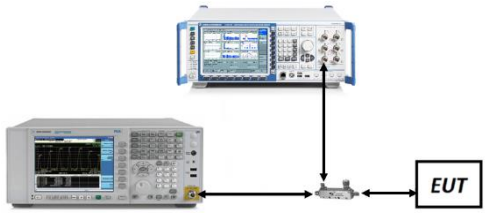
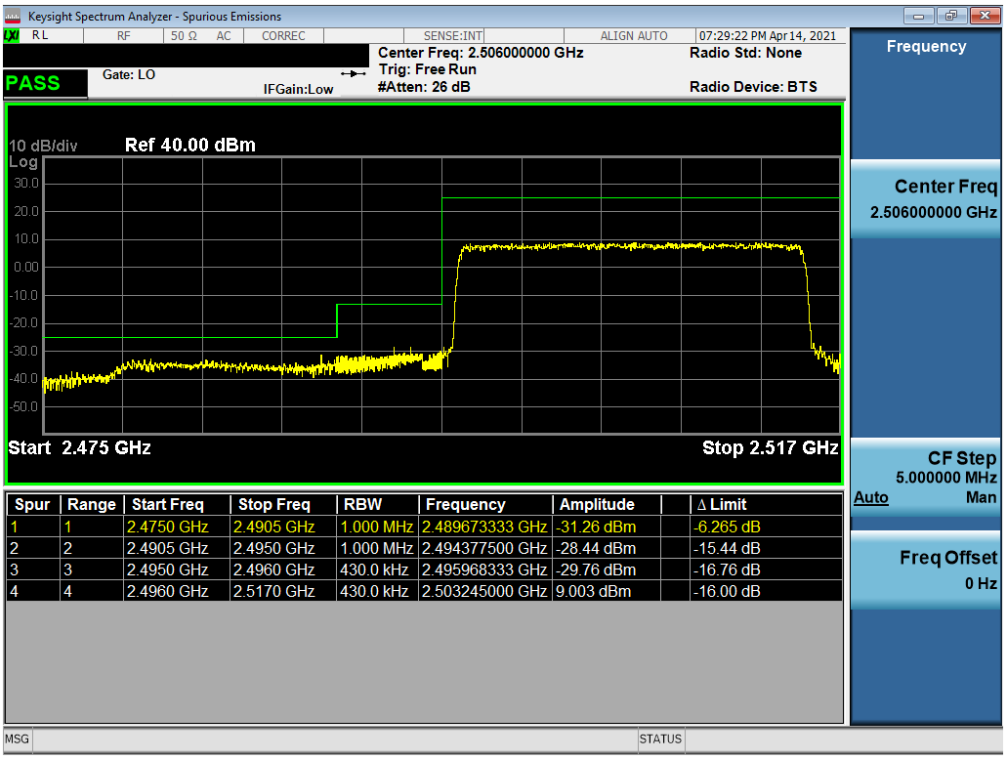



**Figure 7-3. Test Instrument & Measurement Setup**

## Test Notes

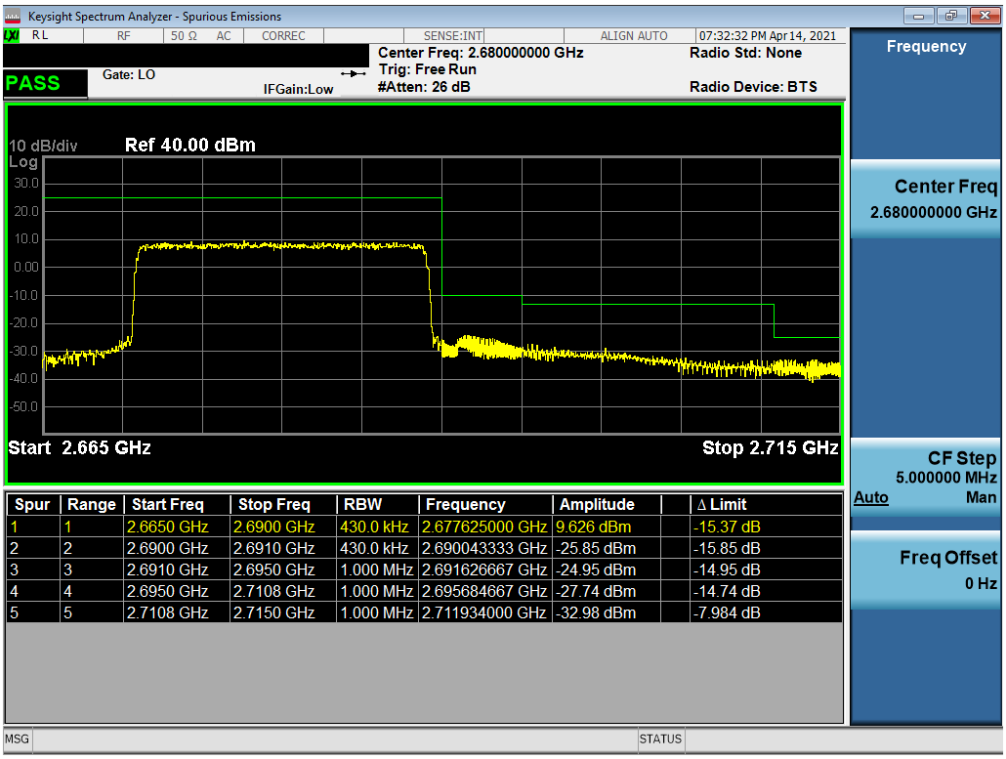
1. Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz.

# LTE Band 41(PC2)



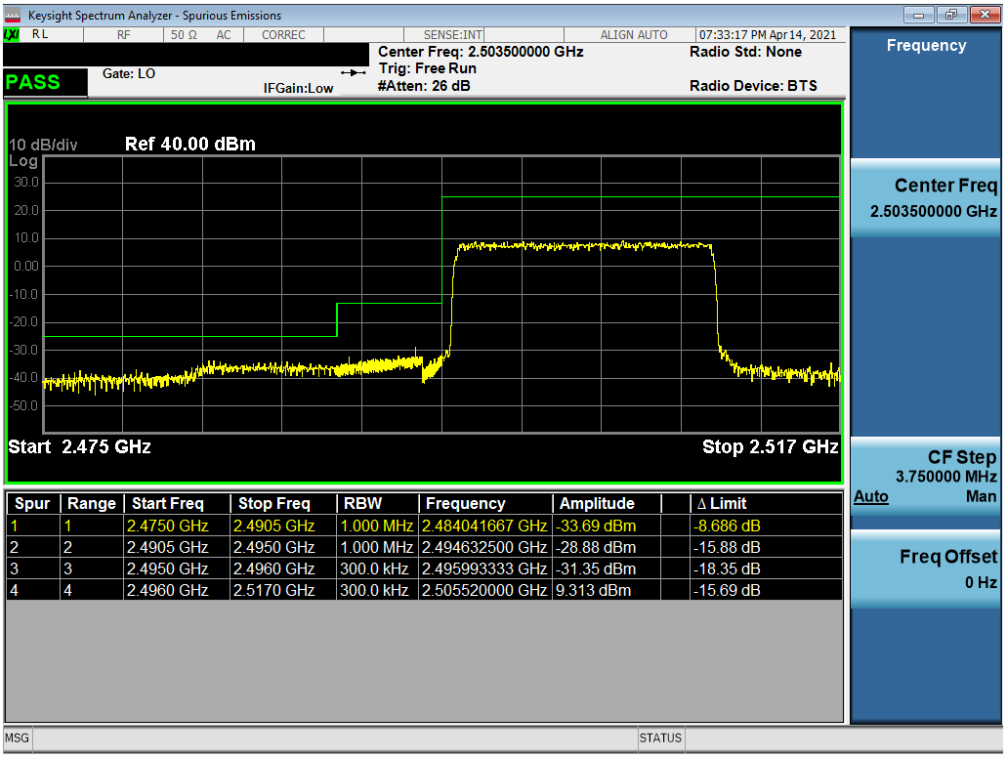

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4750 GHz | 2.4905 GHz | 1.000 MHz | 2.489673333 GHz | -31.26 dBm | -6.265 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.494377500 GHz | -28.44 dBm | -15.44 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 430.0 kHz | 2.495968333 GHz | -29.76 dBm | -16.76 dB |
| 4 | 4 | 2.4960 GHz | 2.5170 GHz | 430.0 kHz | 2.503245000 GHz | 9.003 dBm | -16.00 dB |

**Plot 7-35. Lower ACP Plot (LTE Band 41(PC2) - 20MHz QPSK – Full RB)**



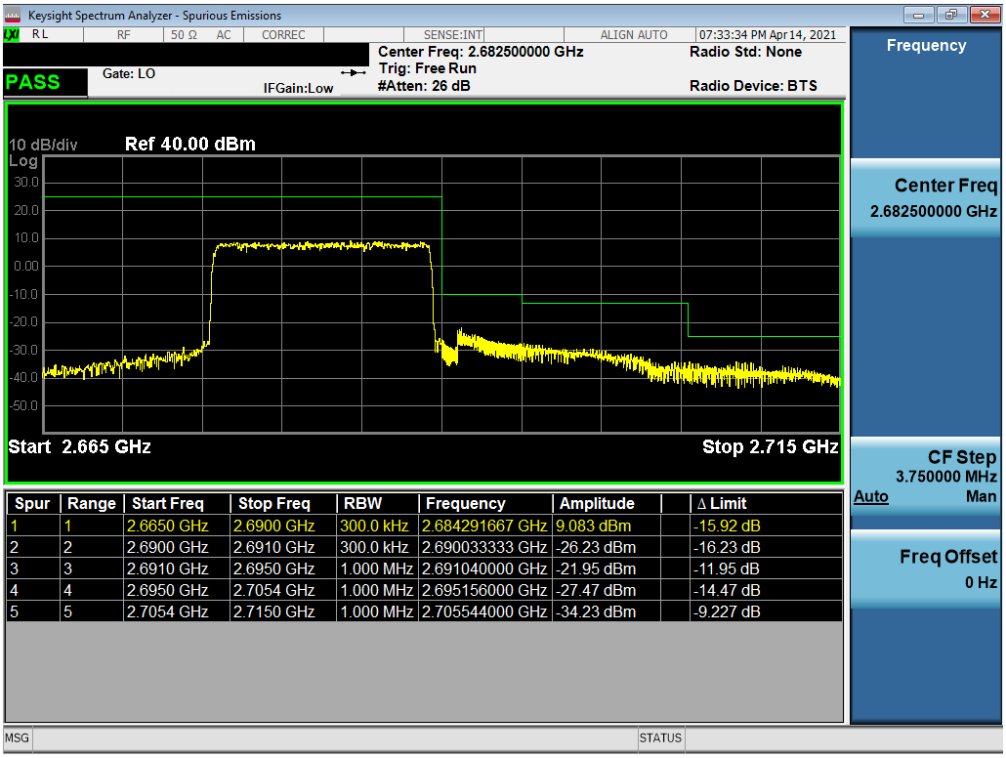

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6650 GHz | 2.6900 GHz | 430.0 kHz | 2.677625000 GHz | 9.626 dBm | -15.37 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 430.0 kHz | 2.690043333 GHz | -25.85 dBm | -15.85 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691626667 GHz | -24.95 dBm | -14.95 dB |
| 4 | 4 | 2.6950 GHz | 2.7108 GHz | 1.000 MHz | 2.695684667 GHz | -27.74 dBm | -14.74 dB |
| 5 | 5 | 2.7108 GHz | 2.7150 GHz | 1.000 MHz | 2.711934000 GHz | -32.98 dBm | -7.984 dB |

**Plot 7-36. Upper ACP Plot (LTE Band 41(PC2) - 20MHz QPSK – Full RB)**



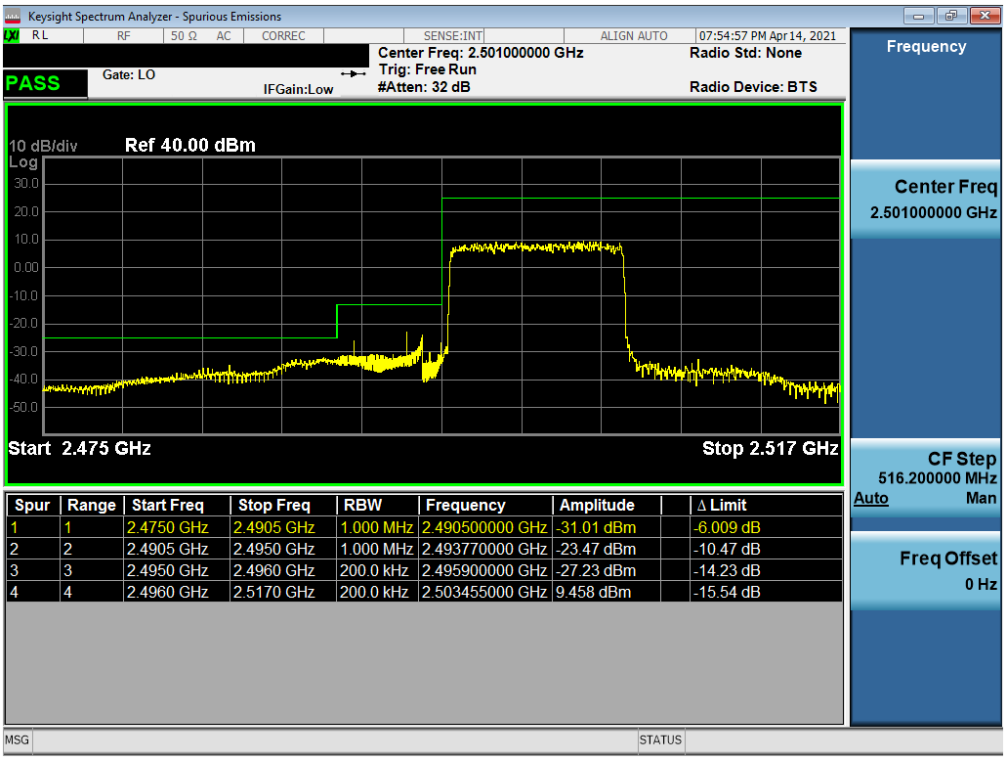

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4750 GHz | 2.4905 GHz | 1.000 MHz | 2.484041667 GHz | -33.69 dBm | -8.686 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.494632500 GHz | -28.88 dBm | -15.88 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 300.0 kHz | 2.495993333 GHz | -31.35 dBm | -18.35 dB |
| 4 | 4 | 2.4960 GHz | 2.5170 GHz | 300.0 kHz | 2.505520000 GHz | 9.313 dBm | -15.69 dB |

**Plot 7-37. Lower ACP Plot (LTE Band 41(PC2) - 15MHz QPSK – Full RB)**



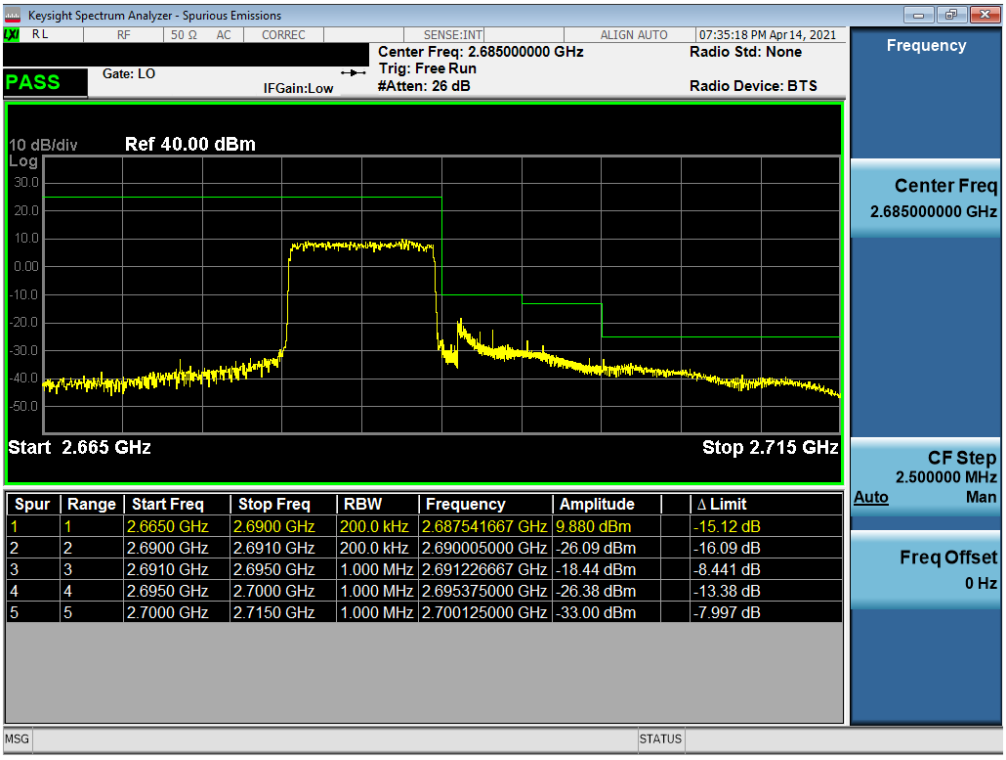

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6650 GHz | 2.6900 GHz | 300.0 kHz | 2.684291667 GHz | 9.083 dBm | -15.92 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 300.0 kHz | 2.690033333 GHz | -26.23 dBm | -16.23 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691040000 GHz | -21.95 dBm | -11.95 dB |
| 4 | 4 | 2.6950 GHz | 2.7054 GHz | 1.000 MHz | 2.695156000 GHz | -27.47 dBm | -14.47 dB |
| 5 | 5 | 2.7054 GHz | 2.7150 GHz | 1.000 MHz | 2.705544000 GHz | -34.23 dBm | -9.227 dB |

**Plot 7-38. Upper ACP Plot (LTE Band 41(PC2) - 15MHz QPSK – Full RB)**



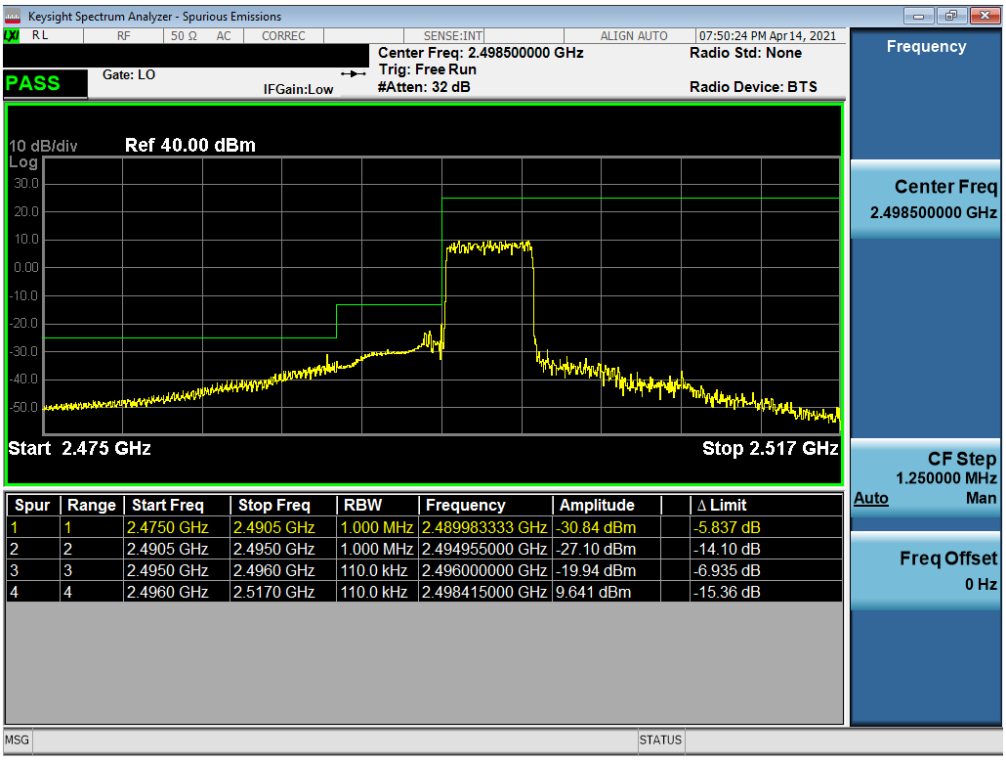

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4750 GHz | 2.4905 GHz | 1.000 MHz | 2.490500000 GHz | -31.01 dBm | -6.009 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.493770000 GHz | -23.47 dBm | -10.47 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 200.0 kHz | 2.495900000 GHz | -27.23 dBm | -14.23 dB |
| 4 | 4 | 2.4960 GHz | 2.5170 GHz | 200.0 kHz | 2.503455000 GHz | 9.458 dBm | -15.54 dB |

**Plot 7-39. Lower ACP Plot (LTE Band 41(PC2) - 10MHz QPSK – Full RB)**



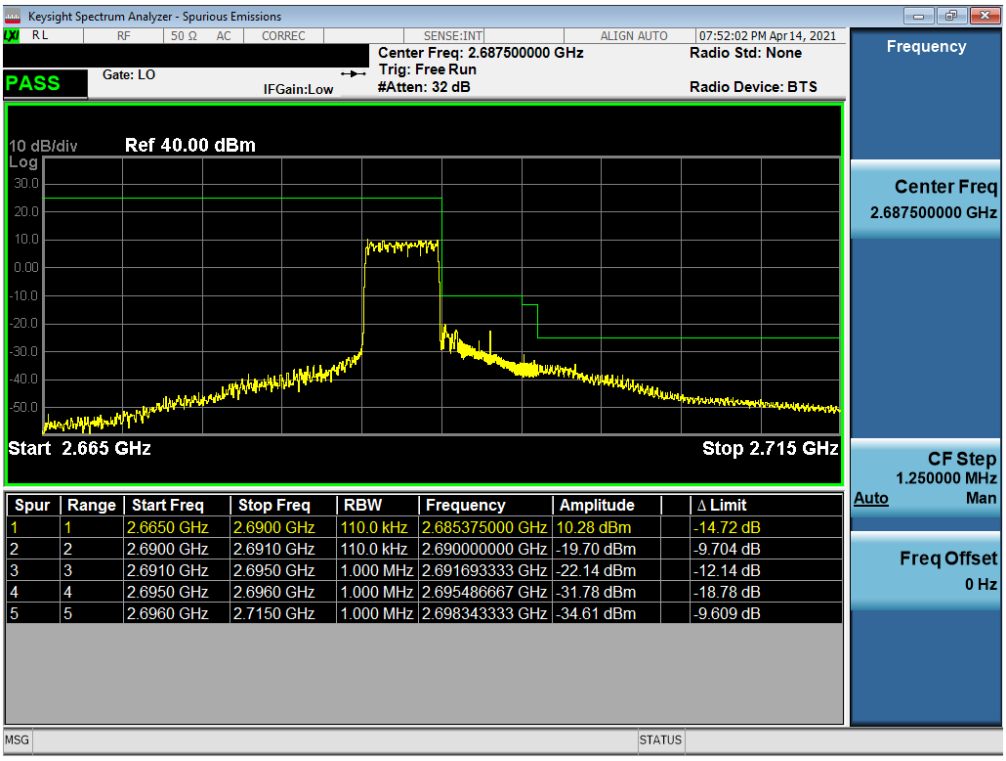

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6650 GHz | 2.6900 GHz | 200.0 kHz | 2.687541667 GHz | 9.880 dBm | -15.12 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 200.0 kHz | 2.690005000 GHz | -26.09 dBm | -16.09 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691226667 GHz | -18.44 dBm | -8.441 dB |
| 4 | 4 | 2.6950 GHz | 2.7000 GHz | 1.000 MHz | 2.695375000 GHz | -26.38 dBm | -13.38 dB |
| 5 | 5 | 2.7000 GHz | 2.7150 GHz | 1.000 MHz | 2.700125000 GHz | -33.00 dBm | -7.997 dB |

**Plot 7-40. Upper ACP Plot (LTE Band 41(PC2) - 10MHz QPSK – Full RB)**




| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4750 GHz | 2.4905 GHz | 1.000 MHz | 2.489983333 GHz | -30.84 dBm | -5.837 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.494955000 GHz | -27.10 dBm | -14.10 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 110.0 kHz | 2.496000000 GHz | -19.94 dBm | -6.935 dB |
| 4 | 4 | 2.4960 GHz | 2.5170 GHz | 110.0 kHz | 2.498415000 GHz | 9.641 dBm | -15.36 dB |

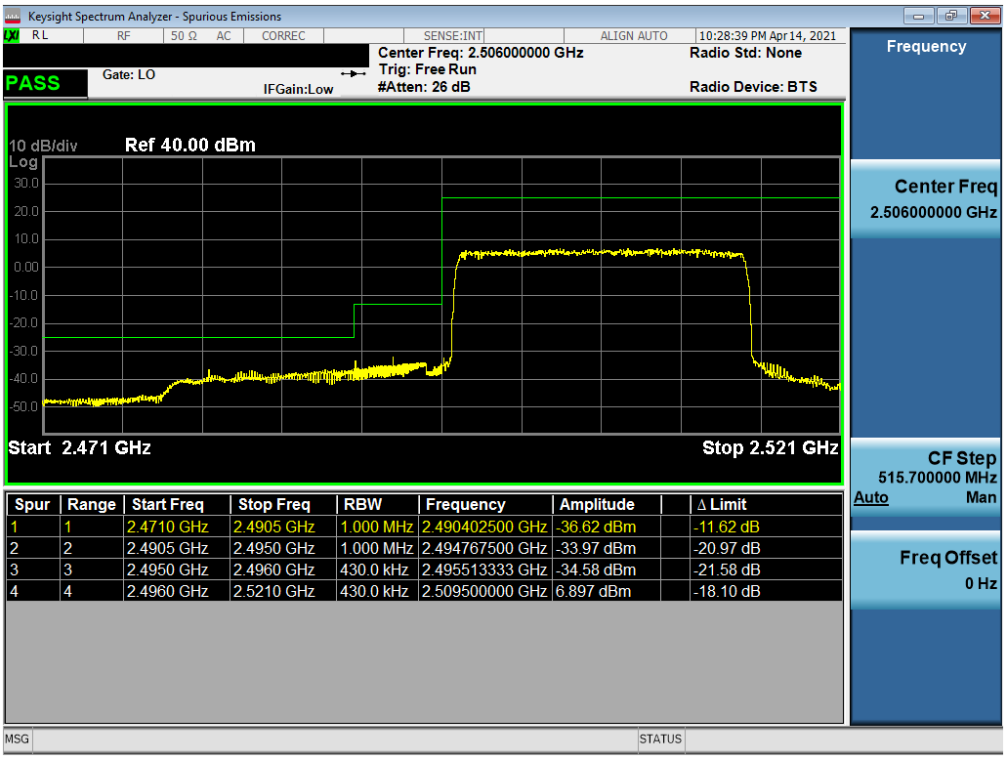
**Plot 7-41. Lower ACP Plot (LTE Band 41(PC2) - 5MHz QPSK – Full RB)**




| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6650 GHz | 2.6900 GHz | 110.0 kHz | 2.685375000 GHz | 10.28 dBm | -14.72 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 110.0 kHz | 2.690000000 GHz | -19.70 dBm | -9.704 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691693333 GHz | -22.14 dBm | -12.14 dB |
| 4 | 4 | 2.6950 GHz | 2.6960 GHz | 1.000 MHz | 2.695486667 GHz | -31.78 dBm | -18.78 dB |
| 5 | 5 | 2.6960 GHz | 2.7150 GHz | 1.000 MHz | 2.698343333 GHz | -34.61 dBm | -9.609 dB |

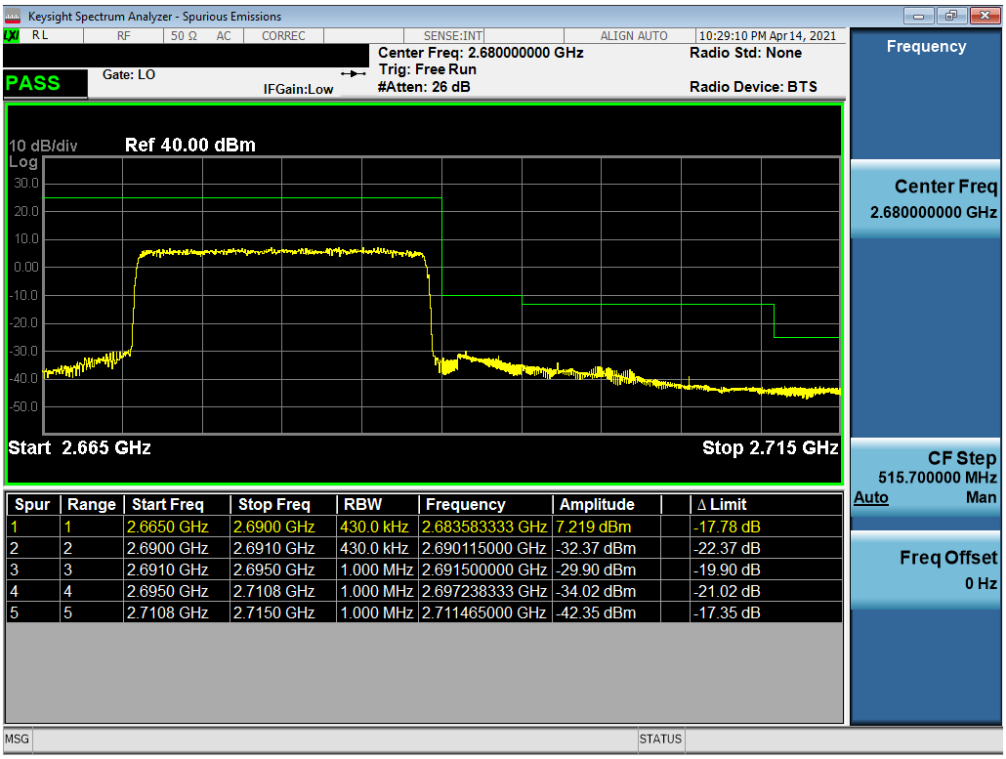
**Plot 7-42. Upper ACP Plot (LTE Band 41(PC2) - 5MHz QPSK – Full RB)**

# LTE Band 41(PC3)



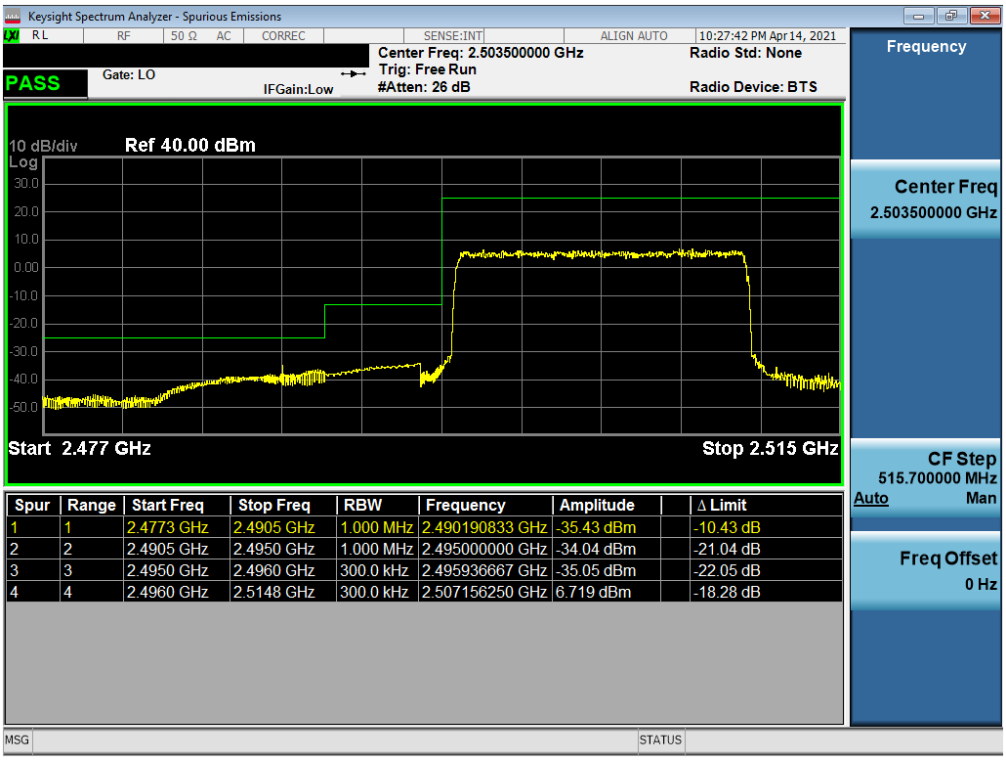

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4710 GHz | 2.4905 GHz | 1.000 MHz | 2.490402500 GHz | -36.62 dBm | -11.62 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.494767500 GHz | -33.97 dBm | -20.97 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 430.0 kHz | 2.495513333 GHz | -34.58 dBm | -21.58 dB |
| 4 | 4 | 2.4960 GHz | 2.5210 GHz | 430.0 kHz | 2.509500000 GHz | 6.897 dBm | -18.10 dB |

**Plot 7-43. Lower ACP Plot (LTE Band 41(PC3) - 20MHz QPSK – Full RB)**



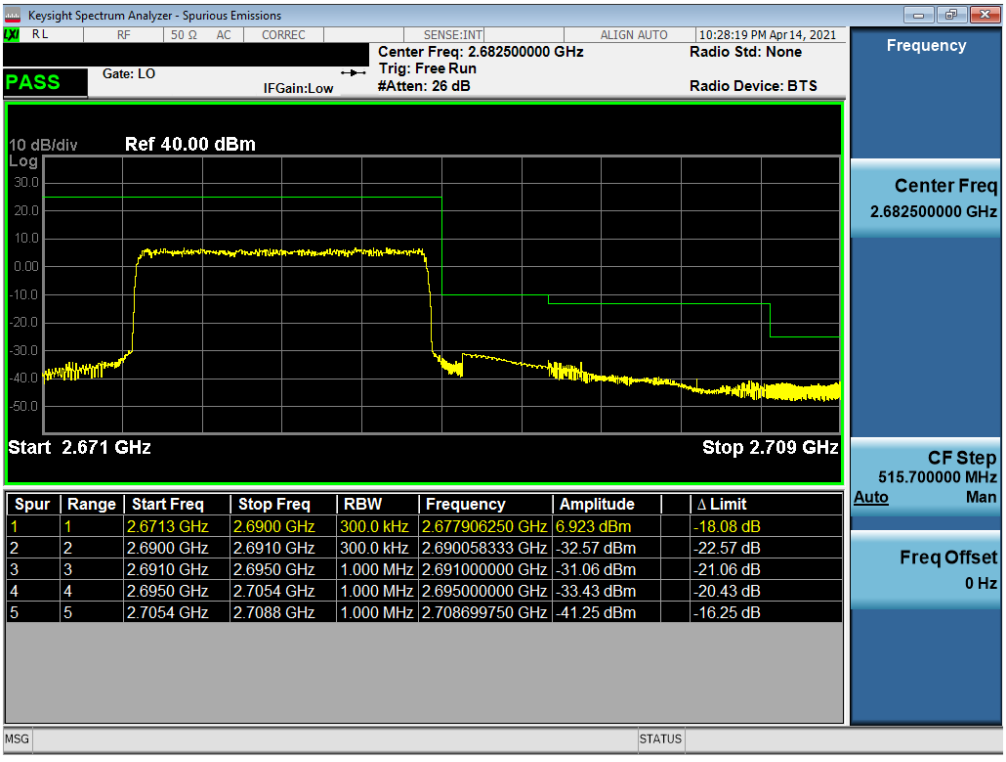

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6650 GHz | 2.6900 GHz | 430.0 kHz | 2.683583333 GHz | 7.219 dBm | -17.78 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 430.0 kHz | 2.690115000 GHz | -32.37 dBm | -22.37 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691500000 GHz | -29.90 dBm | -19.90 dB |
| 4 | 4 | 2.6950 GHz | 2.7108 GHz | 1.000 MHz | 2.697238333 GHz | -34.02 dBm | -21.02 dB |
| 5 | 5 | 2.7108 GHz | 2.7150 GHz | 1.000 MHz | 2.711465000 GHz | -42.35 dBm | -17.35 dB |

**Plot 7-44. Upper ACP Plot (LTE Band 41(PC3) - 20MHz QPSK – Full RB)**



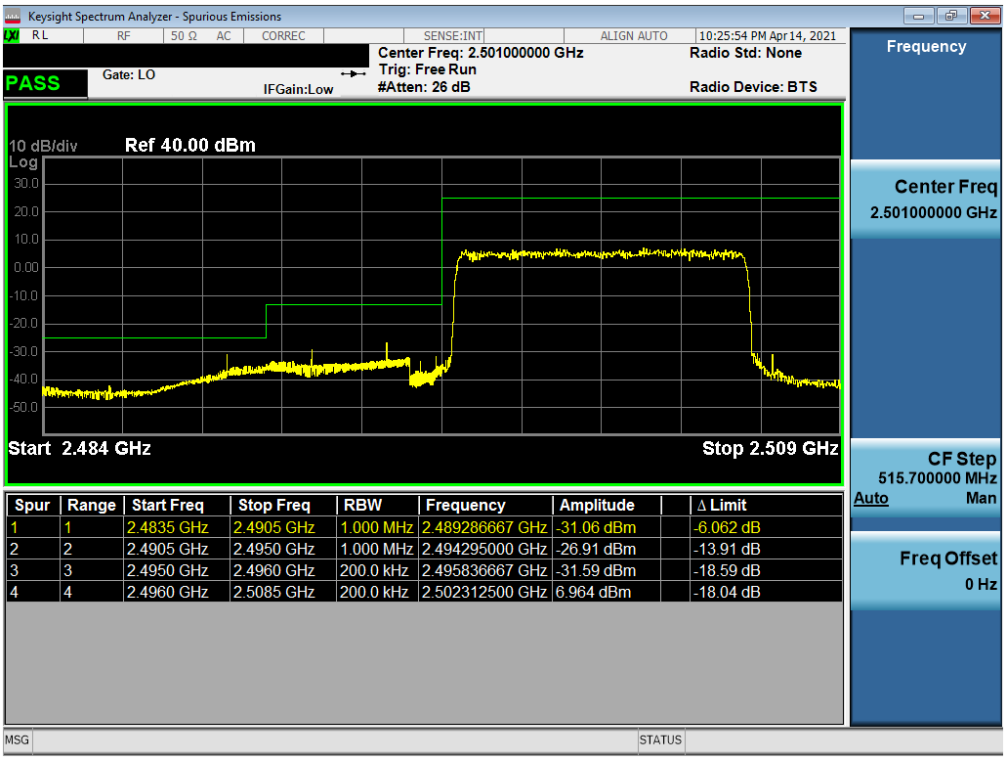

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4773 GHz | 2.4905 GHz | 1.000 MHz | 2.490190833 GHz | -35.43 dBm | -10.43 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.495000000 GHz | -34.04 dBm | -21.04 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 300.0 kHz | 2.495936667 GHz | -35.05 dBm | -22.05 dB |
| 4 | 4 | 2.4960 GHz | 2.5148 GHz | 300.0 kHz | 2.507156250 GHz | 6.719 dBm | -18.28 dB |

**Plot 7-45. Lower ACP Plot (LTE Band 41(PC3) - 15MHz QPSK – Full RB)**



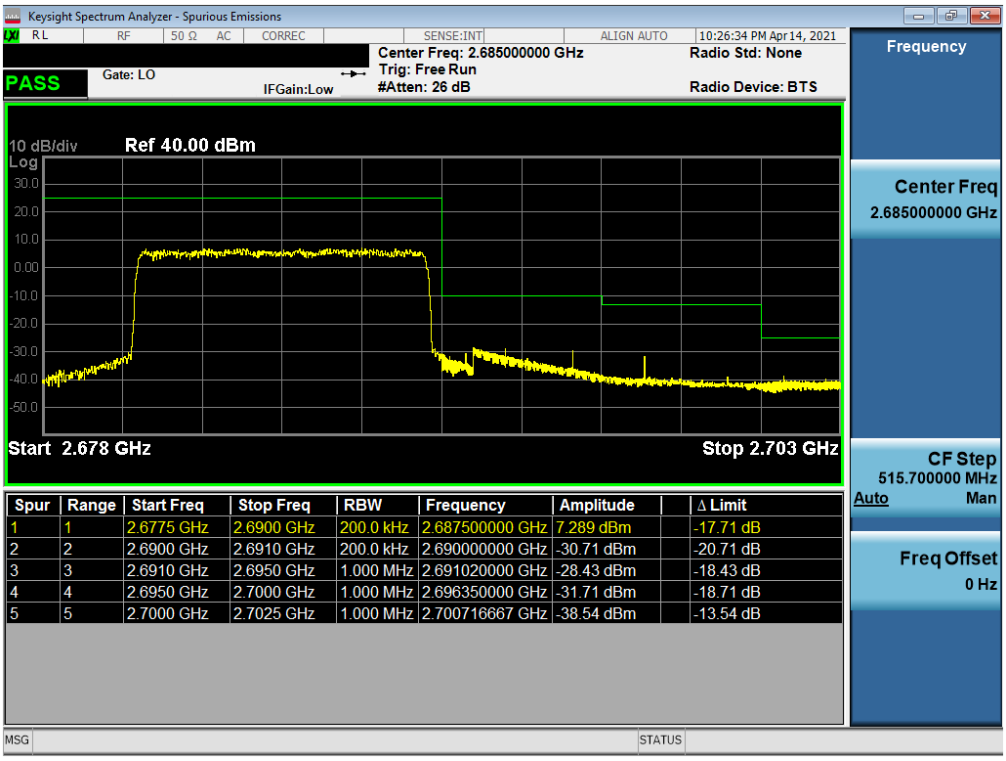

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6713 GHz | 2.6900 GHz | 300.0 kHz | 2.677906250 GHz | 6.923 dBm | -18.08 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 300.0 kHz | 2.690058333 GHz | -32.57 dBm | -22.57 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691000000 GHz | -31.06 dBm | -21.06 dB |
| 4 | 4 | 2.6950 GHz | 2.7054 GHz | 1.000 MHz | 2.695000000 GHz | -33.43 dBm | -20.43 dB |
| 5 | 5 | 2.7054 GHz | 2.7088 GHz | 1.000 MHz | 2.708699750 GHz | -41.25 dBm | -16.25 dB |

**Plot 7-46. Upper ACP Plot (LTE Band 41(PC3) - 15MHz QPSK – Full RB)**



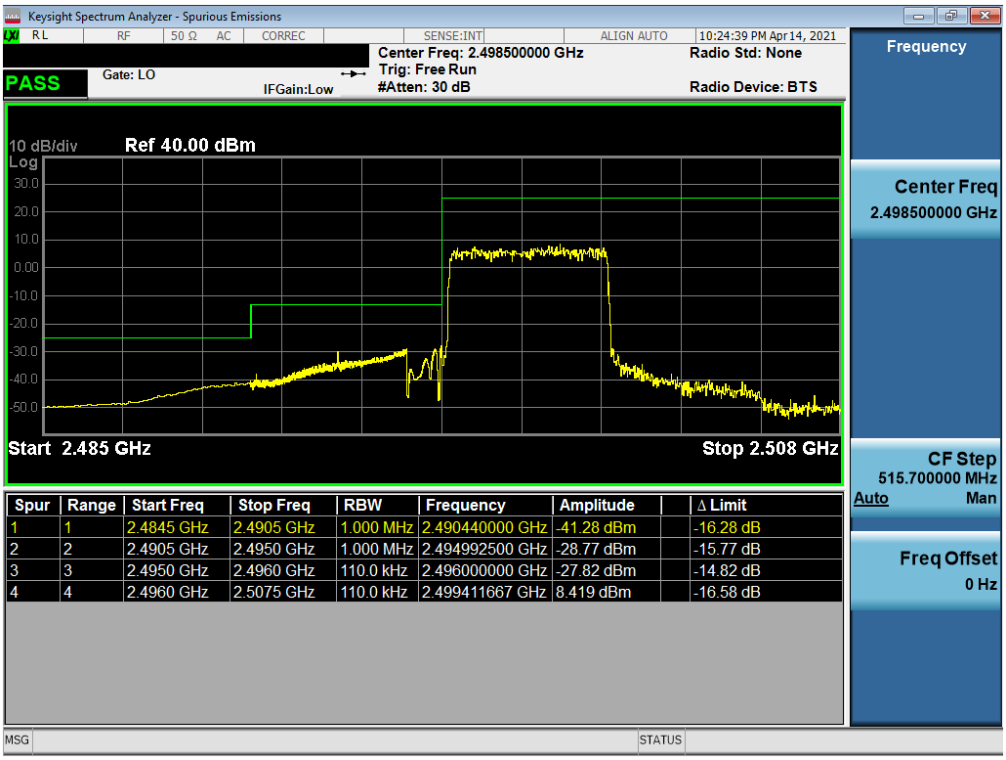

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4835 GHz | 2.4905 GHz | 1.000 MHz | 2.489286667 GHz | -31.06 dBm | -6.062 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.494295000 GHz | -26.91 dBm | -13.91 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 200.0 kHz | 2.495836667 GHz | -31.59 dBm | -18.59 dB |
| 4 | 4 | 2.4960 GHz | 2.5085 GHz | 200.0 kHz | 2.502312500 GHz | 6.964 dBm | -18.04 dB |

**Plot 7-47. Lower ACP Plot (LTE Band 41(PC3) - 10MHz QPSK – Full RB)**



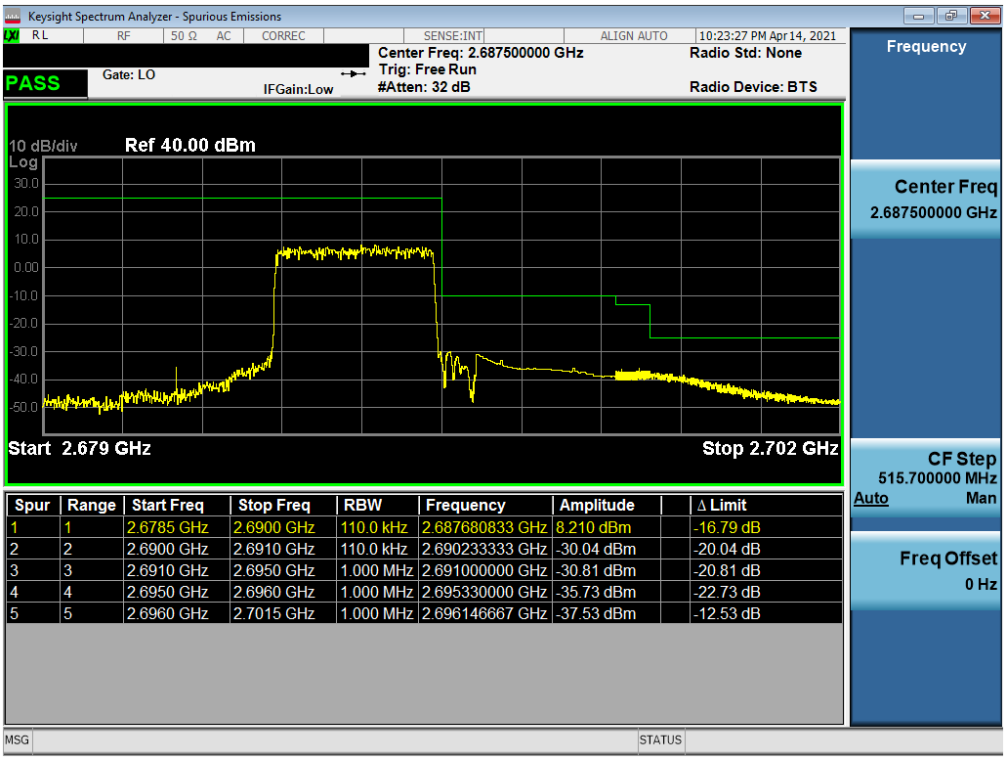

| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6775 GHz | 2.6900 GHz | 200.0 kHz | 2.687500000 GHz | 7.289 dBm | -17.71 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 200.0 kHz | 2.690000000 GHz | -30.71 dBm | -20.71 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691020000 GHz | -28.43 dBm | -18.43 dB |
| 4 | 4 | 2.6950 GHz | 2.7000 GHz | 1.000 MHz | 2.696350000 GHz | -31.71 dBm | -18.71 dB |
| 5 | 5 | 2.7000 GHz | 2.7025 GHz | 1.000 MHz | 2.700716667 GHz | -38.54 dBm | -13.54 dB |

**Plot 7-48. Upper ACP Plot (LTE Band 41(PC3) - 10MHz QPSK – Full RB)**




| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.4845 GHz | 2.4905 GHz | 1.000 MHz | 2.490440000 GHz | -41.28 dBm | -16.28 dB |
| 2 | 2 | 2.4905 GHz | 2.4950 GHz | 1.000 MHz | 2.494992500 GHz | -28.77 dBm | -15.77 dB |
| 3 | 3 | 2.4950 GHz | 2.4960 GHz | 110.0 kHz | 2.496000000 GHz | -27.82 dBm | -14.82 dB |
| 4 | 4 | 2.4960 GHz | 2.5075 GHz | 110.0 kHz | 2.499411667 GHz | 8.419 dBm | -16.58 dB |

**Plot 7-49. Lower ACP Plot (LTE Band 41(PC3) - 5MHz QPSK – Full RB)**




| Spur | Range | Start Freq | Stop Freq | RBW | Frequency | Amplitude | Δ Limit |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2.6785 GHz | 2.6900 GHz | 110.0 kHz | 2.687680833 GHz | 8.210 dBm | -16.79 dB |
| 2 | 2 | 2.6900 GHz | 2.6910 GHz | 110.0 kHz | 2.690233333 GHz | -30.04 dBm | -20.04 dB |
| 3 | 3 | 2.6910 GHz | 2.6950 GHz | 1.000 MHz | 2.691000000 GHz | -30.81 dBm | -20.81 dB |
| 4 | 4 | 2.6950 GHz | 2.6960 GHz | 1.000 MHz | 2.695330000 GHz | -35.73 dBm | -22.73 dB |
| 5 | 5 | 2.6960 GHz | 2.7015 GHz | 1.000 MHz | 2.696146667 GHz | -37.53 dBm | -12.53 dB |

**Plot 7-50. Upper ACP Plot (LTE Band 41(PC3) - 5MHz QPSK – Full RB)**

## 7.5 Radiated Power (EIRP)

**Test Overview**

Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz 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**

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

**Test Settings**

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation. For signals with burst transmission, the signal analyzer's "time domain power" measurement capability is used
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
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". Trigger is set to enable triggering only on full power bursts with the sweep time set less than or equal to the transmission burst duration
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signals with burst transmission, the "gating" function was enabled to ensure that measurements are performed during times in which the transmitter is operating at its maximum power
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.

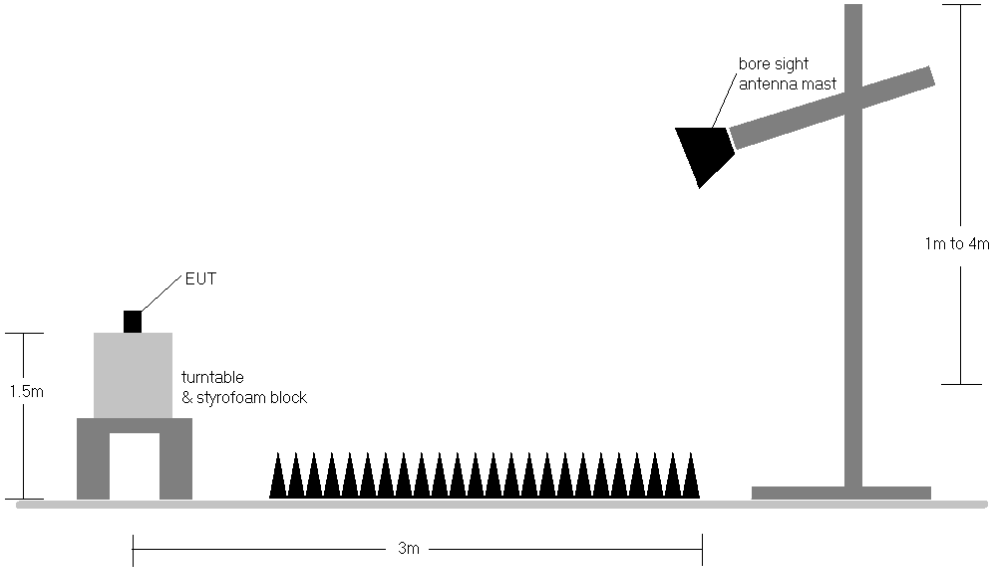



**Figure 7-4. Radiated Test Setup >1GHz**

## 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) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.

| Bandwidth | Mod. | Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Ant. Gain [dBi] | RB Size/Offset | Substitute Level [dBm] | EIRP [dBm] | EIRP [Watts] | EIRP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 MHz | QPSK | 2506.0 | H | 117 | 204 | 9.45 | 1 / 99 | 15.50 | 24.95 | 0.313 | 33.01 | -8.06 |
| | | 2593.0 | H | 102 | 202 | 9.58 | 1 / 50 | 15.83 | **25.41** | 0.348 | 33.01 | -7.60 |
| | | 2680.0 | H | 114 | 201 | 9.86 | 1 / 0 | 15.50 | 25.36 | 0.344 | 33.01 | -7.65 |
| | 16-QAM | 2680.0 | H | 114 | 201 | 9.86 | 1 / 0 | 14.70 | 24.56 | 0.286 | 33.01 | -8.45 |
| 15 MHz | QPSK | 2503.5 | H | 117 | 204 | 9.45 | 1 / 37 | 16.07 | 25.53 | 0.357 | 33.01 | -7.48 |
| | | 2593.0 | H | 102 | 202 | 9.58 | 1 / 0 | 16.45 | **26.03** | 0.401 | 33.01 | -6.98 |
| | | 2682.5 | H | 114 | 201 | 9.86 | 1 / 0 | 15.76 | 25.62 | 0.365 | 33.01 | -7.39 |
| | 16-QAM | 2682.5 | H | 114 | 201 | 9.86 | 1 / 0 | 15.29 | 25.15 | 0.327 | 33.01 | -7.86 |
| 10 MHz | QPSK | 2501.0 | H | 117 | 204 | 9.46 | 1 / 25 | 16.25 | 25.71 | 0.372 | 33.01 | -7.30 |
| | | 2593.0 | H | 102 | 202 | 9.58 | 1 / 25 | 16.39 | **25.97** | 0.396 | 33.01 | -7.04 |
| | | 2685.0 | H | 114 | 201 | 9.85 | 1 / 0 | 15.80 | 25.65 | 0.367 | 33.01 | -7.36 |
| | 16-QAM | 2685.0 | H | 114 | 201 | 9.85 | 1 / 25 | 15.08 | 24.93 | 0.311 | 33.01 | -8.08 |
| 5 MHz | QPSK | 2498.5 | H | 117 | 204 | 9.46 | 1 / 0 | 16.24 | 25.70 | 0.371 | 33.01 | -7.31 |
| | | 2593.0 | H | 102 | 202 | 9.58 | 1 / 12 | 16.39 | **25.97** | 0.395 | 33.01 | -7.04 |
| | | 2687.5 | H | 114 | 201 | 9.85 | 1 / 0 | 15.72 | 25.56 | 0.360 | 33.01 | -7.45 |
| | 16-QAM | 2498.5 | H | 117 | 204 | 9.46 | 1 / 24 | 15.91 | 25.37 | 0.344 | 33.01 | -7.64 |
| 20 MHz | Opposite Pol. | 2593.0 | V | 352 | 297 | 9.59 | 1 / 50 | 14.64 | 24.23 | 0.265 | 33.01 | -8.78 |
| | Half | 2593.0 | H | 110 | 195 | 9.58 | 1 / 50 | 15.80 | 25.38 | 0.345 | 33.01 | -7.63 |
| | WCP | 2593.0 | H | 109 | 209 | 9.58 | 1 / 50 | 13.57 | 23.15 | 0.207 | 33.01 | -9.86 |

**Table 7-2. EIRP Data (LTE Band 41(PC2))**

| Bandwidth | Mod. | Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Ant. Gain [dBi] | RB Size/Offset | Substitute Level [dBm] | EIRP [dBm] | EIRP [Watts] | EIRP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 MHz | QPSK | 2506.0 | H | 109 | 31 | 9.45 | 1 / 50 | 12.50 | 21.95 | 0.157 | 33.01 | -11.06 |
| | | 2593.0 | H | 100 | 34 | 9.58 | 1 / 99 | 13.24 | **22.82** | 0.191 | 33.01 | -10.19 |
| | | 2680.0 | H | 103 | 30 | 9.86 | 1 / 0 | 10.43 | 20.29 | 0.107 | 33.01 | -12.72 |
| | 16-QAM | 2593.0 | H | 100 | 34 | 9.58 | 1 / 99 | 12.13 | 21.71 | 0.148 | 33.01 | -11.30 |
| 15 MHz | QPSK | 2503.5 | H | 109 | 31 | 9.45 | 1 / 37 | 12.51 | 21.96 | 0.157 | 33.01 | -11.05 |
| | | 2593.0 | H | 100 | 34 | 9.58 | 1 / 37 | 13.12 | **22.70** | 0.186 | 33.01 | -10.31 |
| | | 2682.5 | H | 103 | 30 | 9.86 | 1 / 37 | 10.53 | 20.39 | 0.109 | 33.01 | -12.62 |
| | 16-QAM | 2593.0 | H | 100 | 34 | 9.58 | 1 / 37 | 12.55 | 22.13 | 0.163 | 33.01 | -10.88 |
| 10 MHz | QPSK | 2501.0 | H | 109 | 31 | 9.46 | 1 / 25 | 12.22 | 21.68 | 0.147 | 33.01 | -11.33 |
| | | 2593.0 | H | 100 | 34 | 9.58 | 1 / 0 | 12.88 | **22.46** | 0.176 | 33.01 | -10.55 |
| | | 2685.0 | H | 103 | 30 | 9.85 | 1 / 25 | 10.58 | 20.44 | 0.111 | 33.01 | -12.57 |
| | 16-QAM | 2593.0 | H | 100 | 34 | 9.58 | 1 / 0 | 11.94 | 21.52 | 0.142 | 33.01 | -11.49 |
| 5 MHz | QPSK | 2498.5 | H | 109 | 31 | 9.46 | 1 / 24 | 12.24 | 21.70 | 0.148 | 33.01 | -11.31 |
| | | 2593.0 | H | 100 | 34 | 9.58 | 1 / 24 | 13.24 | **22.82** | 0.191 | 33.01 | -10.19 |
| | | 2687.5 | H | 103 | 30 | 9.85 | 1 / 24 | 10.35 | 20.19 | 0.105 | 33.01 | -12.82 |
| | 16-QAM | 2593.0 | H | 100 | 34 | 9.58 | 1 / 24 | 12.18 | 21.77 | 0.150 | 33.01 | -11.24 |
| 20 MHz | Opposite Pol. | 2593.0 | V | 102 | 122 | 9.59 | 1 / 0 | 10.92 | 20.51 | 0.112 | 33.01 | -12.50 |
| | Half | 2593.0 | H | 185 | 28 | 9.58 | 1 / 50 | 9.66 | 19.24 | 0.084 | 33.01 | -13.77 |
| | WCP | 2593.0 | H | 104 | 41 | 9.58 | 1 / 99 | 11.32 | 20.90 | 0.123 | 33.01 | -12.11 |

**Table 7-3. EIRP Data (LTE Band 41(PC3))**

## 7.6 Radiated Spurious Emissions Measurements

**Test Overview**

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

**Test Procedures Used**

KDB 971168 D01 v03r01 – Section 5.8

**Test Settings**

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

## Test Setup

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

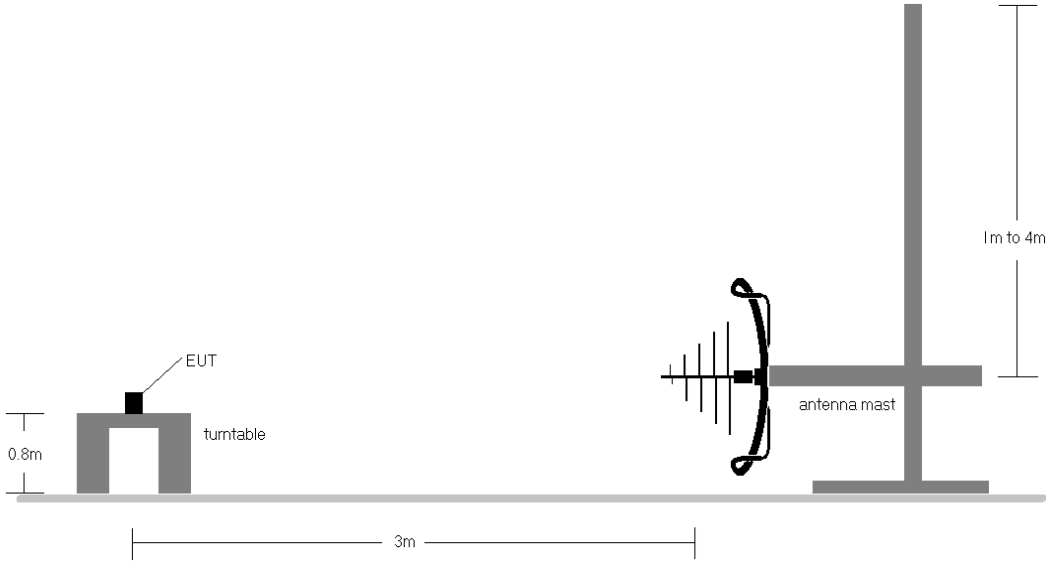



**Figure 7-5. Test Instrument & Measurement Setup < 1GHz**

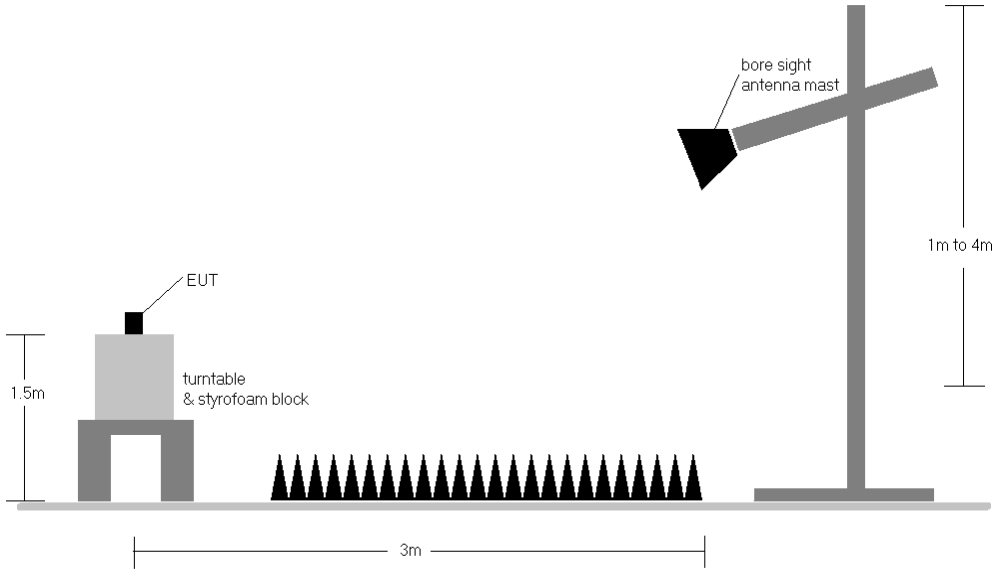



**Figure 7-6. Test Instrument & Measurement Setup >1 GHz**

## Test Notes

1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
   b) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   d) EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2) 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.

3) This unit was tested with its standard battery.

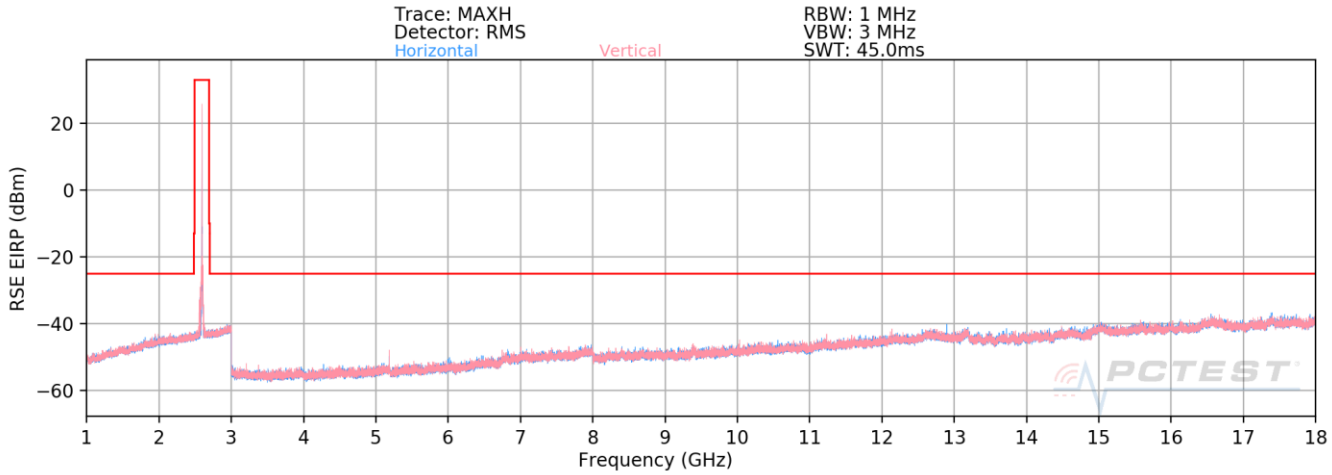
4) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.

5) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

6) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

7) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

## LTE Band 41(PC2)




**Plot 7-51. Radiated Spurious Plot (LTE Band 41(PC2))**

| | |
|---|---|
| **Bandwidth (MHz):** | 20 |
| **Frequency (MHz):** | 2506.0 |
| **RB / Offset:** | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBµV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|
| 5012.0 | V | 118 | 334 | -67.56 | 7.36 | 46.80 | -48.46 | -25.00 | -23.46 |
| 7518.0 | V | - | - | -71.45 | 12.75 | 48.30 | -46.96 | -25.00 | -21.96 |
| 10024.0 | V | - | - | -72.50 | 15.19 | 49.69 | -45.57 | -25.00 | -20.57 |
| 12530.0 | V | 181 | 342 | -72.97 | 18.72 | 52.75 | -42.51 | -25.00 | -17.51 |
| 15036.0 | V | - | - | -73.47 | 22.22 | 55.75 | -39.50 | -25.00 | -14.50 |
| 17542.0 | V | - | - | -74.85 | 25.47 | 57.62 | -37.63 | -25.00 | -12.63 |

**Table 7-4. Radiated Spurious Data (LTE Band 41(PC2) – Low Channel)**

| | |
|---|---|
| **Bandwidth (MHz):** | 20 |
| **Frequency (MHz):** | 2593.0 |
| **RB / Offset:** | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBµV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|
| 5186.0 | V | 109 | 328 | -66.78 | 7.32 | 47.54 | -47.72 | -25.00 | -22.72 |
| 7779.0 | V | - | - | -71.94 | 12.58 | 47.64 | -47.62 | -25.00 | -22.62 |
| 10372.0 | V | - | - | -72.98 | 15.75 | 49.77 | -45.49 | -25.00 | -20.49 |
| 12965.0 | V | - | - | -73.65 | 18.98 | 52.33 | -42.93 | -25.00 | -17.93 |
| 15558.0 | V | - | - | -74.31 | 22.69 | 55.38 | -39.87 | -25.00 | -14.87 |

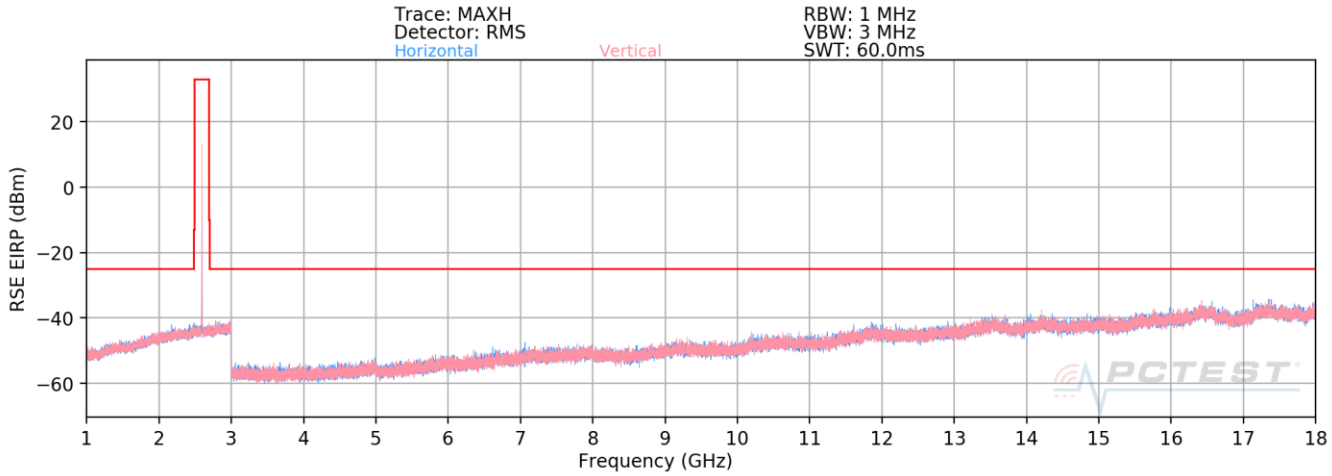
**Table 7-5. Radiated Spurious Data (LTE Band 41(PC2) – Mid Channel)**

| | |
|---|---|
| **Bandwidth (MHz):** | 20 |
| **Frequency (MHz):** | 2680.0 |
| **RB / Offset:** | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBµV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|
| 5360.0 | V | 109 | 318 | -66.28 | 8.14 | 48.86 | -46.40 | -25.00 | -21.40 |
| 8040.0 | V | - | - | -72.69 | 12.93 | 47.24 | -48.02 | -25.00 | -23.02 |
| 10720.0 | V | 185 | 15 | -72.85 | 16.12 | 50.27 | -44.99 | -25.00 | -19.99 |
| 13400.0 | V | - | - | -73.71 | 19.75 | 53.04 | -42.22 | -25.00 | -17.22 |
| 16080.0 | V | - | - | -74.72 | 23.25 | 55.53 | -39.73 | -25.00 | -14.73 |

**Table 7-6. Radiated Spurious Data (LTE Band 41(PC2) – High Channel)**

## LTE Band 41(PC3)




**Plot 7-52. Radiated Spurious Plot (LTE Band 41(PC3))**

| | |
|---|---|
| **Bandwidth (MHz):** | 20 |
| **Frequency (MHz):** | 2506.0 |
| **RB / Offset:** | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBµV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|
| 5012.0 | V | 130 | 86 | -72.22 | 10.13 | 44.91 | -50.35 | -25.00 | -25.35 |
| 7518.0 | V | - | - | -73.34 | 16.03 | 49.69 | -45.57 | -25.00 | -20.57 |
| 10024.0 | V | - | - | -75.29 | 19.52 | 51.23 | -44.02 | -25.00 | -19.02 |
| 12530.0 | V | - | - | -75.96 | 23.72 | 54.76 | -40.50 | -25.00 | -15.50 |

**Table 7-7. Radiated Spurious Data (LTE Band 41(PC3) – Low Channel)**

| | |
|---|---|
| **Bandwidth (MHz):** | 20 |
| **Frequency (MHz):** | 2593.0 |
| **RB / Offset:** | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBµV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|
| 5186.0 | V | 129 | 86 | -73.15 | 10.42 | 44.27 | -50.98 | -25.00 | -25.98 |
| 7779.0 | V | - | - | -73.84 | 16.35 | 49.51 | -45.74 | -25.00 | -20.74 |
| 10372.0 | V | - | - | -75.10 | 20.17 | 52.07 | -43.19 | -25.00 | -18.19 |

**Table 7-8. Radiated Spurious Data (LTE Band 41(PC3) – Mid Channel)**

| | |
|---|---|
| **Bandwidth (MHz):** | 20 |
| **Frequency (MHz):** | 2680.0 |
| **RB / Offset:** | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBµV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|
| 5360.0 | V | - | - | -72.29 | 11.06 | 45.77 | -49.49 | -25.00 | -24.49 |
| 8040.0 | V | - | - | -73.17 | 16.68 | 50.51 | -44.75 | -25.00 | -19.75 |
| 10720.0 | V | - | - | -75.85 | 20.87 | 52.02 | -43.24 | -25.00 | -18.24 |

**Table 7-9. Radiated Spurious Data (LTE Band 41(PC3) – High Channel)**

## 7.7 Frequency Stability / Temperature Variation

**Test Overview and Limit**

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

**Test Procedure Used**

ANSI/TIA-603-E-2016

**Test Settings**

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

**Test Setup**

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

**Test Notes**

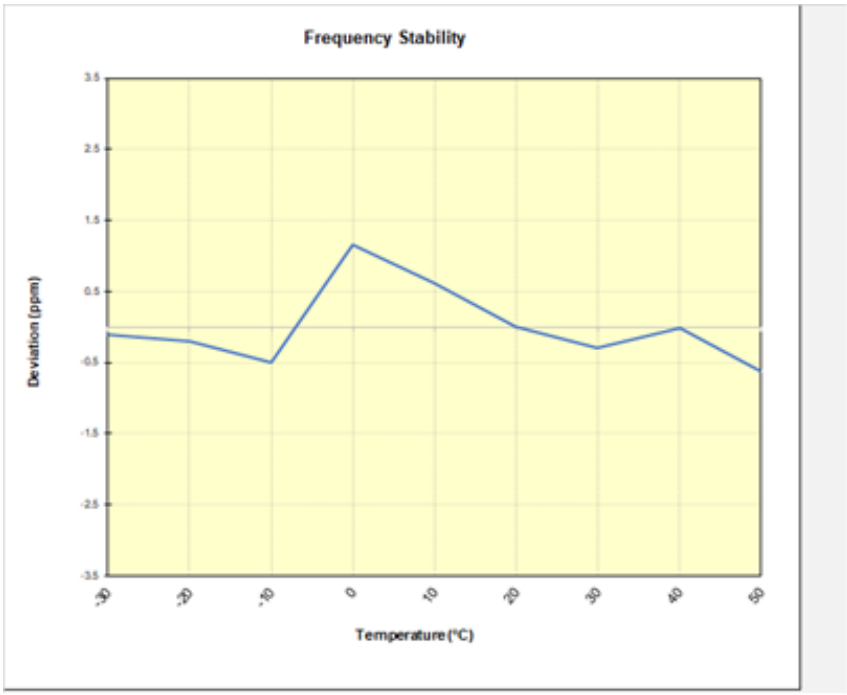
None

## LTE Band 41

| | |
|---|---|
| Operating Frequency (Hz): | 2,593,000,000 |
| Ref. Voltage (VDC): | 4.32 |

| Voltage (%) | Power (VDC) | Temp (°C) | Frequency (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 4.32 | - 30 | 2,593,001,238 | -293 | -0.0000113 |
| | | - 20 | 2,593,001,023 | -509 | -0.0000196 |
| | | - 10 | 2,593,000,216 | -1,315 | -0.0000507 |
| | | 0 | 2,593,004,527 | 2,996 | 0.0001155 |
| | | + 10 | 2,593,003,136 | 1,605 | 0.0000619 |
| | | + 20 (Ref) | 2,593,001,531 | 0 | 0.0000000 |
| | | + 30 | 2,593,000,764 | -768 | -0.0000296 |
| | | + 40 | 2,593,001,475 | -56 | -0.0000022 |
| | | + 50 | 2,592,999,919 | -1,612 | -0.0000622 |
| Battery Endpoint | 3.51 | + 20 | 2,592,999,469 | -2,062 | -0.0000795 |

**Table 7-10. LTE Band 41(PC2) Frequency Stability Data**




**Plot 7-53. LTE Band 41(PC2) Frequency Stability Chart**

# 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the Samsung **Portable Handset FCC ID: A3LSMF711B** complies with all the requirements of Part 27 of the FCC rules.