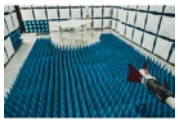
PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



# MEASUREMENT REPORT
## FCC Part 22 & 90

**Applicant Name:**
LG Electronics MobileComm U.S.A
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

**Date of Testing:**
3/27 - 5/2/2018
**Test Site/Location:**
PCTEST Lab. Columbia, MD, USA
**Test Report Serial No.:**
1M1803280057-04.ZNF

| | |
|---|---|
| **FCC ID:** | **ZNFQ710US** |
| **APPLICANT:** | **LG Electronics MobileComm U.S.A** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model:** | LM-Q710US, LM-Q710ULM |
| **Additional Model(s):** | LMQ710US, Q710US, LMQ710ULM, Q710ULM |
| **EUT Type:** | Portable Handset |
| **FCC Classification:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FCC Rule Part:** | §2.1049, §22(H), §90.691 |
| **Test Procedure(s):** | ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01 |

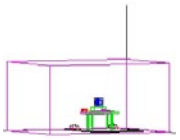
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

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.

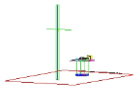
Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

# TABLE OF CONTENTS



# MEASUREMENT REPORT
## FCC Part 22(H) & 90



| Mode | Tx Frequency (MHz) | Measurement | Max. Power (W) | Max. Power (dBm) | Emission Designator | Modulation |
|---|---|---|---|---|---|---|
| CDMA800 (BC10) | 817.9 - 823.1 | Conducted | 0.328 | 25.16 | 1M28F9W | CDMA |
| LTE Band 26 | 814.7 - 823.3 | Conducted | 0.292 | 24.65 | 1M09G7D | QPSK |
| LTE Band 26 | 814.7 - 823.3 | Conducted | 0.229 | 23.60 | 1M08W7D | 16-QAM |
| LTE Band 26 | 814.7 - 823.3 | Conducted | 0.174 | 22.40 | 1M08W7D | 64-QAM |
| LTE Band 26 | 815.5 - 822.5 | Conducted | 0.291 | 24.64 | 2M69G7D | QPSK |
| LTE Band 26 | 815.5 - 822.5 | Conducted | 0.230 | 23.61 | 2M69W7D | 16-QAM |
| LTE Band 26 | 815.5 - 822.5 | Conducted | 0.184 | 22.65 | 2M69W7D | 64-QAM |
| LTE Band 26 | 816.5 - 821.5 | Conducted | 0.294 | 24.68 | 4M50G7D | QPSK |
| LTE Band 26 | 816.5 - 821.5 | Conducted | 0.227 | 23.56 | 4M49W7D | 16-QAM |
| LTE Band 26 | 816.5 - 821.5 | Conducted | 0.178 | 22.50 | 4M50W7D | 64-QAM |
| LTE Band 26 | 819 | Conducted | 0.286 | 24.57 | 8M98G7D | QPSK |
| LTE Band 26 | 819 | Conducted | 0.226 | 23.54 | 8M96W7D | 16-QAM |
| LTE Band 26 | 819 | Conducted | 0.175 | 22.42 | 8M97W7D | 64-QAM |
| LTE Band 26 | 821.5 | Conducted | 0.277 | 24.43 | 13M5G7D | QPSK |
| LTE Band 26 | 821.5 | Conducted | 0.219 | 23.40 | 13M4W7D | 16-QAM |
| LTE Band 26 | 821.5 | Conducted | 0.173 | 22.38 | 13M4W7D | 64-QAM |
| LTE Band 26 | 821.5 | ERP | 0.098 | 19.93 | 13M5G7D | QPSK |
| LTE Band 26 | 821.5 | ERP | 0.082 | 19.12 | 13M4W7D | 16-QAM |
| LTE Band 26 | 821.5 | ERP | 0.072 | 18.56 | 13M4W7D | 64-QAM |

**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 Engineering Lab located in Columbia, MD 21046, U.S.A.**

- PCTEST is an ISO 17025-2005 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 **LG Portable Handset FCC ID: ZNFQ710US**. 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 22(H) and 90.691.

**Test Device Serial No.:** 00061, 00079, 00053,,00002

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO Rev0/A (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE)

## 2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-D-2010 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

## 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 document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-D-2010) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v03r01) were used in the measurement of the EUT**.**

## 3.2 Radiated Power and Radiated Spurious Emissions

**§2.1053, §90.635, §90.691**

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 wooden turntable 80cm above the ground plane and 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. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions' occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v03r01.

Per the guidance of ANSI/TIA-603-D-2010, a half-wave dipole is then 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 $_{[dB]}$.

The calculated $P_d$ levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of 43 + $10\log_{10}$(Power $_{[Watts]}$) specified in 90.691.

For fundamental radiated power measurements, the guidance of KDB 971168 D01 v03r01 is used to record the EUT power level that is subsequently matched via the aforementioned substitution method given in ANSI/TIA-603-D-2010.

# 4.0 MEASUREMENT UNCERTAINTY

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

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

# 5.0 TEST EQUIPMENT CALIBRATION DATA

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

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|---|---|---|---|---|---|---|
| - | LTx2 | Licensed Transmitter Cable Set | 8/10/2017 | Annual | 8/10/2018 | LTx2 |
| - | RE1 | Radiated Emissions Cable Set (UHF/EHF) | 6/21/2017 | Annual | 6/21/2018 | RE1 |
| Agilent | N9020A | MXA Signal Analyzer | 1/24/2018 | Annual | 1/24/2019 | US46470561 |
| Agilent | N9030A | PXA Signal Analyzer (26.5GHz) | 8/28/2017 | Annual | 8/28/2018 | MY49432391 |
| ETS Lindgren | 3117 | 1-18 GHz DRG Horn (Medium) | 12/1/2016 | Biennial | 12/1/2018 | 125518 |
| Huber+Suhner | Sucoflex 102A | 40GHz Radiated Cable | 5/19/2017 | Annual | 5/19/2018 | 251425001 |
| Keysight Technologies | N9030A | 3Hz-44GHz PXA Signal Analyzer | 3/20/2018 | Annual | 3/20/2019 | MY49430494 |
| Mini Circuits | TVA-11-422 | RF Power Amp | N/A | | | QA1317001 |
| Mini-Circuits | PWR-SEN-4RMS | USB Power Sensor | 4/24/2017 | Annual | 4/24/2018 | 11210140001 |
| Mini-Circuits | SSG-4000HP | Synthesized Signal Generator | N/A | | | 11403100002 |
| Pasternack | NMLC-1 | Line Conducted Emissions Cable (NM) | 5/31/2017 | Annual | 5/31/2018 | NMLC-1 |
| Rohde & Schwarz | ESU26 | EMI Test Receiver (26.5GHz) | 4/19/2017 | Annual | 4/19/2018 | 100342 |
| Rohde & Schwarz | ESU40 | EMI Test Receiver (40GHz) | 7/31/2017 | Annual | 7/31/2018 | 100348 |
| Rohde & Schwarz | SFUNIT-Rx | Shielded Filter Unit | 7/3/2017 | Annual | 7/3/2018 | 102135 |
| Rohde & Schwarz | SFUNIT-Rx | Shielded Filter Unit | 7/3/2017 | Annual | 7/3/2018 | 102134 |
| Rohde & Schwarz | TS-PR26 | 18-26.5 GHz Pre-Amplifier | 5/11/2017 | Annual | 5/11/2018 | 100040 |
| Rohde & Schwarz | TS-PR40 | 26.5-40 GHz Pre-Amplifier | 5/11/2017 | Annual | 5/11/2018 | 100037 |
| Seekonk | NC-100 | Torque Wrench 5/16", 8" lbs | 1/22/2018 | Annual | 1/22/2019 | N/A |
| Solar Electronics | 8012-50-R-24-BNC | Line Impedance Stabilization Network | 8/14/2017 | Biennial | 8/14/2019 | 310233 |
| Sunol Sciences | JB6 | JB6 Antenna | 9/27/2016 | Biennial | 9/27/2018 | A082816 |

**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

## CDMA Emission Designator

**Emission Designator = 1M25F9W**

CDMA BW = 1.25 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data) (Measured at the 99.75% power bandwidth)

## Spurious Radiated Emission – BC10

**Example: Channel 476 CDMA BC10 Mode 3rd Harmonic (2453.70MHz)**

The average spectrum analzyer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 2453.70 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc.

## LTE Emission Designator

### QPSK Modulation

**Emission Designator = 8M62G7D**

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

### 16QAM Modulation

**Emission Designator = 8M45W7D**

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

## Spurious Radiated Emission – LTE Band

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

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

# 7.0 TEST RESULTS

## 7.1 Summary

Company Name: LG Electronics MobileComm U.S.A

FCC ID: ZNFQ710US

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

Mode(s): CDMA / EvDO / LTE

Band: Band Class 10 / Band 26

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|
| 2.1049 | Occupied Bandwidth | N/A | CONDUCTED | PASS | Section 7.2 |
| 2.1051<br>90.691 | Conducted Band Edge / Spurious Emissions | > 43 + $\log_{10}$ (P[Watts]) for all out-of-band emissions except > 50 + 10$\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge | | PASS | Sections 7.3, 7.4 |
| 2.1055<br>90.213 | Frequency Stability | < 2.5 ppm | | PASS | Section 7.8 |
| 2.1046<br>90.635 | Conducted Power | < 100 Watts | | PASS | Section 7.5 |
| 22.913(a.2) | Effective Radiated Power (Band 26) | < 7 Watts max. ERP | RADIATED | PASS | Section 7.6 |
| 2.1053<br>90.691 | Radiated Spurious Emissions | > 43 + $\log_{10}$ (P[Watts]) for all out-of-band emissions except > 50 + 10$\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge | | 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 shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "2G/3G Automation," Version 3.9.

## 7.2 Occupied Bandwidth

**§2.1049**

### 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.

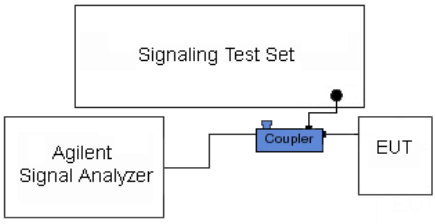
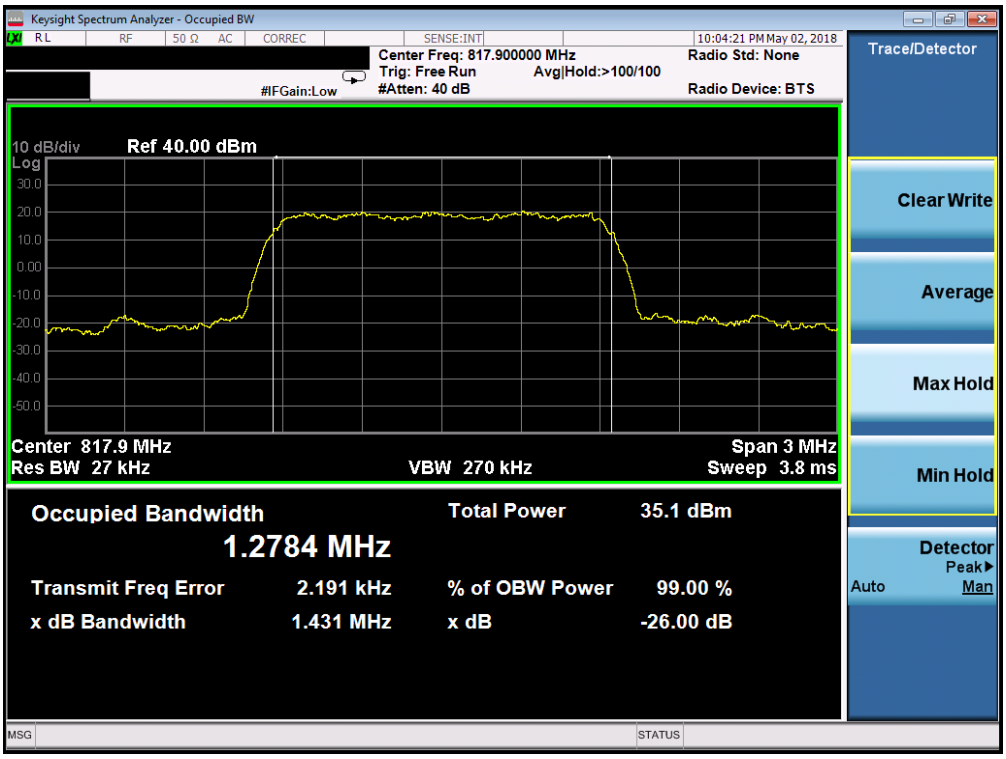


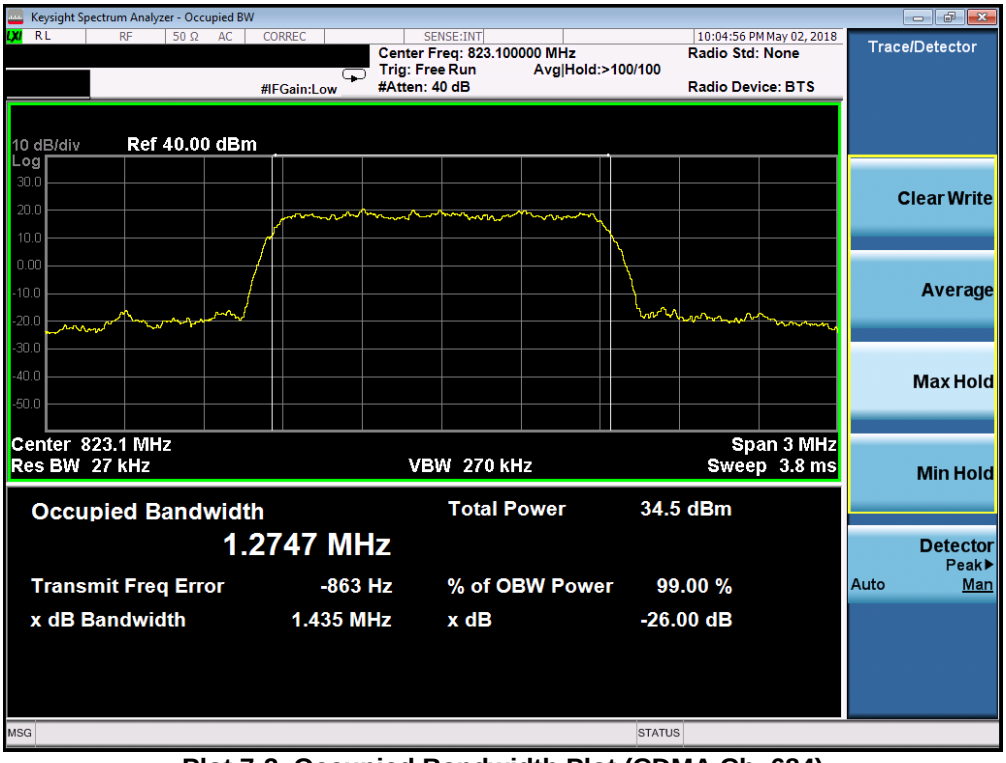

**Figure 7-1. Test Instrument & Measurement Setup**

### Test Notes

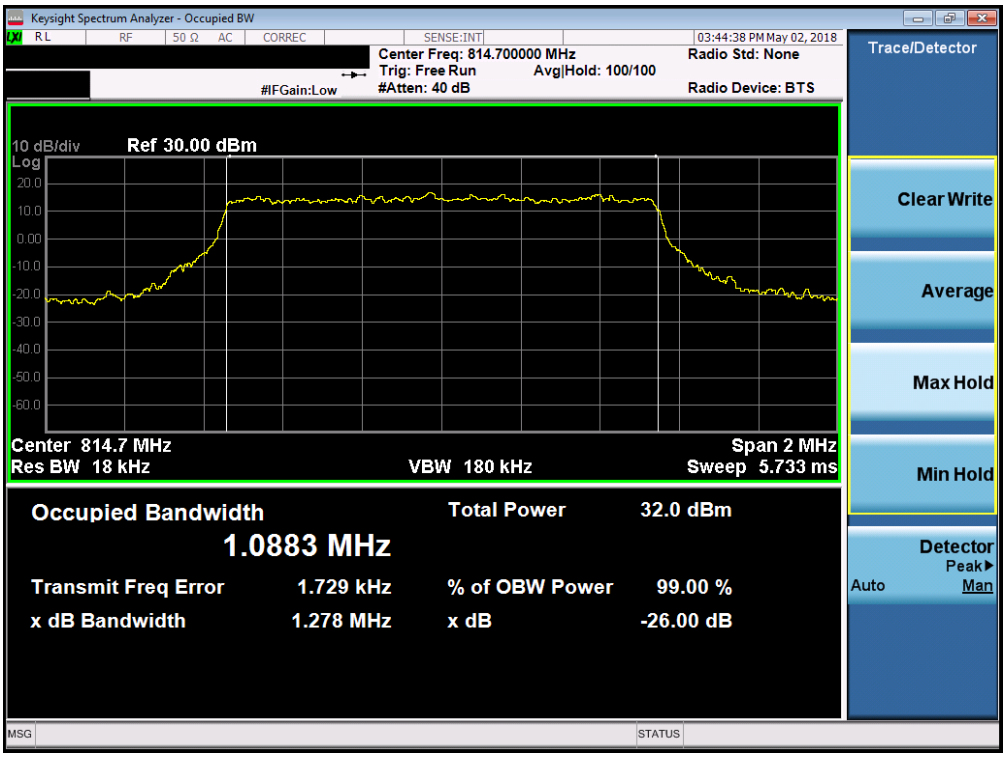
None.



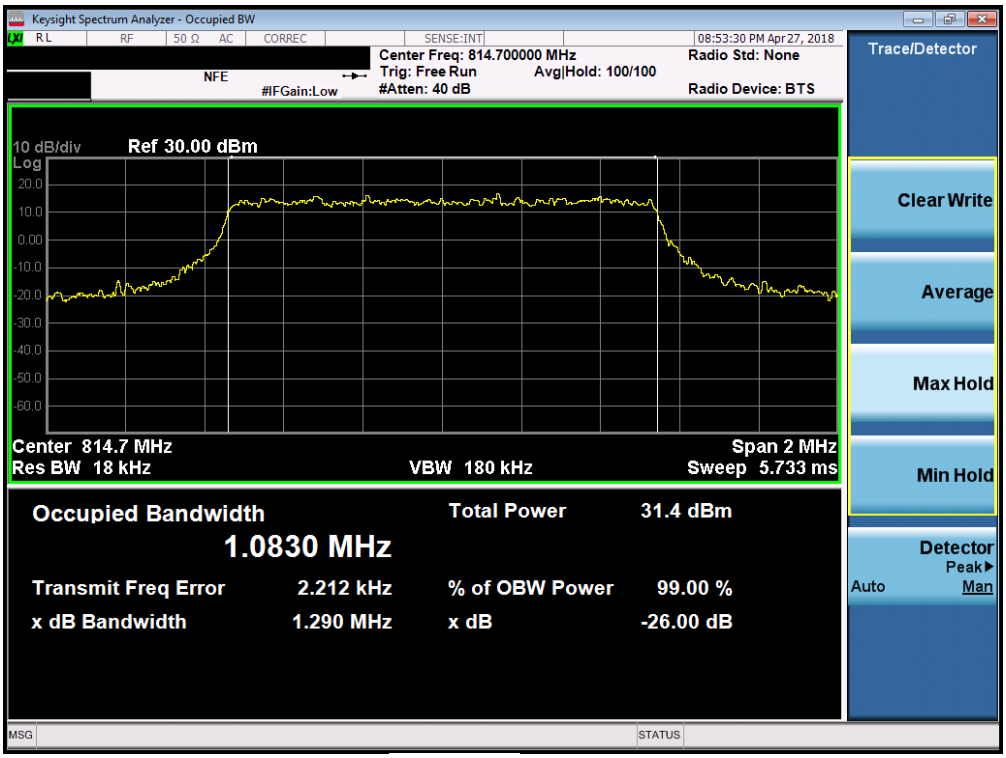

**Plot 7-1. Occupied Bandwidth Plot (CDMA Ch. 476)**



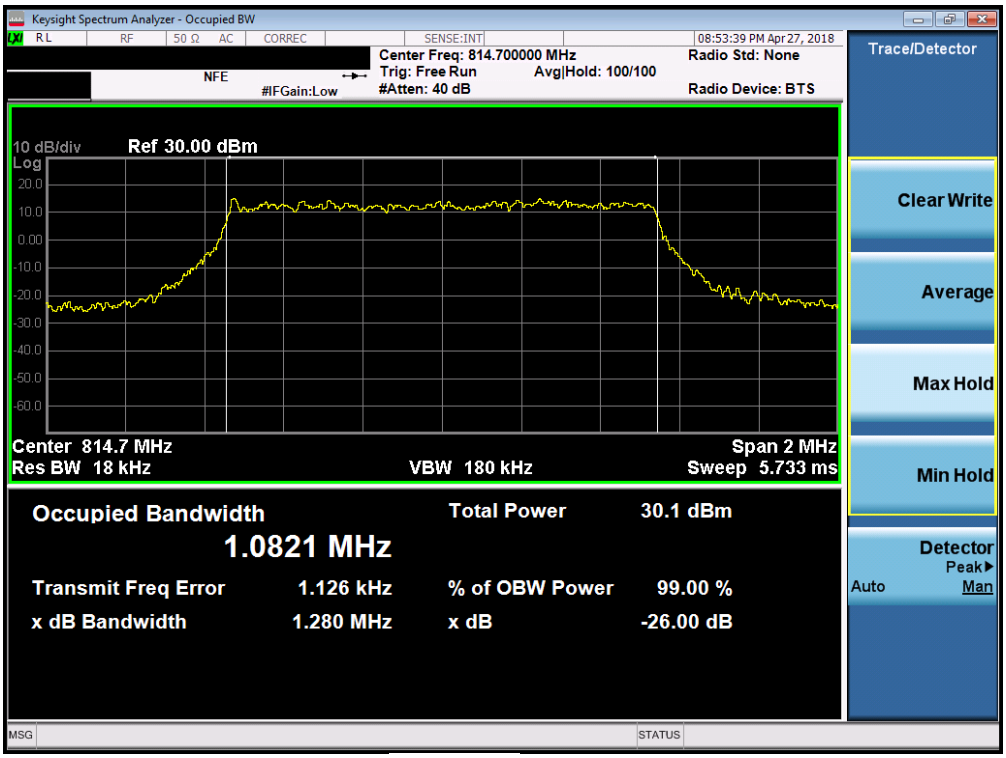

**Plot 7-2. Occupied Bandwidth Plot (CDMA Ch. 684)**



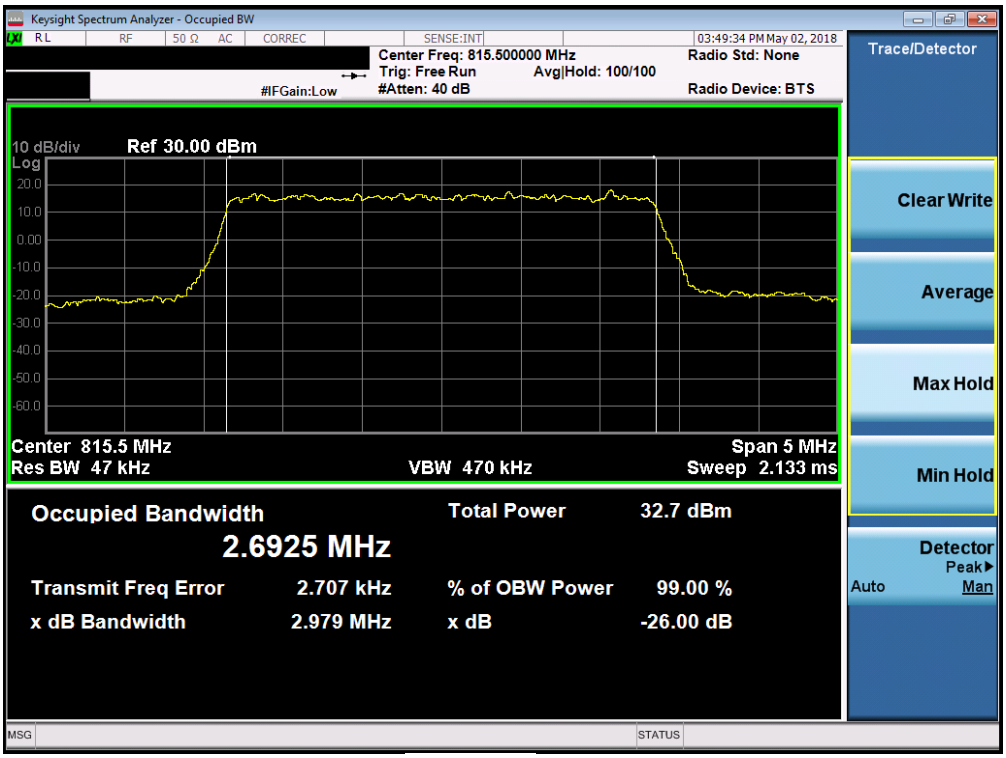

**Plot 7-3. Occupied Bandwidth Plot (LTE B26 - 1.4MHz QPSK – RB Size 6– Low Channel)**



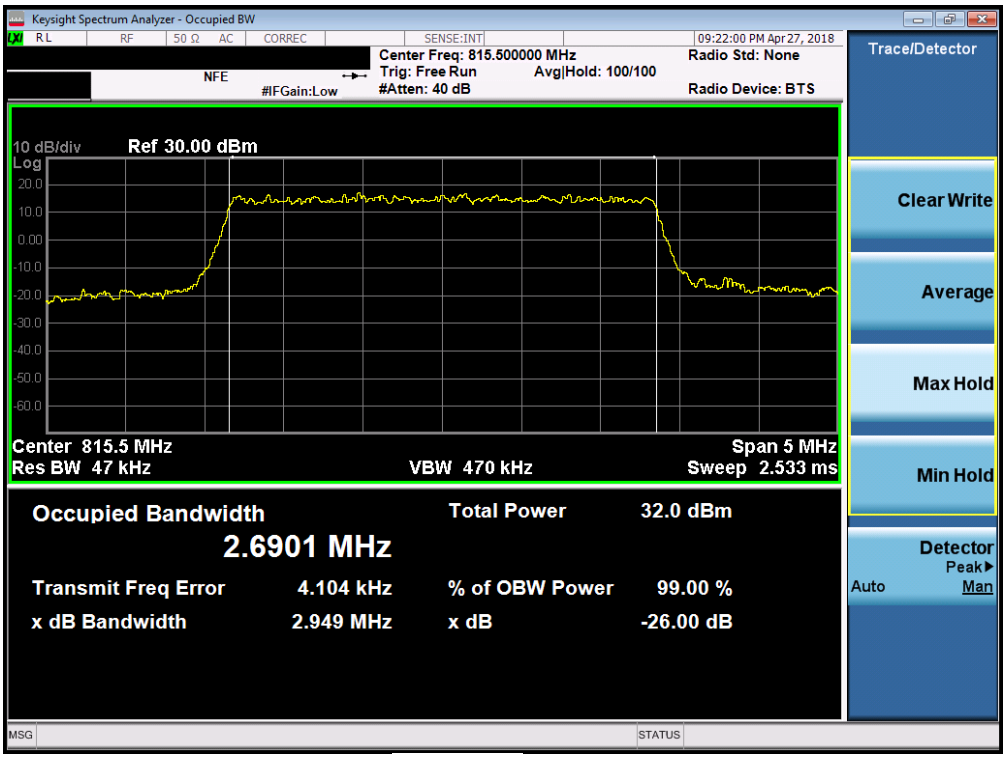

**Plot 7-4. Occupied Bandwidth Plot (LTE B26 - 1.4MHz 16-QAM – RB Size 6– Low Channel)**



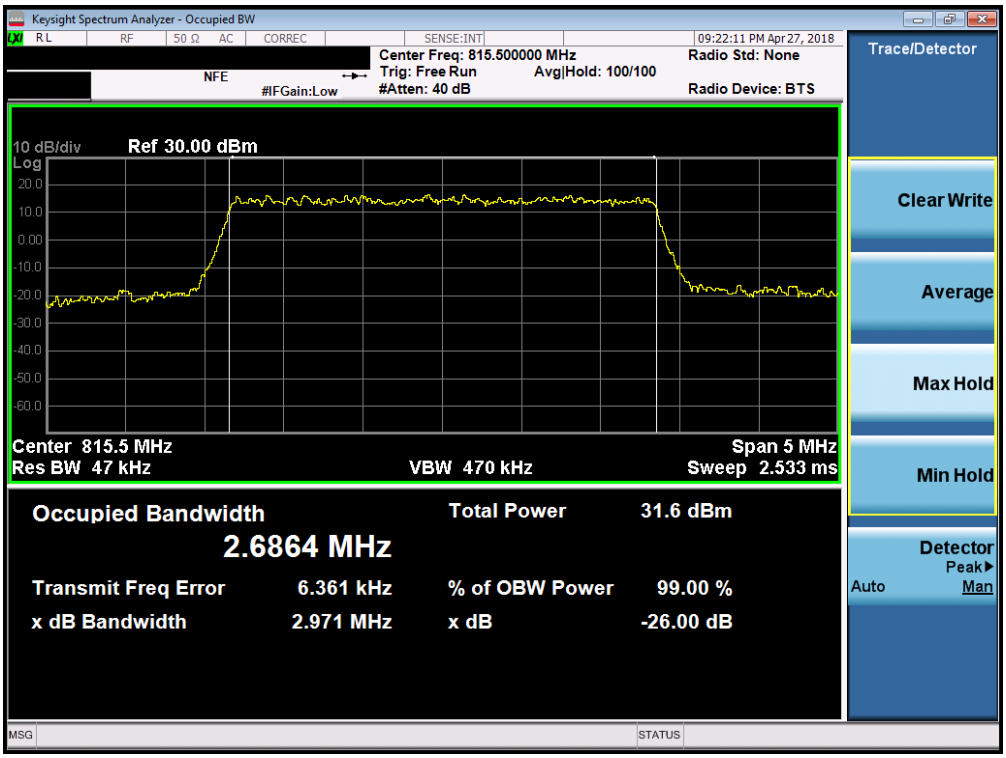

**Plot 7-5. Occupied Bandwidth Plot (LTE B26 - 1.4MHz 64-QAM – RB Size 6– Low Channel)**



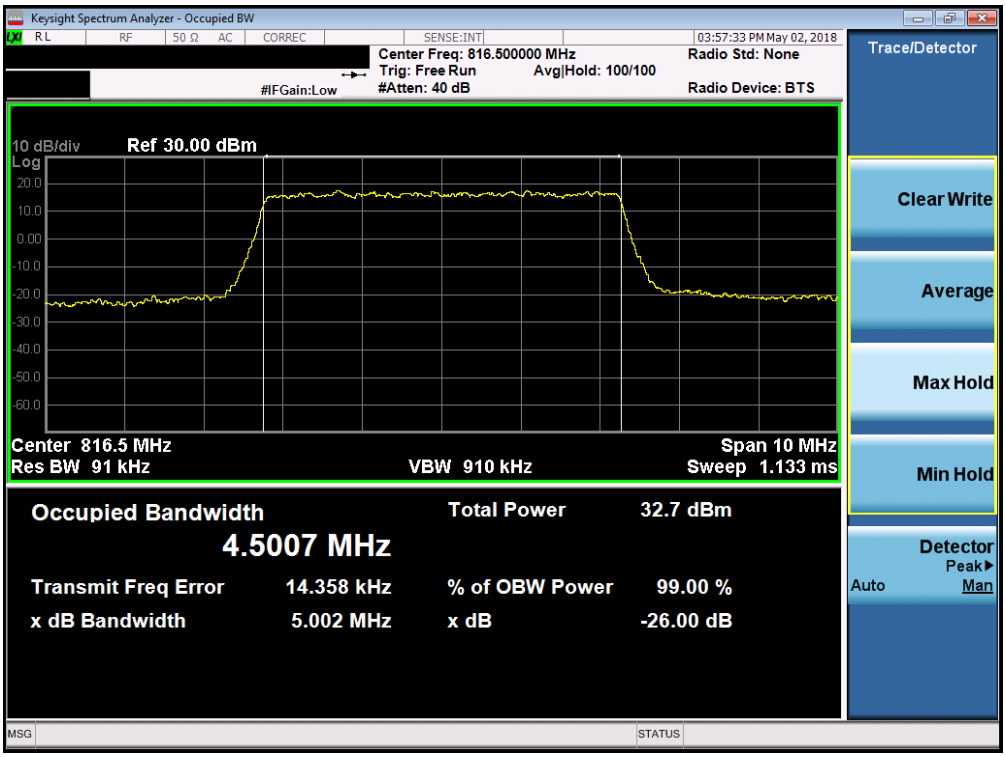

**Plot 7-6. Occupied Bandwidth Plot (LTE B26 - 3MHz QPSK – RB Size 15– Low Channel)**



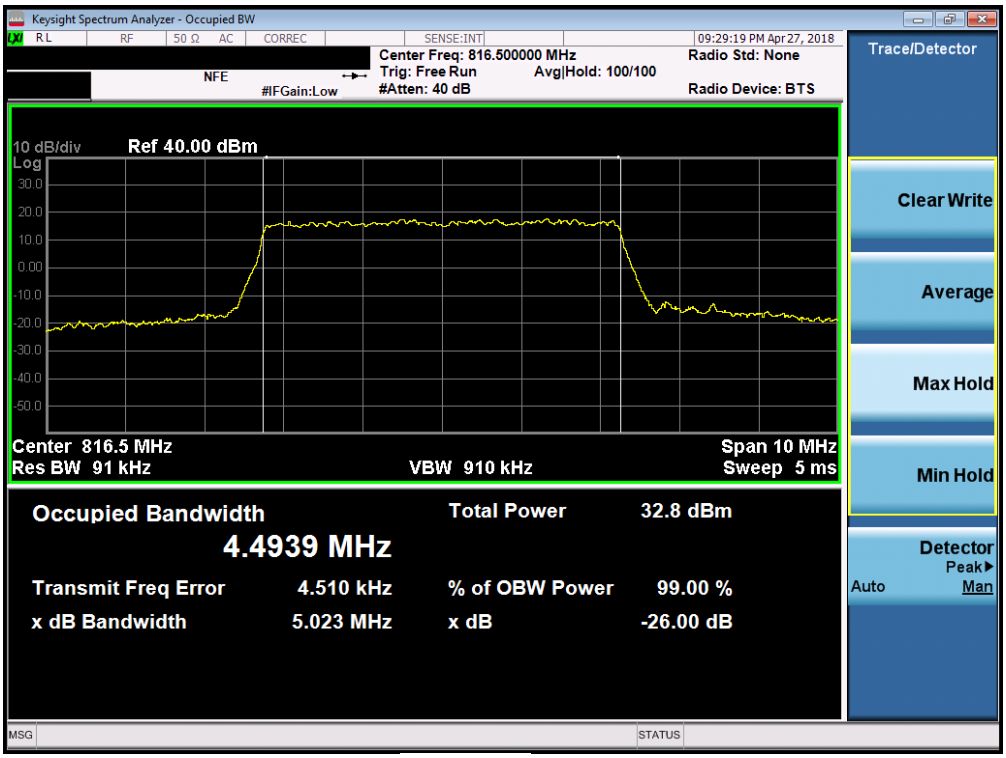

**Plot 7-7. Occupied Bandwidth Plot (LTE B26 - 3MHz 16-QAM – RB Size 15– Low Channel)**



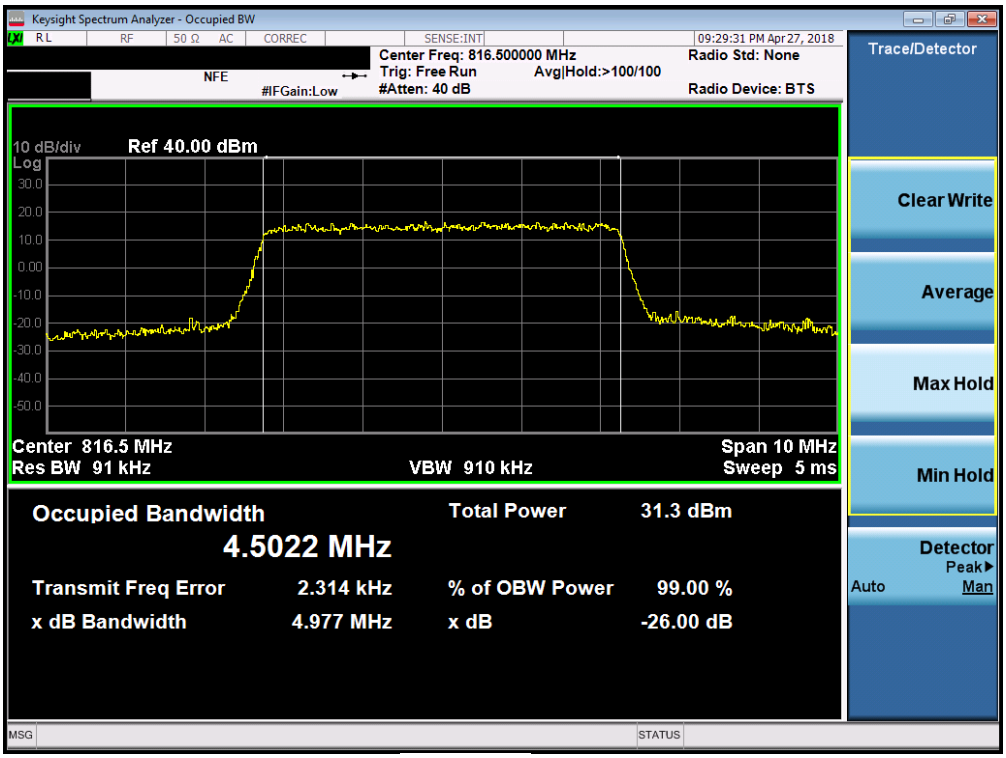

**Plot 7-8. Occupied Bandwidth Plot (LTE B26 - 3MHz 64-QAM – RB Size 15– Low Channel)**



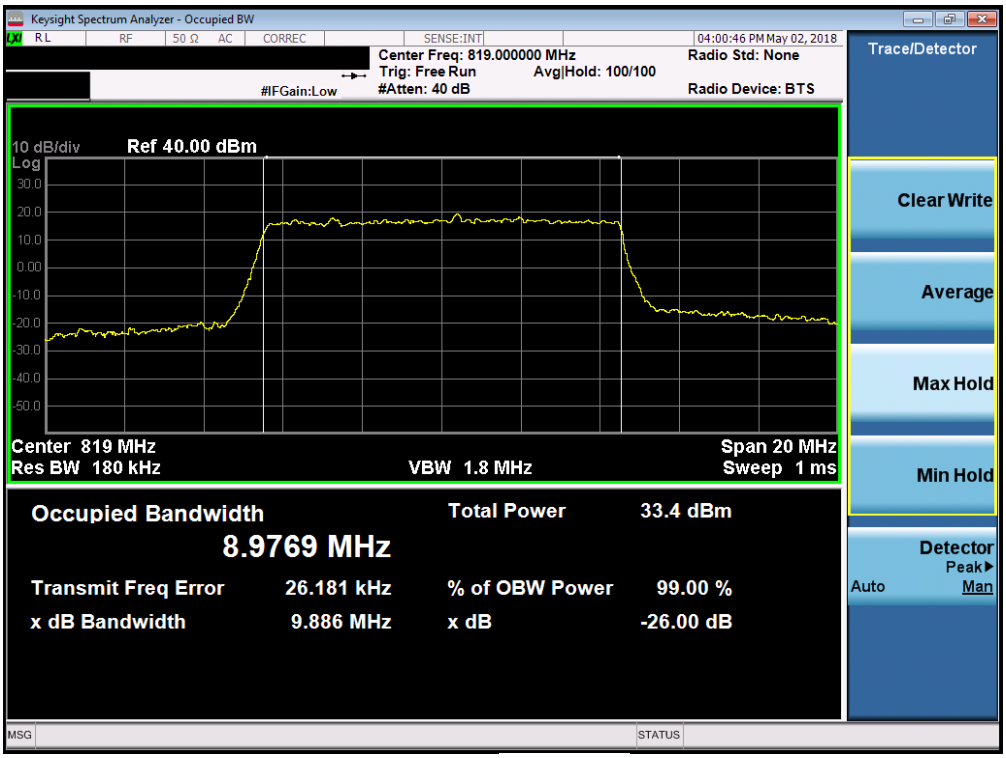

**Plot 7-9. Occupied Bandwidth Plot (LTE B26 - 5MHz QPSK – RB Size 25– Low Channel)**



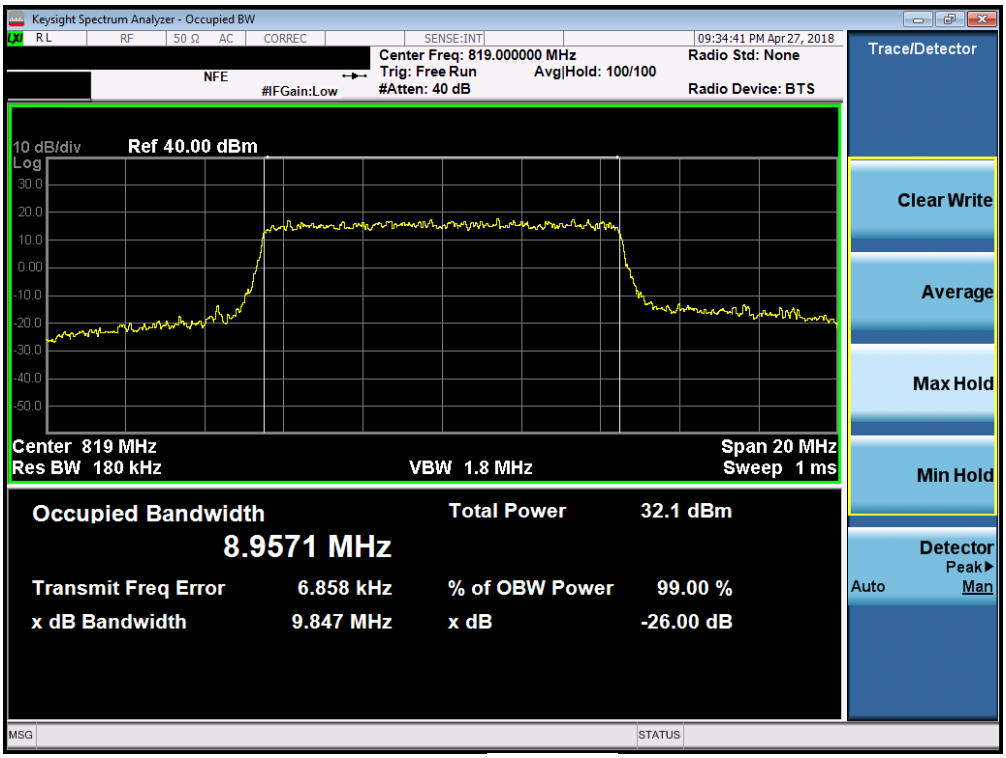

**Plot 7-10. Occupied Bandwidth Plot (LTE B26 - 5MHz 16-QAM – RB Size 25– Low Channel)**



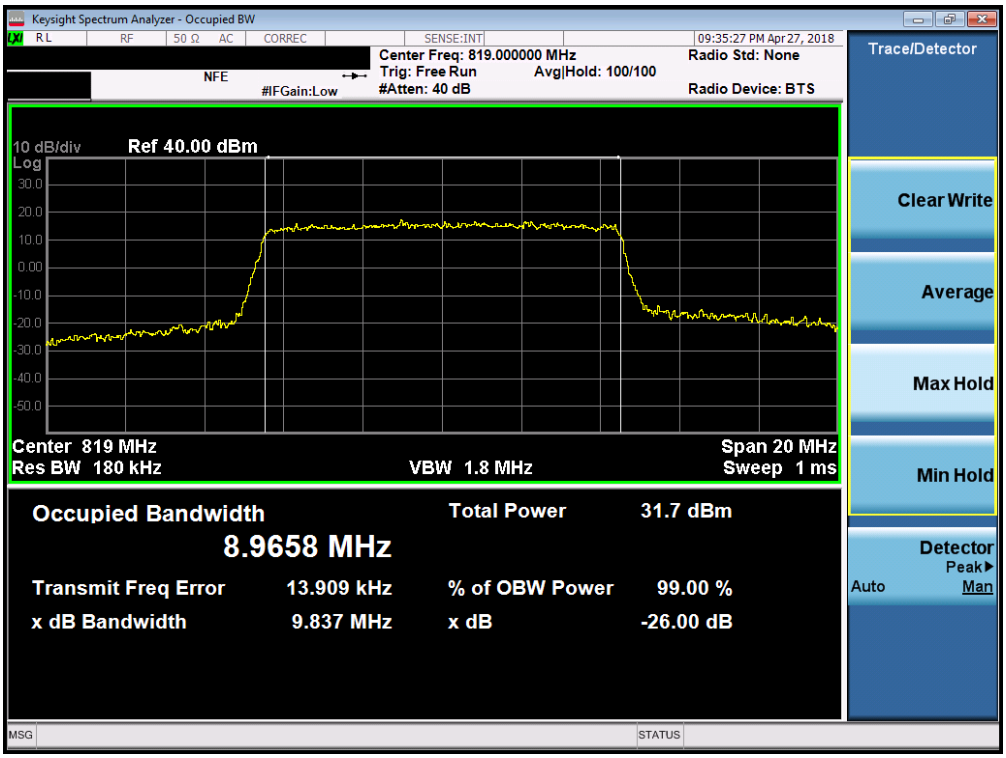

**Plot 7-11. Occupied Bandwidth Plot (LTE B26 - 5MHz 64-QAM – RB Size 25– Low Channel)**



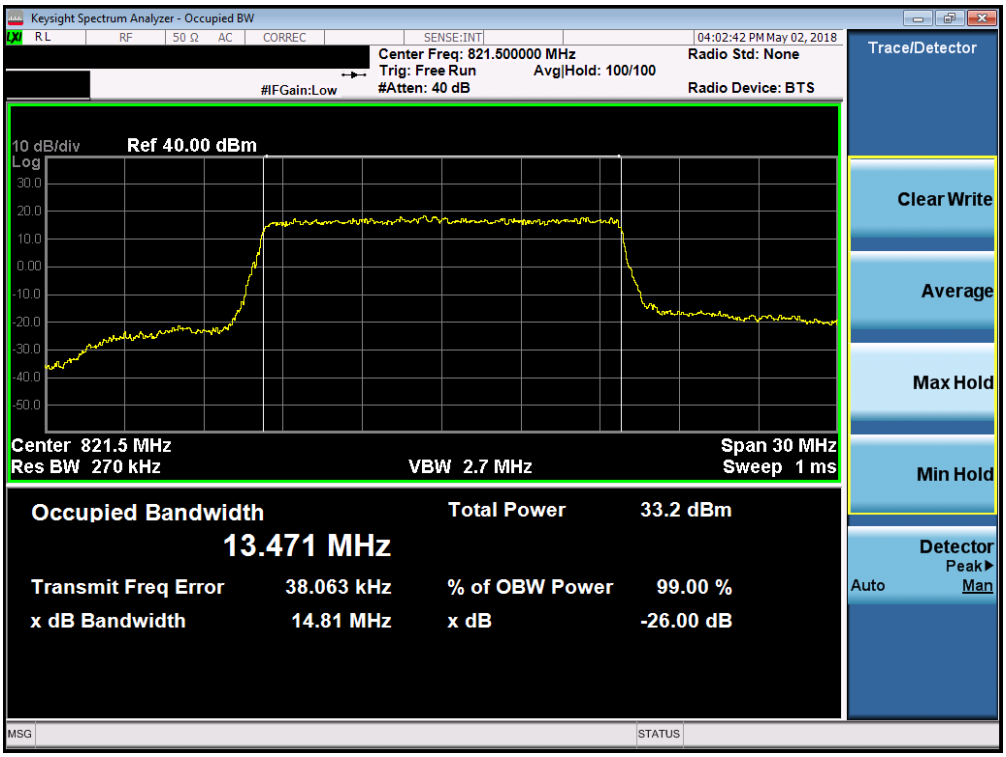

**Plot 7-12. Occupied Bandwidth Plot (LTE B26 - 10MHz QPSK – RB Size 50)**



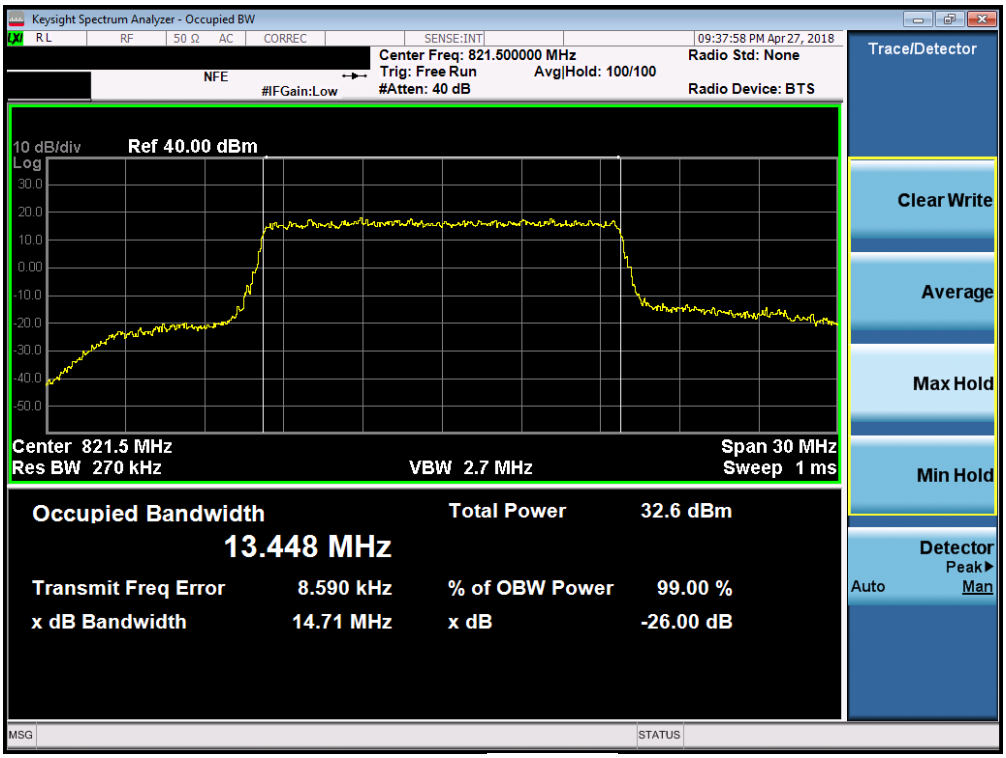

**Plot 7-13. Occupied Bandwidth Plot (LTE B26 - 10MHz 16-QAM – RB Size 50)**



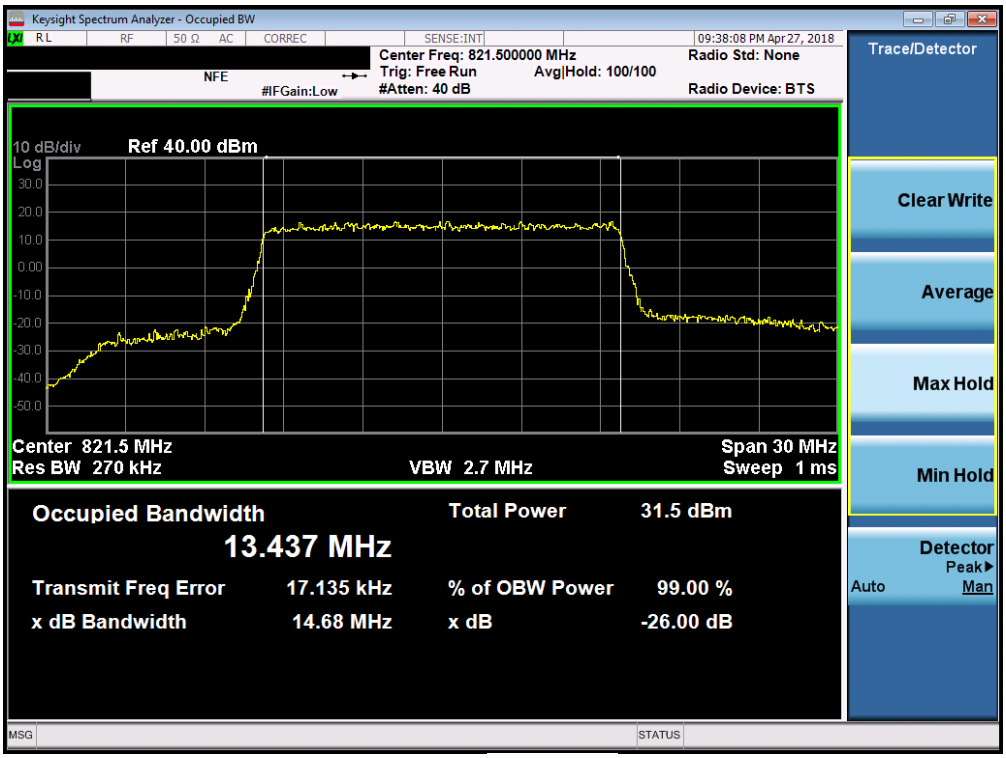

**Plot 7-14. Occupied Bandwidth Plot (LTE B26 - 10MHz 64-QAM – RB Size 50)**




**Plot 7-15. Occupied Bandwidth Plot (LTE B26 - 15MHz QPSK – RB Size 75)**




**Plot 7-16. Occupied Bandwidth Plot (LTE B26 - 15MHz 16-QAM – RB Size 75)**




**Plot 7-17. Occupied Bandwidth Plot (LTE B26 - 15MHz 64-QAM – RB Size 75)**

## 7.3 Spurious and Harmonic Emissions at Antenna Terminal

**§2.1051 §90.691**

### 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 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in 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. RBW ≥ 1MHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

### Test Setup

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

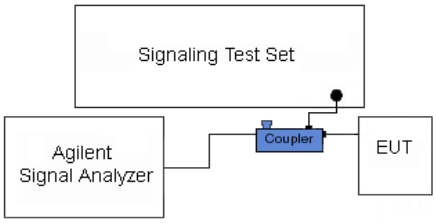
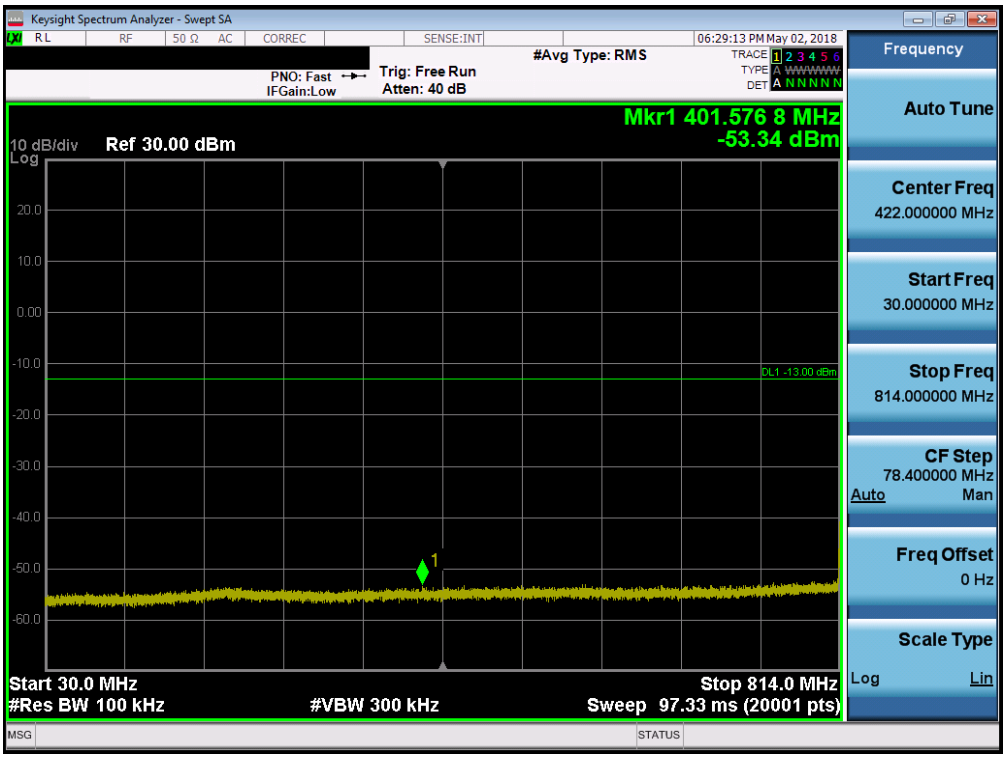


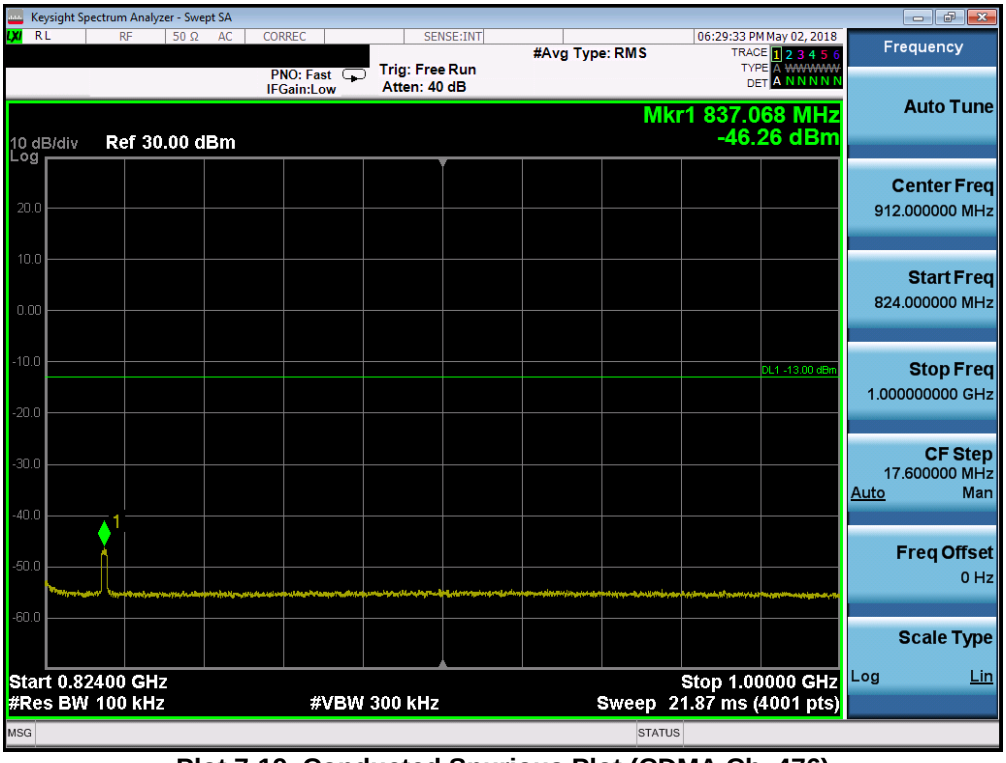

**Figure 7-2. Test Instrument & Measurement Setup**

### Test Notes

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 22. 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.

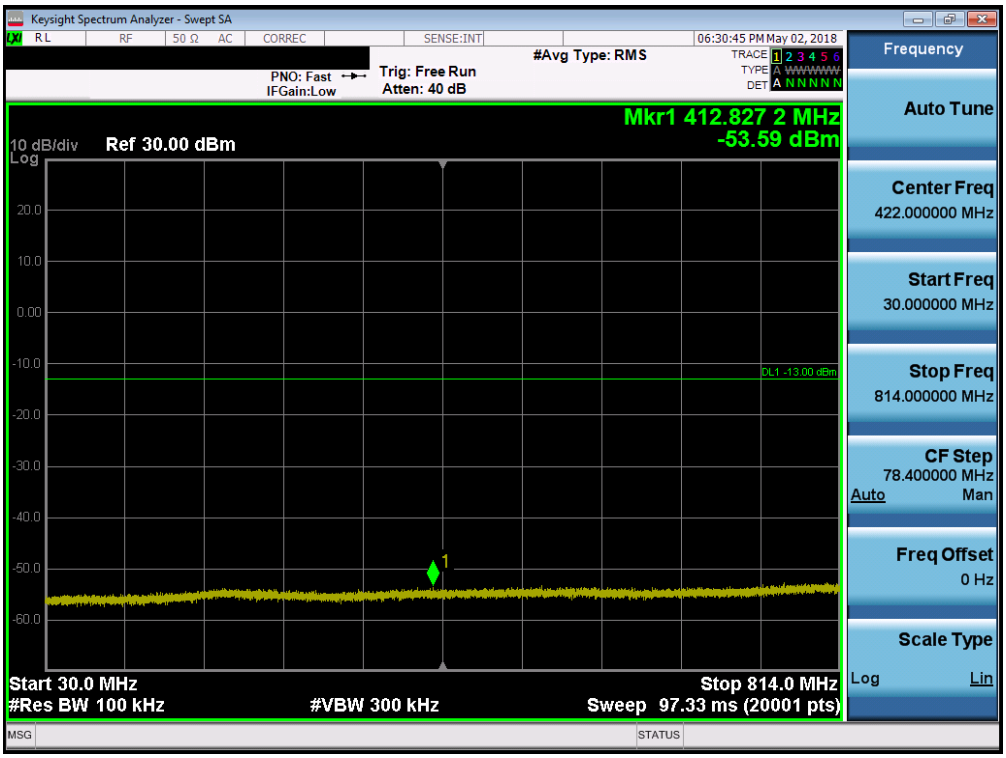



**Plot 7-18. Conducted Spurious Plot (CDMA Ch. 476)**

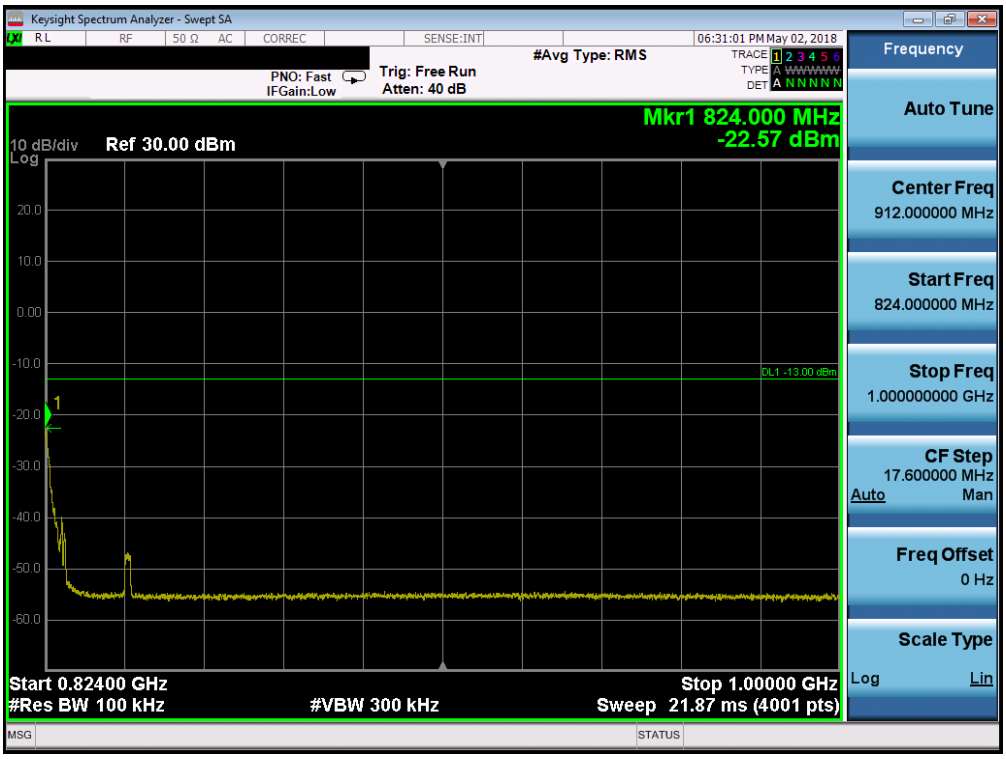



**Plot 7-19. Conducted Spurious Plot (CDMA Ch. 476)**

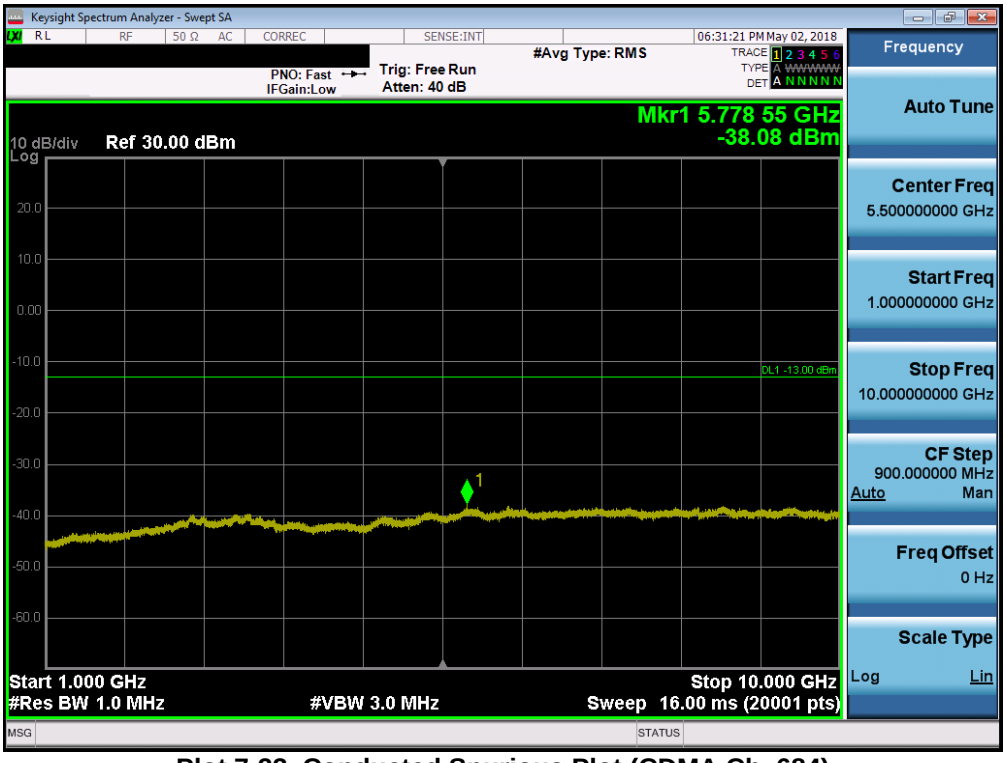

**Plot 7-20. Conducted Spurious Plot (CDMA Ch. 476)**



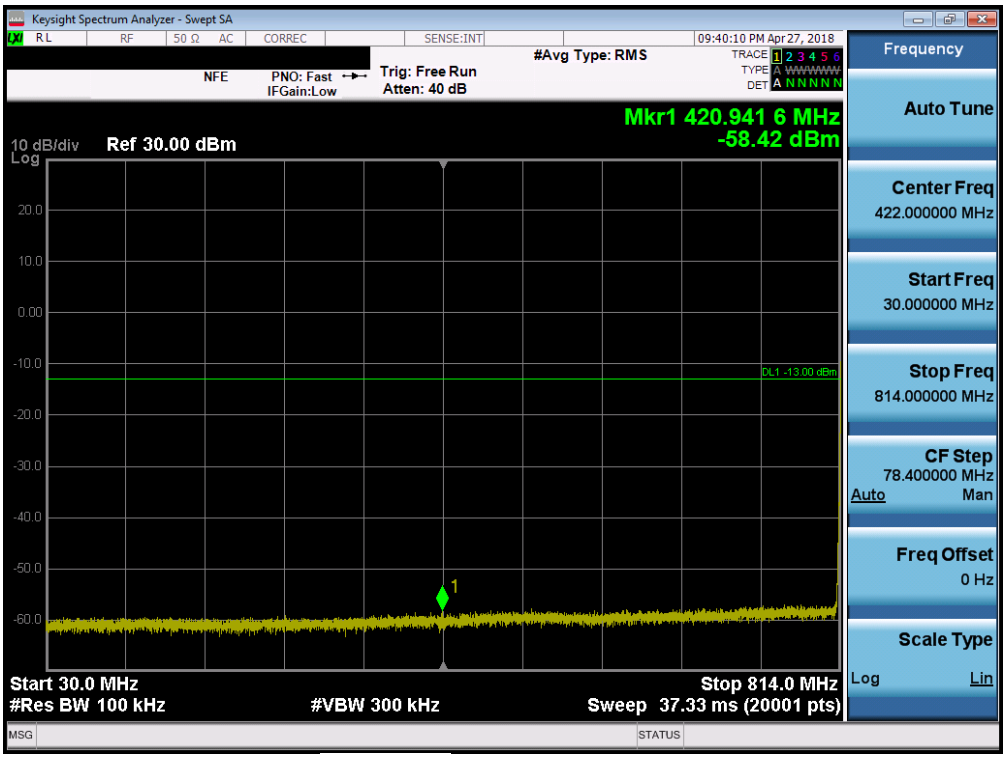

**Plot 7-21. Conducted Spurious Plot (CDMA Ch. 684)**



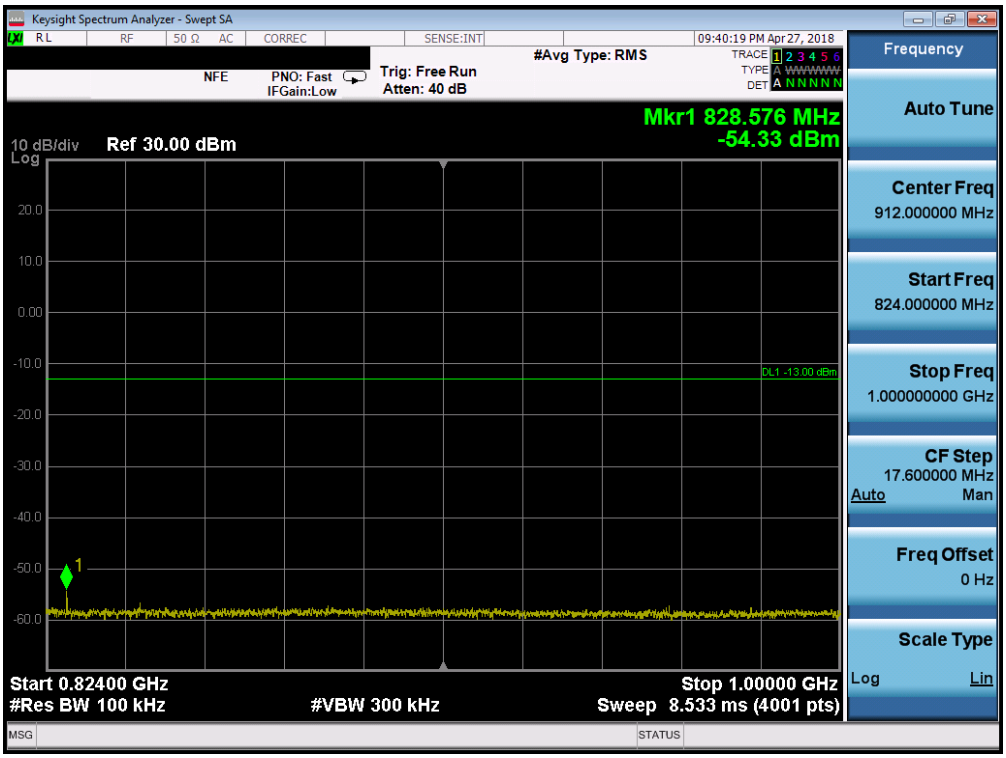

**Plot 7-22. Conducted Spurious Plot (CDMA Ch. 684)**



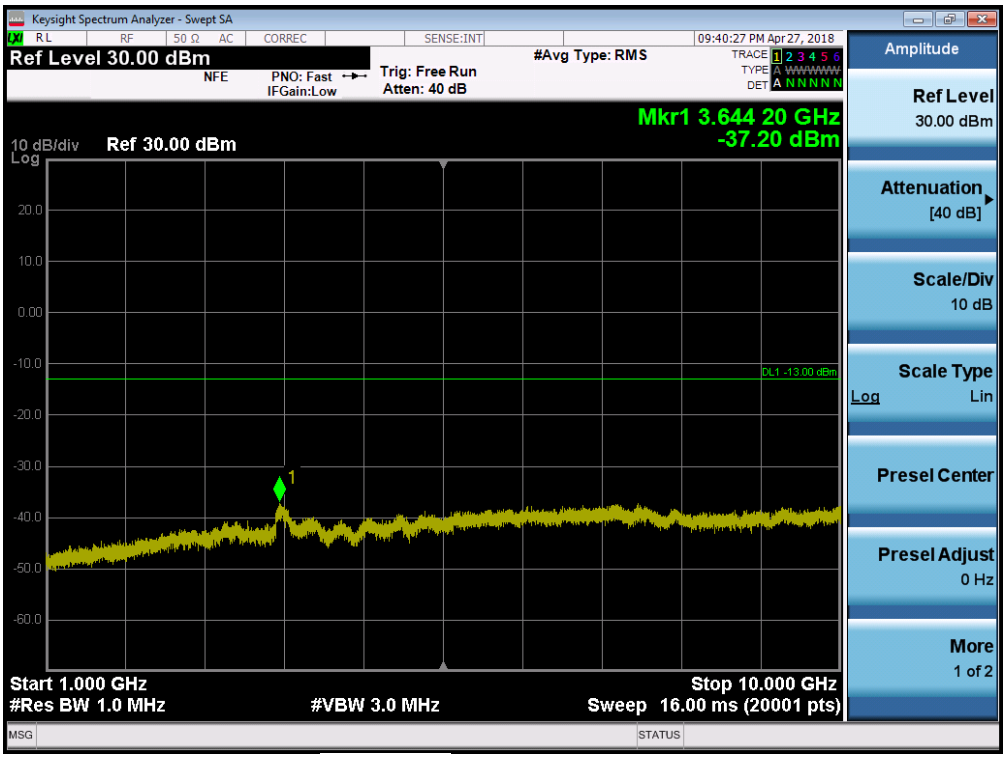

**Plot 7-23. Conducted Spurious Plot (CDMA Ch. 684)**



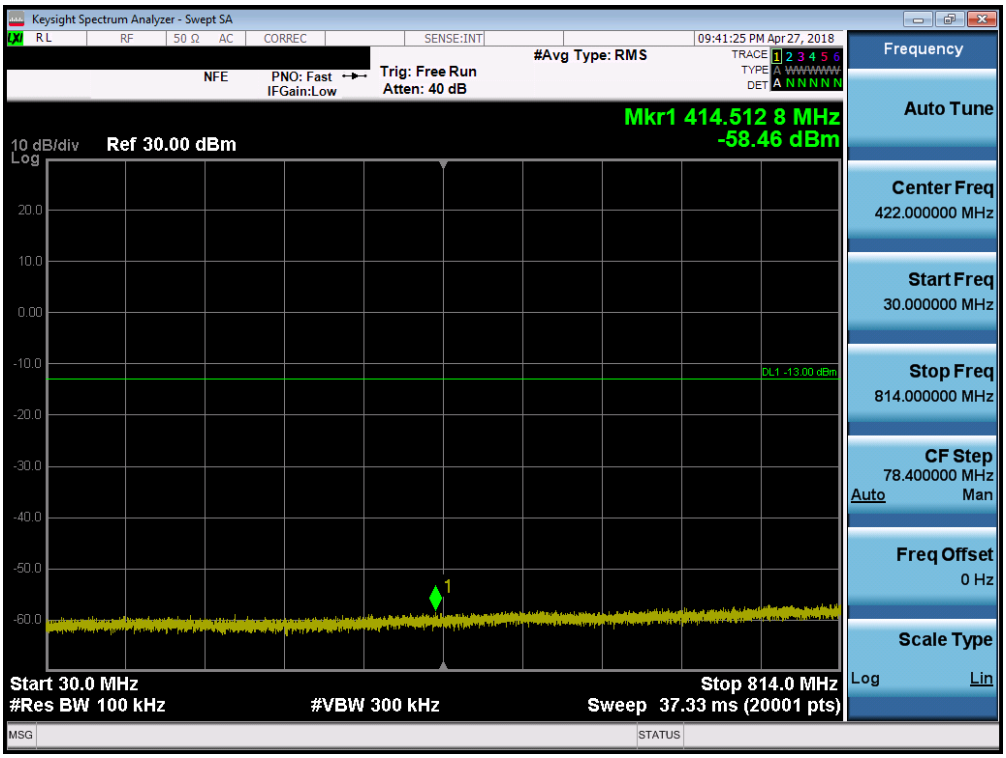

**Plot 7-24. Conducted Spurious Plot (LTE B26 - 1.4 MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**



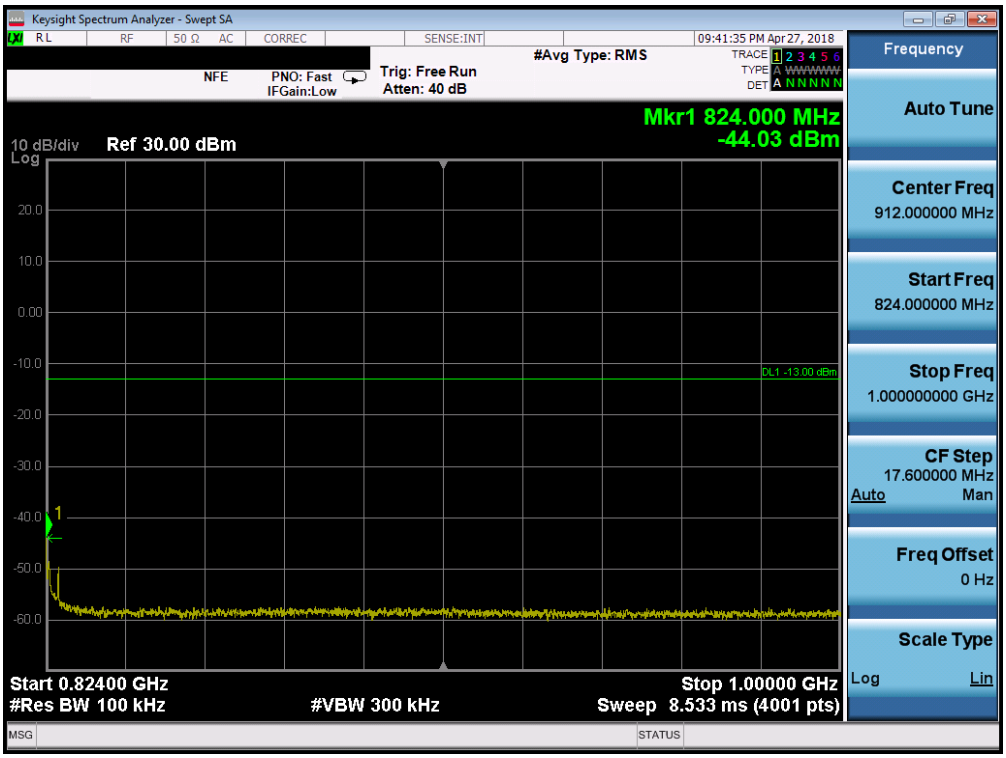

**Plot 7-25. Conducted Spurious Plot (LTE B26 - 1.4 MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**



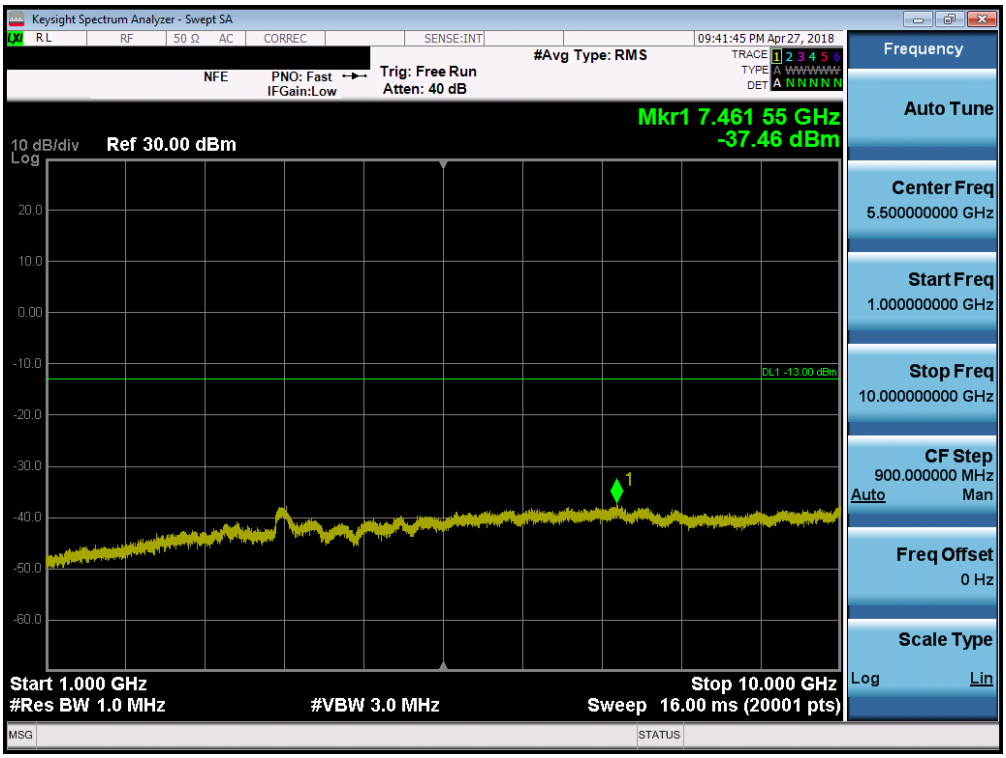

**Plot 7-26. Conducted Spurious Plot (LTE B26 - 1.4 MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**




**Plot 7-27. Conducted Spurious Plot (LTE B26 - 1.4 MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**




**Plot 7-28. Conducted Spurious Plot (LTE B26 - 1.4 MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**




**Plot 7-29. Conducted Spurious Plot (LTE B26 - 1.4 MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**

## 7.4 Band Edge Emissions at Antenna Terminal

**§2.1051 §90.691**

### 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 of any spurious emission removed from the EA licensee's frequency block by greater than 37.5 kHz is 43 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.***

***The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is 50 + 10 $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.***

### Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

### Test Settings

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

### Test Setup

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

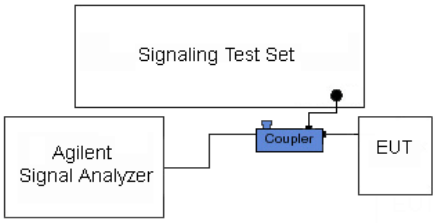


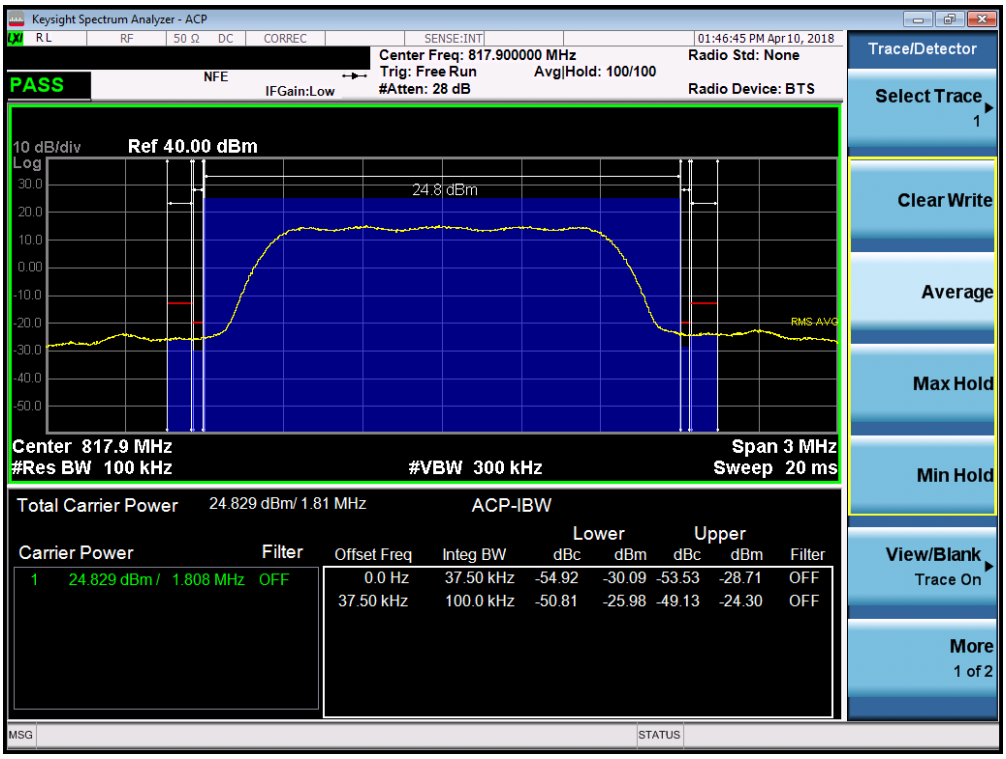

**Figure 7-3. Test Instrument & Measurement Setup**

### Test Notes

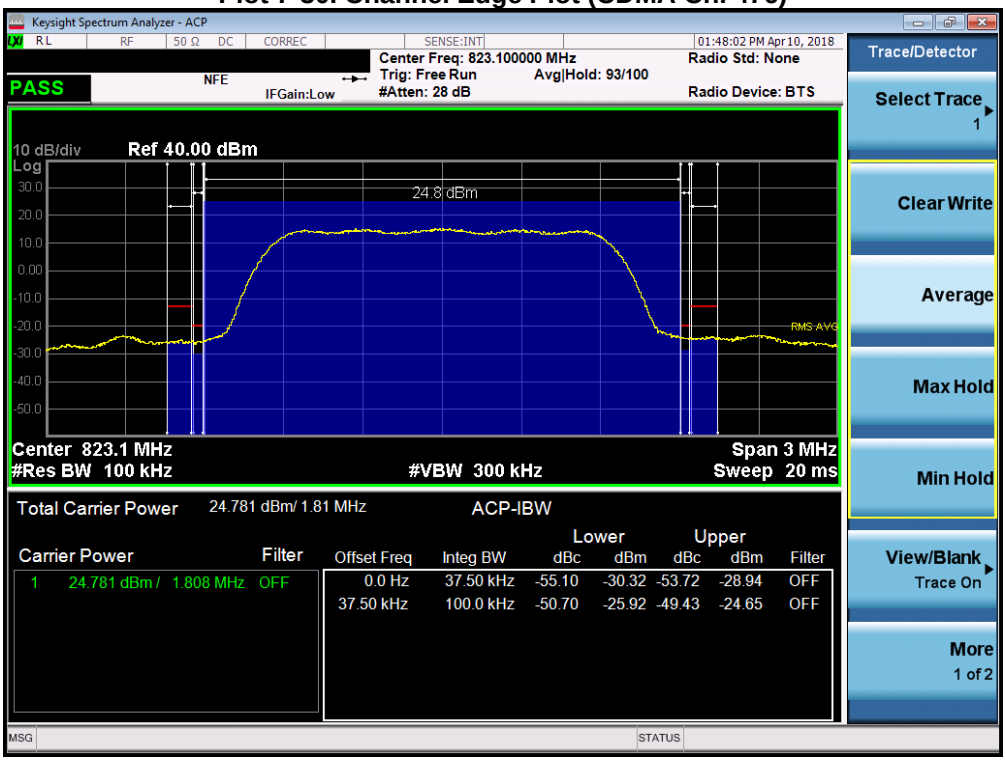
For channel edge emission, the signal analyzer's "ACP" measurement capability is used.

Per 22.917(b) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

## CDMA B10

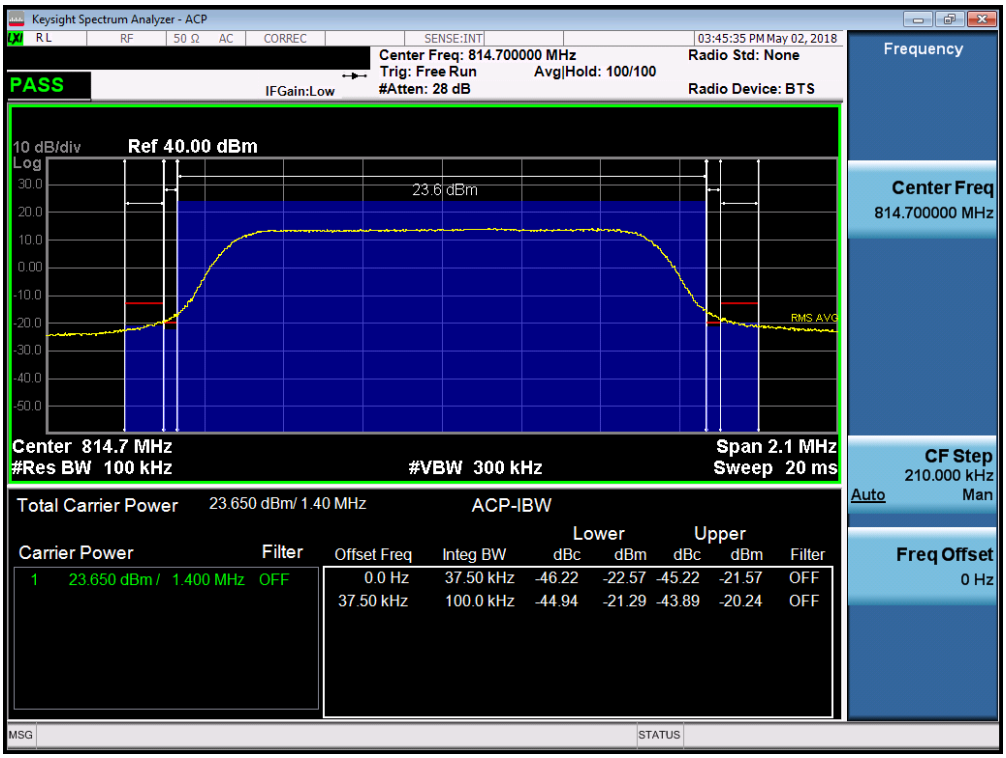



**Plot 7-30. Channel Edge Plot (CDMA Ch. 476)**

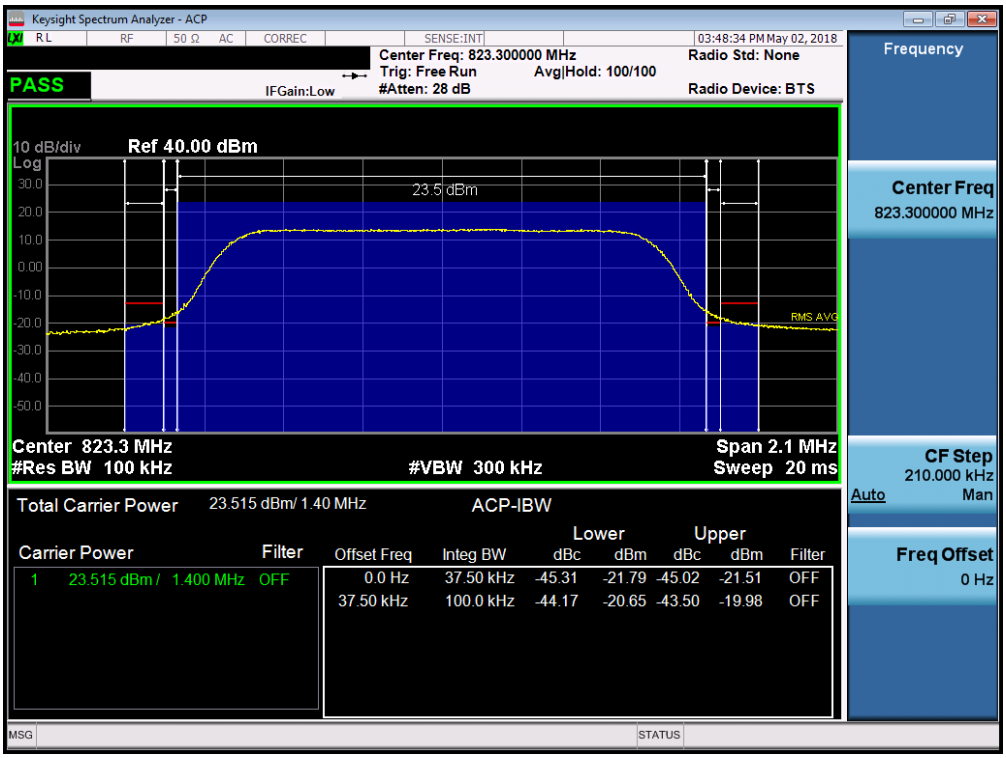



**Plot 7-31. Channel Edge Plot (CDMA Ch. 684)**

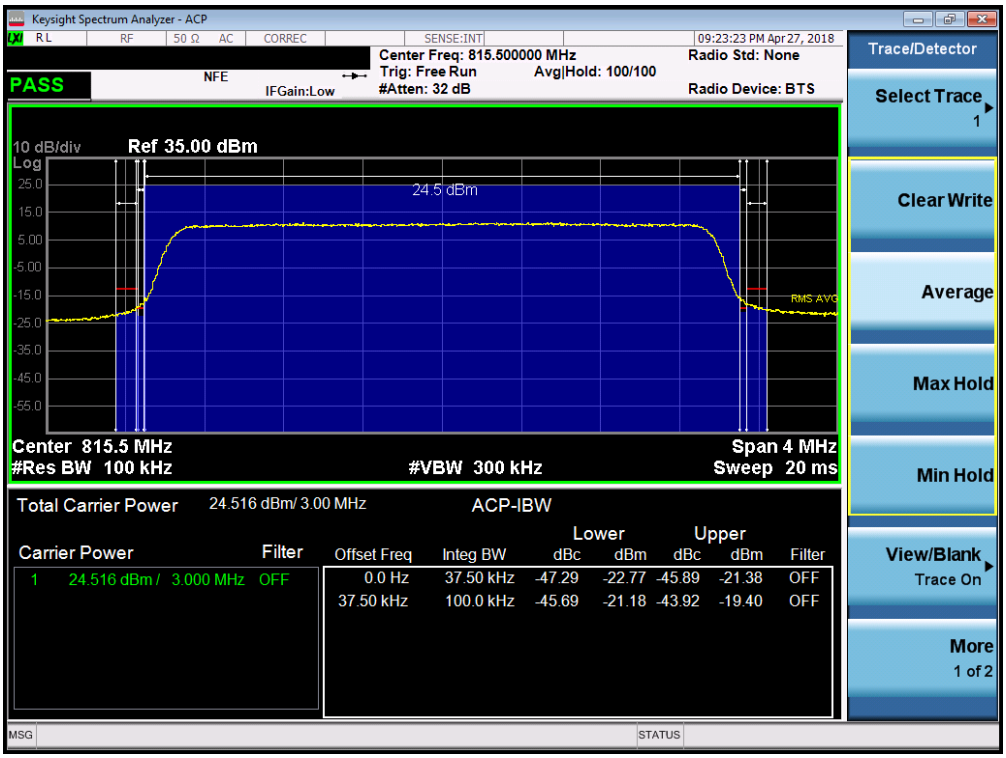
## LTE B26



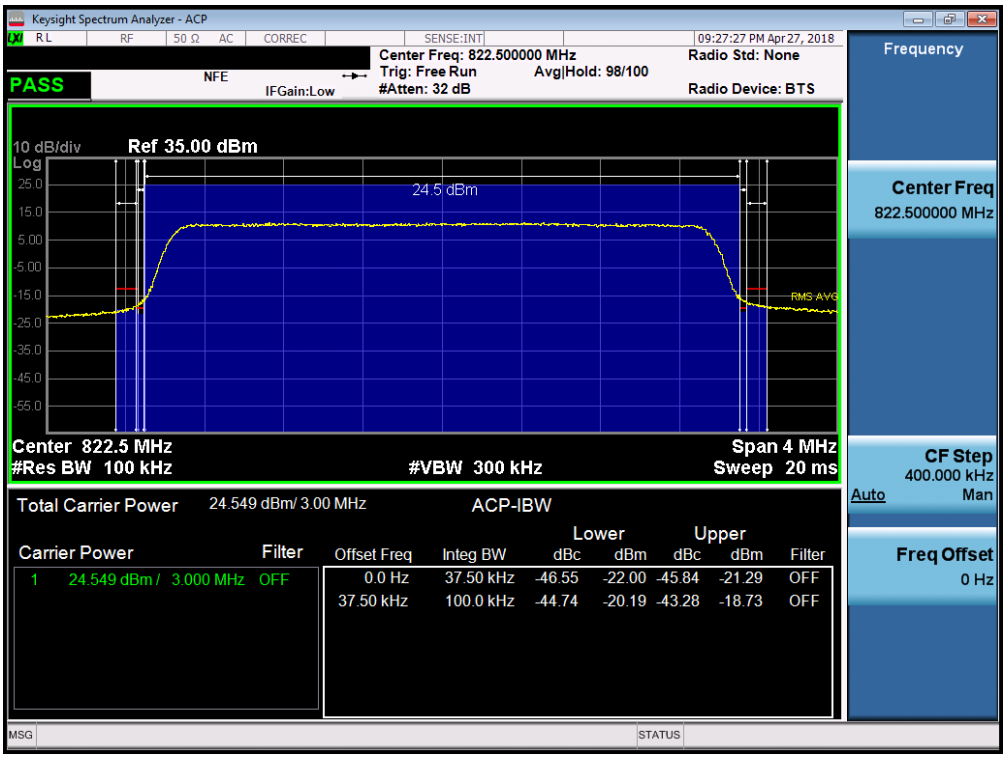

**Plot 7-32. Channel Edge Plot (LTE B26 - 1.4MHz QPSK – RB Size 6– Low Channel)**



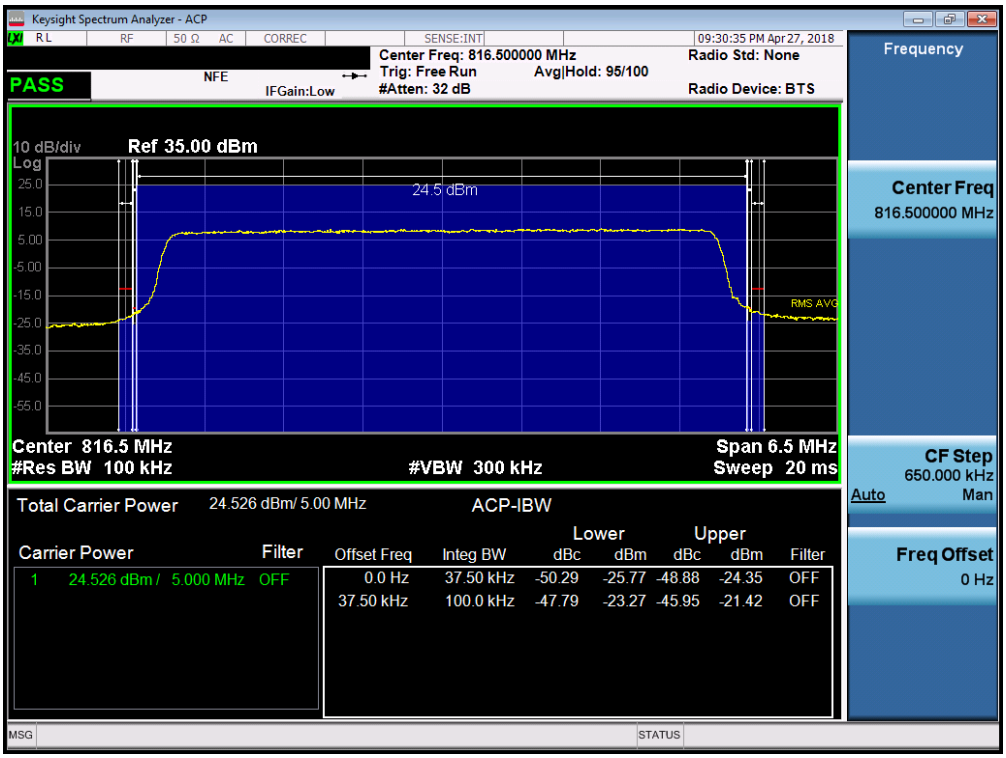

**Plot 7-33. Channel Edge Plot (LTE B26 - 1.4MHz QPSK – RB Size 6 – High Channel)**



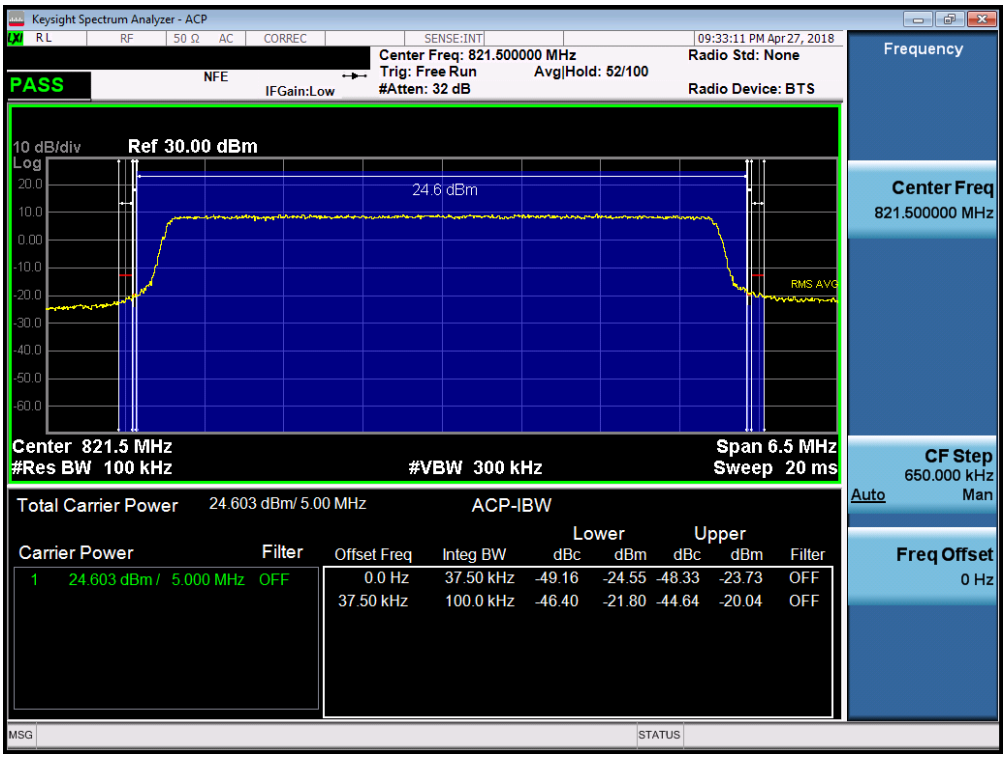

**Plot 7-34. Channel Edge Plot (LTE B26 - 3MHz QPSK – RB Size 15– Low Channel)**



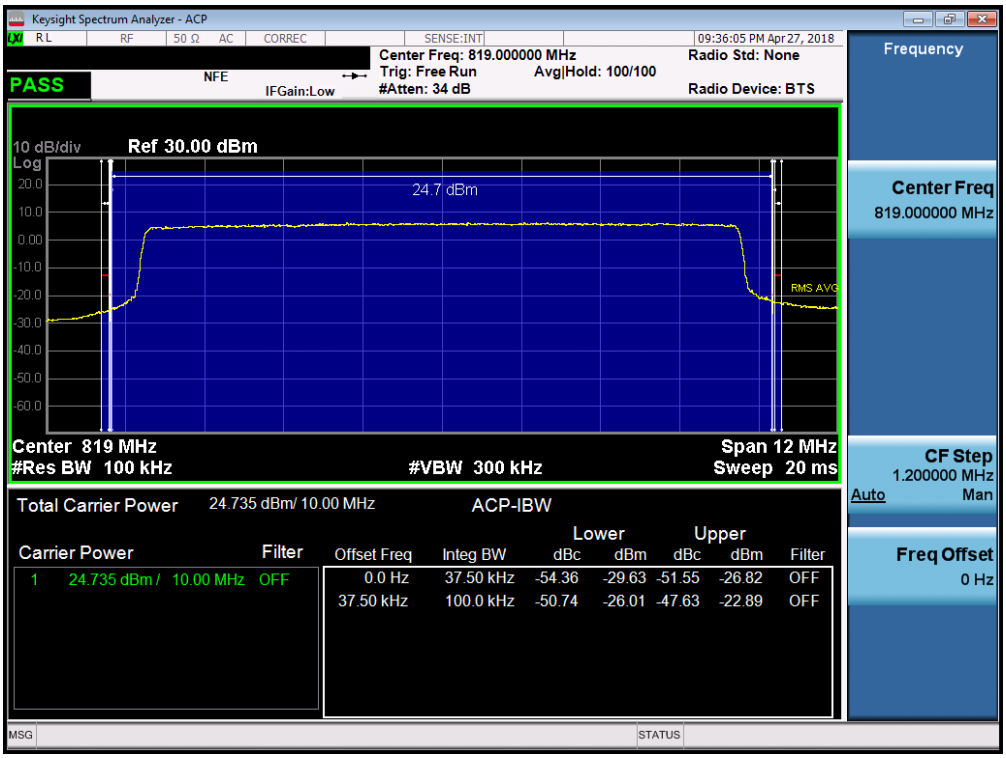

**Plot 7-35. Channel Edge Plot (LTE B26 - 3MHz QPSK – RB Size 15 – High Channel)**



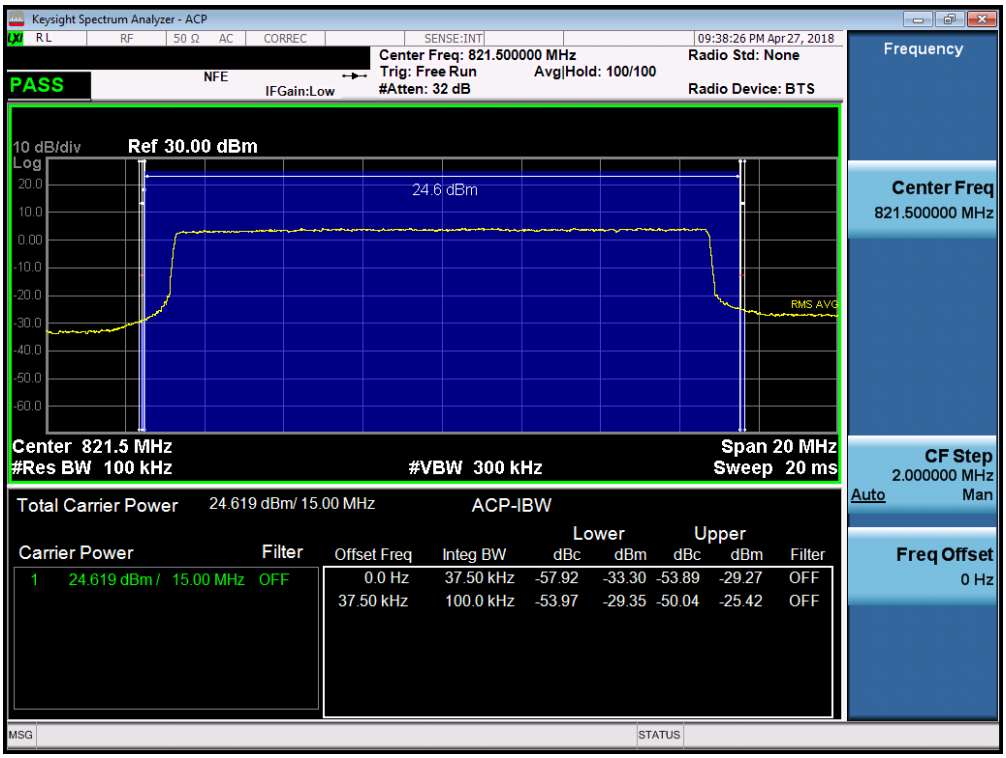

**Plot 7-36. Channel Edge Plot (LTE B26 - 5MHz QPSK – RB Size 25– Low Channel)**




**Plot 7-37. Channel Edge Plot (LTE B26 - 5MHz QPSK – RB Size 25 – High Channel)**




**Plot 7-38. Channel Edge Plot (LTE B26 - 10MHz QPSK – RB Size 50)**




**Plot 7-39. Channel Edge Plot (LTE B26 - 15MHz QPSK – RB Size 75)**

## 7.5 Conducted Power Output Data

**§90.635**

| Frequency [MHz] | BC10 [Channel] | Battery Type | Cond. PWR [dBm] | Cond. PWR [Watts] | Cond. PWR Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 817.90 | 476 | Standard | 25.10 | 0.324 | 50.00 | -24.90 |
| 823.10 | 684 | Standard | **25.16** | **0.328** | 50.00 | -24.84 |

**Table 7-2. CDMA BC10 Conducted Power Output Data**

| Frequency [MHz] | Channel Bandwidth [MHz] | Mod. | Cond. PWR [dBm] | Cond. PWR [Watts] | Cond. PWR Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 814.70 | 1.4 | QPSK | **24.65** | 0.292 | 50.00 | -25.35 |
| 823.30 | 1.4 | QPSK | 24.35 | 0.272 | 50.00 | -25.65 |
| 814.70 | 1.4 | 16-QAM | 23.53 | 0.225 | 50.00 | -26.47 |
| 823.30 | 1.4 | 16-QAM | **23.60** | 0.229 | 50.00 | -26.40 |
| 814.70 | 1.4 | 64-QAM | **22.40** | 0.174 | 50.00 | -27.60 |
| 823.30 | 1.4 | 64-QAM | 22.38 | 0.173 | 50.00 | -27.62 |
| 815.50 | 3 | QPSK | 24.62 | 0.290 | 50.00 | -25.38 |
| 822.50 | 3 | QPSK | **24.64** | 0.291 | 50.00 | -25.36 |
| 815.50 | 3 | 16-QAM | 23.53 | 0.225 | 50.00 | -26.47 |
| 822.50 | 3 | 16-QAM | **23.61** | 0.230 | 50.00 | -26.39 |
| 815.50 | 3 | 64-QAM | 22.47 | 0.177 | 50.00 | -27.53 |
| 822.50 | 3 | 64-QAM | **22.65** | 0.184 | 50.00 | -27.35 |
| 816.50 | 5 | QPSK | 24.57 | 0.286 | 50.00 | -25.43 |
| 821.50 | 5 | QPSK | **24.68** | **0.294** | 50.00 | -25.32 |
| 816.50 | 5 | 16-QAM | 23.54 | 0.226 | 50.00 | -26.46 |
| 821.50 | 5 | 16-QAM | **23.56** | 0.227 | 50.00 | -26.44 |
| 816.50 | 5 | 64-QAM | **22.50** | 0.178 | 50.00 | -27.50 |
| 821.50 | 5 | 64-QAM | 22.38 | 0.173 | 50.00 | -27.62 |
| 819.00 | 10 | QPSK | **24.57** | 0.286 | 50.00 | -25.43 |
| 819.00 | 10 | 16-QAM | **23.54** | 0.226 | 50.00 | -26.46 |
| 819.00 | 10 | 64-QAM | **22.42** | 0.175 | 50.00 | -27.58 |
| 821.50 | 15 | QPSK | **24.43** | 0.277 | 50.00 | -25.57 |
| 821.50 | 15 | 16-QAM | **23.40** | 0.219 | 50.00 | -26.60 |
| 821.50 | 15 | 64-QAM | **22.38** | 0.173 | 50.00 | -27.62 |

**Table 7-3. LTE Band 26 Conducted Power Output Data**

**NOTES:**

1. For CDMA mode, this device was tested under all R.C.s and S.O.s and the worst case is reported with RC3/SO55 with "All Up" power control bits. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.

2. This unit was tested with its standard battery.

## 7.6 Radiated Power (ERP)

**§22.913(a.2)**

### Test Overview

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

### Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-D-2010 – 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.
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".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

## Test Setup

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

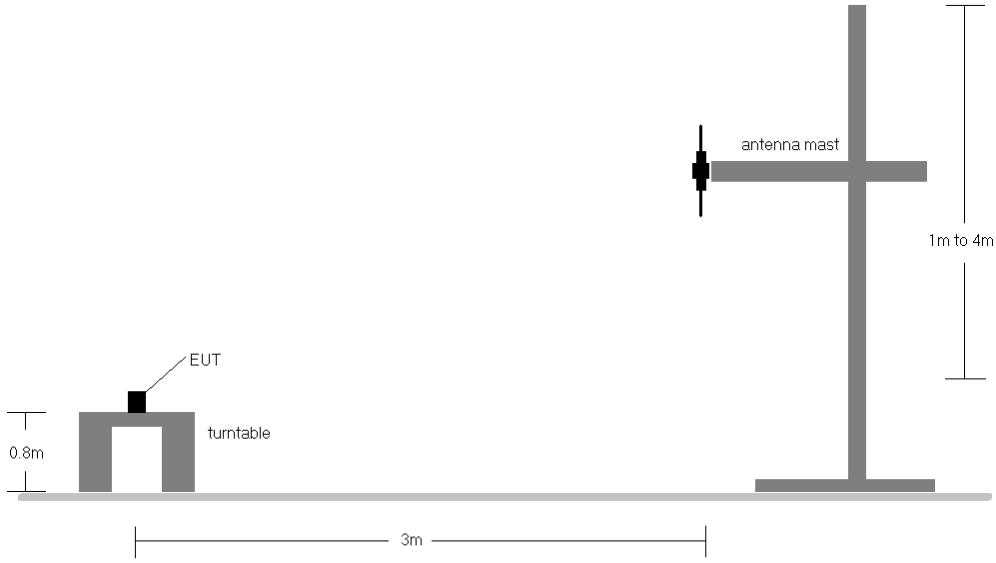



**Figure 7-4. Radiated Test Setup <1GHz**

## 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.

| Frequency [MHz] | Channel Bandwidth [MHz] | Mod. | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | RB Size/Offset | Substitute Level [dBm] | Ant. Gain [dBi] | ERP [dBm] | ERP [Watts] | ERP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 821.50 | 15 | QPSK | H | 358 | 72 | 1 / 0 | 20.59 | 1.49 | **19.93** | 0.098 | 38.45 | -18.52 |
| 821.50 | 15 | 16-QAM | H | 358 | 72 | 1 / 0 | 19.78 | 1.49 | **19.12** | 0.082 | 38.45 | -19.33 |
| 821.50 | 15 | 64-QAM | H | 358 | 72 | 1 / 0 | 19.22 | 1.49 | **18.56** | 0.072 | 38.45 | -19.89 |

**Table 7-40. ERP Data (Band 26)**

## 7.7 Radiated Spurious Emissions Measurements

**§2.1053 §90.691**

### Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 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

ANSI/TIA-603-D-2010 – Section 2.2.12

### 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.

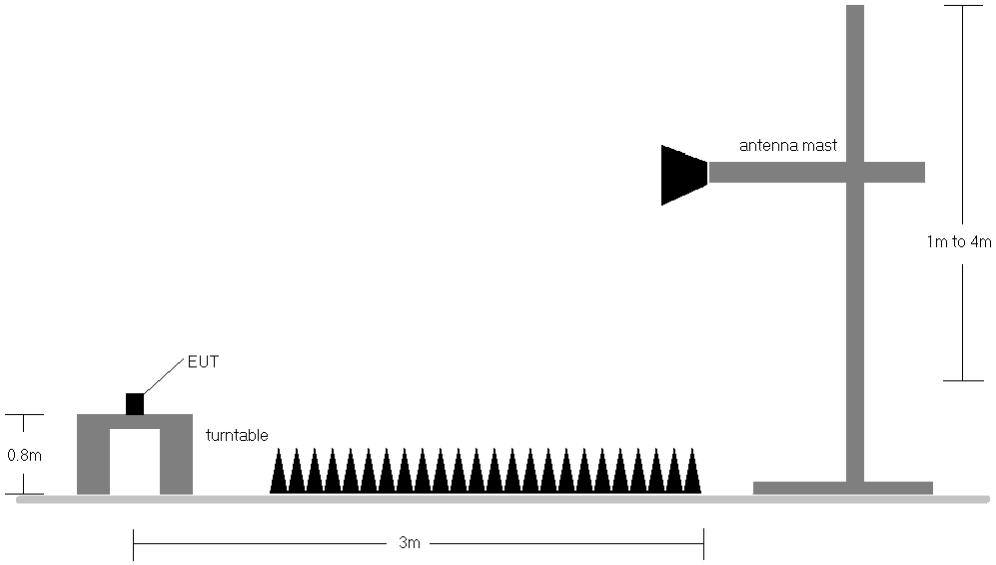



**Figure 7-5. Test Instrument & Measurement Setup**

## Test Notes

1. For CDMA mode, this device was tested under all R.C.s and S.O.s and the worst case is reported with RC3/SO55 with "All Up" power control bits.

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

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

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 817.90 | MHz |
| CHANNEL: | 476 | |
| MODULATION SIGNAL: | CDMA | |
| DISTANCE: | 3 | meters |
| LIMIT: | -13.00 | dBm |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 1635.80 | H | 110 | 284 | -64.13 | 9.00 | -55.13 | -42.1 |
| 2453.70 | H | 100 | 229 | -58.25 | 8.94 | -49.31 | -36.3 |
| 3271.60 | H | - | - | -57.86 | 9.26 | -48.60 | -35.6 |

**Table 7-4. CDMA BC10 Radiated Spurious Data (Ch. 476)**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 823.10 | MHz |
| CHANNEL: | 684 | |
| MODULATION SIGNAL: | CDMA | |
| DISTANCE: | 3 | meters |
| LIMIT: | -13.00 | dBm |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 1646.20 | H | 105 | 246 | -63.69 | 9.04 | -54.65 | -41.6 |
| 2469.30 | H | 100 | 284 | -57.58 | 8.96 | -48.62 | -35.6 |
| 3292.40 | H | - | - | -57.05 | 9.28 | -47.77 | -34.8 |

**Table 7-5. CDMA BC10 Radiated Spurious Data (Ch. 684)**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 814.70 | MHz |
| CHANNEL: | 26697 | |
| MODULATION SIGNAL: | QPSK | |
| BANDWIDTH: | 1.4 | MHz |
| DISTANCE: | 3 | meters |
| LIMIT: | -13.00 | dBm |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 1629.40 | H | 116 | 310 | -64.18 | 8.98 | -55.20 | -42.2 |
| 2444.10 | H | - | - | -60.20 | 8.94 | -51.26 | -38.3 |

**Table 7-6. LTE B26 Radiated Spurious Data (Ch. 26697)**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 823.30 | MHz |
| CHANNEL: | 26783 | |
| MODULATION SIGNAL: | QPSK | |
| BANDWIDTH: | 1.4 | MHz |
| DISTANCE: | 3 | meters |
| LIMIT: | -13.00 | dBm |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 1646.60 | H | - | - | -65.37 | 9.04 | -56.33 | -43.3 |
| 2469.90 | H | - | - | -59.69 | 8.96 | -50.73 | -37.7 |

**Table 7-7. LTE B26 Radiated Spurious Data (Ch. 26783)**

## 7.8 Frequency Stability / Temperature Variation

**§2.1055 §90.213**

**Test Overview and Limit**

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-D-2010. 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.

***The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.***

**Test Procedure Used**

ANSI/TIA-603-D-2010

**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

## Frequency Stability / Temperature Variation

**§2.1055, §90.213**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 817,900,000 | Hz |
| CHANNEL: | 476 | |
| REFERENCE VOLTAGE: | 4.40 | VDC |
| DEVIATION LIMIT: | ± 0.00025 % or 2.5 ppm | |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 4.40 | + 20 (Ref) | 817,899,974 | -26 | -0.0000032 |
| 100 % | | - 30 | 817,900,153 | 153 | 0.0000187 |
| 100 % | | - 20 | 817,900,195 | 195 | 0.0000238 |
| 100 % | | - 10 | 817,899,879 | -121 | -0.0000148 |
| 100 % | | 0 | 817,899,668 | -332 | -0.0000406 |
| 100 % | | + 10 | 817,899,925 | -75 | -0.0000092 |
| 100 % | | + 20 | 817,899,876 | -124 | -0.0000152 |
| 100 % | | + 30 | 817,900,124 | 124 | 0.0000152 |
| 100 % | | + 40 | 817,900,264 | 264 | 0.0000323 |
| 100 % | | + 50 | 817,899,634 | -366 | -0.0000447 |
| BATT. ENDPOINT | 3.40 | + 20 | 817,899,805 | -195 | -0.0000238 |

**Table 7-8. CDMA BC10 Frequency Stability Data (Ch. 670)**

## Frequency Stability / Temperature Variation

**§2.1055, §90.213**

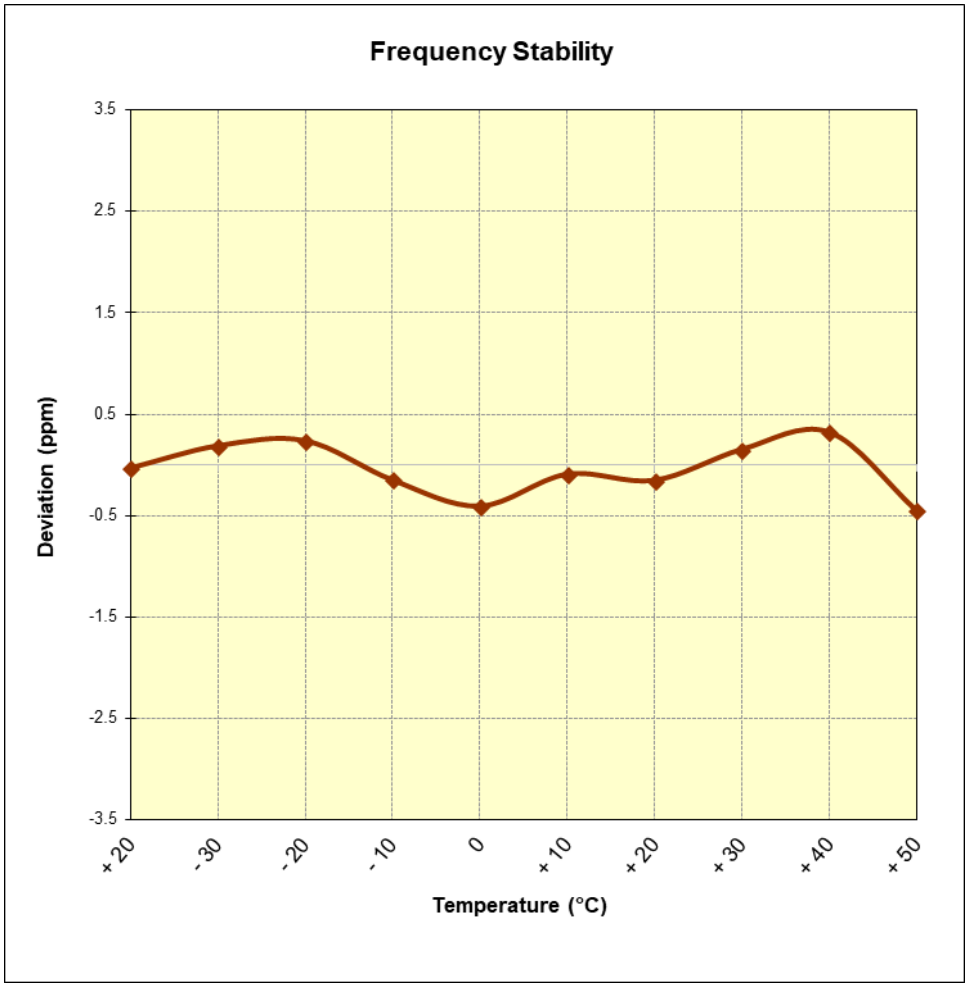



**Figure 7-6. CDMA BC10 Frequency Stability Graph (Ch. 670)**

## Frequency Stability / Temperature Variation

**§2.1055, §90.213**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 819,000,000 | Hz |
| CHANNEL: | 26740 | |
| REFERENCE VOLTAGE: | 4.40 | VDC |
| DEVIATION LIMIT: | ± 0.00025 % or 2.5 ppm | |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 4.40 | + 20 (Ref) | 819,000,015 | 15 | 0.0000018 |
| 100 % | | - 30 | 818,999,891 | -109 | -0.0000133 |
| 100 % | | - 20 | 818,999,707 | -293 | -0.0000358 |
| 100 % | | - 10 | 818,999,860 | -140 | -0.0000171 |
| 100 % | | 0 | 818,999,923 | -77 | -0.0000094 |
| 100 % | | + 10 | 818,999,849 | -151 | -0.0000184 |
| 100 % | | + 20 | 818,999,742 | -258 | -0.0000315 |
| 100 % | | + 30 | 819,000,031 | 31 | 0.0000038 |
| 100 % | | + 40 | 818,999,919 | -81 | -0.0000099 |
| 100 % | | + 50 | 819,000,066 | 66 | 0.0000081 |
| BATT. ENDPOINT | 3.40 | + 20 | 818,999,846 | -154 | -0.0000188 |

**Table 7-9. LTE Band 26 Frequency Stability Data (Ch. 26697)**

## Frequency Stability / Temperature Variation

**§2.1055, §90.213**

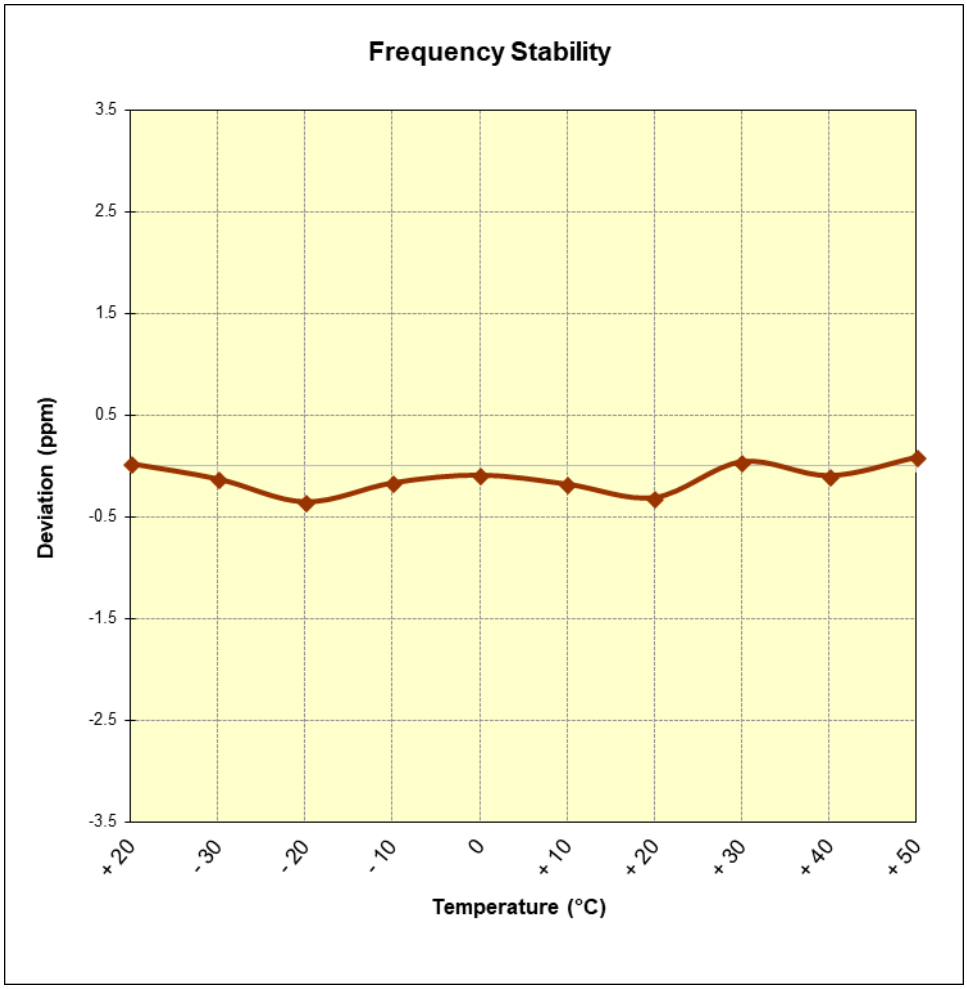



**Table 7-10. LTE Band 26 Frequency Stability Data (Ch. 26697)**

# 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFQ710US** complies with all the requirements of Parts 22(H) and 90 of the FCC rules.