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

# MEASUREMENT REPORT
## FCC Part 22, 24, & 27

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

**Date of Testing:**
8/23 - 9/8/2016
**Test Site/Location:**
PCTEST Lab., Columbia, MD, USA
**Test Report Serial No.:**
0Y1608291506.A3L

| | |
|---|---|
| **FCC ID:** | **A3LSMG610M** |
| **APPLICANT:** | **SAMSUNG ELECTRONICS CO., LTD.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model(s):** | SM-G610M, SM-G610M/DS |
| **EUT Type:** | Portable Handset |
| **FCC Classification:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FCC Rule Part(s):** | §2 §22(H) §24(E) §27(L) |
| **Test Procedure(s):** | ANSI/TIA-603-D-2010, KDB 971168 D01 v02r02 |
| **Test Device Serial No.:** | *identical prototype* [S/N: 01044] |

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



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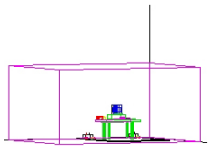
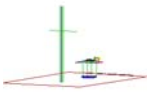


# MEASUREMENT REPORT
## FCC Part 22, 24, & 27



## §2.1033 General Information

| | |
|---|---|
| **APPLICANT:** | Samsung Electronics Co., Ltd. |
| **APPLICANT ADDRESS:** | 129, Samsung-ro,<br>Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea |
| **TEST SITE:** | PCTEST ENGINEERING LABORATORY, INC. |
| **TEST SITE ADDRESS:** | 7185 Oakland Mills Road, Columbia, MD 21046 USA |
| **FCC RULE PART(S):** | §2 §22(H) §24(E) §27(L) |
| **BASE MODEL:** | SM-G610M, SM-G610M/DS |
| **FCC ID:** | A3LSMG610M |
| **FCC CLASSIFICATION:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **MODE:** | GSM / EDGE / WCDMA |
| **FREQUENCY TOLERANCE:** | ±0.00025 % (2.5 ppm) |
| **Test Device Serial No.:** | 01044 ☐ Production ☒ Pre-Production ☐ Engineering |
| **DATE(S) OF TEST:** | 8/23 - 9/8/2016 |
| **TEST REPORT S/N:** | 0Y1608291506.A3L |

## Test Facility / Accreditations

**Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.**

- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.

- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GPRS, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.



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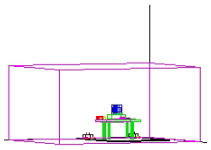

# MEASUREMENT REPORT
## FCC Part 22, 24, & 27

| Mode | FCC Rule Part | Tx Frequency (MHz) | ERP/EIRP | | Emission Designator |
|---|---|---|---|---|---|
| | | | Max. Power (W) | Max. Power (dBm) | |
| GPRS850 | 22H | 824.2 - 848.8 | 0.890 | 29.49 | 236KGXW |
| EDGE850 | 22H | 824.2 - 848.8 | 0.388 | 25.88 | 239KG7W |
| GPRS1900 | 24E | 1850.2 - 1909.8 | 1.574 | 31.97 | 238KGXW |
| EDGE1900 | 24E | 1850.2 - 1909.8 | 0.459 | 26.62 | 248KG7W |
| WCDMA850 | 22H | 826.4 - 846.6 | 0.115 | 20.60 | 4M12F9W |
| WCDMA1700 | 27 | 1712.4 - 1752.6 | 0.319 | 25.04 | 4M13F9W |
| WCDMA1900 | 24E | 1852.4 - 1907.6 | 0.269 | 24.29 | 4M15F9W |

**EUT Overview**



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# 1.0 INTRODUCTION

## 1.1 Scope

Measurement and determination of electromagnetic emissions (EME) 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 Industry Canada Certification and Engineering Bureau.

## 1.2 Testing Facility

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (*See Figure 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39º 10'23" N latitude and 76º 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

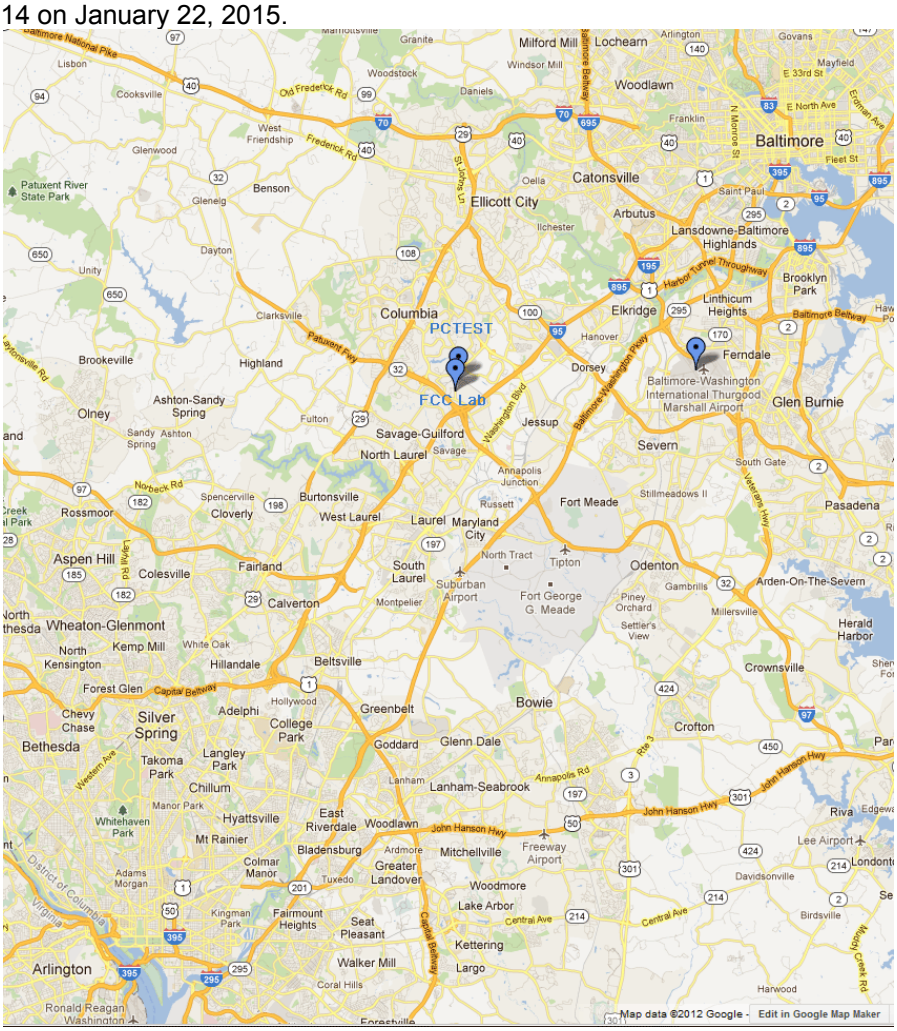


**Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area**



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# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Electronics Co., Ltd. Portable Handset FCC ID: A3LSMG610M**. The test data contained in this report pertains only to the emissions due to the EUT's 2G/3G licensed transmitters.

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, Bluetooth (1x, EDR, LE), ANT+

## 2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-D-2010 and KDB 971168 D01 v02r02. 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.


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# 3.0 DESCRIPTION OF TESTS

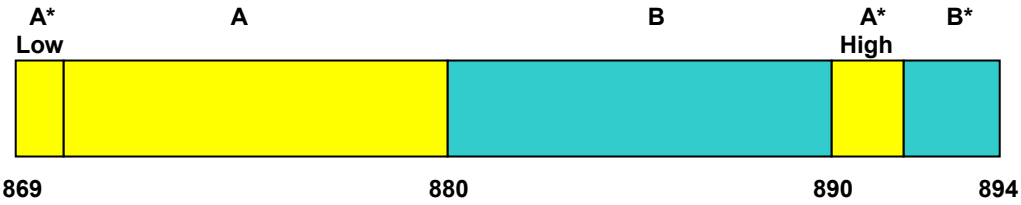
## 3.1 Evaluation Procedure

The measurement procedures described in the "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-D-2010) and "Measurement Guidance for Certification of Licensed Digital Transmitters" (KDB 971168 D01 v02r02) were used in the measurement of the EUT.

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

## 3.2 Cellular - Base Frequency Blocks

**§22.905**




**BLOCK 1: 869 – 880 MHz (A* Low + A)**

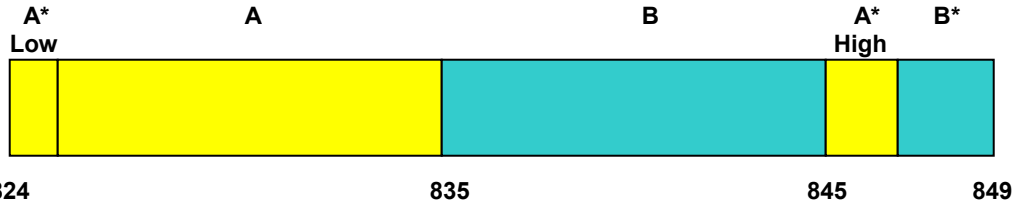
**BLOCK 2: 880 – 890 MHz (B)**

**BLOCK 3: 890 – 891.5 MHz (A* High)**

**BLOCK 4: 891.5 – 894 MHz (B*)**

## 3.3 Cellular - Mobile Frequency Blocks

**§22.905**




**BLOCK 1: 824 – 835 MHz (A* Low + A)**

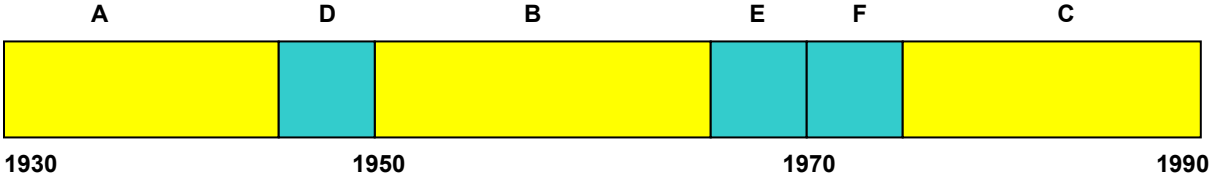
**BLOCK 2: 835 – 845 MHz (B)**

**BLOCK 3: 845 – 846.5 MHz (A* High)**

**BLOCK 4: 846.5 – 849 MHz (B*)**

## 3.4 PCS - Base Frequency Blocks

**§24.229**




**BLOCK 1: 1930 – 1945 MHz (A)**

**BLOCK 2: 1945 – 1950 MHz (D)**

**BLOCK 3: 1950 – 1965 MHz (B)**

**BLOCK 4: 1965 – 1970 MHz (E)**

**BLOCK 5: 1970 – 1975 MHz (F)**

**BLOCK 6: 1975 – 1990 MHz (C)**



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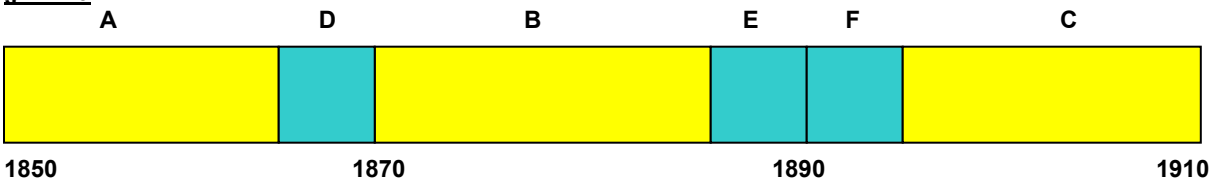
## 3.5 PCS - Mobile Frequency Blocks

§24.229




BLOCK 1: 1850 – 1865 MHz (A)

BLOCK 2: 1865 – 1870 MHz (D)

BLOCK 3: 1870 – 1885 MHz (B)

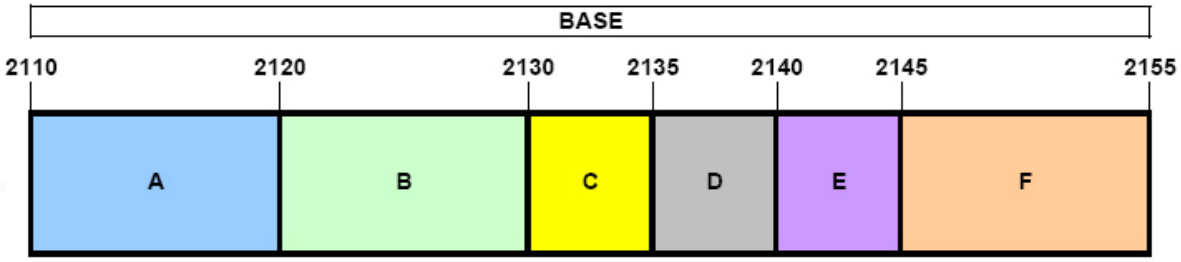
BLOCK 4: 1885 – 1890 MHz (E)

BLOCK 5: 1890 – 1895 MHz (F)

BLOCK 6: 1895 – 1910 MHz (C)

## 3.6 AWS - Base Frequency Blocks

§27.5(h)




BLOCK 1: 2110 – 2120 MHz (A)

BLOCK 2: 2120 – 2130 MHz (B)

BLOCK 3: 2130 – 2135 MHz (C)

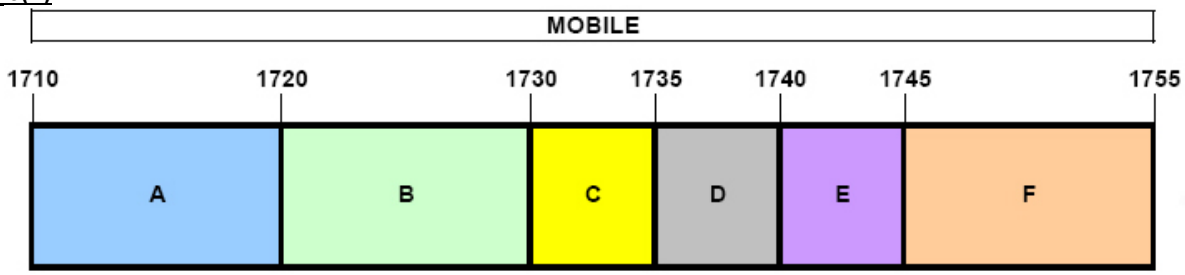
BLOCK 4: 2135 – 2140 MHz (D)

BLOCK 5: 2140 – 2145 MHz (E)

BLOCK 6: 2145 – 2155 MHz (F)

## 3.7 AWS - Mobile Frequency Blocks

§27.5(h)




BLOCK 1: 1710 – 1720 MHz (A)

BLOCK 2: 1720 – 1730 MHz (B)

BLOCK 3: 1730 – 1735 MHz (C)

BLOCK 4: 1735 – 1740 MHz (D)

BLOCK 5: 1740 – 1745 MHz (E)

BLOCK 6: 1745 – 1755 MHz (F)



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## 3.8 Radiated Measurements

**§2.1053 §22.913(a.2) §22.917(a) §24.232(c) §24.238(a) §27.50(d)(10) §27.53(h**

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. A 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm.

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.

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 $_{[dB]}$.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI/ITA-603-D-2010.


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# 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 data shown herein 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 |


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# 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 C63.5-2006.

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|---|---|---|---|---|---|---|
| - | LTx3 | LIcensed Transmitter Cable Set | 7/12/2016 | Annual | 7/12/2017 | LTx3 |
| - | RE1 | Radiated Emissions Cable Set (UHF/EHF) | 7/11/2016 | Annual | 7/11/2017 | RE1 |
| Agilent | N9020A | MXA Signal Analyzer | 11/5/2015 | Annual | 11/5/2016 | US46470561 |
| Agilent | E8267C | Vector Signal Generator | 1/28/2016 | Biennial | 1/28/2018 | US42340152 |
| Com-Power | PAM-103 | Pre-Amplifier (1-1000MHz) | 7/11/2016 | Annual | 7/11/2017 | 441128 |
| Emco | 6502 | Active Loop Antenna (10k - 30 MHz) | 8/9/2016 | Biennial | 8/9/2018 | 2936 |
| Emco | 3115 | Horn Antenna (1-18GHz) | 3/10/2016 | Biennial | 3/10/2018 | 9704-5182 |
| Espec | ESX-2CA | Environmental Chamber | 3/4/2016 | Annual | 3/4/2017 | 17620 |
| ETS Lindgren | 3117 | 1-18 GHz DRG Horn (Medium) | 4/26/2016 | Biennial | 4/26/2018 | 125518 |
| ETS Lindgren | 3164-08 | Quad Ridge Horn Antenna | 10/22/2014 | Biennial | 10/22/2016 | 128338 |
| Mini Circuits | PWR-SEN-4GHS | USB Power Sensor | 3/4/2016 | Annual | 3/4/2017 | 11401010036 |
| Mini Circuits | TVA-11-422 | RF Power Amp | N/A | | | QA1317001 |
| Mini-Circuits | SSG-4000HP | Synthesized Signal Generator | N/A | | | 11208010032 |
| PCTEST | - | EMC Switch System | 7/11/2016 | Annual | 7/11/2017 | NM1 |
| Rhode & Schwarz | TS-PR18 | Pre-Amplifier | 7/6/2016 | Annual | 7/6/2017 | 101622 |
| Rohde & Schwarz | FSW67 | Signal / Spectrum Analyzer | 7/27/2016 | Annual | 7/27/2017 | 103200 |
| Rohde & Schwarz | CMU200 | Base Station Simulator | 6/2/2016 | Annual | 6/2/2017 | 109892 |
| Rohde & Schwarz | ESU40 | EMI Test Receiver (40GHz) | 7/15/2016 | Annual | 7/15/2017 | 100348 |
| Rohde & Schwarz | TS-PR26 | 18-26.5 GHz Pre-Amplifier | 3/7/2016 | Annual | 3/7/2017 | 100040 |
| Schwarzbeck | UHA 9105 | Dipole Antenna (400 - 1GHz) Rx | 11/18/2015 | Biennial | 11/18/2017 | 91052523RX |
| Seekonk | NC-100 | Torque Wrench 5/16", 8" lbs | 3/2/2016 | Biennial | 3/2/2018 | N/A |
| Sunol | JB5 | Bi-Log Antenna (30M - 5GHz) | 3/14/2016 | Biennial | 3/14/2018 | A051107 |
| Sunol Sciences | DRH-118 | Horn Antenna (1-18GHz) | 7/1/2015 | Biennial | 7/1/2017 | A060215 |

**Table 5-1. Test Equipment**

**Notes:**

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


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# 6.0 SAMPLE CALCULATIONS

## GPRS Emission Designator

**Emission Designator = 250KGXW**

GPRS BW = 250 kHz
G = Phase Modulation
X = Cases not otherwise covered
W = Combination (Audio/Data)

## EDGE Emission Designator

**Emission Designator = 250KG7W**

EDGE BW = 250 kHz
G = Phase Modulation
7 = Quantized/Digital Info
W = Combination (Audio/Data)

## WCDMA Emission Designator

**Emission Designator = 4M16F9W**

WCDMA BW = 4.16 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)

## 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.


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# 7.0 TEST RESULTS

## 7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMG610M

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

Mode(s): GSM / EDGE / WCDMA

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|
| **TRANSMITTER MODE (TX)** | | | | | |
| 2.1049 | Occupied Bandwidth | N/A | CONDUCTED | PASS | Section 7.2 |
| 2.1051<br>22.917(a)<br>24.238(a)<br>27.53(h) | Conducted Band Edge / Spurious Emissions | > 43 + $\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions | | PASS | Sections 7.3, 7.4 |
| 24.232(d) | Peak-Average Ratio | < 13 dB | | PASS | Section 7.5 |
| 2.1046 | Transmitter Conducted Output Power | N/A | | PASS | RF Exposure Report |
| 2.1055 22.355<br>24.235 27.54 | Frequency Stability | < 2.5 ppm (Part 22)<br>Emission must remain in band (Part 24, 27) | | PASS | Section 7.8 |
| 22.913(a.2) | Effective Radiated Power | < 7 Watts max. ERP | RADIATED | PASS | Section 7.6 |
| 24.232(c) | Equivalent Isotropic Radiated Power | < 2 Watts max. EIRP | | PASS | Section 7.6 |
| 27.50(d.4) | Equivalent Isotropic Radiated Power | < 1 Watts max. EIRP | | PASS | Section 7.6 |
| 2.1053<br>22.917(a)<br>24.238(a)<br>27.53(h) | Radiated Spurious Emissions | > 43 + $\log_{10}$ (P[Watts]) for all out-of-band emissions | | 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) 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 3.4.



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## 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 v02r02 – 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.

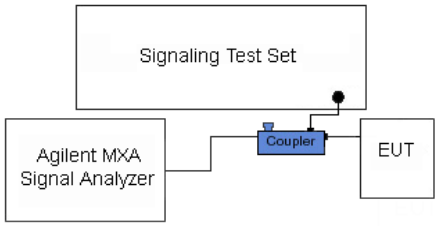


**Figure 7-1. Test Instrument & Measurement Setup**

### Test Notes

None.


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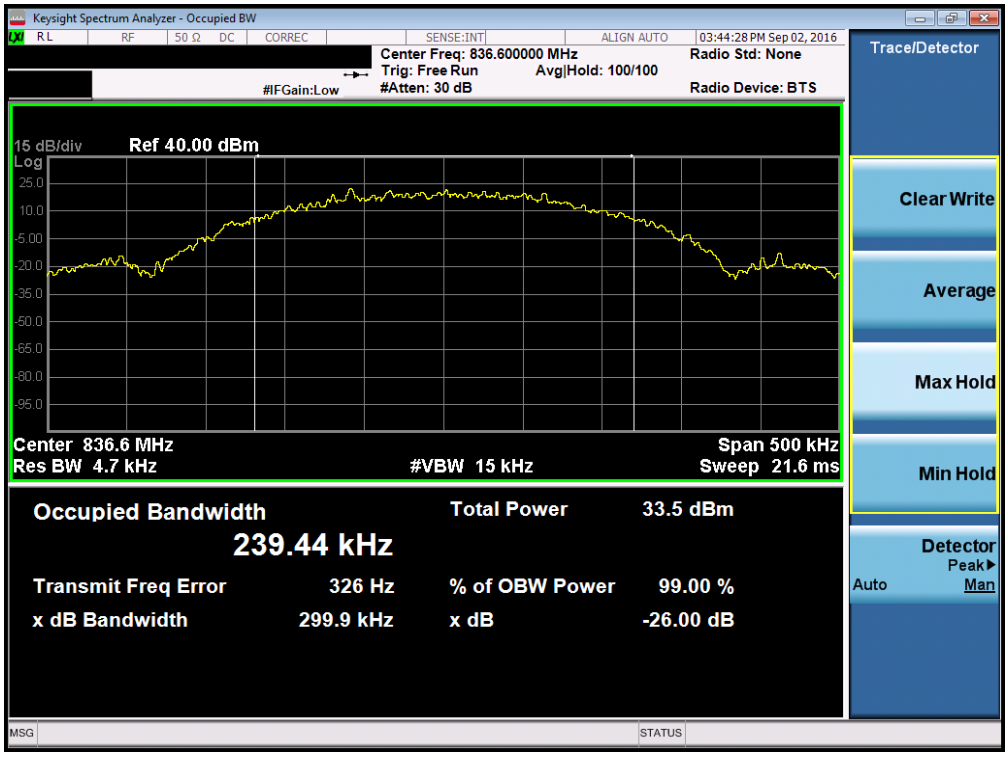
**Plot 7-1. Occupied Bandwidth Plot (Cellular GPRS Mode – Ch. 190)**




**Plot 7-2. Occupied Bandwidth Plot (EDGE850 Mode – Ch. 190)**



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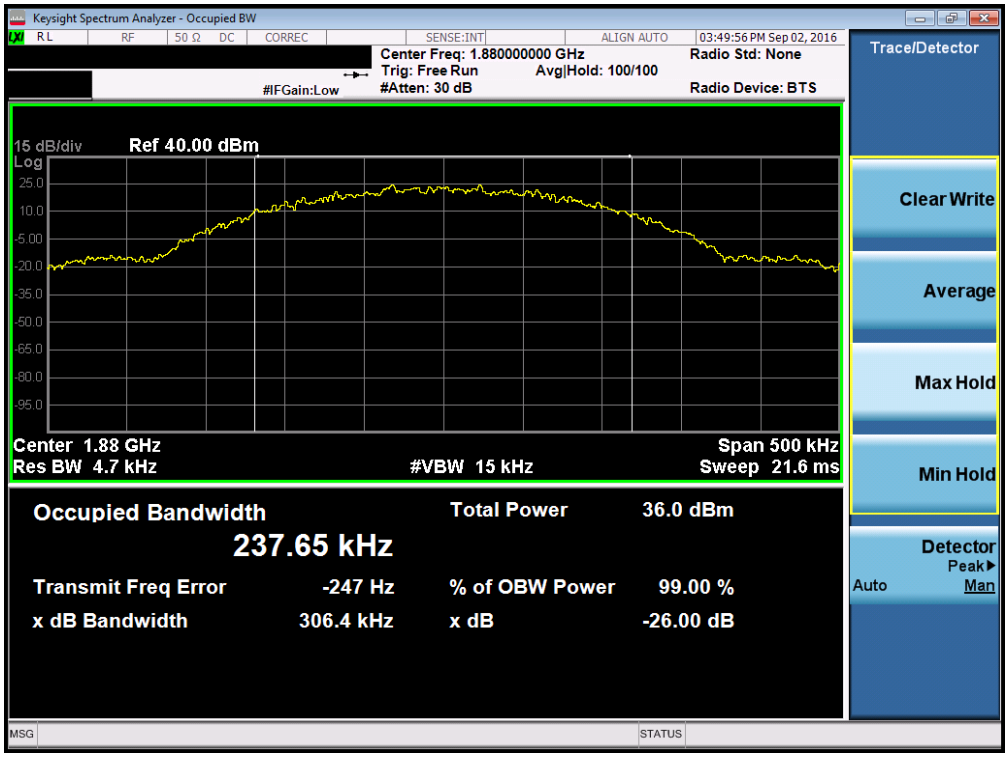


**Plot 7-3. Occupied Bandwidth Plot (PCS GPRS Mode – Ch. 661)**

**Plot 7-4. Occupied Bandwidth Plot (EDGE1900 Mode – Ch. 661)**



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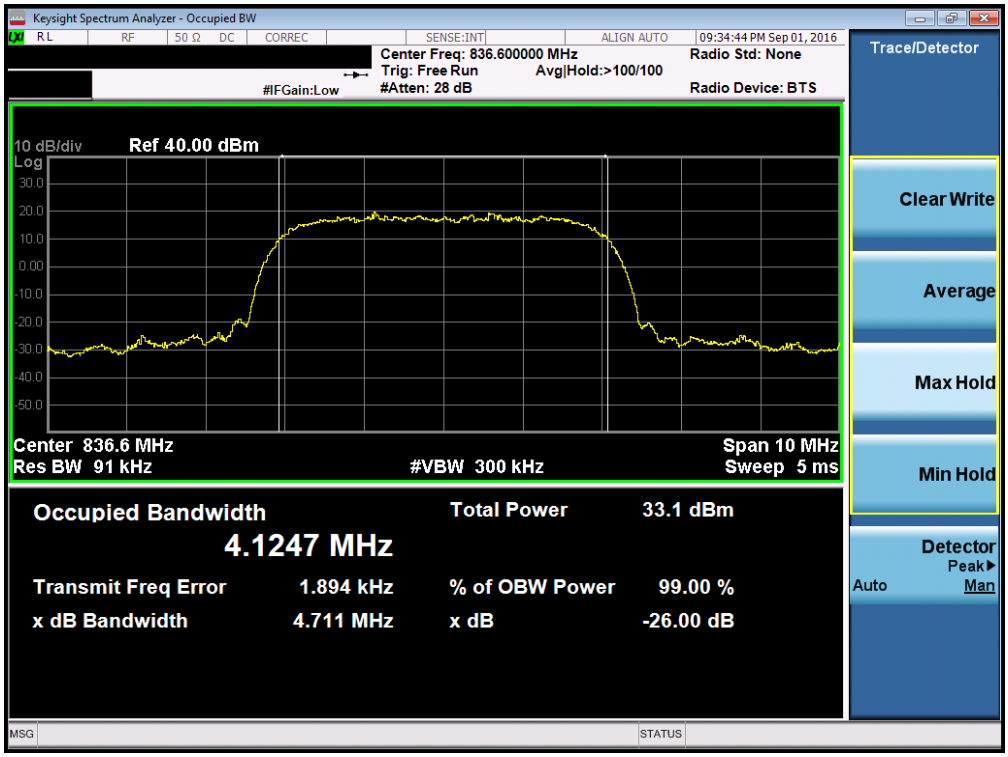


**Plot 7-5. Occupied Bandwidth Plot (Cellular WCDMA Mode – Ch. 4183)**

**Plot 7-6. Occupied Bandwidth Plot (AWS WCDMA Mode – Ch. 1412)**



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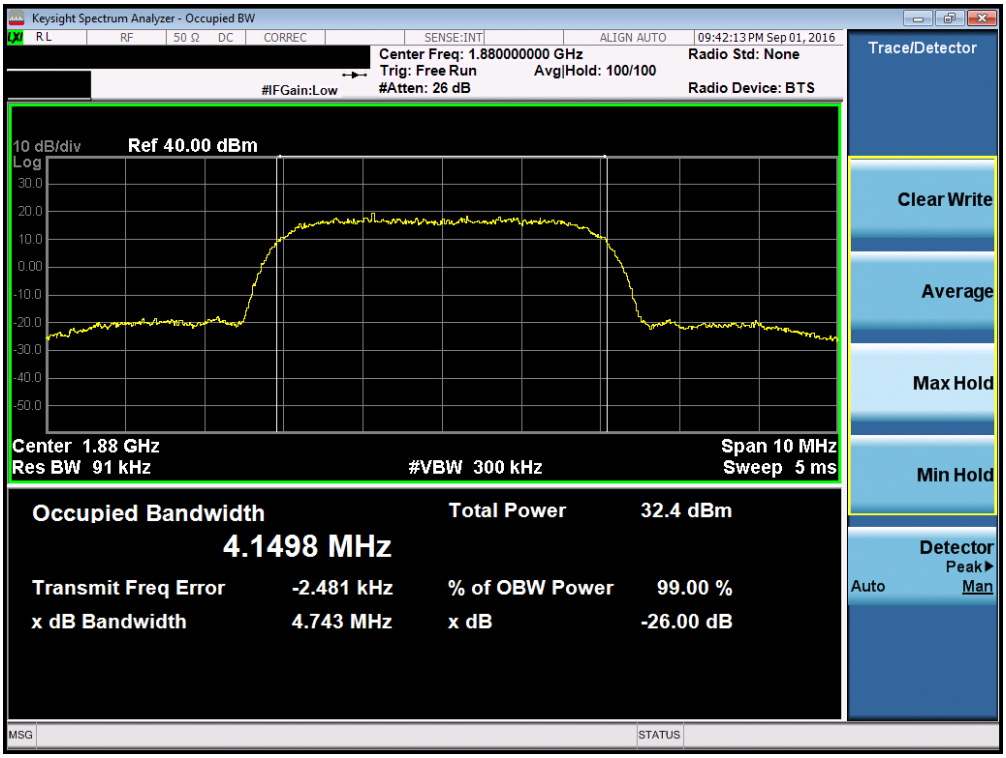


**Plot 7-7. Occupied Bandwidth Plot (PCS WCDMA Mode – Ch. 9400)**



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## 7.3 Spurious and Harmonic Emissions at Antenna Terminal

**§2.1051 §22.917(a) §24.238(a) §27.53(h)**

### 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 v02r02 – Section 6.0

### Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz for Cell, 20GHz for AWS, 20GHz for PCS (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.

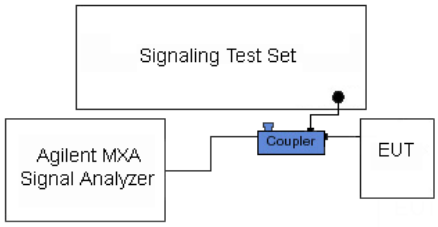


**Figure 7-2. Test Instrument & Measurement Setup**

### Test Notes

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 and 1 MHz or greater for Part 24, Part 27. 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.



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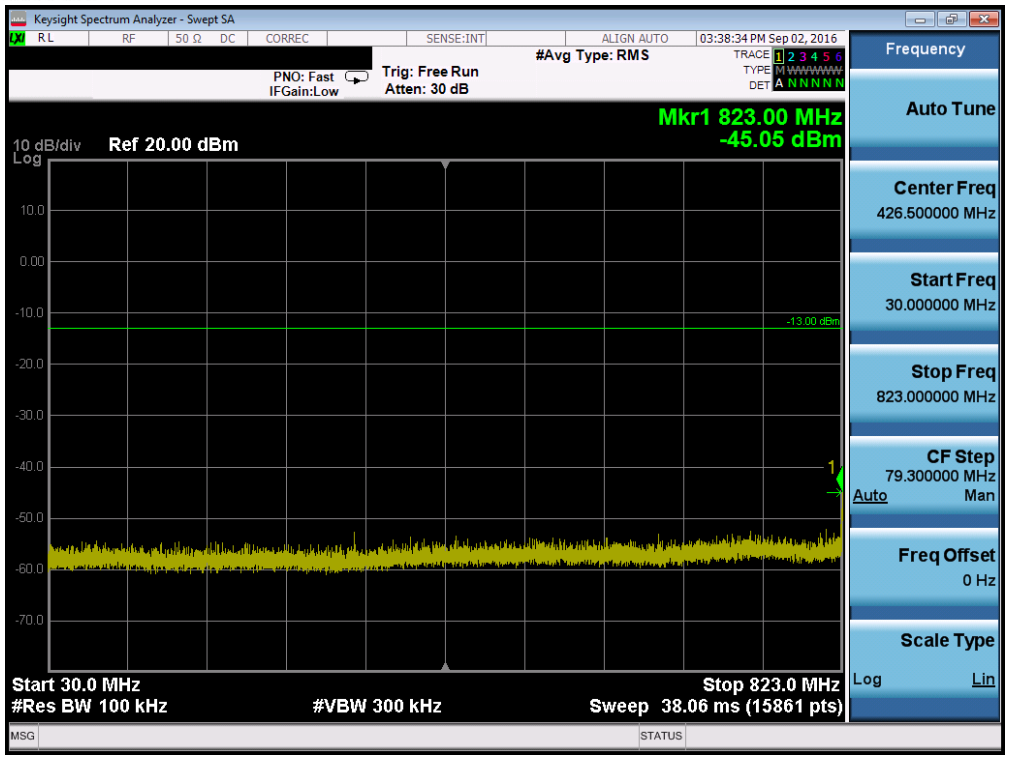
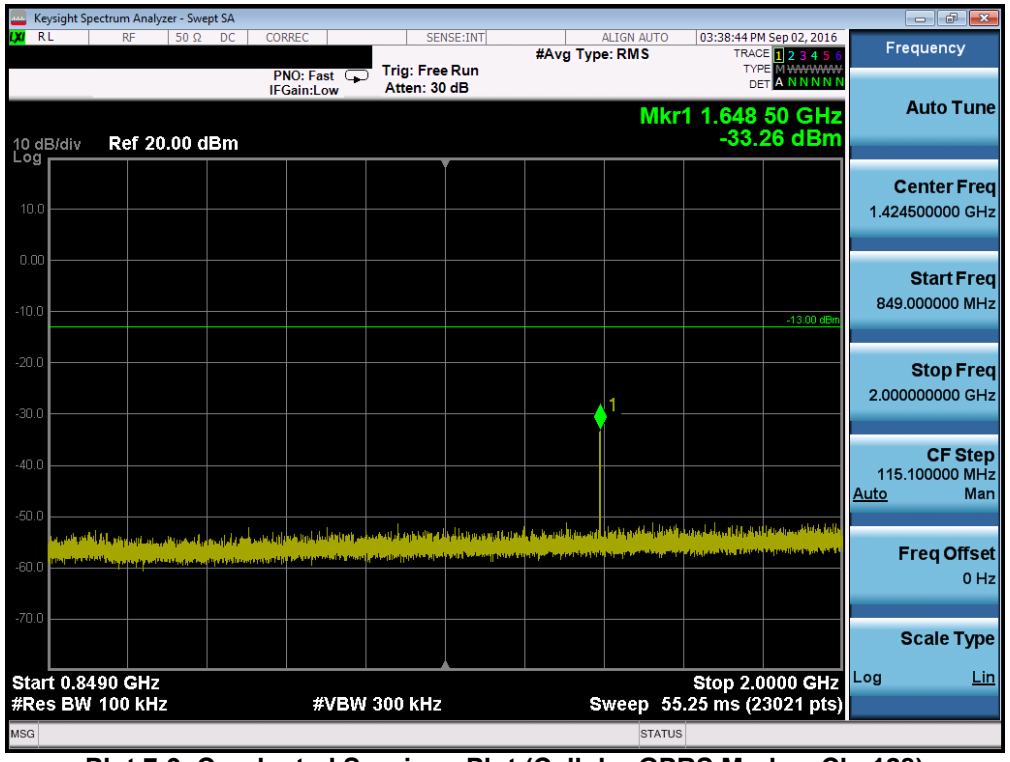



**Plot 7-8. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 128)**




**Plot 7-9. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 128)**



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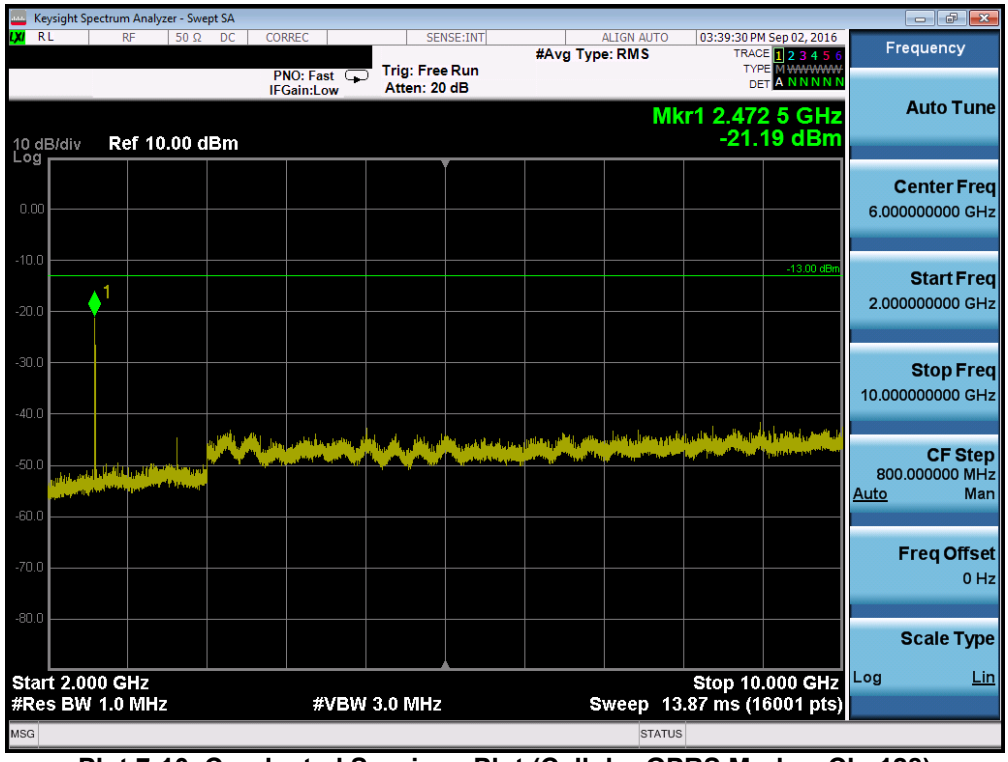
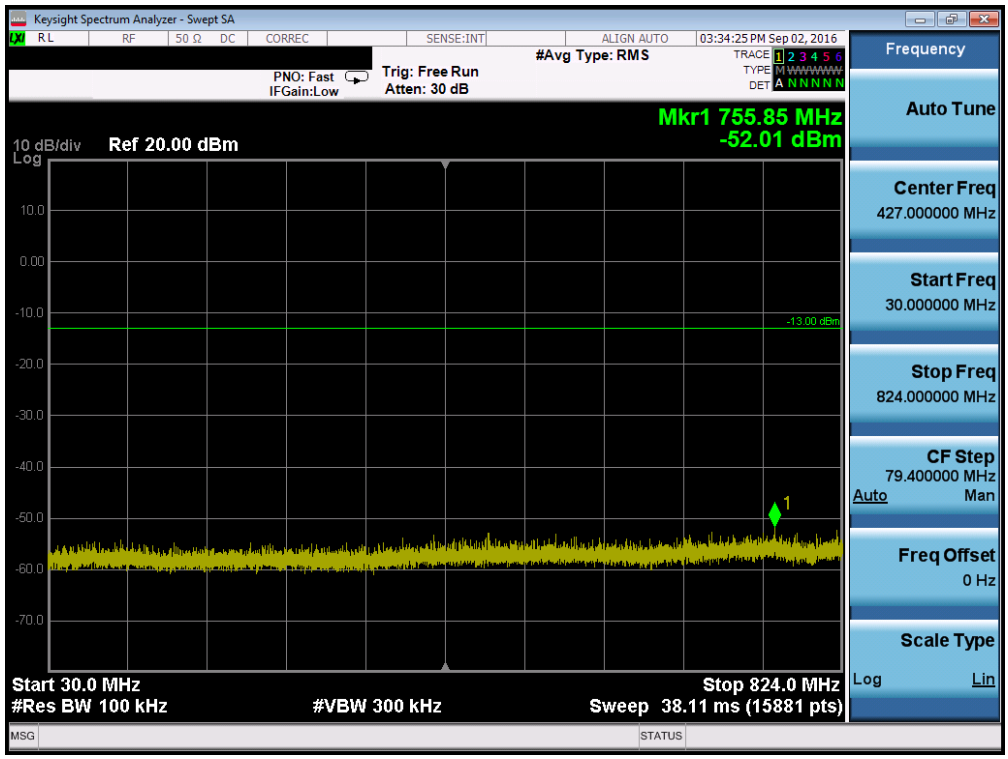



**Plot 7-10. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 128)**




**Plot 7-11. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 190)**



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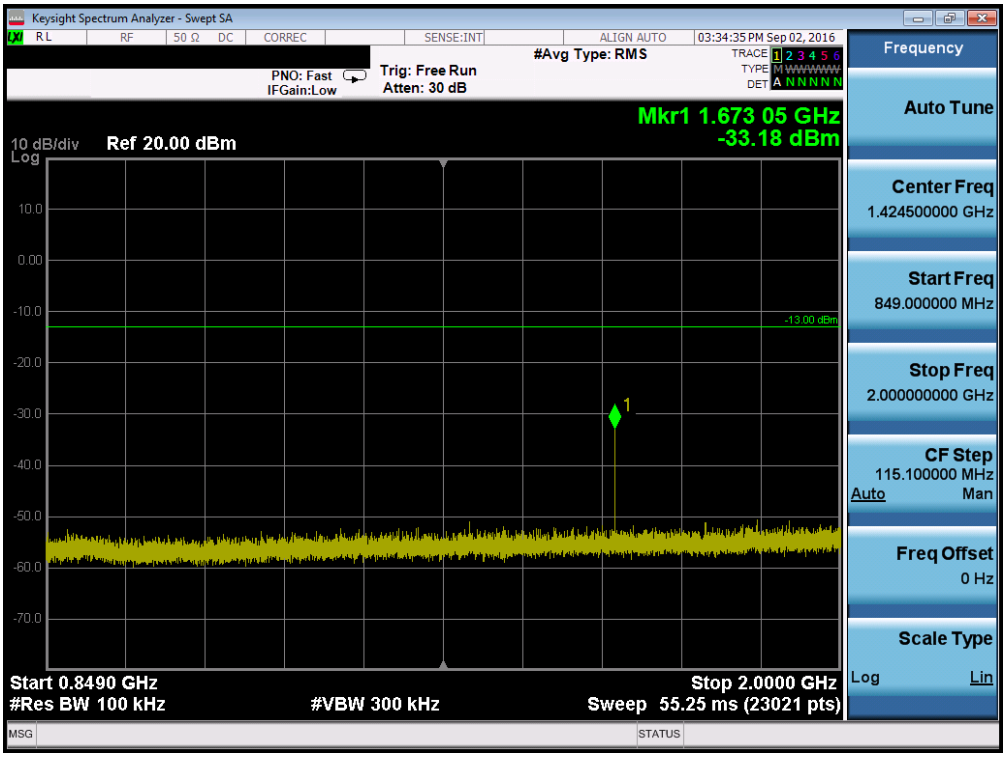
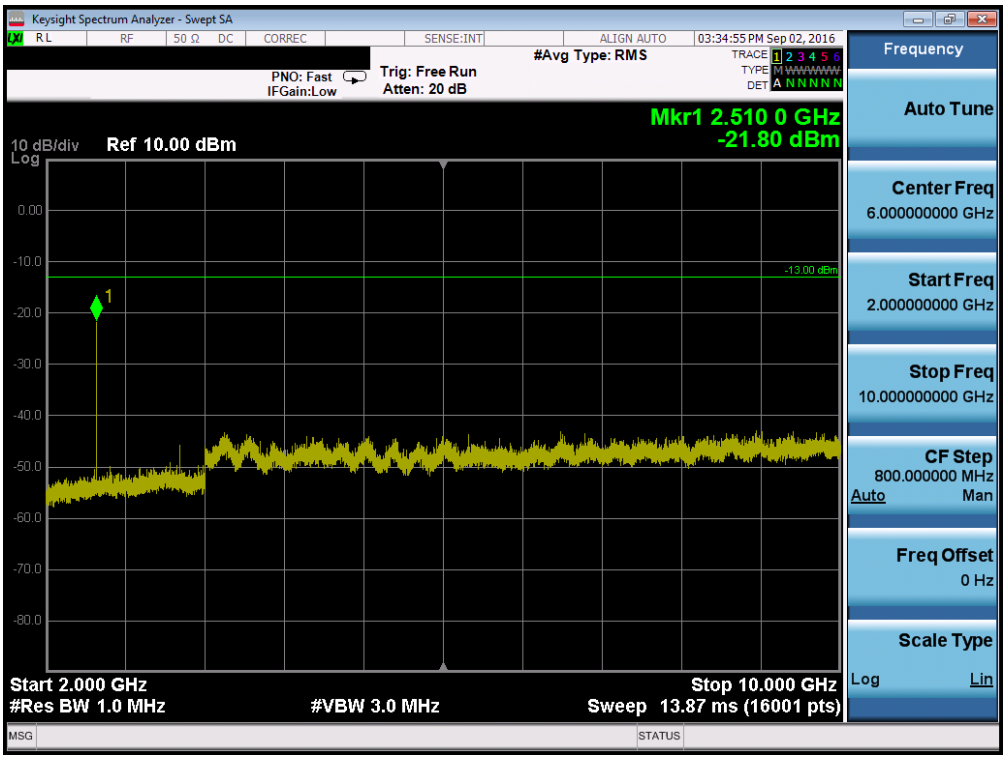



**Plot 7-12. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 190)**




**Plot 7-13. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 190)**



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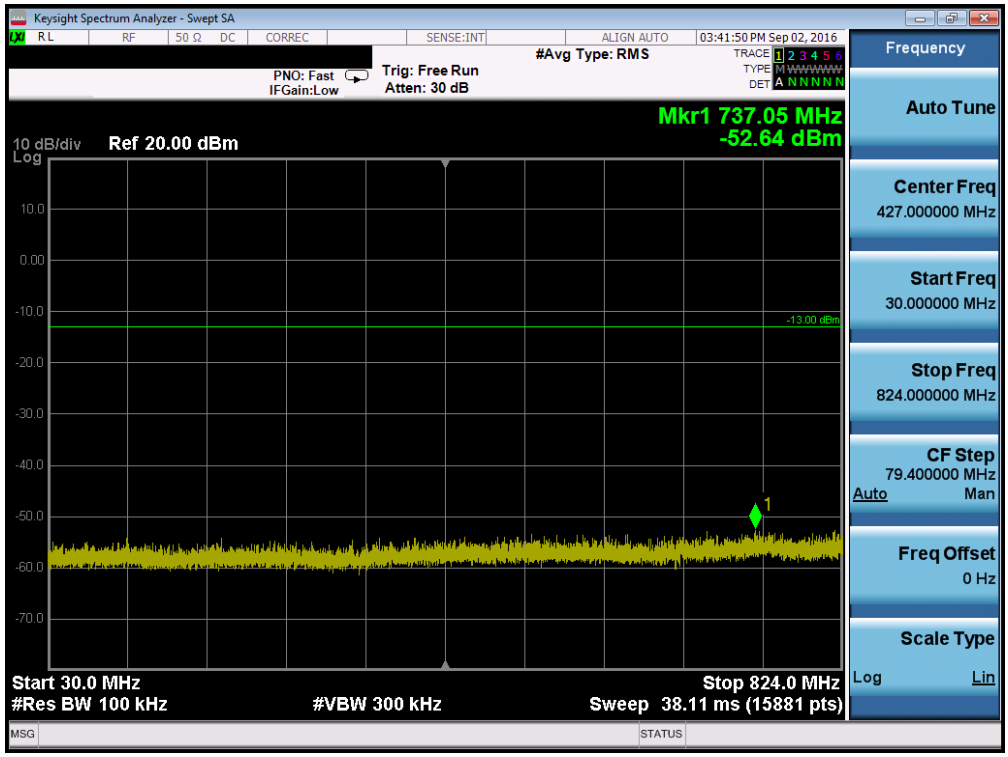
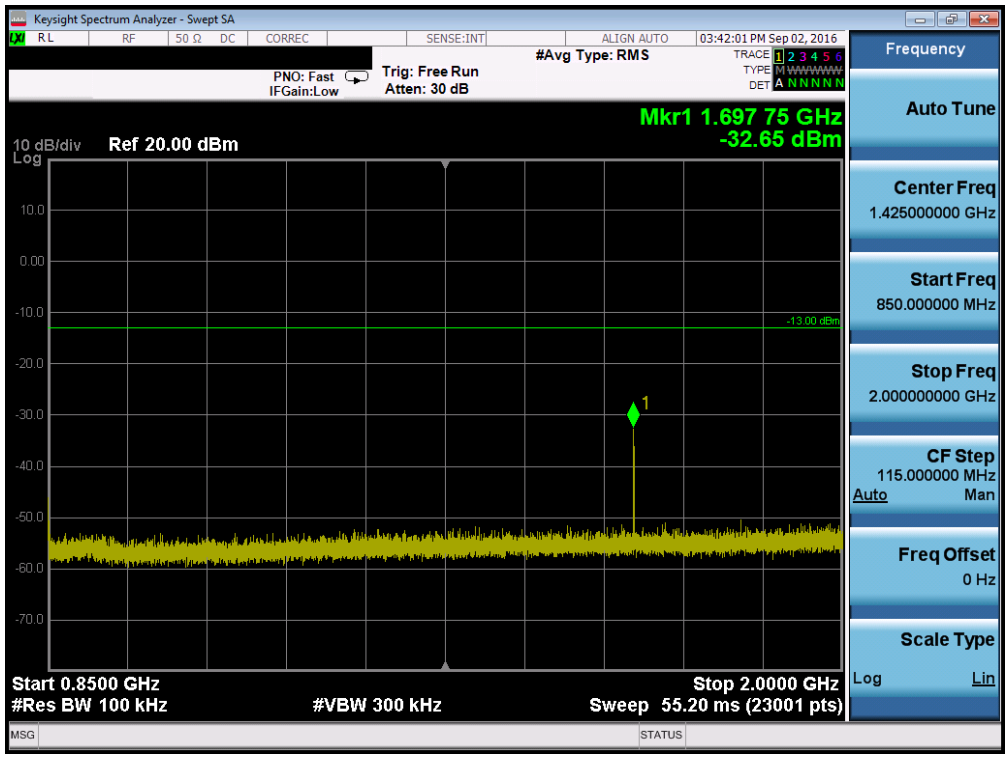



**Plot 7-14. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 251)**




**Plot 7-15. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 251)**



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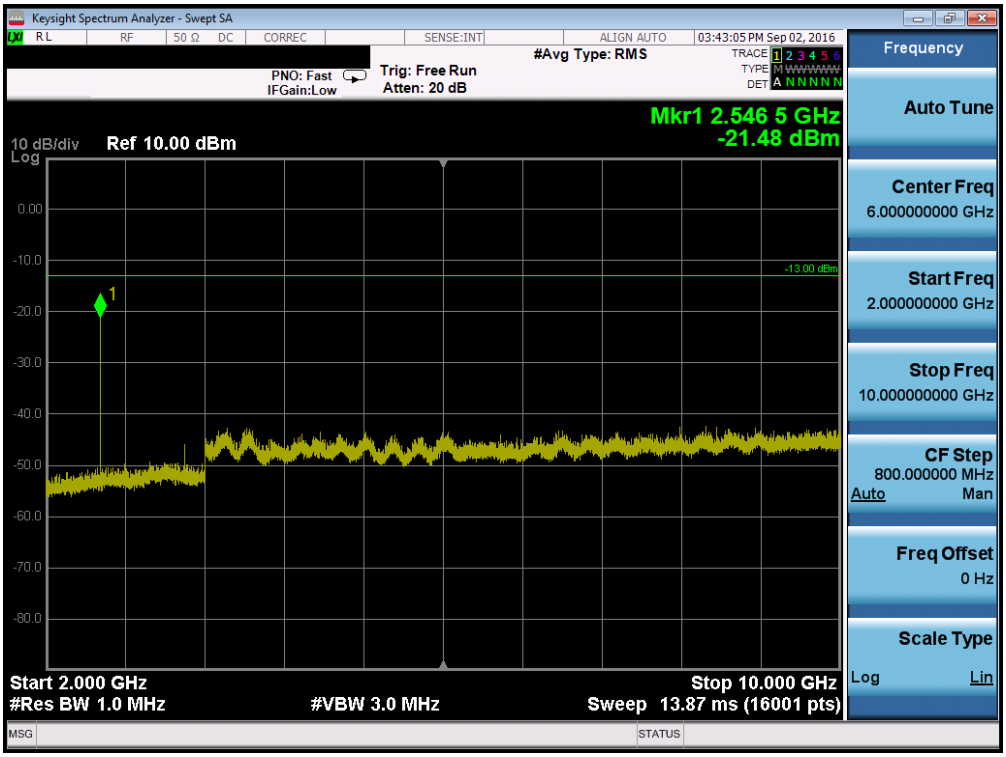
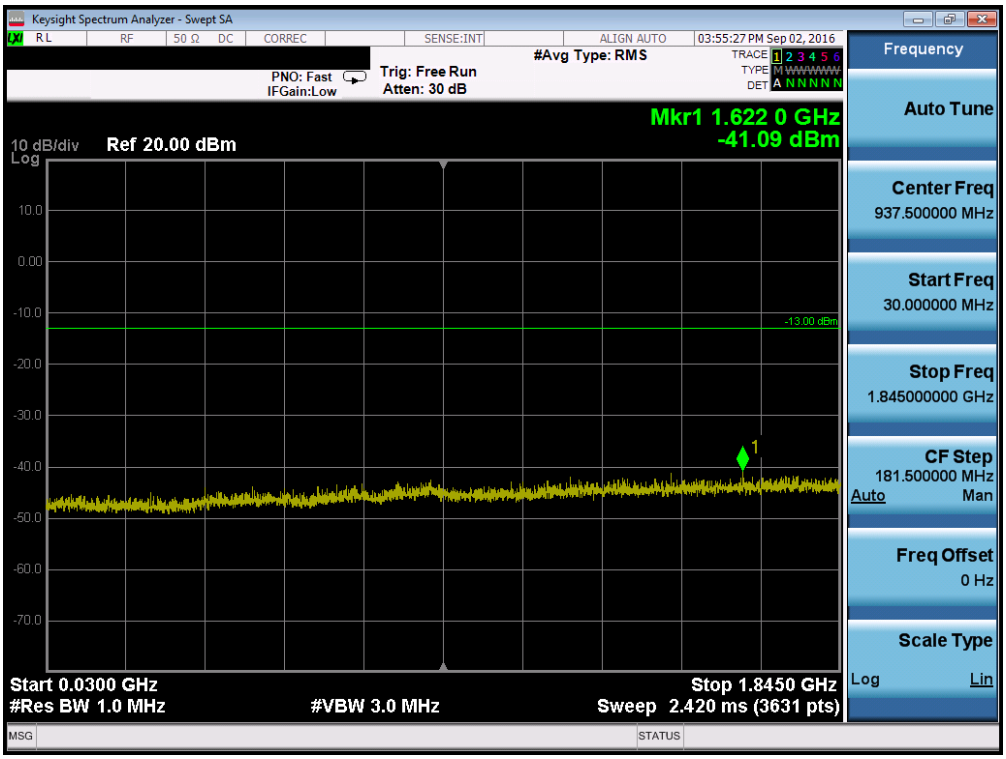



**Plot 7-16. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 251)**




**Plot 7-17. Conducted Spurious Plot (PCS GPRS Mode – Ch. 512)**



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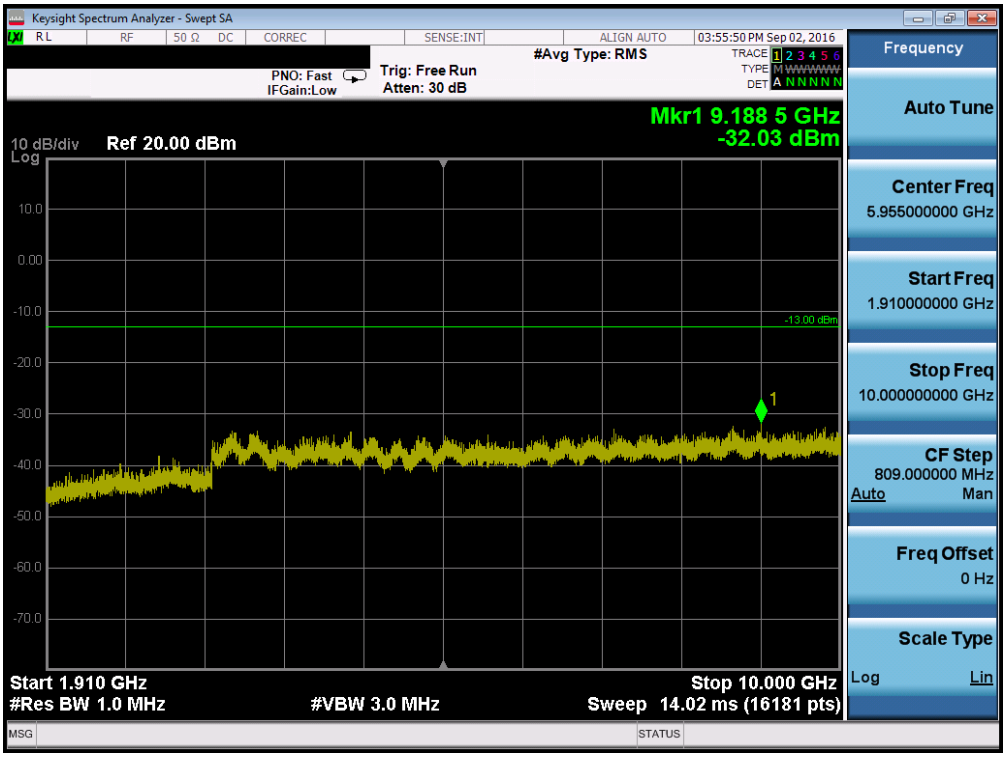
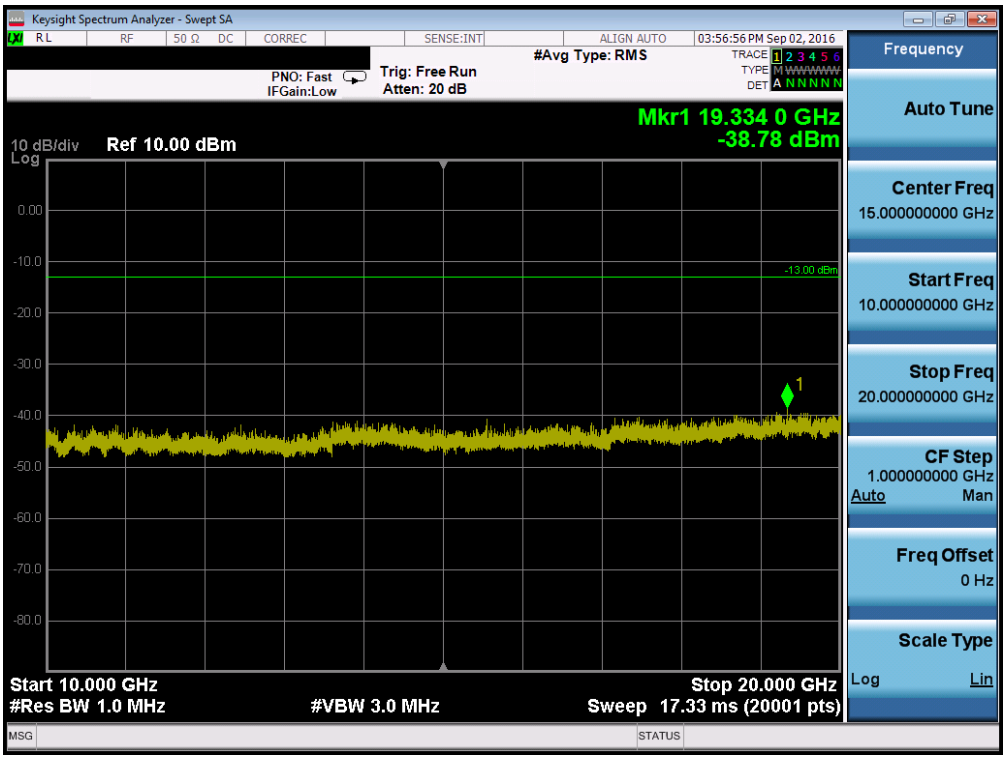



**Plot 7-18. Conducted Spurious Plot (PCS GPRS Mode – Ch. 512)**




**Plot 7-19. Conducted Spurious Plot (PCS GPRS Mode – Ch. 512)**



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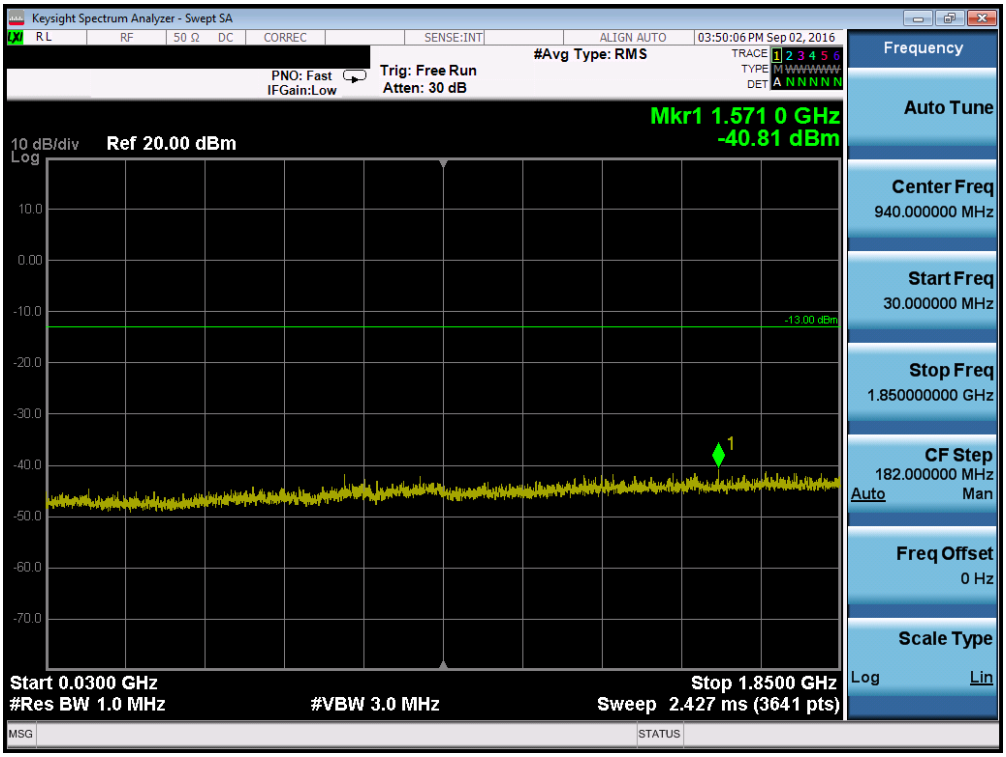
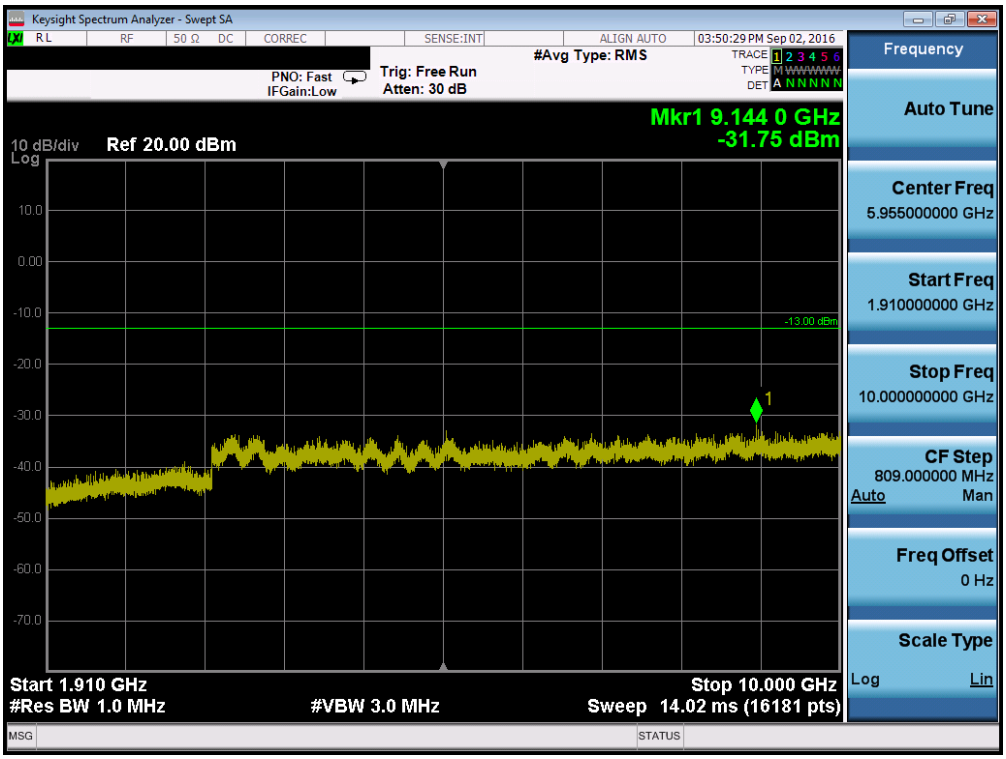



**Plot 7-20. Conducted Spurious Plot (PCS GPRS Mode – Ch. 661)**




**Plot 7-21. Conducted Spurious Plot (PCS GPRS Mode – Ch. 661)**



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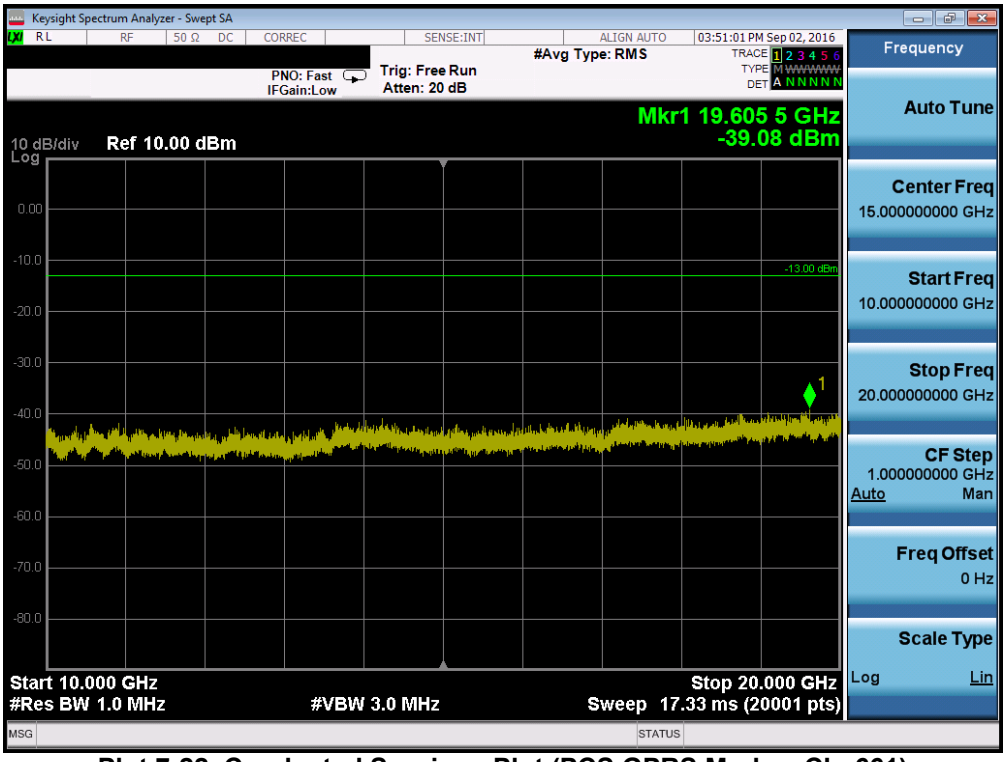
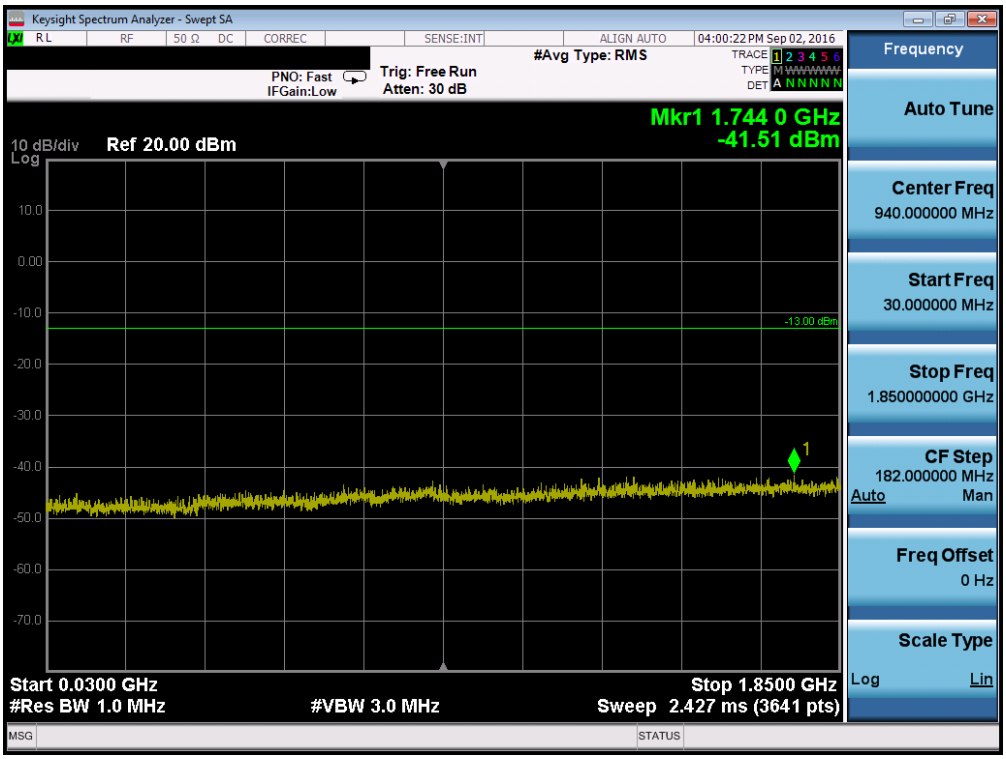



**Plot 7-22. Conducted Spurious Plot (PCS GPRS Mode – Ch. 661)**




**Plot 7-23. Conducted Spurious Plot (PCS GPRS Mode – Ch. 810)**



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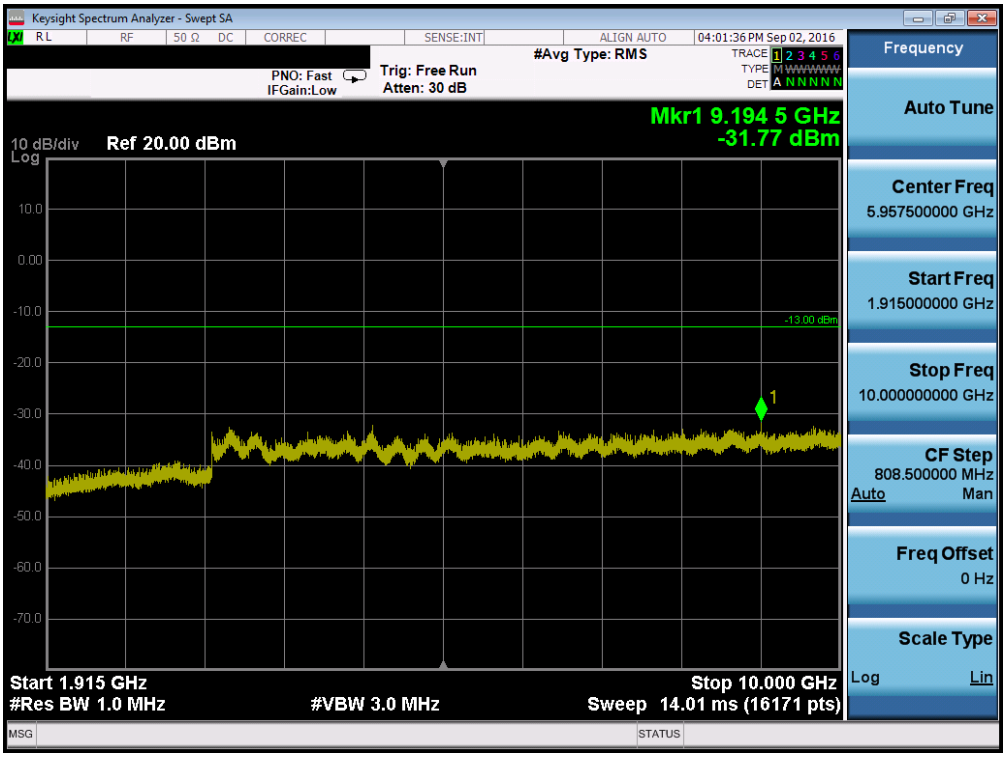
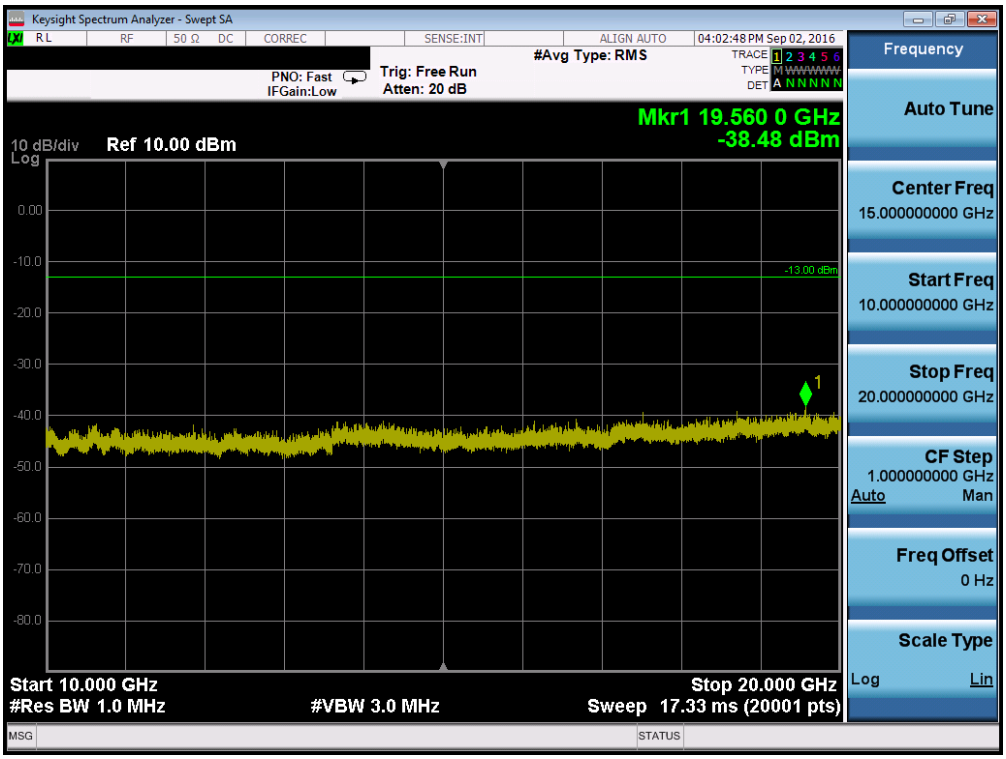



**Plot 7-24. Conducted Spurious Plot (PCS GPRS Mode – Ch. 810)**




**Plot 7-25. Conducted Spurious Plot (PCS GPRS Mode – Ch. 810)**



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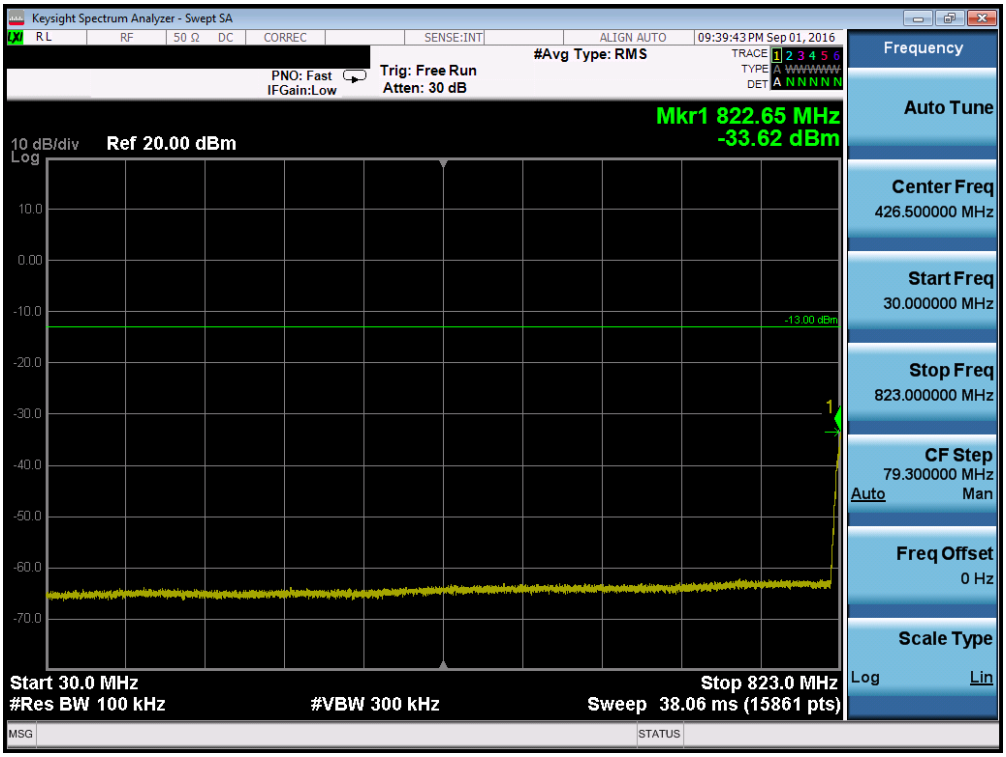
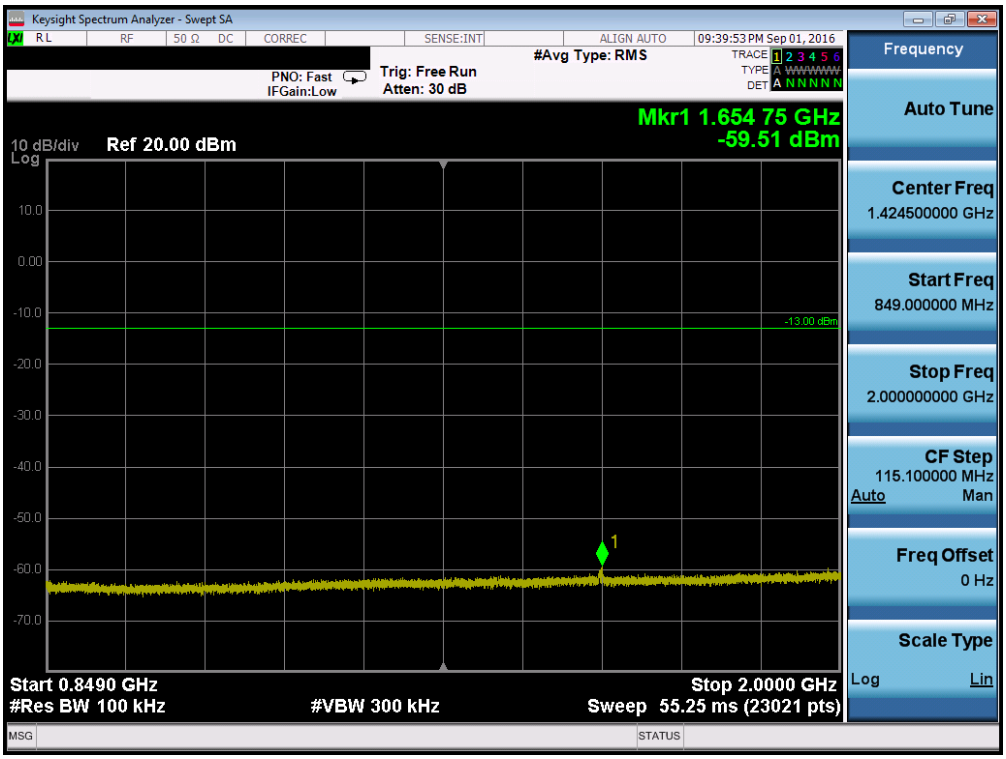



**Plot 7-26. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4132)**




**Plot 7-27. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4132)**



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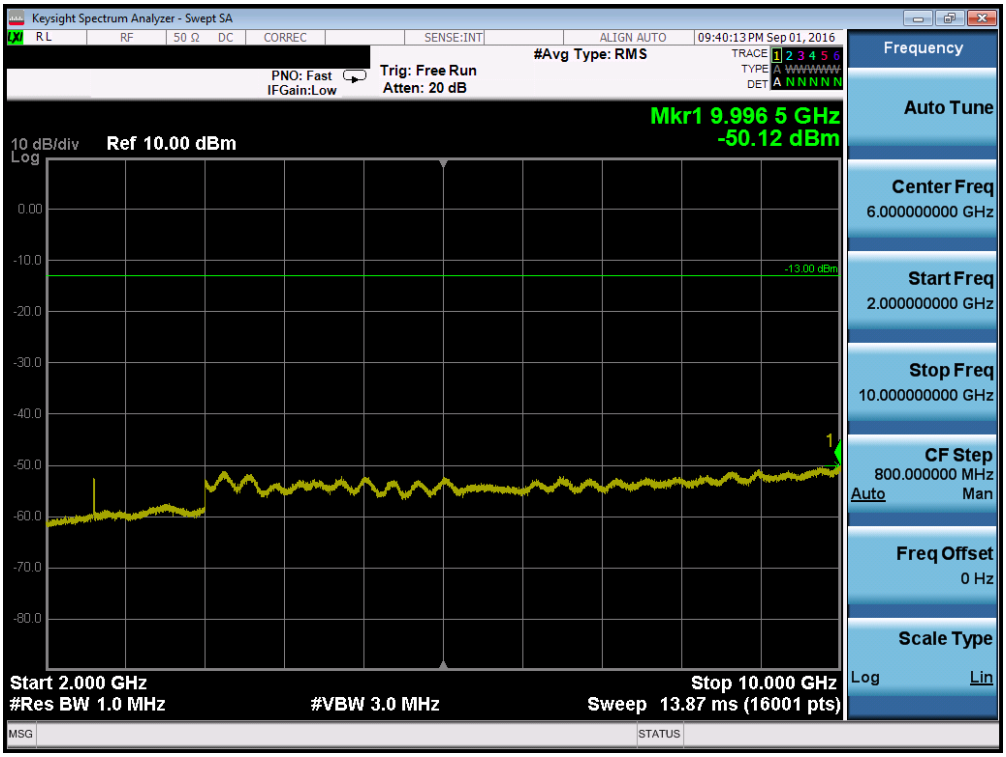
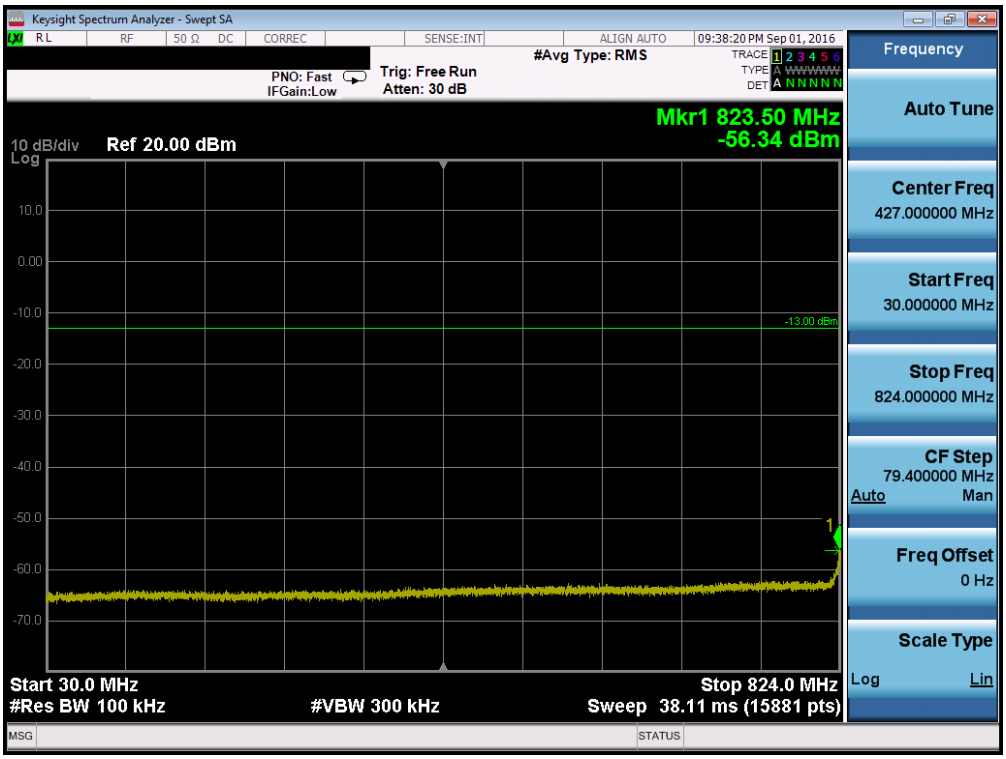



**Plot 7-28. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4132)**




**Plot 7-29. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4183)**



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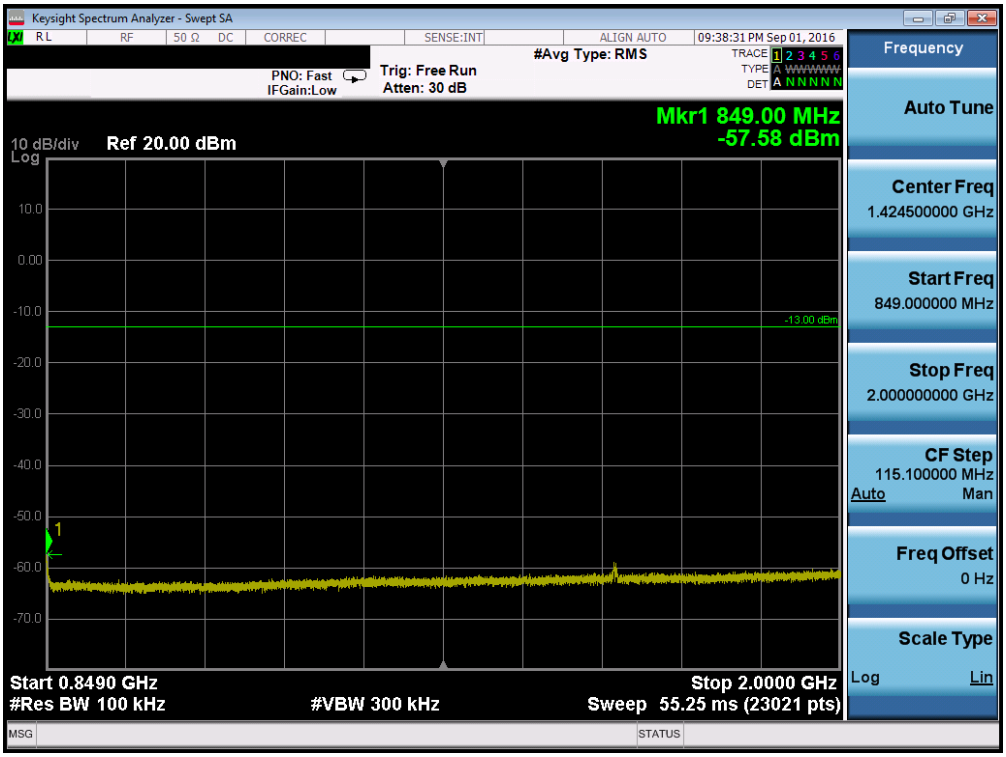
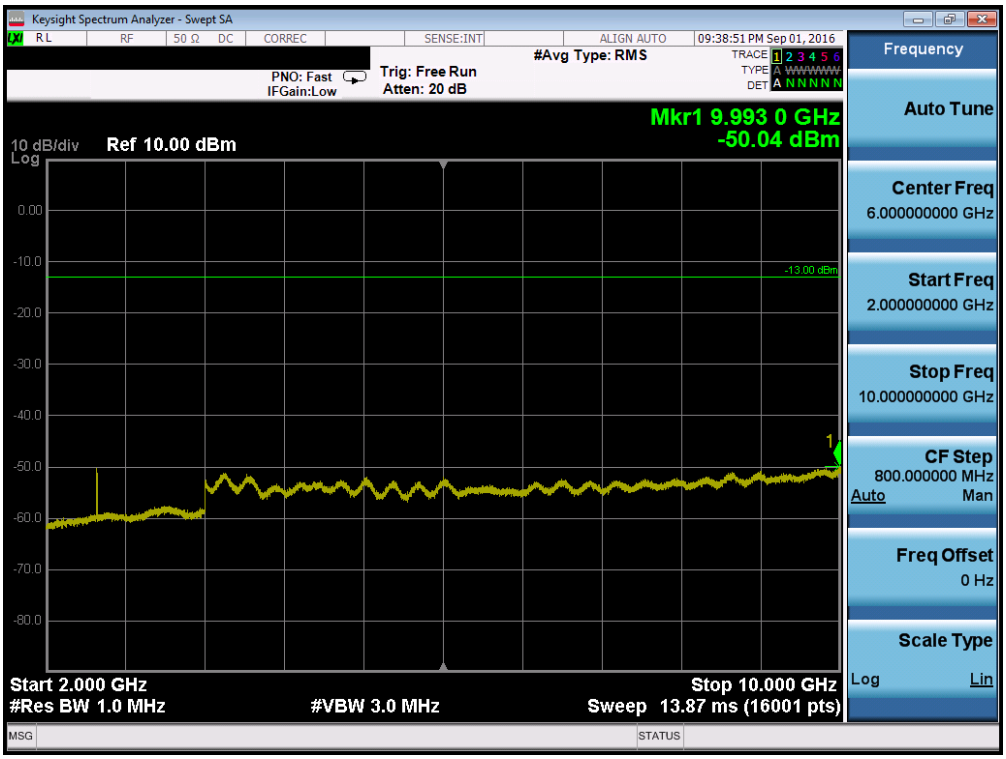



**Plot 7-30. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4183)**




**Plot 7-31. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4183)**



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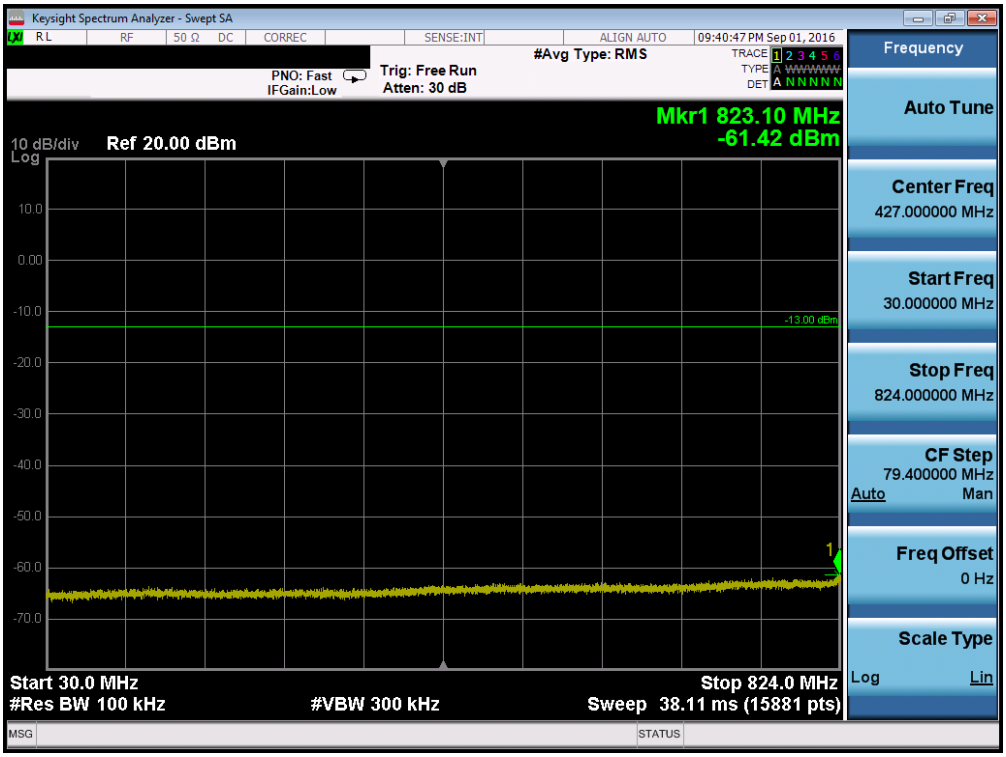
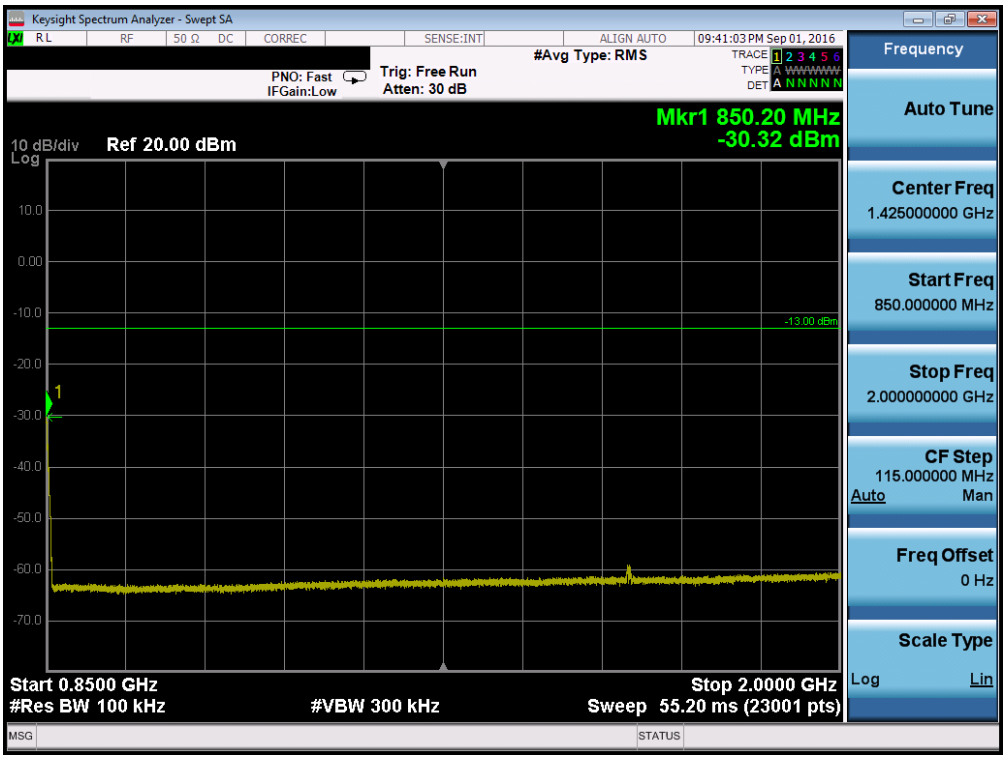



**Plot 7-32. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4233)**




**Plot 7-33. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4233)**



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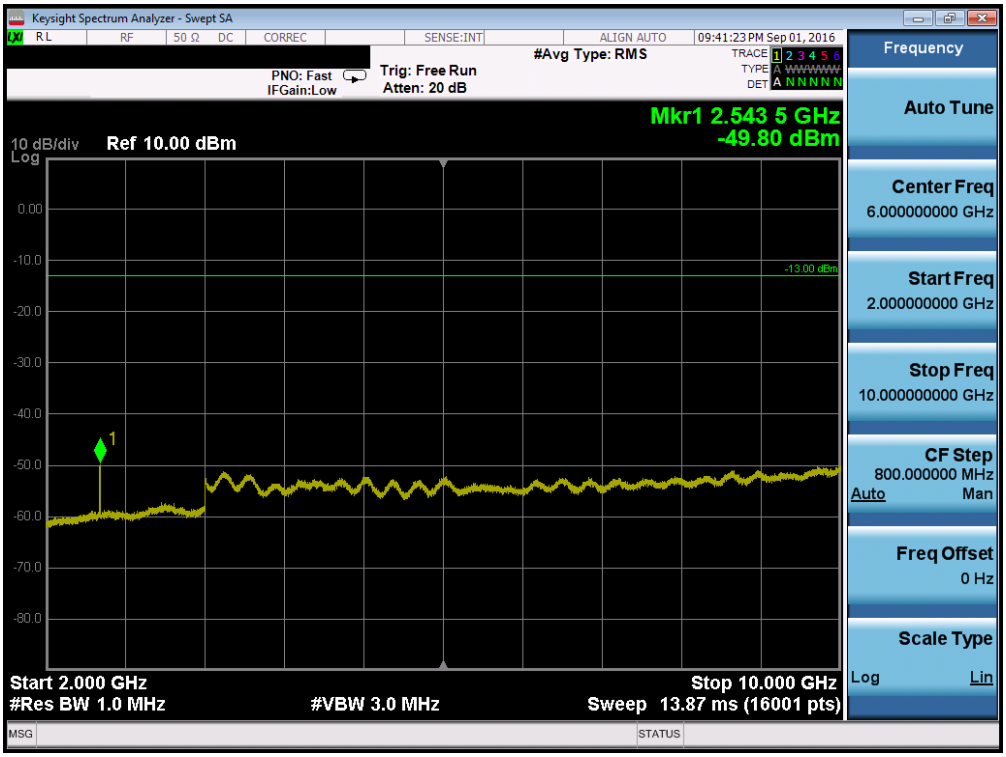
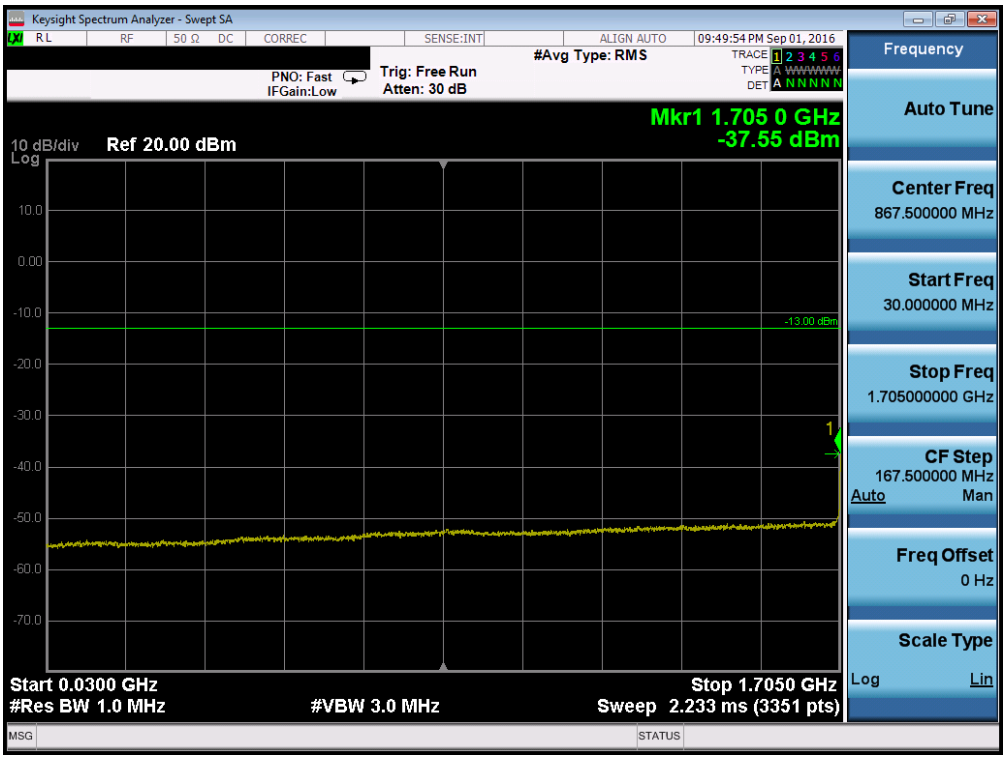



**Plot 7-34. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4233)**




**Plot 7-35. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1312)**



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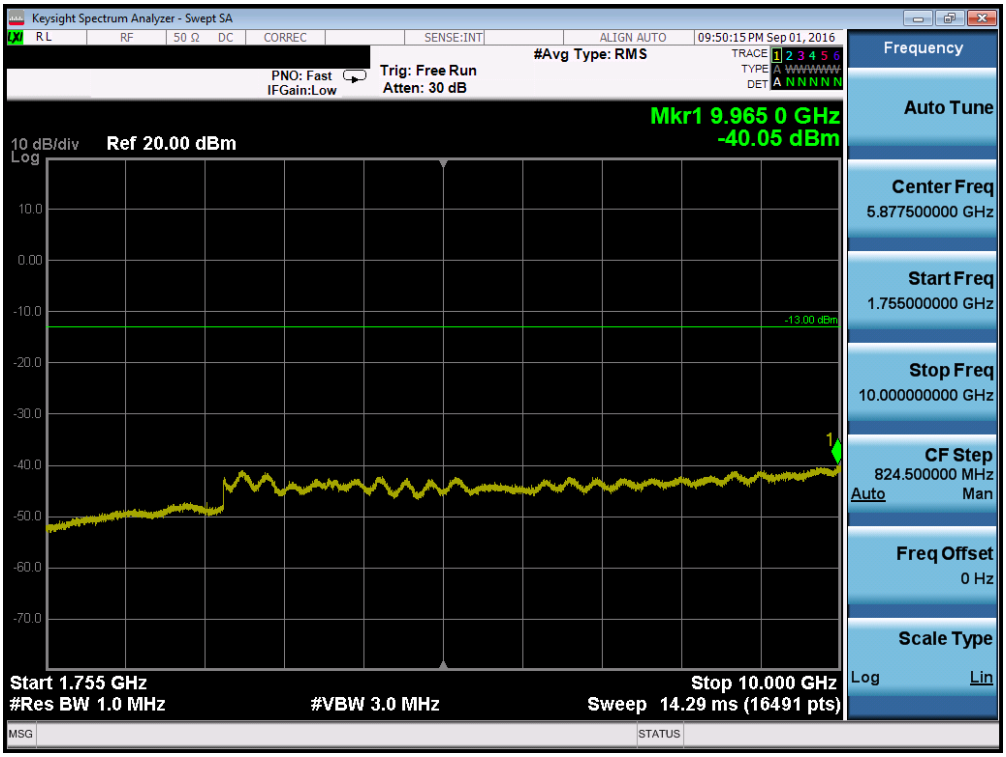
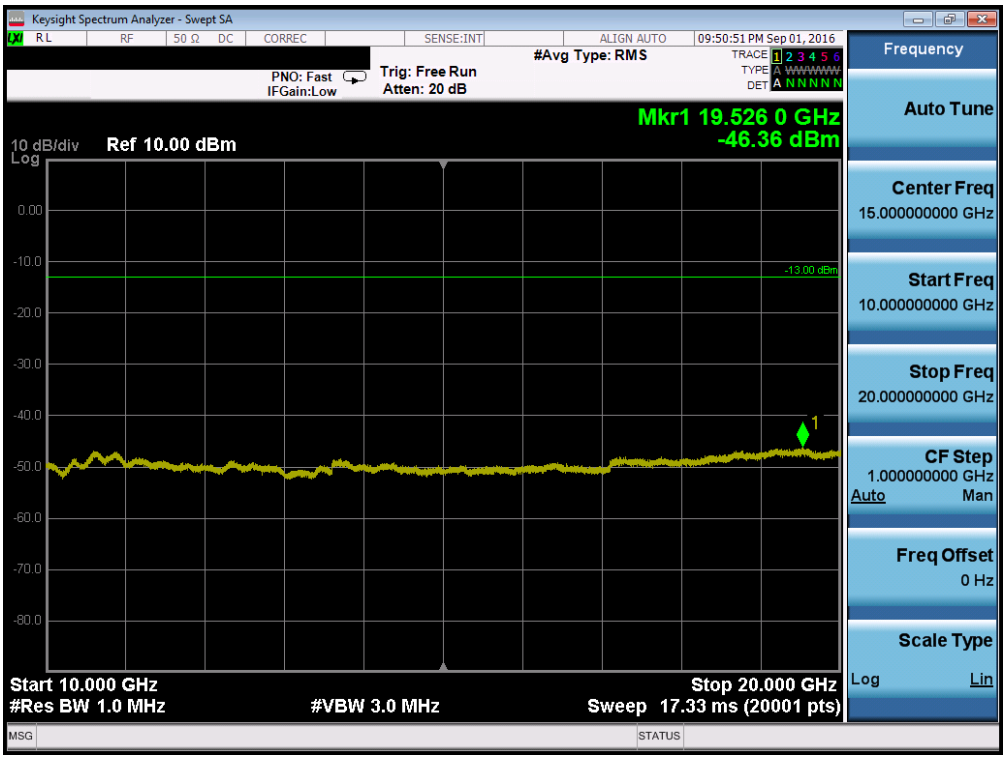



**Plot 7-36. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1312)**




**Plot 7-37. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1312)**



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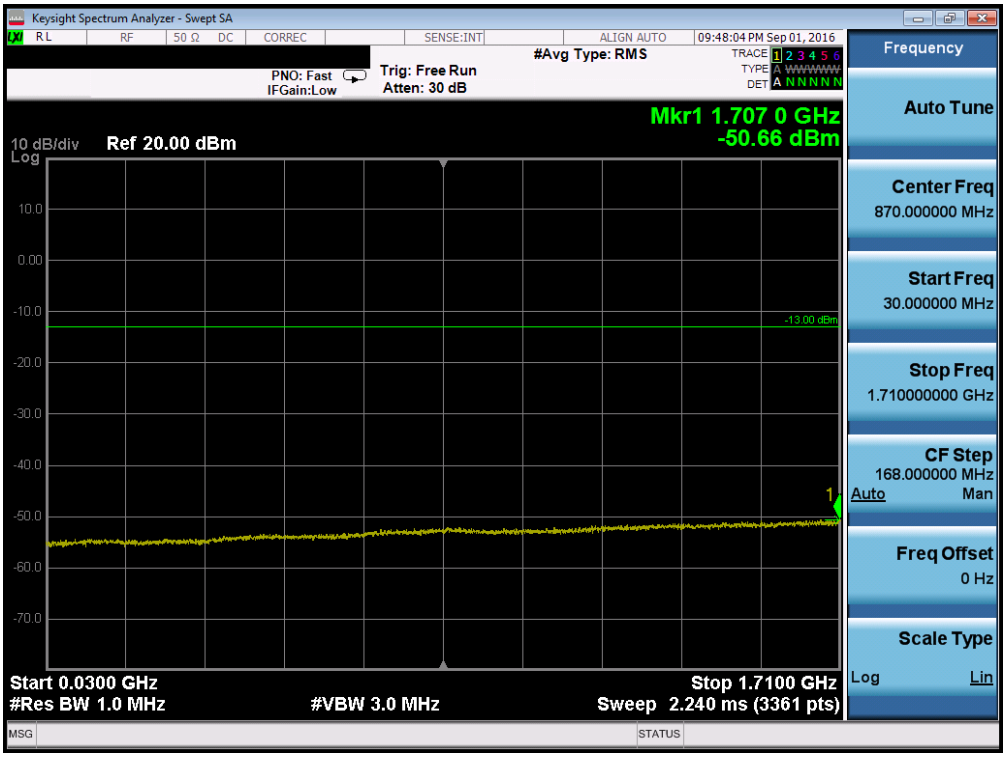
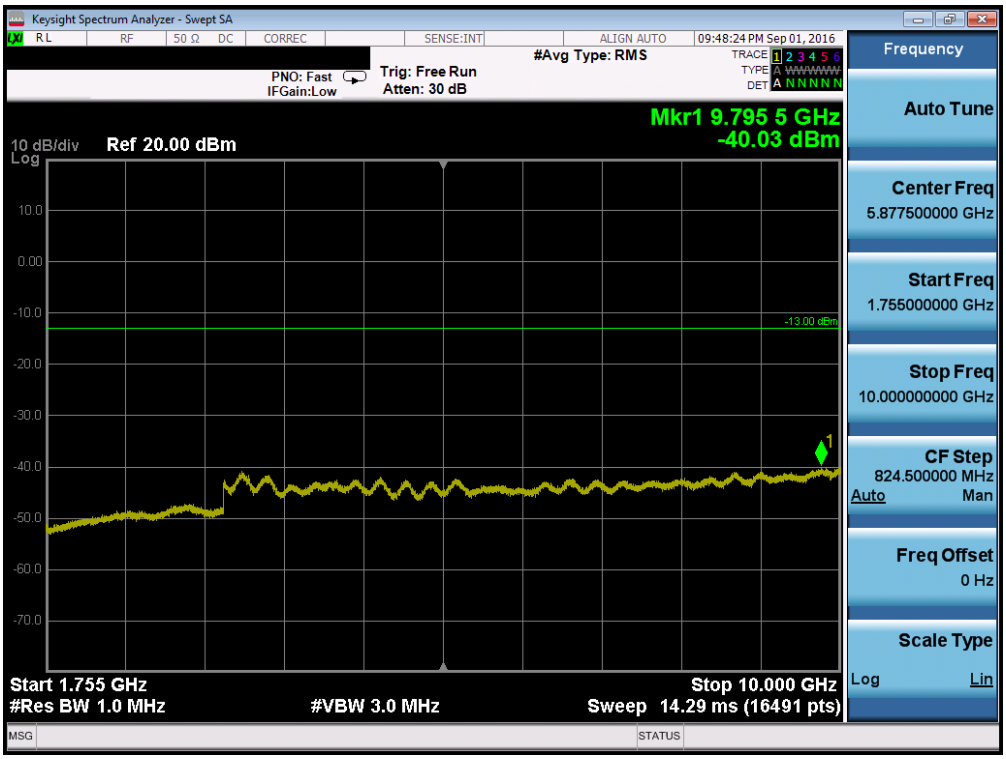



**Plot 7-38. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1412)**




**Plot 7-39. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1412)**



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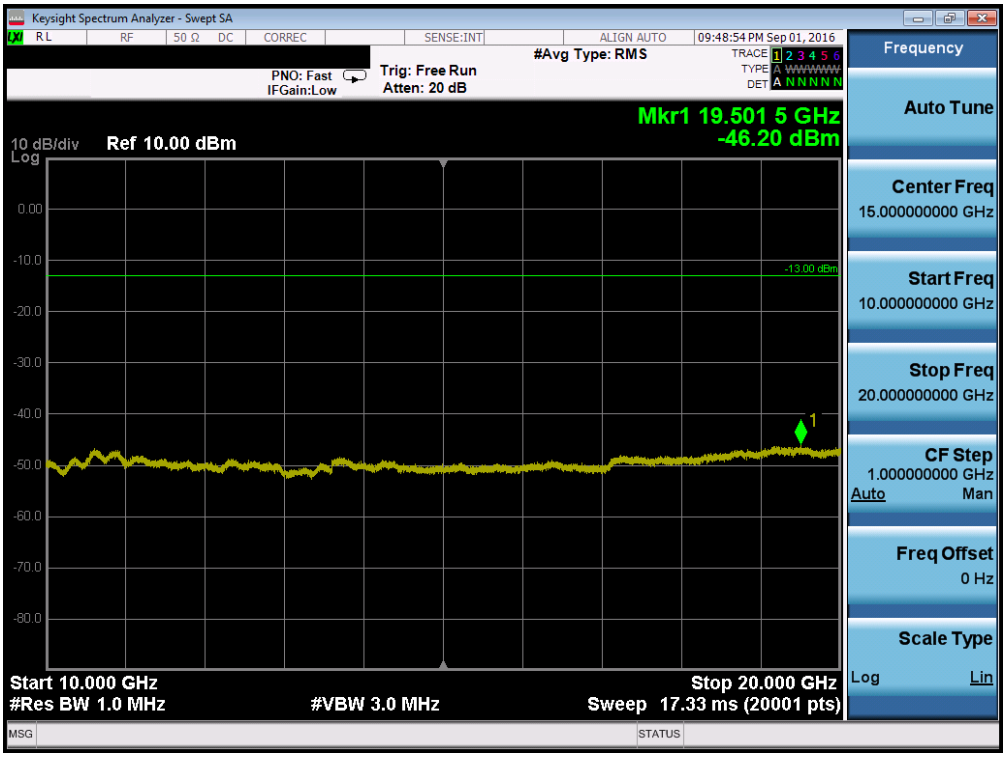
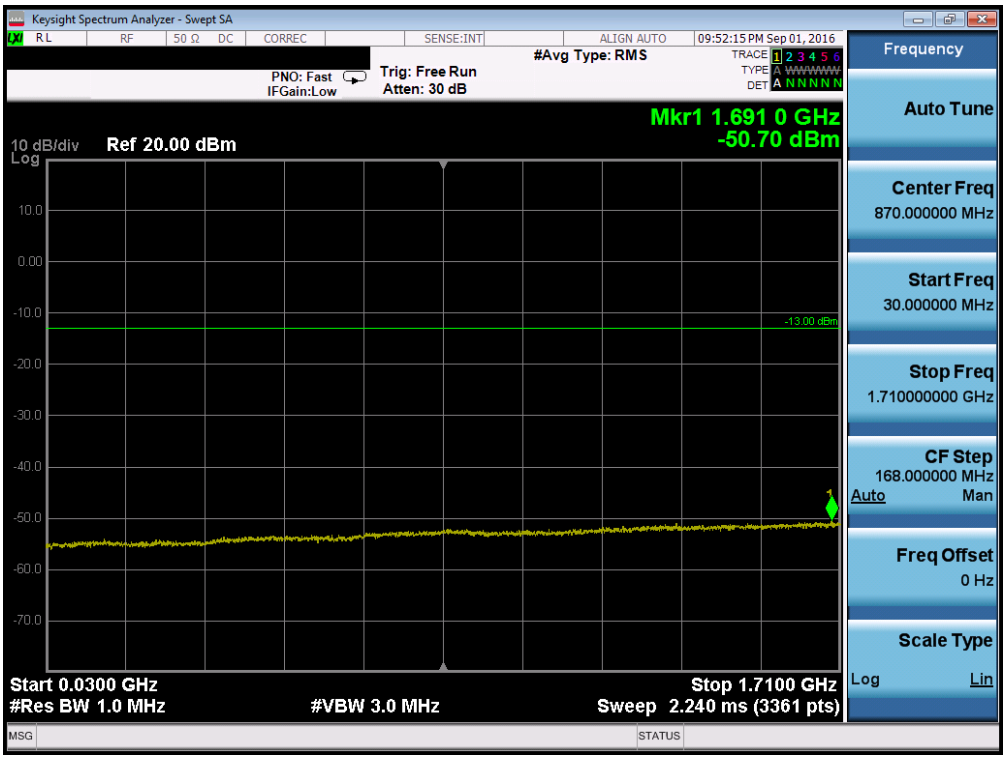



**Plot 7-40. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1412)**




**Plot 7-41. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1513)**



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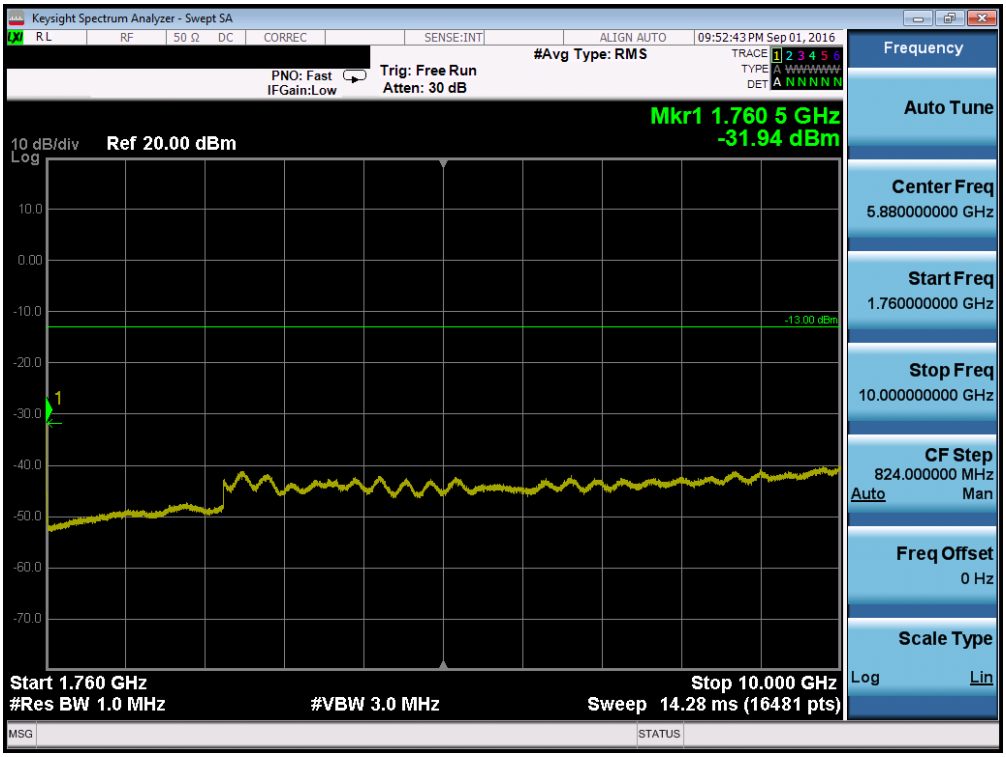
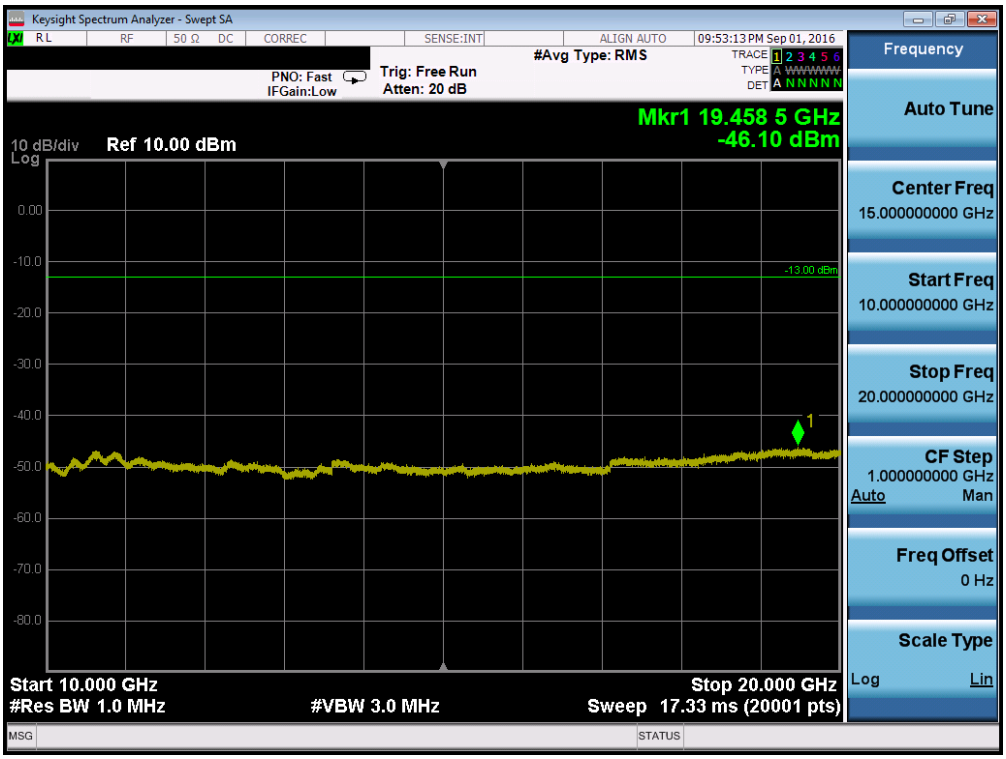



**Plot 7-42. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1513)**




**Plot 7-43. Conducted Spurious Plot (AWS WCDMA Mode – Ch. 1513)**



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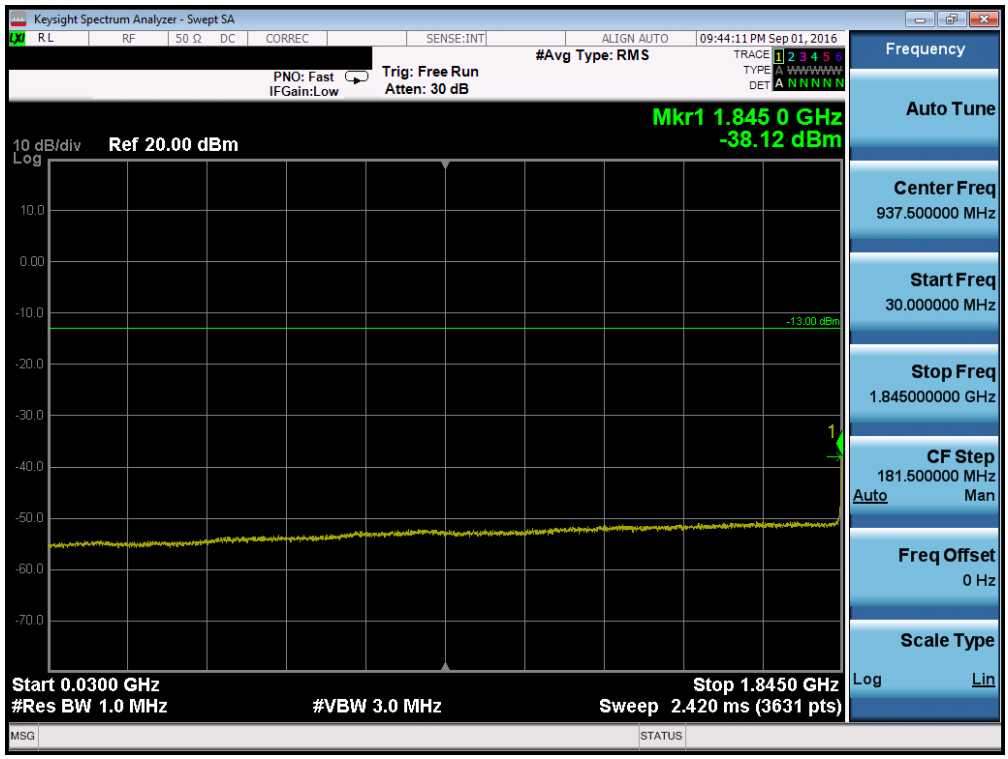
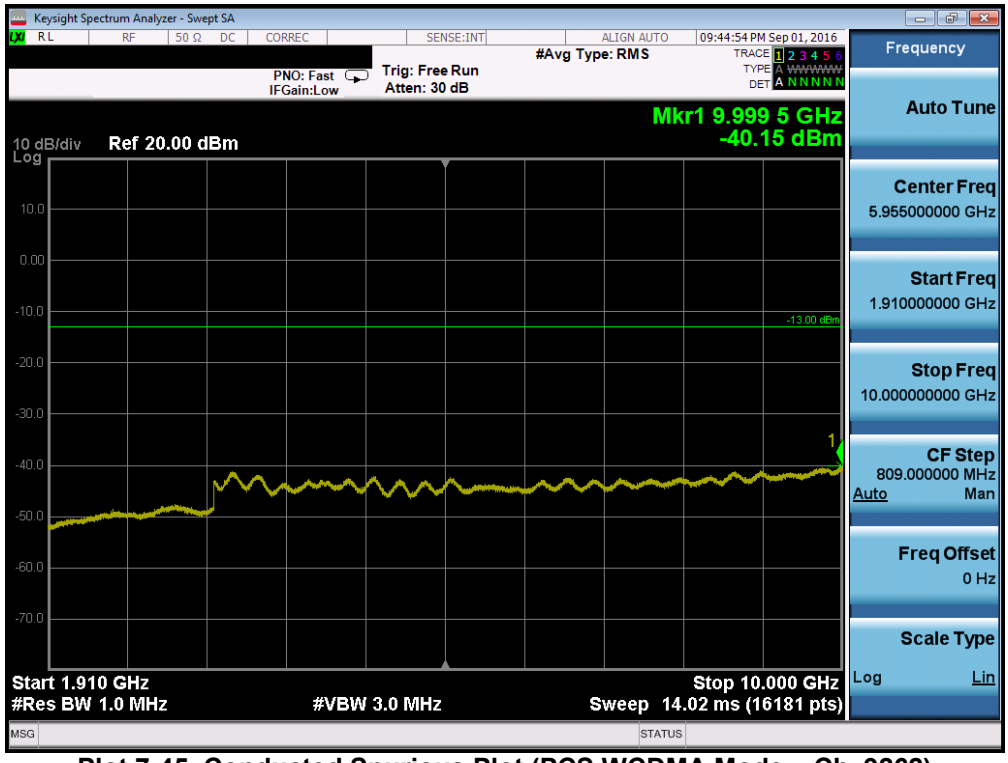



**Plot 7-44. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9262)**




**Plot 7-45. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9262)**



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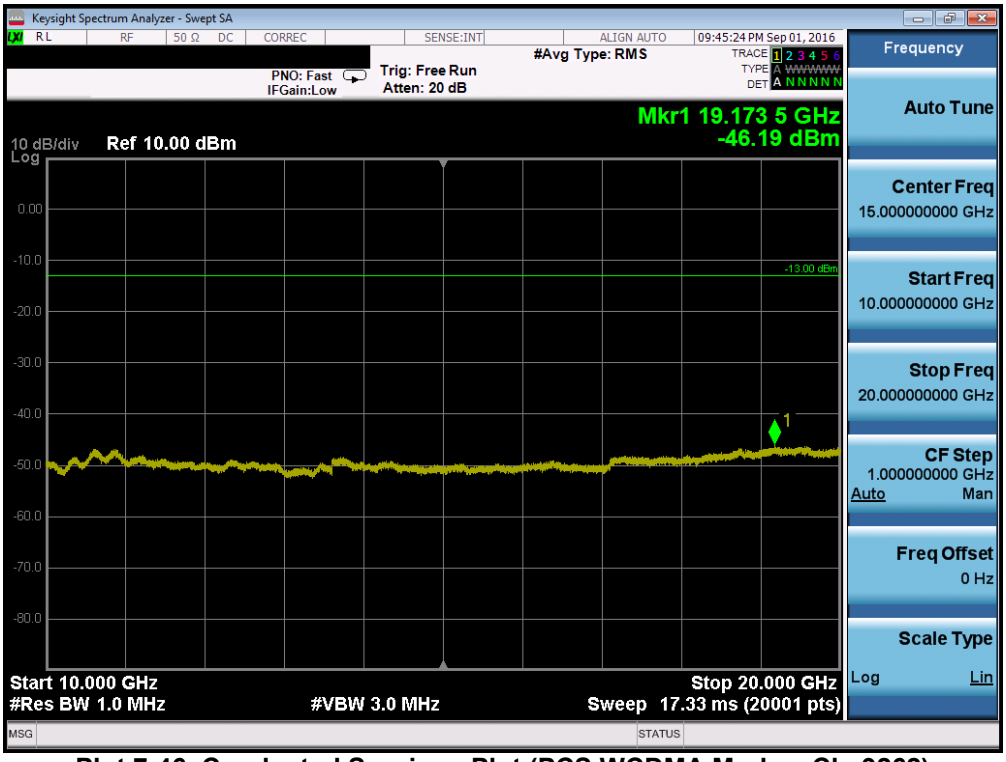
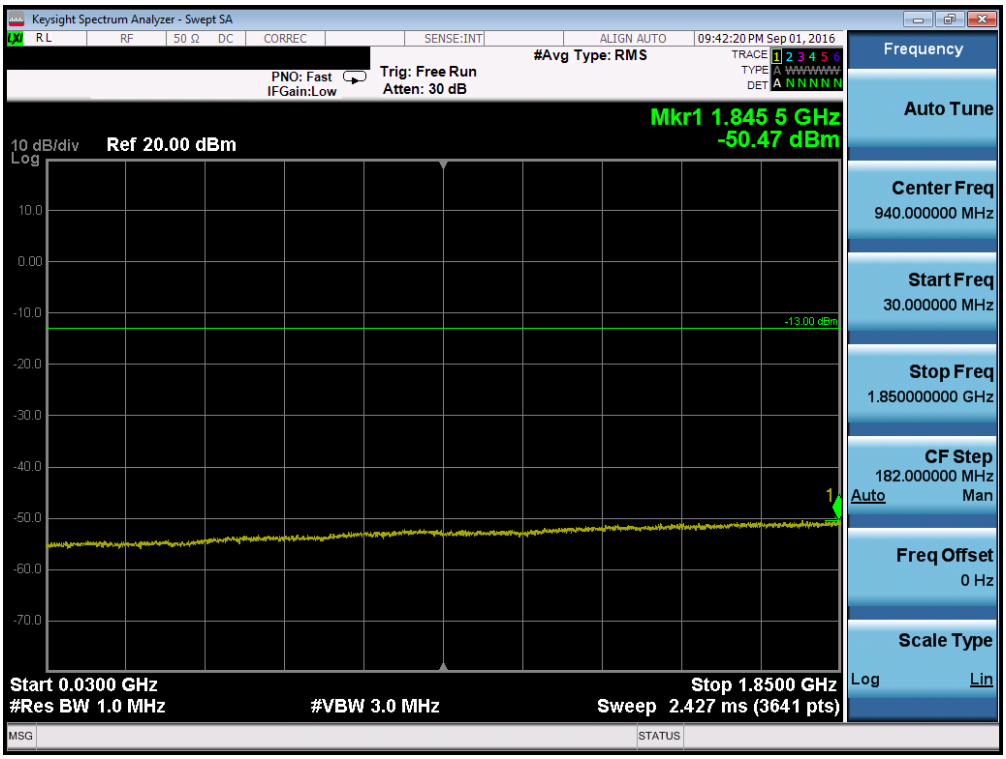



**Plot 7-46. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9262)**




**Plot 7-47. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9400)**



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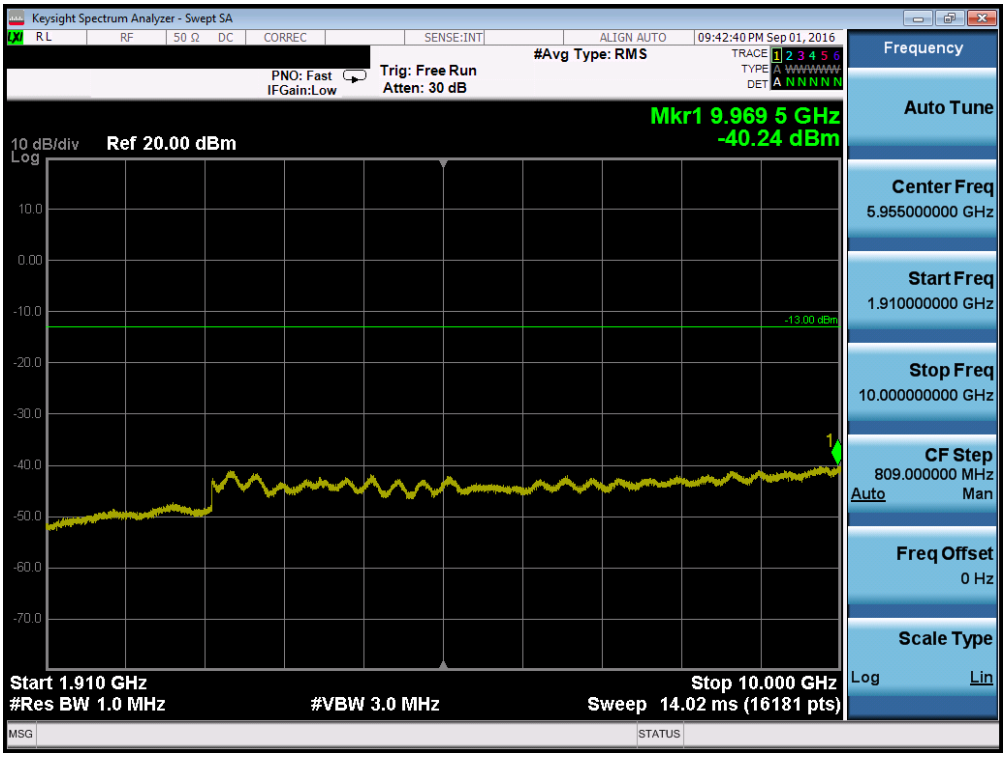
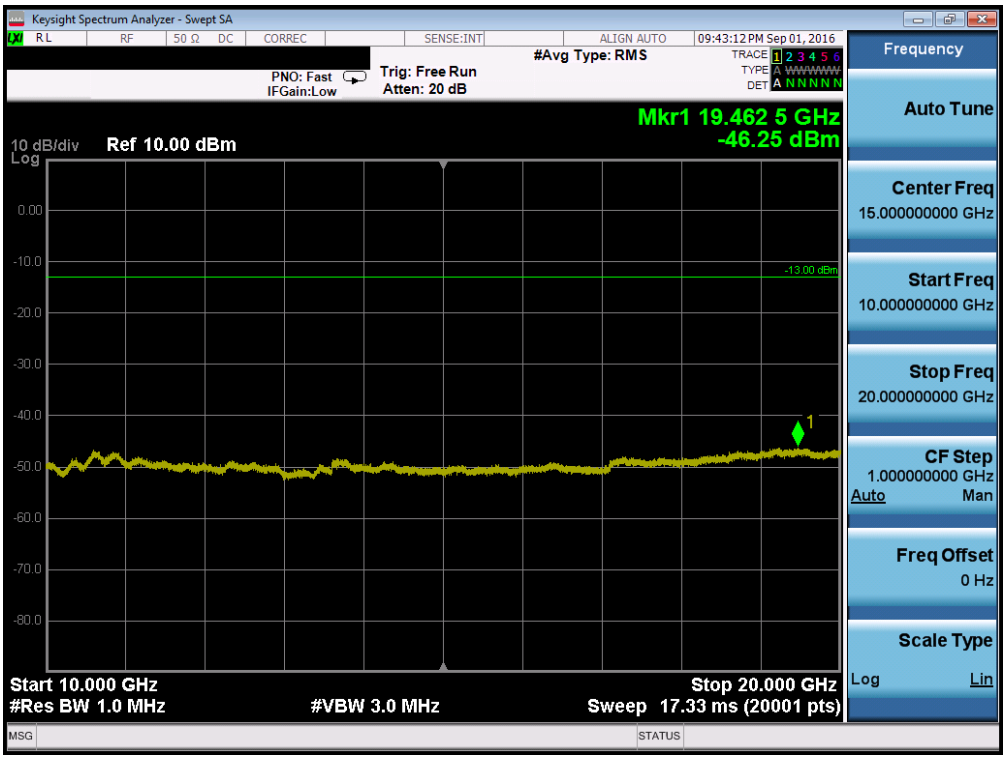



**Plot 7-48. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9400)**




**Plot 7-49. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9400)**



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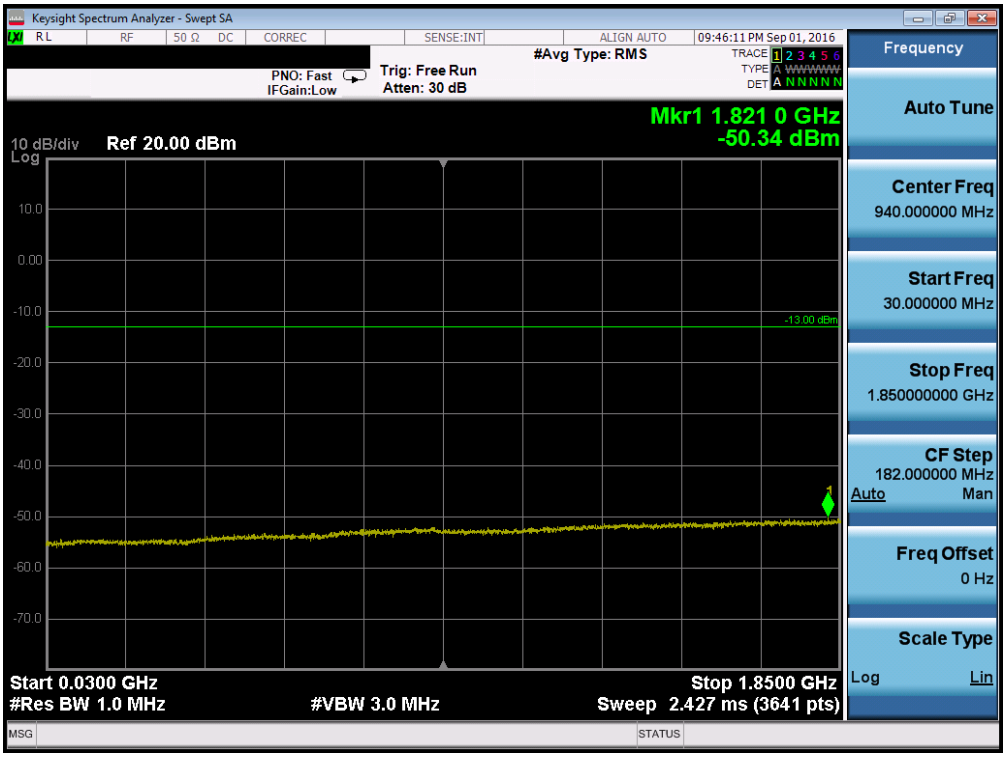
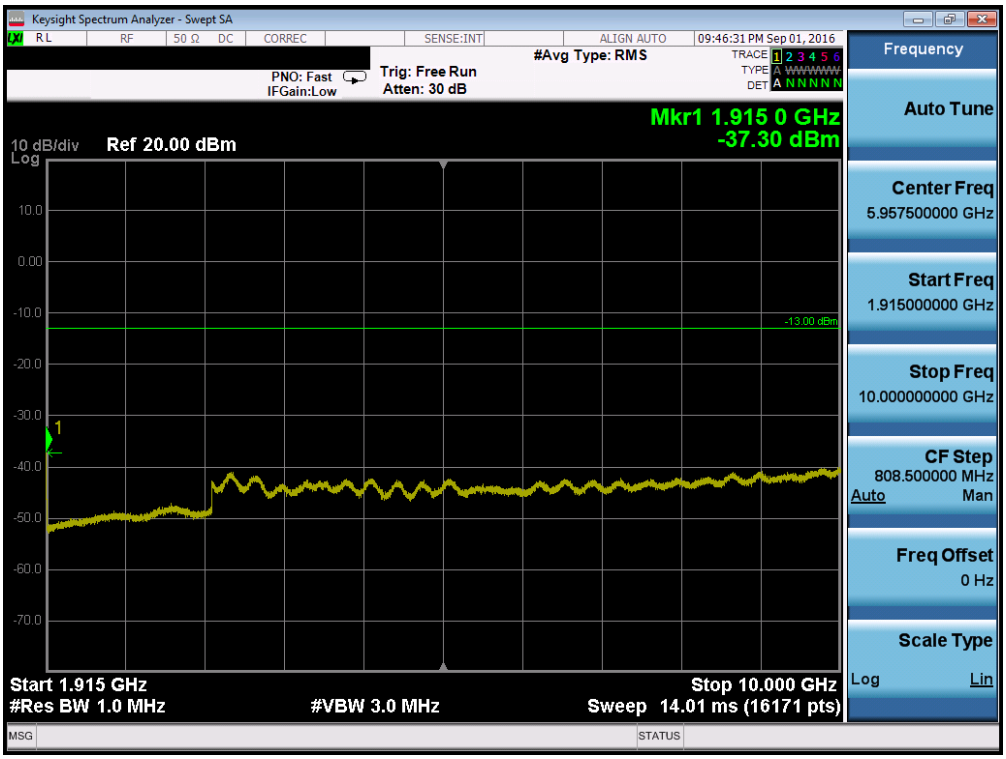



**Plot 7-50. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9538)**




**Plot 7-51. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9538)**



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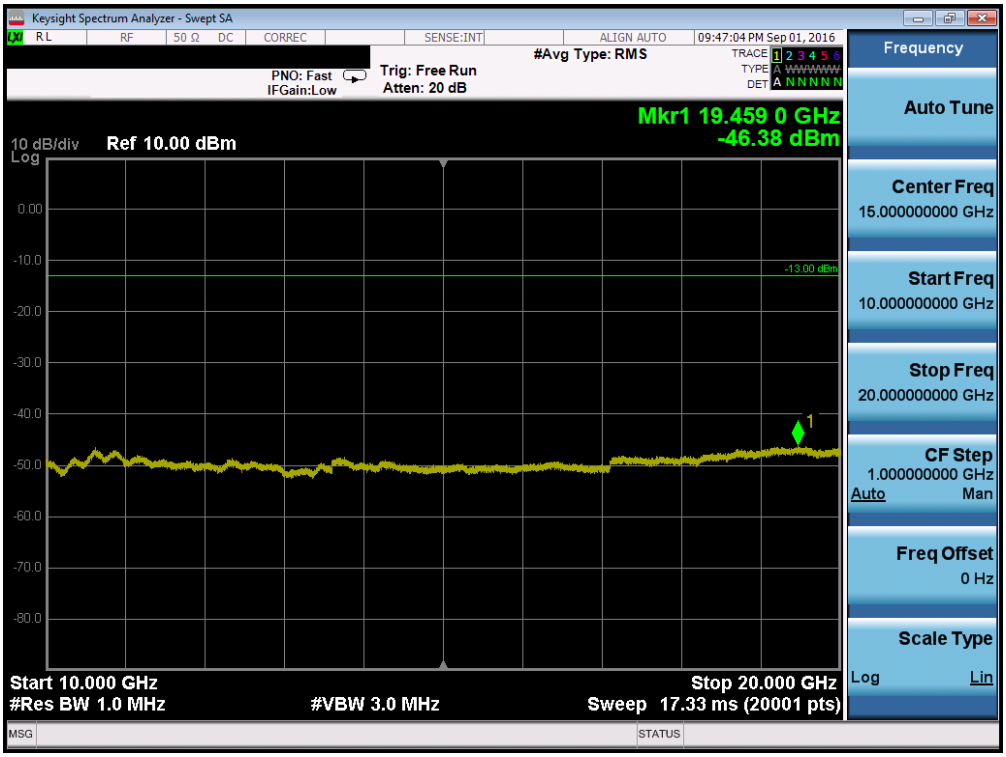


**Plot 7-52. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9538)**



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## 7.4 Band Edge Emissions at Antenna Terminal

**§2.1051 §22.917(a) §24.238(a) §27.53(h)**

### 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 is 43 + $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.***

### Test Procedure Used

KDB 971168 D01 v02r02 – 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.

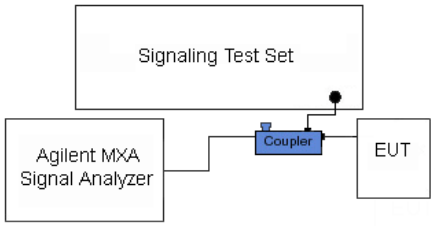


**Figure 7-3. Test Instrument & Measurement Setup**

### Test Notes

Per 22.917(b), 24.238(b), 27.53(h)(3), 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.



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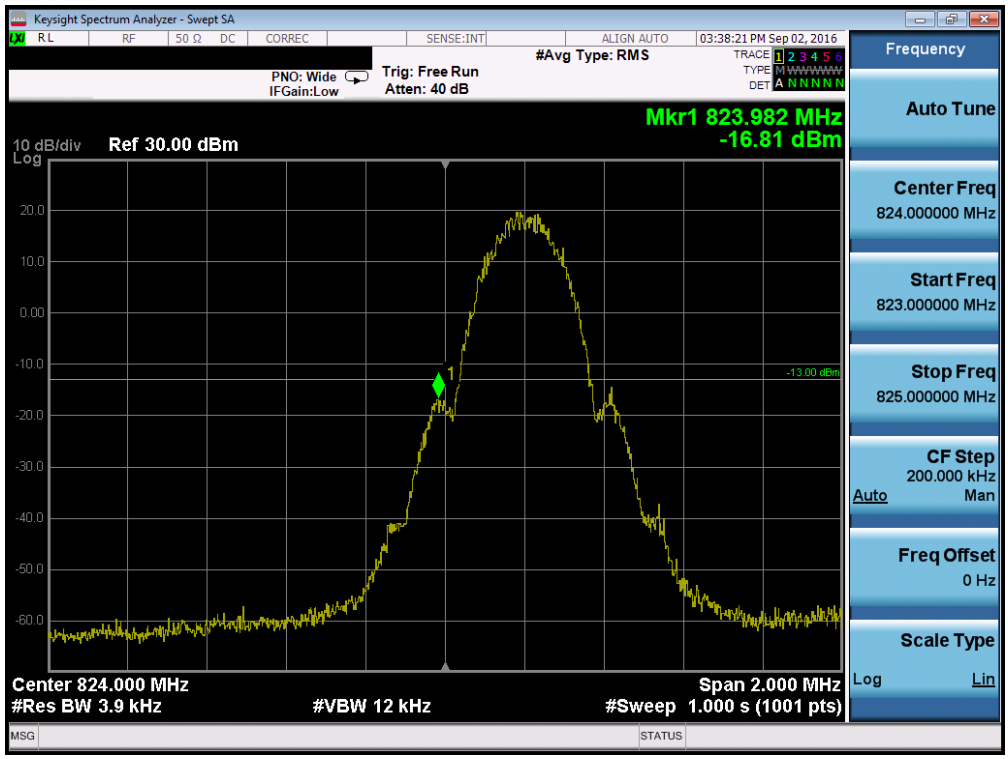
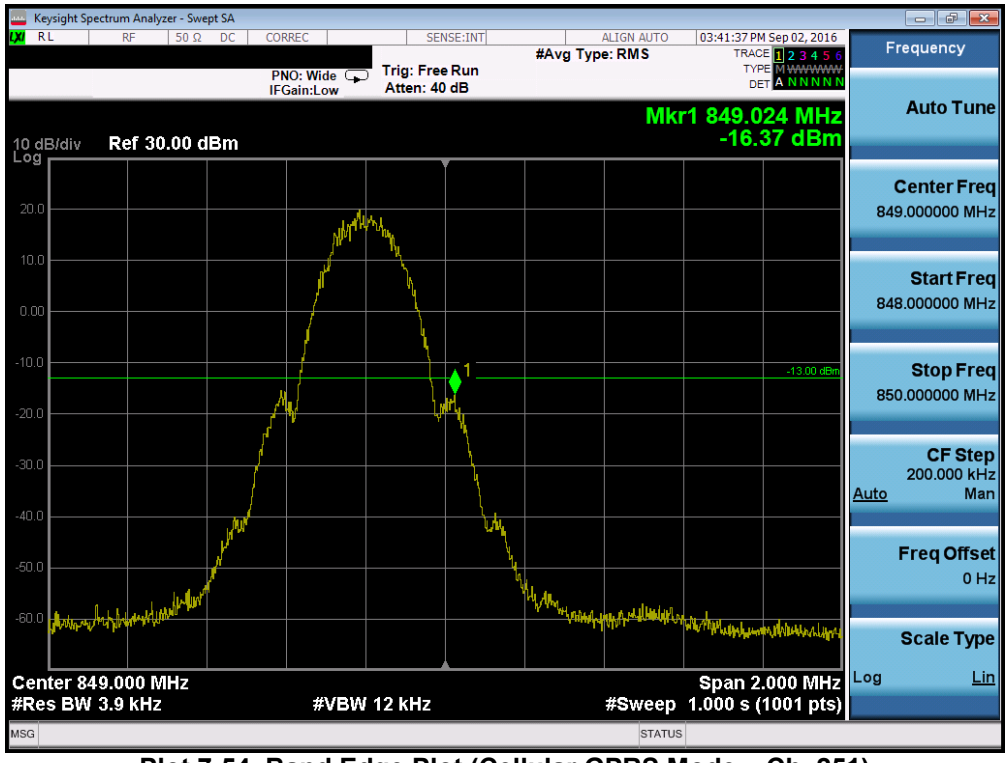



**Plot 7-53. Band Edge Plot (Cellular GPRS Mode – Ch. 128)**




**Plot 7-54. Band Edge Plot (Cellular GPRS Mode – Ch. 251)**



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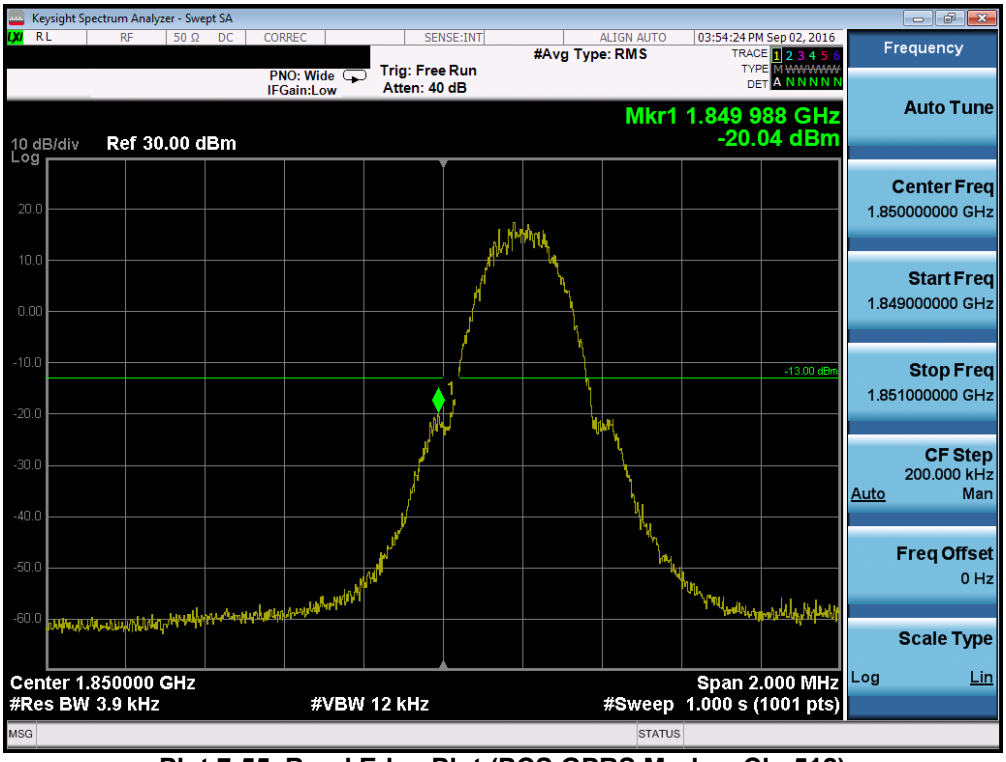
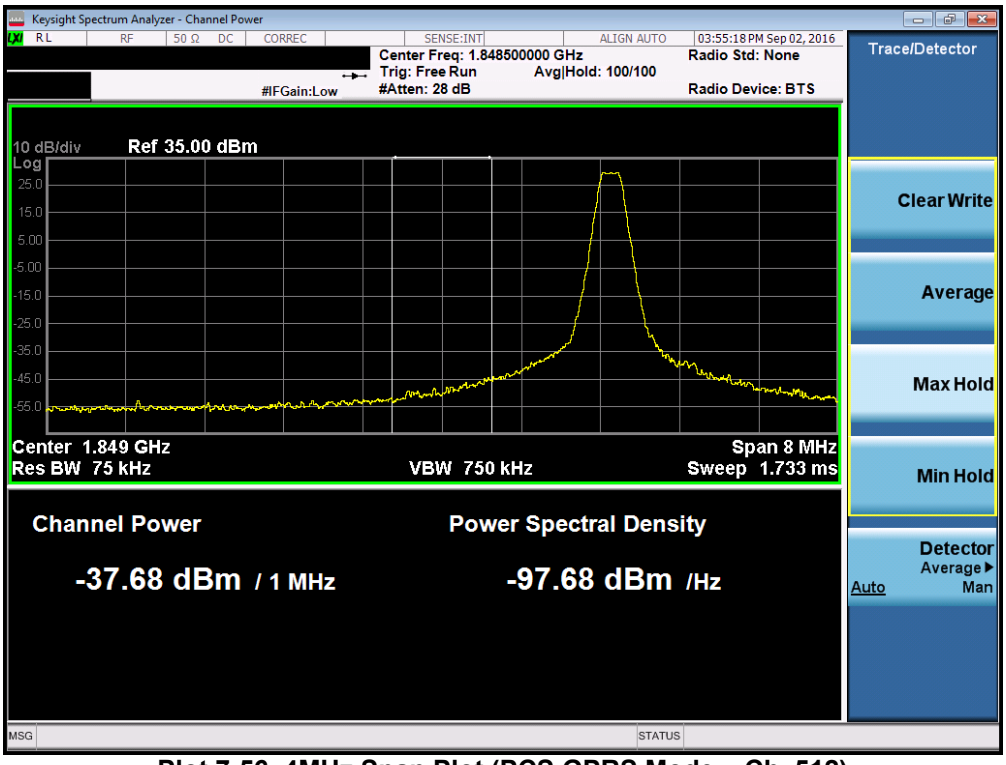



**Plot 7-55. Band Edge Plot (PCS GPRS Mode – Ch. 512)**




**Plot 7-56. 4MHz Span Plot (PCS GPRS Mode – Ch. 512)**



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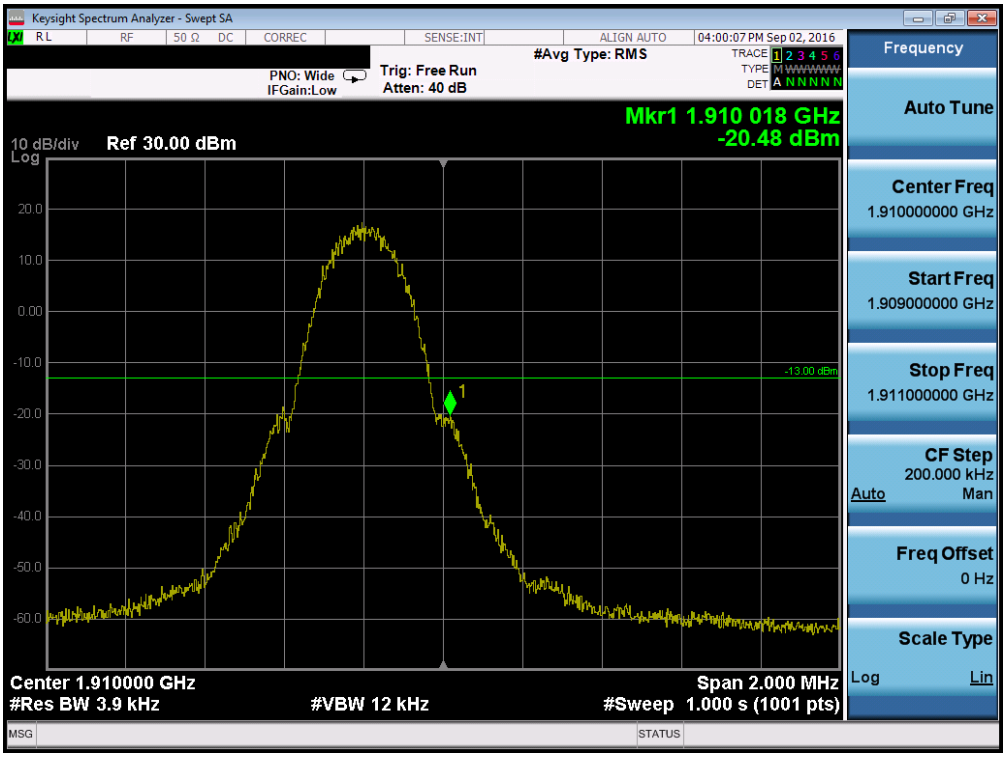
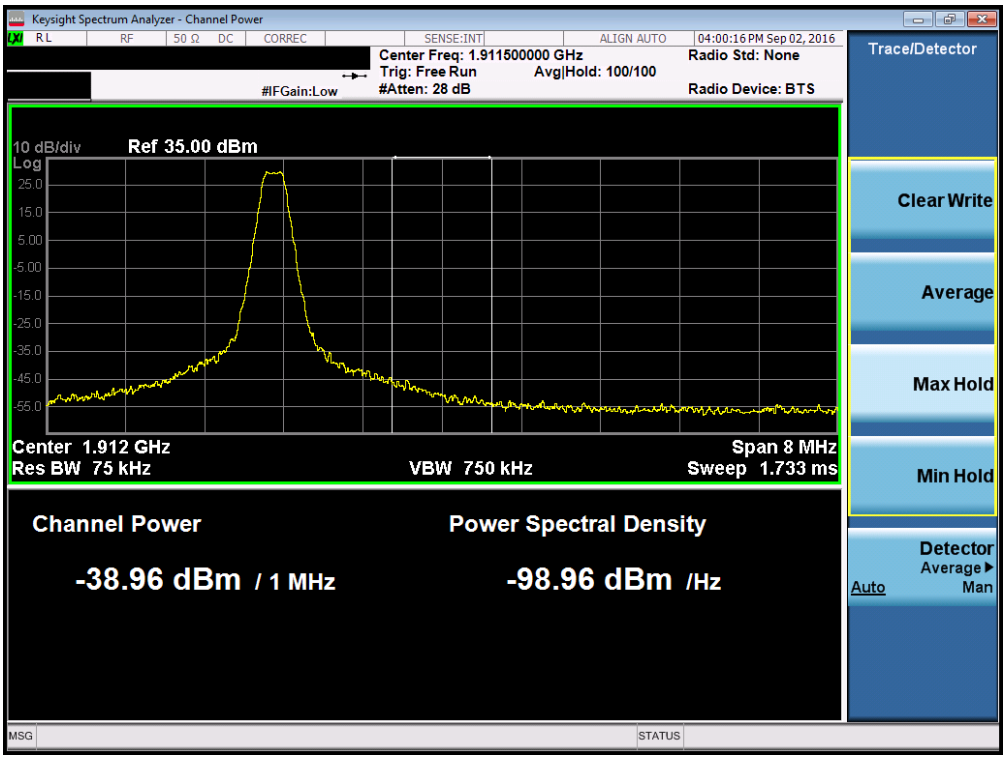



**Plot 7-57. Band Edge Plot (PCS GPRS Mode – Ch. 810)**




**Plot 7-58. 4MHz Span Plot (PCS GPRS Mode – Ch. 810)**



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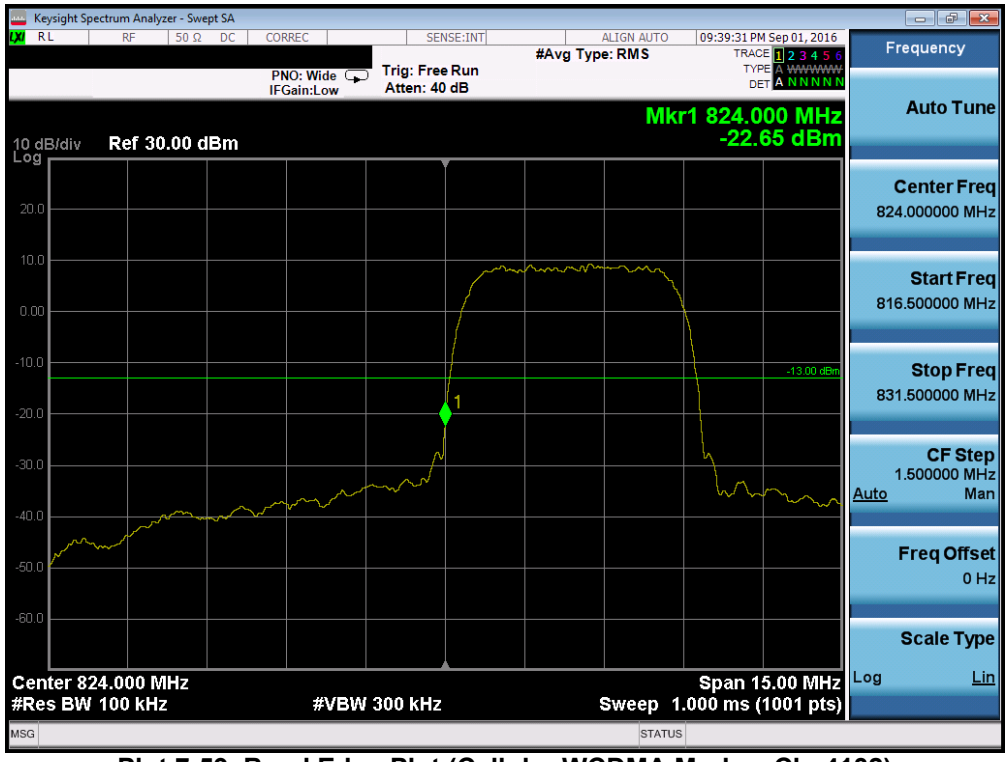
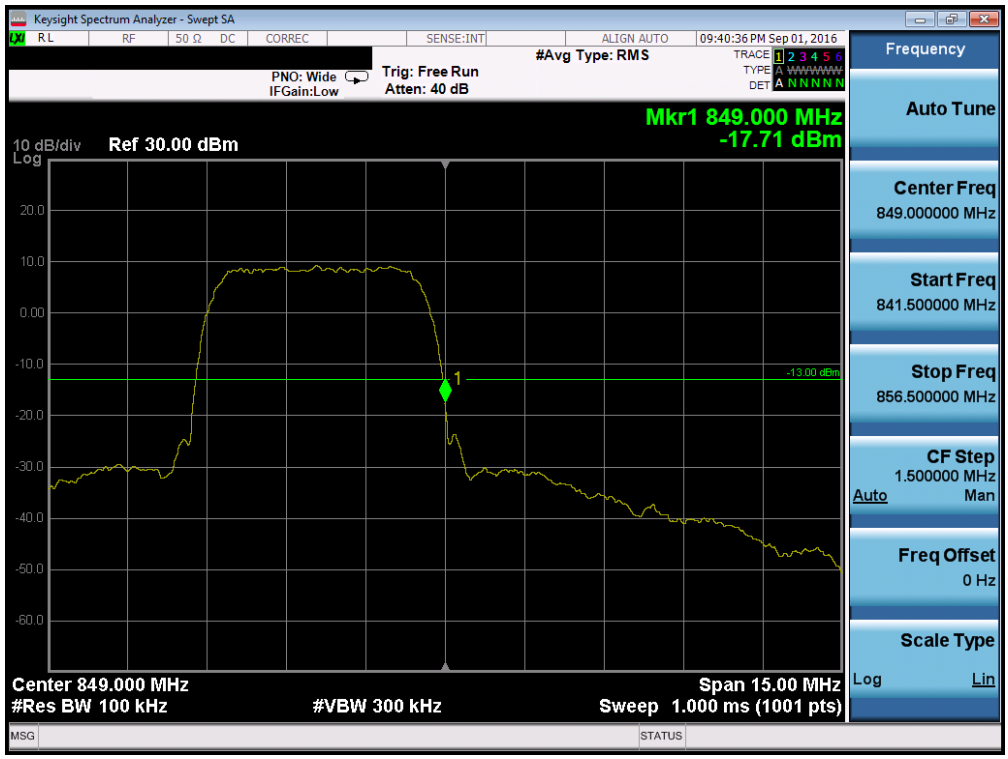



**Plot 7-59. Band Edge Plot (Cellular WCDMA Mode – Ch. 4132)**




**Plot 7-60. Band Edge Plot (Cellular WCDMA Mode – Ch. 4233)**



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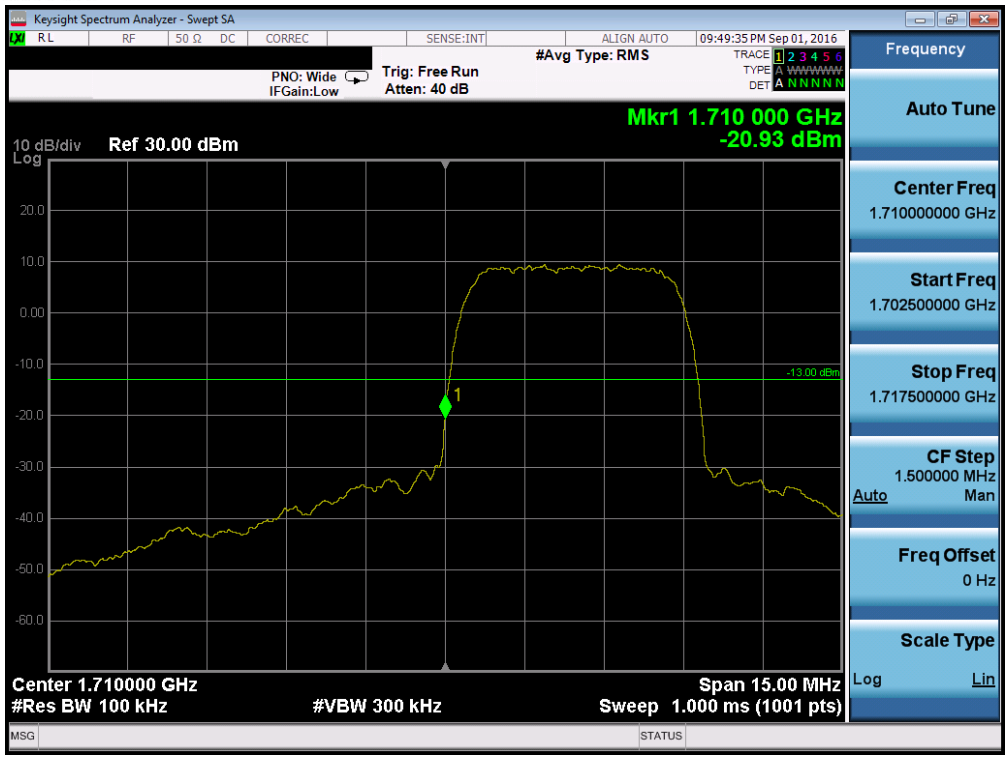
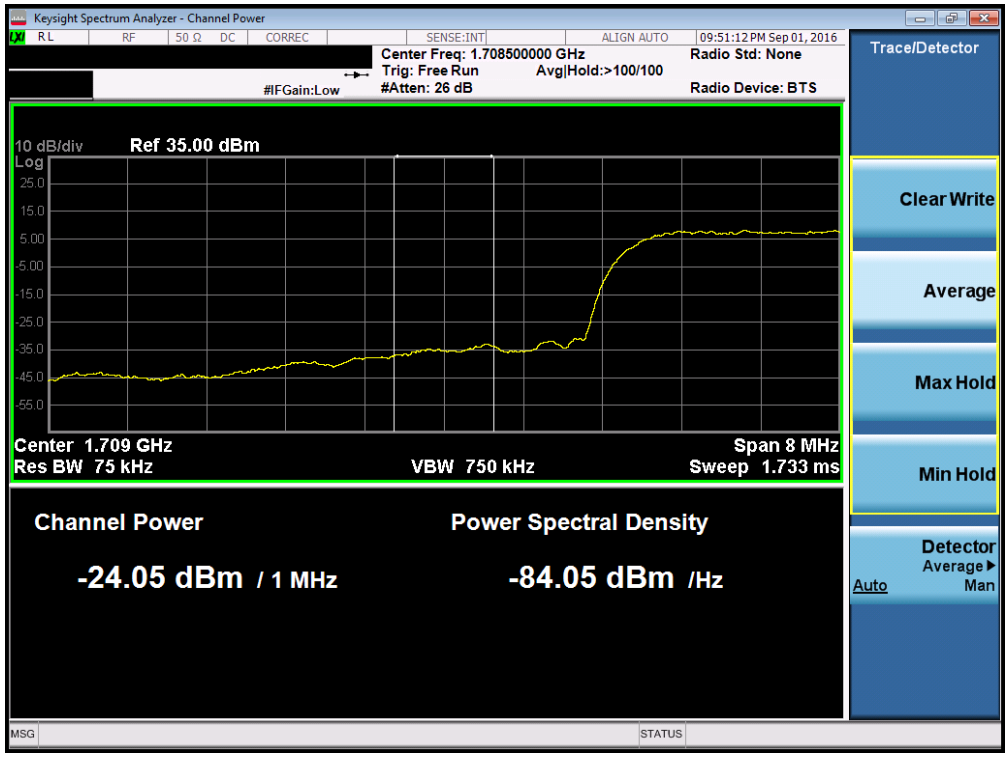



**Plot 7-61. Band Edge Plot (AWS WCDMA Mode – Ch. 1312)**




**Plot 7-62. 4MHz Span Plot (AWS WCDMA Mode – Ch. 1312)**



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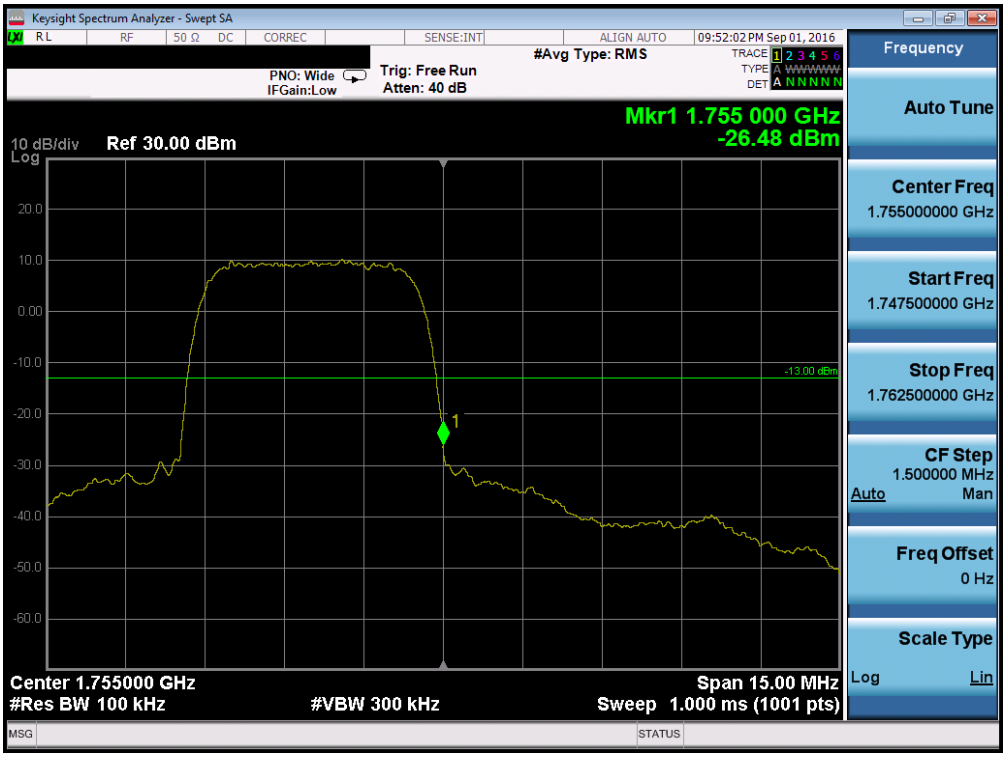
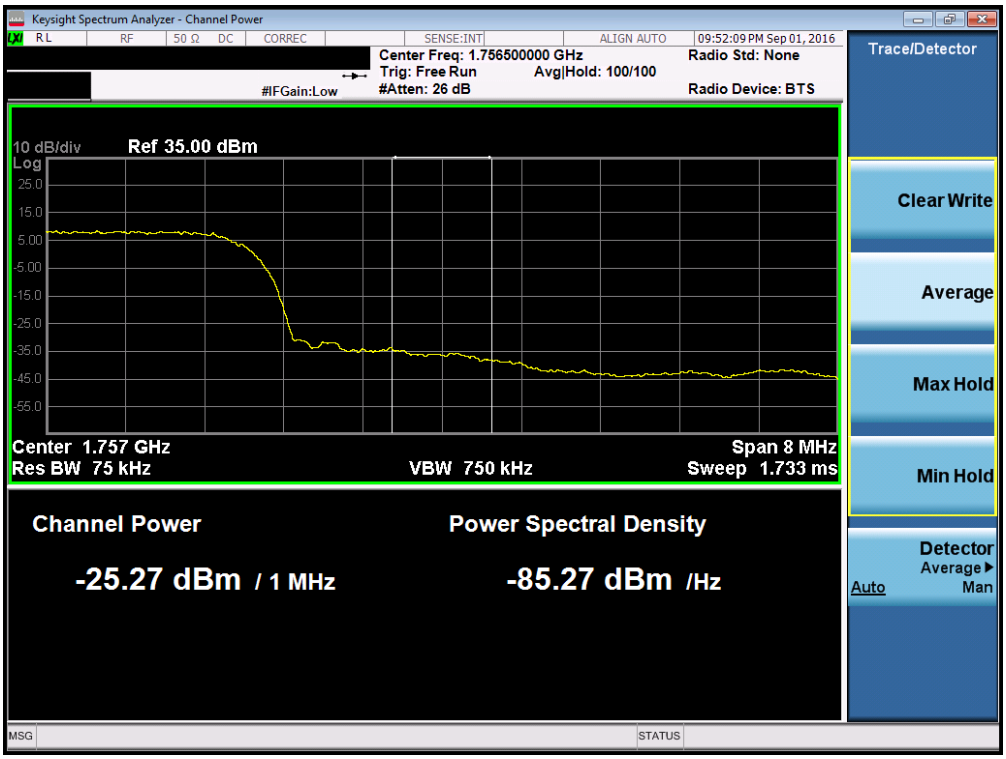



**Plot 7-63. Band Edge Plot (AWS WCDMA Mode – Ch. 1513)**




**Plot 7-64. 4MHz Span Plot (AWS WCDMA Mode – Ch. 1513)**



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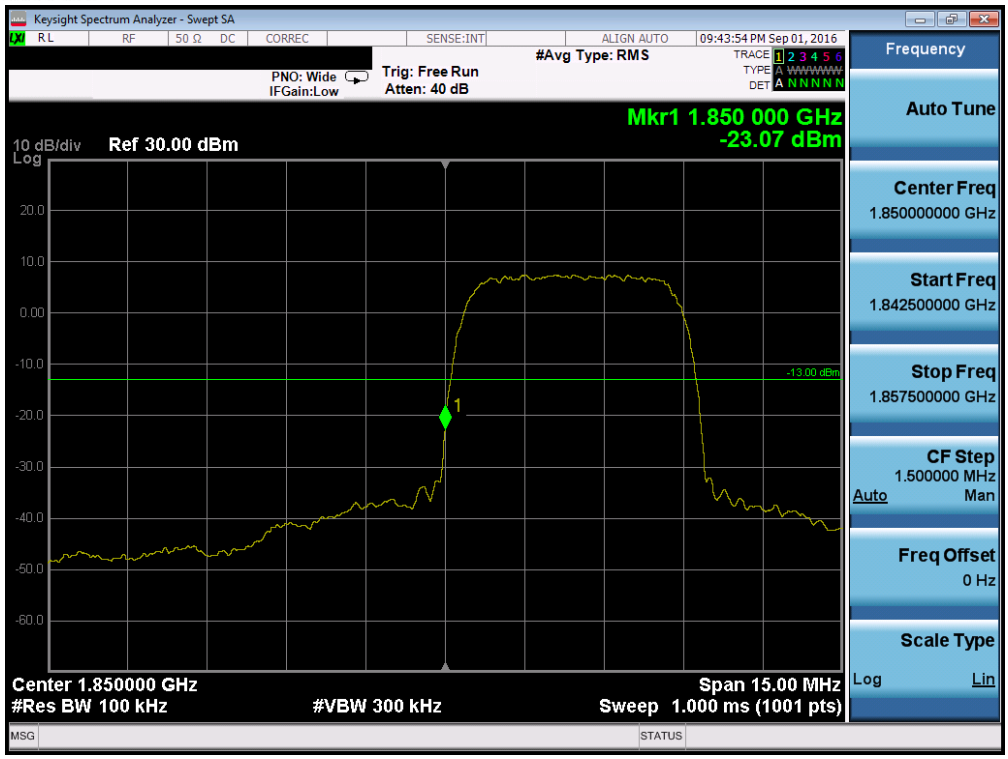
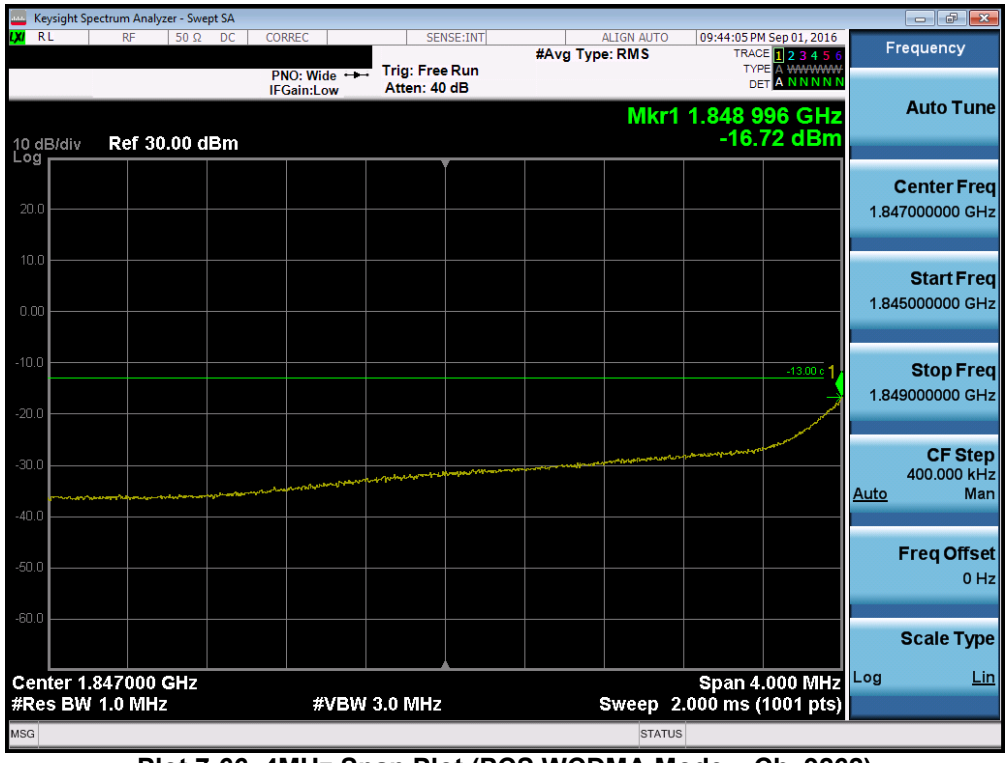



**Plot 7-65. Band Edge Plot (PCS WCDMA Mode – Ch. 9262)**




**Plot 7-66. 4MHz Span Plot (PCS WCDMA Mode – Ch. 9262)**



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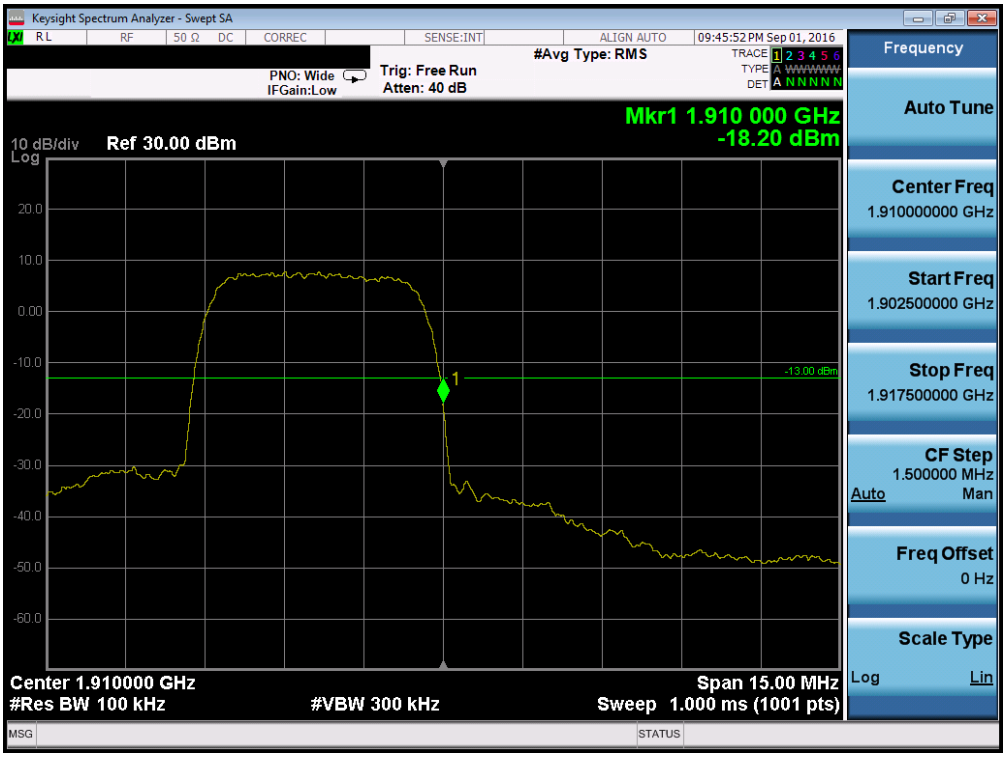
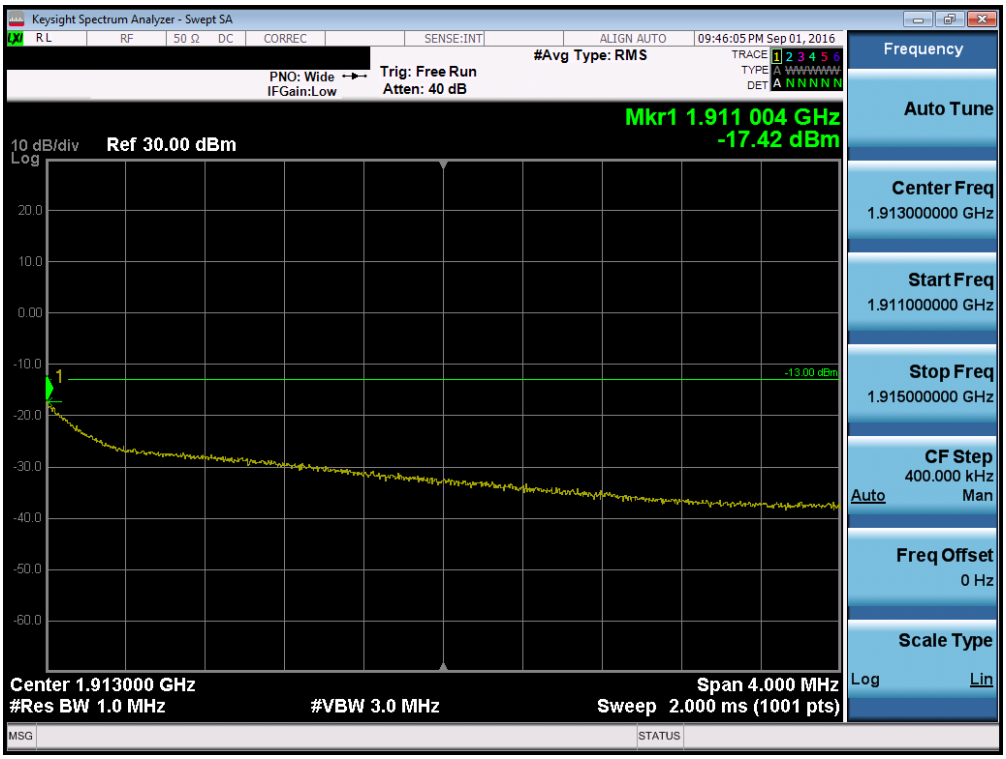



**Plot 7-67. Band Edge Plot (PCS WCDMA Mode – Ch. 9538)**




**Plot 7-68. 4MHz Span Plot (PCS WCDMA Mode – Ch. 9538)**



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## 7.5 Peak-Average Ratio

**§24.232(d)**

### Test Overview

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

### Test Procedure Used

KDB 971168 D01 v02r02 – Section 5.7.1

### Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

### Test Setup

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

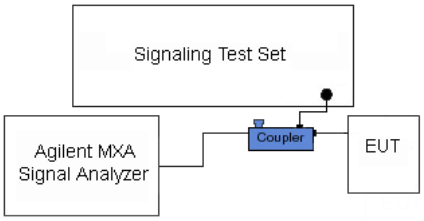


**Figure 7-4. Test Instrument & Measurement Setup**

### Test Notes

None

.



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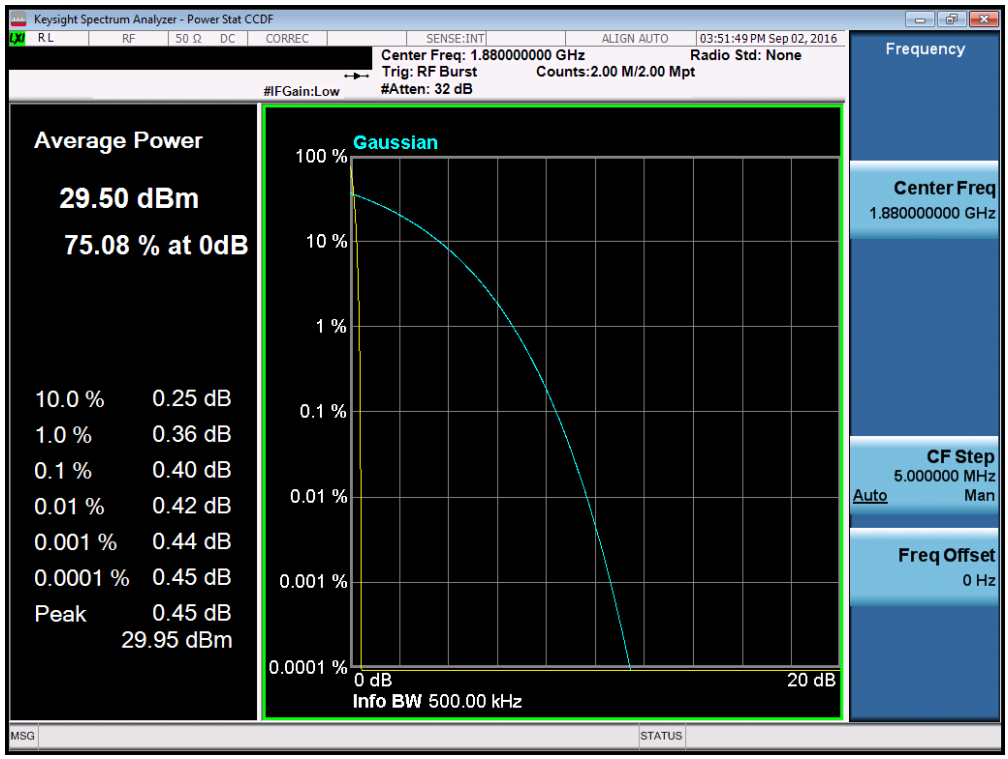
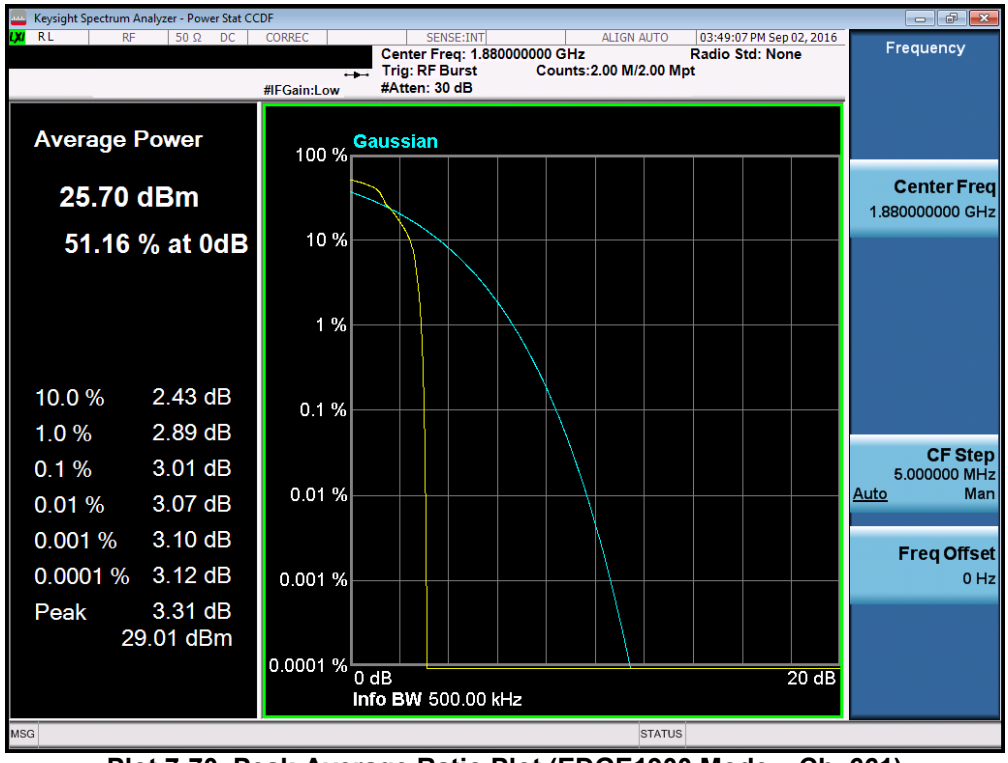



**Plot 7-69. Peak-Average Ratio Plot (PCS GPRS Mode – Ch. 661)**




**Plot 7-70. Peak-Average Ratio Plot (EDGE1900 Mode – Ch. 661)**



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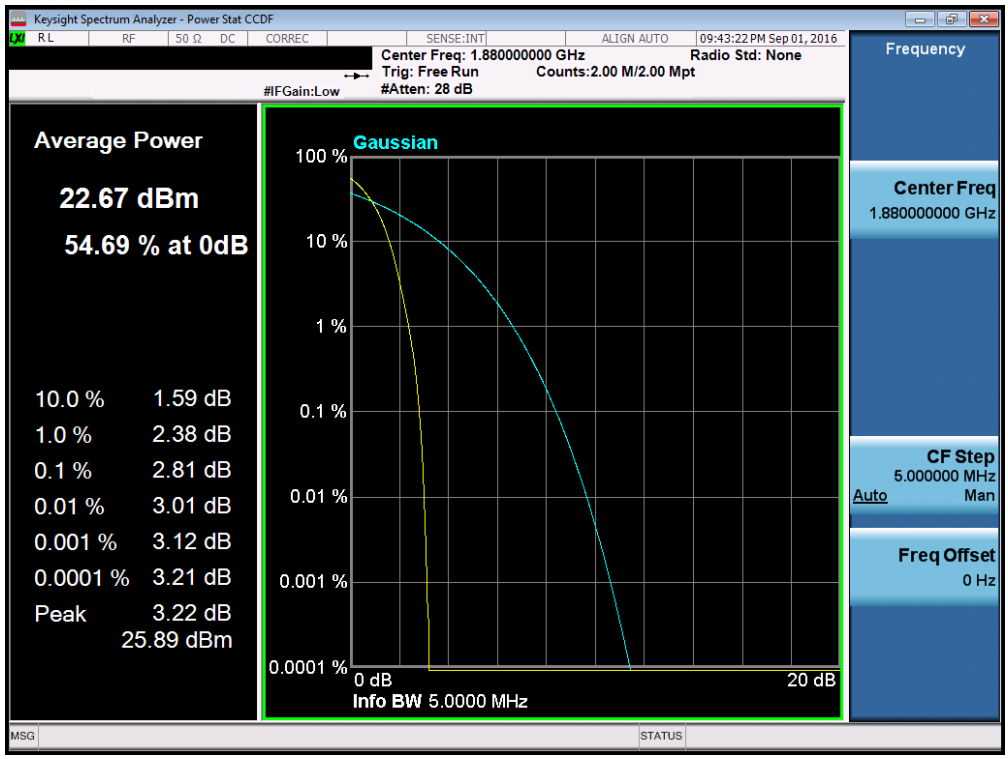


**Plot 7-71. Peak-Average Ratio Plot (PCS WCDMA Mode – Ch. 9400)**



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## 7.6 Radiated Power (ERP/EIRP)

**§22.913(a)(2) 24.232(c) 27.50(d.4)**

### Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) 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. 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 v02r02 – 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. 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


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## Test Setup

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

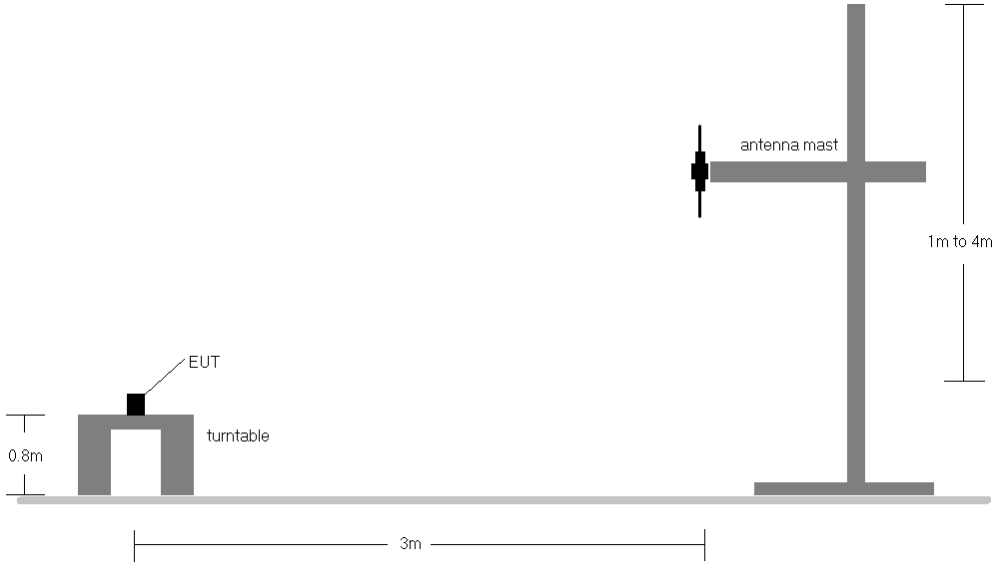


**Figure 7-5. Radiated Test Setup <1GHz**

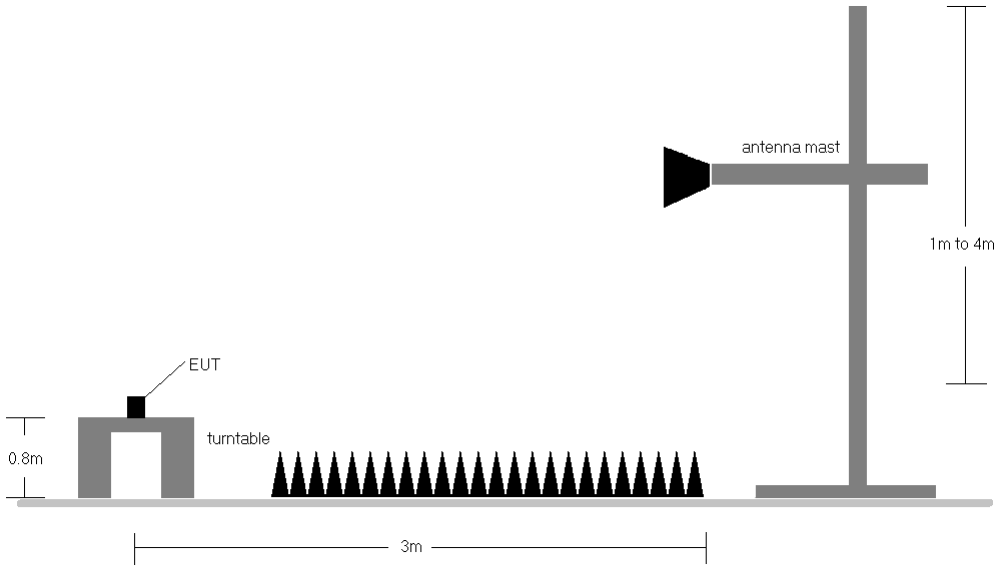


**Figure 7-6. Radiated Test Setup >1GHz**



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## Test Notes

1) This device employs GSM, GPRS, and EDGE capabilities. The EUT was tested under all configurations and the highest power is reported in GPRS mode while transmitting with one slot active.

2) This device employs UMTS technology with WCDMA (AMR/RMC), HSDPA, and HSUPA capabilities. For WCDMA and HSUPA transmission, all configurations were investigated and the worst case UMTS emissions were found in RMC WCDMA mode at 12.2kbps with HSDPA inactive and TPC bits all set to “1."

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.


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| Frequency [MHz] | Mode | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Substitute Level [dBm] | Ant. Gain [dBd] | ERP [dBm] | ERP [Watts] | ERP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 824.20 | GPRS850 | H | 156 | 217 | 24.49 | 5.00 | 29.49 | 0.890 | 38.45 | -8.96 |
| 836.60 | GPRS850 | H | 155 | 224 | 23.71 | 5.16 | 28.87 | 0.771 | 38.45 | -9.58 |
| 848.80 | GPRS850 | H | 156 | 210 | 22.46 | 5.31 | 27.77 | 0.598 | 38.45 | -10.68 |
| 824.20 | GPRS850 | V | 52 | 205 | 19.58 | 4.94 | 24.52 | 0.283 | 38.45 | -13.93 |
| 824.20 | EDGE850 | H | 156 | 217 | 20.88 | 5.00 | 25.88 | 0.388 | 38.45 | -12.57 |

**Table 7-2. ERP (Cellular GPRS)**

| Frequency [MHz] | Mode | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Substitute Level [dBm] | Ant. Gain [dBd] | ERP [dBm] | ERP [Watts] | ERP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 826.40 | WCDMA850 | H | 216 | 320 | 15.57 | 5.03 | 20.60 | 0.115 | 38.45 | -17.85 |
| 836.60 | WCDMA850 | H | 222 | 315 | 14.54 | 5.16 | 19.70 | 0.093 | 38.45 | -18.75 |
| 846.60 | WCDMA850 | H | 202 | 322 | 14.03 | 5.28 | 19.31 | 0.085 | 38.45 | -19.14 |
| 826.40 | WCDMA850 | V | 213 | 59 | 10.09 | 4.95 | 15.04 | 0.032 | 38.45 | -23.41 |

**Table 7-3. ERP (Cellular WCDMA)**

| Frequency [MHz] | Mode | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Substitute Level [dBm] | Ant. Gain [dBi] | EIRP [dBm] | EIRP [Watts] | EIRP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1712.40 | WCDMA1700 | H | 114 | 120 | 15.39 | 9.65 | 25.04 | 0.319 | 30.00 | -4.96 |
| 1732.60 | WCDMA1700 | H | 289 | 117 | 15.28 | 9.61 | 24.89 | 0.309 | 30.00 | -5.11 |
| 1752.60 | WCDMA1700 | H | 112 | 63 | 14.75 | 9.57 | 24.32 | 0.271 | 30.00 | -5.68 |
| 1712.40 | WCDMA1700 | V | 100 | 266 | 11.49 | 9.66 | 21.15 | 0.130 | 30.00 | -8.85 |

**Table 7-4. EIRP (AWS WCDMA)**


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| Frequency [MHz] | Mode | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Substitute Level [dBm] | Ant. Gain [dBi] | EIRP [dBm] | EIRP [Watts] | EIRP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1850.20 | GPRS1900 | H | 250 | 105 | 22.62 | 9.35 | 31.97 | 1.574 | 33.01 | -1.04 |
| 1880.00 | GPRS1900 | H | 247 | 104 | 22.42 | 9.27 | 31.69 | 1.477 | 33.01 | -1.32 |
| 1909.80 | GPRS1900 | H | 242 | 100 | 22.09 | 9.25 | 31.34 | 1.361 | 33.01 | -1.67 |
| 1850.20 | GPRS1900 | V | 258 | 268 | 20.00 | 9.21 | 29.21 | 0.834 | 33.01 | -3.80 |
| 1850.20 | EDGE1900 | H | 255 | 100 | 17.27 | 9.35 | 26.62 | 0.459 | 33.01 | -6.39 |

**Table 7-5. EIRP (PCS GPRS)**

| Frequency [MHz] | Mode | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Substitute Level [dBm] | Ant. Gain [dBi] | EIRP [dBm] | EIRP [Watts] | EIRP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1852.40 | WCDMA1900 | H | 265 | 289 | 14.94 | 9.34 | 24.28 | 0.268 | 33.01 | -8.73 |
| 1880.00 | WCDMA1900 | H | 103 | 289 | 14.81 | 9.27 | 24.08 | 0.256 | 33.01 | -8.93 |
| 1907.60 | WCDMA1900 | H | 100 | 290 | 15.05 | 9.24 | 24.29 | 0.269 | 33.01 | -8.72 |
| 1907.60 | WCDMA1900 | V | 100 | 267 | 12.36 | 9.35 | 21.71 | 0.148 | 33.01 | -11.30 |

**Table 7-6. EIRP (PCS WCDMA)**


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## 7.7 Radiated Spurious Emissions Measurements

**§2.1053 §22.917(a) 24.238(a) 27.53(h)**

**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 v02r02 – 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



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## Test Setup

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

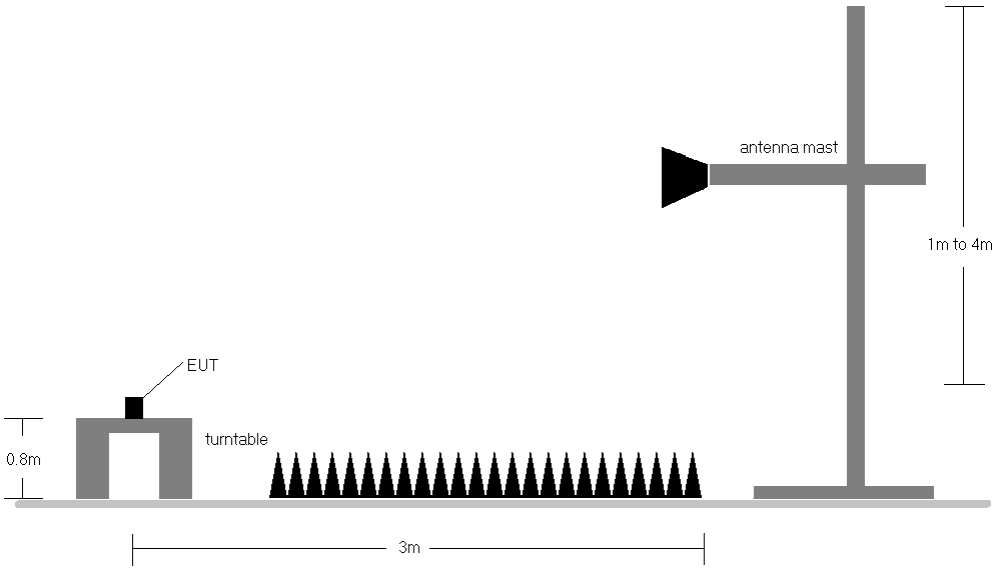


**Figure 7-7. Test Instrument & Measurement Setup**

## Test Notes

1) This device employs GSM, GPRS, and EDGE capabilities. The EUT was tested under all configurations and the highest power is reported in GPRS mode while transmitting with one slot active.

2) This device employs UMTS technology with WCDMA (AMR/RMC), HSDPA, and HSUPA capabilities. For WCDMA and HSUPA transmission, all configurations were investigated and the worst case UMTS emissions were found in RMC WCDMA mode at 12.2kbps with HSDPA inactive and TPC bits all set to “1."

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.



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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 824.20 | | | MHz |
| CHANNEL: | 128 | | | |
| MEASURED OUTPUT POWER: | 29.49 | dBm | = | 0.890 W |
| MODULATION SIGNAL: | GPRS (GMSK) | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 42.49 | | dBc |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | [dBc] |
|---|---|---|---|---|---|---|---|
| 1648.40 | H | 135 | 73 | -56.39 | 6.69 | -49.69 | 79.2 |
| 2472.60 | H | 110 | 94 | -60.96 | 7.51 | -53.46 | 82.9 |
| 3296.80 | H | 142 | 123 | -58.04 | 7.36 | -50.68 | 80.2 |
| 4121.00 | H | 159 | 215 | -57.61 | 8.07 | -49.54 | 79.0 |
| 4945.20 | H | - | - | -65.54 | 8.74 | -56.81 | 86.3 |

**Table 7-7. Radiated Spurious Data (Cellular GPRS Mode – Ch. 128)**

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 836.60 | | | MHz |
| CHANNEL: | 190 | | | |
| MEASURED OUTPUT POWER: | 28.87 | dBm | = | 0.771 W |
| MODULATION SIGNAL: | GPRS (GMSK) | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 41.87 | | dBc |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | [dBc] |
|---|---|---|---|---|---|---|---|
| 1673.20 | H | 119 | 250 | -59.78 | 6.70 | -53.09 | 82.0 |
| 2509.80 | H | 129 | 92 | -53.07 | 7.63 | -45.44 | 74.3 |
| 3346.40 | H | 130 | 199 | -59.84 | 7.52 | -52.32 | 81.2 |
| 4183.00 | H | 183 | 196 | -62.43 | 8.23 | -54.21 | 83.1 |
| 5019.60 | H | - | - | -65.44 | 8.75 | -56.69 | 85.6 |

**Table 7-8. Radiated Spurious Data (Cellular GPRS Mode – Ch. 190)**


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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 848.80 | | | MHz |
| CHANNEL: | 251 | | | |
| MEASURED OUTPUT POWER: | 27.77 | dBm | = | 0.598 W |
| MODULATION SIGNAL: | GPRS (GMSK) | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 40.77 | | dBc |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | [dBc] |
|---|---|---|---|---|---|---|---|
| 1697.60 | H | 195 | 135 | -57.33 | 6.70 | -50.64 | 78.4 |
| 2546.40 | H | 122 | 99 | -49.72 | 7.60 | -42.12 | 69.9 |
| 3395.20 | H | 186 | 155 | -62.19 | 7.68 | -54.52 | 82.3 |
| 4244.00 | H | 142 | 77 | -65.88 | 8.41 | -57.47 | 85.2 |
| 5092.80 | H | - | - | -64.85 | 8.62 | -56.23 | 84.0 |

**Table 7-9. Radiated Spurious Data (Cellular GPRS Mode – Ch. 251)**

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 826.40 | | | MHz |
| CHANNEL: | 4132 | | | |
| MEASURED OUTPUT POWER: | 20.60 | dBm | = | 0.115 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 33.60 | | dBc |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | [dBc] |
|---|---|---|---|---|---|---|---|
| 1652.80 | H | 136 | 73 | -74.28 | 6.70 | -67.59 | 88.2 |
| 2479.20 | H | 134 | 126 | -70.61 | 7.54 | -63.08 | 83.7 |
| 3305.60 | H | - | - | -69.02 | 7.38 | -61.64 | 82.2 |

**Table 7-10. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4132)**


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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 836.60 | | | MHz |
| CHANNEL: | 4183 | | | |
| MEASURED OUTPUT POWER: | 19.70 | dBm | = | 0.093 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 32.70 | | dBc |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | [dBc] |
|---|---|---|---|---|---|---|---|
| 1673.20 | H | 129 | 84 | -72.86 | 6.70 | -66.17 | 85.9 |
| 2509.80 | H | - | - | -72.66 | 7.63 | -65.03 | 84.7 |

**Table 7-11. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4183)**

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 846.60 | | | MHz |
| CHANNEL: | 4233 | | | |
| MEASURED OUTPUT POWER: | 19.31 | dBm | = | 0.085 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 32.31 | | dBc |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | [dBc] |
|---|---|---|---|---|---|---|---|
| 1693.20 | H | 113 | 261 | -68.99 | 6.70 | -62.29 | 81.6 |
| 2539.80 | H | 112 | 83 | -72.25 | 7.60 | -64.65 | 84.0 |
| 3386.40 | H | - | - | -69.88 | 7.65 | -62.24 | 81.5 |

**Table 7-12. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4233)**


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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1712.40 | | | MHz |
| CHANNEL: | 1312 | | | |
| MEASURED OUTPUT POWER: | 25.04 | dBm | = | 0.319 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 38.04 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3424.80 | H | 111 | 248 | -65.81 | 9.87 | -55.94 | 81.0 |
| 5137.20 | H | - | - | -67.56 | 10.76 | -56.80 | 81.8 |

**Table 7-13. Radiated Spurious Data (AWS WCDMA Mode – Ch. 1312)**

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1732.60 | | | MHz |
| CHANNEL: | 1413 | | | |
| MEASURED OUTPUT POWER: | 24.89 | dBm | = | 0.309 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 37.89 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3465.20 | H | 111 | 87 | -62.74 | 9.91 | -52.82 | 77.7 |
| 5197.80 | H | - | - | -66.50 | 10.75 | -55.75 | 80.6 |

**Table 7-14. Radiated Spurious Data (AWS WCDMA Mode – Ch. 1413)**


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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1752.60 | | | MHz |
| CHANNEL: | 1513 | | | |
| MEASURED OUTPUT POWER: | 24.32 | dBm | = | 0.271 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 37.32 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3505.20 | H | 205 | 207 | -66.68 | 9.95 | -56.73 | 81.1 |
| 5257.80 | H | - | - | -67.22 | 10.71 | -56.51 | 80.8 |

**Table 7-15. Radiated Spurious Data (AWS WCDMA Mode – Ch. 1513)**

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1850.20 | | | MHz |
| CHANNEL: | 512 | | | |
| MEASURED OUTPUT POWER: | 31.97 | dBm | = | 1.574 W |
| MODULATION SIGNAL: | GPRS (GMSK) | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 44.97 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3700.40 | H | 120 | 240 | -63.32 | 9.53 | -53.79 | 85.8 |
| 5550.60 | H | 100 | 215 | -64.12 | 11.01 | -53.12 | 85.1 |
| 7400.80 | H | - | - | -57.06 | 10.94 | -46.12 | 78.1 |

**Table 7-16. Radiated Spurious Data (PCS GPRS Mode – Ch. 512)**


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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1880.00 | | | MHz |
| CHANNEL: | 661 | | | |
| MEASURED OUTPUT POWER: | 31.69 | dBm | = 1.477 | W |
| MODULATION SIGNAL: | GPRS (GMSK) | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 44.69 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3760.00 | H | 185 | 273 | -64.71 | 9.39 | -55.33 | 87.0 |
| 5640.00 | H | 187 | 40 | -63.35 | 11.22 | -52.13 | 83.8 |
| 7520.00 | H | - | - | -57.14 | 11.10 | -46.04 | 77.7 |

**Table 7-17. Radiated Spurious Data (PCS GPRS Mode – Ch. 661)**

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1909.80 | | | MHz |
| CHANNEL: | 810 | | | |
| MEASURED OUTPUT POWER: | 31.34 | dBm | = 1.361 | W |
| MODULATION SIGNAL: | GPRS (GMSK) | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 44.34 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3819.60 | H | 199 | 267 | -63.00 | 9.32 | -53.68 | 85.0 |
| 5729.40 | H | - | - | -64.14 | 11.37 | -52.77 | 84.1 |

**Table 7-18. Radiated Spurious Data (PCS GPRS Mode – Ch. 810)**


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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1852.40 | | | MHz |
| CHANNEL: | 9262 | | | |
| MEASURED OUTPUT POWER: | 24.28 | dBm | = | 0.268 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 37.28 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3704.80 | H | 202 | 269 | -64.49 | 9.52 | -54.97 | 79.3 |
| 5557.20 | H | - | - | -67.66 | 11.03 | -56.63 | 80.9 |

**Table 7-19. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9262)**

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1880.00 | | | MHz |
| CHANNEL: | 9400 | | | |
| MEASURED OUTPUT POWER: | 24.08 | dBm | = | 0.256 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 37.08 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3760.00 | H | 204 | 258 | -62.65 | 9.39 | -53.27 | 77.4 |
| 5640.00 | H | - | - | -67.84 | 11.22 | -56.62 | 80.7 |

**Table 7-20. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9400)**


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| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 1907.60 | | | MHz |
| CHANNEL: | 9538 | | | |
| MEASURED OUTPUT POWER: | 24.29 | dBm | = | 0.269 W |
| MODULATION SIGNAL: | WCDMA | | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 37.29 | | dBc |

| 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] | [dBc] |
|---|---|---|---|---|---|---|---|
| 3815.20 | H | 203 | 272 | -66.21 | 9.32 | -56.90 | 81.2 |
| 5722.80 | H | - | - | -66.88 | 11.35 | -55.53 | 79.8 |

**Table 7-21. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9538)**


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## 7.8 Frequency Stability / Temperature Variation

**§2.1055 §22.355 §24.235 §27.54**

**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.

***For Part 22, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency. For Part 24 and Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.***

**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


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## Frequency Stability / Temperature Variation

**§2.1055 §22.355**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 836,600,000 | Hz |
| CHANNEL: | 190 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |
| DEVIATION LIMIT: | ± 0.00025 % or 2.5 ppm | |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 836,599,935 | -65 | -0.0000078 |
| 100 % | | - 30 | 836,599,901 | -99 | -0.0000118 |
| 100 % | | - 20 | 836,599,996 | -4 | -0.0000004 |
| 100 % | | - 10 | 836,599,885 | -115 | -0.0000137 |
| 100 % | | 0 | 836,599,954 | -46 | -0.0000055 |
| 100 % | | + 10 | 836,599,802 | -198 | -0.0000236 |
| 100 % | | + 20 | 836,599,991 | -9 | -0.0000011 |
| 100 % | | + 30 | 836,599,983 | -17 | -0.0000020 |
| 100 % | | + 40 | 836,599,968 | -32 | -0.0000038 |
| 100 % | | + 50 | 836,599,897 | -103 | -0.0000123 |
| BATT. ENDPOINT | 3.45 | + 20 | 836,599,906 | -94 | -0.0000113 |

**Table 7-22. Frequency Stability Data (Cellular GPRS Mode – Ch. 190)**



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## Frequency Stability / Temperature Variation

**§2.1055 §22.355**

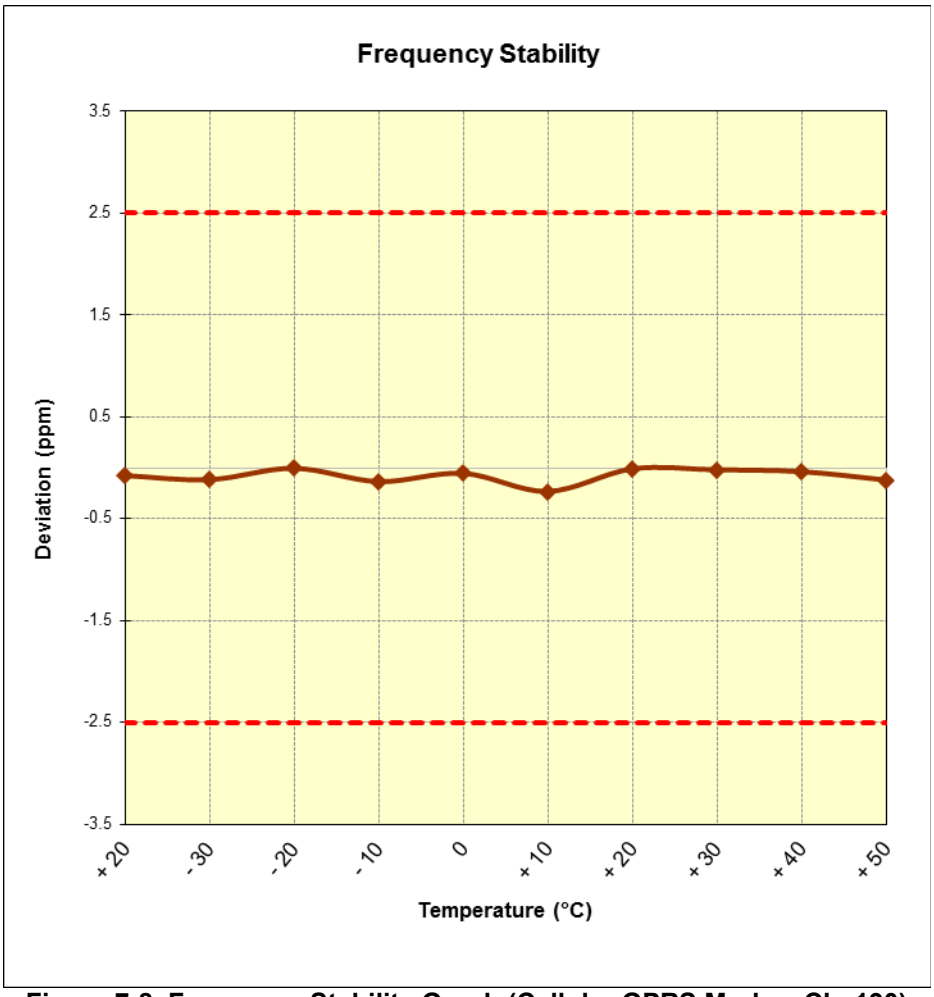


**Figure 7-8. Frequency Stability Graph (Cellular GPRS Mode – Ch. 190)**



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## Frequency Stability / Temperature Variation

**§2.1055 §22.355**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 836,600,000 | Hz |
| CHANNEL: | 4183 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |
| DEVIATION LIMIT: | ± 0.00025 % or 2.5 ppm | |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 836,599,810 | -190 | -0.0000227 |
| 100 % | | - 30 | 836,599,998 | -2 | -0.0000003 |
| 100 % | | - 20 | 836,599,824 | -176 | -0.0000211 |
| 100 % | | - 10 | 836,599,949 | -51 | -0.0000061 |
| 100 % | | 0 | 836,599,852 | -148 | -0.0000176 |
| 100 % | | + 10 | 836,599,873 | -127 | -0.0000152 |
| 100 % | | + 20 | 836,599,886 | -114 | -0.0000136 |
| 100 % | | + 30 | 836,599,828 | -172 | -0.0000206 |
| 100 % | | + 40 | 836,599,878 | -122 | -0.0000145 |
| 100 % | | + 50 | 836,599,802 | -198 | -0.0000236 |
| BATT. ENDPOINT | 3.45 | + 20 | 836,599,986 | -14 | -0.0000016 |

**Table 7-23. Frequency Stability Data (Cellular WCDMA Mode – Ch. 4183)**



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## Frequency Stability / Temperature Variation

**§2.1055 §22.355**

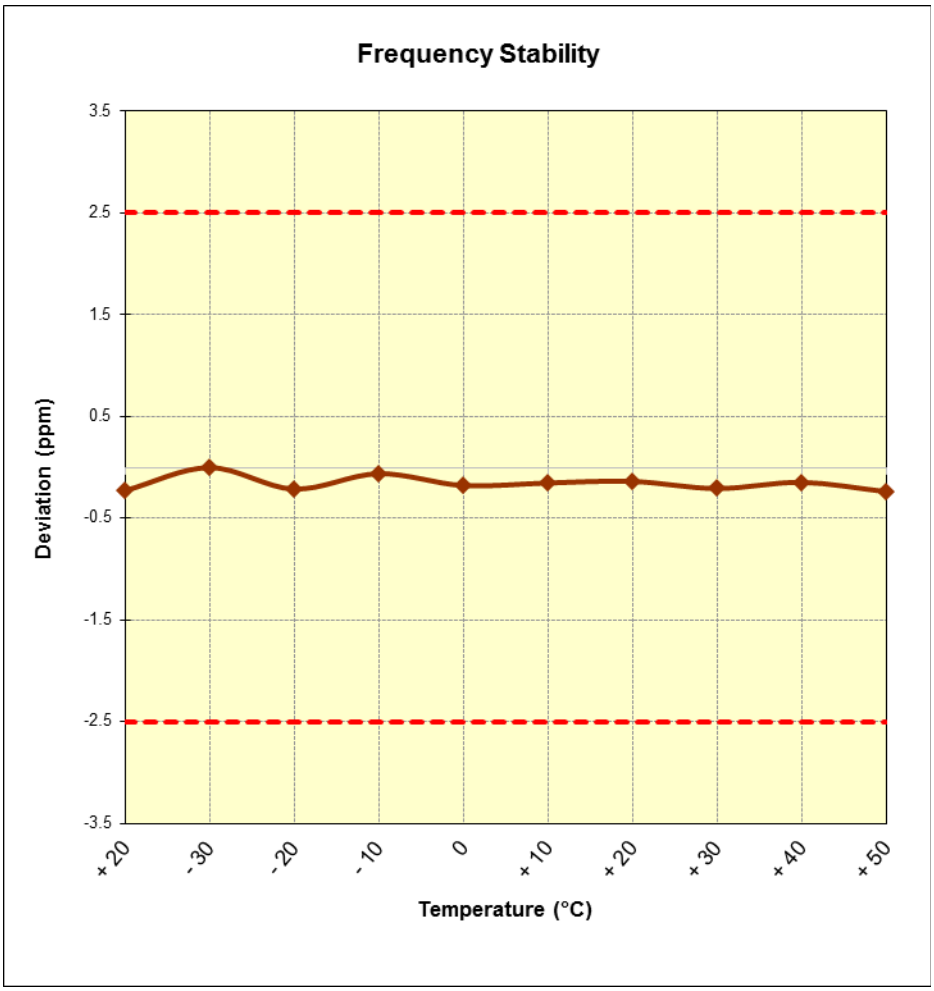


**Figure 7-9. Frequency Stability Graph (Cellular WCDMA Mode – Ch. 4183)**



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## Frequency Stability / Temperature Variation

**§2.1055 §27.54**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 1,732,600,000 | Hz |
| CHANNEL: | 1413 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 1,732,599,949 | -51 | -0.0000029 |
| 100 % | | - 30 | 1,732,599,992 | -8 | -0.0000004 |
| 100 % | | - 20 | 1,732,599,867 | -133 | -0.0000077 |
| 100 % | | - 10 | 1,732,599,846 | -154 | -0.0000089 |
| 100 % | | 0 | 1,732,599,893 | -107 | -0.0000062 |
| 100 % | | + 10 | 1,732,599,839 | -161 | -0.0000093 |
| 100 % | | + 20 | 1,732,599,976 | -24 | -0.0000014 |
| 100 % | | + 30 | 1,732,599,820 | -180 | -0.0000104 |
| 100 % | | + 40 | 1,732,599,998 | -2 | -0.0000001 |
| 100 % | | + 50 | 1,732,599,968 | -32 | -0.0000018 |
| BATT. ENDPOINT | 3.45 | + 20 | 1,732,599,914 | -86 | -0.0000049 |

**Table 7-24. Frequency Stability Data (AWS WCDMA Mode – Ch. 1413)**



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## Frequency Stability / Temperature Variation

**§2.1055 §27.54**

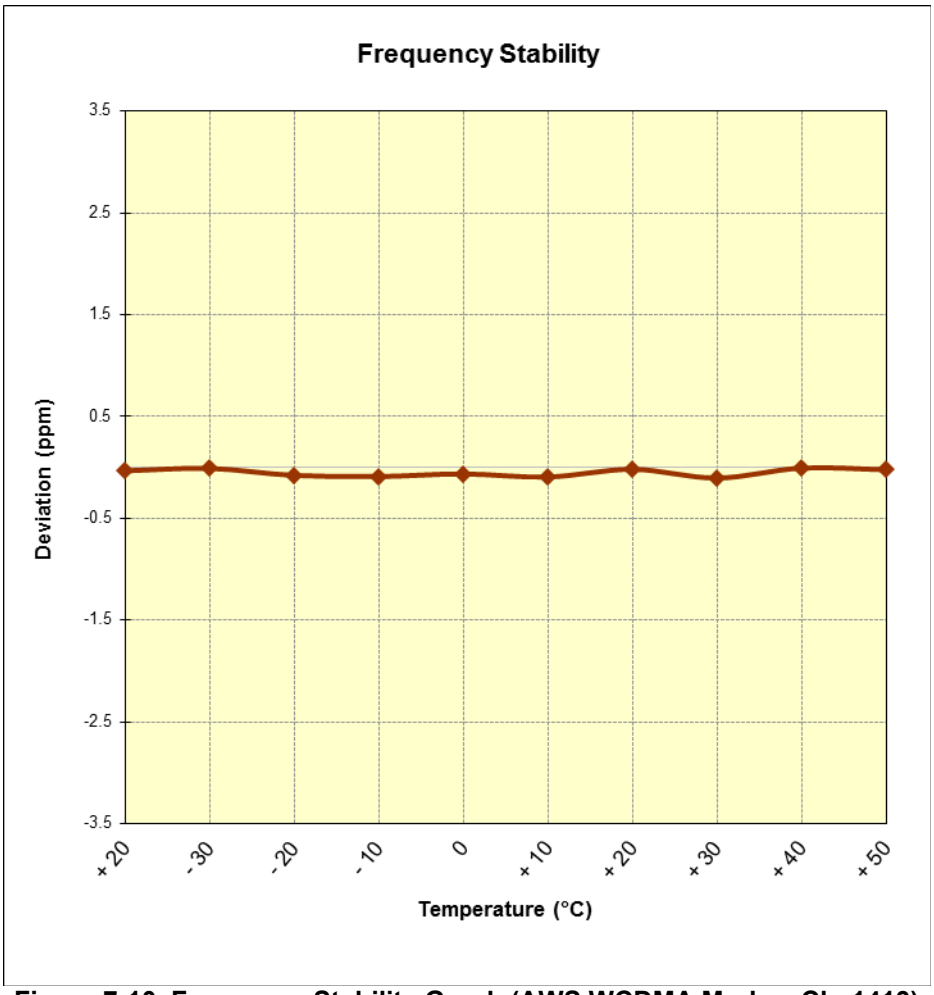


**Figure 7-10. Frequency Stability Graph (AWS WCDMA Mode – Ch. 1413)**



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## Frequency Stability / Temperature Variation

**§2.1055 §24.235**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 1,880,000,000 | Hz |
| CHANNEL: | 661 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 1,879,999,903 | -97 | -0.0000051 |
| 100 % | | - 30 | 1,879,999,815 | -185 | -0.0000099 |
| 100 % | | - 20 | 1,879,999,856 | -144 | -0.0000077 |
| 100 % | | - 10 | 1,879,999,847 | -153 | -0.0000082 |
| 100 % | | 0 | 1,879,999,965 | -35 | -0.0000019 |
| 100 % | | + 10 | 1,879,999,922 | -78 | -0.0000042 |
| 100 % | | + 20 | 1,879,999,936 | -64 | -0.0000034 |
| 100 % | | + 30 | 1,879,999,999 | -1 | 0.0000000 |
| 100 % | | + 40 | 1,879,999,902 | -98 | -0.0000052 |
| 100 % | | + 50 | 1,879,999,895 | -105 | -0.0000056 |
| BATT. ENDPOINT | 3.45 | + 20 | 1,879,999,866 | -134 | -0.0000071 |

**Table 7-25. Frequency Stability Data (PCS GPRS Mode – Ch. 661)**

**Note:**

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



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## Frequency Stability / Temperature Variation

**§2.1055 §24.235**

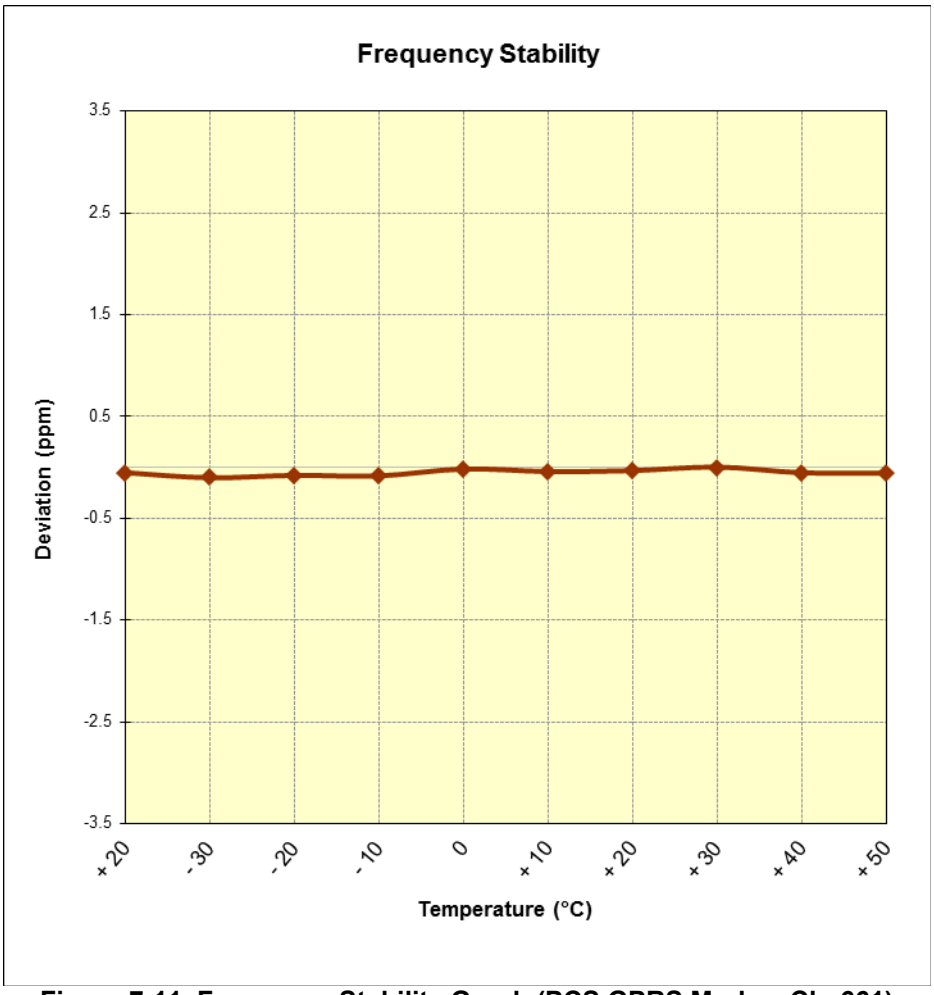


**Figure 7-11. Frequency Stability Graph (PCS GPRS Mode – Ch. 661)**



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## Frequency Stability / Temperature Variation

**§2.1055 §24.235**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 1,880,000,000 | Hz |
| CHANNEL: | 9400 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 1,879,999,973 | -27 | -0.0000014 |
| 100 % | | - 30 | 1,879,999,996 | -4 | -0.0000002 |
| 100 % | | - 20 | 1,879,999,846 | -154 | -0.0000082 |
| 100 % | | - 10 | 1,879,999,910 | -90 | -0.0000048 |
| 100 % | | 0 | 1,879,999,914 | -86 | -0.0000046 |
| 100 % | | + 10 | 1,879,999,923 | -77 | -0.0000041 |
| 100 % | | + 20 | 1,879,999,872 | -128 | -0.0000068 |
| 100 % | | + 30 | 1,879,999,859 | -141 | -0.0000075 |
| 100 % | | + 40 | 1,879,999,921 | -79 | -0.0000042 |
| 100 % | | + 50 | 1,879,999,915 | -85 | -0.0000045 |
| BATT. ENDPOINT | 3.45 | + 20 | 1,879,999,956 | -44 | -0.0000023 |

**Table 7-26. Frequency Stability Data (PCS WCDMA Mode – Ch. 9400)**

**Note:**

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



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## Frequency Stability / Temperature Variation

**§2.1055 §24.235**

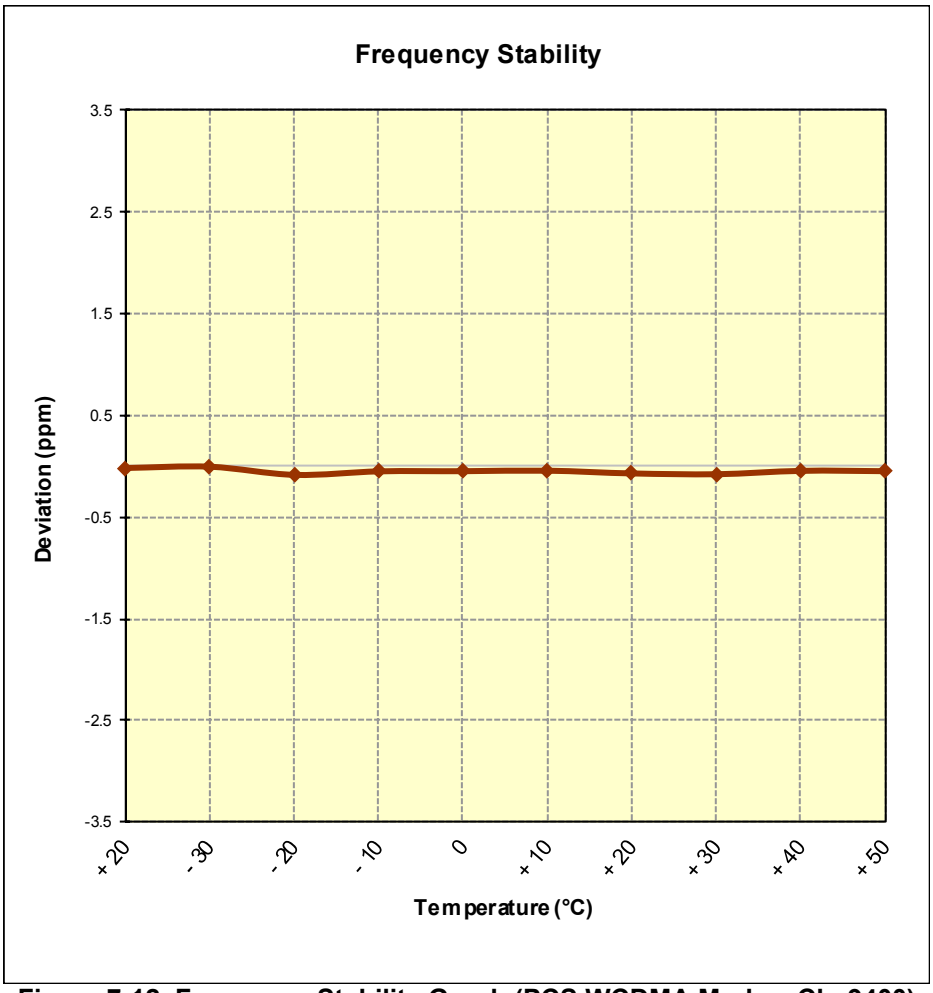


**Figure 7-12. Frequency Stability Graph (PCS WCDMA Mode – Ch. 9400)**



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# 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Electronics Co., Ltd. Portable Handset FCC ID: A3LSMG610M** complies with all the requirements of Parts 22, 24, & 27 of the FCC rules.



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