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MEASUREMENT REPORT
FCC Part 22 & 24

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

Date of Testing:
6/13 - 7/6/2017
Test Site/Location:
PCTEST Lab., Columbia, MD, USA
Test Report Serial No.:
1M1706130193-02.ZNF

FCC ID:	**ZNFUN220**
APPLICANT:	**LG ELECTRONICS MOBILECOMM U.S.A**

Application Type:	Certification
Model:	LG-UN220
Additional Model(s):	LGUN220, UN220
EUT Type:	Portable Handset
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§2 §22(H) §24(E)
Test Procedure(s):	ANSI/TIA-603-D-2010, KDB 971168 D01 v02r02
Test Device Serial No.:	*identical prototype* [S/N: 01703, 01711, 01687]

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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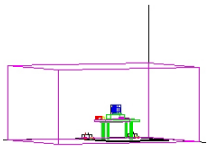

MEASUREMENT REPORT
FCC Part 22 & 24

§2.1033 General Information

APPLICANT:	LG Electronics MobileComm U.S.A
APPLICANT ADDRESS:	1000 Sylvan Avenue Englewood Cliffs, NJ 07632, United States
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)
BASE MODEL:	LG-UN220
FCC ID:	ZNFUN220
FCC CLASSIFICATION:	PCS Licensed Transmitter Held to Ear (PCE)
MODE:	GSM / GPRS / EDGE / CDMA / WCDMA
FREQUENCY TOLERANCE:	±0.00025 % (2.5 ppm)
Test Device Serial No.:	01703, 01711, 01687 ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	6/13 - 7/6/2017
TEST REPORT S/N:	1M1706130193-02.ZNF

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, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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Mode	FCC Rule Part	Tx Frequency (MHz)	ERP/EIRP		Emission Designator
			Max. Power (W)	Max. Power (dBm)	
GPRS850	22H	824.2 - 848.8	0.911	29.60	246KGXW
EDGE850	22H	824.2 - 848.8	0.371	25.69	242KG7W
WCDMA850	22H	826.4 - 846.6	0.165	22.17	4M16F9W
CDMA850	22H	824.70 - 848.31	0.240	23.81	1M27F9W
GPRS1900	24E	1850.2 - 1909.8	0.836	29.22	246KGXW
EDGE1900	24E	1850.2 - 1909.8	0.139	21.42	238KG7W
WCDMA1900	24E	1852.4 - 1907.6	0.188	22.74	4M17F9W
CDMA1900	24E	1851.25 - 1908.75	0.243	23.86	1M28F9W

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.

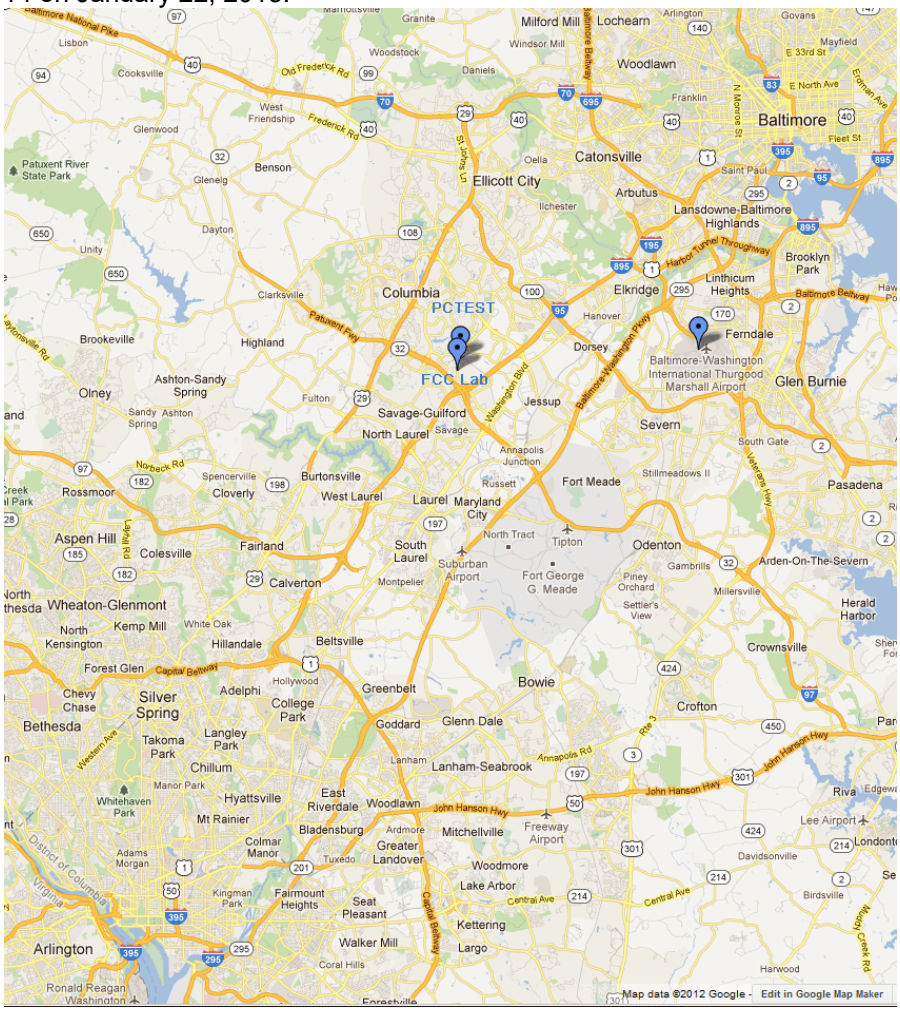

Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LGE Portable Handset FCC ID: ZNFUN220**. 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 CDMA/EvDO (BC0, BC1), 850/1900 GSM/GPRS/EDGE, 850/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 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 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

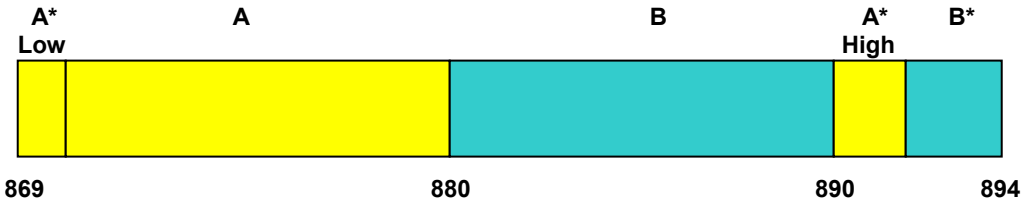
3.1 Evaluation Procedure

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)

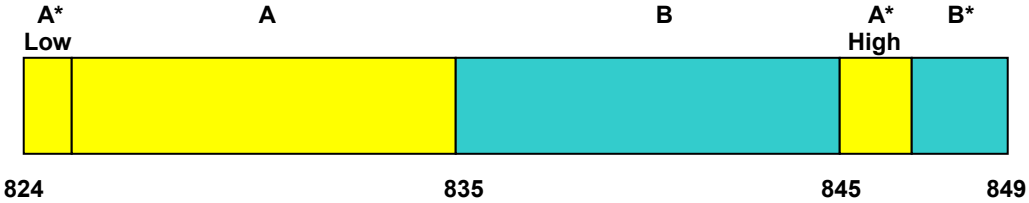
BLOCK 2: 880 – 890 MHz (B)

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)

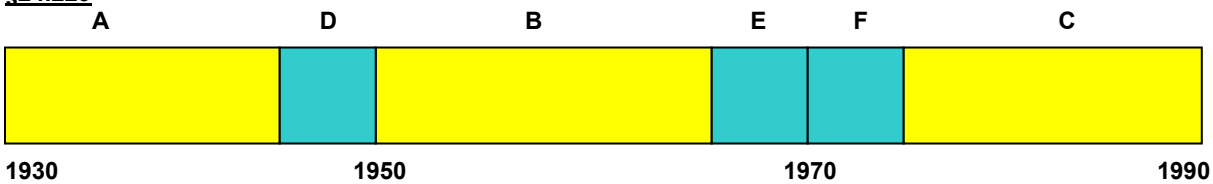
BLOCK 2: 835 – 845 MHz (B)

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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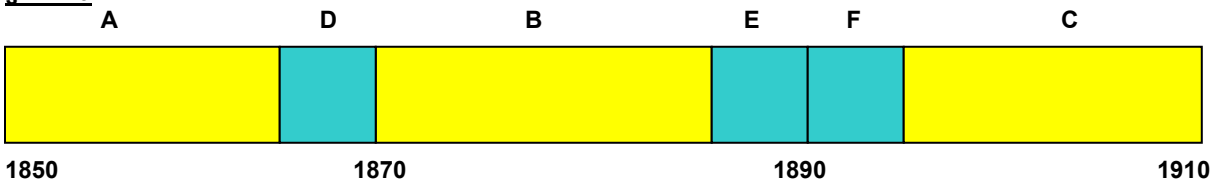
3.5 PCS - Mobile Frequency Blocks

§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 Radiated Measurements

§2.1053 §22.913(a.2) §22.917(a) §24.232(c) §24.238(a)

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 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

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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	10/28/2016	Annual	10/28/2017	US46470561
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	4/11/2017	Annual	4/11/2018	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	4/26/2016	Biennial	4/26/2018	128337
ETS Lindgren	3160-09	18-26.5 GHz Standard Gain Horn	8/23/2016	Biennial	8/23/2018	135427
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	3/24/2017	Annual	3/24/2018	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
PCTEST	-	EMC Switch System	7/6/2016	Annual	7/6/2017	NM2
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	7/27/2016	Annual	7/27/2017	103200
Rohde & Schwarz	CMU200	Base Station Simulator	5/22/2017	Annual	5/22/2018	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	5/11/2017	Annual	5/11/2018	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. 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.

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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)

CDMA Emission Designator

Emission Designator = 1M25F9W

CDMA BW = 1.25 MHz
F = Frequency Modulation
9 = Composite 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: LG Electronics MobileComm U.S.A

FCC ID: ZNFUN220

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

Mode(s): GSM / GPRS / EDGE / CDMA / WCDMA

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 22.917(a) 24.238(a)	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 24.235	Frequency Stability	< 2.5 ppm (Part 22) Emission must remain in band (Part 24)		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
2.1053 22.917(a) 24.238(a)	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 3.9.

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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.

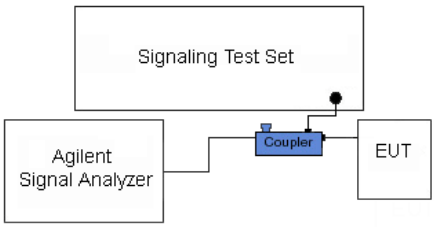

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

The spectrum analyzer settings used in this section were deemed appropriate to determine the worst case bandwidth measurements.

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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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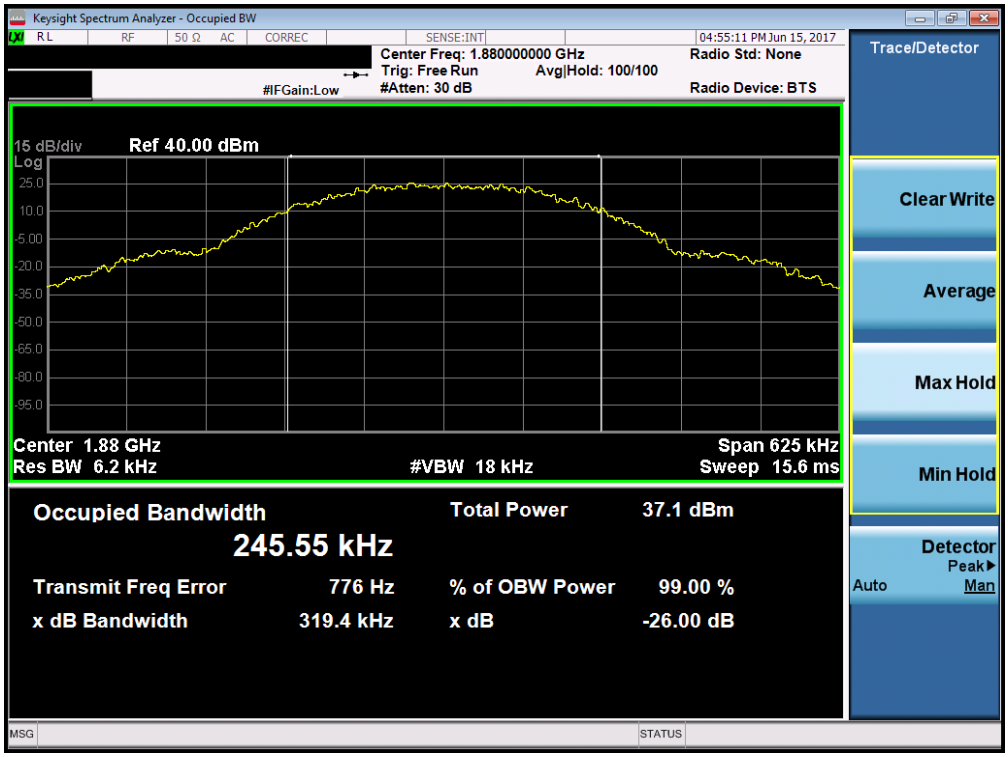
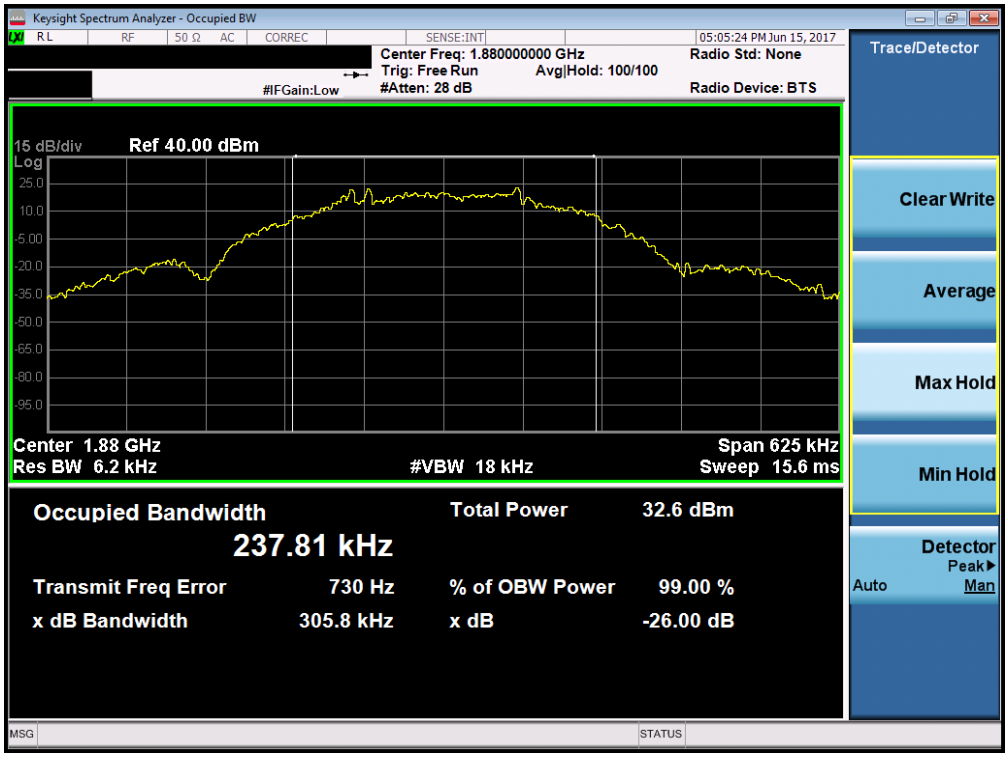


Plot 7-3. Occupied Bandwidth Plot (PCS GPRS Mode – Ch. 661)



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

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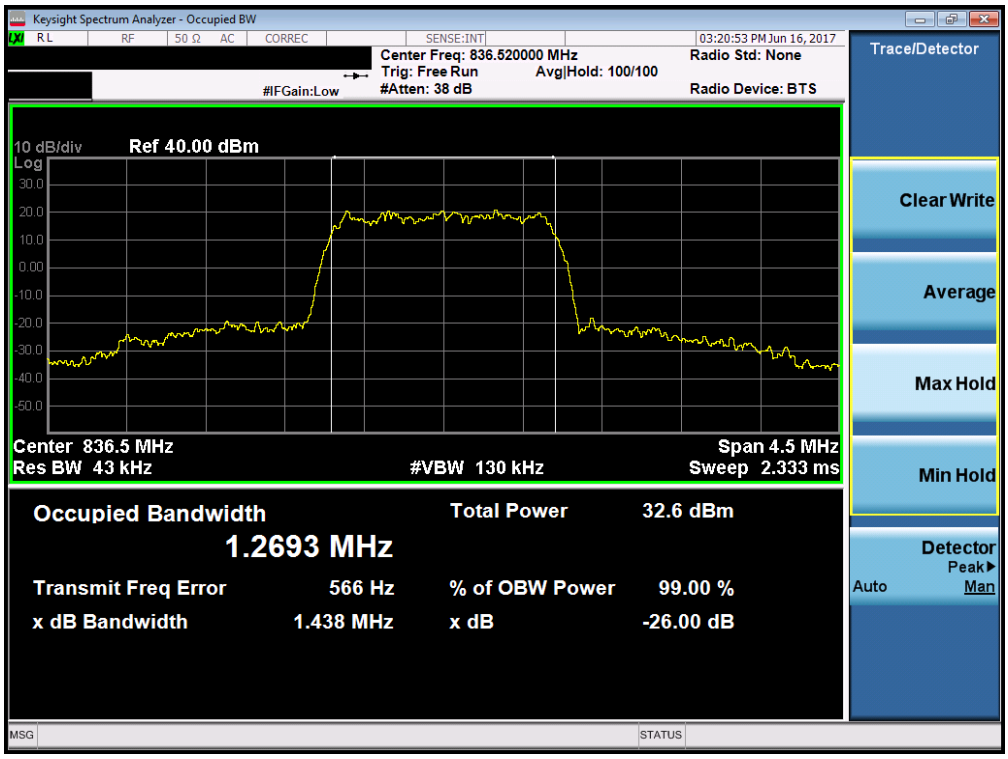

Plot 7-5. Occupied Bandwidth Plot (Cellular CDMA Mode – Ch. 384)

Plot 7-6. Occupied Bandwidth Plot (PCS CDMA Mode – Ch. 600)

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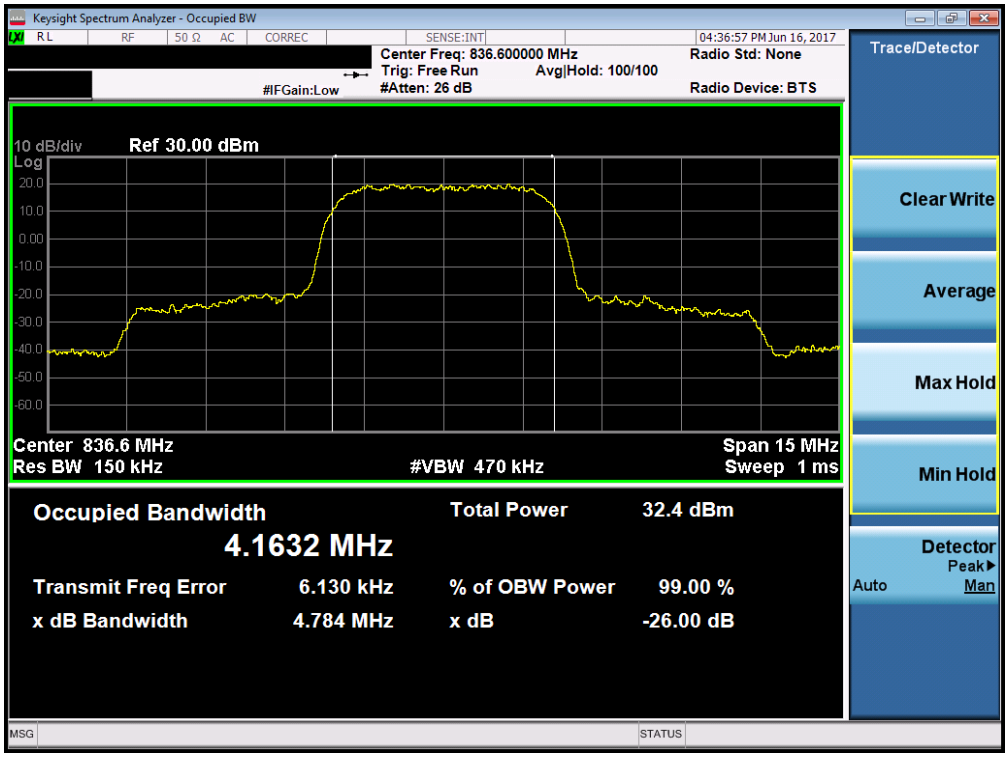

Plot 7-7. Occupied Bandwidth Plot (Cellular WCDMA Mode – Ch. 4183)

Plot 7-8. 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)

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 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.

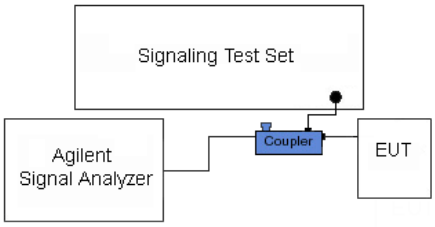

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 1MHz, and 100 kHz or greater for Part 22 measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

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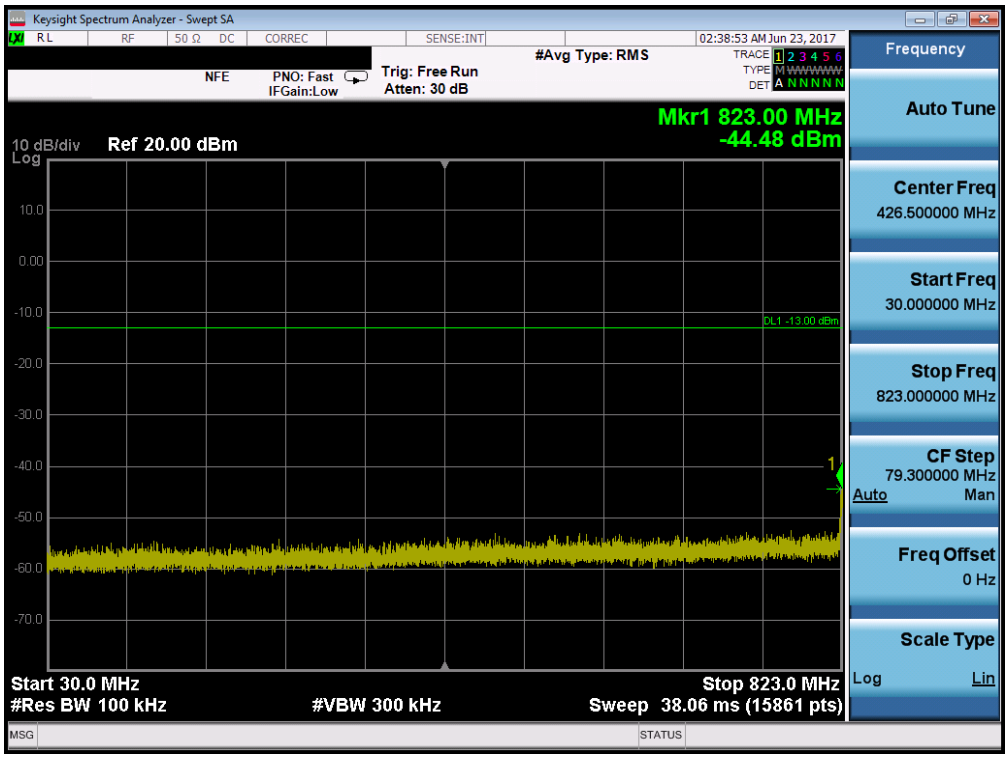
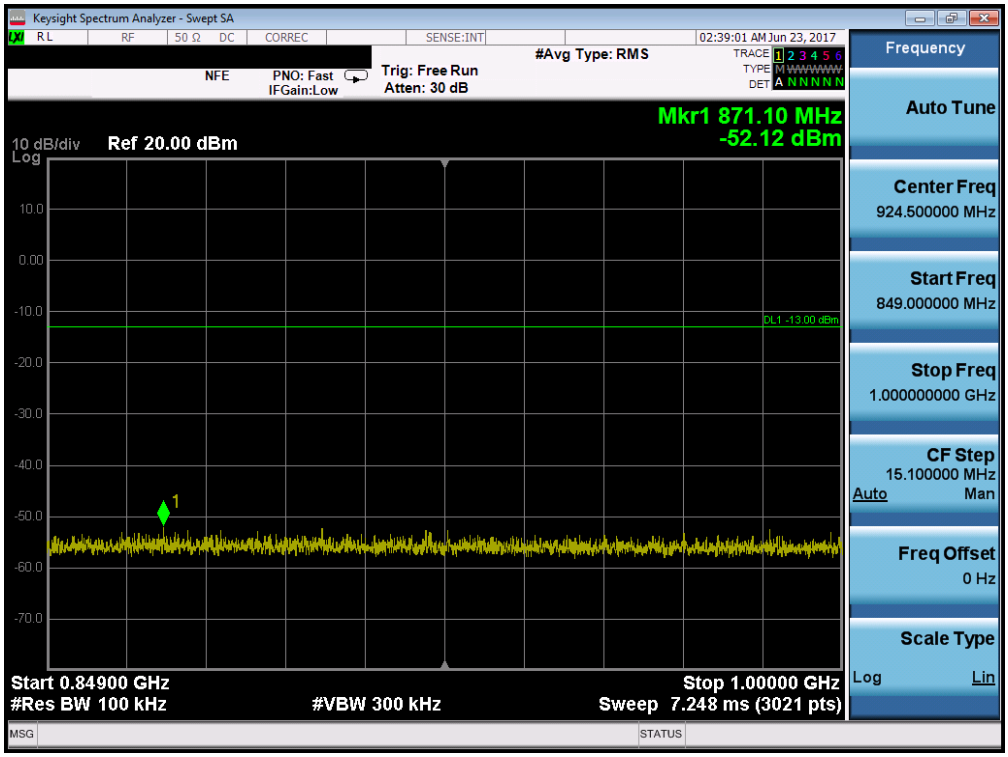


Plot 7-9. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 128)



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

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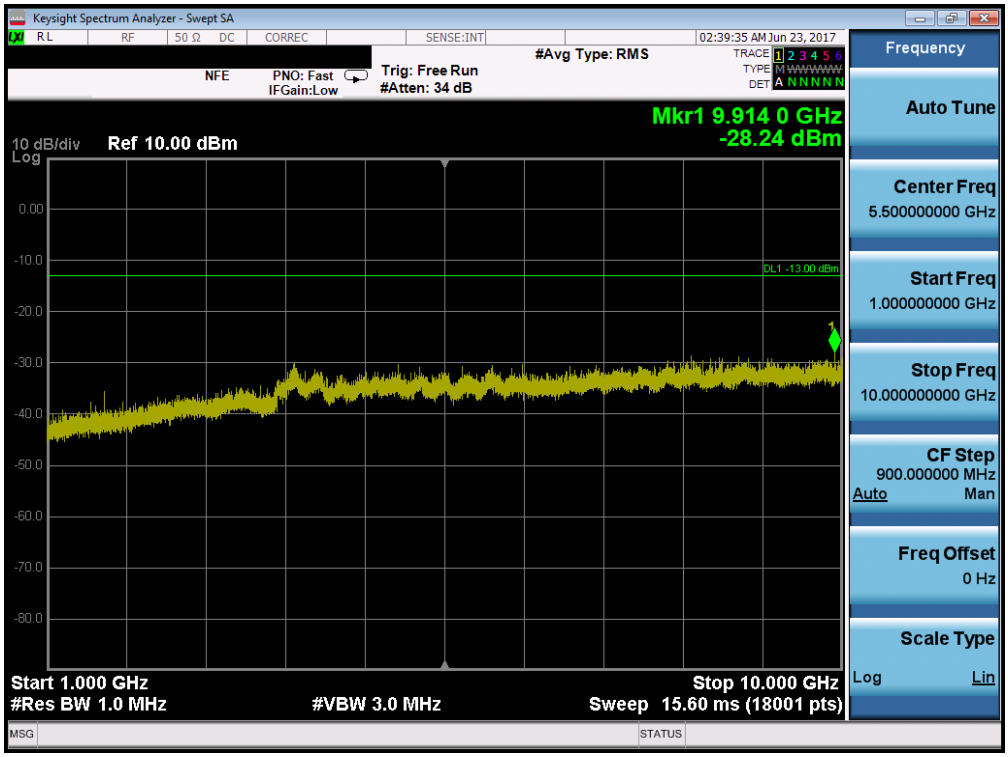
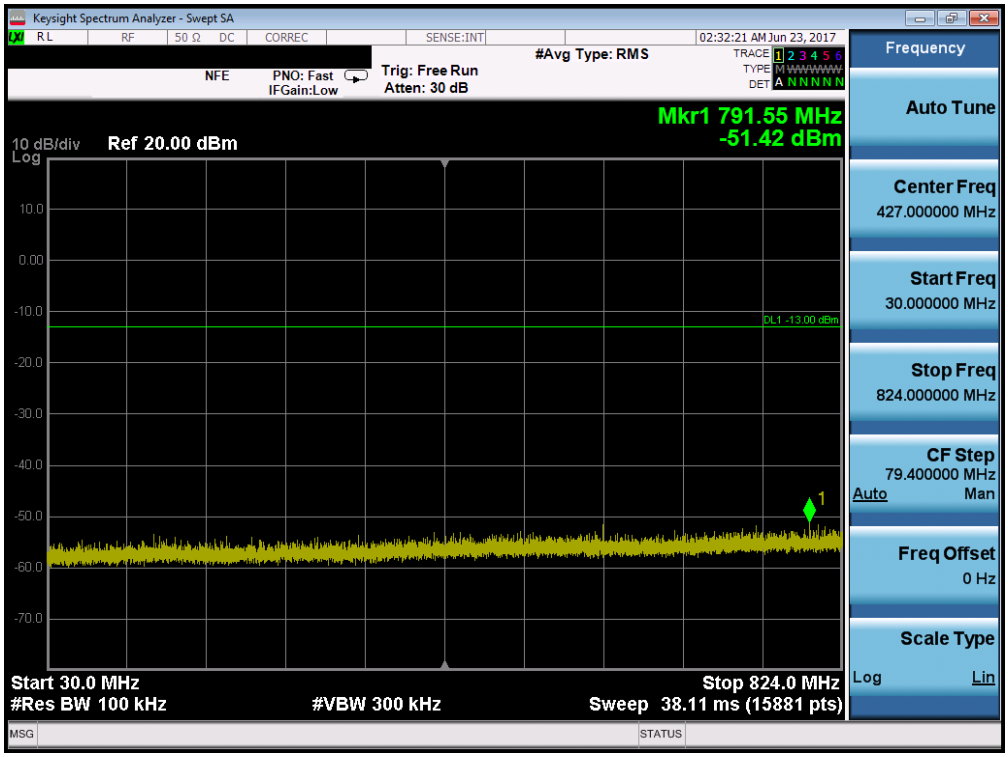


Plot 7-11. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 128)



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

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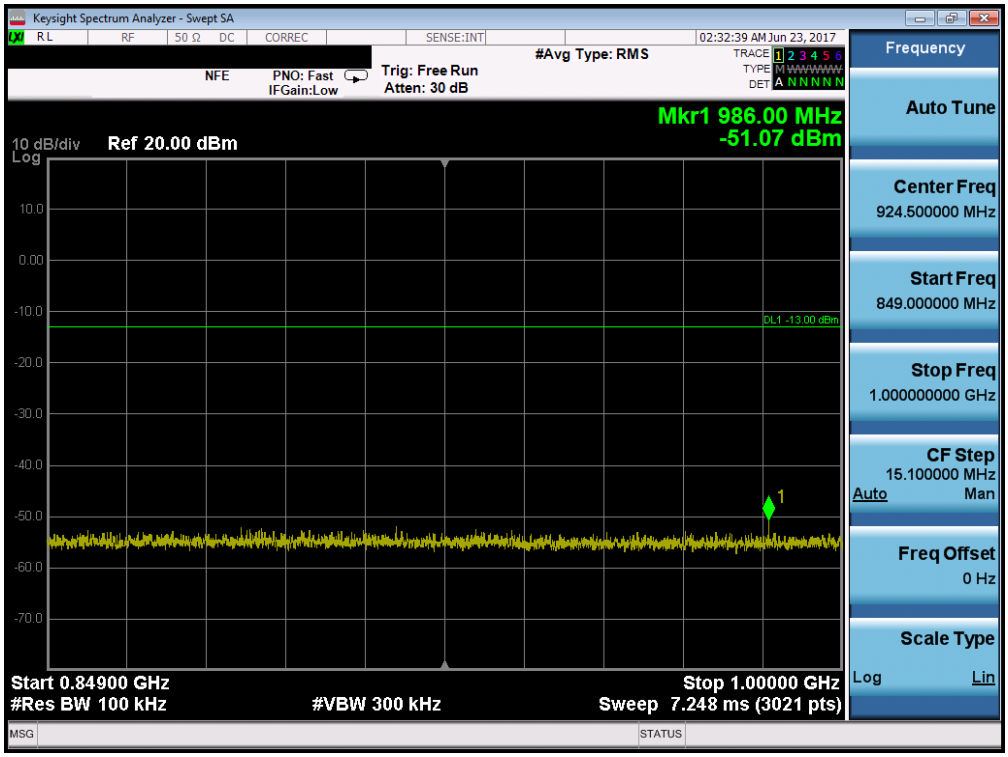
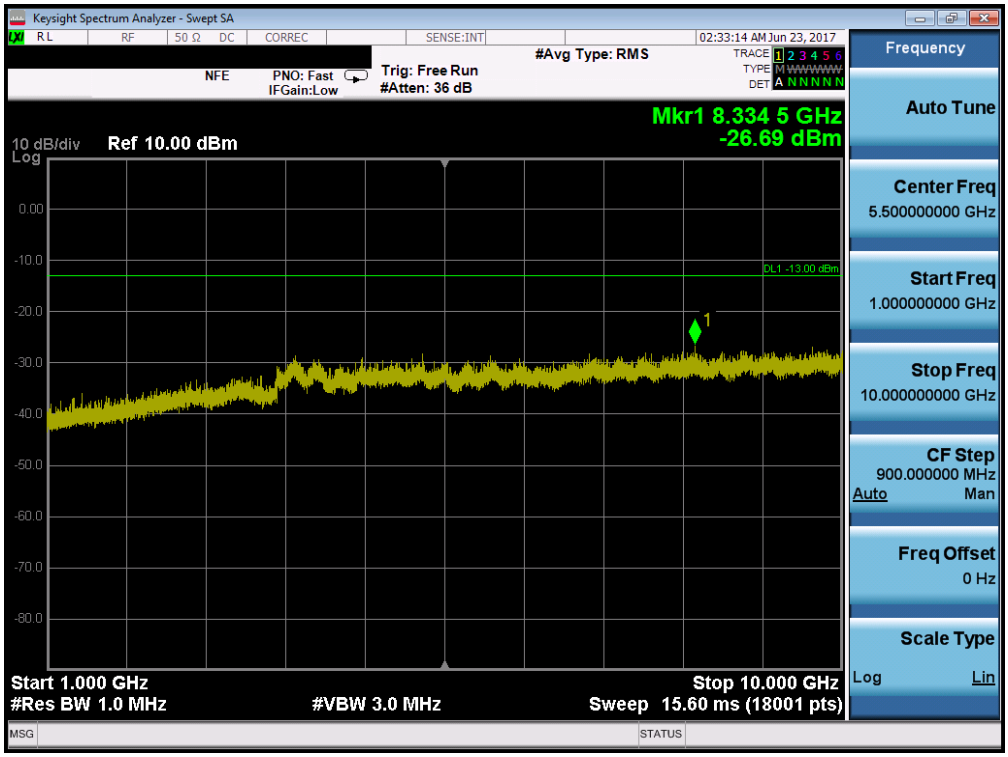


Plot 7-13. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 190)



Plot 7-14. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 190)

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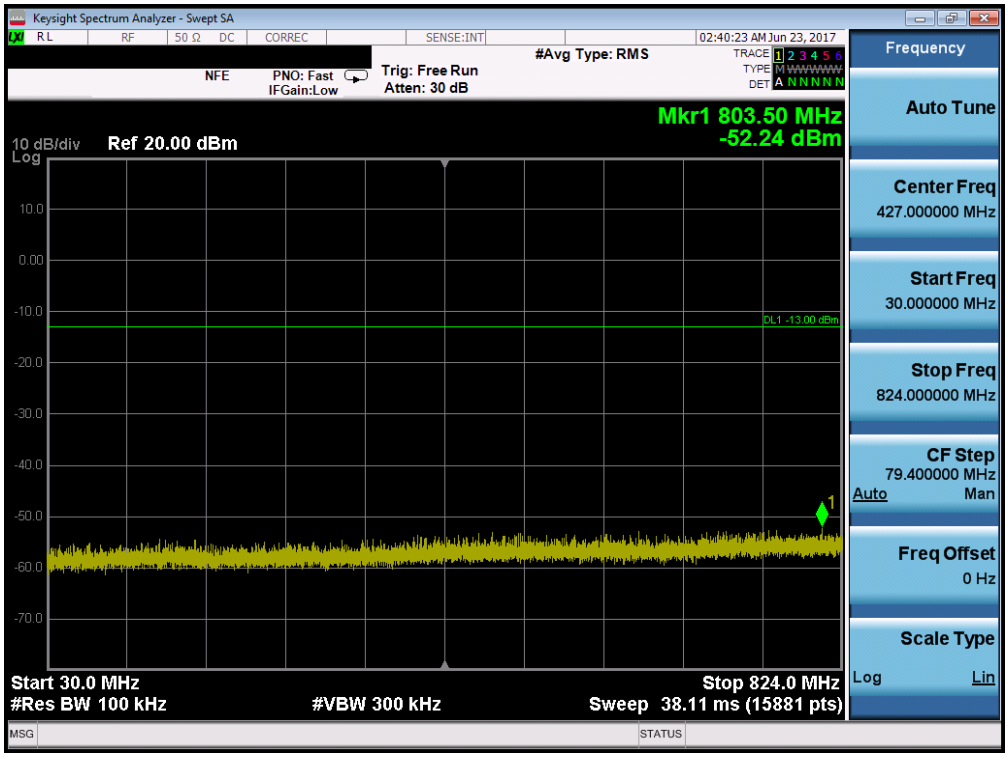
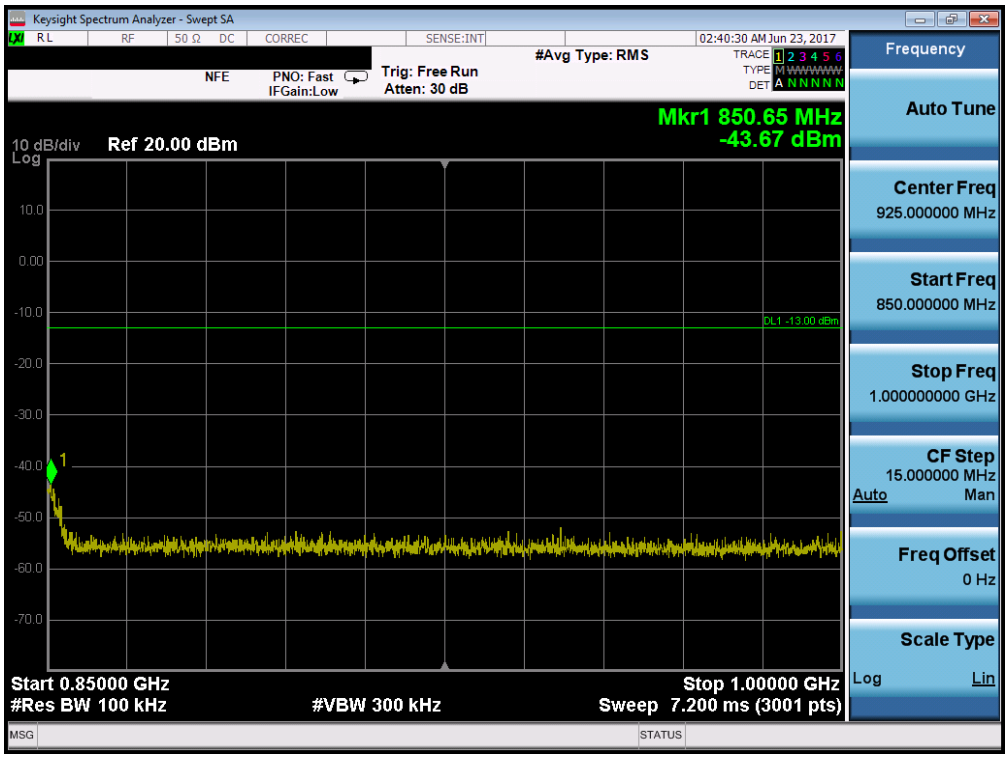


Plot 7-15. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 251)



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

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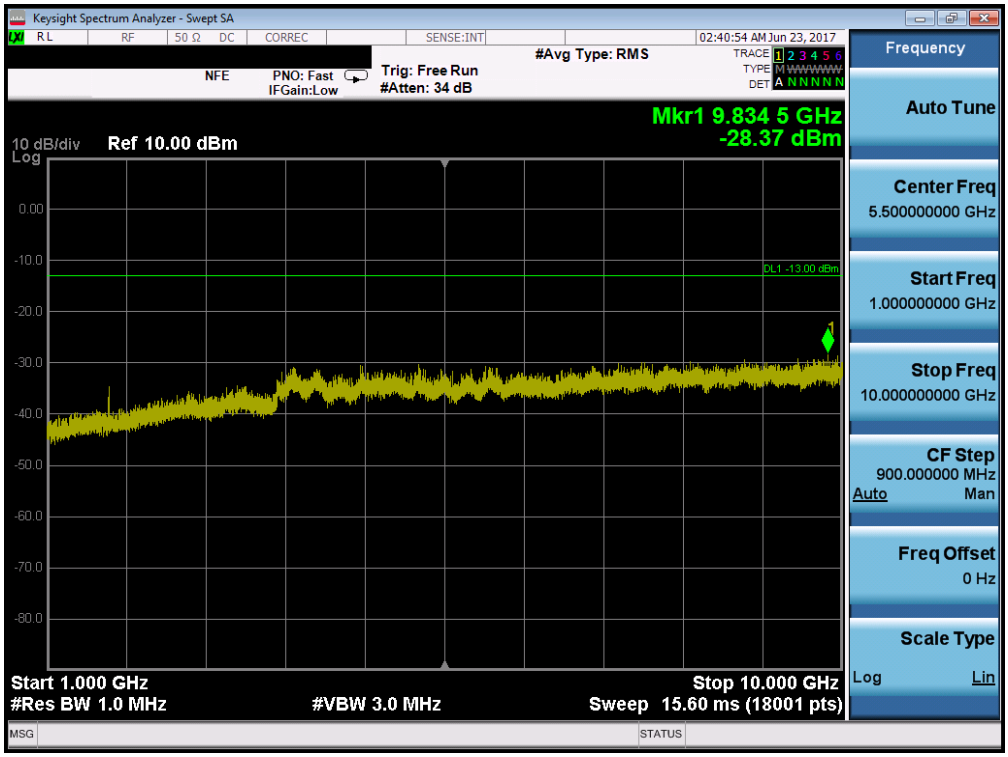
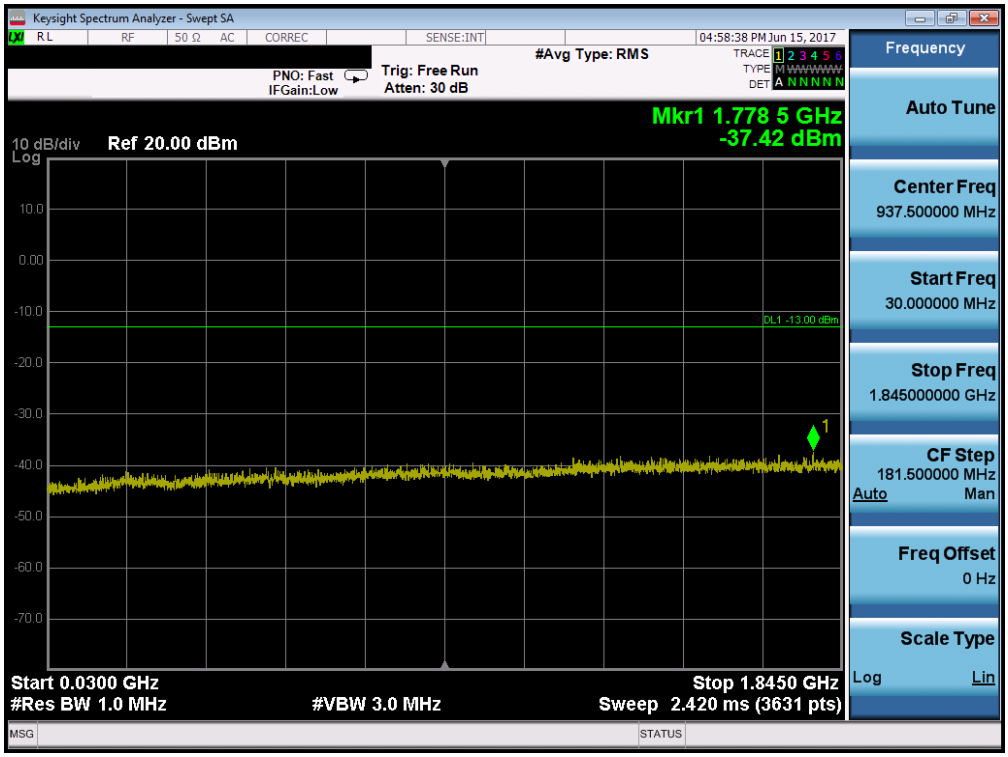


Plot 7-17. Conducted Spurious Plot (Cellular GPRS Mode – Ch. 251)



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

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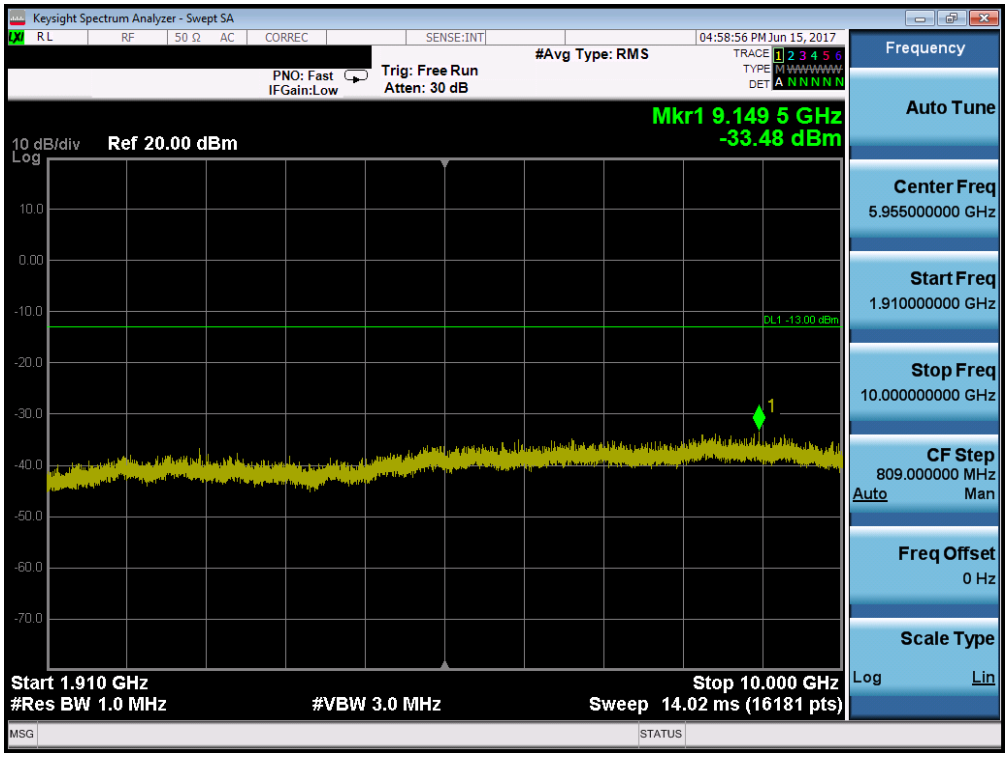
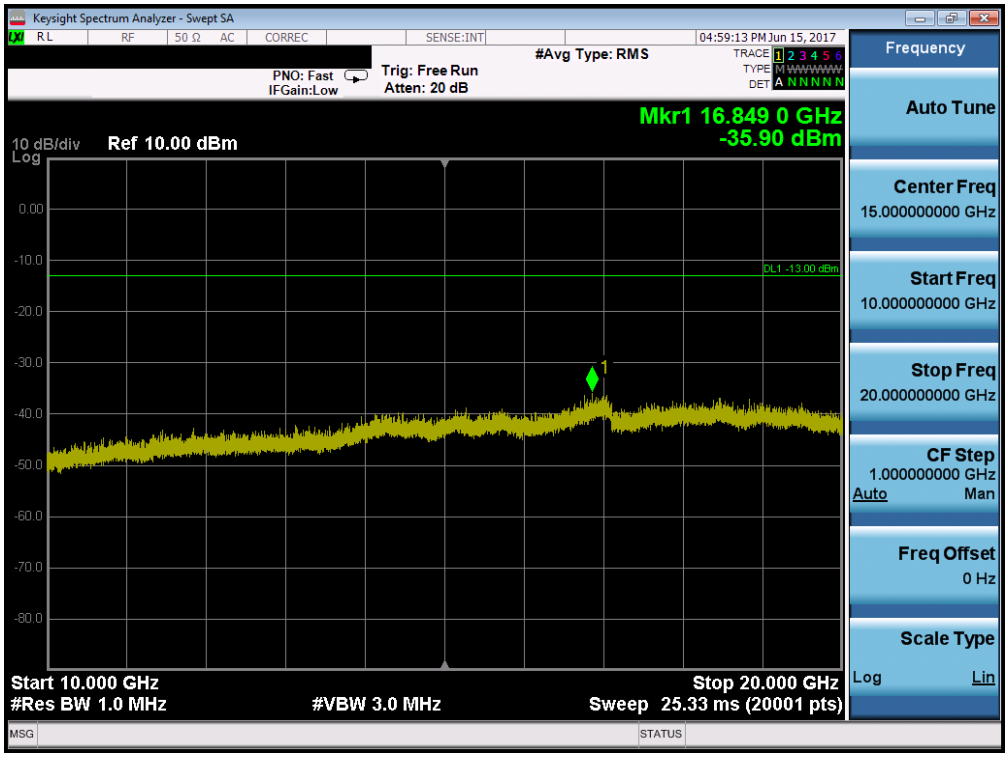


Plot 7-19. Conducted Spurious Plot (PCS GPRS Mode – Ch. 512)



Plot 7-20. Conducted Spurious Plot (PCS GPRS Mode – Ch. 512)

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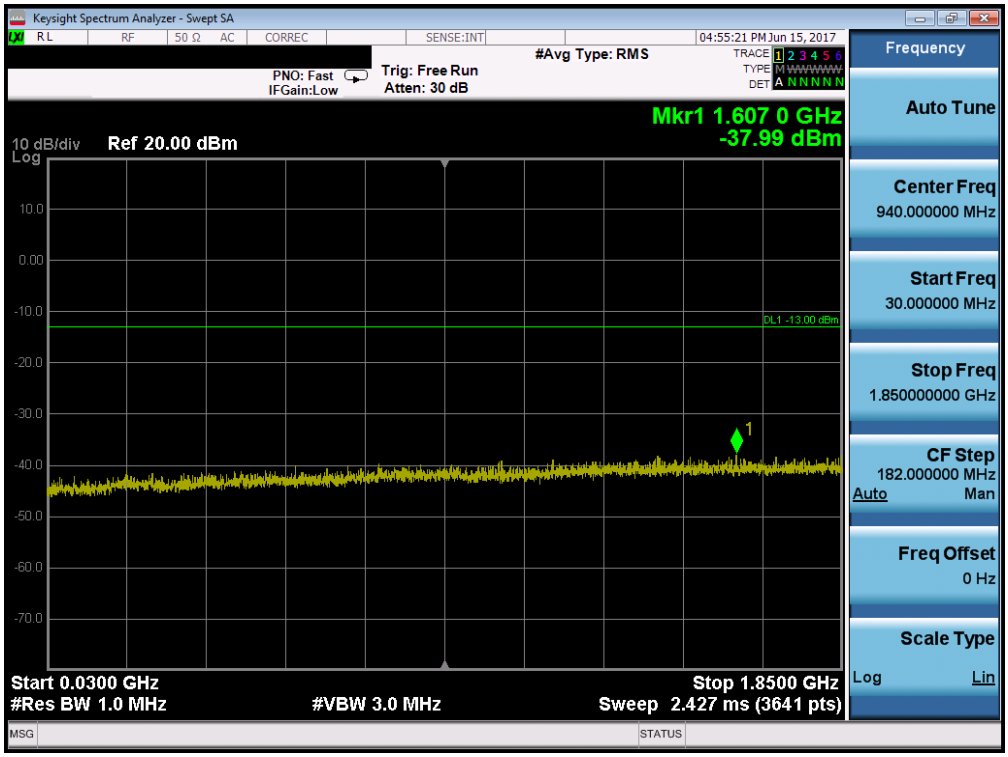
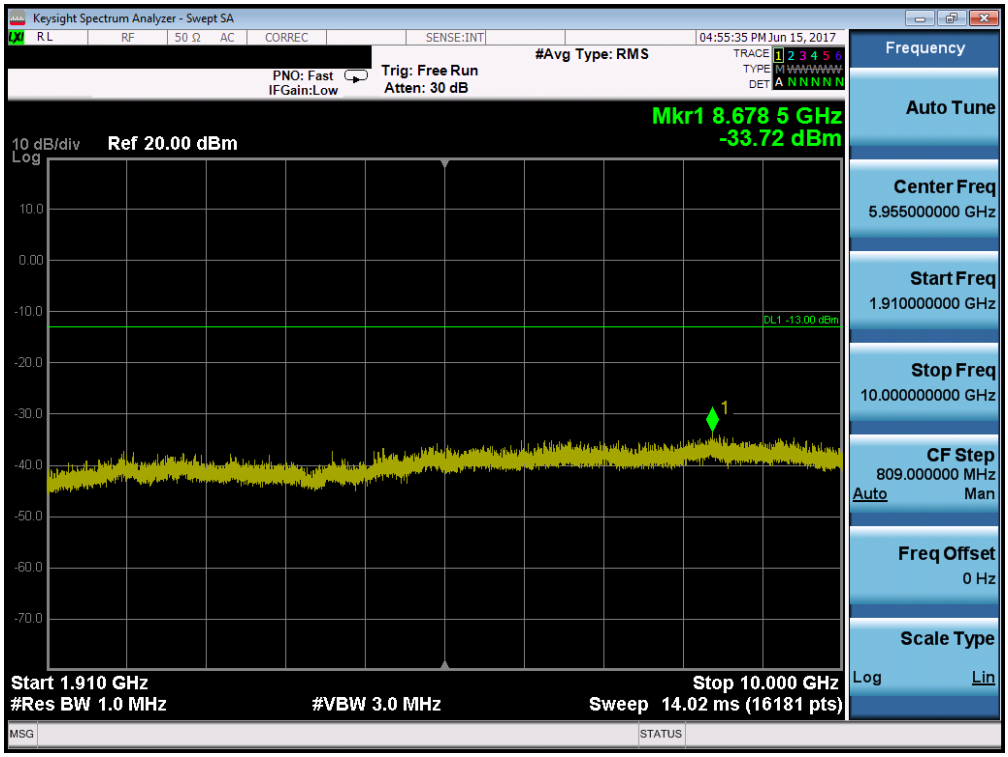


Plot 7-21. Conducted Spurious Plot (PCS GPRS Mode – Ch. 661)



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

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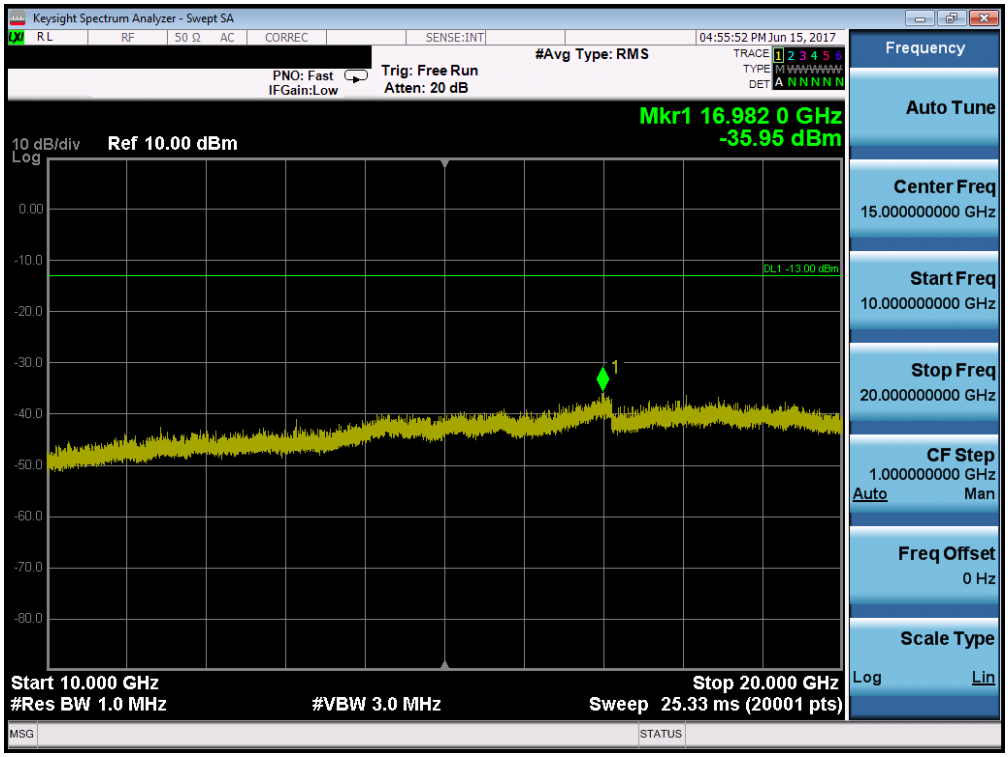
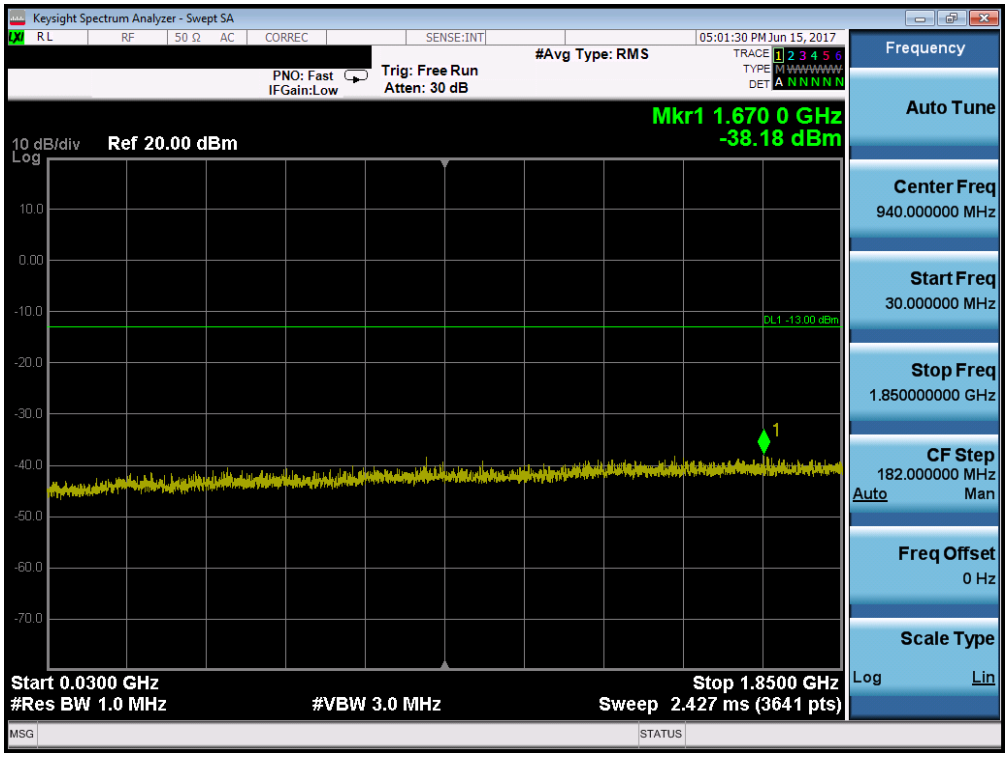


Plot 7-23. Conducted Spurious Plot (PCS GPRS Mode – Ch. 661)



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

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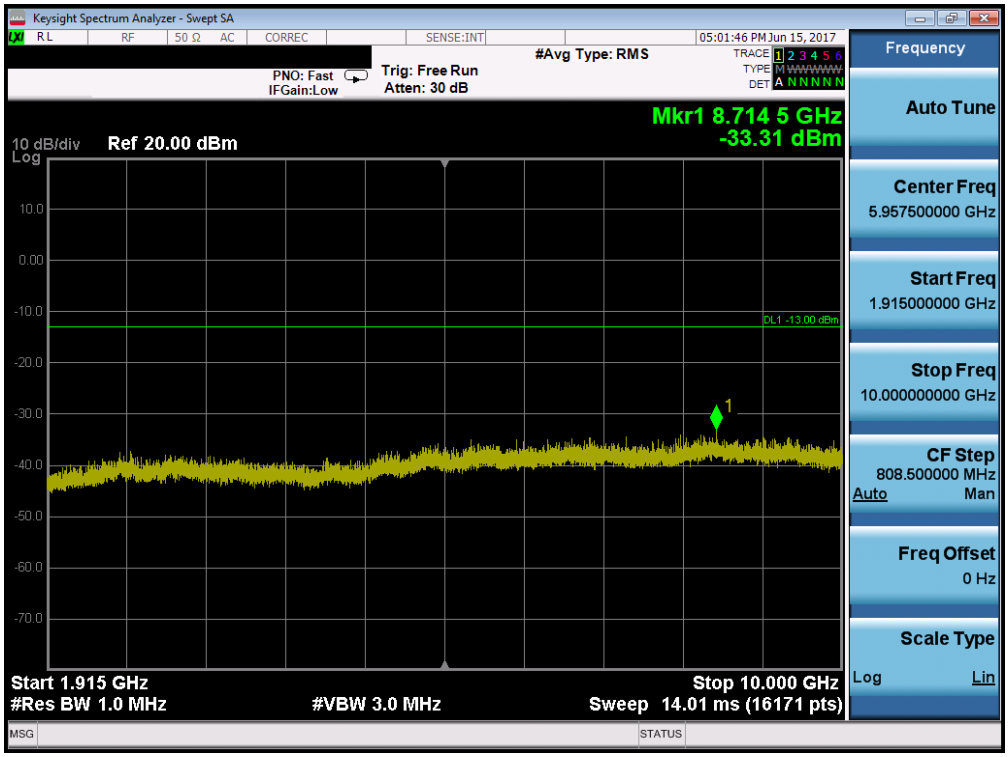
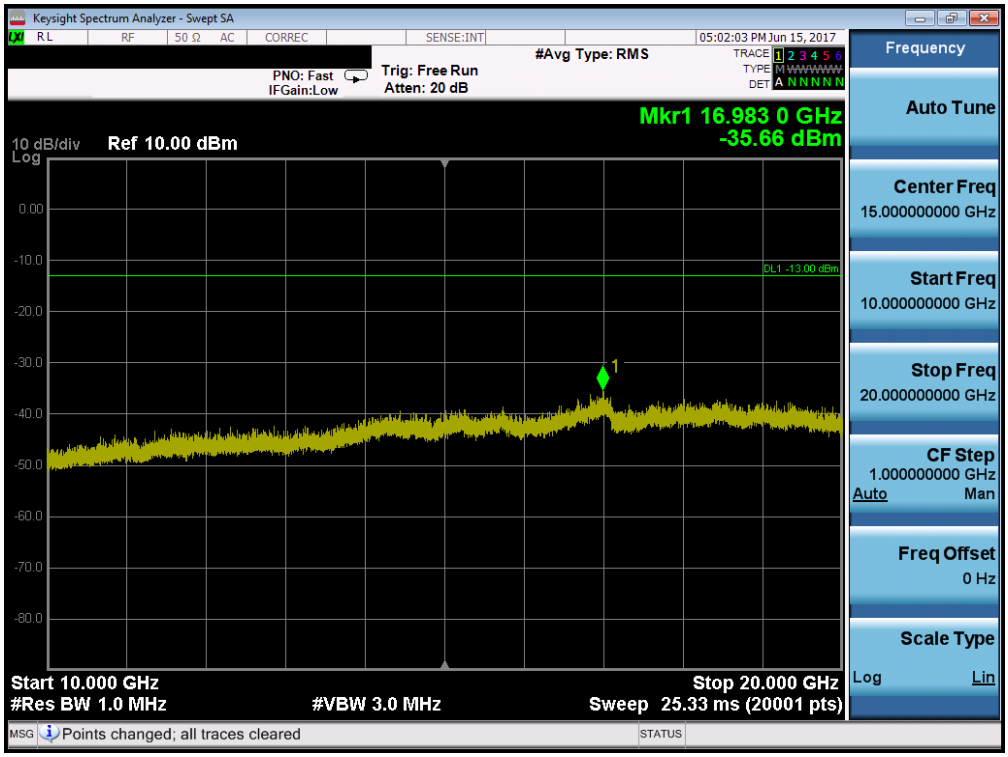


Plot 7-25. Conducted Spurious Plot (PCS GPRS Mode – Ch. 810)



Plot 7-26. Conducted Spurious Plot (PCS GPRS Mode – Ch. 810)

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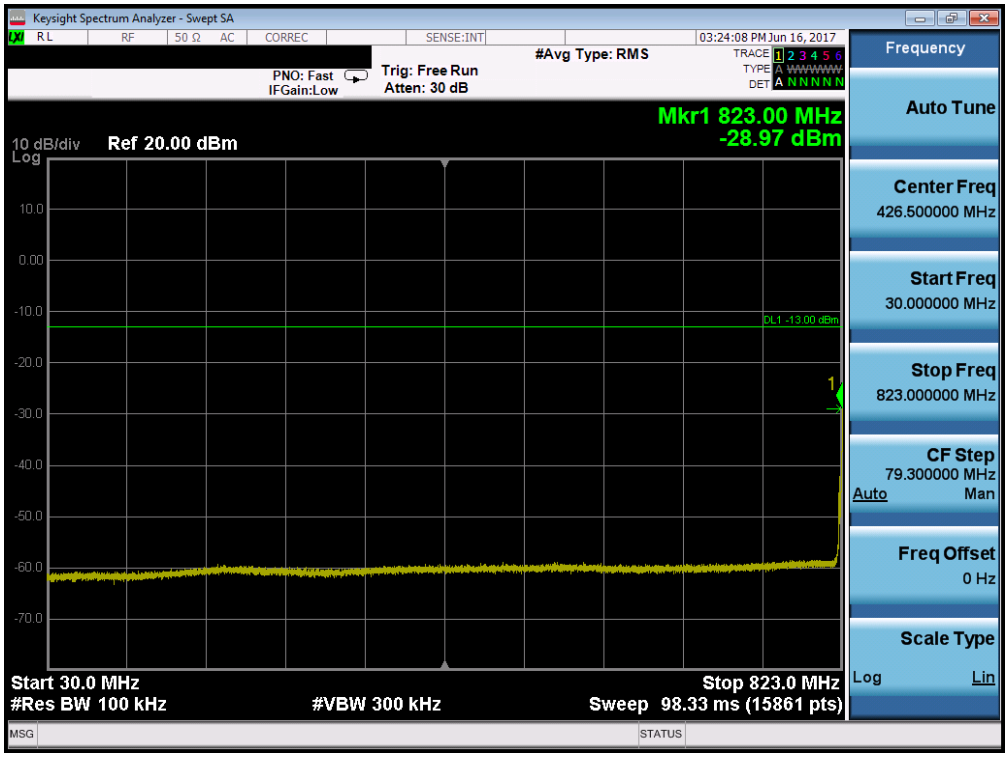
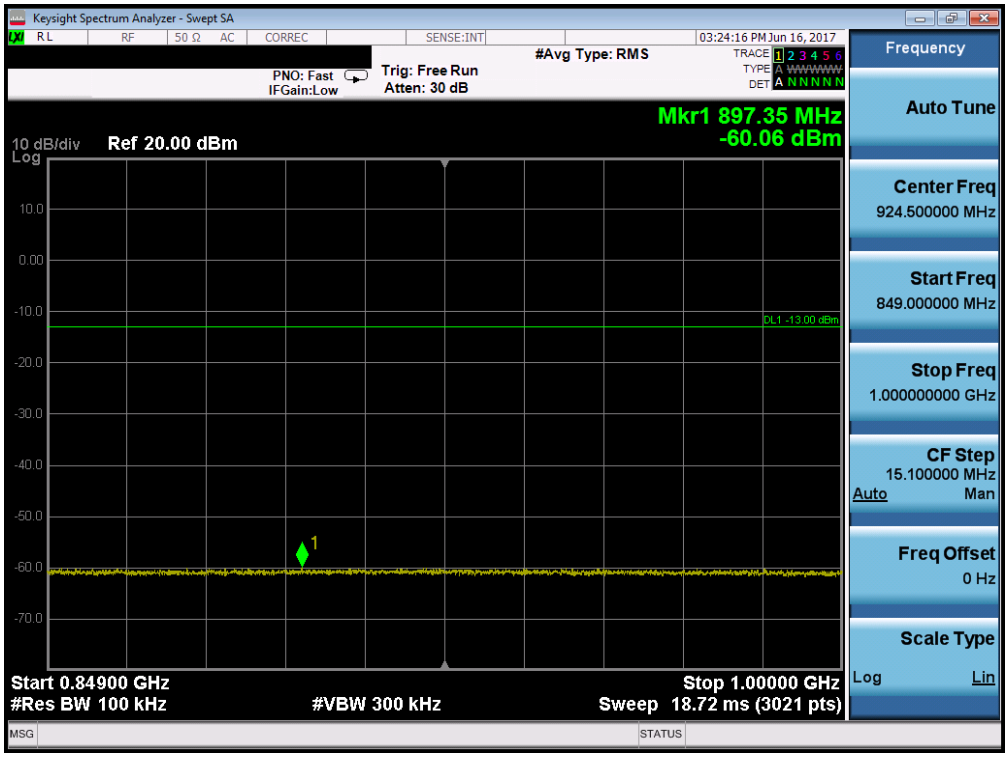


Plot 7-27. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 1013)



Plot 7-28. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 1013)

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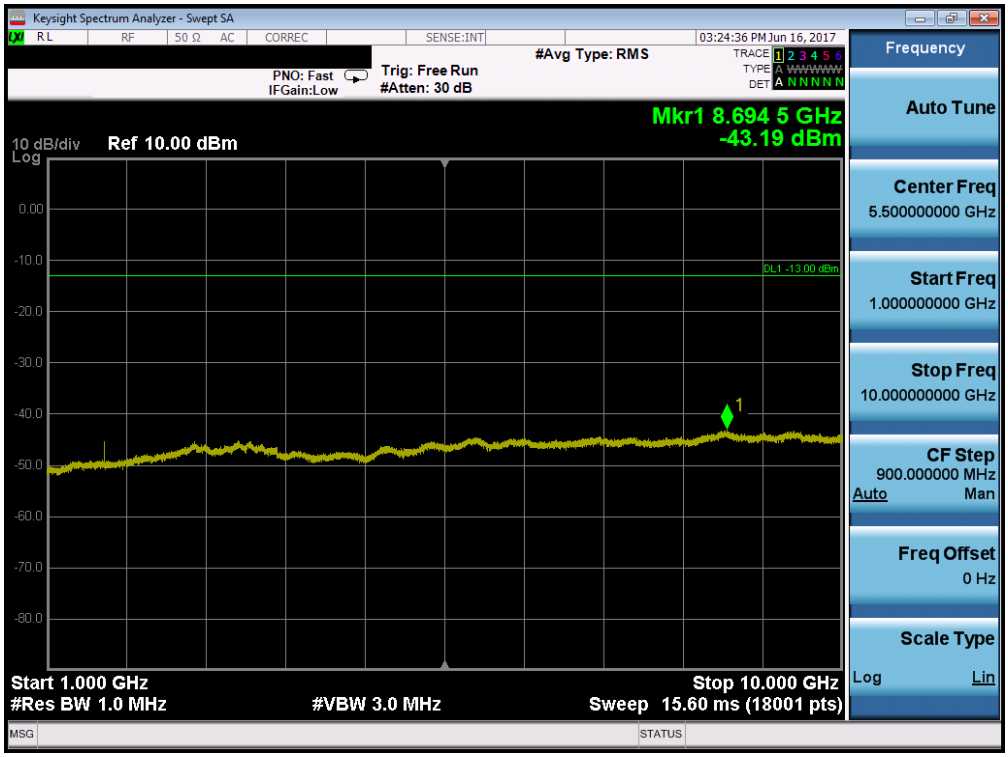
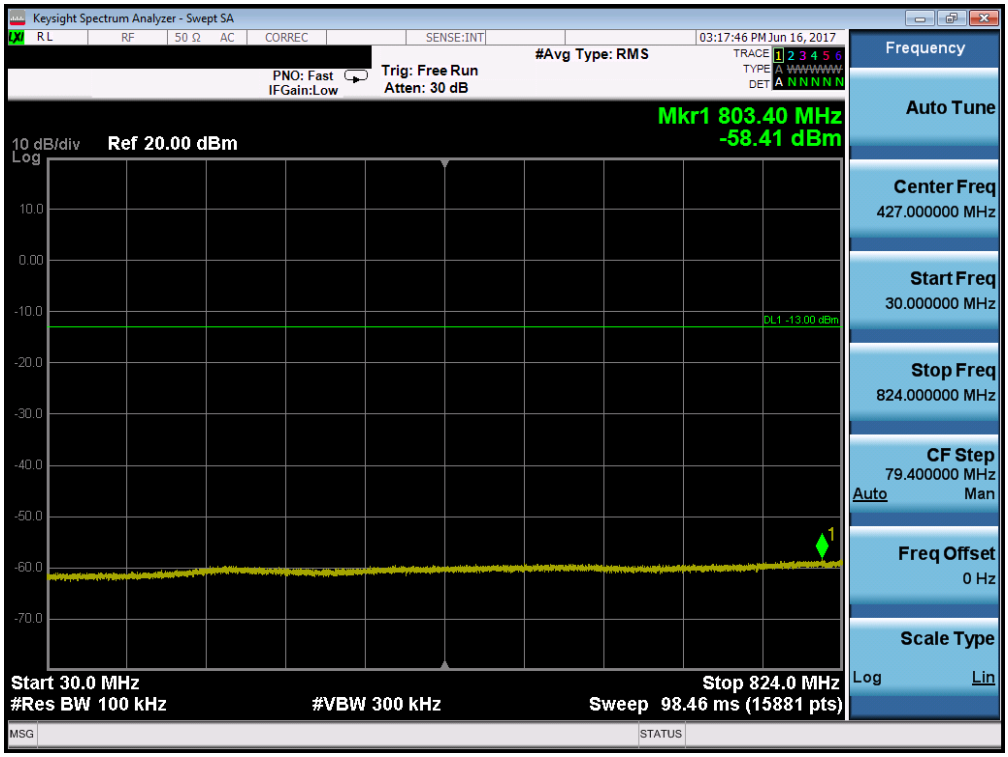


Plot 7-29. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 1013)



Plot 7-30. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 384)

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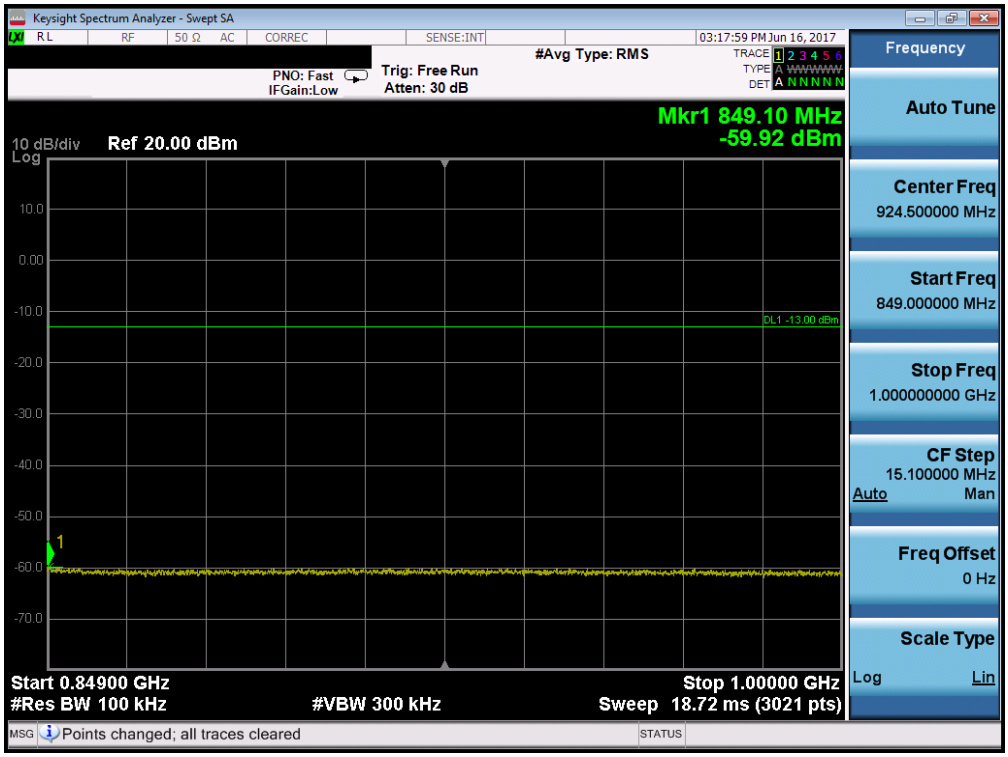

Plot 7-31. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 384)

Plot 7-32. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 384)

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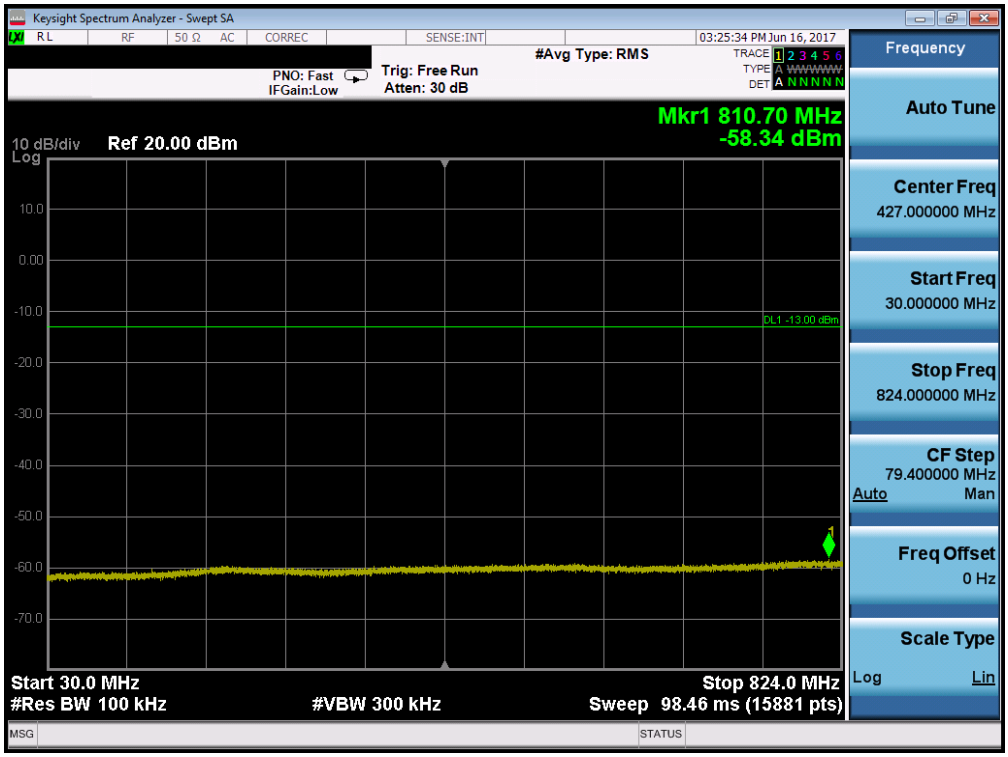
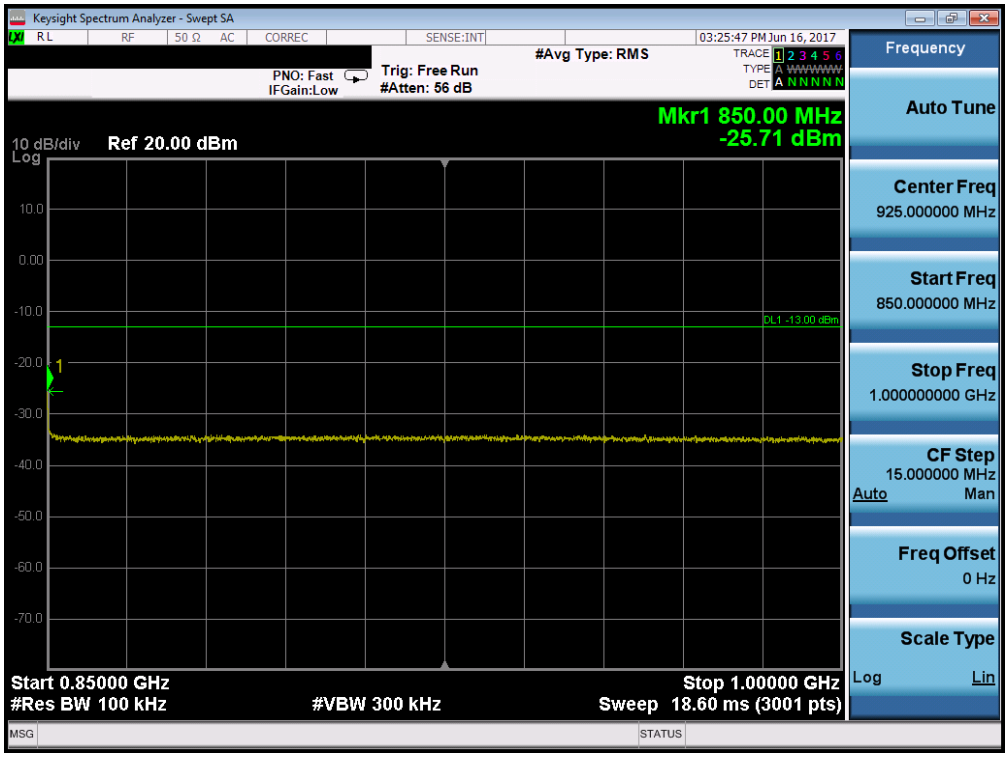


Plot 7-33. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 777)



Plot 7-34. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 777)

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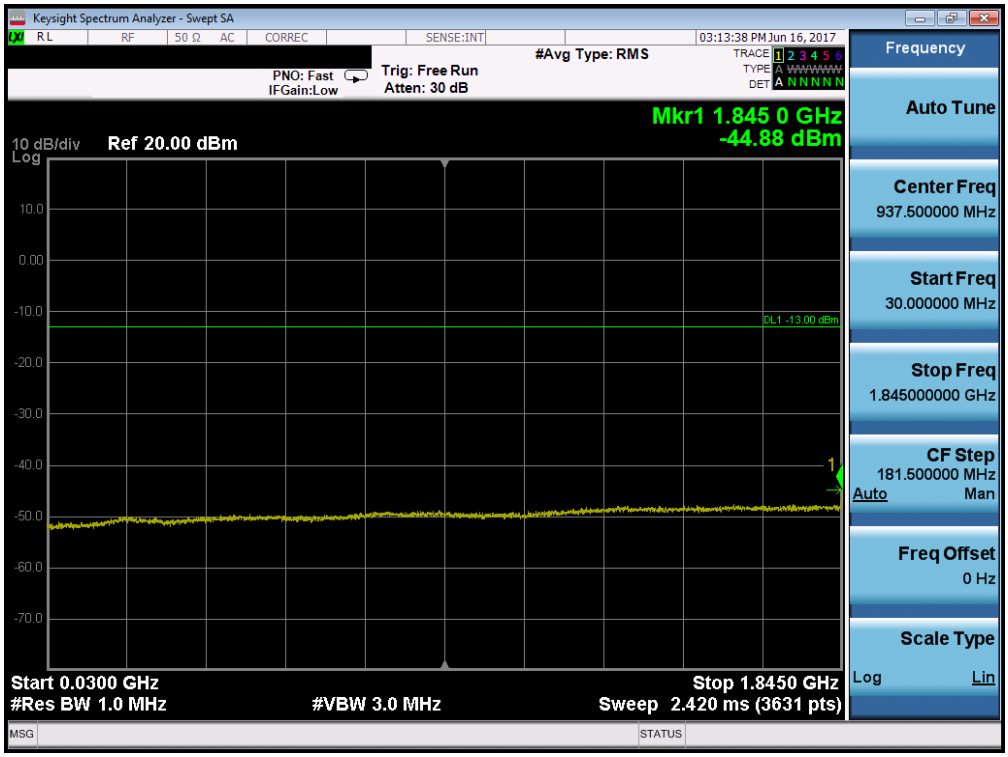
Plot 7-35. Conducted Spurious Plot (Cellular CDMA Mode – Ch. 777)



Plot 7-36. Conducted Spurious Plot (PCS CDMA Mode – Ch. 25)

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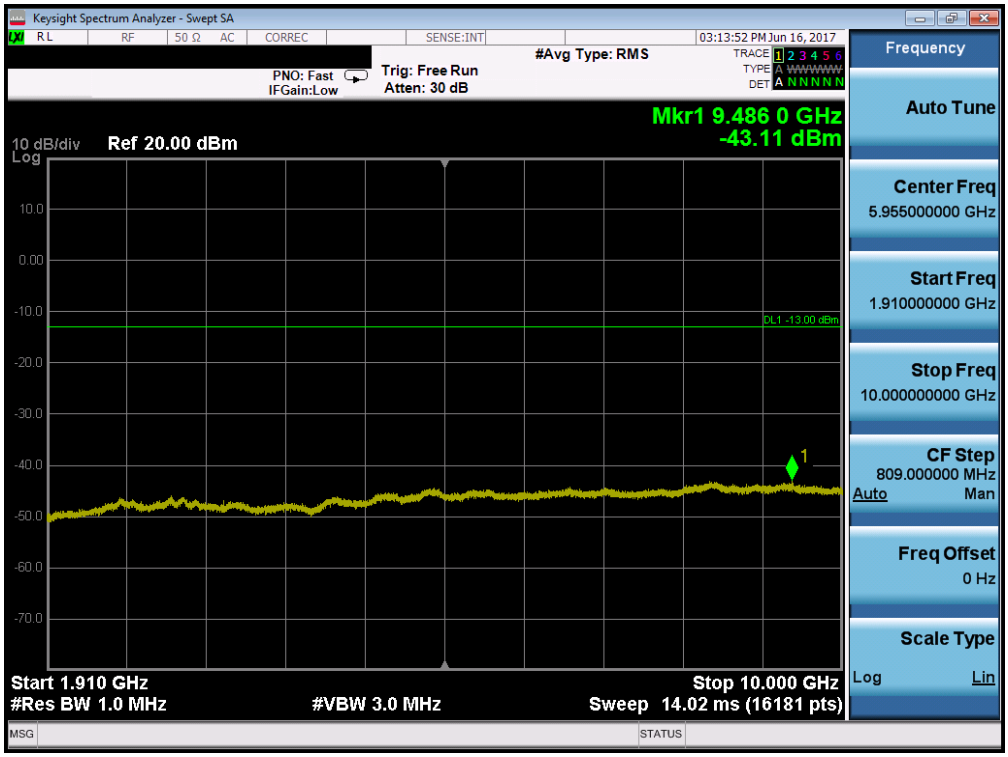

Plot 7-37. Conducted Spurious Plot (PCS CDMA Mode – Ch. 25)

Plot 7-38. Conducted Spurious Plot (PCS CDMA Mode – Ch. 25)

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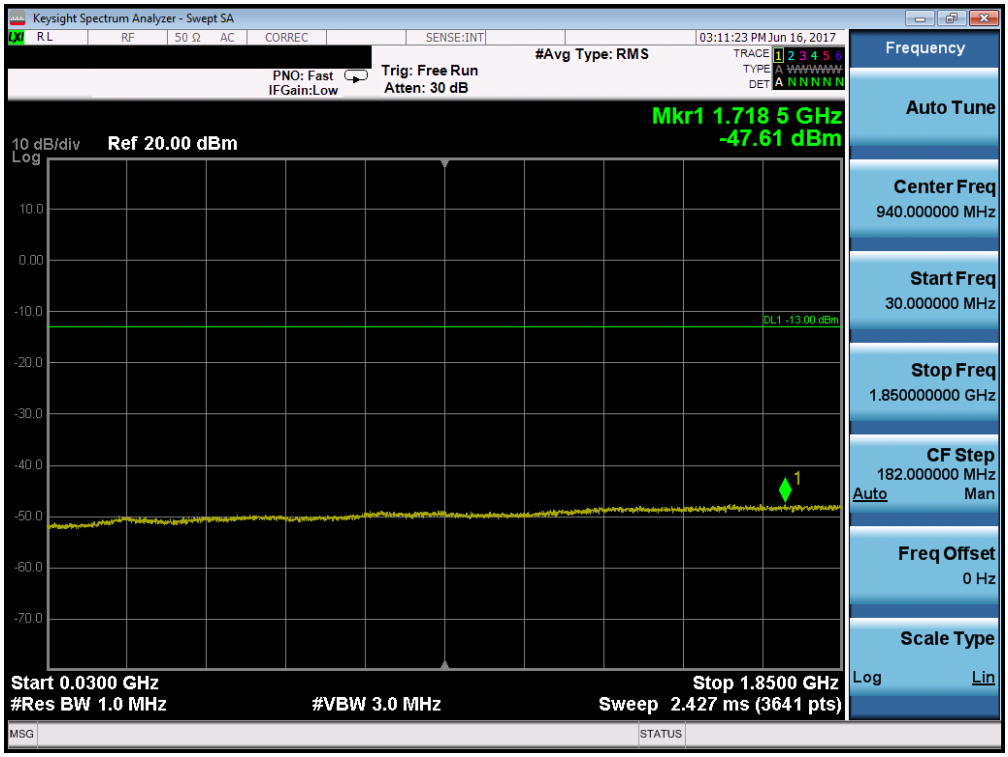
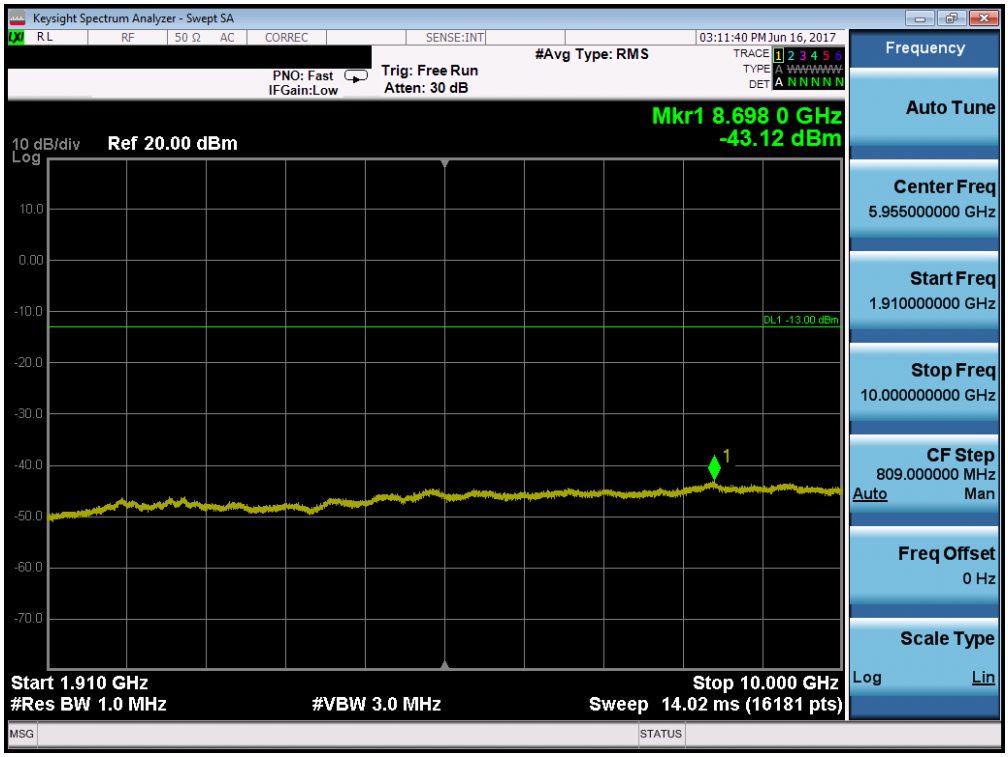


Plot 7-39. Conducted Spurious Plot (PCS CDMA Mode – Ch. 600)



Plot 7-40. Conducted Spurious Plot (PCS CDMA Mode – Ch. 600)

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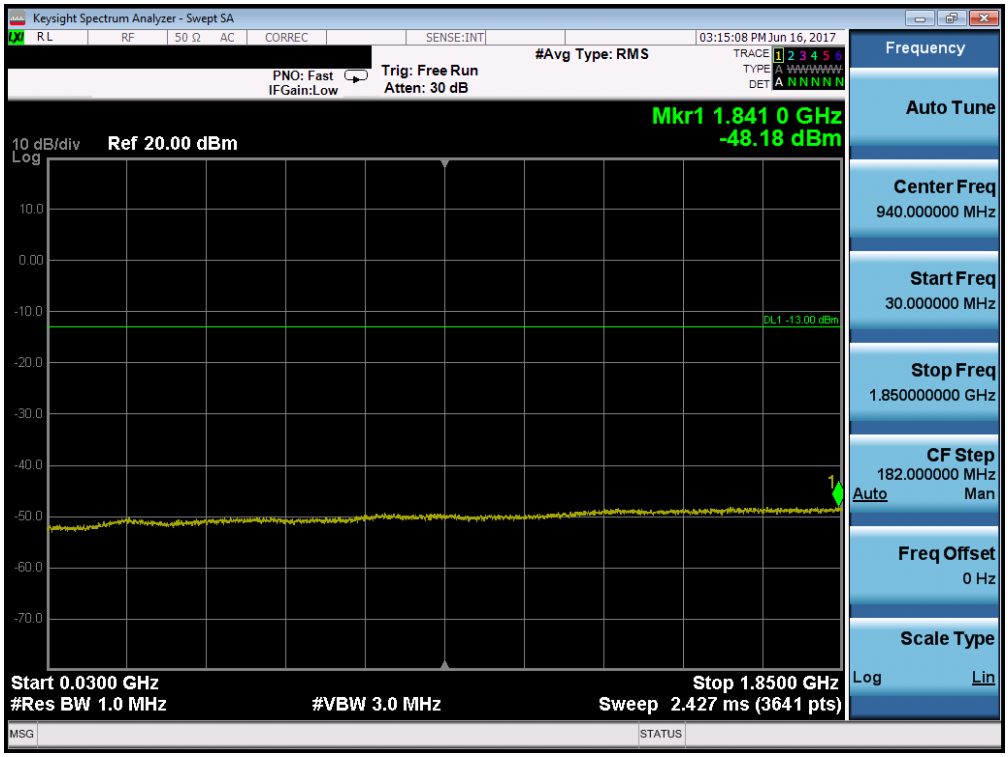
Plot 7-41. Conducted Spurious Plot (PCS CDMA Mode – Ch. 600)



Plot 7-42. Conducted Spurious Plot (PCS CDMA Mode – Ch. 1175)

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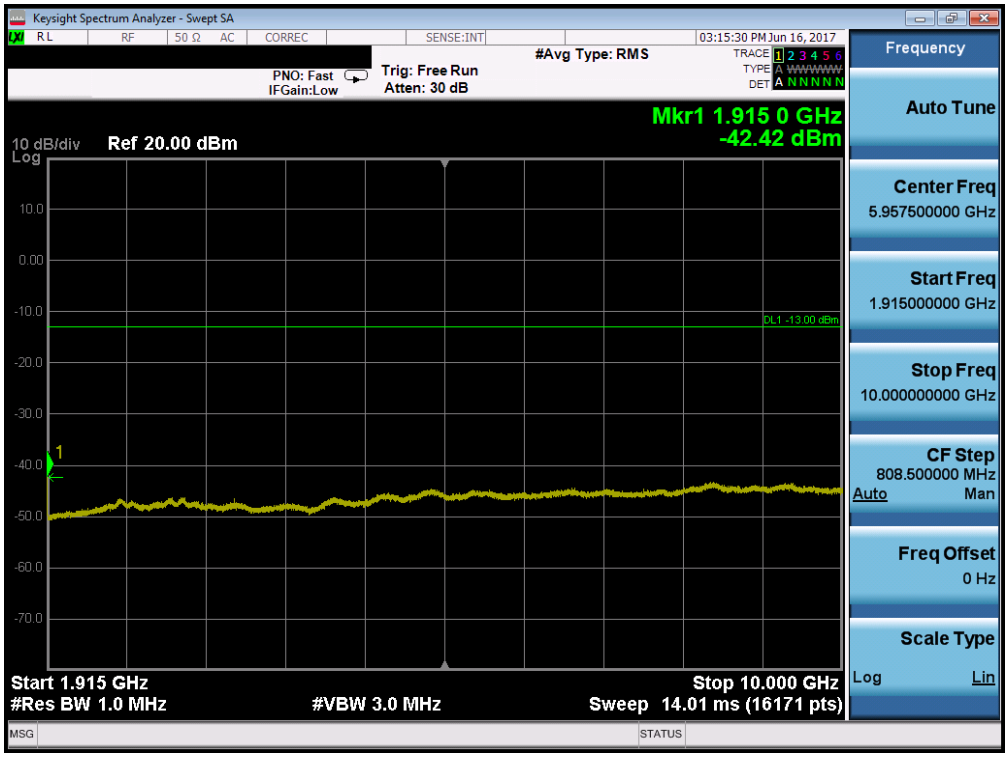

Plot 7-43. Conducted Spurious Plot (PCS CDMA Mode – Ch. 1175)

Plot 7-44. Conducted Spurious Plot (PCS CDMA Mode – Ch. 1175)

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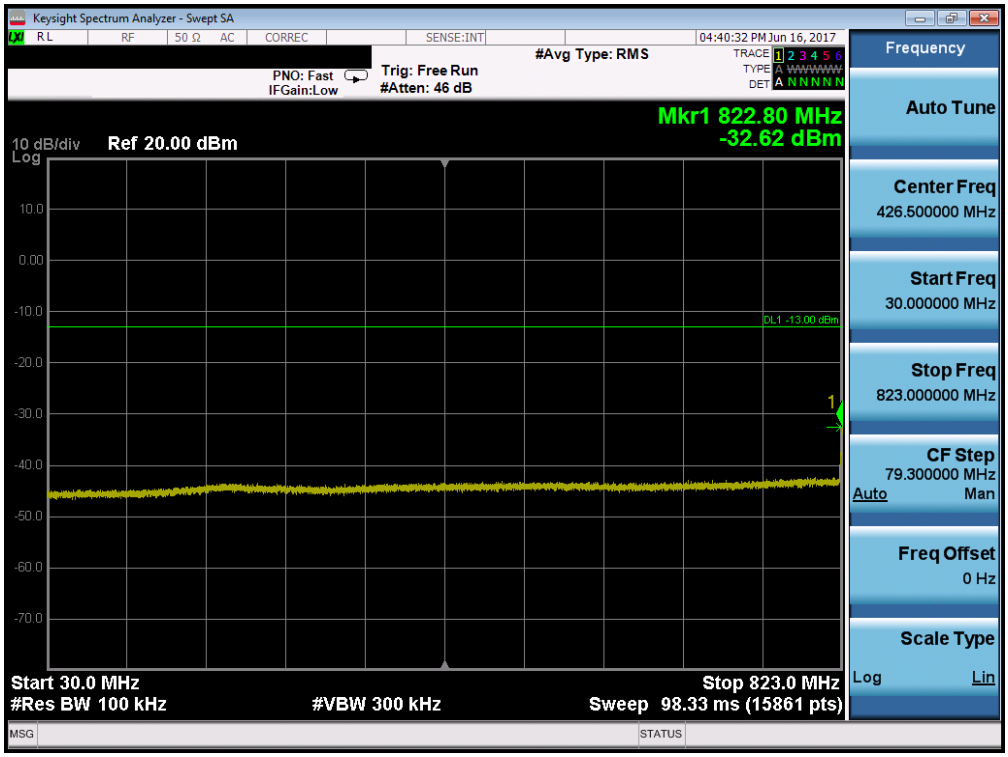
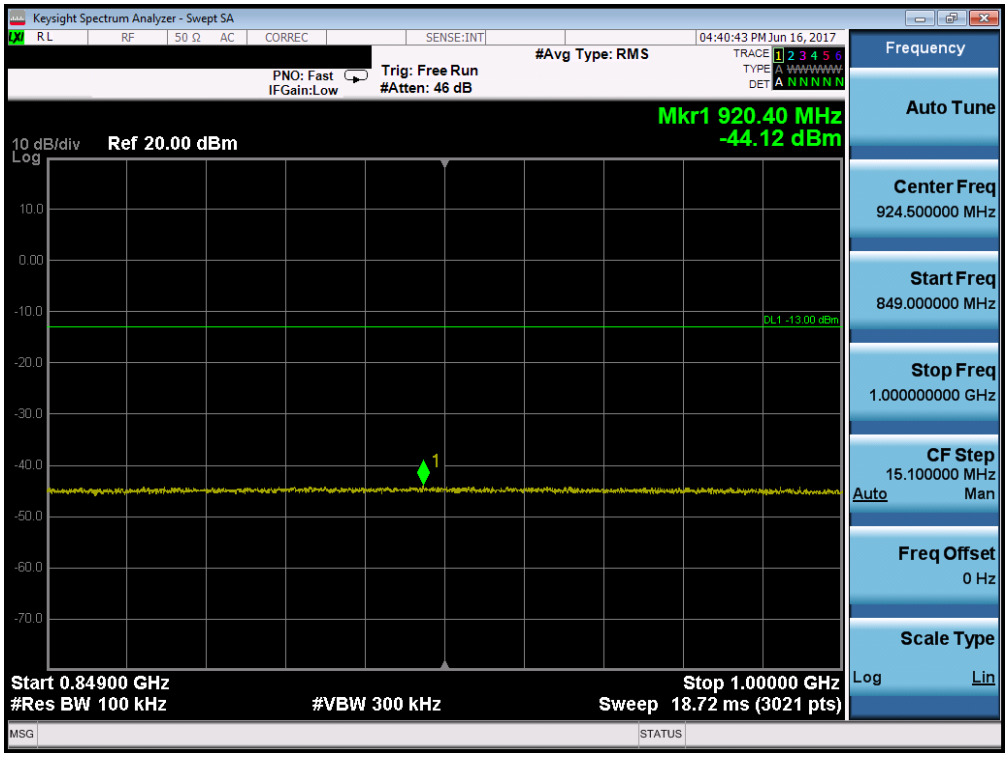


Plot 7-45. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4132)



Plot 7-46. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4132)

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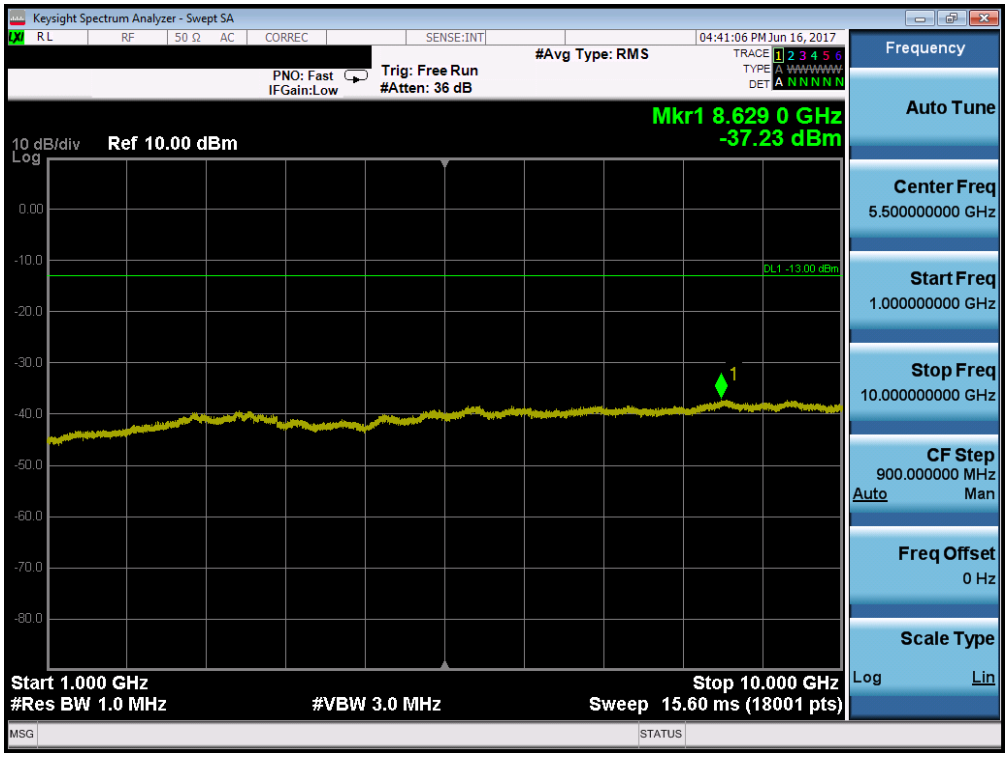
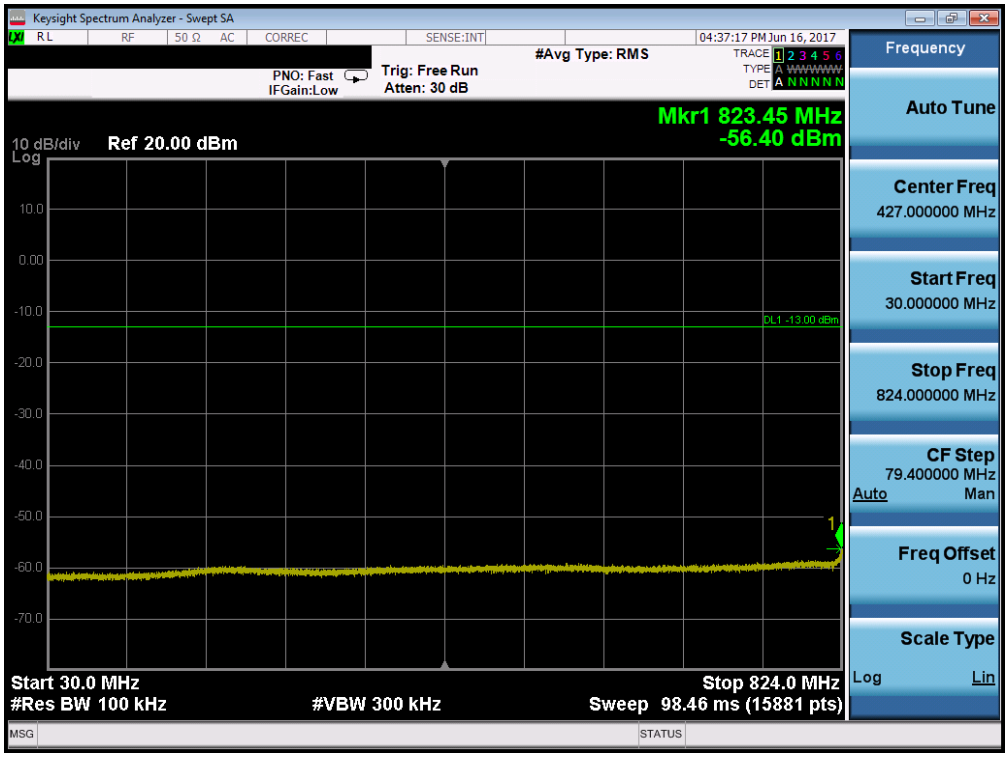


Plot 7-47. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4132)



Plot 7-48. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4183)

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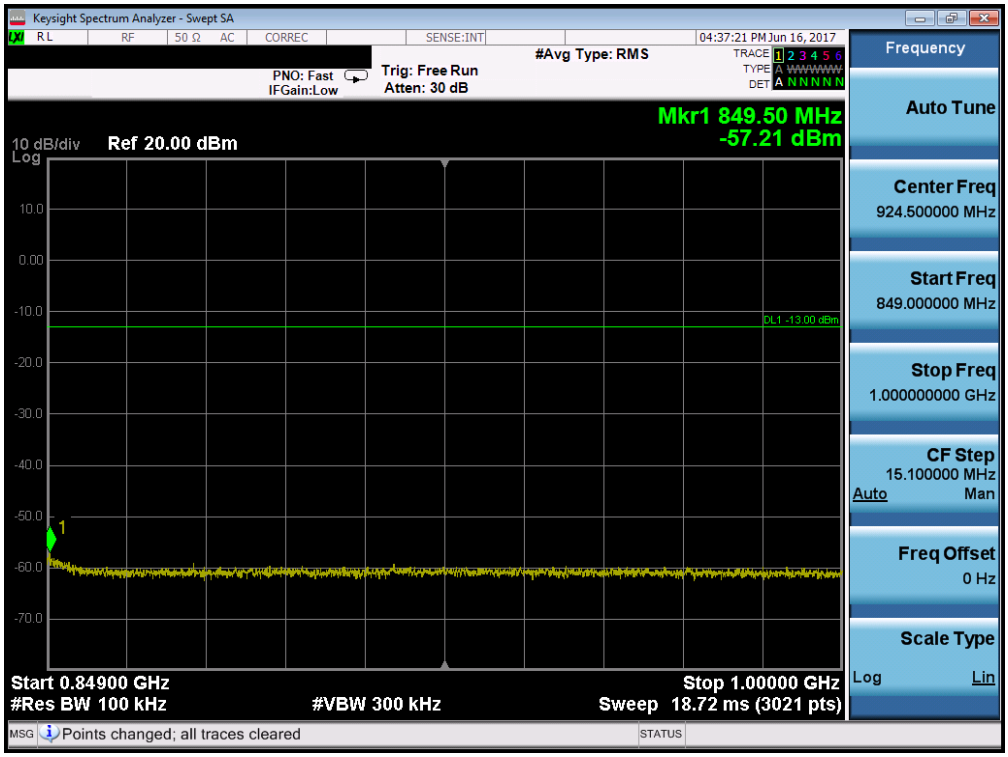

Plot 7-49. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4183)

Plot 7-50. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4183)

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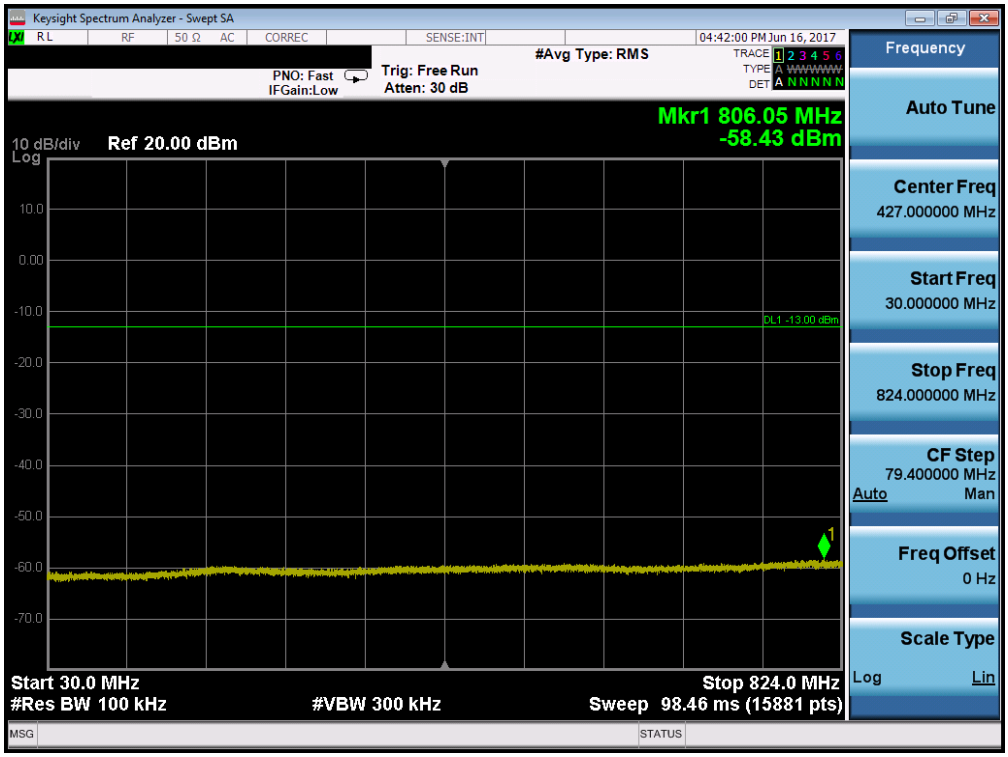
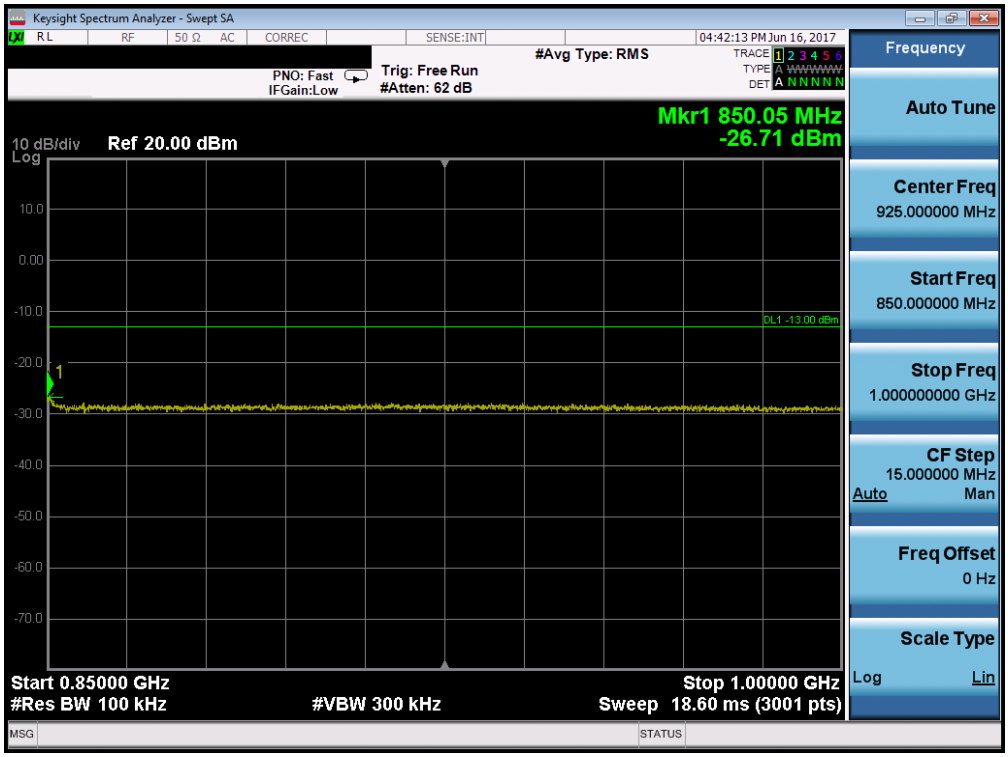


Plot 7-51. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4233)



Plot 7-52. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4233)

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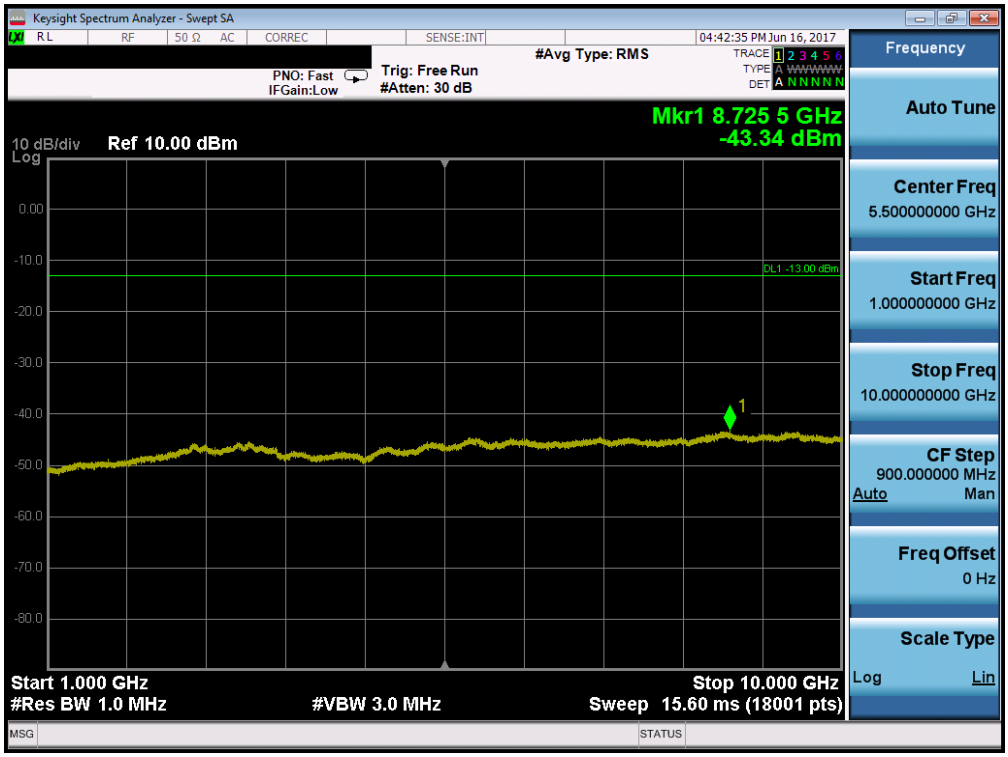
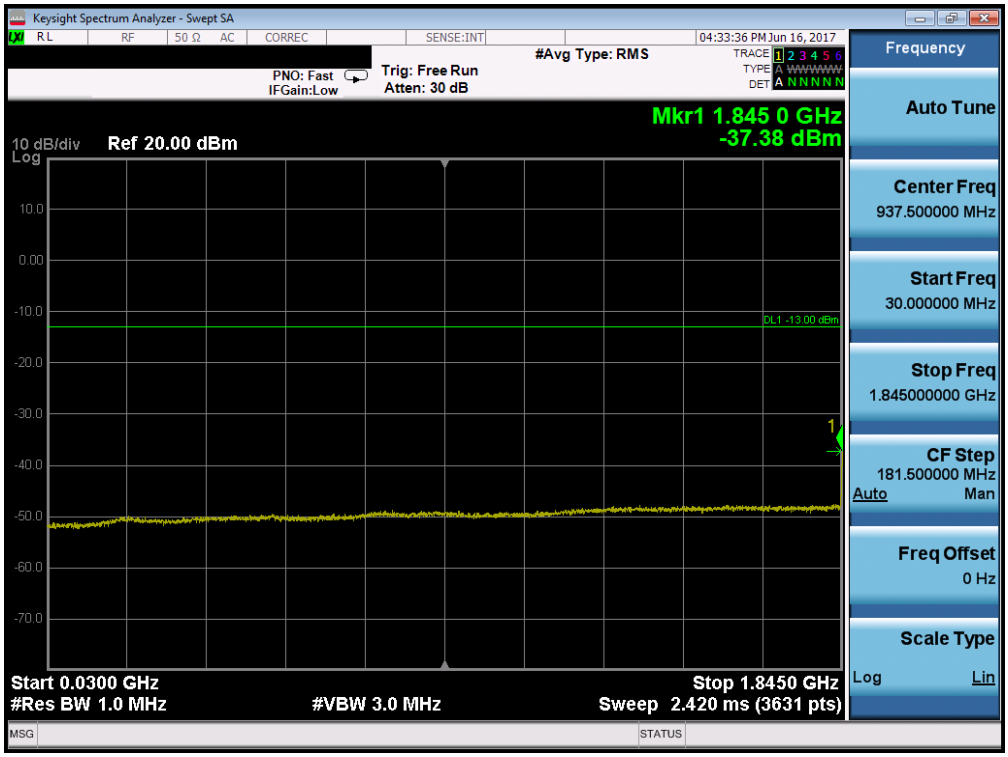


Plot 7-53. Conducted Spurious Plot (Cellular WCDMA Mode – Ch. 4233)



Plot 7-54. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9262)

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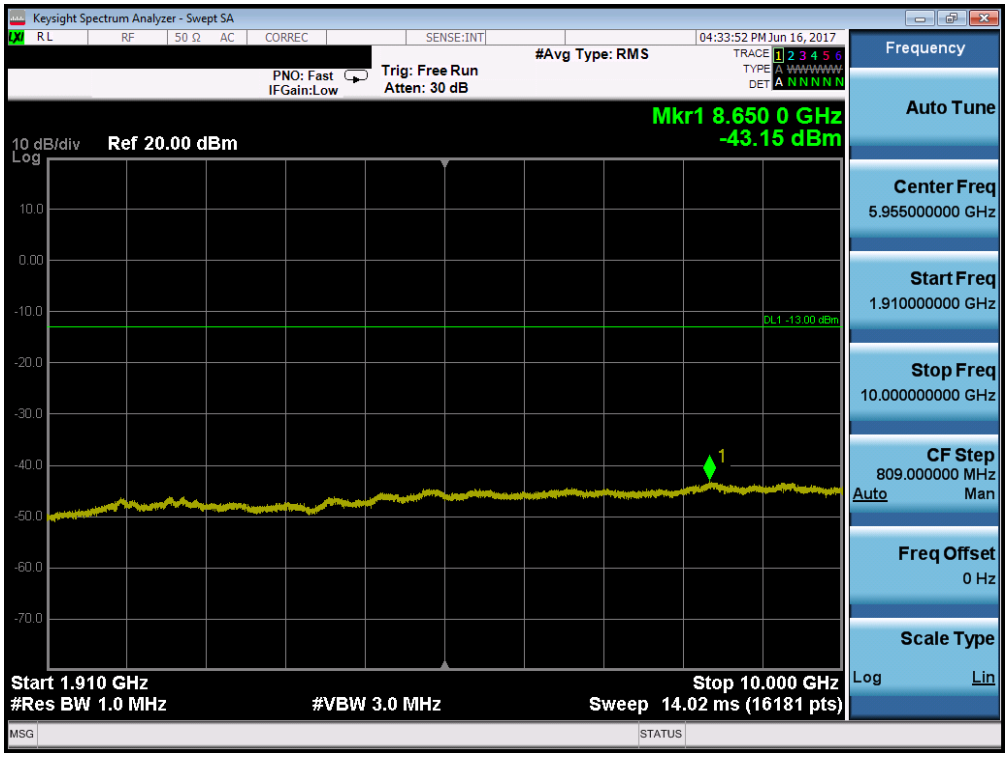

Plot 7-55. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9262)

Plot 7-56. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9262)

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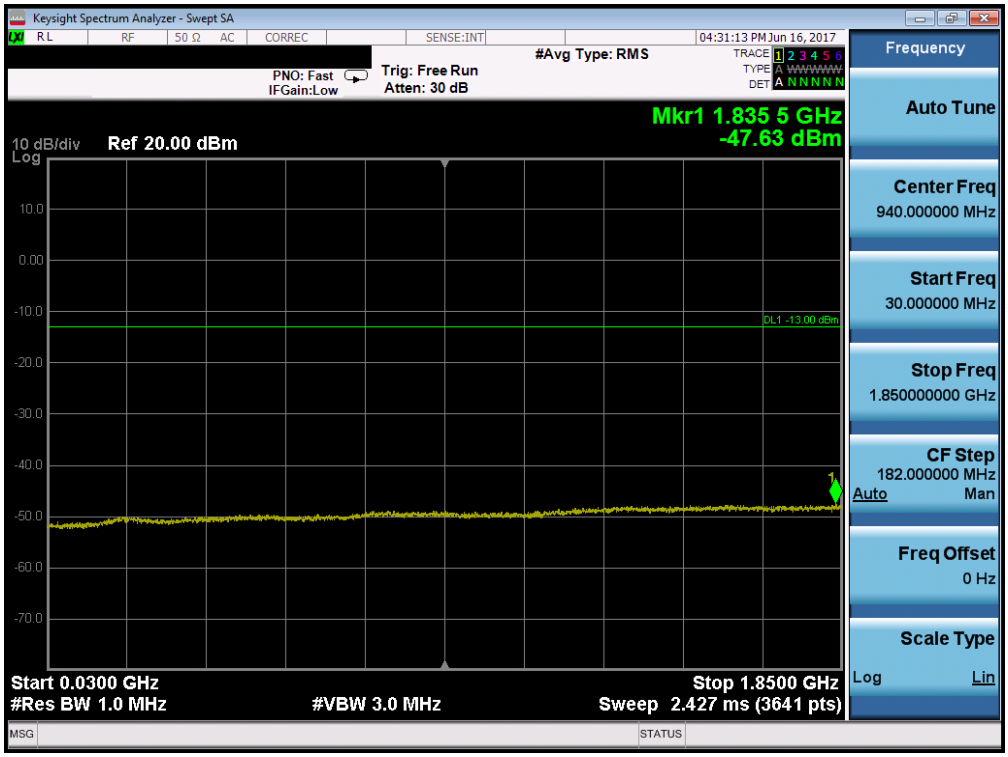
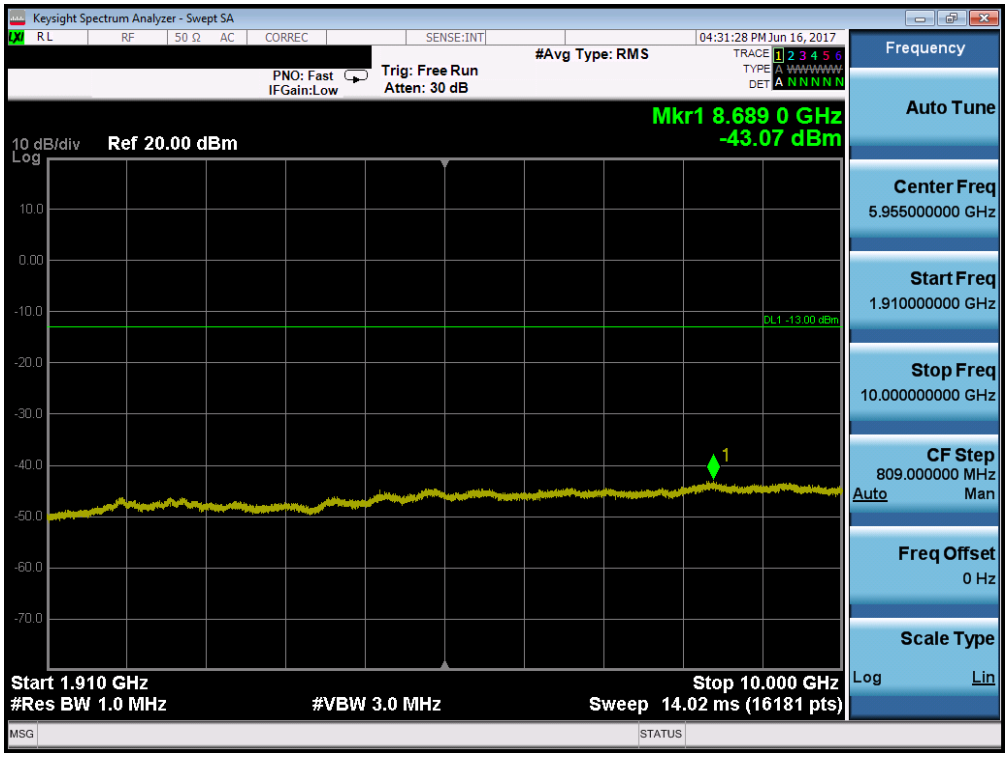


Plot 7-57. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9400)



Plot 7-58. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9400)

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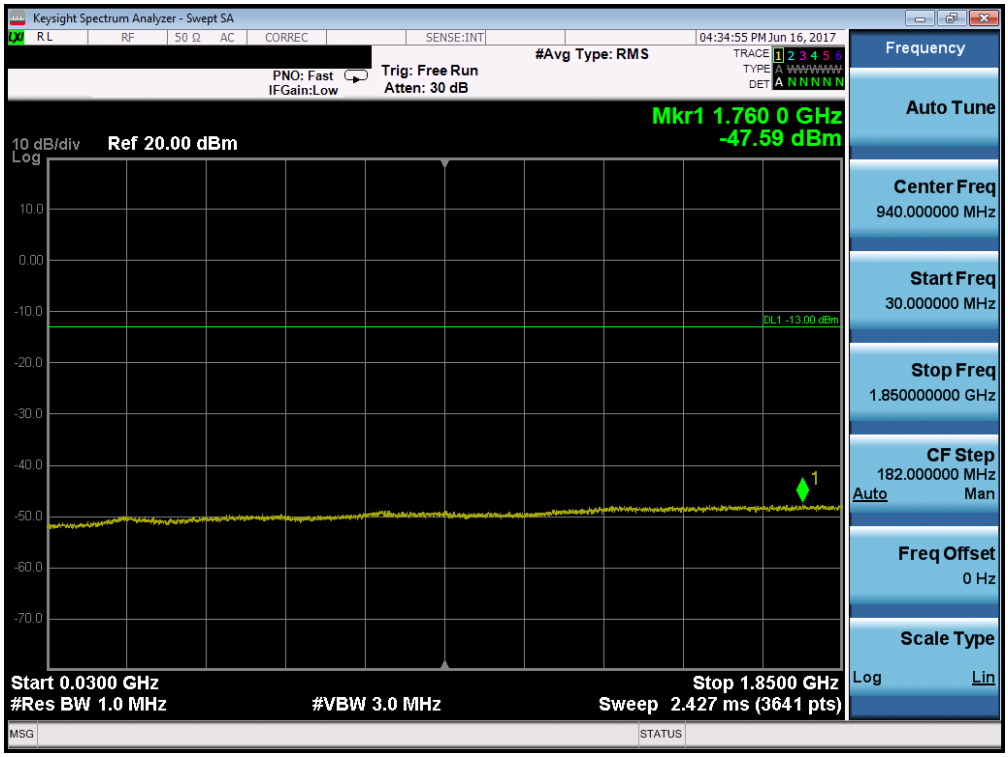
Plot 7-59. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9400)



Plot 7-60. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9538)

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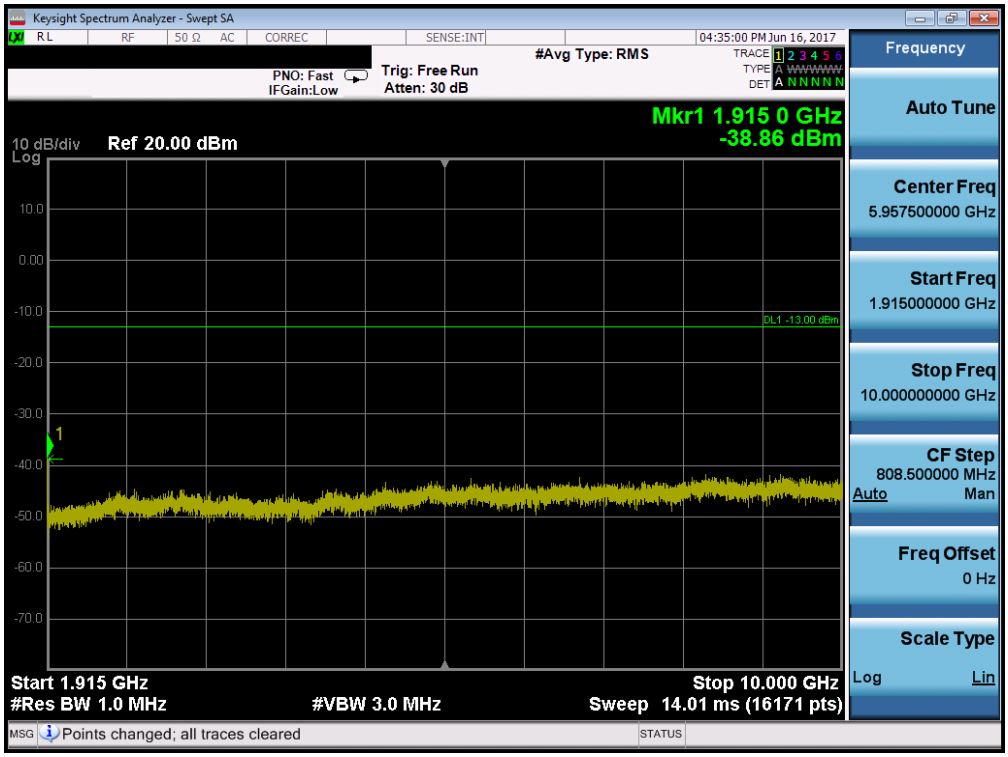

Plot 7-61. Conducted Spurious Plot (PCS WCDMA Mode – Ch. 9538)

Plot 7-62. 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)

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.

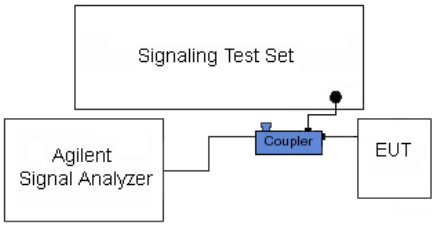

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

Per 22.917(b), 24.238(b), 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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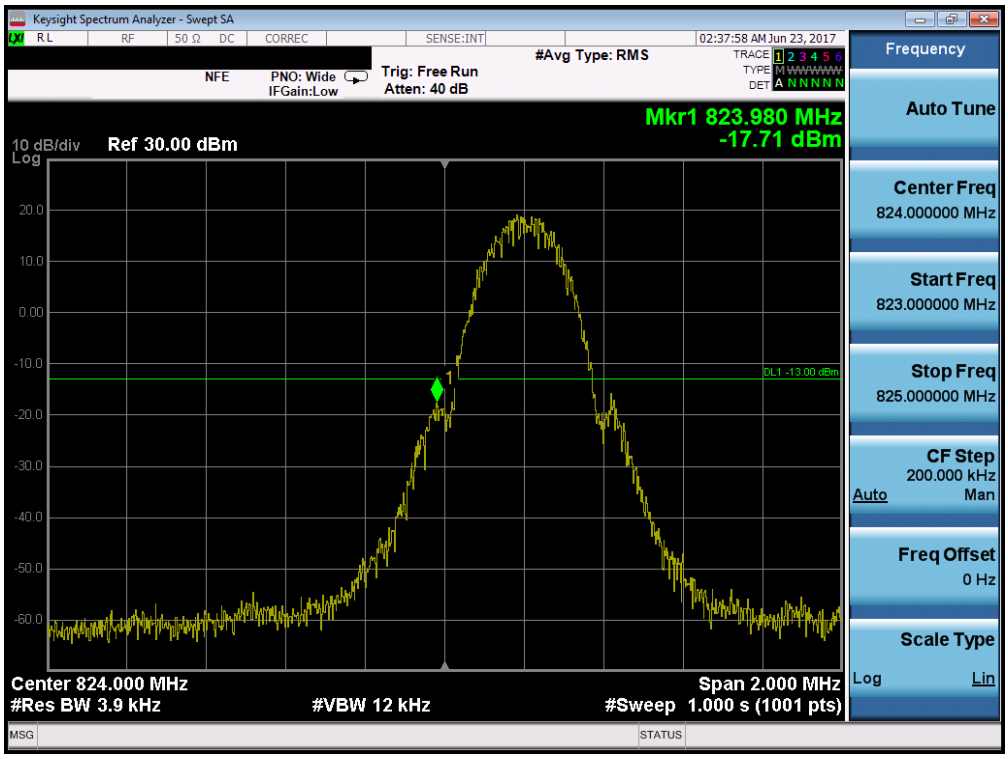
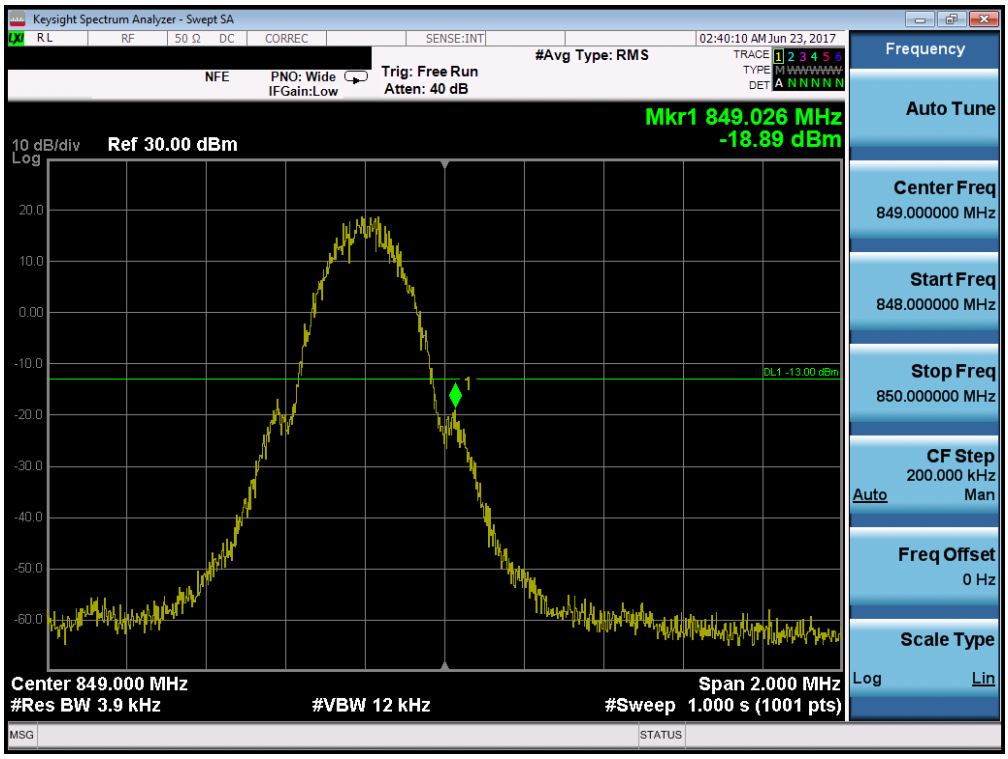


Plot 7-63. Band Edge Plot (Cellular GPRS Mode – Ch. 128)



Plot 7-64. Band Edge Plot (Cellular GPRS Mode – Ch. 251)

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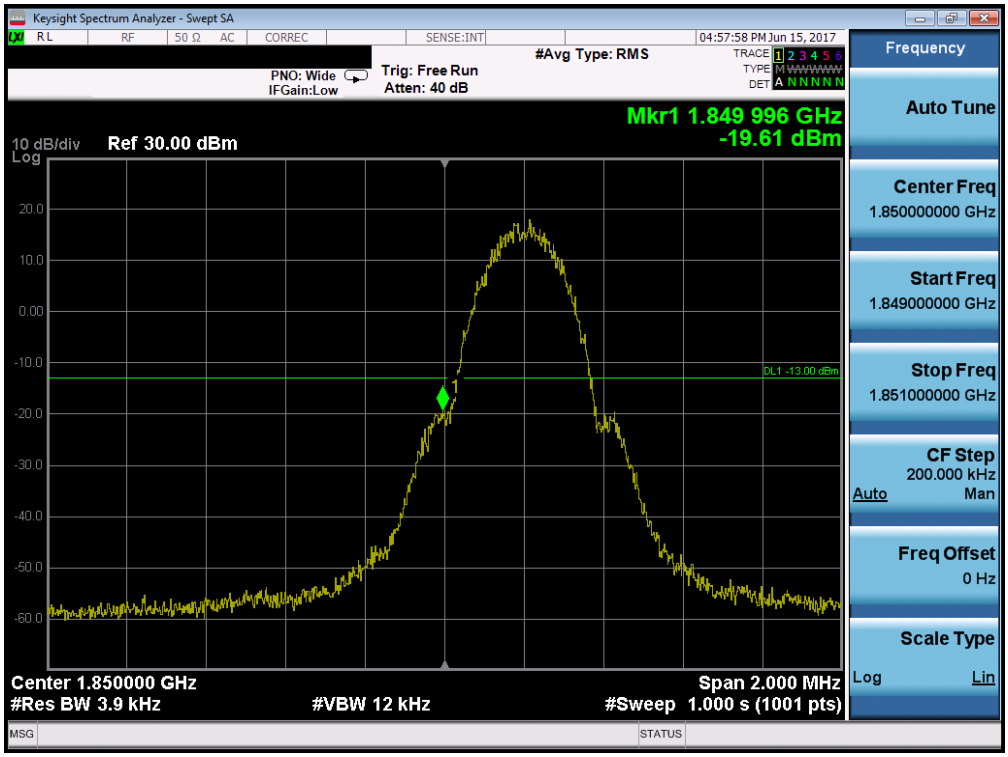
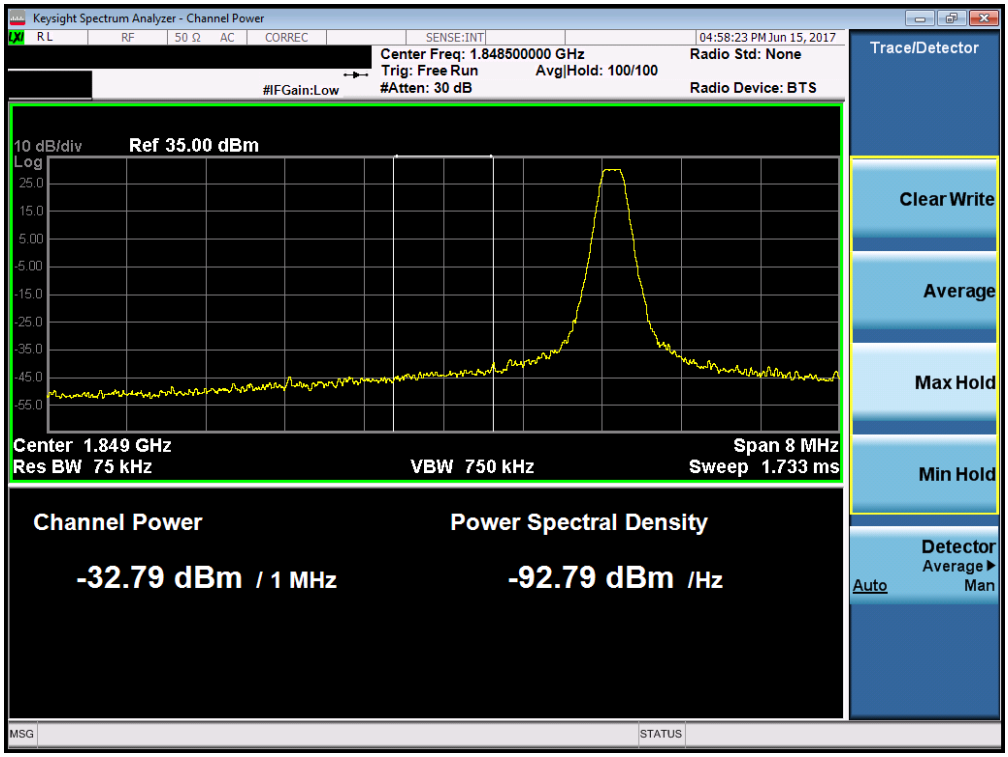


Plot 7-65. Band Edge Plot (PCS GPRS Mode – Ch. 512)



Plot 7-66. 4MHz Span Plot (PCS GPRS Mode – Ch. 512)

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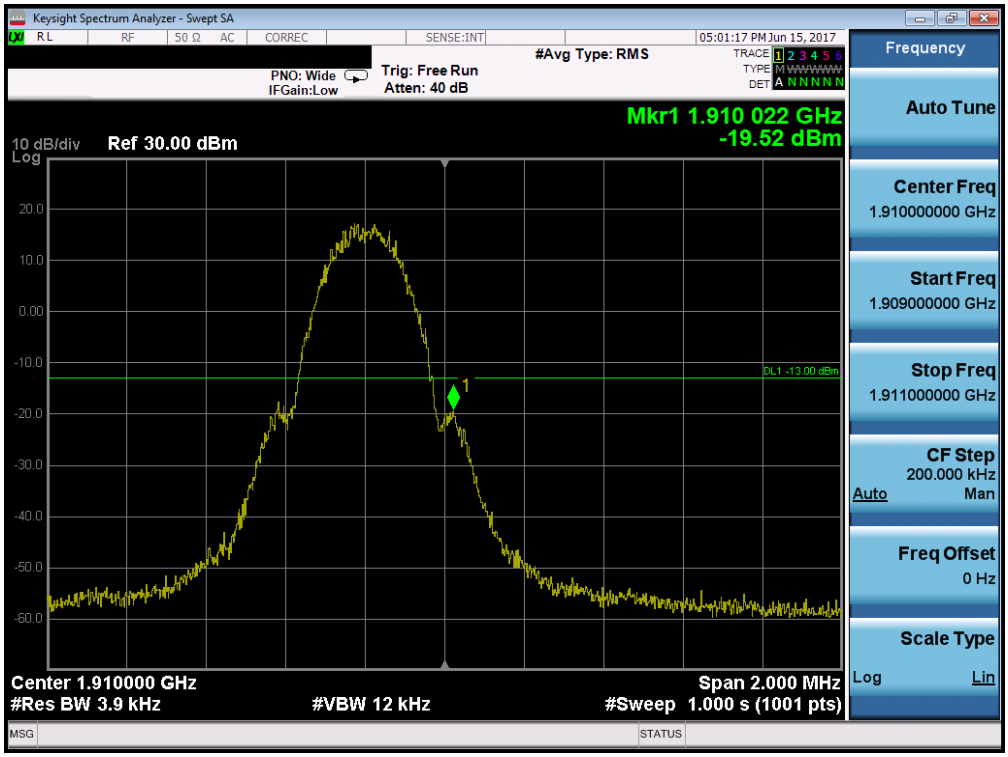
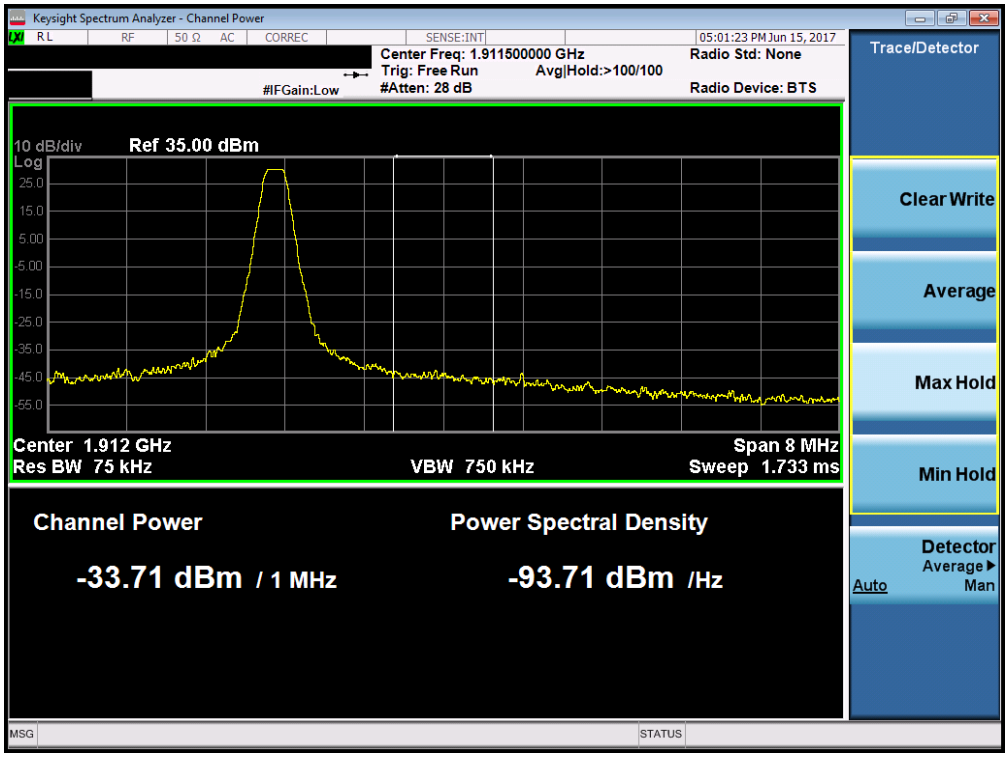


Plot 7-67. Band Edge Plot (PCS GPRS Mode – Ch. 810)



Plot 7-68. 4MHz Span Plot (PCS GPRS Mode – Ch. 810)

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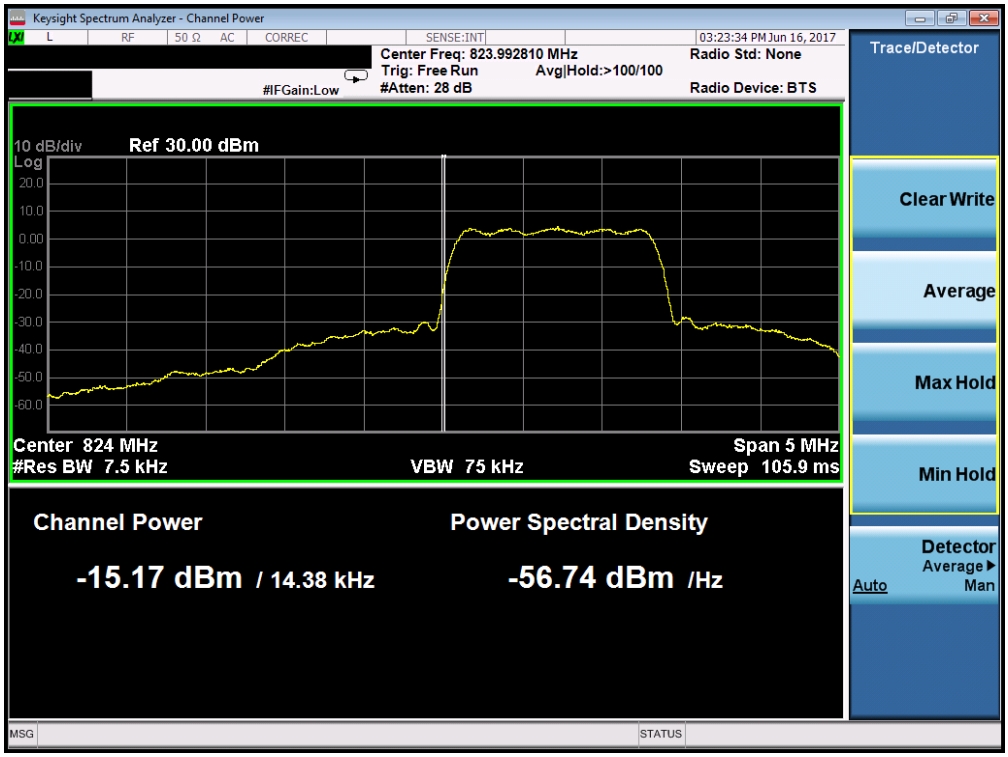

Plot 7-69. Band Edge Plot (Cellular CDMA Mode – Ch. 1013)

Plot 7-70. 4MHz Span Plot (Cellular CDMA Mode – Ch. 1013)

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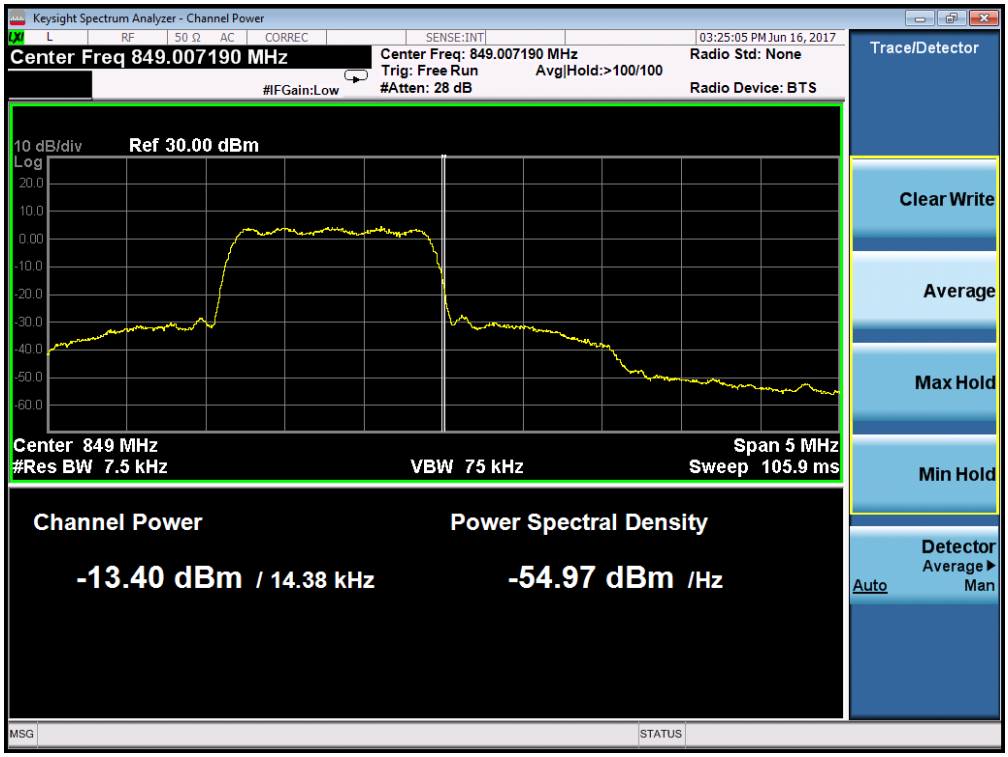

Plot 7-71. Band Edge Plot (Cellular CDMA Mode – Ch. 777)

Plot 7-72. 4MHz Span Plot (Cellular CDMA Mode – Ch. 777)

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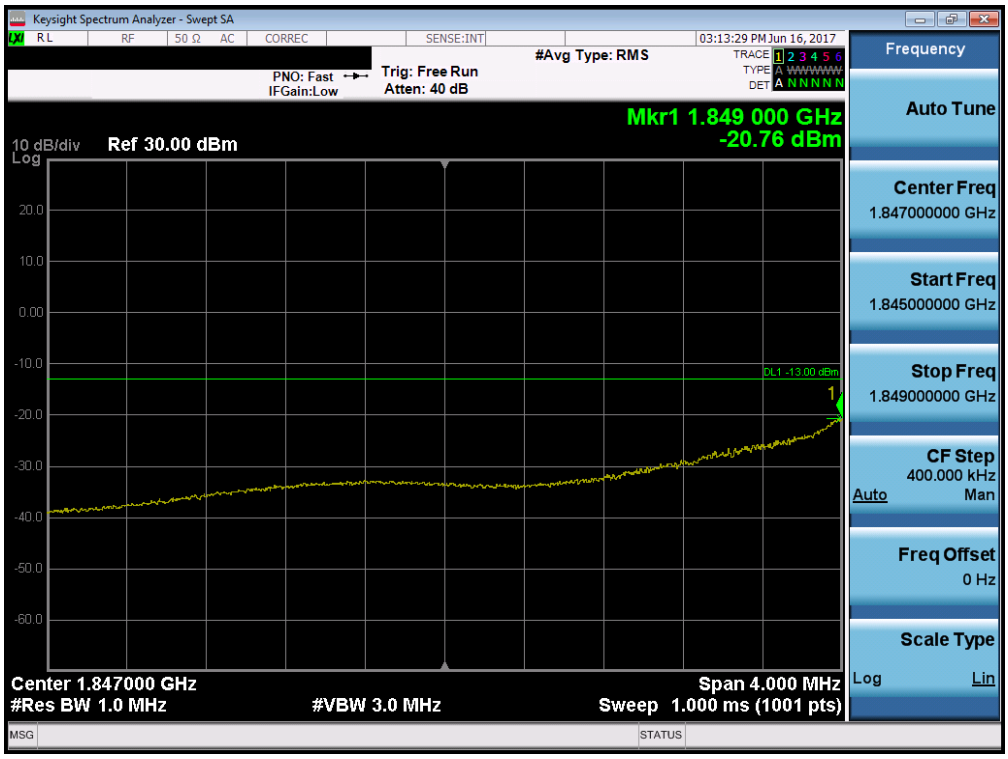
Plot 7-73. Band Edge Plot (PCS CDMA Mode – Ch. 25)



Plot 7-74. 4MHz Span Plot (PCS CDMA Mode – Ch. 25)

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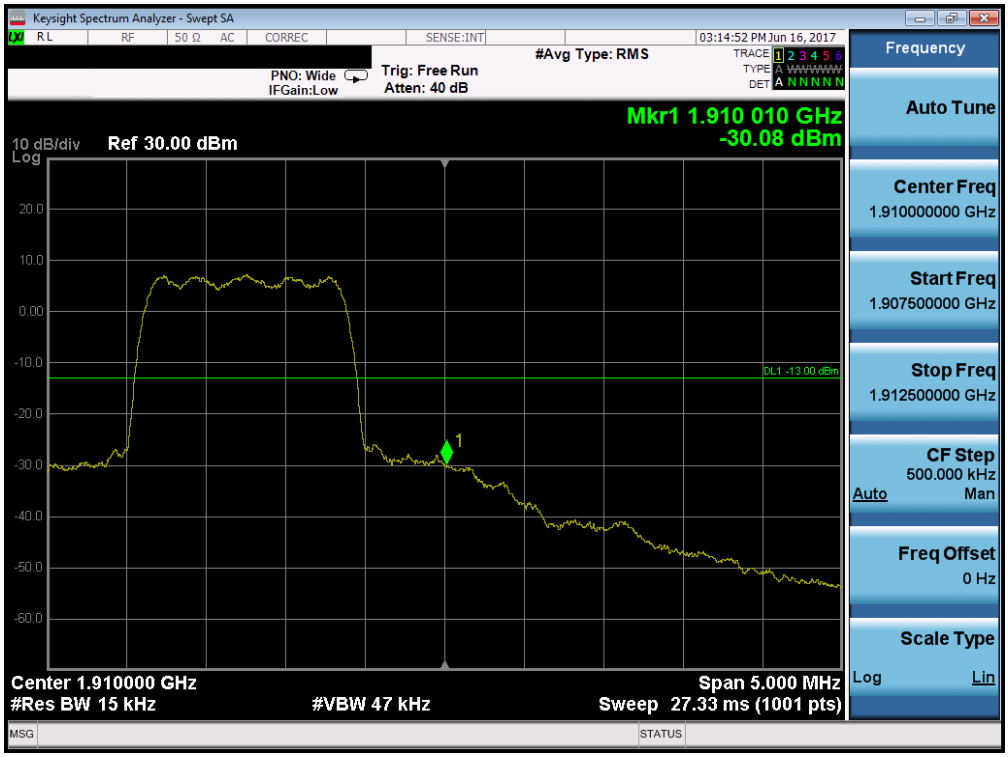
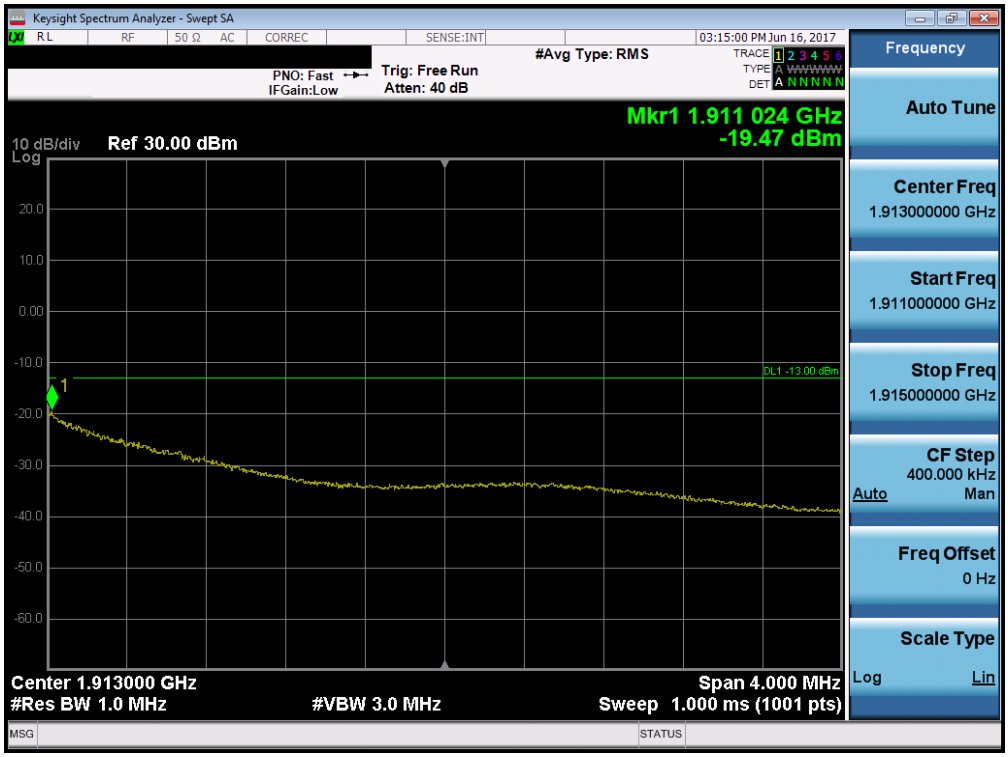


Plot 7-75. Band Edge Plot (PCS CDMA Mode – Ch. 1175)



Plot 7-76. 4MHz Span Plot (PCS CDMA Mode – Ch. 1175)

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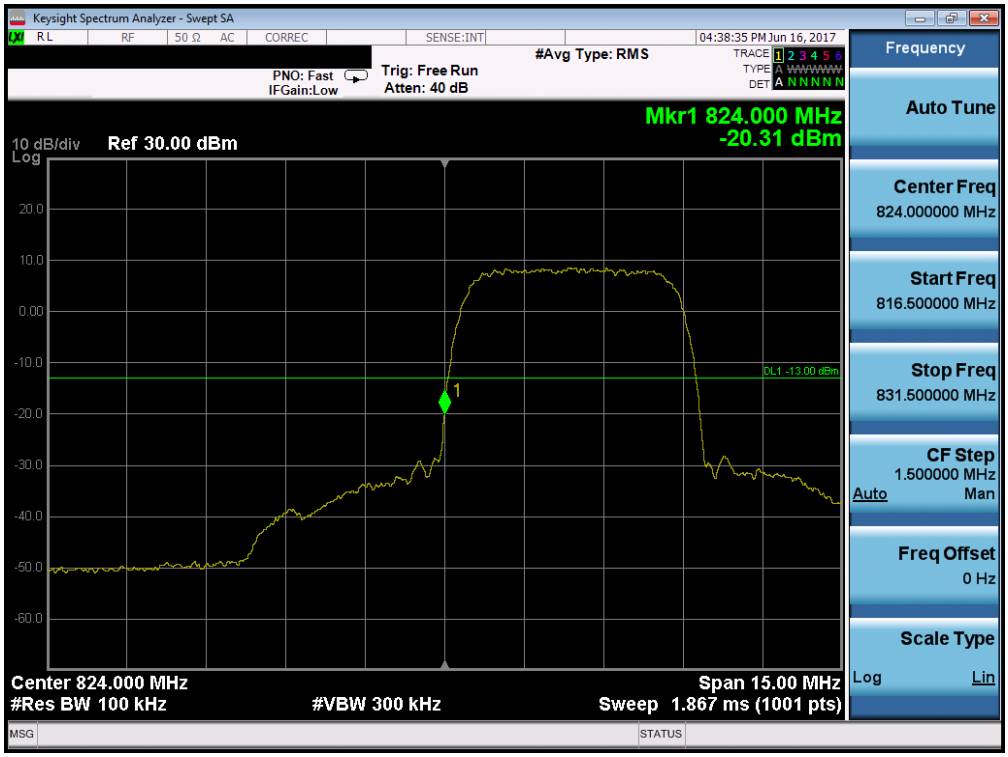

Plot 7-77. Band Edge Plot (Cellular WCDMA Mode – Ch. 4132)

Plot 7-78. Band Edge Plot (Cellular WCDMA Mode – Ch. 4233)

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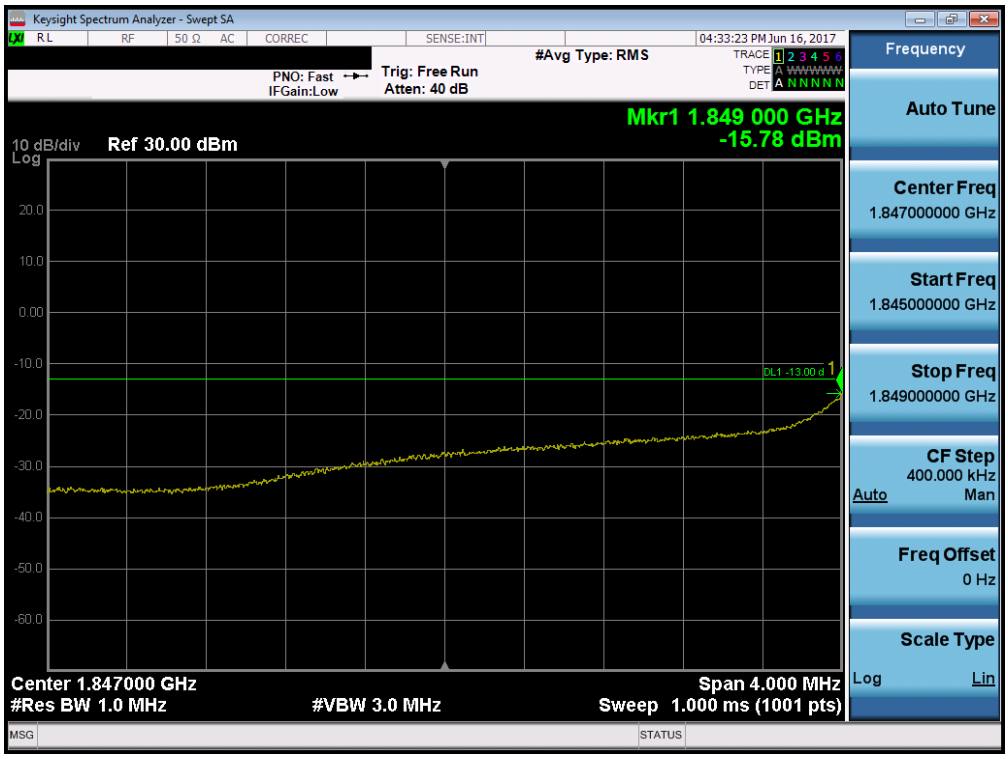
Plot 7-79. Band Edge Plot (PCS WCDMA Mode – Ch. 9262)



Plot 7-80. 4MHz Span Plot (PCS WCDMA Mode – Ch. 9262)

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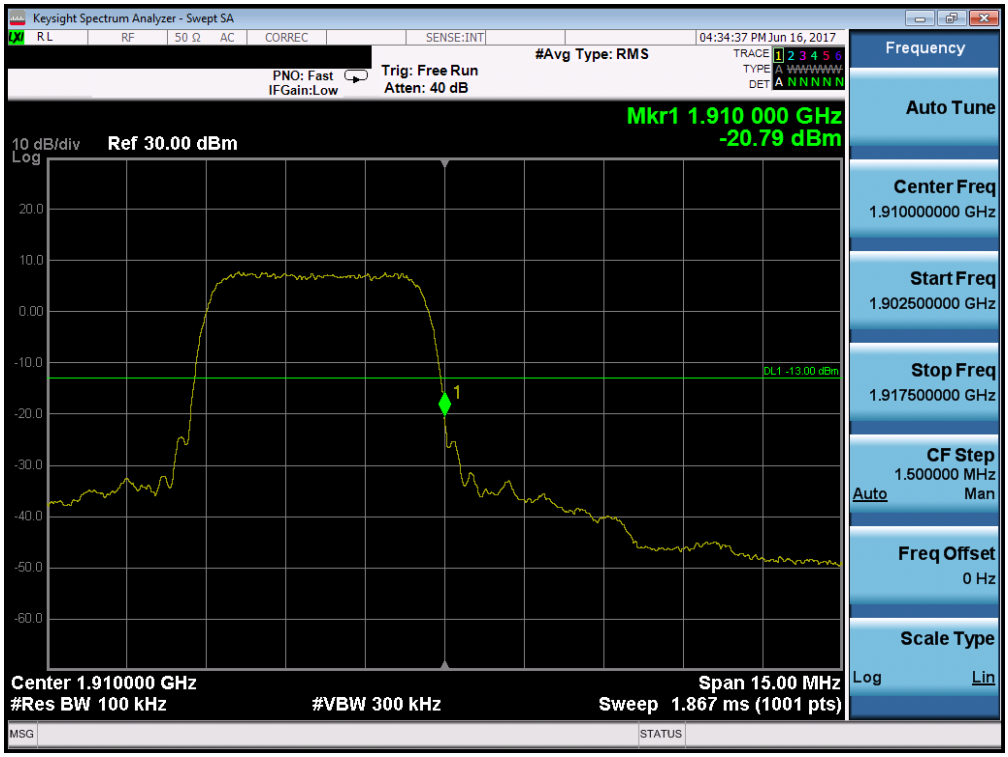
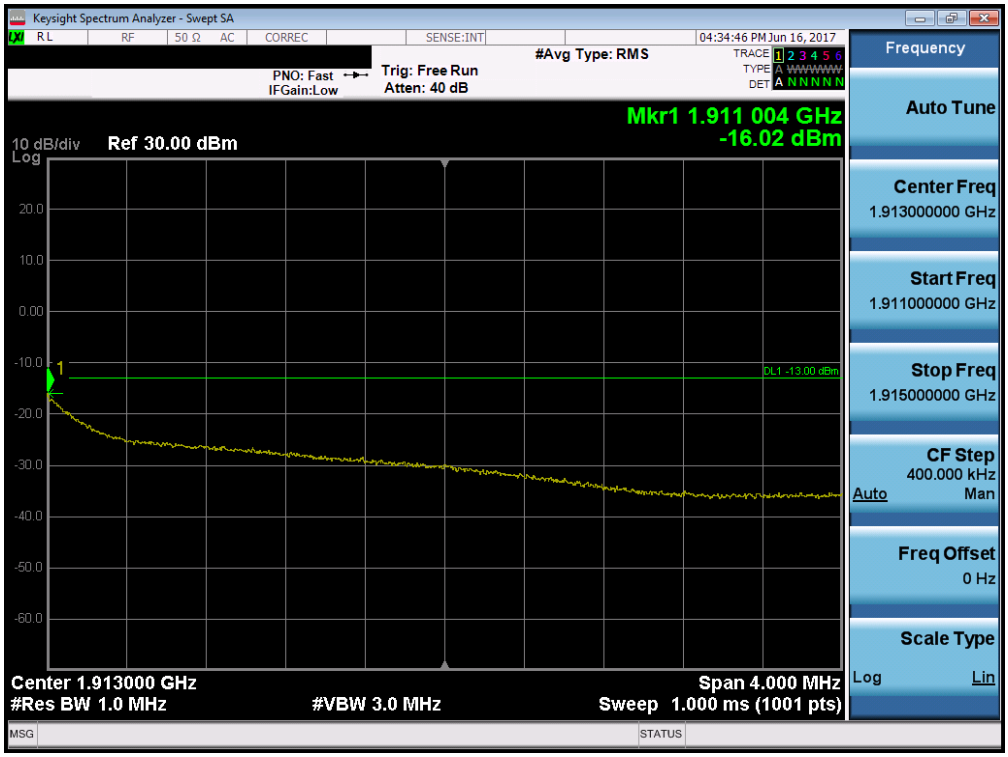


Plot 7-81. Band Edge Plot (PCS WCDMA Mode – Ch. 9538)



Plot 7-82. 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.

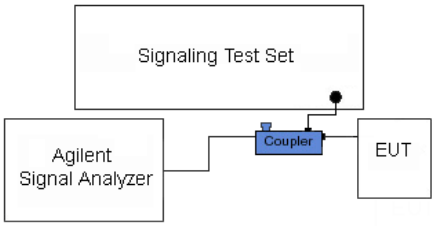

Figure 7-4. Test Instrument & Measurement Setup

Test Notes

None

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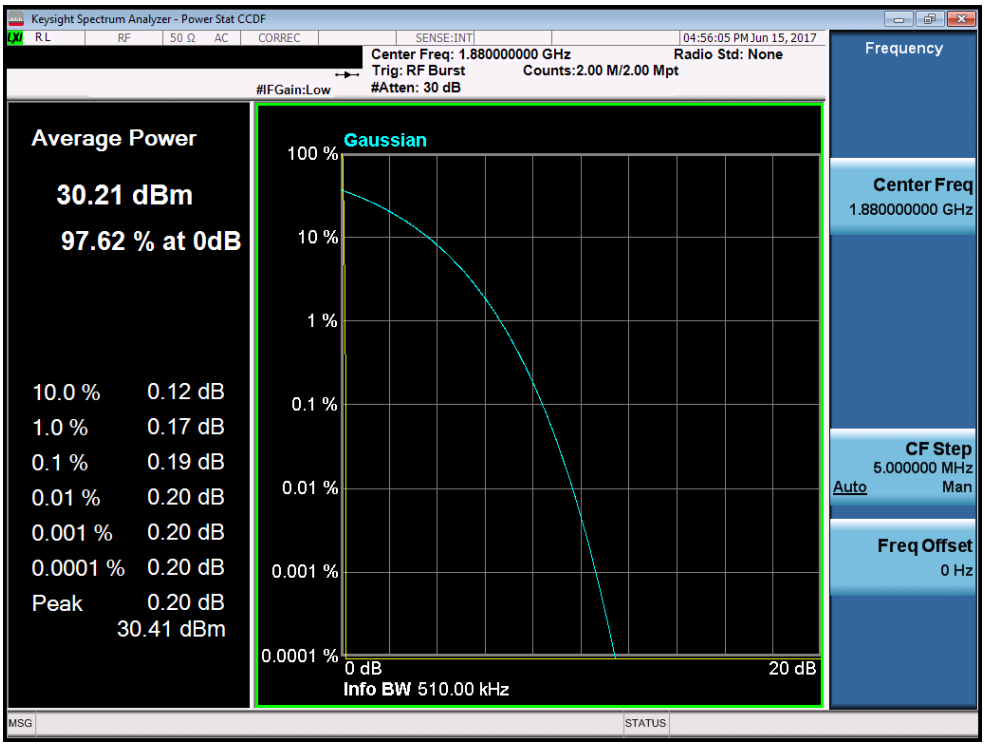
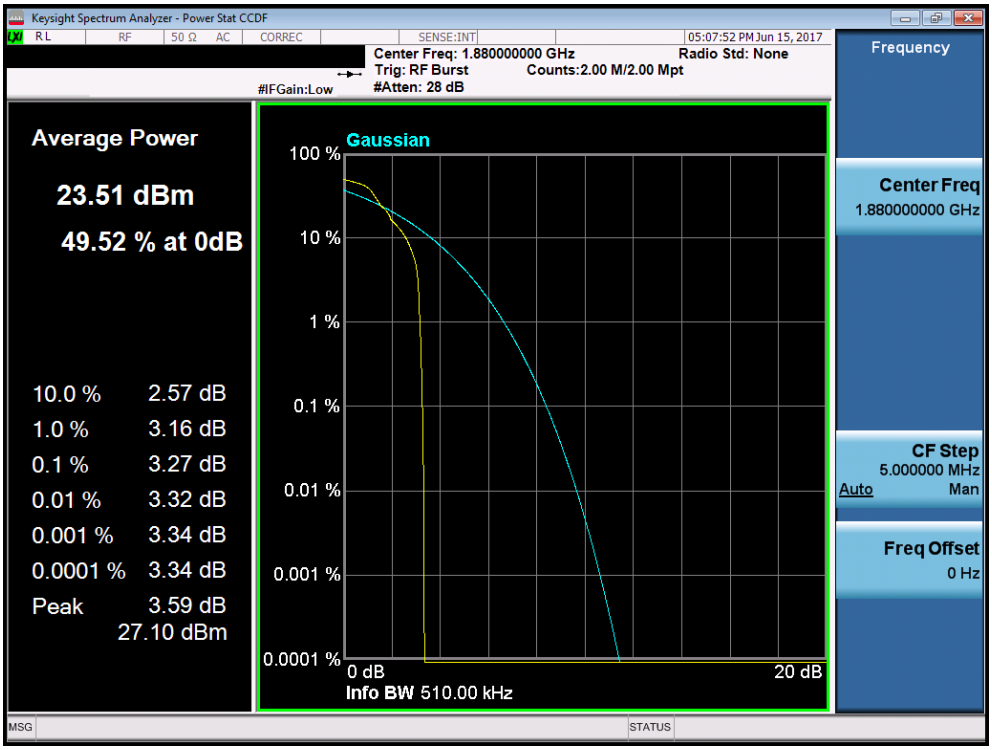


Plot 7-83. Peak-Average Ratio Plot (PCS GPRS Mode – Ch. 661)



Plot 7-84. Peak-Average Ratio Plot (EDGE1900 Mode – Ch. 661)

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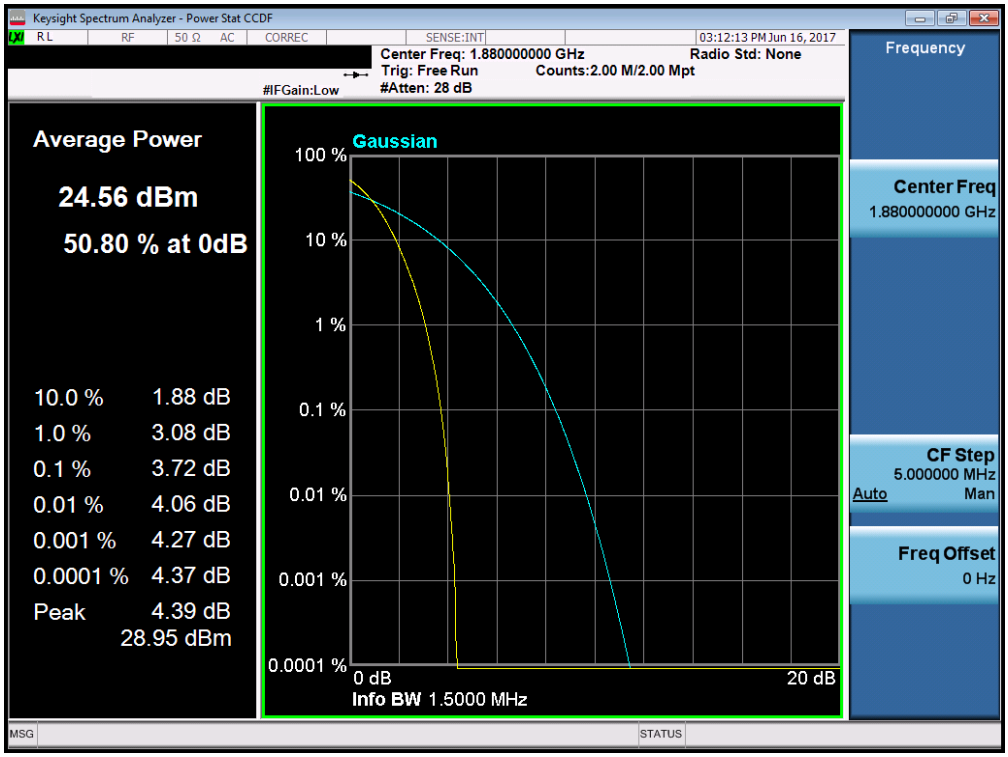
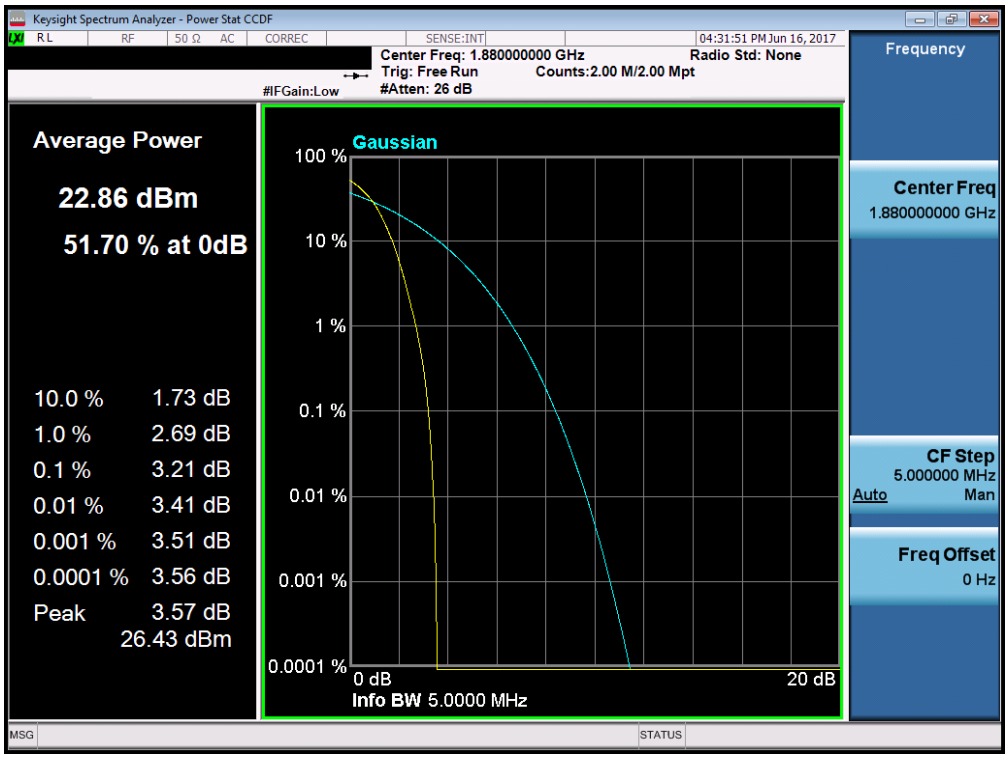


Plot 7-85. Peak-Average Ratio Plot (PCS CDMA Mode – Ch. 600)



Plot 7-86. 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)

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.

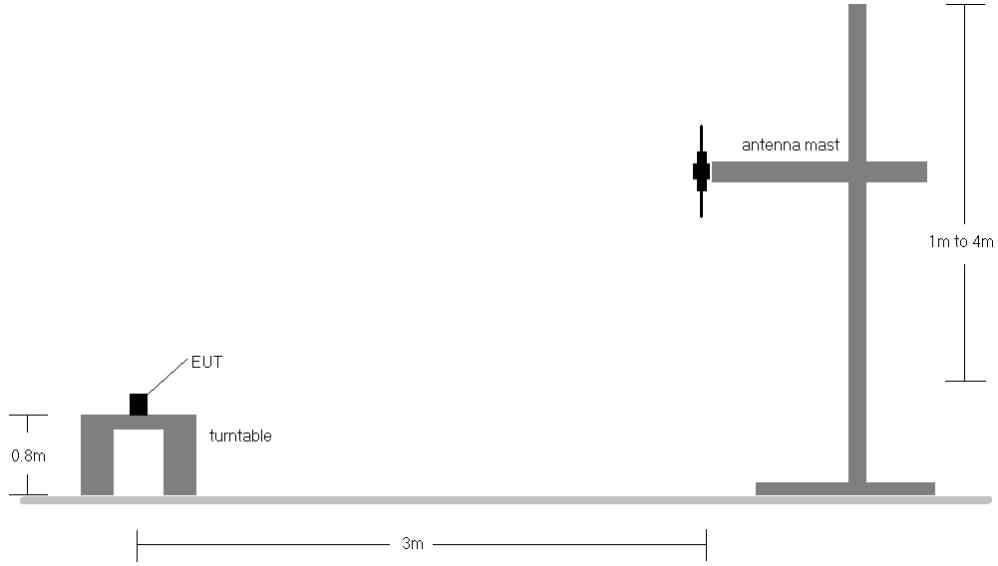

Figure 7-5. Radiated Test Setup <1GHz

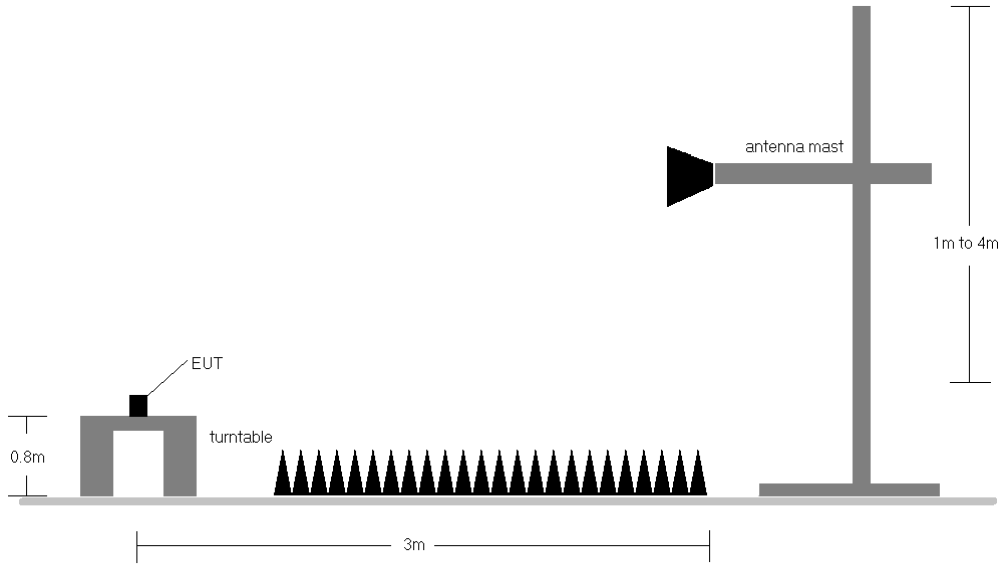

Figure 7-6. Radiated Test Setup >1GHz

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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 device employs CDMA/EvDO capabilities. This device was tested under all RC and SO combinations and the worst case is reported with RC3/SO55 with "All Up" power control bits.

4) This unit was tested with its standard battery.

5) 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.

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	206	214	24.11	5.49	29.60	0.911	38.45	-8.85
836.60	GPRS850	H	100	200	23.14	5.13	28.27	0.672	38.45	-10.18
848.80	GPRS850	H	100	218	24.69	4.68	29.37	0.865	38.45	-9.08
824.20	GPRS850	V	186	340	23.71	5.13	28.84	0.766	38.45	-9.61
824.20	EDGE850	H	203	222	20.20	5.49	25.69	0.371	38.45	-12.76

Table 7-2. ERP (Cellular GPRS)

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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]
824.70	CDMA850	H	150	18	24.13	-0.65	23.48	0.223	38.45	-14.97
836.52	CDMA850	H	150	22	24.45	-0.65	23.80	0.240	38.45	-14.65
848.31	CDMA850	H	150	25	24.46	-0.65	23.81	0.240	38.45	-14.64
848.31	CDMA850	V	150	26	21.74	-0.65	21.09	0.129	38.45	-17.36

Table 7-3. ERP (Cellular CDMA)

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	150	17	22.72	-0.65	22.07	0.161	38.45	-16.38
836.60	WCDMA850	H	150	20	22.82	-0.65	22.17	0.165	38.45	-16.28
846.60	WCDMA850	H	150	18	22.65	-0.65	22.00	0.158	38.45	-16.45
836.60	WCDMA850	V	150	23	20.54	-0.65	19.89	0.097	38.45	-18.56

Table 7-4. 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]
1850.20	GPRS1900	H	100	91	16.66	9.12	25.78	0.378	33.01	-7.23
1880.00	GPRS1900	H	103	191	18.76	9.10	27.86	0.611	33.01	-5.15
1909.80	GPRS1900	H	100	191	20.06	9.16	29.22	0.836	33.01	-3.79
1909.80	GPRS1900	V	110	260	18.65	9.16	27.81	0.604	33.01	-5.20
1909.80	EDGE1900	H	100	191	12.44	8.98	21.42	0.139	33.01	-11.59

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]
1851.25	CDMA1900	V	150	277	19.07	4.79	23.86	0.243	33.01	-9.15
1880.00	CDMA1900	V	150	269	18.35	4.84	23.19	0.209	33.01	-9.82
1908.75	CDMA1900	V	150	282	17.86	4.86	22.72	0.187	33.01	-10.29
1851.25	CDMA1900	H	150	93	19.01	4.82	23.83	0.242	33.01	-9.18

Table 7-6. EIRP (PCS CDMA)

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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]
1852.40	WCDMA1900	V	150	261	17.95	4.79	22.74	0.188	33.01	-10.27
1880.00	WCDMA1900	V	150	262	17.66	4.84	22.50	0.178	33.01	-10.51
1907.60	WCDMA1900	V	150	269	15.22	4.87	20.09	0.102	33.01	-12.92
1852.40	WCDMA1900	H	150	72	16.06	4.81	20.87	0.122	33.01	-12.14

Table 7-7. EIRP (PCS WCDMA)

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7.7 Radiated Spurious Emissions Measurements

§2.1053 §22.917(a) 24.238(a)

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.

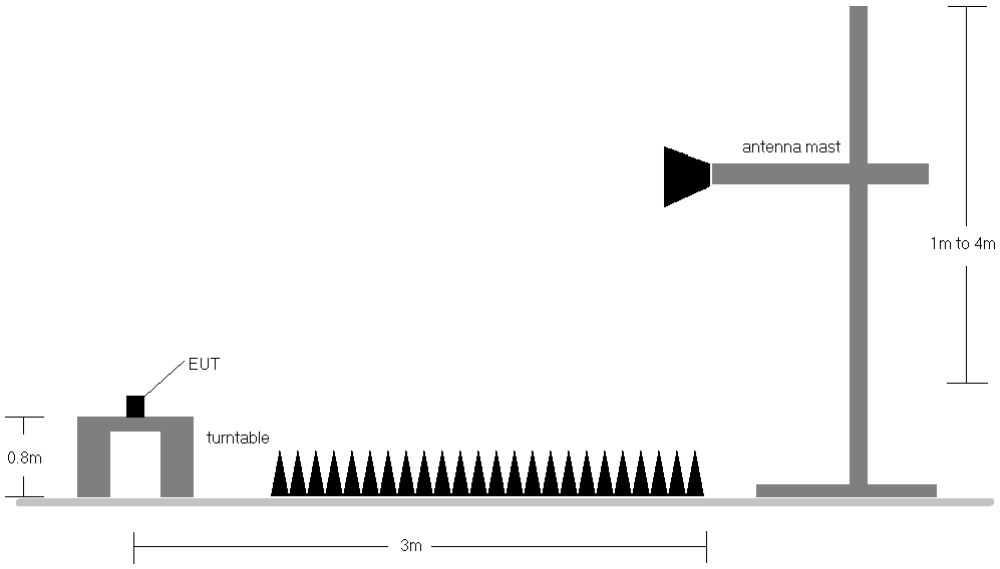

Figure 7-7. Test Instrument & Measurement Setup

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 device employs CDMA/EvDO capabilities. This device was tested under all RC and SO combinations and the worst case is reported with RC3/SO55 with "All Up" power control bits.

4) This unit was tested with its standard battery.

5) 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.

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

7) 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.

8) 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:	29.60	dBm =	0.911	W
MODULATION SIGNAL:	GPRS (GMSK)			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	42.60		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]
1648.40	H	119	294	-42.78	6.30	-36.48	66.1
2472.60	H	139	85	-47.72	6.85	-40.87	70.5
3296.80	H	-	-	-61.90	7.12	-54.78	84.4

Table 7-8. Radiated Spurious Data (Cellular GPRS Mode – Ch. 128)

OPERATING FREQUENCY:	836.60			MHz
CHANNEL:	190			
MEASURED OUTPUT POWER:	28.27	dBm =	0.672	W
MODULATION SIGNAL:	GPRS (GMSK)			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	41.27		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	179	-49.69	6.21	-43.49	71.8
2509.80	H	122	290	-36.78	6.86	-29.92	58.2
3346.40	H	-	-	-61.84	7.26	-54.58	82.9

Table 7-9. Radiated Spurious Data (Cellular GPRS Mode – Ch. 190)

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OPERATING FREQUENCY:	848.80			MHz
CHANNEL:	251			
MEASURED OUTPUT POWER:	29.37	dBm =	0.865	W
MODULATION SIGNAL:	GPRS (GMSK)			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	42.37		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	103	207	-49.92	6.12	-43.80	73.2
2546.40	H	196	51	-37.33	6.97	-30.36	59.7
3395.20	H	105	108	-58.25	7.41	-50.84	80.2
4244.00	H	178	32	-39.58	8.39	-31.19	60.6
5092.80	H	-	-	-64.50	8.84	-55.66	85.0

Table 7-10. Radiated Spurious Data (Cellular GPRS Mode – Ch. 251)

OPERATING FREQUENCY:	824.70			MHz
CHANNEL:	1013			
MEASURED OUTPUT POWER:	23.48	dBm =	0.223	W
MODULATION SIGNAL:	CDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	36.48		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]
1649.40	H	-	-	-76.28	6.30	-69.98	93.5

Table 7-11. Radiated Spurious Data (Cellular CDMA Mode – Ch. 1013)

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OPERATING FREQUENCY:	836.52			MHz
CHANNEL:	384			
MEASURED OUTPUT POWER:	23.80	dBm =	0.240	W
MODULATION SIGNAL:	CDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	36.80		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]
1673.04	H	114	294	-66.95	6.21	-60.74	84.5
2509.56	H	-	-	-72.68	6.86	-65.82	89.6

Table 7-12. Radiated Spurious Data (Cellular CDMA Mode – Ch. 384)

OPERATING FREQUENCY:	848.31			MHz
CHANNEL:	777			
MEASURED OUTPUT POWER:	23.81	dBm =	0.240	W
MODULATION SIGNAL:	CDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	36.81		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]
1696.62	H	100	226	-63.59	6.12	-57.46	81.3
2544.93	H	-	-	-72.41	6.96	-65.44	89.3

Table 7-13. Radiated Spurious Data (Cellular CDMA Mode – Ch. 777)

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OPERATING FREQUENCY:	826.40			MHz
CHANNEL:	4132			
MEASURED OUTPUT POWER:	22.07	dBm	= 0.161	W
MODULATION SIGNAL:	WCDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	35.07		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	127	171	-72.57	6.28	-66.28	88.4
2479.20	H	-	-	-71.53	6.84	-64.69	86.8

Table 7-14. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4132)

OPERATING FREQUENCY:	836.60			MHz
CHANNEL:	4183			
MEASURED OUTPUT POWER:	22.17	dBm	= 0.165	W
MODULATION SIGNAL:	WCDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	35.17		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	117	279	-69.70	6.21	-63.50	85.7
2509.80	H	-	-	-71.12	6.86	-64.26	86.4

Table 7-15. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4183)

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OPERATING FREQUENCY:	846.60			MHz
CHANNEL:	4233			
MEASURED OUTPUT POWER:	22.00	dBm =	0.158	W
MODULATION SIGNAL:	WCDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		35.00	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	112	176	-62.71	6.13	-56.58	78.6
2539.80	H	-	-	-71.38	6.95	-64.43	86.4

Table 7-16. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4233)

OPERATING FREQUENCY:	1850.20			MHz
CHANNEL:	512			
MEASURED OUTPUT POWER:	25.78	dBm =	0.378	W
MODULATION SIGNAL:	GPRS (GMSK)			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		38.78	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	188	102	-61.42	8.83	-52.58	78.4
5550.60	H	142	147	-67.65	13.08	-54.57	80.3
7400.80	H	-	-	-57.31	10.29	-47.03	72.8

Table 7-17. Radiated Spurious Data (PCS GPRS Mode – Ch. 512)

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OPERATING FREQUENCY:	1880.00			MHz
CHANNEL:	661			
MEASURED OUTPUT POWER:	27.86	dBm	= 0.611	W
MODULATION SIGNAL:	GPRS (GMSK)			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		40.86	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	373	284	-65.04	9.25	-55.79	83.6
5640.00	H	-	-	-69.31	13.28	-56.03	83.9

Table 7-18. Radiated Spurious Data (PCS GPRS Mode – Ch. 661)

OPERATING FREQUENCY:	1909.80			MHz
CHANNEL:	810			
MEASURED OUTPUT POWER:	29.22	dBm	= 0.836	W
MODULATION SIGNAL:	GPRS (GMSK)			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		42.22	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	154	150	-64.79	9.44	-55.35	84.6
5729.40	H	146	115	-65.44	13.41	-52.03	81.3
7639.20	H	174	25	-55.55	10.52	-45.03	74.3
9549.00	H	-	-	-48.19	7.51	-40.67	69.9

Table 7-19. Radiated Spurious Data (PCS GPRS Mode – Ch. 810)

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OPERATING FREQUENCY:	1851.25			MHz
CHANNEL:	25			
MEASURED OUTPUT POWER:	23.86	dBm	= 0.243	W
MODULATION SIGNAL:	CDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		36.86	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]
3702.50	H	208	109	-69.36	10.02	-59.33	83.2
5553.75	H	-	-	-68.80	11.19	-57.62	81.5

Table 7-20. Radiated Spurious Data (PCS CDMA Mode – Ch. 25)

OPERATING FREQUENCY:	1880.00			MHz
CHANNEL:	600			
MEASURED OUTPUT POWER:	23.19	dBm	= 0.209	W
MODULATION SIGNAL:	CDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		36.19	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	-	-	-69.01	9.79	-59.22	82.4

Table 7-21. Radiated Spurious Data (PCS CDMA Mode – Ch. 600)

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OPERATING FREQUENCY:	1908.75			MHz
CHANNEL:	1175			
MEASURED OUTPUT POWER:	22.72	dBm	= 0.187	W
MODULATION SIGNAL:	CDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		35.72	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]
3817.50	H	171	105	-68.73	9.56	-59.16	81.9
5726.25	H	-	-	-68.96	11.43	-57.53	80.2

Table 7-22. Radiated Spurious Data (PCS CDMA Mode – Ch. 1175)

OPERATING FREQUENCY:	1852.40			MHz
CHANNEL:	9262			
MEASURED OUTPUT POWER:	22.74	dBm	= 0.188	W
MODULATION SIGNAL:	WCDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		35.74	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	-	-	-69.20	10.01	-59.18	81.9

Table 7-23. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9262)

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OPERATING FREQUENCY:	1880.00			MHz
CHANNEL:	9400			
MEASURED OUTPUT POWER:	22.50	dBm	= 0.178	W
MODULATION SIGNAL:	WCDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		35.50	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	-	-	-68.99	9.79	-59.20	81.7

Table 7-24. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9400)

OPERATING FREQUENCY:	1907.60			MHz
CHANNEL:	9538			
MEASURED OUTPUT POWER:	20.09	dBm	= 0.102	W
MODULATION SIGNAL:	WCDMA			
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =		33.09	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	176	104	-66.91	9.57	-57.33	77.4
5722.80	H	-	-	-67.86	11.43	-56.42	76.5

Table 7-25. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9538)

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7.8 Frequency Stability / Temperature Variation

§2.1055 §22.355 §24.235

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 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:	3.80	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	836,599,939	-61	-0.0000073
100 %		- 30	836,599,907	-93	-0.0000111
100 %		- 20	836,599,902	-98	-0.0000117
100 %		- 10	836,599,960	-40	-0.0000048
100 %		0	836,599,916	-84	-0.0000100
100 %		+ 10	836,599,996	-4	-0.0000005
100 %		+ 20	836,599,923	-77	-0.0000093
100 %		+ 30	836,599,935	-65	-0.0000078
100 %		+ 40	836,599,843	-157	-0.0000188
100 %		+ 50	836,599,838	-162	-0.0000194
BATT. ENDPOINT	3.40	+ 20	836,599,960	-40	-0.0000048

Table 7-26. Frequency Stability Data (Cellular GPRS Mode – Ch. 190)

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Frequency Stability / Temperature Variation

§2.1055 §22.355

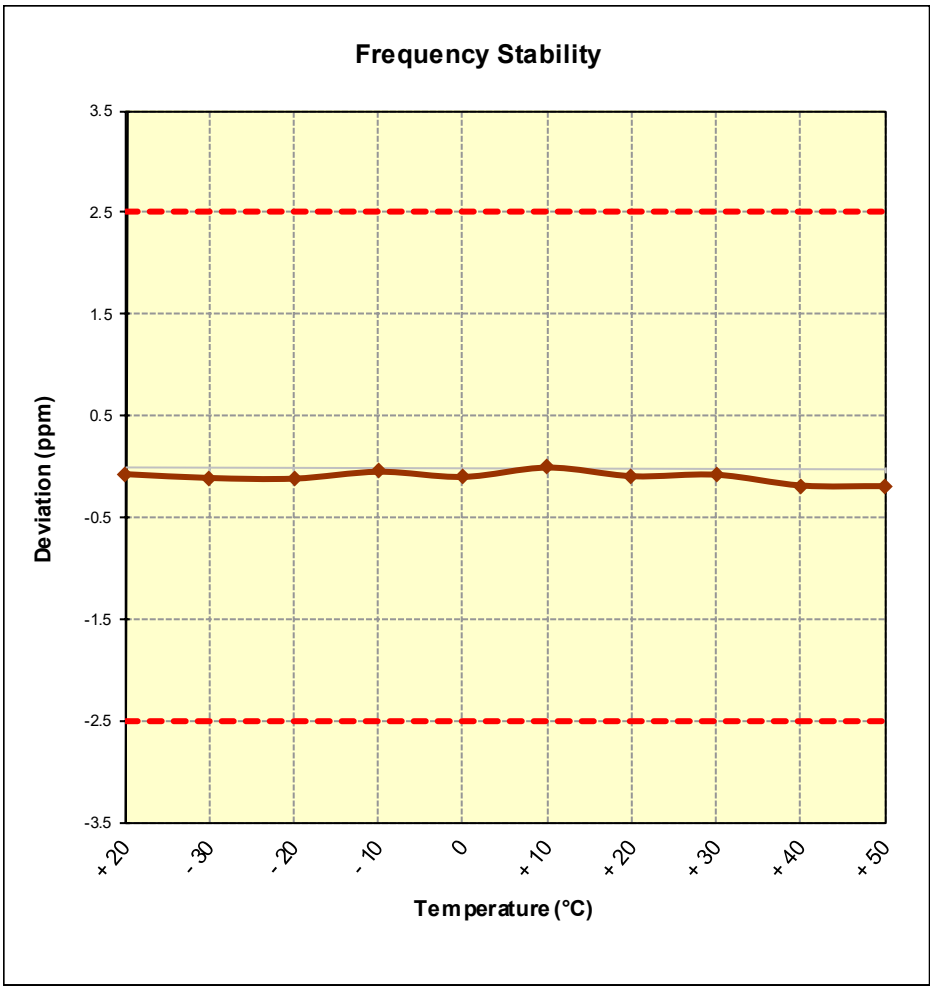

Figure 7-8. Frequency Stability Graph (Cellular GPRS Mode – Ch. 190)

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Frequency Stability / Temperature Variation
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OPERATING FREQUENCY:	836,520,000	Hz
CHANNEL:	384	
REFERENCE VOLTAGE:	3.80	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	836,519,944	-56	-0.0000067
100 %		- 30	836,519,869	-131	-0.0000156
100 %		- 20	836,519,989	-11	-0.0000014
100 %		- 10	836,519,847	-153	-0.0000183
100 %		0	836,519,850	-150	-0.0000179
100 %		+ 10	836,519,834	-166	-0.0000198
100 %		+ 20	836,519,810	-190	-0.0000227
100 %		+ 30	836,519,821	-179	-0.0000214
100 %		+ 40	836,519,893	-107	-0.0000128
100 %		+ 50	836,519,807	-193	-0.0000231
BATT. ENDPOINT	3.40	+ 20	836,519,830	-170	-0.0000203

Table 7-27. Frequency Stability Data (Cellular CDMA Mode – Ch. 384)

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Frequency Stability / Temperature Variation

§2.1055 §22.355

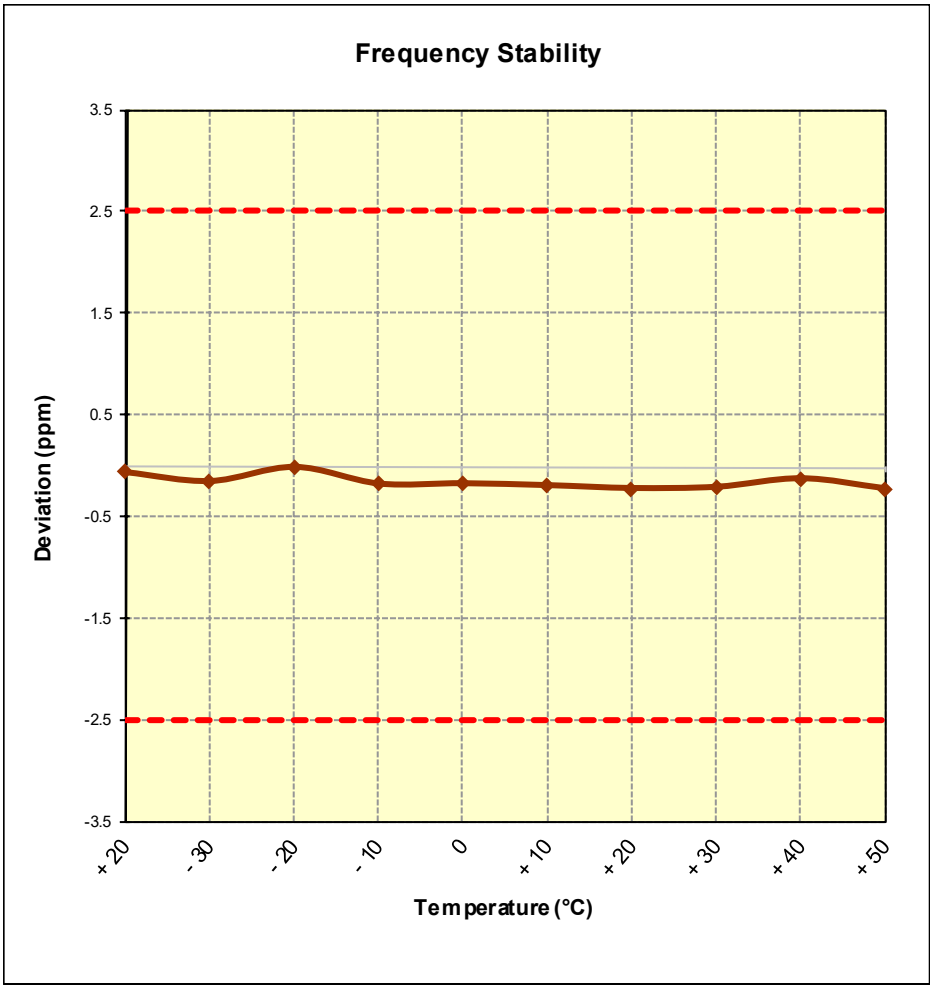

Figure 7-9. Frequency Stability Graph (Cellular CDMA Mode – Ch. 384)

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Frequency Stability / Temperature Variation

§2.1055 §22.355

OPERATING FREQUENCY:	836,600,000	Hz
CHANNEL:	4183	
REFERENCE VOLTAGE:	3.80	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	836,599,816	-184	-0.0000220
100 %		- 30	836,599,946	-54	-0.0000065
100 %		- 20	836,599,944	-56	-0.0000067
100 %		- 10	836,599,830	-170	-0.0000203
100 %		0	836,599,874	-126	-0.0000150
100 %		+ 10	836,599,936	-64	-0.0000077
100 %		+ 20	836,599,926	-74	-0.0000088
100 %		+ 30	836,599,931	-69	-0.0000083
100 %		+ 40	836,599,937	-63	-0.0000075
100 %		+ 50	836,599,949	-51	-0.0000061
BATT. ENDPOINT	3.40	+ 20	836,599,856	-144	-0.0000172

Table 7-28. Frequency Stability Data (Cellular WCDMA Mode – Ch. 4183)

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Frequency Stability / Temperature Variation

§2.1055 §22.355

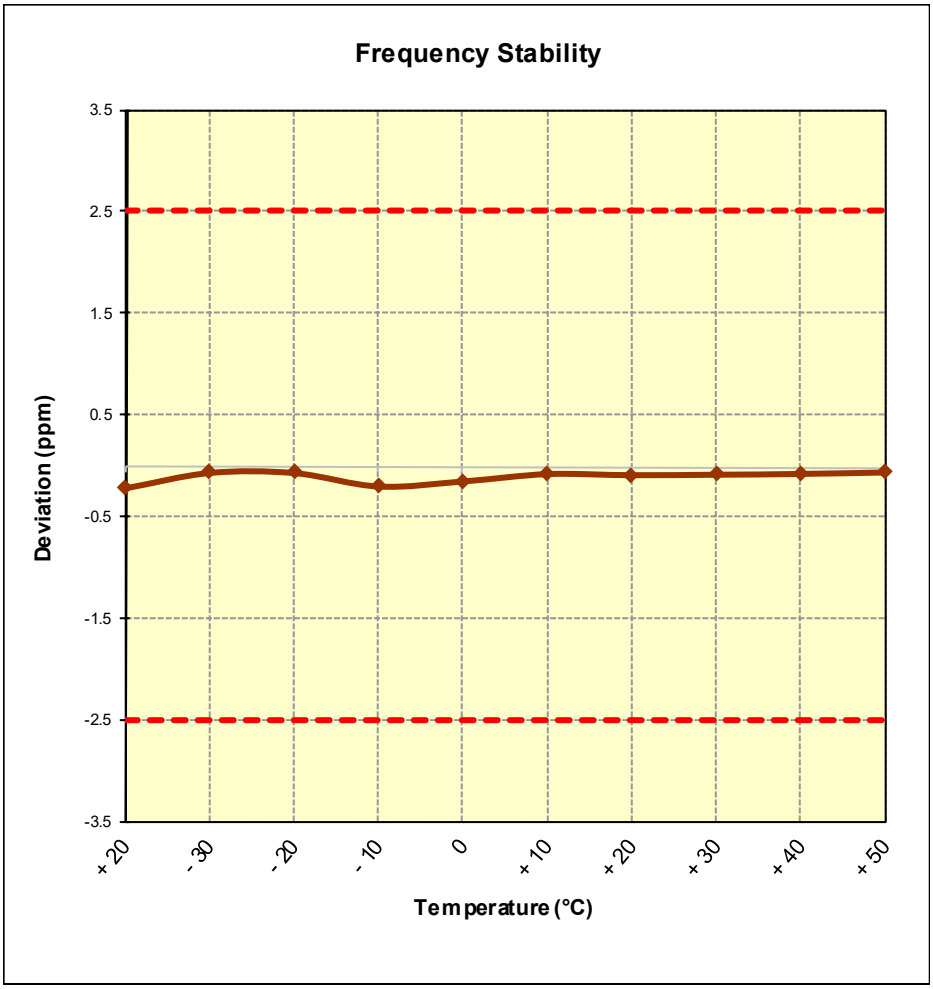

Figure 7-10. Frequency Stability Graph (Cellular WCDMA Mode – Ch. 4183)

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Frequency Stability / Temperature Variation

§2.1055 §24.235

OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	661	
REFERENCE VOLTAGE:	3.80	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	1,879,999,921	-79	-0.0000042
100 %		- 30	1,879,999,911	-89	-0.0000047
100 %		- 20	1,879,999,811	-189	-0.0000100
100 %		- 10	1,879,999,874	-126	-0.0000067
100 %		0	1,879,999,989	-11	-0.0000006
100 %		+ 10	1,879,999,984	-16	-0.0000009
100 %		+ 20	1,879,999,987	-13	-0.0000007
100 %		+ 30	1,879,999,813	-187	-0.0000100
100 %		+ 40	1,879,999,978	-22	-0.0000012
100 %		+ 50	1,879,999,911	-89	-0.0000047
BATT. ENDPOINT	3.40	+ 20	1,879,999,819	-181	-0.0000096

Table 7-29. 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

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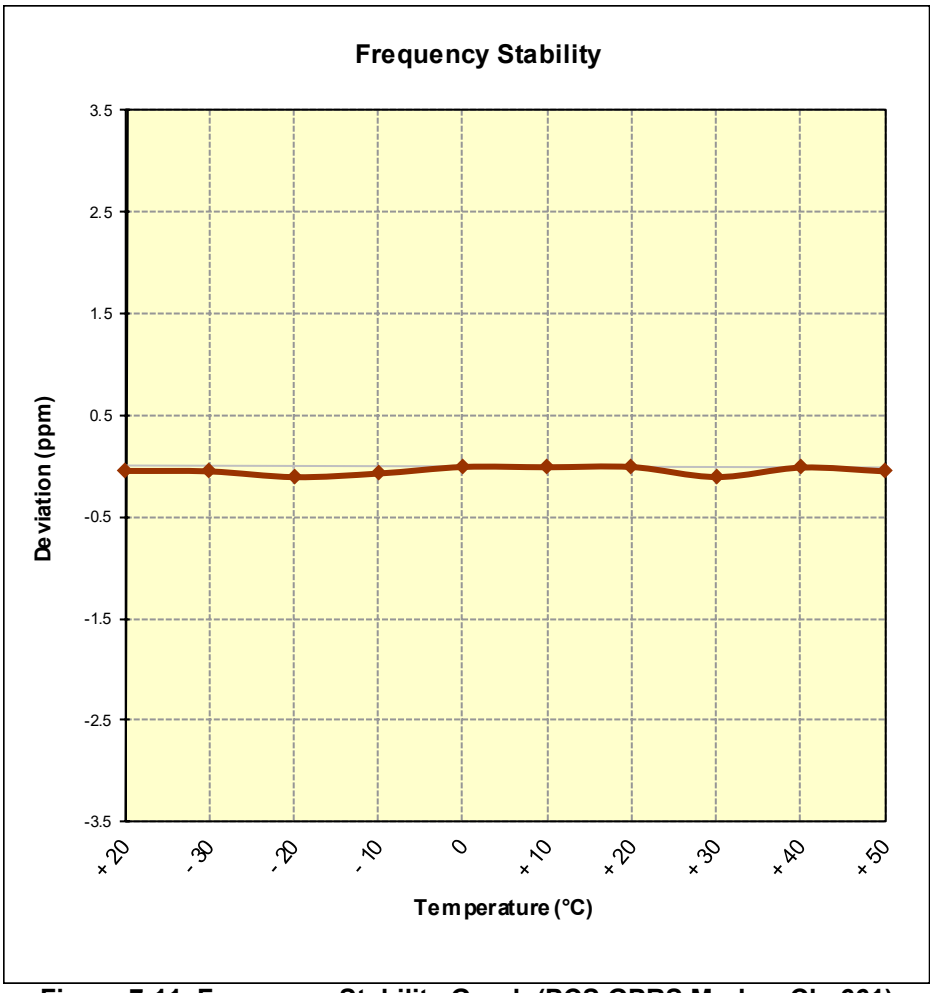

Figure 7-11. Frequency Stability Graph (PCS GPRS Mode – Ch. 661)

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Frequency Stability / Temperature Variation
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OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	600	
REFERENCE VOLTAGE:	3.80	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	1,879,999,869	-131	-0.0000070
100 %		- 30	1,879,999,915	-85	-0.0000045
100 %		- 20	1,879,999,946	-54	-0.0000029
100 %		- 10	1,879,999,868	-132	-0.0000070
100 %		0	1,879,999,859	-141	-0.0000075
100 %		+ 10	1,879,999,837	-163	-0.0000087
100 %		+ 20	1,879,999,900	-100	-0.0000053
100 %		+ 30	1,879,999,840	-160	-0.0000085
100 %		+ 40	1,879,999,996	-4	-0.0000002
100 %		+ 50	1,879,999,984	-16	-0.0000008
BATT. ENDPOINT	3.40	+ 20	1,879,999,844	-156	-0.0000083

Table 7-30. Frequency Stability Data (PCS CDMA Mode – Ch. 600)

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

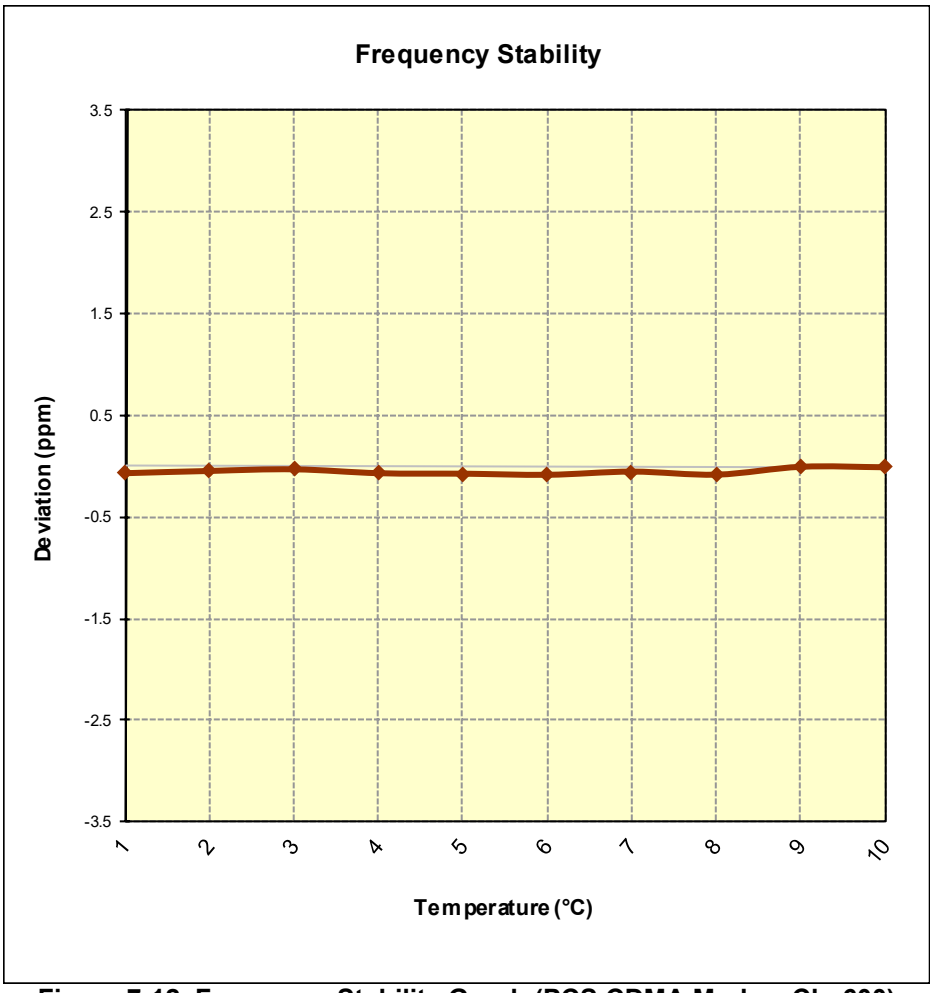

Figure 7-12. Frequency Stability Graph (PCS CDMA Mode – Ch. 600)

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Frequency Stability / Temperature Variation
§2.1055 §24.235

OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	9400	
REFERENCE VOLTAGE:	3.80	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	1,879,999,909	-91	-0.0000048
100 %		- 30	1,879,999,816	-184	-0.0000098
100 %		- 20	1,879,999,877	-123	-0.0000066
100 %		- 10	1,879,999,897	-103	-0.0000055
100 %		0	1,879,999,803	-197	-0.0000105
100 %		+ 10	1,879,999,945	-55	-0.0000029
100 %		+ 20	1,879,999,800	-200	-0.0000106
100 %		+ 30	1,879,999,912	-88	-0.0000047
100 %		+ 40	1,879,999,940	-60	-0.0000032
100 %		+ 50	1,879,999,948	-52	-0.0000028
BATT. ENDPOINT	3.40	+ 20	1,879,999,998	-2	-0.0000001

Table 7-31. 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

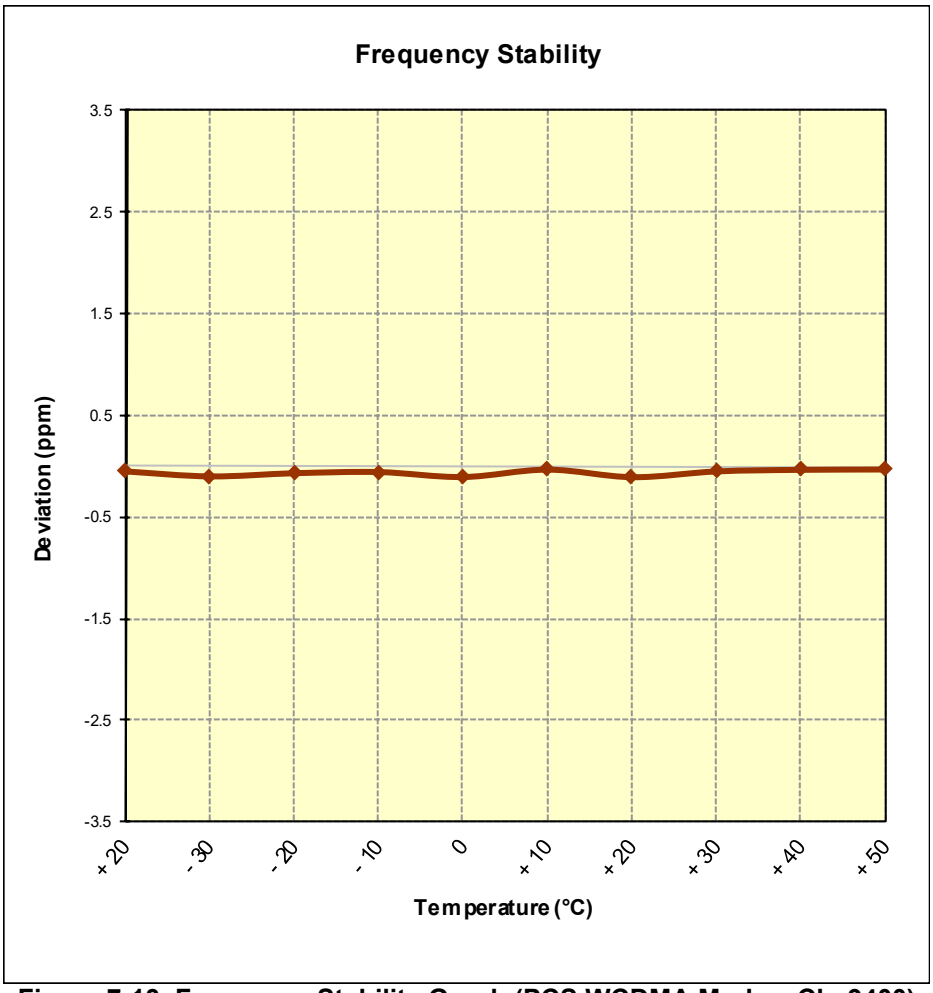

Figure 7-13. Frequency Stability Graph (PCS WCDMA Mode – Ch. 9400)

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LGE Portable Handset FCC ID: ZNFUN220** complies with all the requirements of Parts 22 & 24 of the FCC rules.

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