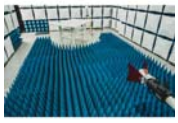
PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



MEASUREMENT REPORT
GSM / GPRS / EDGE / CDMA / WCDMA

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

Date of Testing:
June 1 - June 22, 2018
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M1805310115-02.ZNF

FCC ID:	**ZNFX410PM**
APPLICANT:	**LG Electronics MobileComm U.S.A**

Application Type:	Certification
Model:	LM-X410PM
Additional Model(s):	LMX410PM, X410PM
EUT Type:	Portable Handset
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	22, 24, & 27
Test Procedure(s):	ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01

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

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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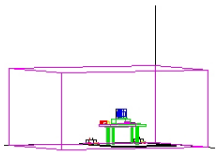
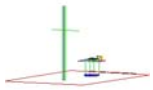


MEASUREMENT REPORT
GSM / GPRS / EDGE / CDMA / WCDMA



Mode	FCC Rule Part	Tx Frequency (MHz)	ERP		EIRP		Emission Designator
			Max. Power (W)	Max. Power (dBm)	Max. Power (W)	Max. Power (dBm)	
GPRS850	22H	824.2 - 848.8	1.218	30.86	1.999	33.01	248KGXW
EDGE850	22H	824.2 - 848.8	0.248	23.94	0.406	26.09	246KG7W
CDMA850	22H	824.70 - 848.31	0.174	22.41	0.286	24.56	1M28F9W
WCDMA850	22H	826.4 - 846.6	0.234	23.70	0.385	25.85	4M18F9W
WCDMA1700	27	1712.4 - 1752.6			0.231	23.64	4M21F9W
GPRS1900	24E	1850.2 - 1909.8			1.279	31.07	247KGXW
EDGE1900	24E	1850.2 - 1909.8			0.386	25.86	244KG7W
CDMA1900	24E	1851.25 - 1908.75			0.463	26.65	1M28F9W
WCDMA1900	24E	1852.4 - 1907.6			0.411	26.14	4M22F9W

EUT Overview

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

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

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

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

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

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFX410PM**. The test data contained in this report pertains only to the emissions due to the EUT's 2G/3G licensed transmitters.

Test Device Serial No.: 00261, 00260, 00281, 00288

2.2 Device Capabilities

This device contains the following capabilities:

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

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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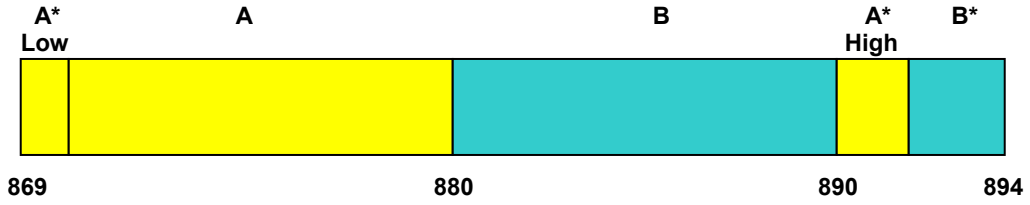
3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Measurement Guidance for Certification of Licensed Digital Transmitters" (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure……..None

3.2 Cellular - Base Frequency Blocks



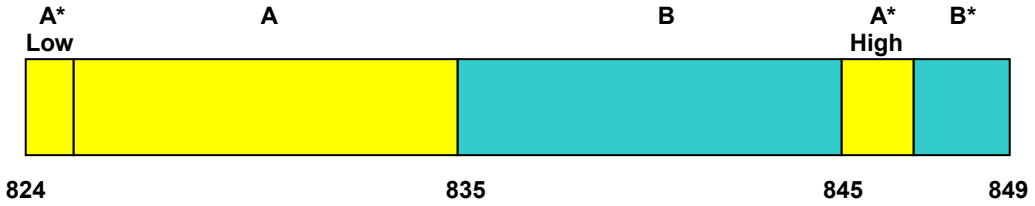
BLOCK 1: 869 – 880 MHz (A* Low + A)

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



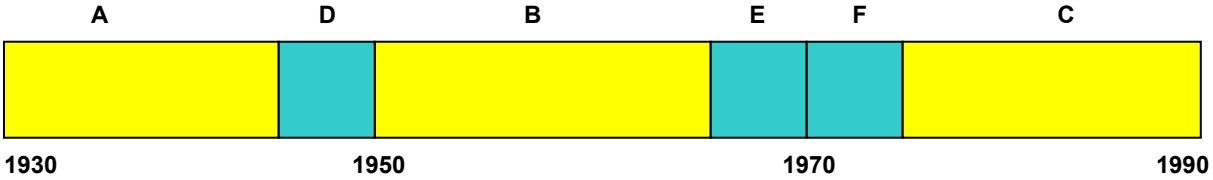
BLOCK 1: 824 – 835 MHz (A* Low + A)

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



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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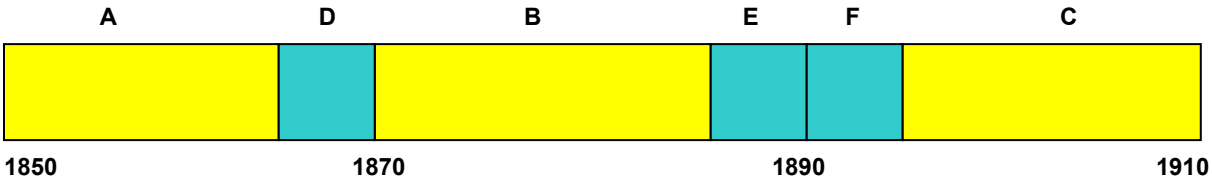
3.5 PCS - Mobile Frequency Blocks



BLOCK 1: 1850 – 1865 MHz (A)

BLOCK 2: 1865 – 1870 MHz (D)

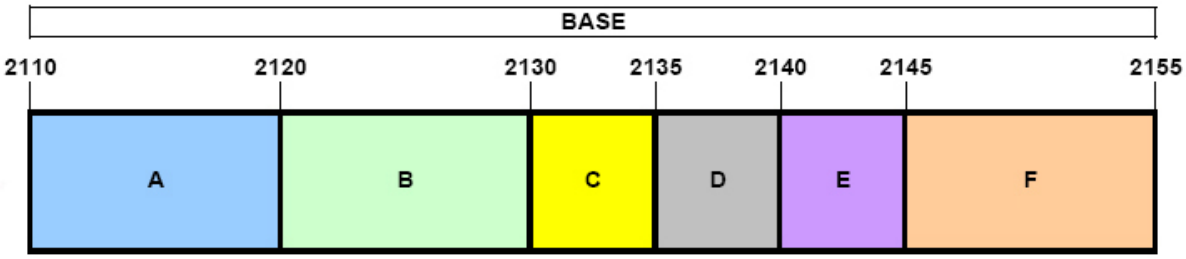
BLOCK 3: 1870 – 1885 MHz (B)

BLOCK 4: 1885 – 1890 MHz (E)

BLOCK 5: 1890 – 1895 MHz (F)

BLOCK 6: 1895 – 1910 MHz (C)

3.6 AWS - Base Frequency Blocks



BLOCK 1: 2110 – 2120 MHz (A)

BLOCK 2: 2120 – 2130 MHz (B)

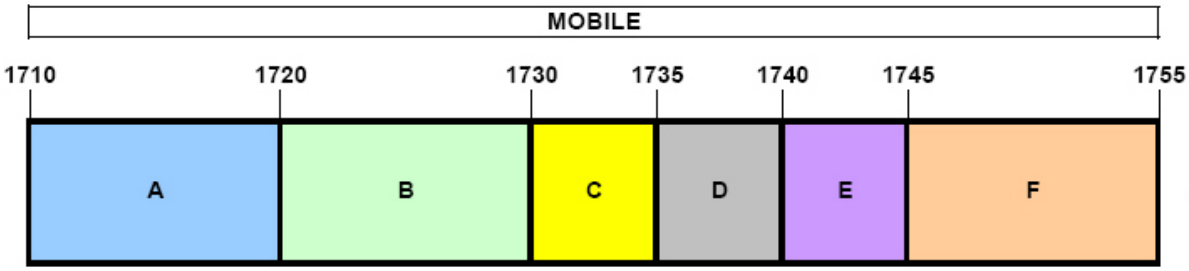
BLOCK 3: 2130 – 2135 MHz (C)

BLOCK 4: 2135 – 2140 MHz (D)

BLOCK 5: 2140 – 2145 MHz (E)

BLOCK 6: 2145 – 2155 MHz (F)

3.7 AWS - Mobile Frequency Blocks



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

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

Per the guidance of ANSI/TIA-603-E-2016, 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/TIA-603-E-2016.

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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 C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTx2	Licensed Transmitter Cable Set	8/10/2017	Annual	8/10/2018	LTx2
Agilent	N9020A	MXA Signal Analyzer	1/24/2018	Annual	1/24/2019	US46470561
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
EMCO	3160-09	Small Horn (18 - 26.5GHz)	8/23/2016	Biennial	8/23/2018	135427
Espec	ESX-2CA	Environmental Chamber	3/28/2018	Annual	3/28/2019	17620
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	12/1/2016	Biennial	12/1/2018	125518
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/28/2018	Biennial	3/28/2020	128337
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	1/23/2018	Annual	1/23/2019	251425001
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	3/30/2018	Annual	3/30/2019	11401010036
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Rohde & Schwarz	CMW500	Radio Communication Tester	10/13/2017	Annual	10/13/2018	102060
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	7/31/2017	Annual	7/31/2018	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	8/11/2017	Annual	8/11/2018	103200
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/3/2017	Annual	7/3/2018	102135
Rohde & Schwarz	TC-TA18	Cross-Pol Antenna 400MHz-18GHz	10/30/2017	Annual	10/30/2018	101058
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	1/24/2018	Annual	1/24/2019	100040
Schwarzbeck	UHA 9105	Dipole Antenna	8/26/2016	Biennial	8/26/2018	2696
Sunol	DRH-118	Horn Antenna (1-18GHz)	8/11/2017	Biennial	8/11/2019	A050307

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: ZNFX410PM

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

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

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	RSS-Gen (4.6.1) RSS-133(2.3) RSS-139(2.3)	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 22.917(a) 24.238(a) 27.53(h)	RSS-132(5.5) RSS-133(6.5) RSS-139(6.6)	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)	RSS-132(5.4) RSS-133(6.4) RSS-139(6.5)	Peak-Average Ratio	< 13 dB		PASS	Section 7.5
2.1046	RSS-132(5.4) RSS-133(4.1) RSS-139(4.1)	Transmitter Conducted Output Power	N/A		PASS	RF Exposure Report
2.1055 22.355 24.235 27.54	RSS-132(5.3) RSS-133(6.3) RSS-139(6.4)	Frequency Stability	< 2.5 ppm (Part 22) Emission must remain in band (Part 24, 27)		PASS	Section 7.8
22.913(a)(5)	RSS-132(5.4)	Effective Radiated Power	< 7 Watts max. ERP	RADIATED	PASS	Section 7.6
24.232(c)	RSS-133(6.4)	Equivalent Isotropic Radiated Power	< 2 Watts max. EIRP		PASS	Section 7.6
27.50(d)(4)	RSS-139(6.5)	Equivalent Isotropic Radiated Power	< 1 Watts max. EIRP		PASS	Section 7.6
2.1053 22.917(a) 24.238(a) 27.53(h)	RSS-132(5.5) RSS-133(6.5) RSS-139(6.6)	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

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

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

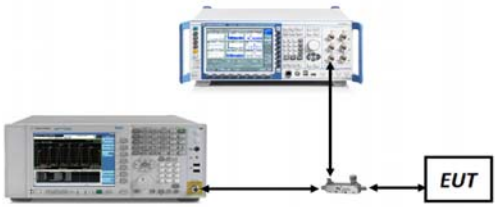

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None.

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Plot 7-1. Occupied Bandwidth Plot (Cellular GPRS Mode)

Plot 7-2. Occupied Bandwidth Plot (EDGE850 Mode)

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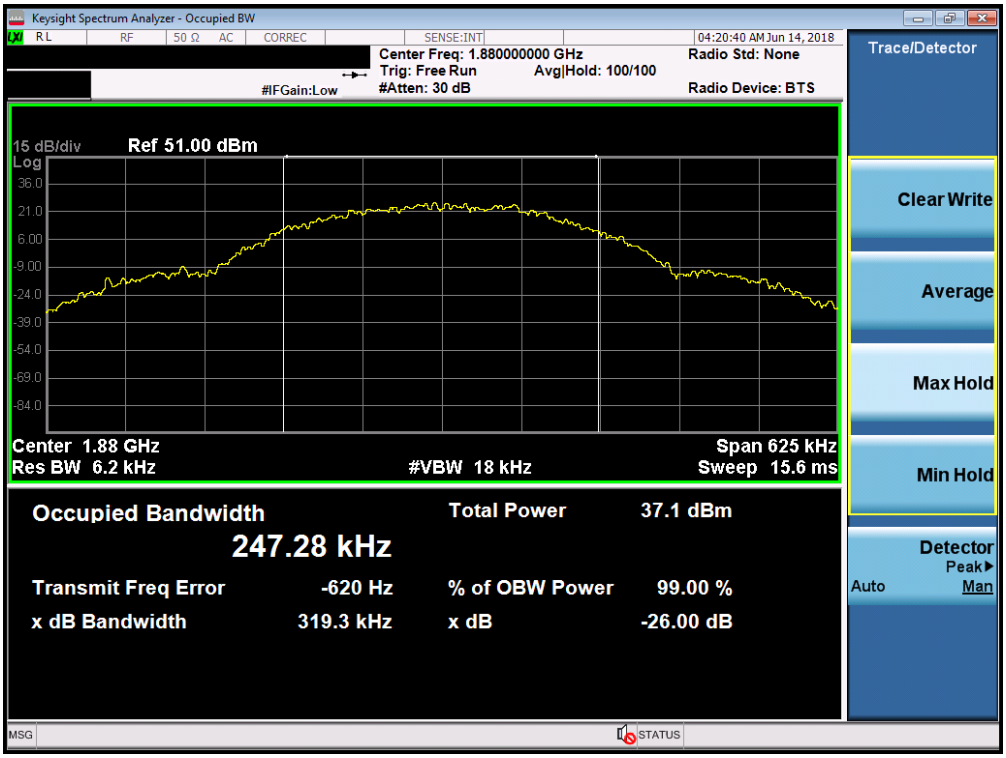
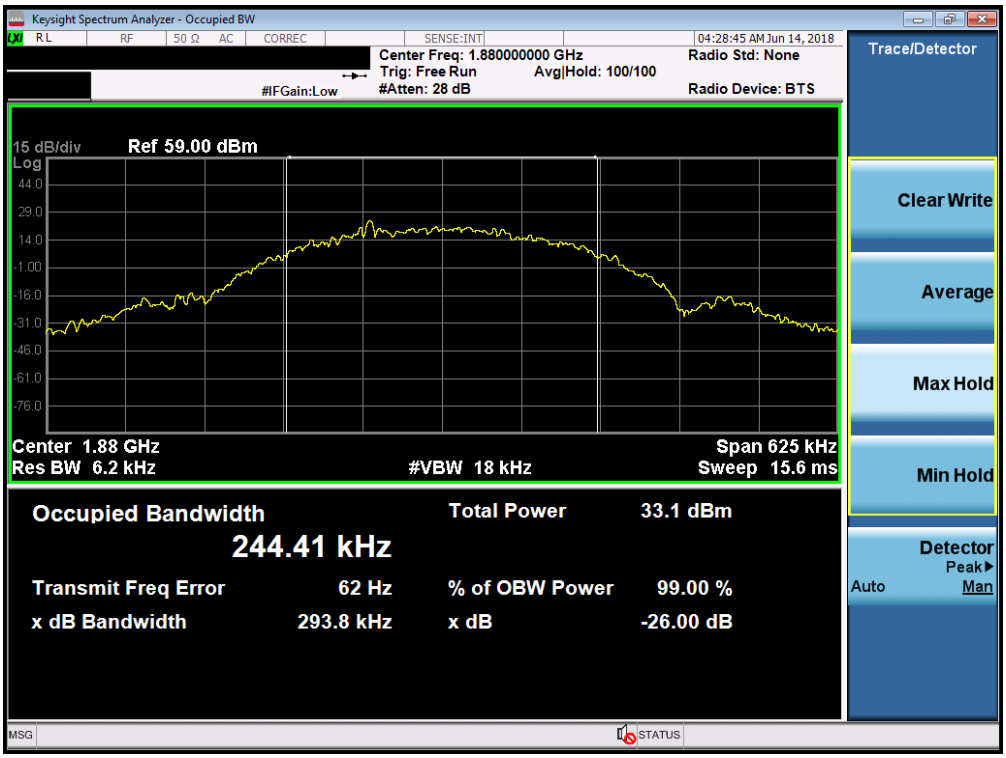


Plot 7-3. Occupied Bandwidth Plot (PCS GPRS Mode)



Plot 7-4. Occupied Bandwidth Plot (EDGE1900 Mode)

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

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

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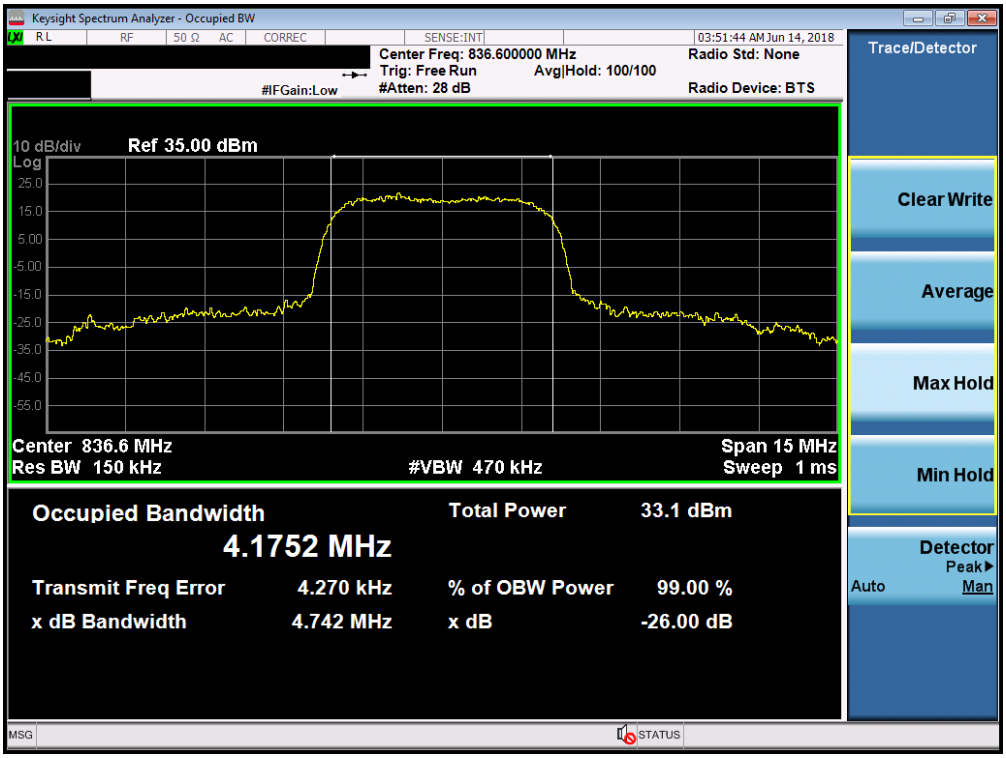

Plot 7-7. Occupied Bandwidth Plot (Cellular WCDMA Mode)

Plot 7-8. Occupied Bandwidth Plot (AWS WCDMA Mode)

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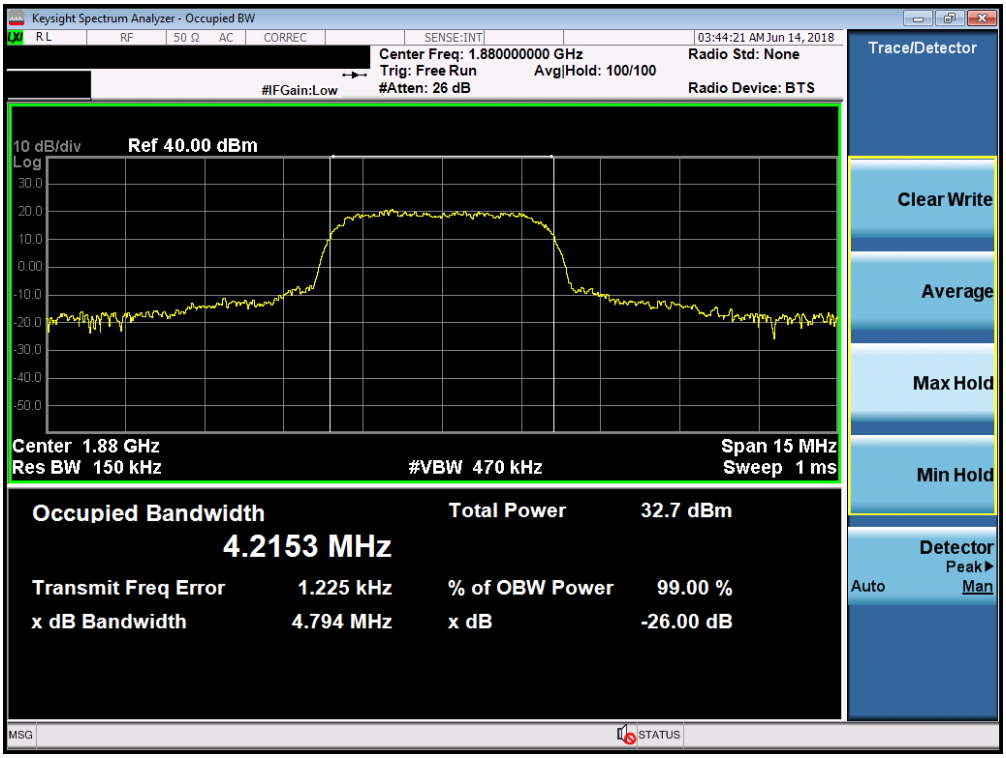

Plot 7-9. Occupied Bandwidth Plot (PCS WCDMA Mode)

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7.3 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz 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.

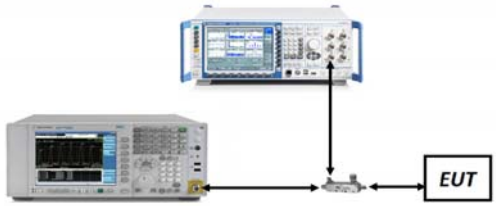

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

Per 24.238(b), 27.53(h)(3), and RSS-133(6.5), RSS-139(6.5), 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 and RSS-132 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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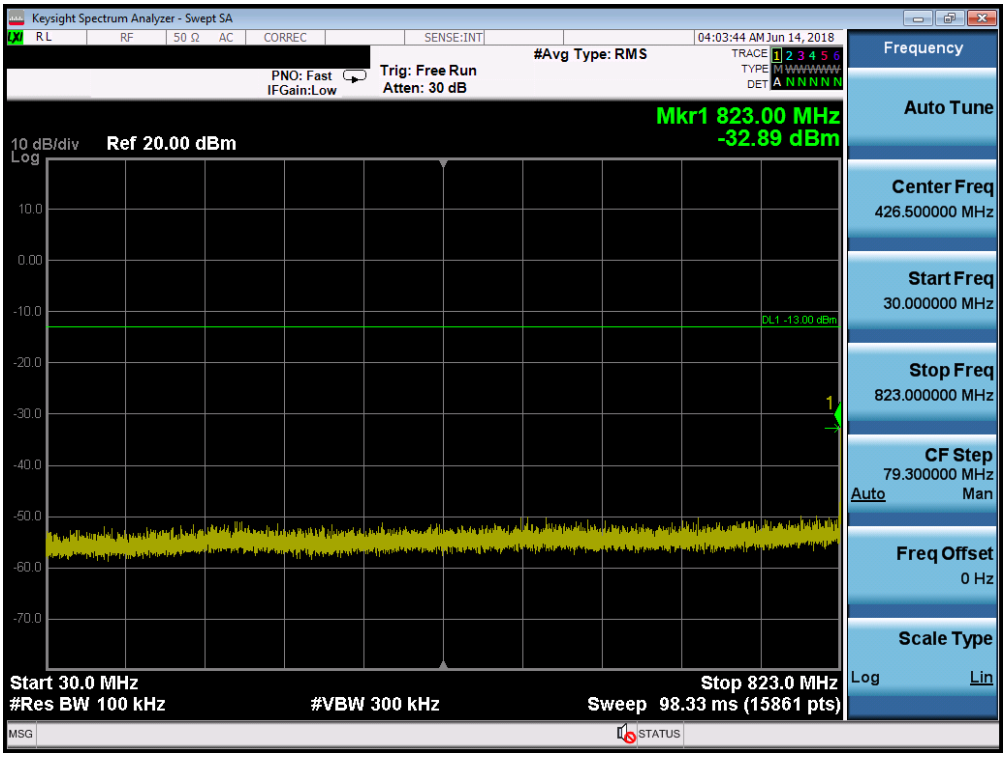
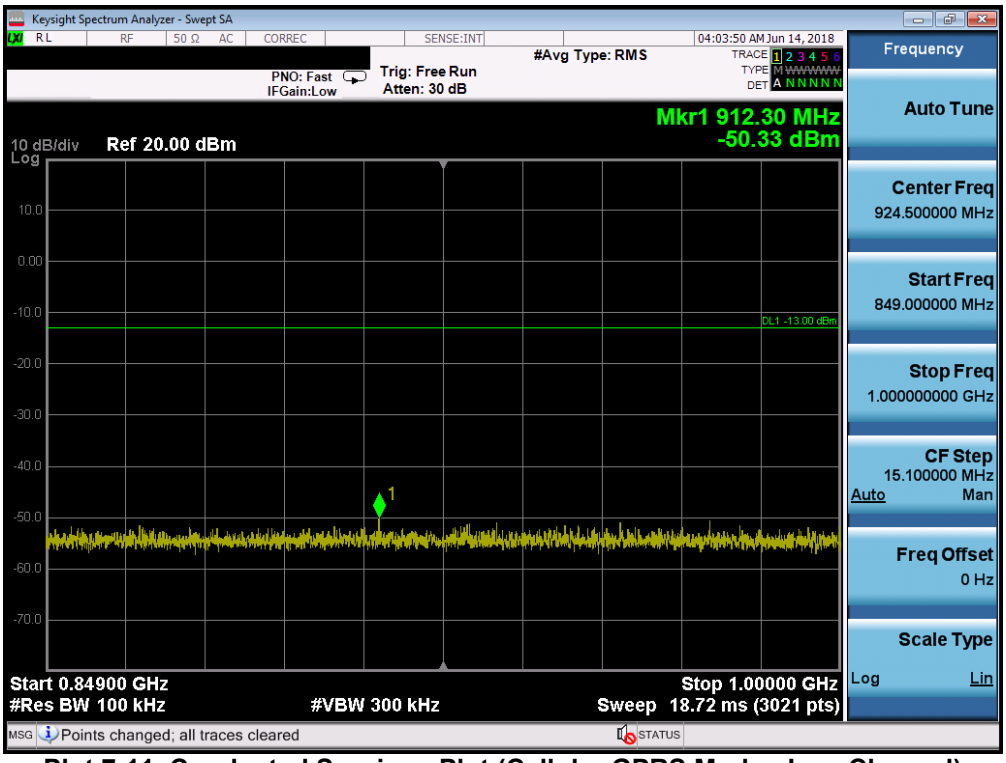
Cellular GPRS Mode



Plot 7-10. Conducted Spurious Plot (Cellular GPRS Mode - Low Channel)



Plot 7-11. Conducted Spurious Plot (Cellular GPRS Mode - Low Channel)

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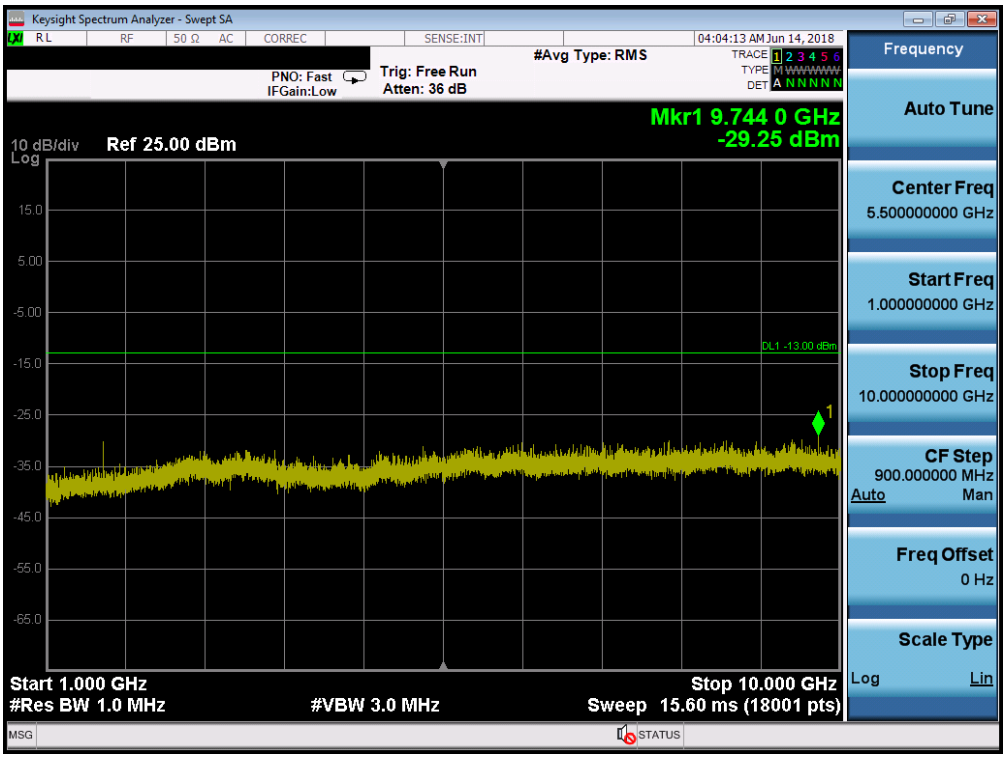
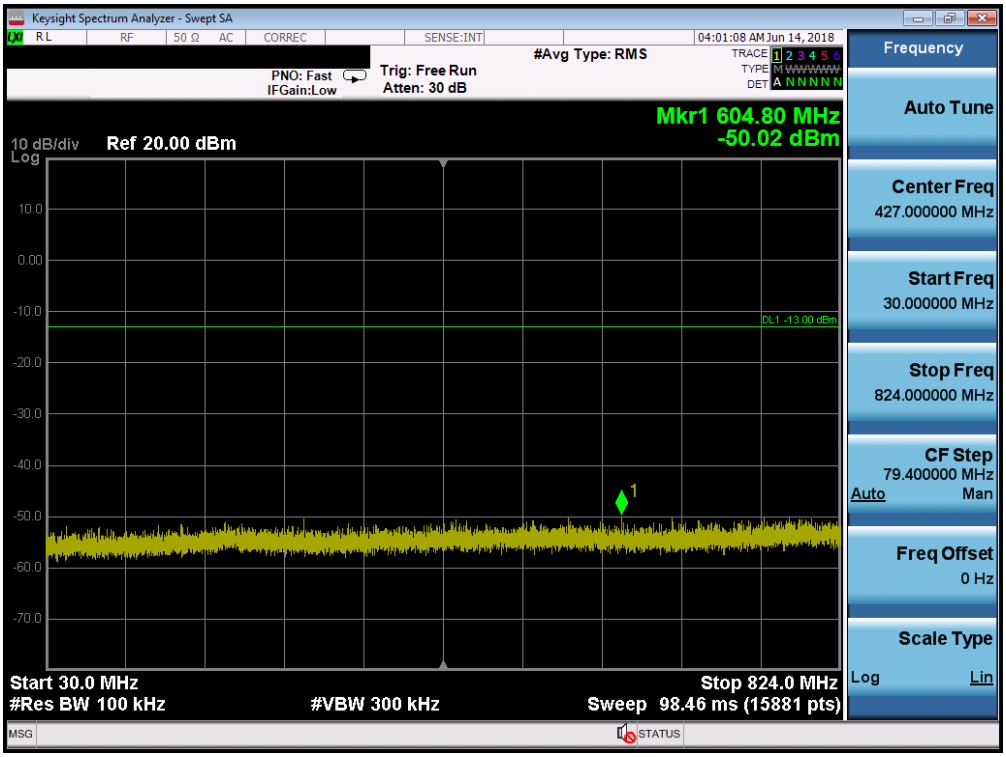


Plot 7-12. Conducted Spurious Plot (Cellular GPRS Mode - Low Channel)



Plot 7-13. Conducted Spurious Plot (Cellular GPRS Mode - Mid Channel)

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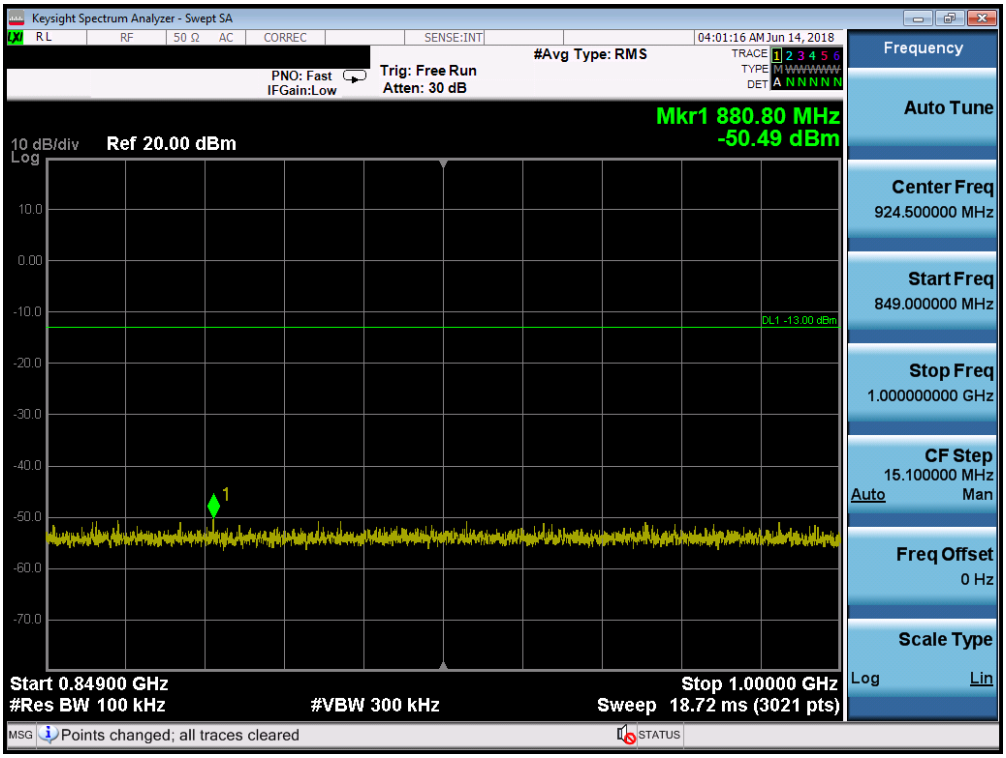
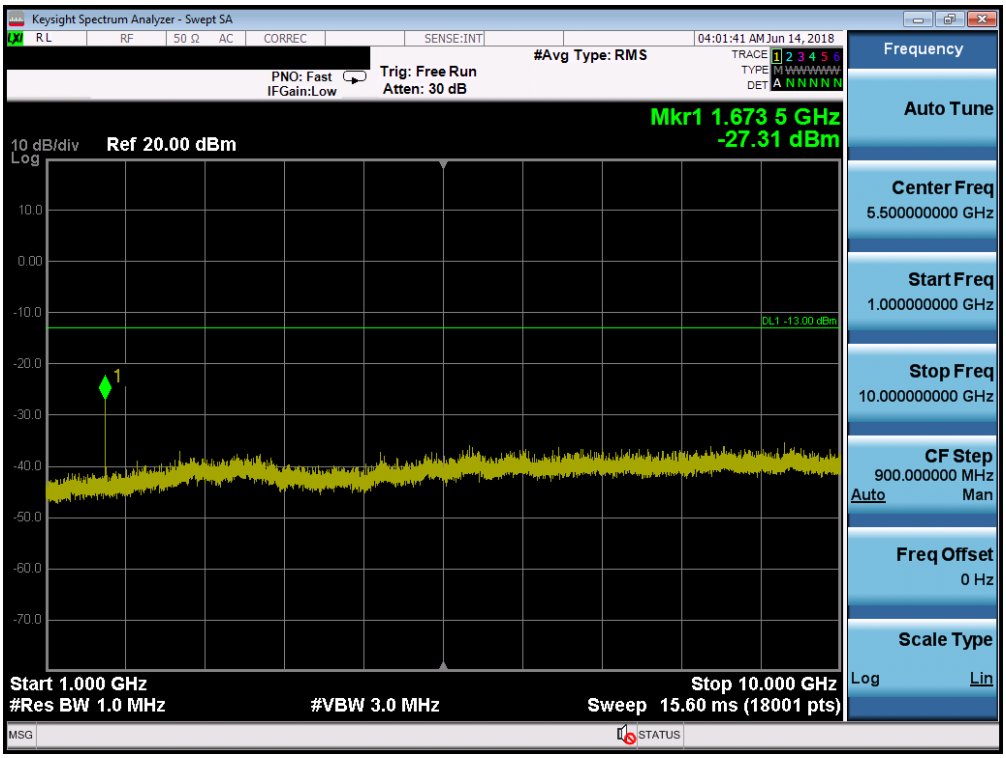


Plot 7-14. Conducted Spurious Plot (Cellular GPRS Mode - Mid Channel)



Plot 7-15. Conducted Spurious Plot (Cellular GPRS Mode - Mid Channel)

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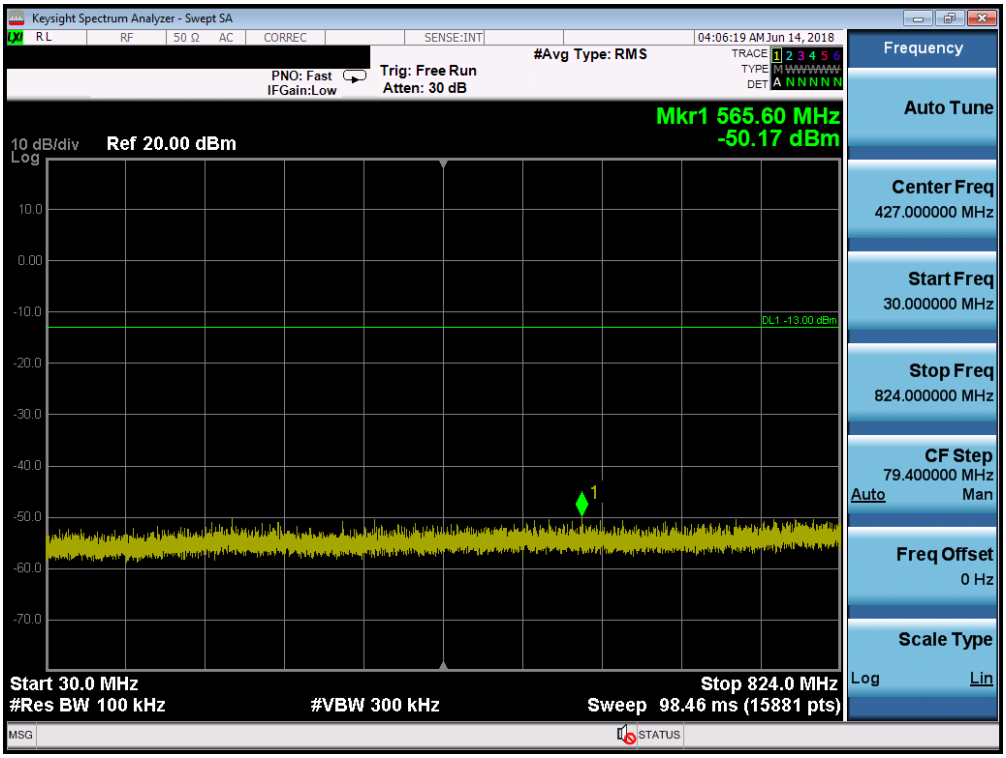
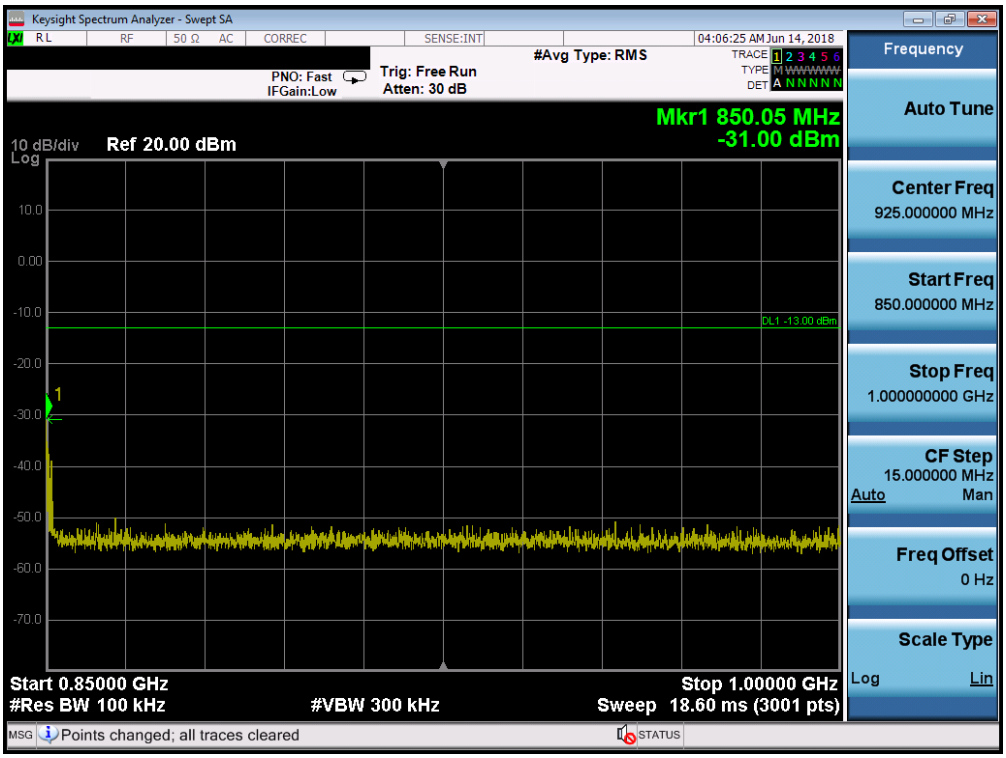


Plot 7-16. Conducted Spurious Plot (Cellular GPRS Mode - High Channel)



Plot 7-17. Conducted Spurious Plot (Cellular GPRS Mode - High Channel)

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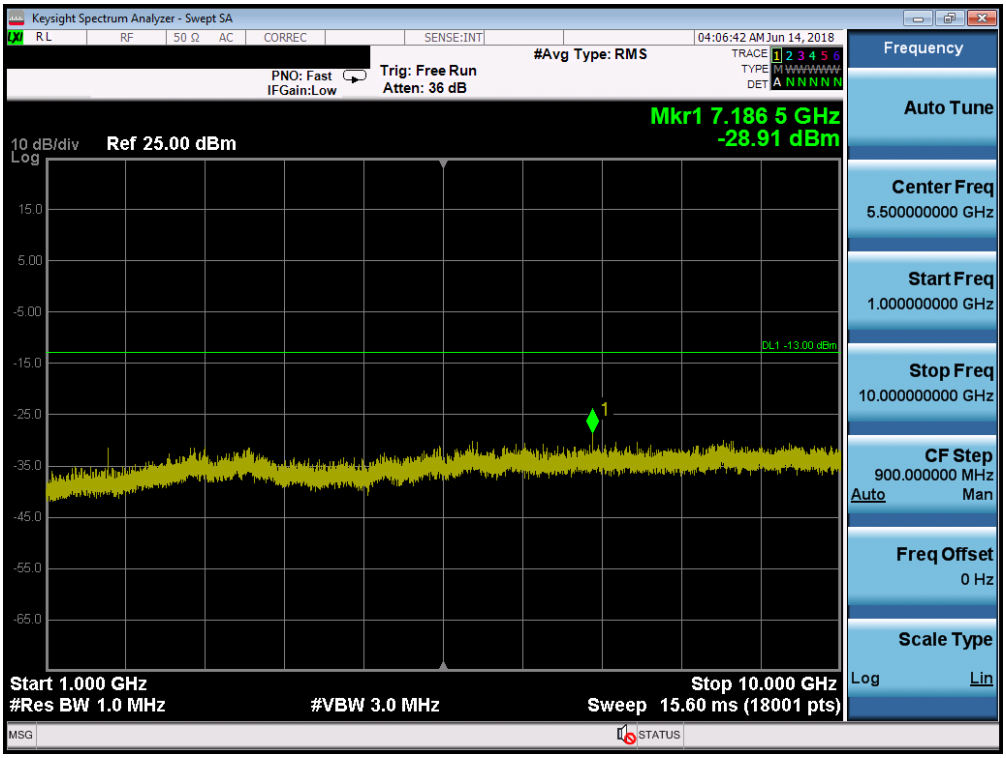

Plot 7-18. Conducted Spurious Plot (Cellular GPRS Mode - High Channel)

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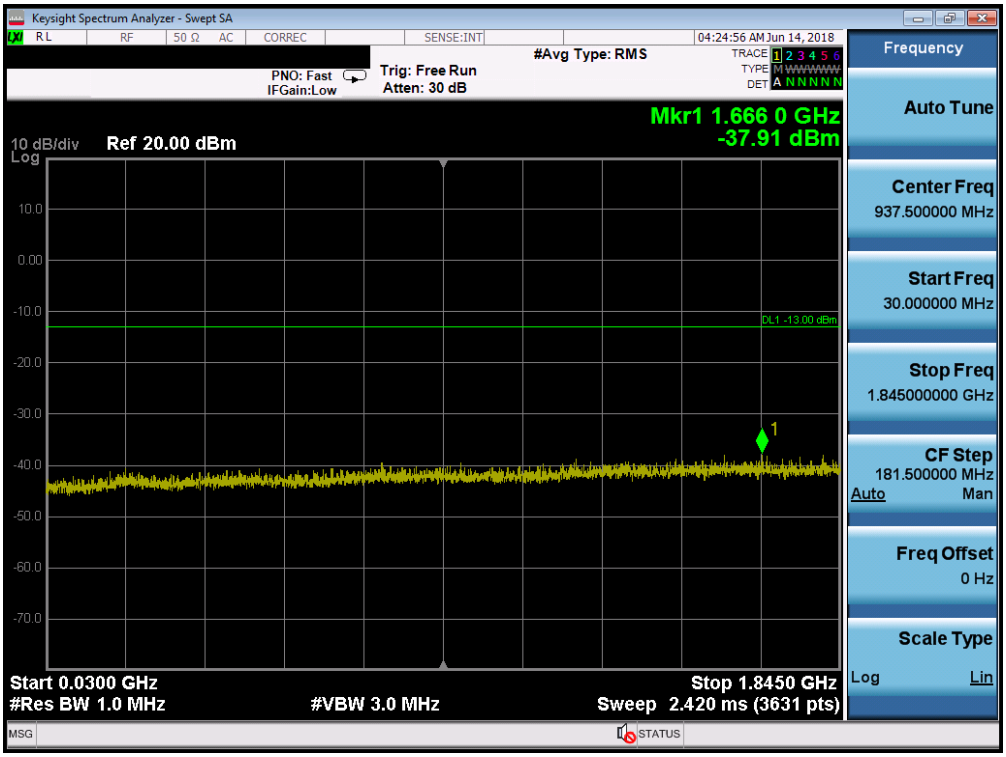
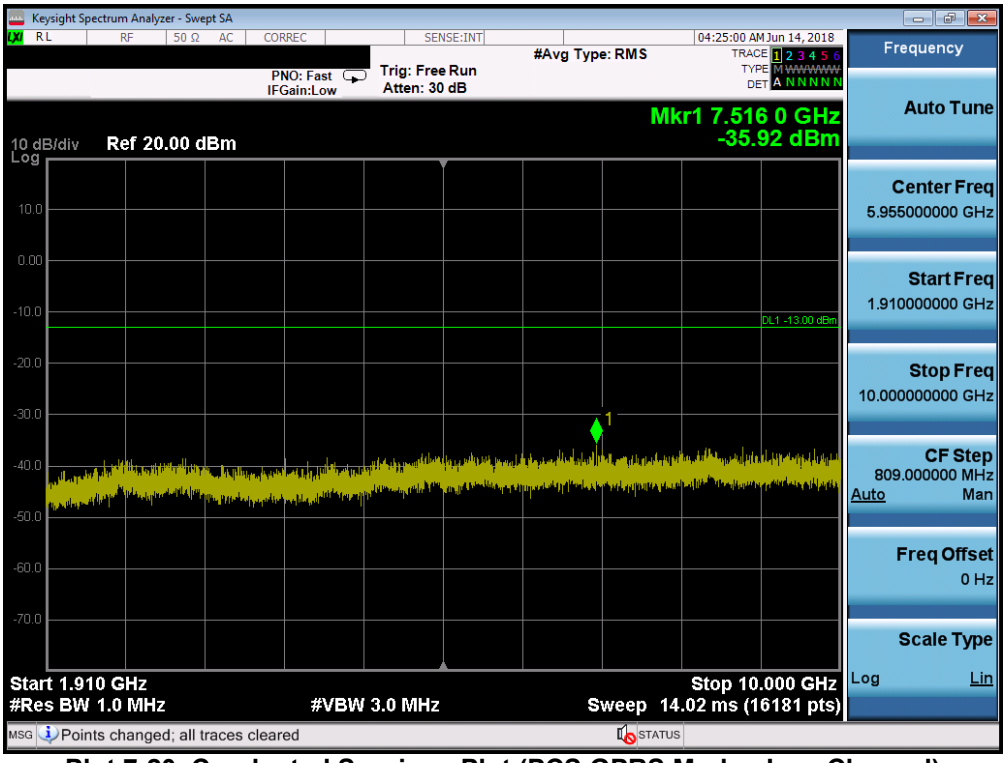
PCS GPRS Mode



Plot 7-19. Conducted Spurious Plot (PCS GPRS Mode - Low Channel)



Plot 7-20. Conducted Spurious Plot (PCS GPRS Mode - Low Channel)

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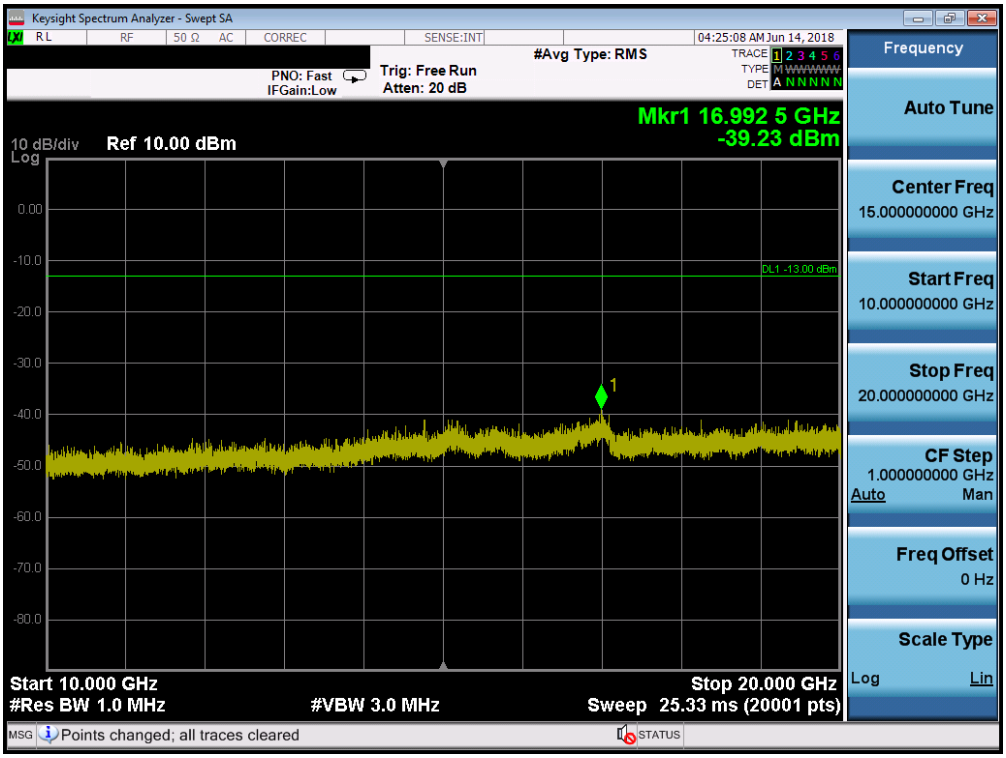
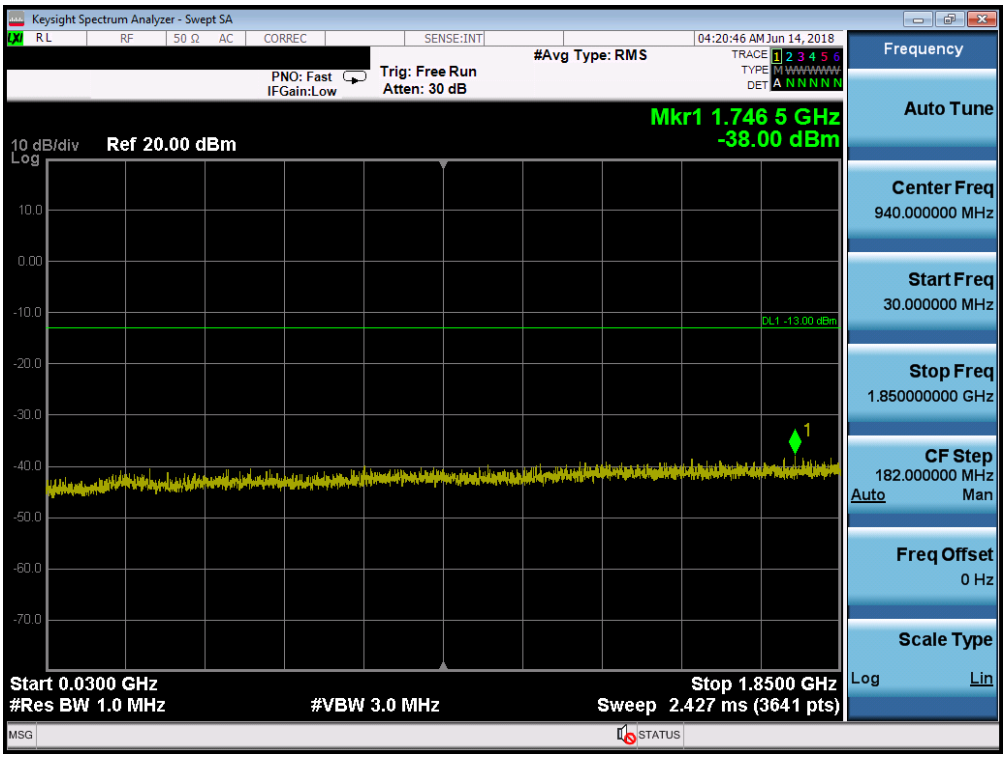


Plot 7-21. Conducted Spurious Plot (PCS GPRS Mode - Low Channel)



Plot 7-22. Conducted Spurious Plot (PCS GPRS Mode - Mid Channel)

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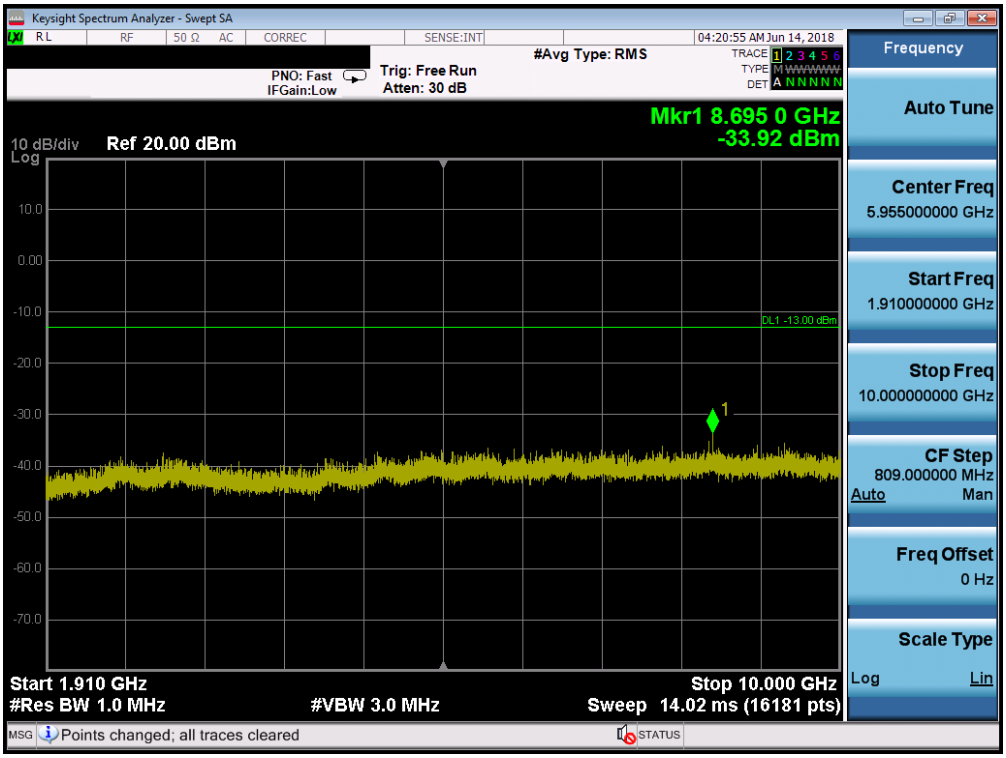
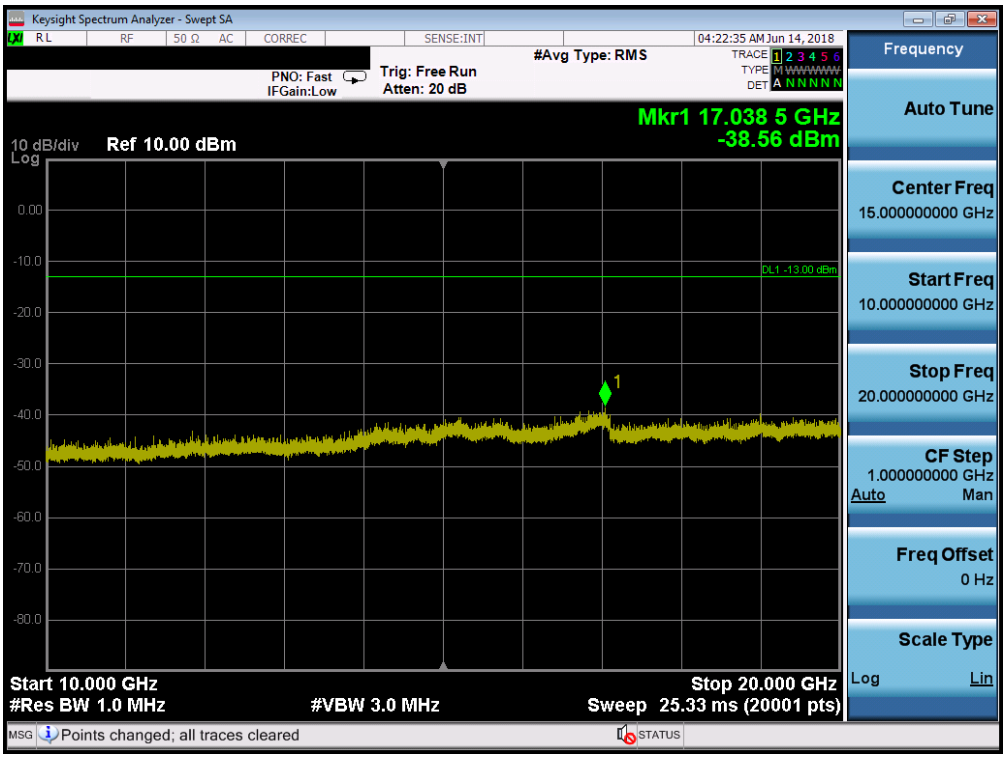


Plot 7-23. Conducted Spurious Plot (PCS GPRS Mode - Mid Channel)



Plot 7-24. Conducted Spurious Plot (PCS GPRS Mode - Mid Channel)

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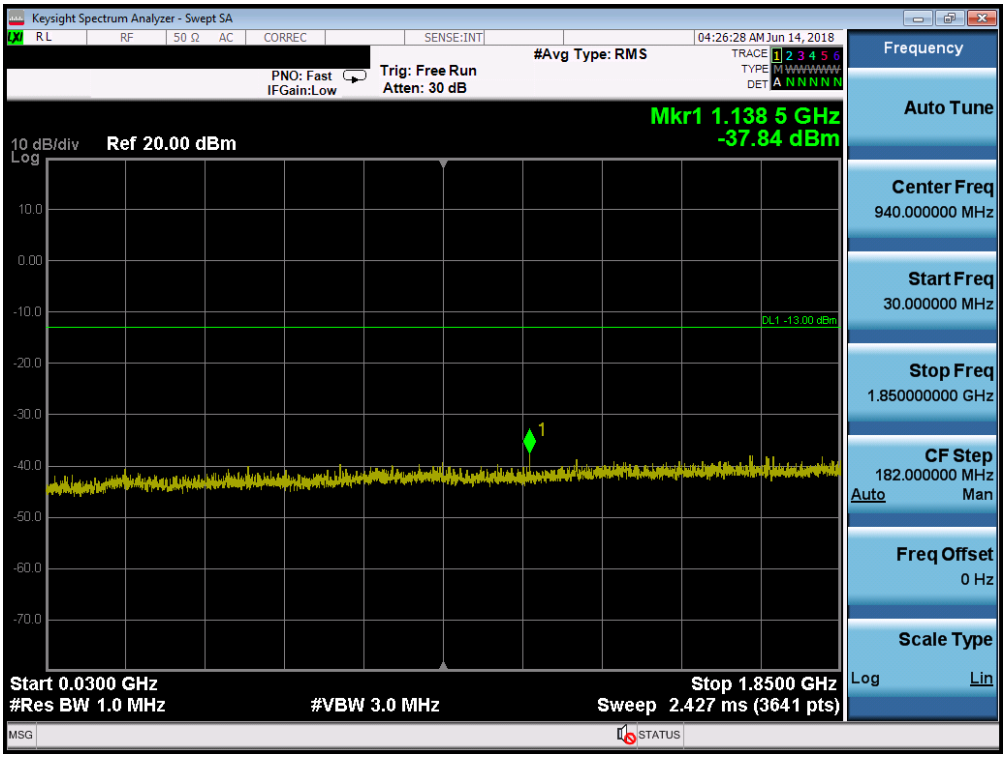
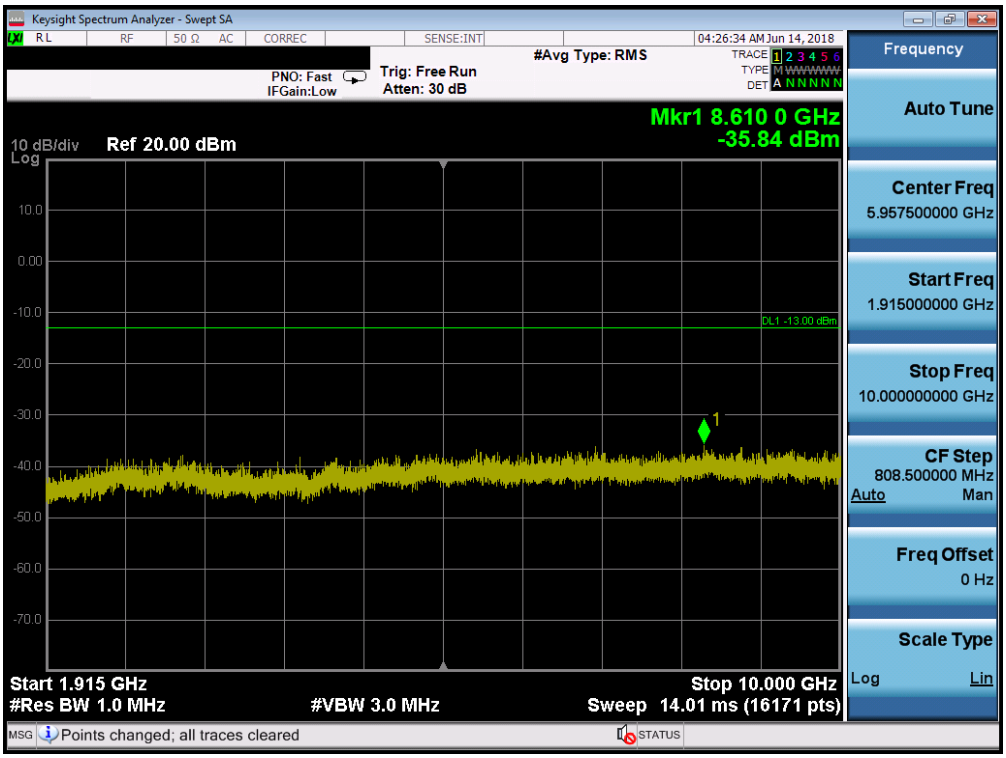


Plot 7-25. Conducted Spurious Plot (PCS GPRS Mode - High Channel)



Plot 7-26. Conducted Spurious Plot (PCS GPRS Mode - High Channel)

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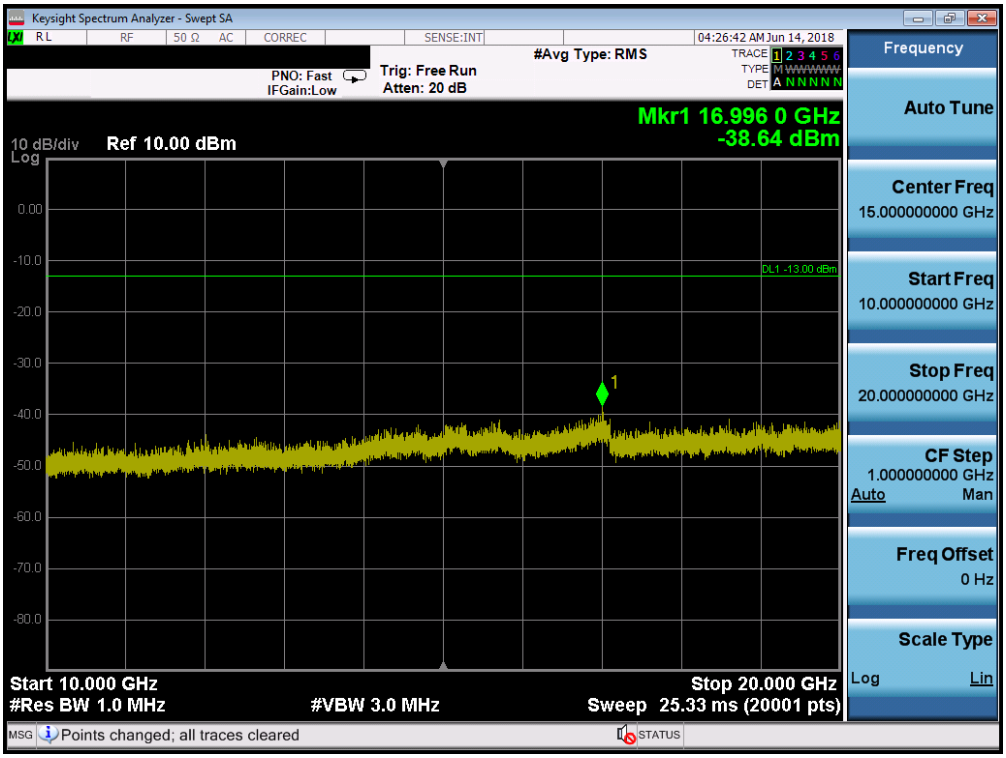

Plot 7-27. Conducted Spurious Plot (PCS GPRS Mode - High Channel)

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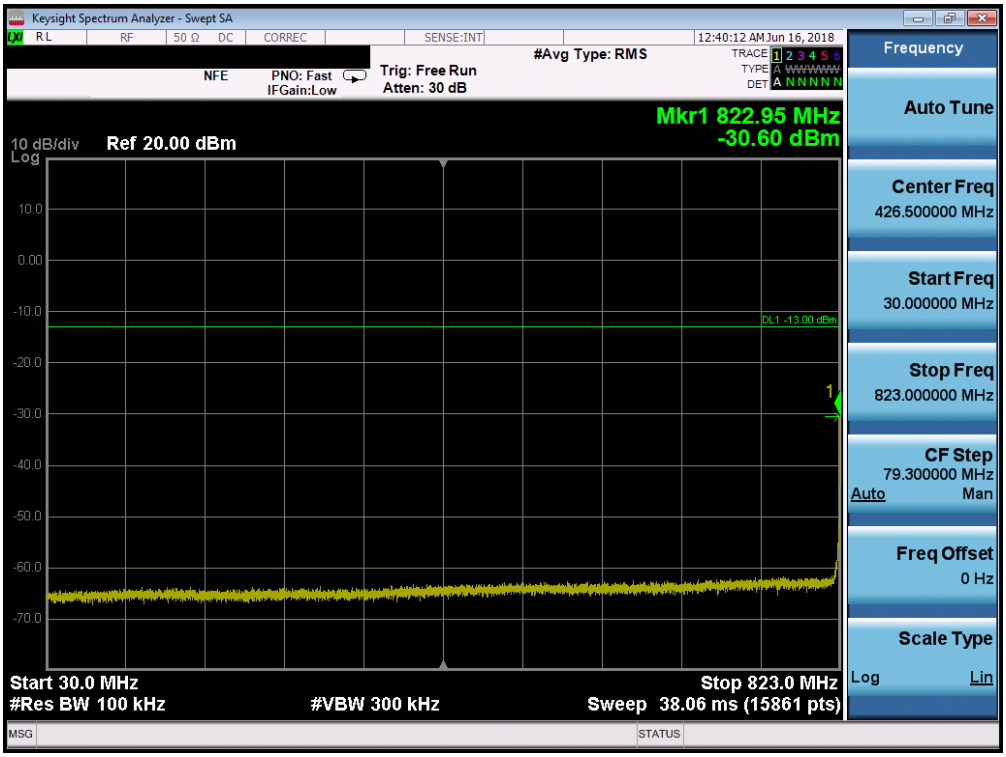
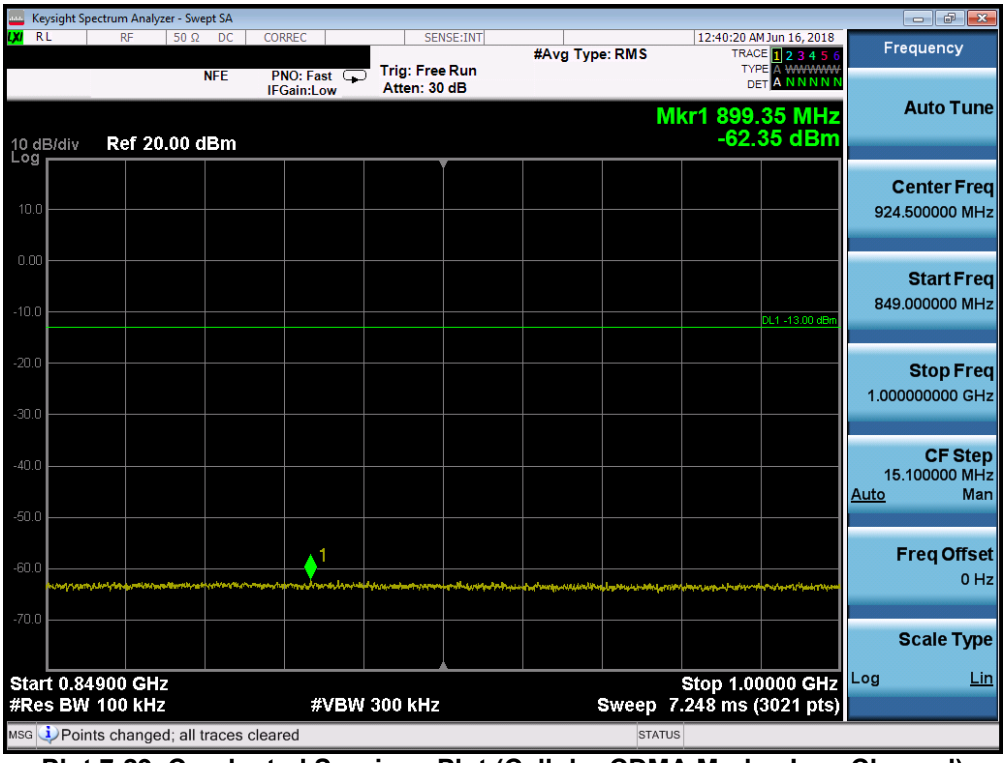
Cellular CDMA Mode



Plot 7-28. Conducted Spurious Plot (Cellular CDMA Mode - Low Channel)



Plot 7-29. Conducted Spurious Plot (Cellular CDMA Mode - Low Channel)

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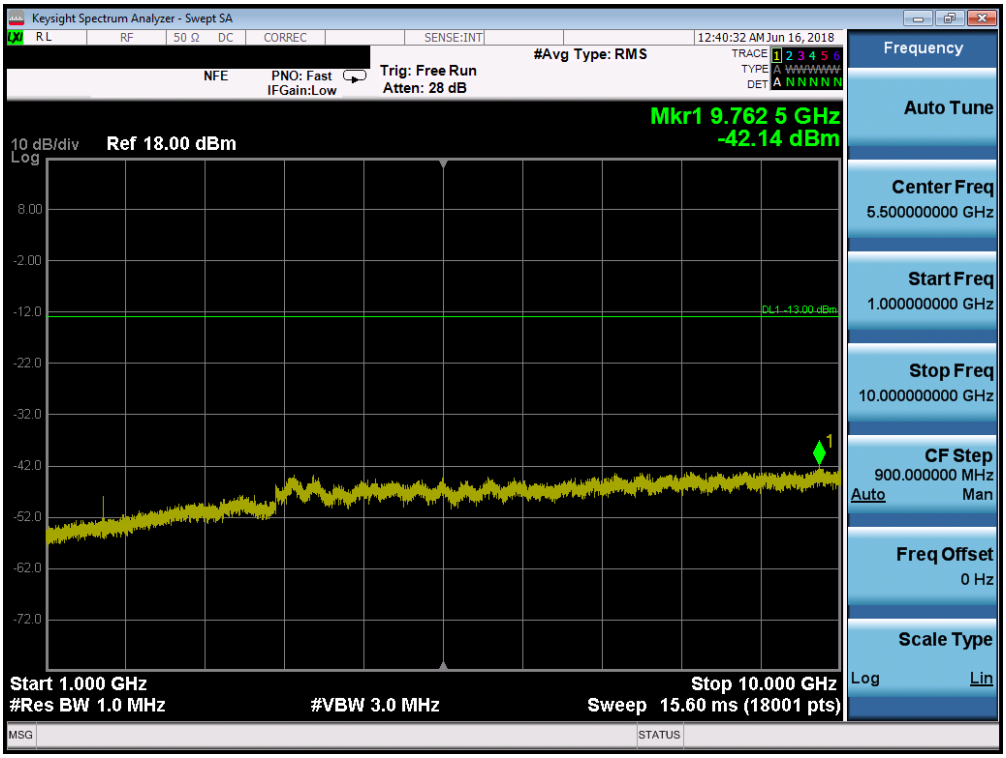
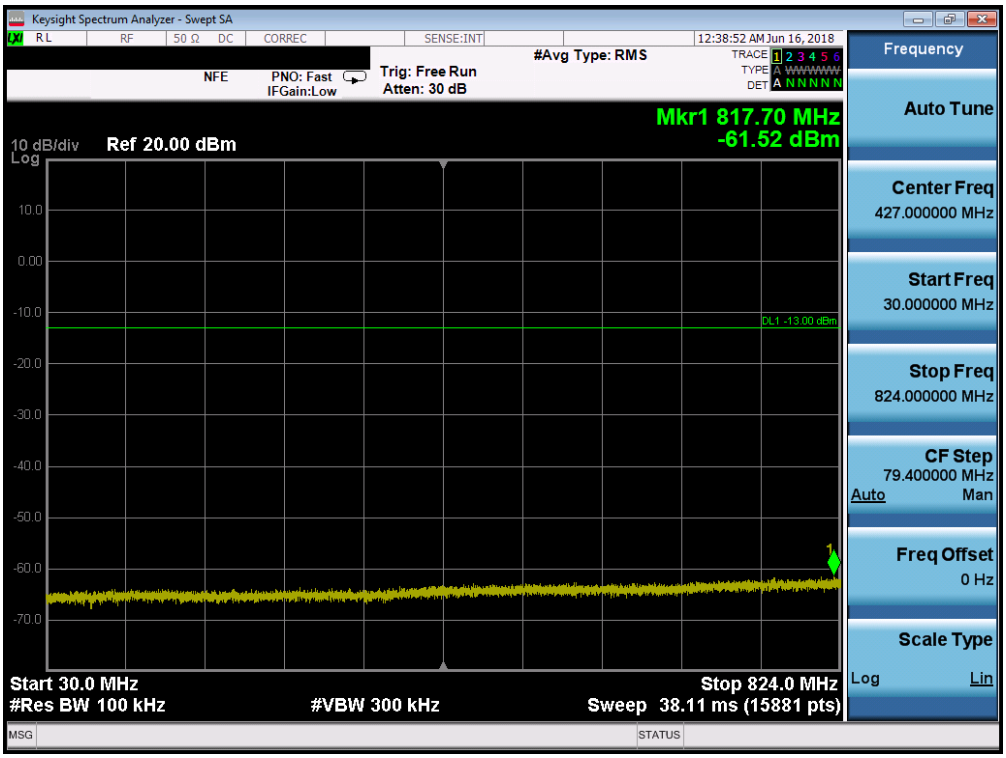


Plot 7-30. Conducted Spurious Plot (Cellular CDMA Mode - Low Channel)



Plot 7-31. Conducted Spurious Plot (Cellular CDMA Mode - Mid Channel)

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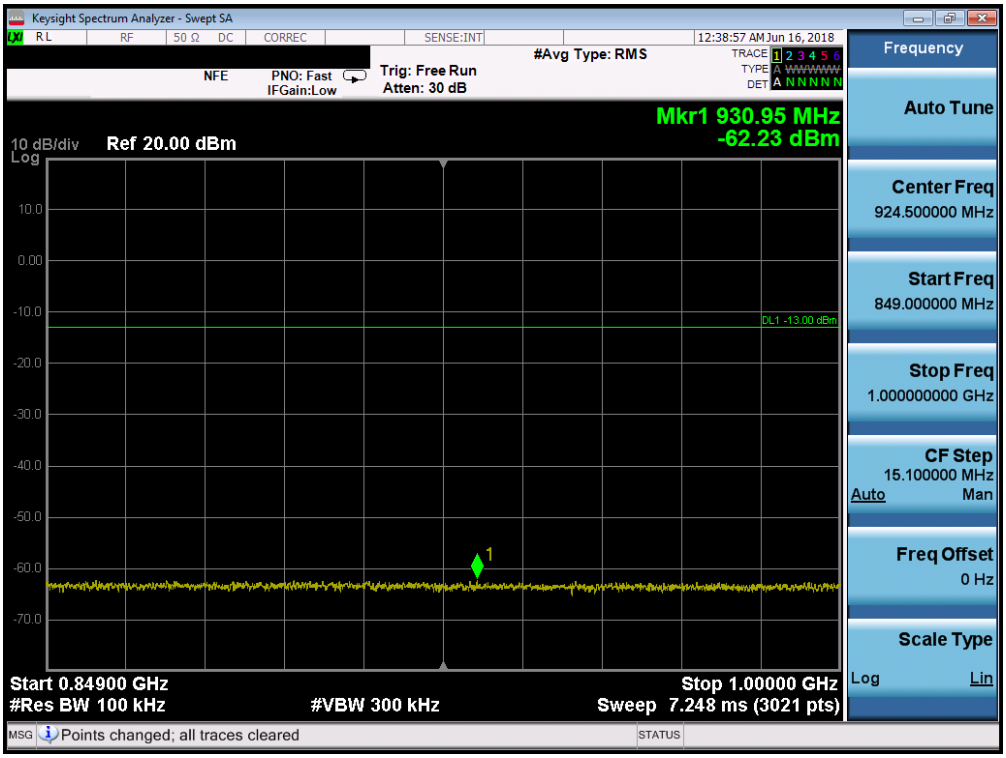
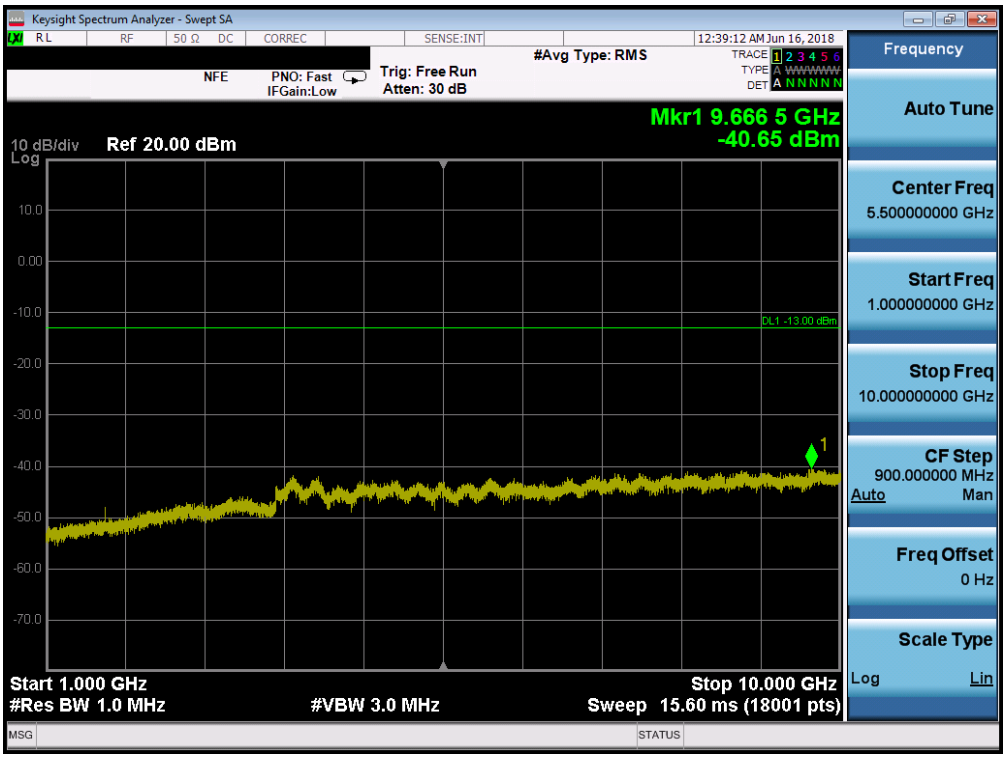


Plot 7-32. Conducted Spurious Plot (Cellular CDMA Mode - Mid Channel)



Plot 7-33. Conducted Spurious Plot (Cellular CDMA Mode - Mid Channel)

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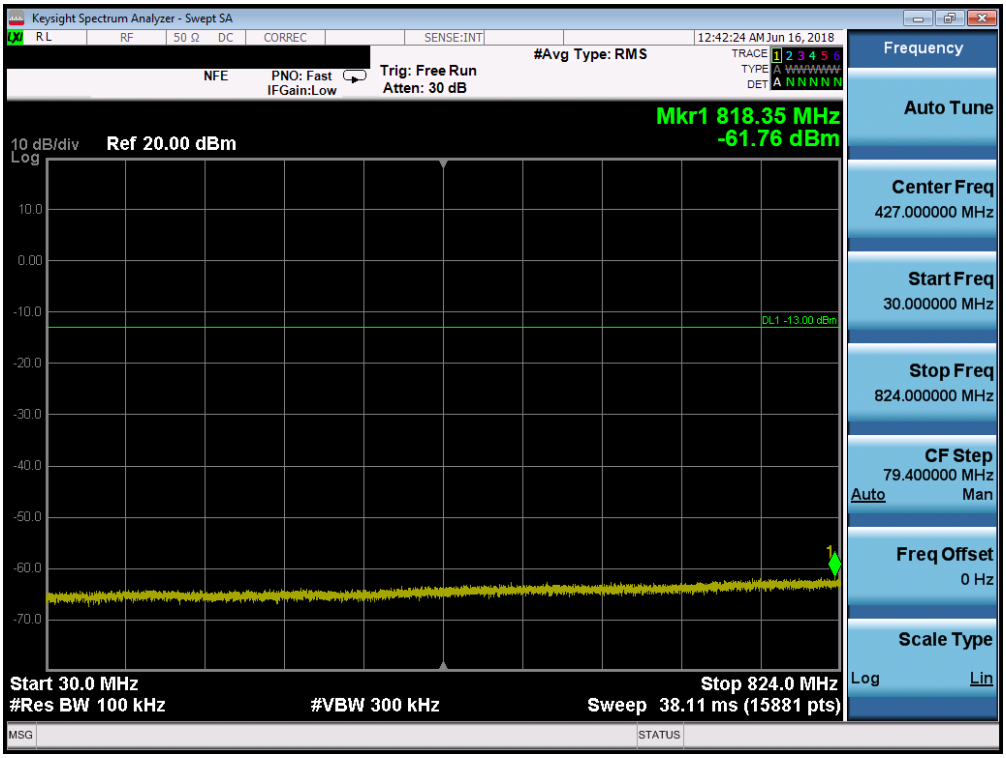
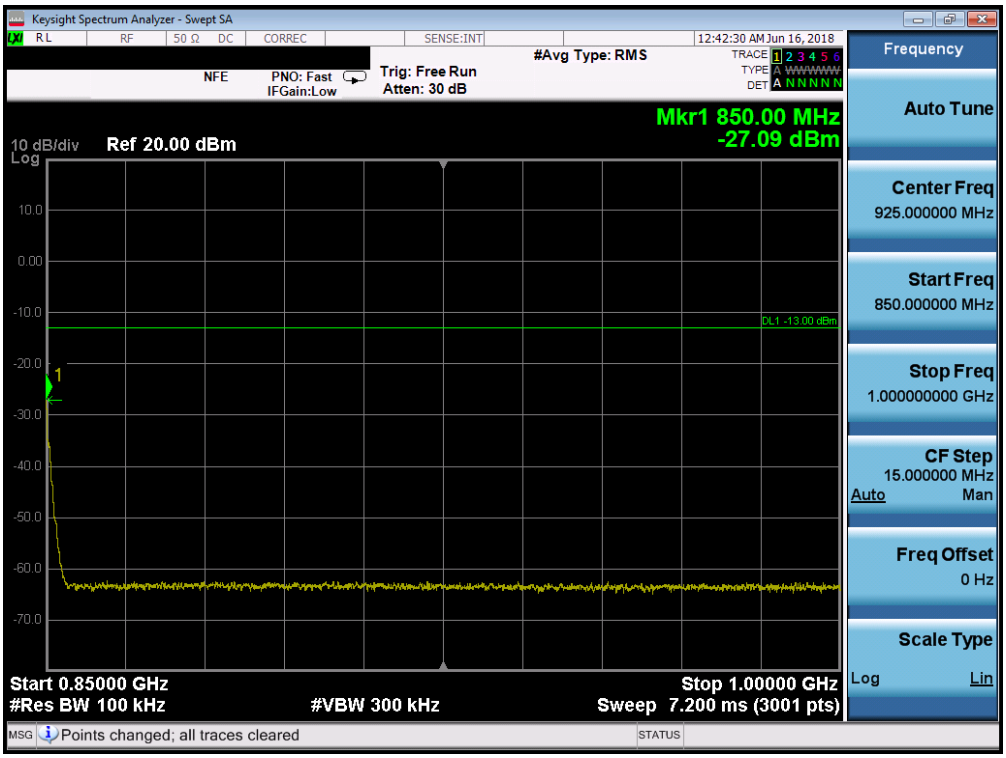


Plot 7-34. Conducted Spurious Plot (Cellular CDMA Mode - High Channel)



Plot 7-35. Conducted Spurious Plot (Cellular CDMA Mode - High Channel)

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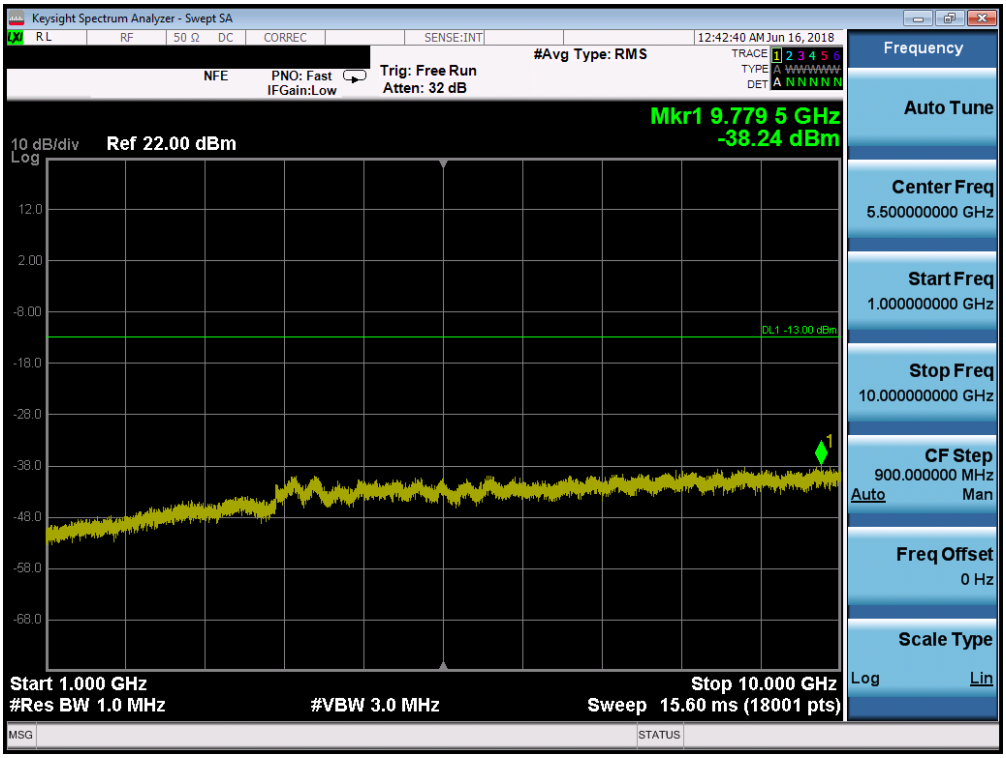

Plot 7-36. Conducted Spurious Plot (Cellular CDMA Mode - High Channel)

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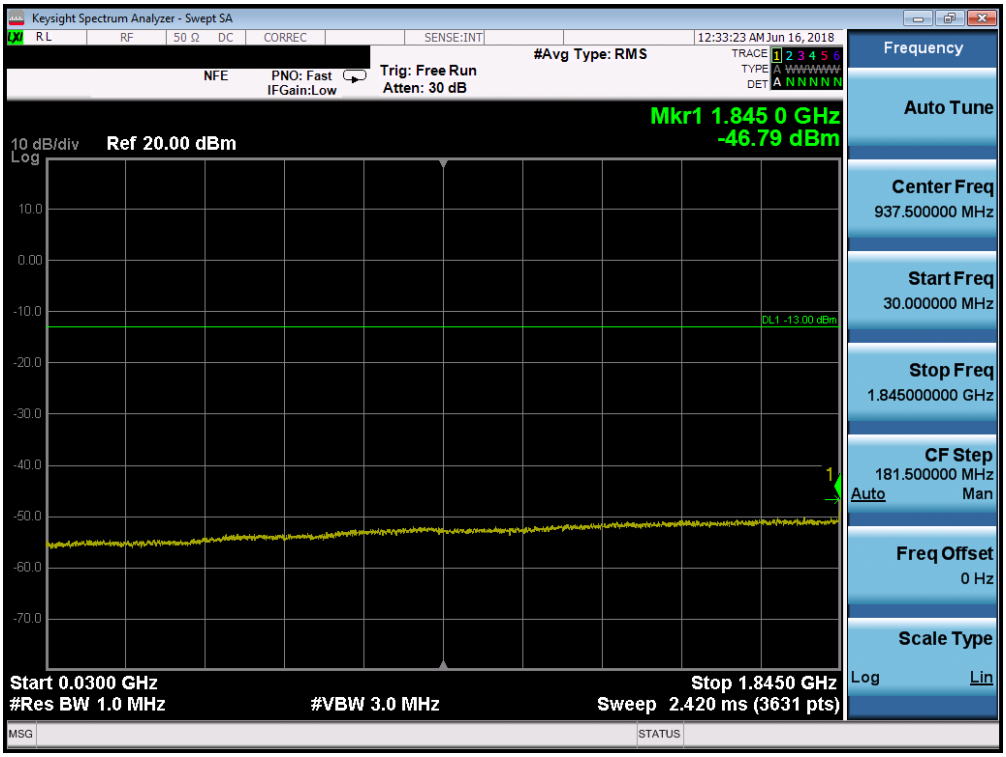
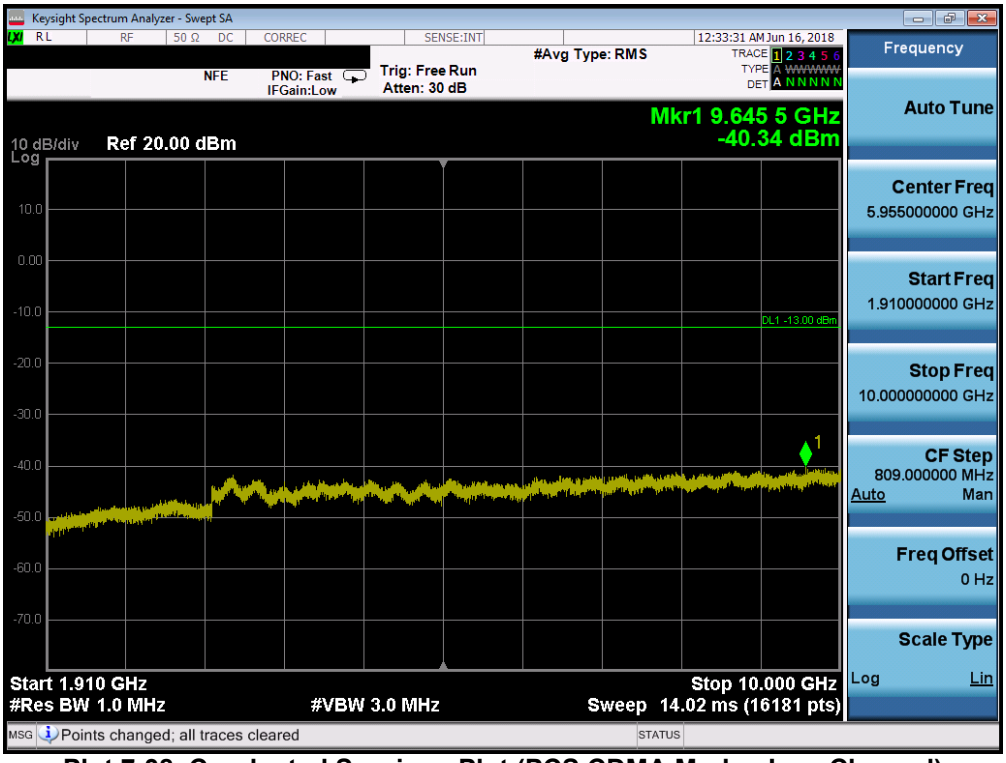
PCS CDMA Mode



Plot 7-37. Conducted Spurious Plot (PCS CDMA Mode - Low Channel)



Plot 7-38. Conducted Spurious Plot (PCS CDMA Mode - Low Channel)

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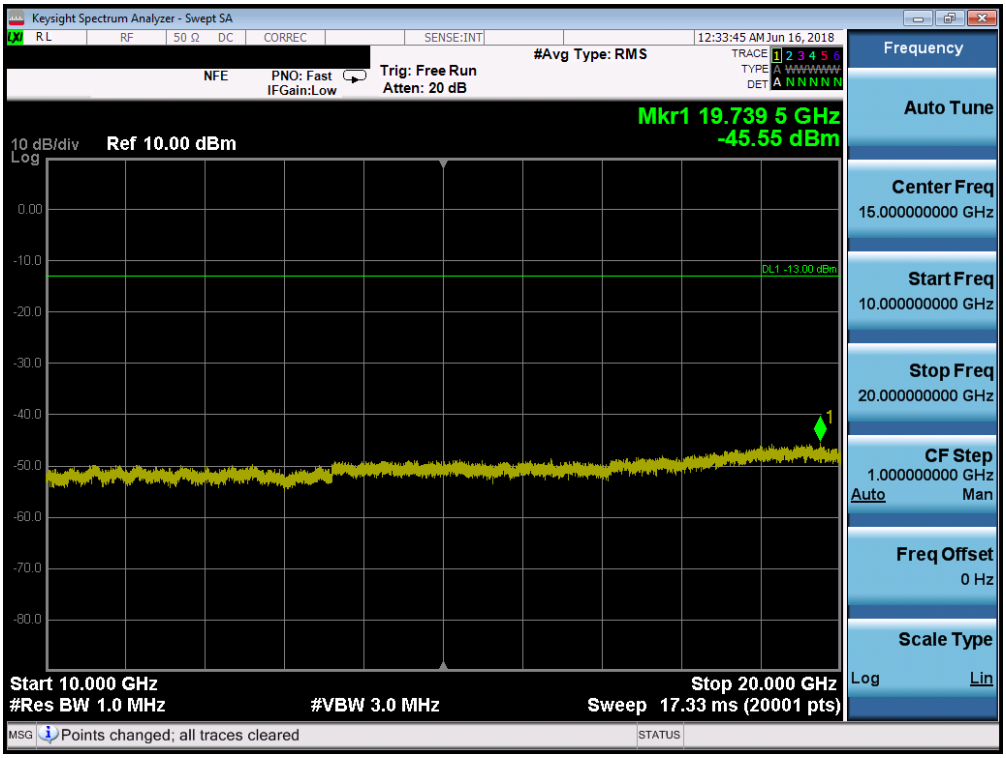
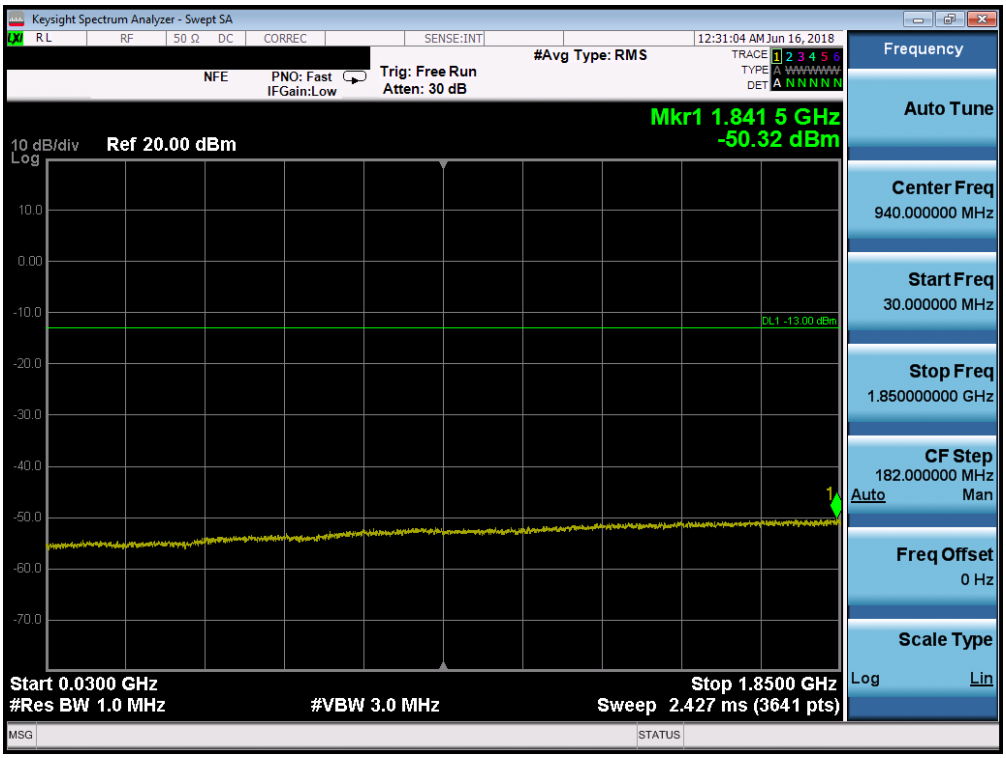


Plot 7-39. Conducted Spurious Plot (PCS CDMA Mode - Low Channel)



Plot 7-40. Conducted Spurious Plot (PCS CDMA Mode - Mid Channel)

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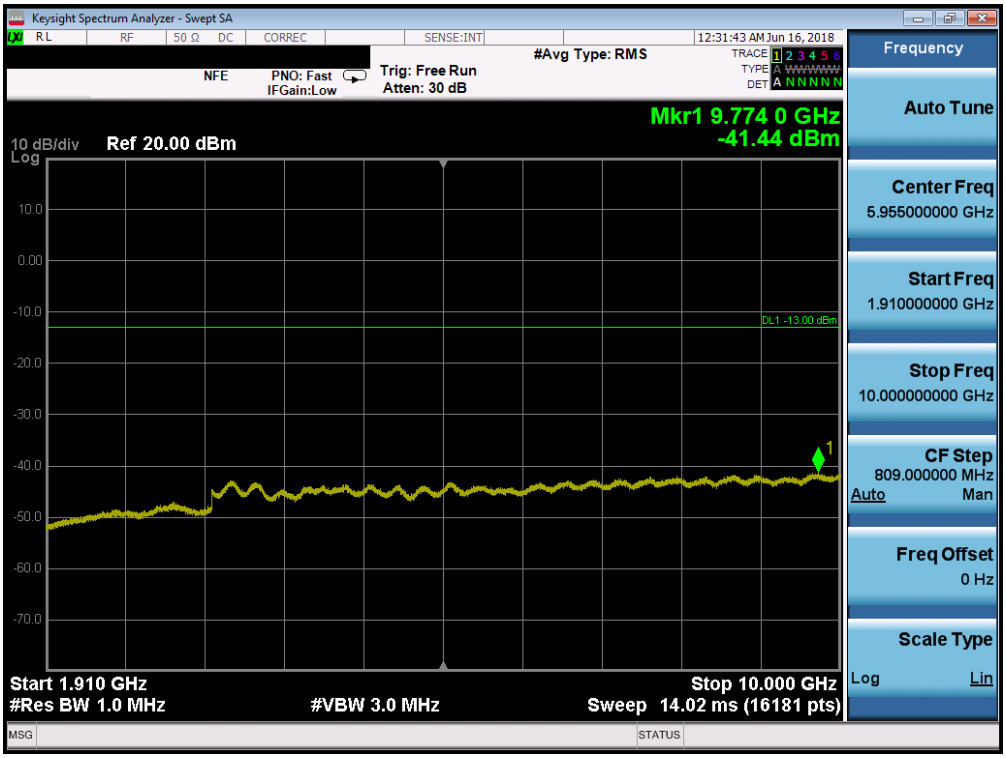
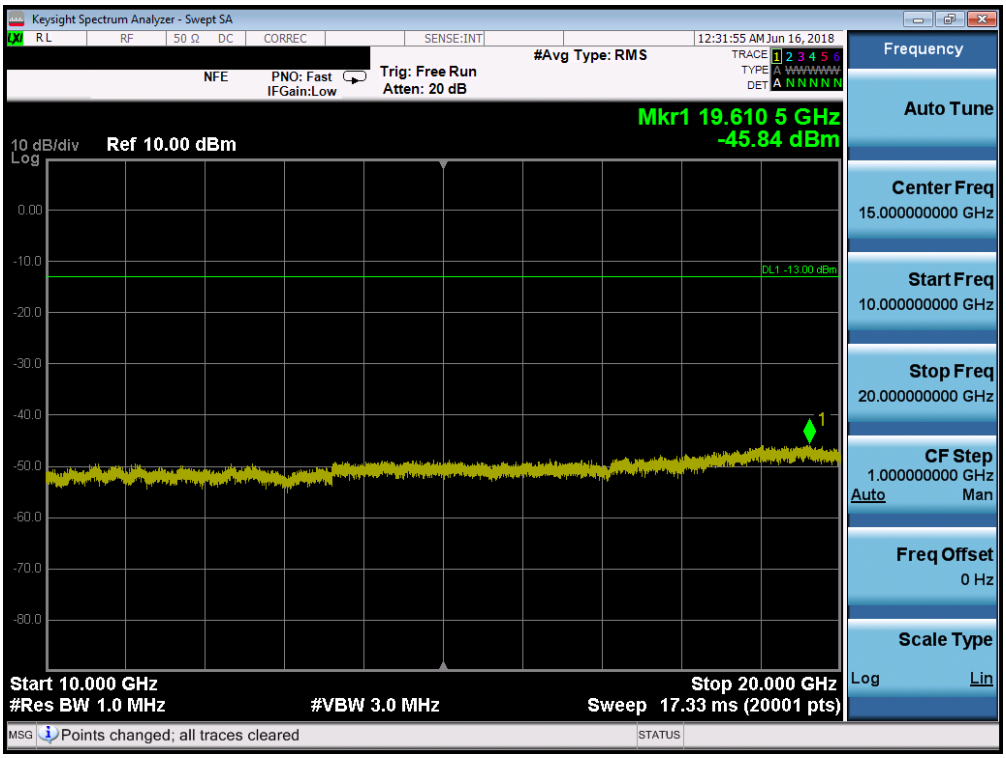


Plot 7-41. Conducted Spurious Plot (PCS CDMA Mode - Mid Channel)



Plot 7-42. Conducted Spurious Plot (PCS CDMA Mode - Mid Channel)

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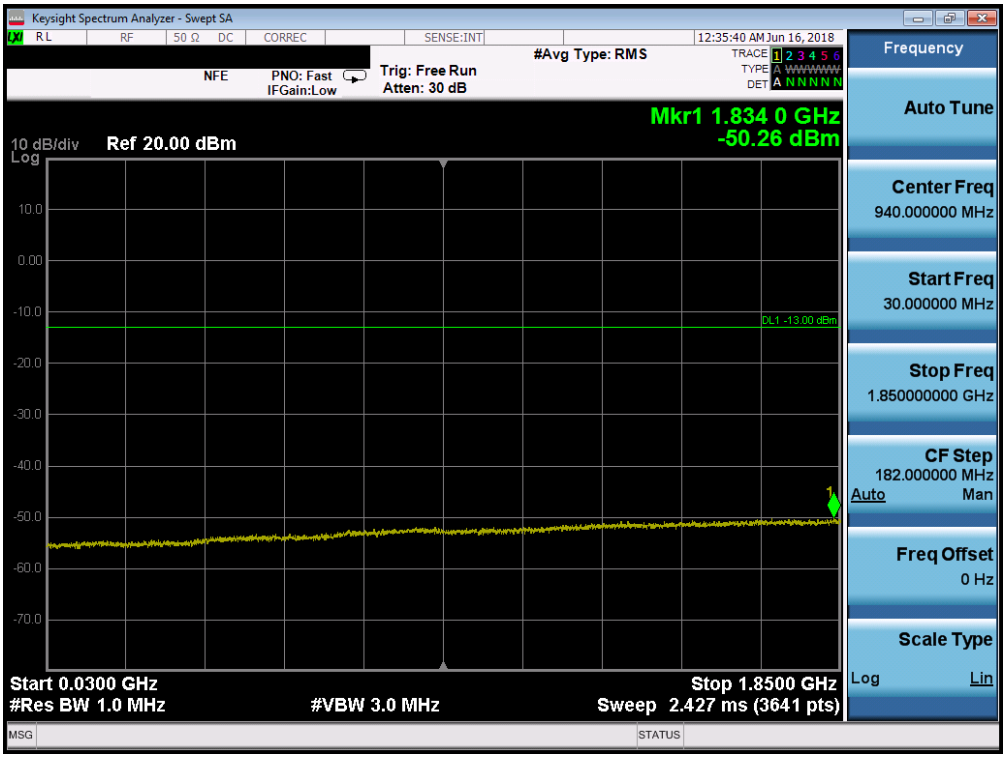
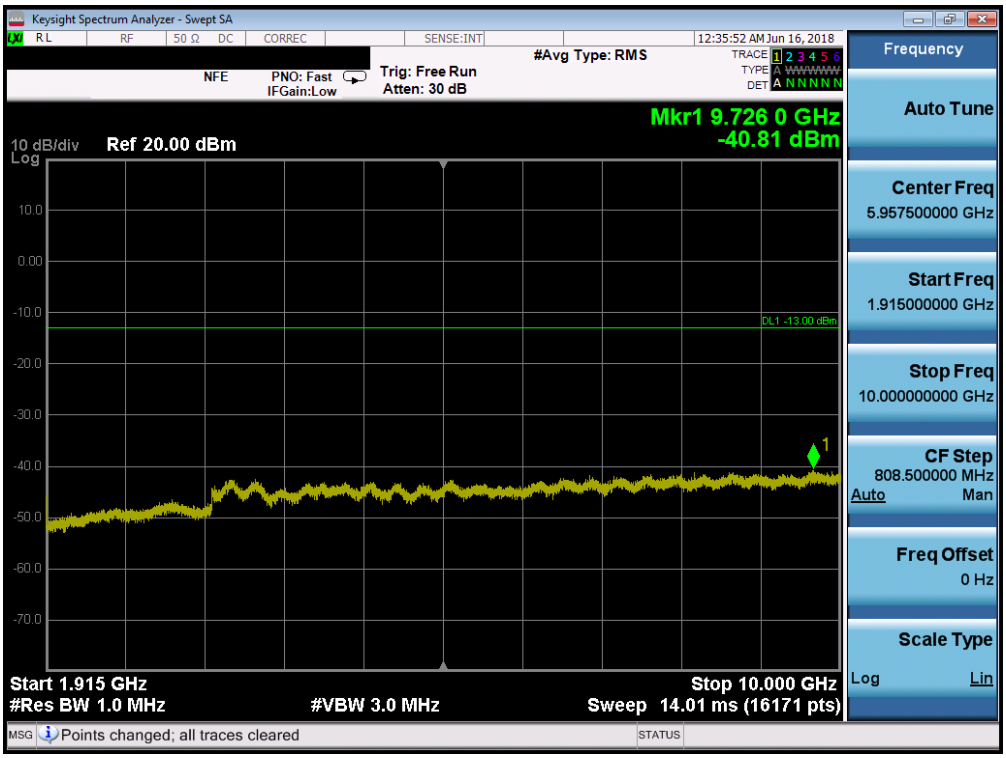


Plot 7-43. Conducted Spurious Plot (PCS CDMA Mode - High Channel)



Plot 7-44. Conducted Spurious Plot (PCS CDMA Mode - High Channel)

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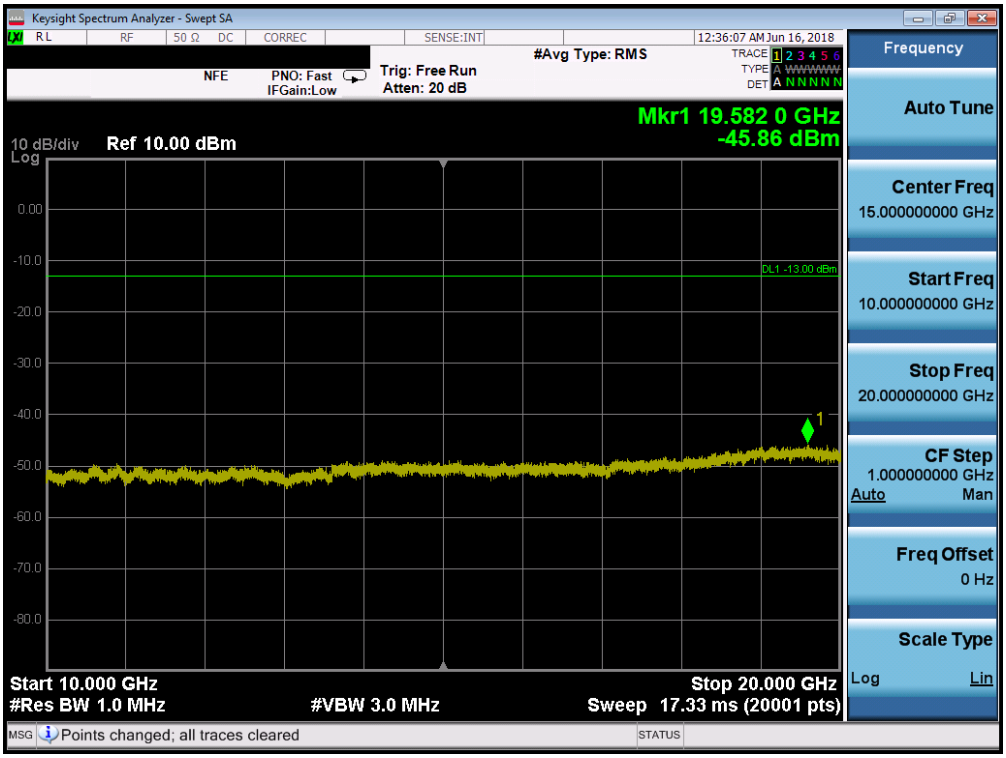

Plot 7-45. Conducted Spurious Plot (PCS CDMA Mode - High Channel)

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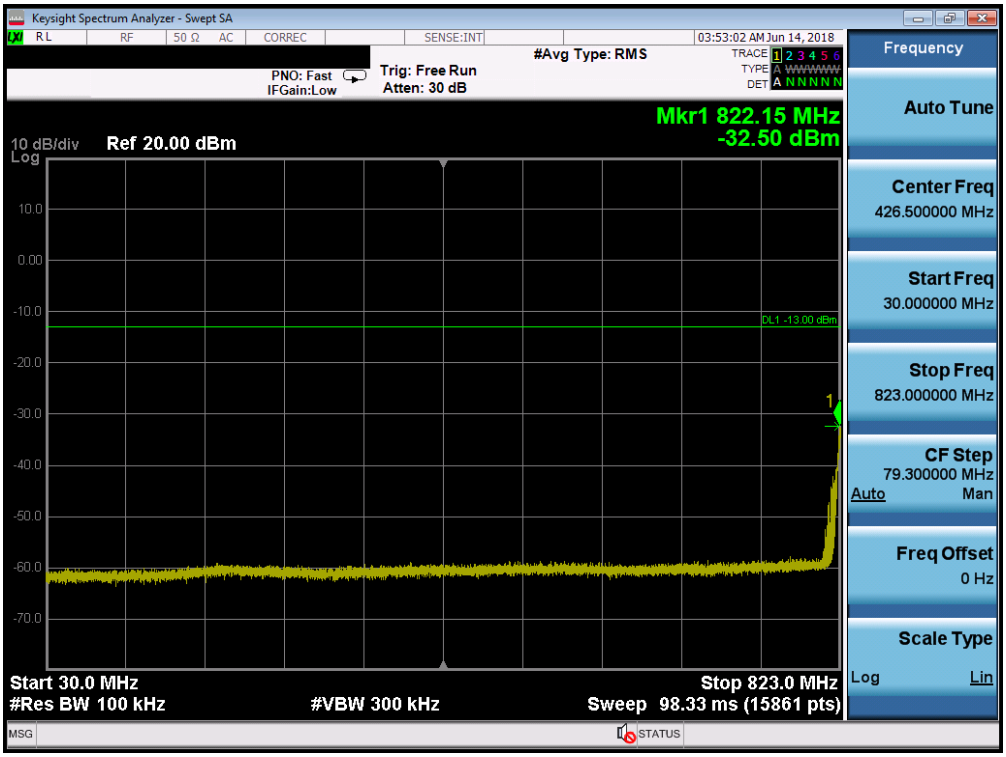
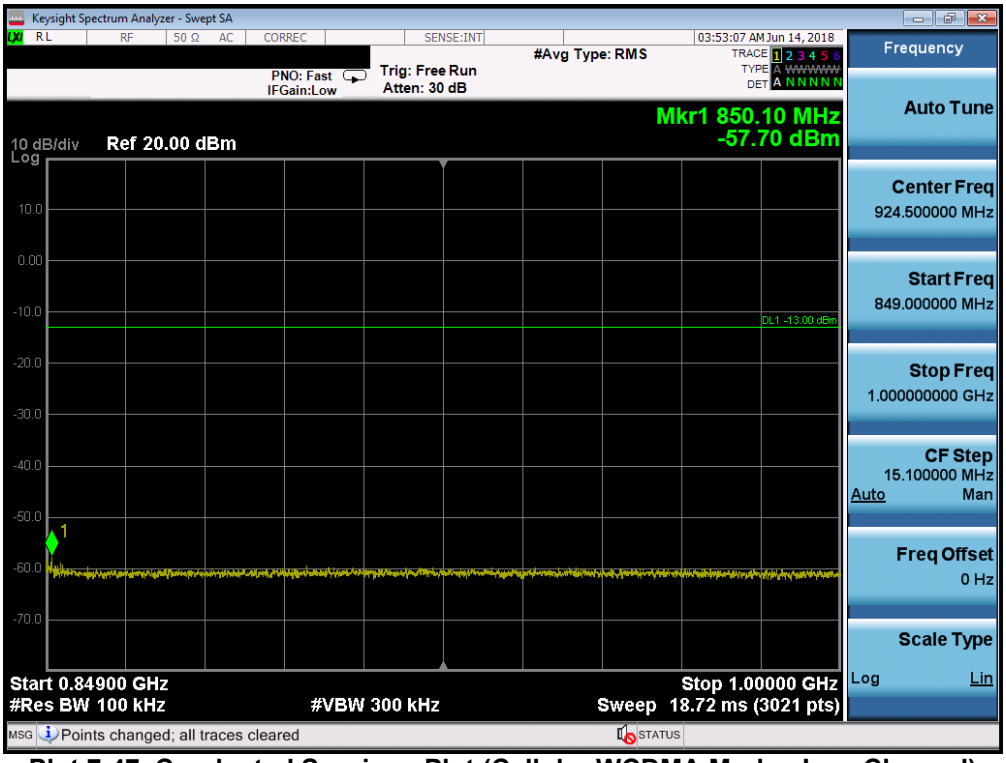
Cellular WCDMA Mode



Plot 7-46. Conducted Spurious Plot (Cellular WCDMA Mode - Low Channel)



Plot 7-47. Conducted Spurious Plot (Cellular WCDMA Mode - Low Channel)

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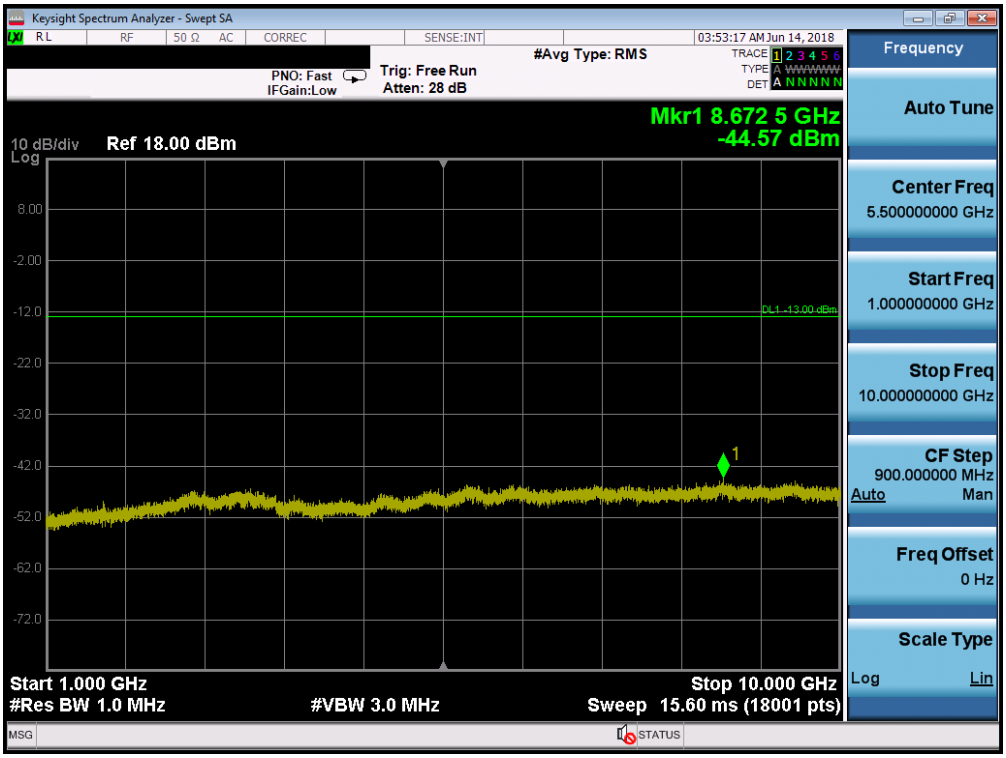
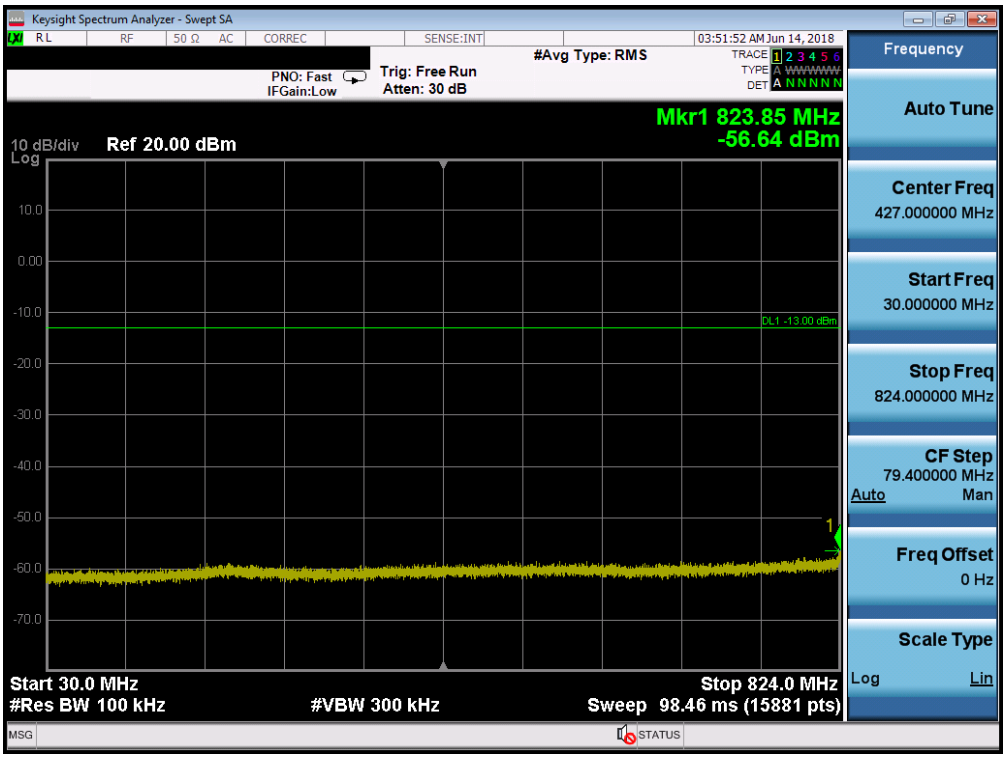


Plot 7-48. Conducted Spurious Plot (Cellular WCDMA Mode - Low Channel)



Plot 7-49. Conducted Spurious Plot (Cellular WCDMA Mode - Mid Channel)

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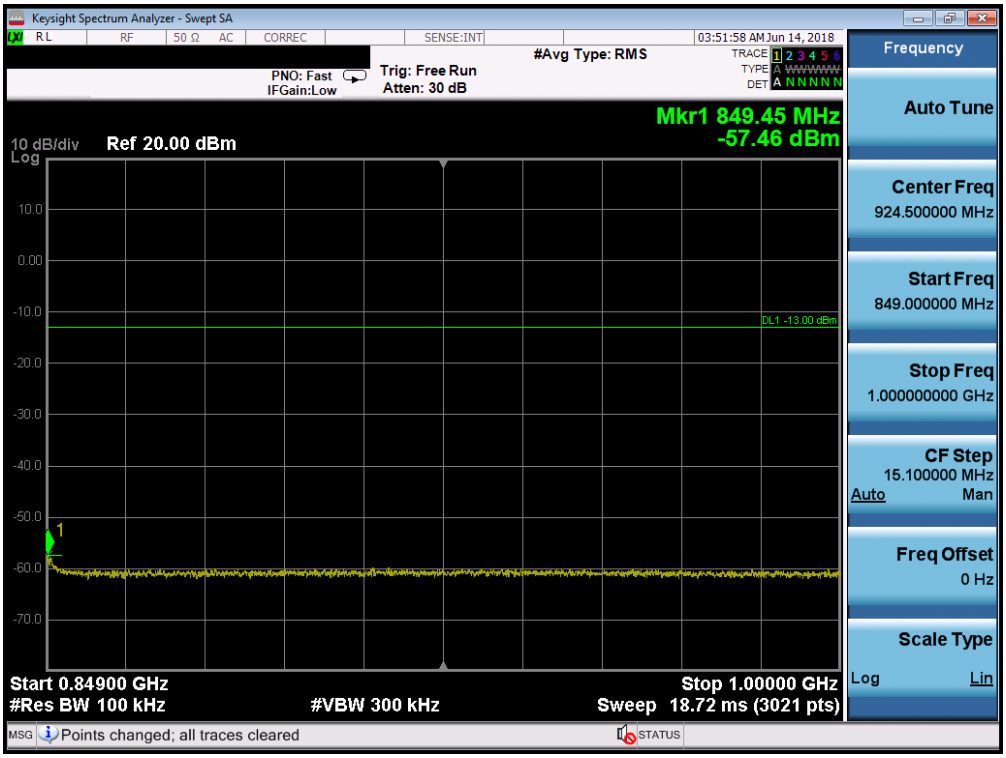
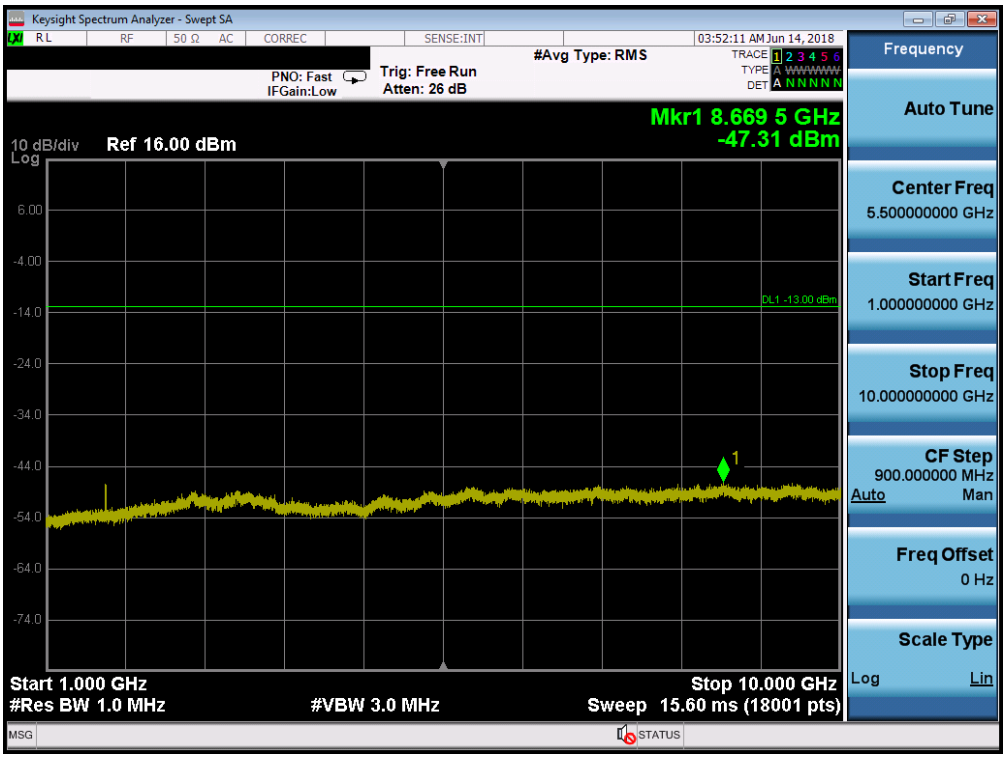


Plot 7-50. Conducted Spurious Plot (Cellular WCDMA Mode - Mid Channel)



Plot 7-51. Conducted Spurious Plot (Cellular WCDMA Mode - Mid Channel)

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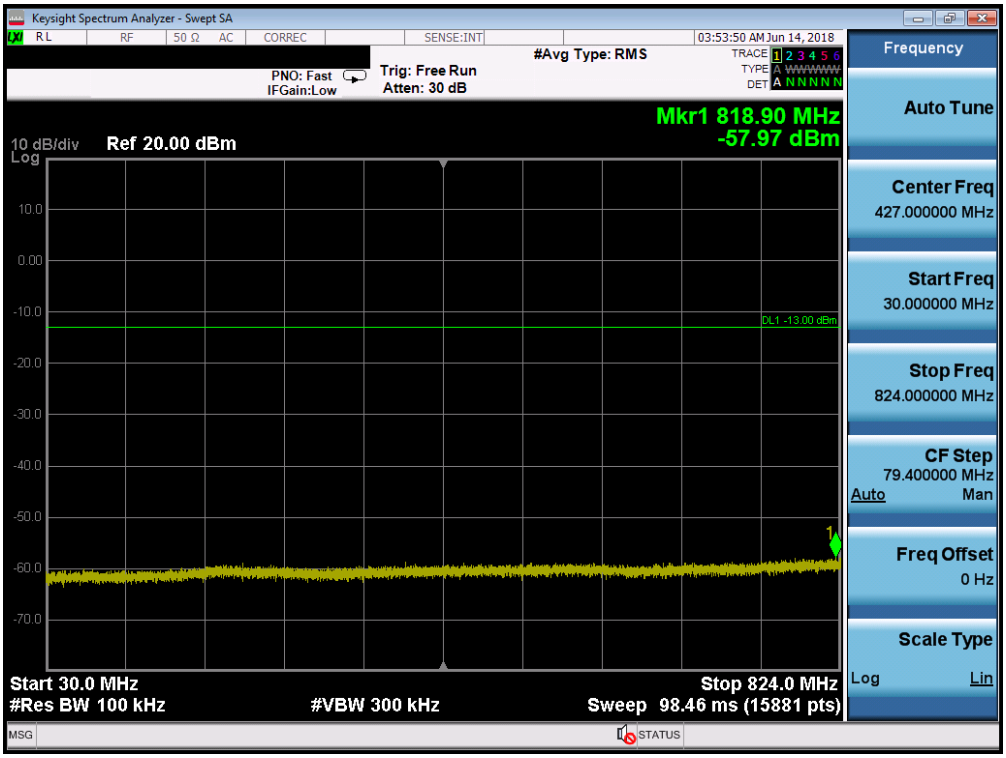
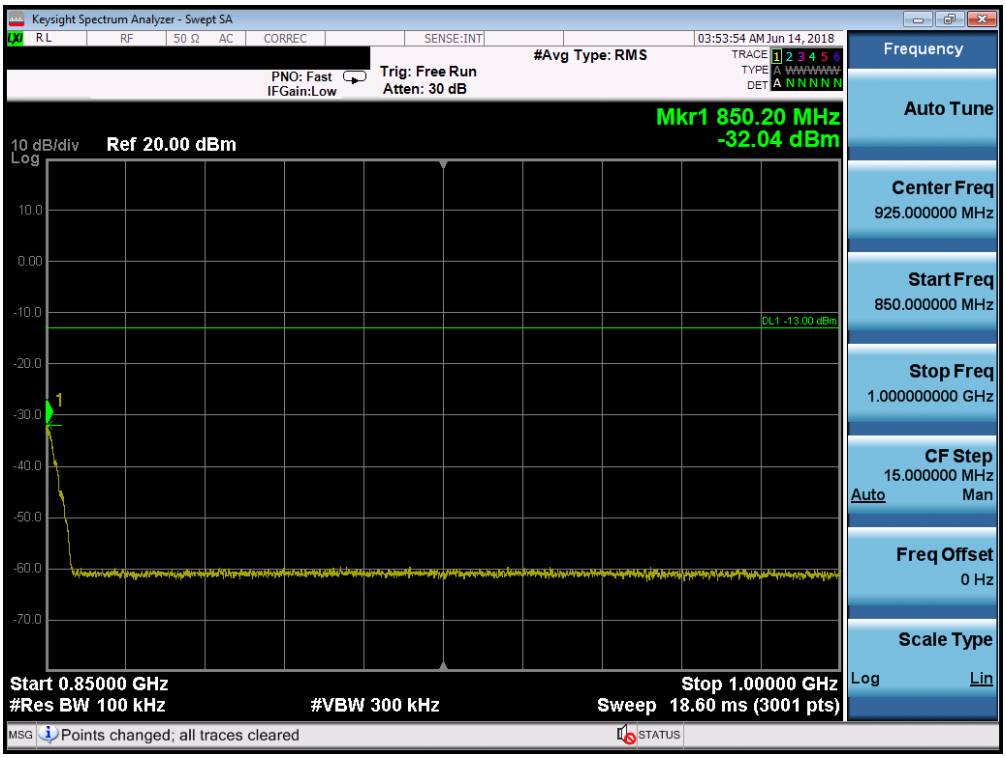


Plot 7-52. Conducted Spurious Plot (Cellular WCDMA Mode - High Channel)



Plot 7-53. Conducted Spurious Plot (Cellular WCDMA Mode - High Channel)

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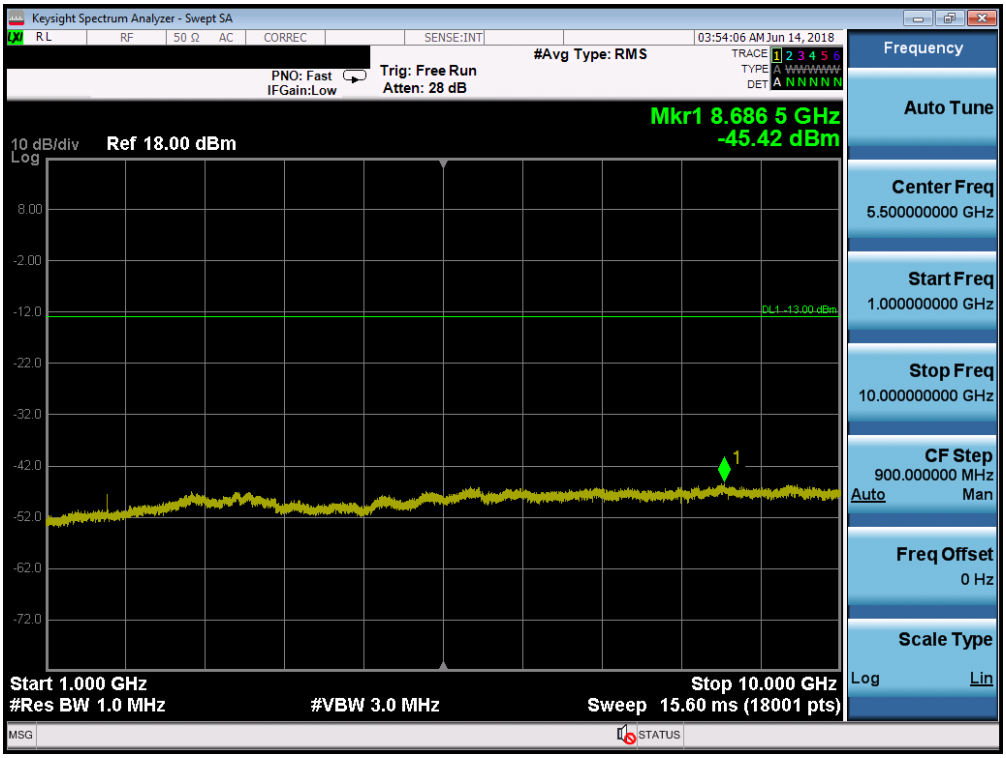

Plot 7-54. Conducted Spurious Plot (Cellular WCDMA Mode - High Channel)

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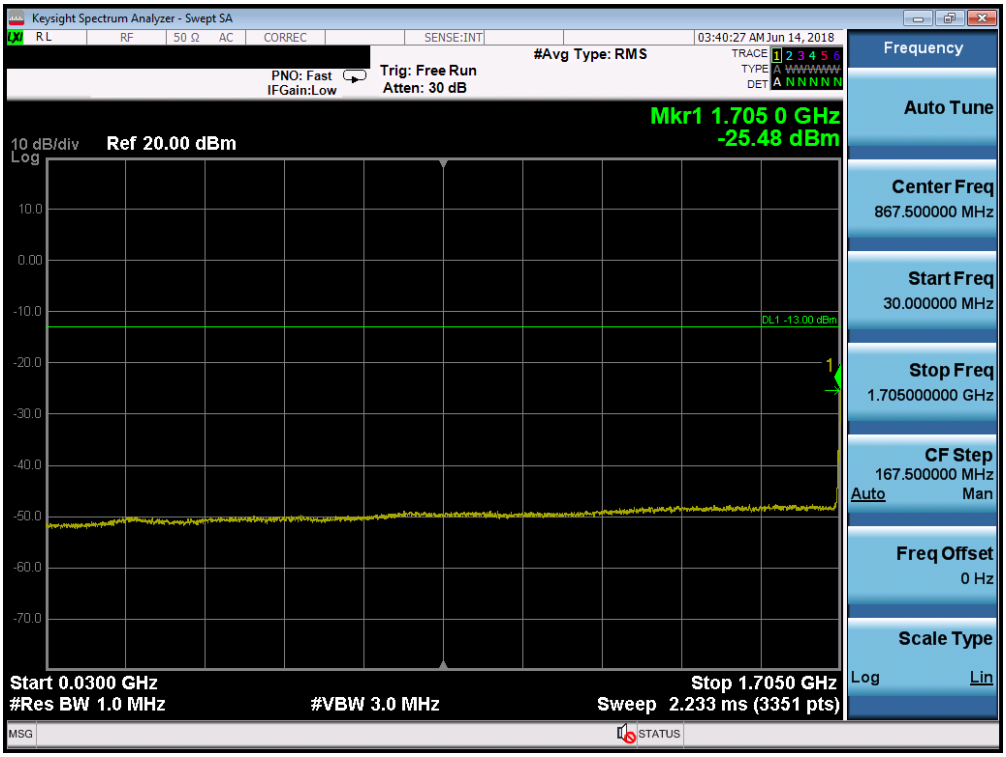
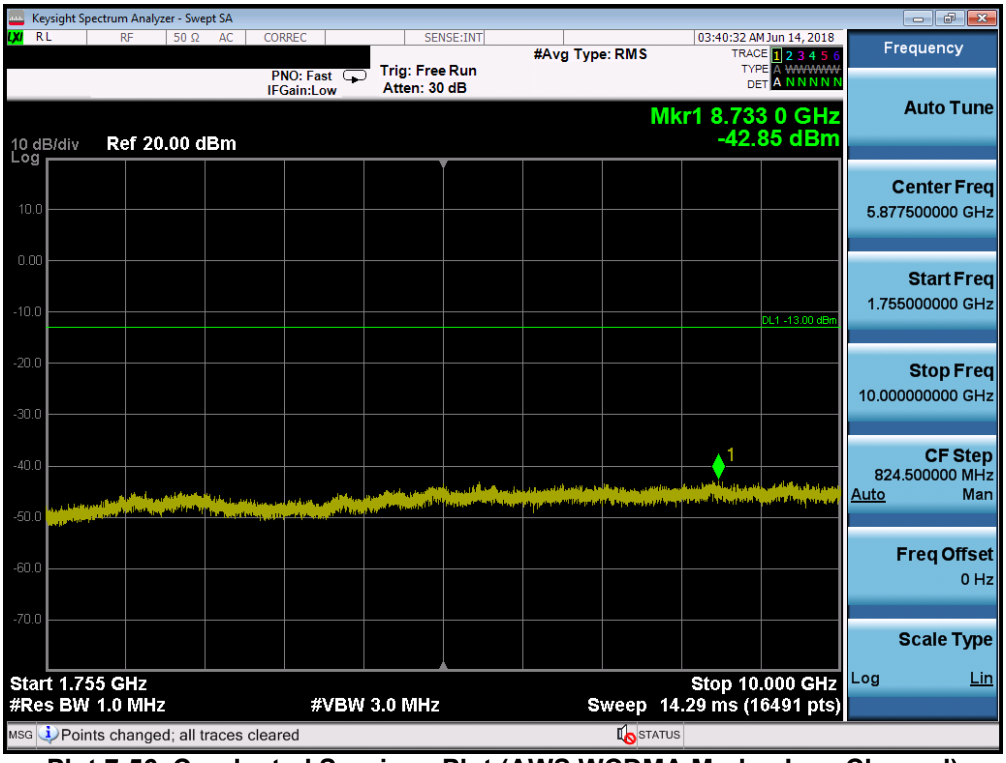
AWS WCDMA Mode



Plot 7-55. Conducted Spurious Plot (AWS WCDMA Mode - Low Channel)



Plot 7-56. Conducted Spurious Plot (AWS WCDMA Mode - Low Channel)

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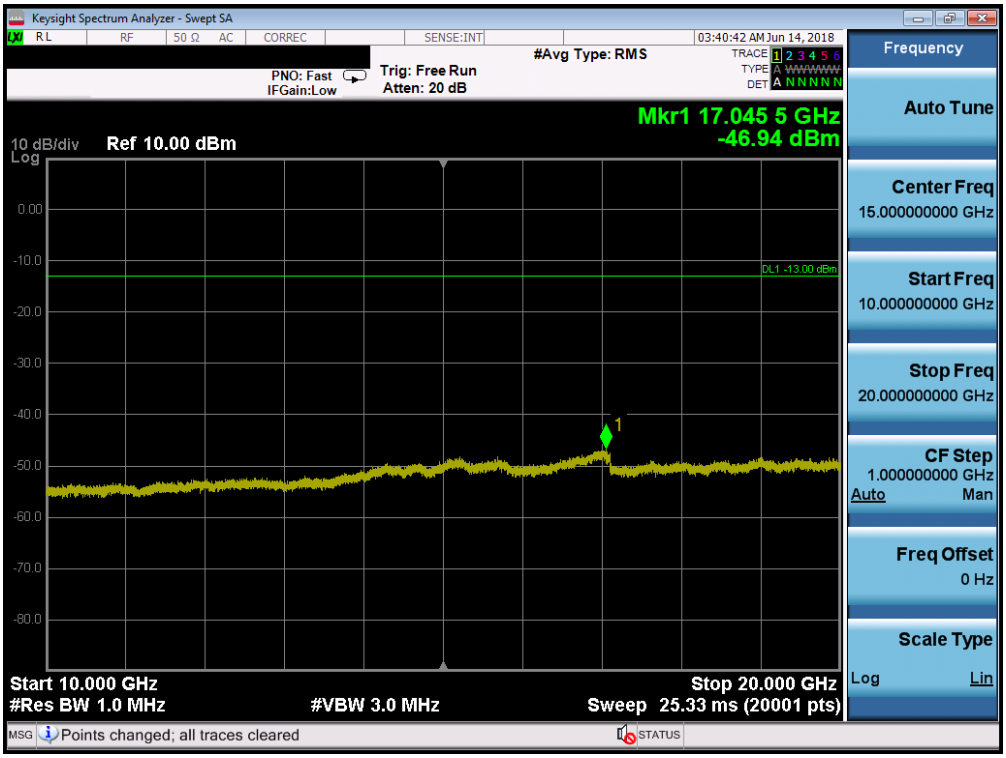

Plot 7-57. Conducted Spurious Plot (AWS WCDMA Mode - Low Channel)

Plot 7-58. Conducted Spurious Plot (AWS WCDMA Mode - Mid Channel)

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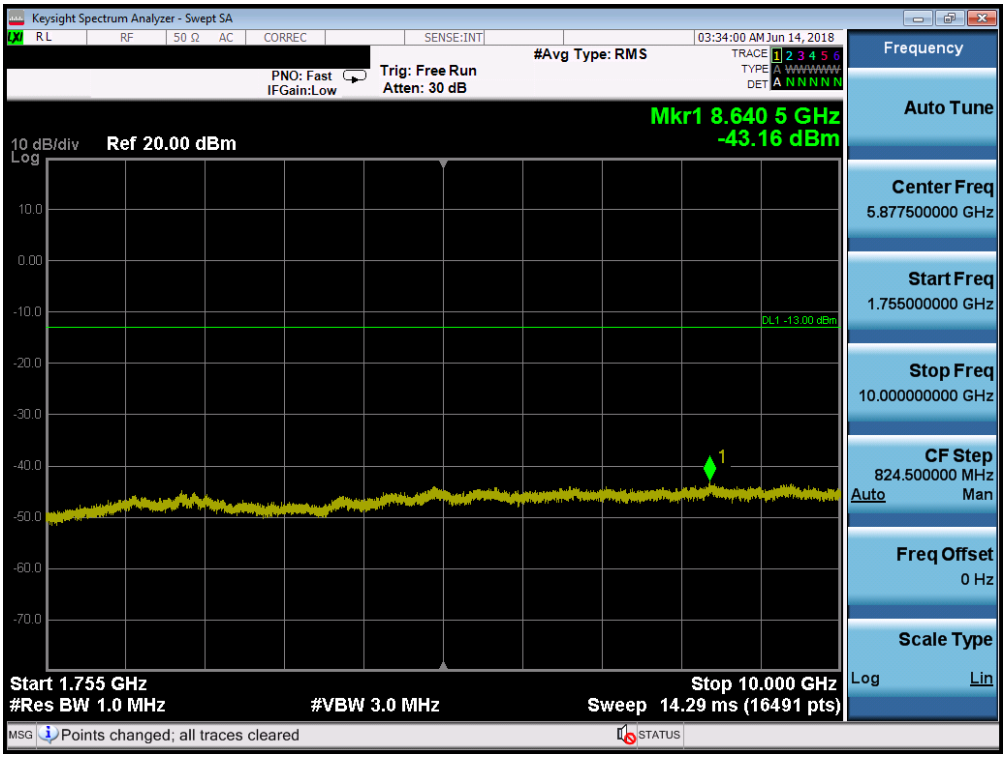
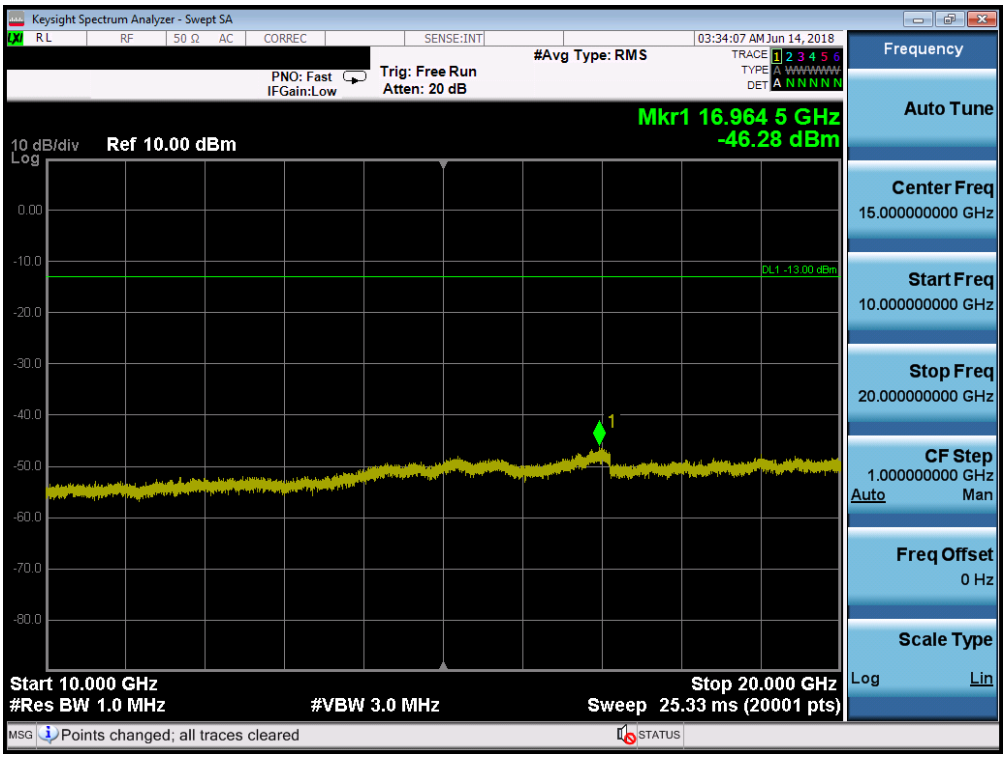


Plot 7-59. Conducted Spurious Plot (AWS WCDMA Mode - Mid Channel)



Plot 7-60. Conducted Spurious Plot (AWS WCDMA Mode - Mid Channel)

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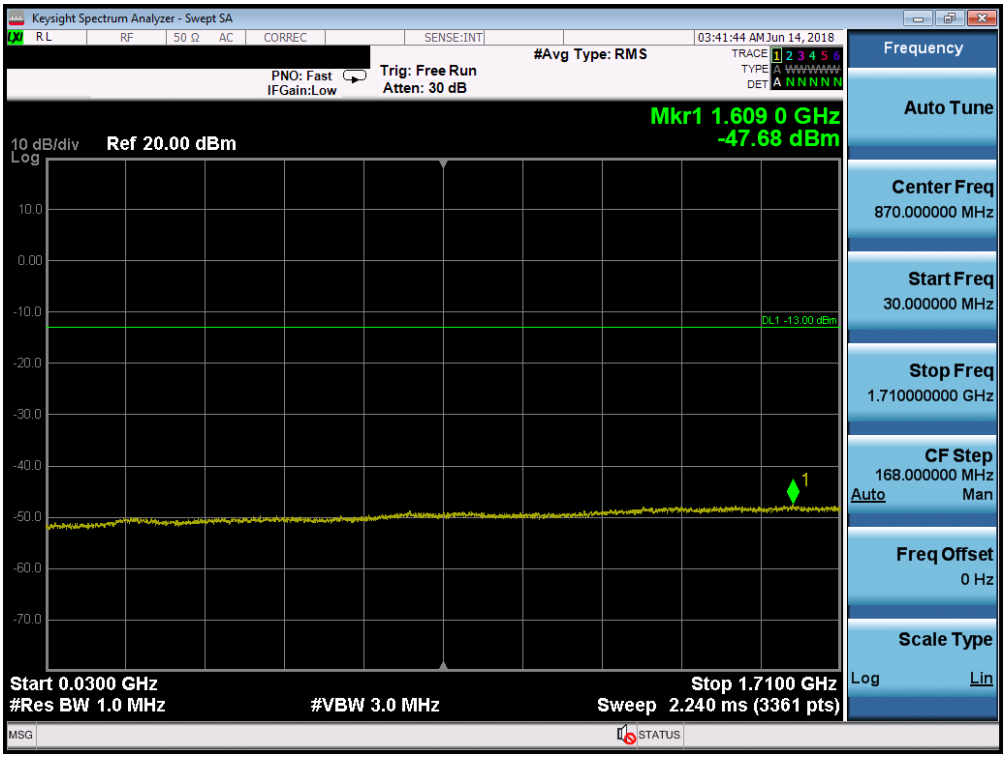
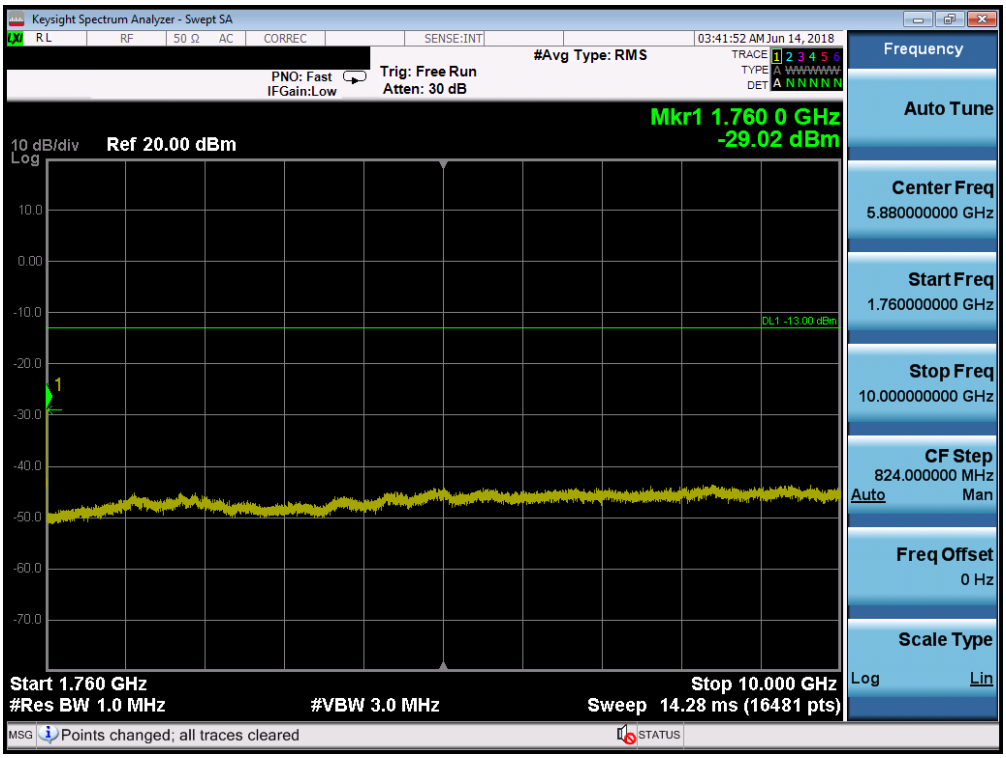


Plot 7-61. Conducted Spurious Plot (AWS WCDMA Mode - High Channel)



Plot 7-62. Conducted Spurious Plot (AWS WCDMA Mode - High Channel)

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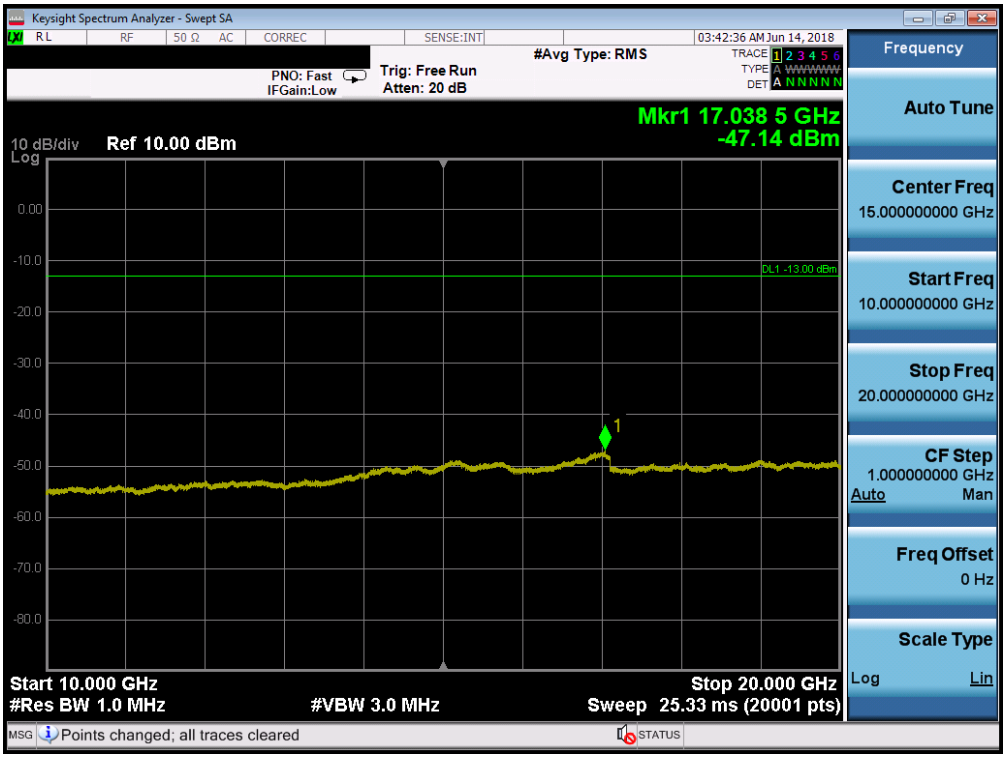

Plot 7-63. Conducted Spurious Plot (AWS WCDMA Mode - High Channel)

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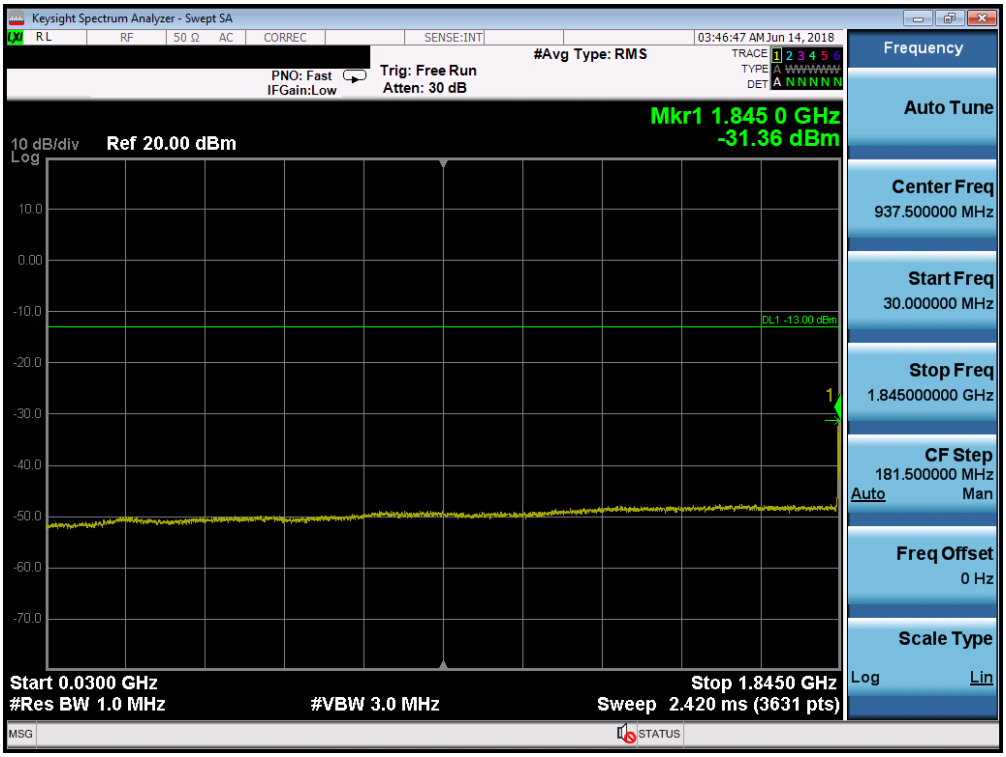
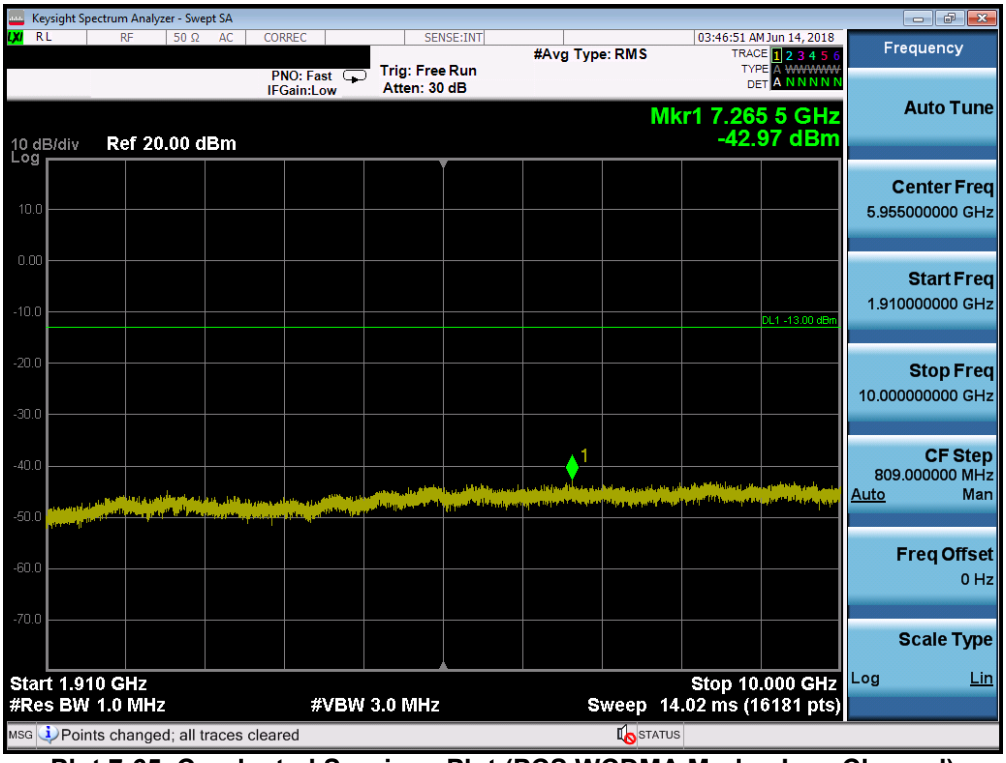
PCS WCDMA Mode



Plot 7-64. Conducted Spurious Plot (PCS WCDMA Mode - Low Channel)



Plot 7-65. Conducted Spurious Plot (PCS WCDMA Mode - Low Channel)

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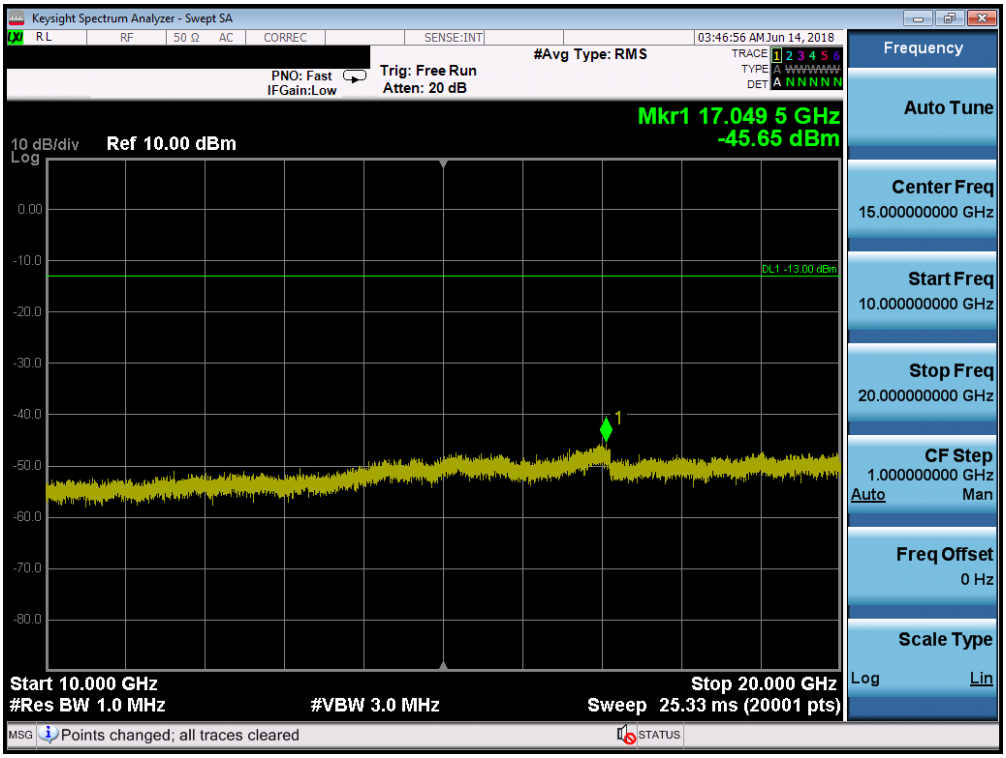
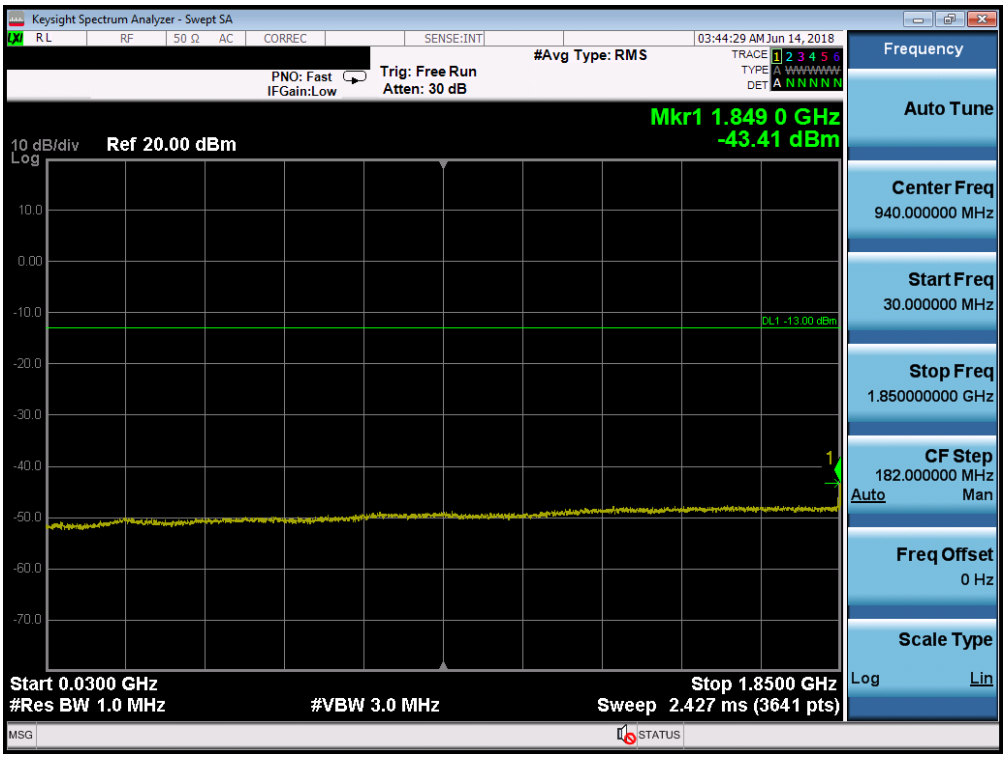


Plot 7-66. Conducted Spurious Plot (PCS WCDMA Mode - Low Channel)



Plot 7-67. Conducted Spurious Plot (PCS WCDMA Mode - Mid Channel)

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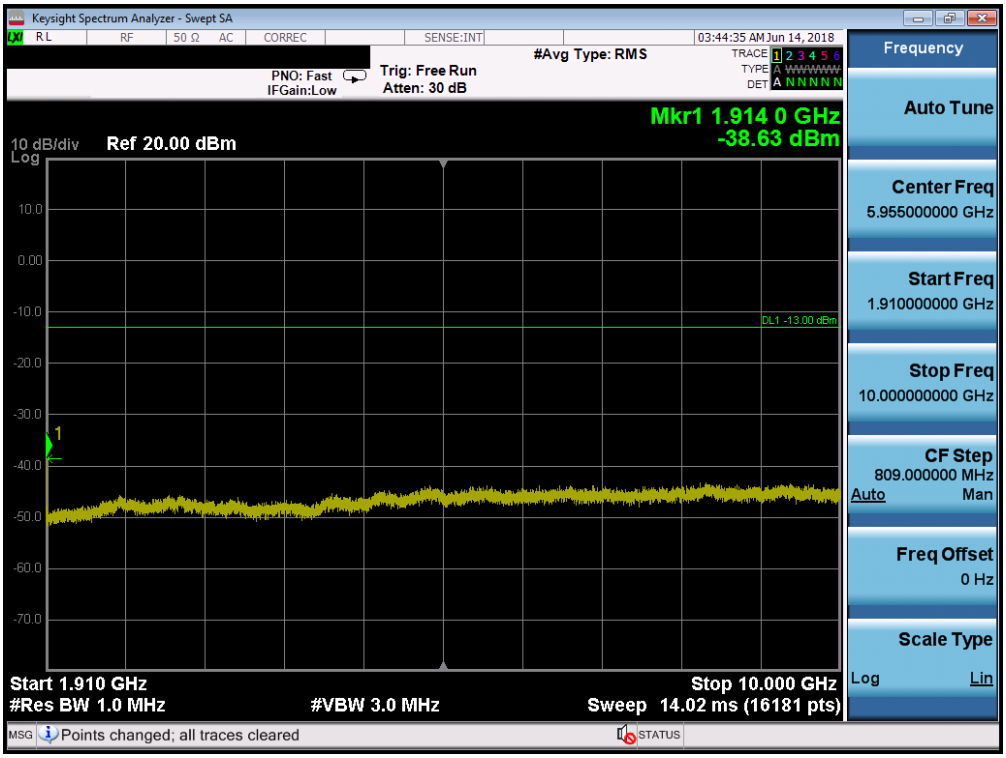
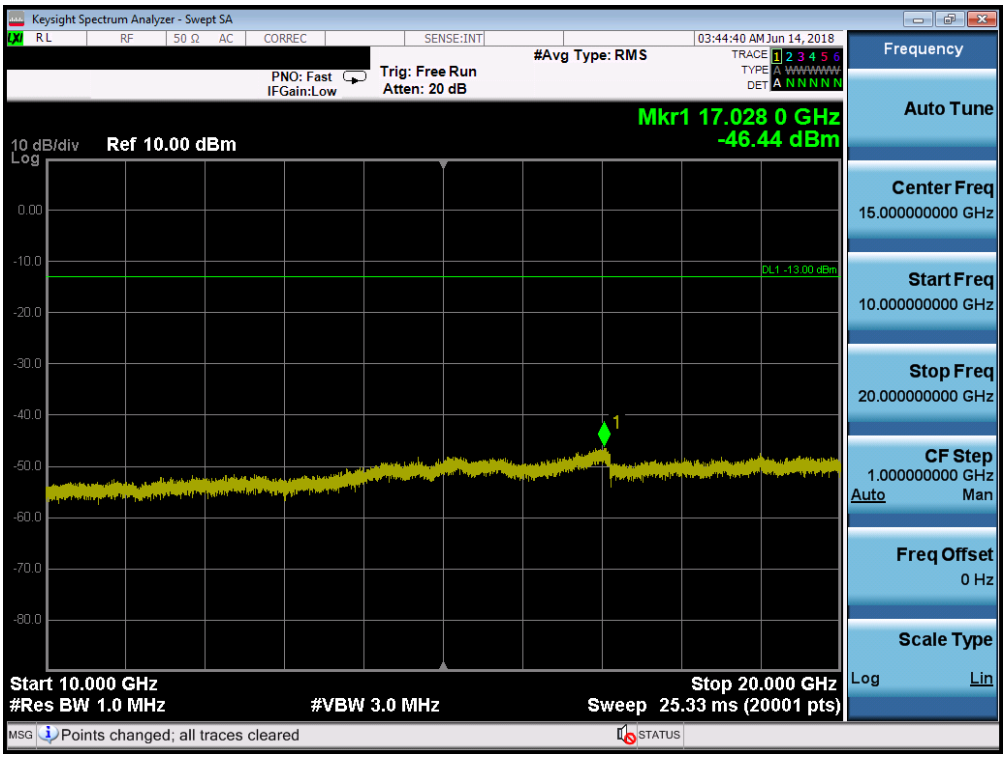


Plot 7-68. Conducted Spurious Plot (PCS WCDMA Mode - Mid Channel)



Plot 7-69. Conducted Spurious Plot (PCS WCDMA Mode - Mid Channel)

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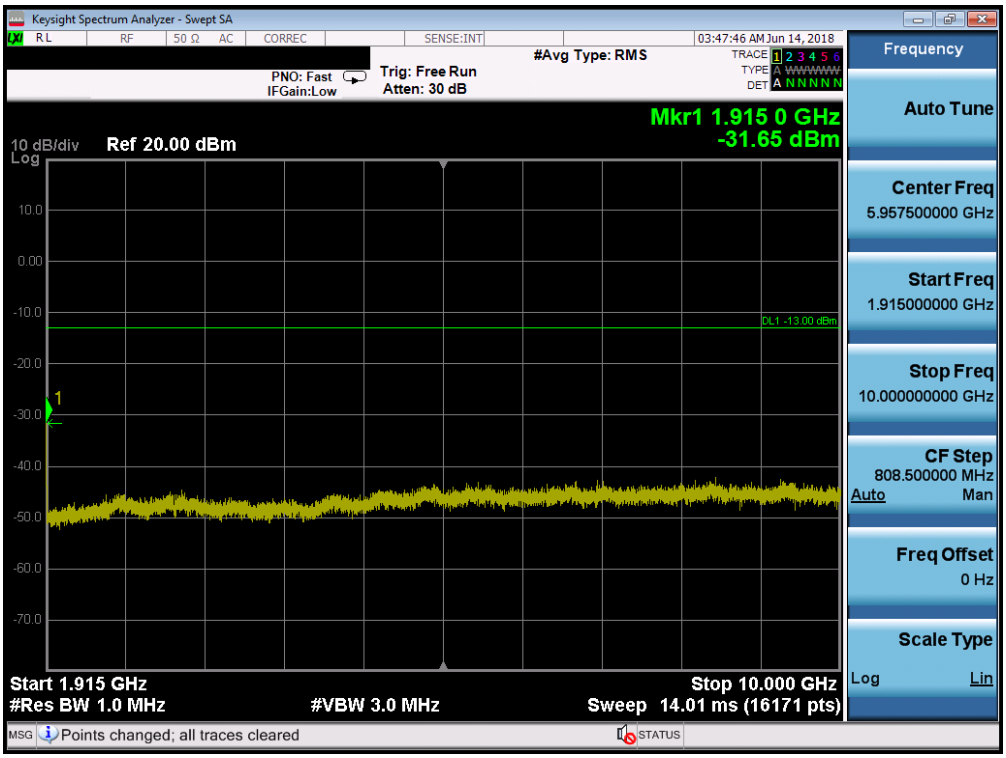
Plot 7-70. Conducted Spurious Plot (PCS WCDMA Mode - High Channel)



Plot 7-71. Conducted Spurious Plot (PCS WCDMA Mode - High Channel)

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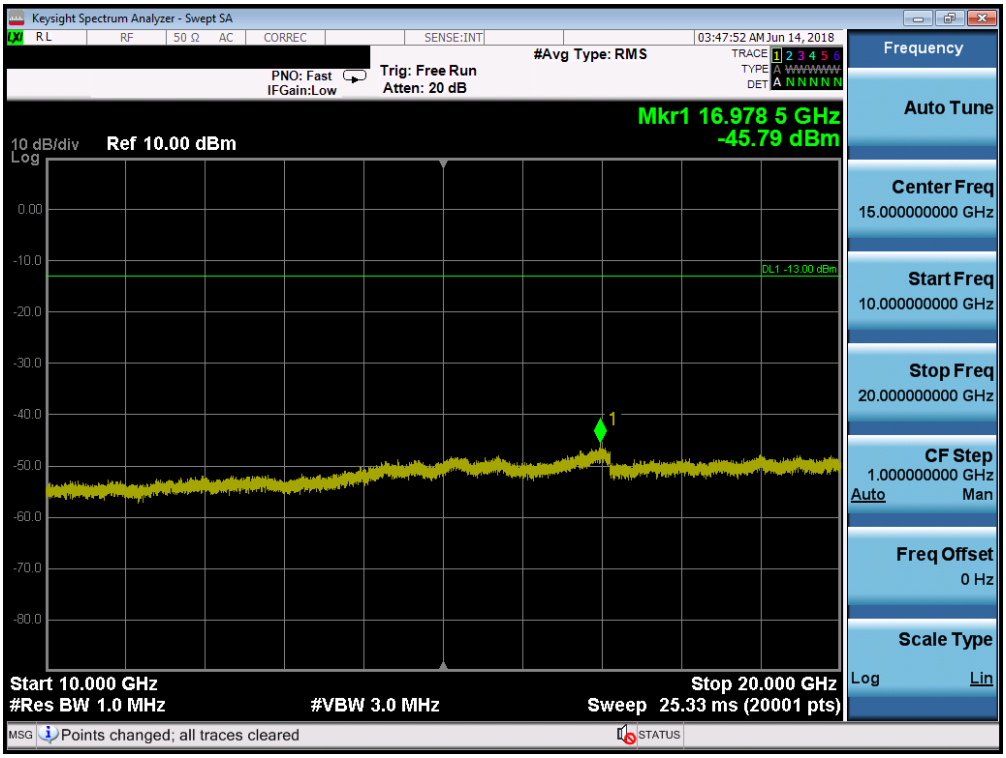

Plot 7-72. Conducted Spurious Plot (PCS WCDMA Mode - High Channel)

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7.4 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start 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.

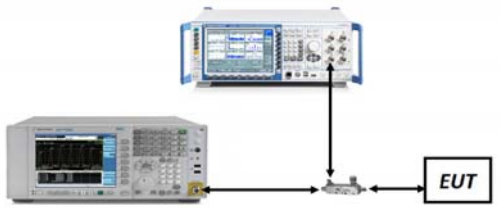

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

Per 22.917(b), 24.238(b), 27.53(h)(3), and RSS-132(5.5), RSS-133(6.5), RSS-139(6.5), 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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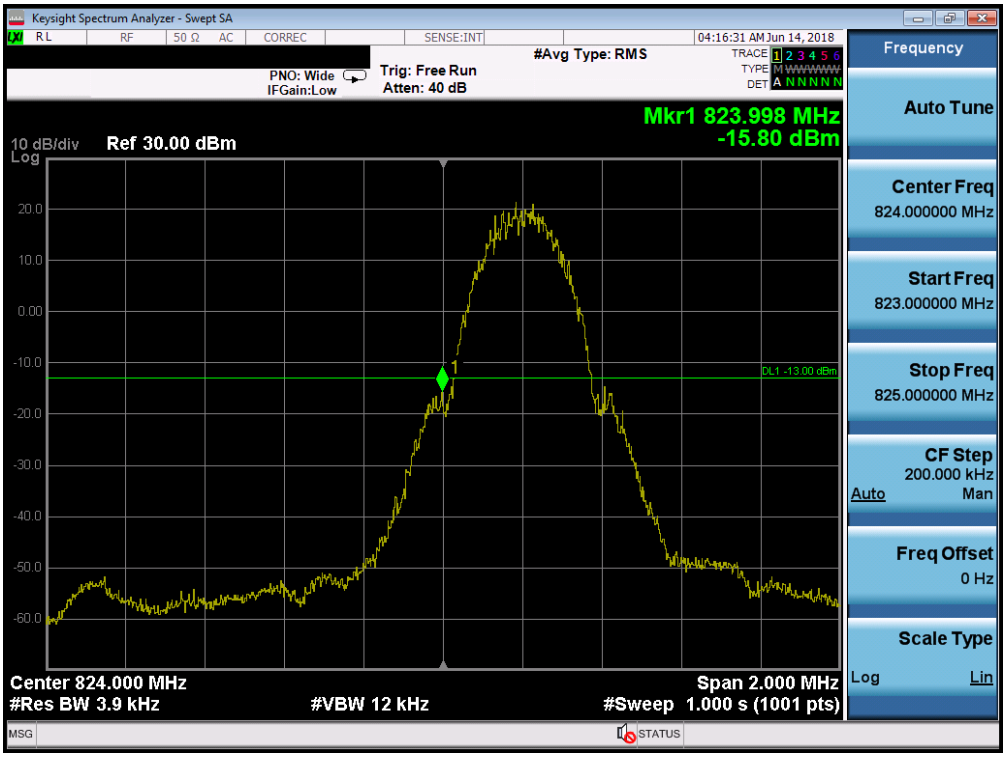
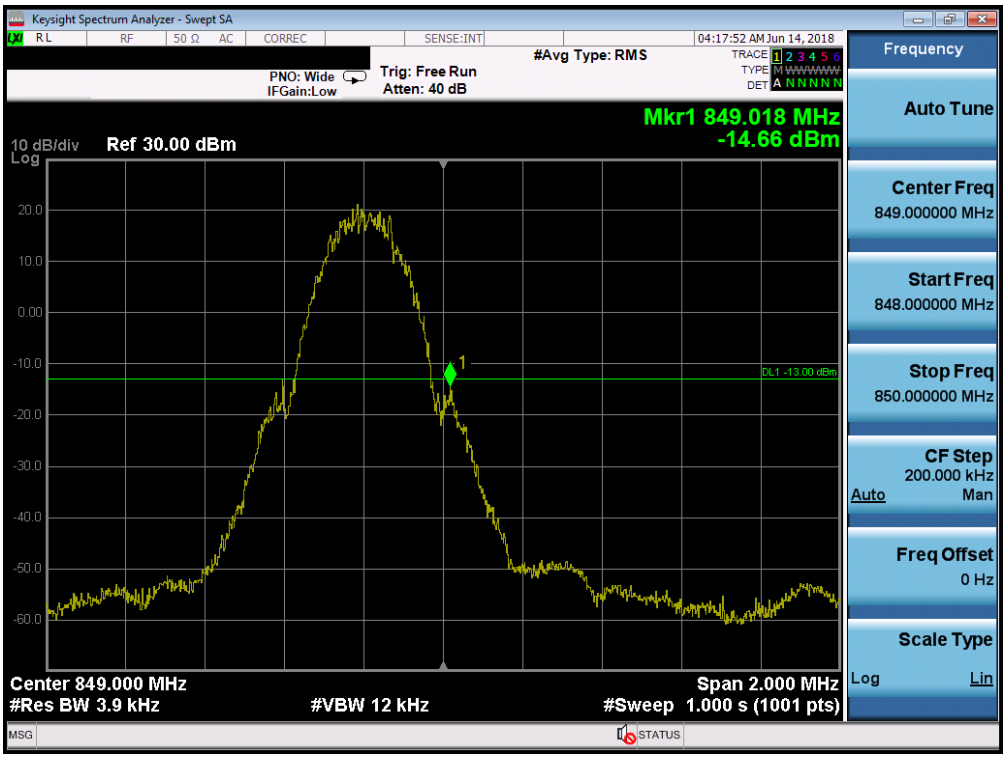
Cellular GPRS Mode



Plot 7-73. Band Edge Plot (Cellular GPRS Mode - Low Channel)



Plot 7-74. Band Edge Plot (Cellular GPRS Mode - High Channel)

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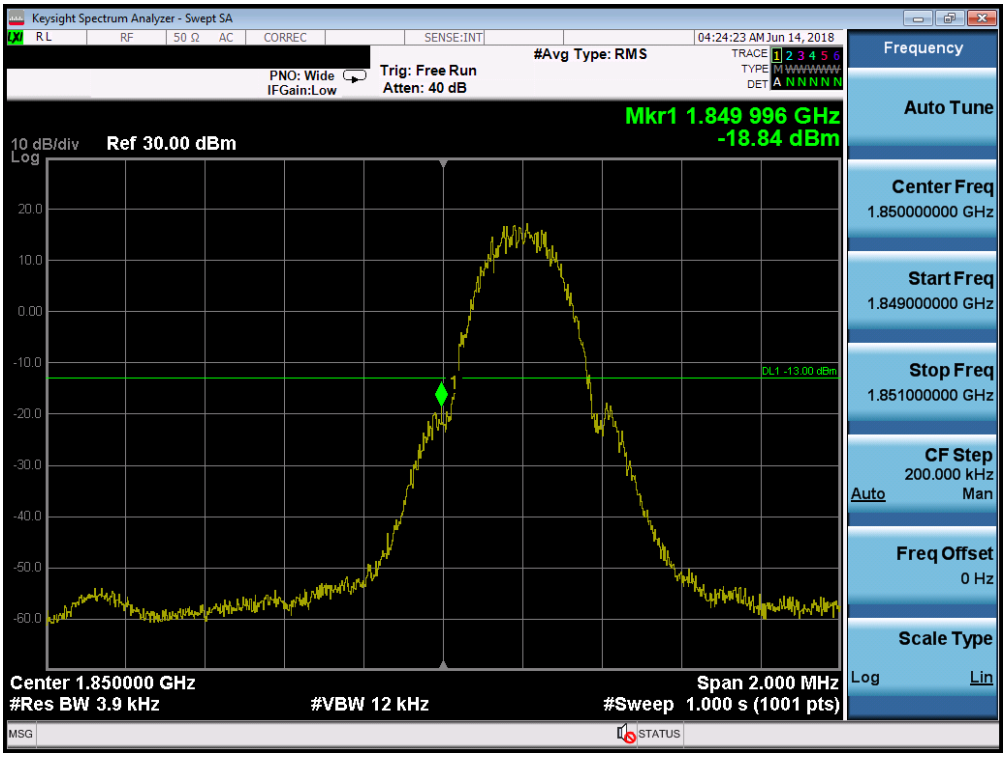
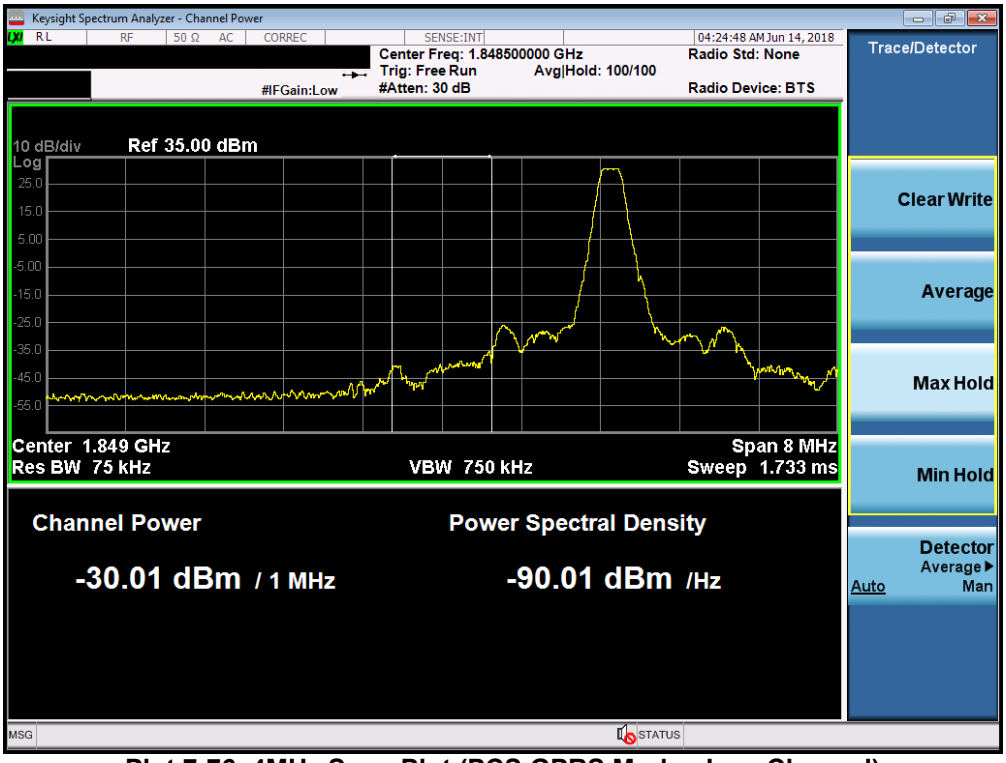
PCS GPRS Mode



Plot 7-75. Band Edge Plot (PCS GPRS Mode - Low Channel)



Plot 7-76. 4MHz Span Plot (PCS GPRS Mode - Low Channel)

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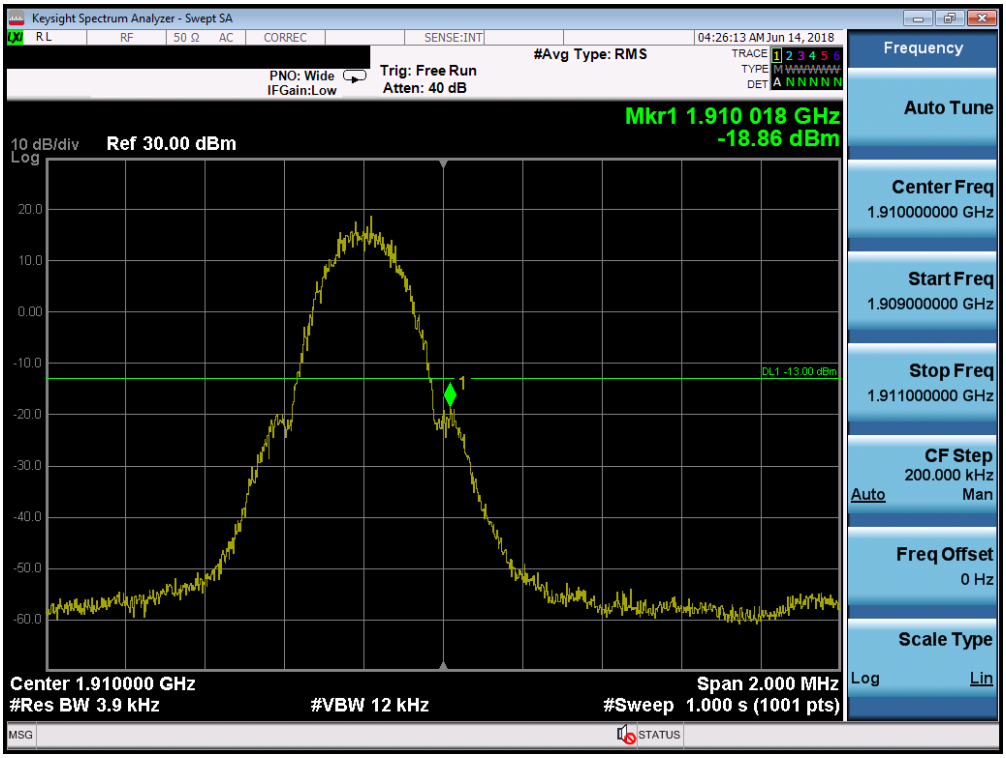
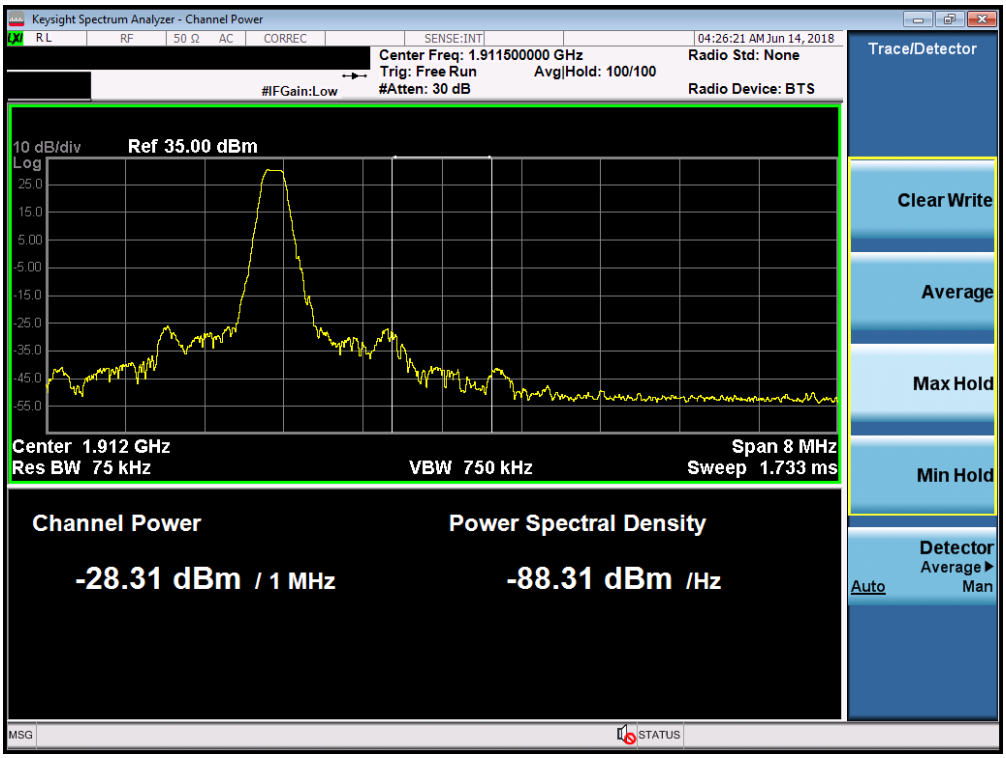


Plot 7-77. Band Edge Plot (PCS GPRS Mode - High Channel)



Plot 7-78. 4MHz Span Plot (PCS GPRS Mode - High Channel)

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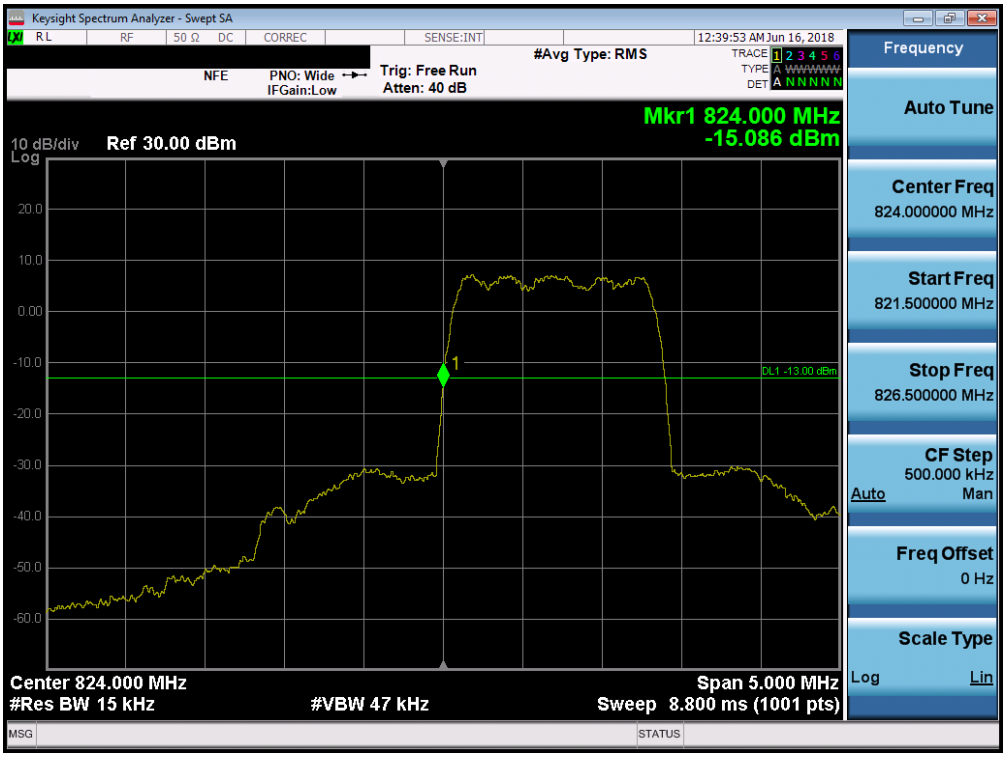
Cellular CDMA Mode



Plot 7-79. Band Edge Plot (Cellular CDMA Mode - Low Channel)

Plot 7-80. 4MHz Span Plot (Cellular CDMA Mode - Low Channel)

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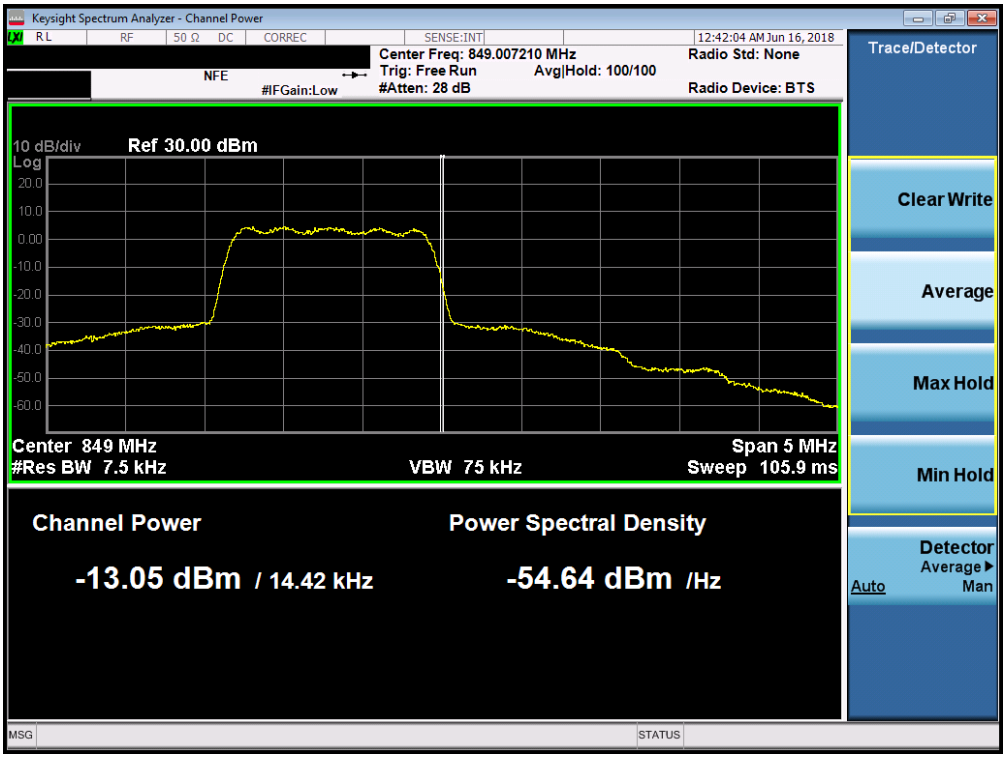
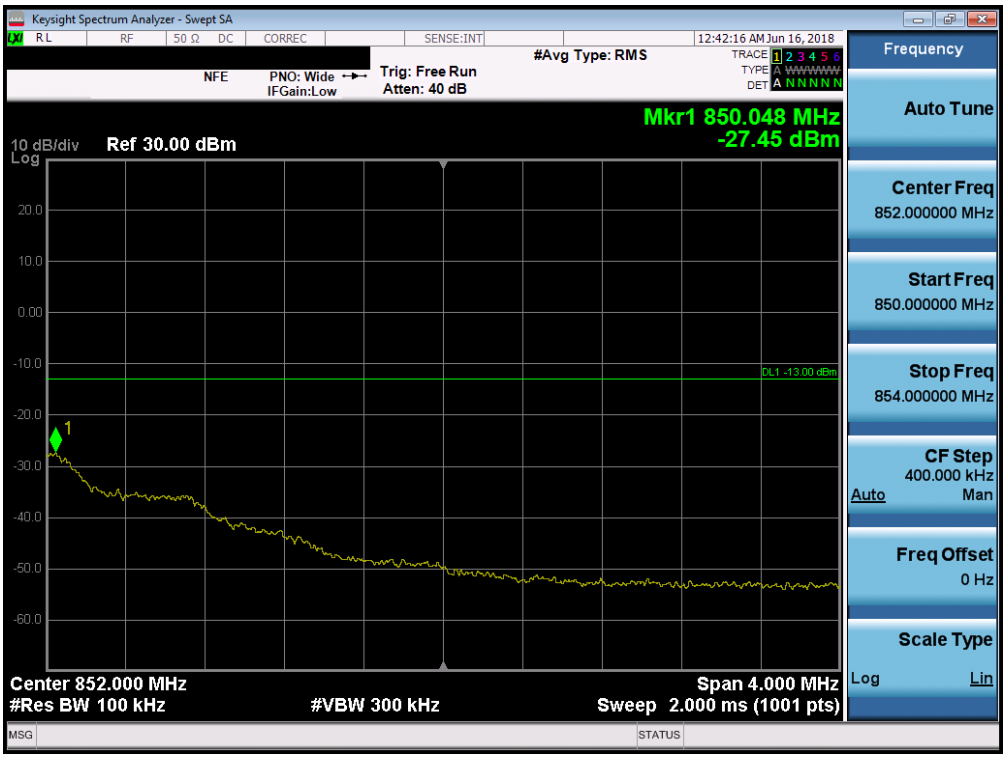


Plot 7-81. Band Edge Plot (Cellular CDMA Mode - High Channel)



Plot 7-82. 4MHz Span Plot (Cellular CDMA Mode - High Channel)

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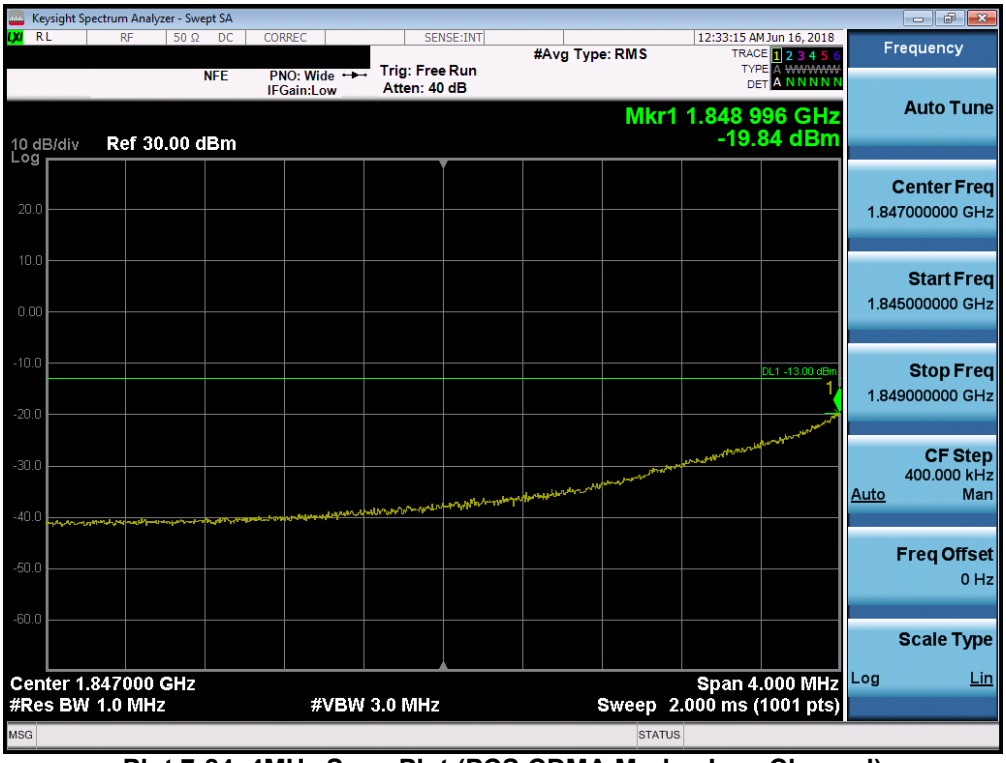
PCS CDMA Mode

Plot 7-83. Band Edge Plot (PCS CDMA Mode - Low Channel)



Plot 7-84. 4MHz Span Plot (PCS CDMA Mode - Low Channel)

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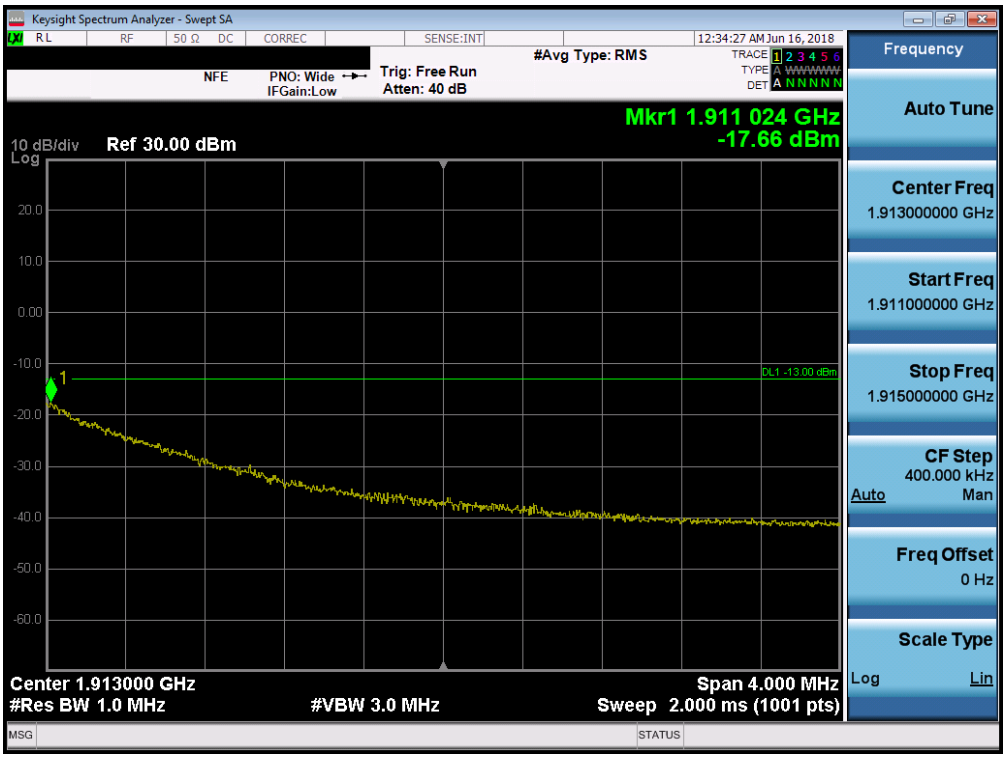
Plot 7-85. Band Edge Plot (PCS CDMA Mode - High Channel)



Plot 7-86. 4MHz Span Plot (PCS CDMA Mode - High Channel)

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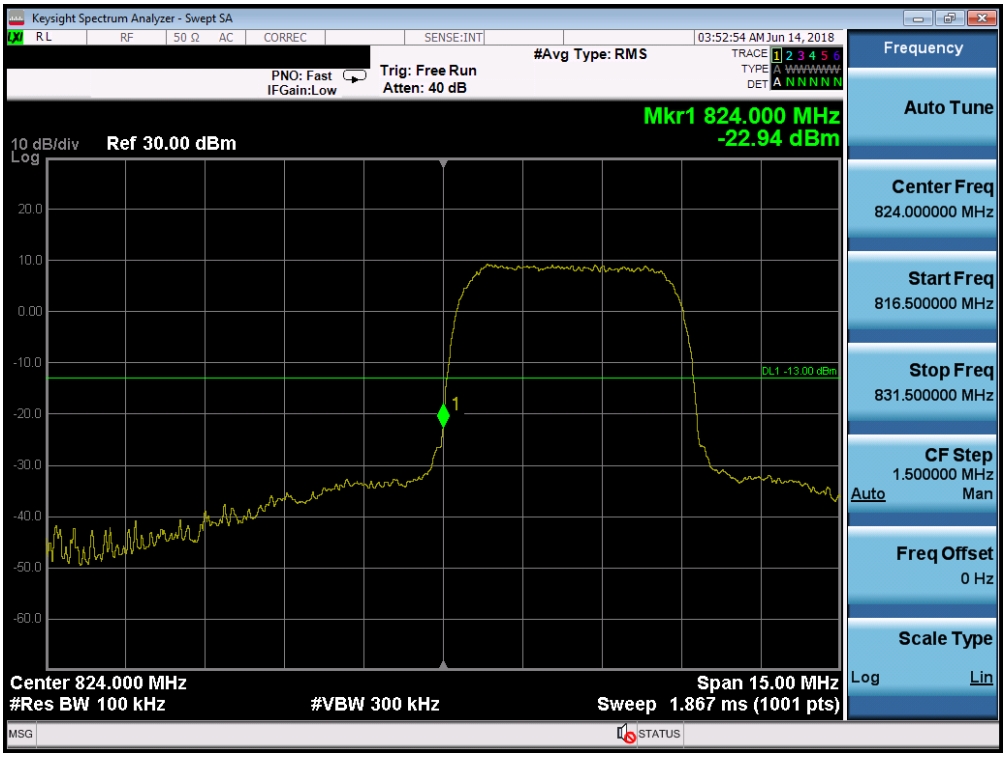
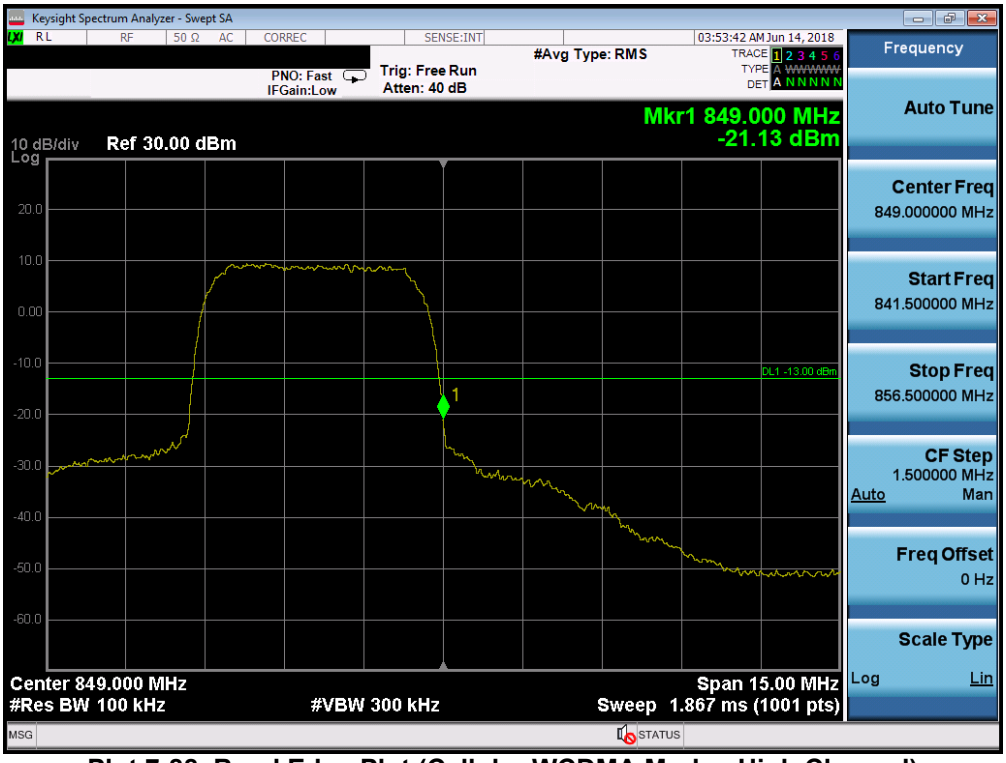
Cellular WCDMA Mode



Plot 7-87. Band Edge Plot (Cellular WCDMA Mode - Low Channel)



Plot 7-88. Band Edge Plot (Cellular WCDMA Mode - High Channel)

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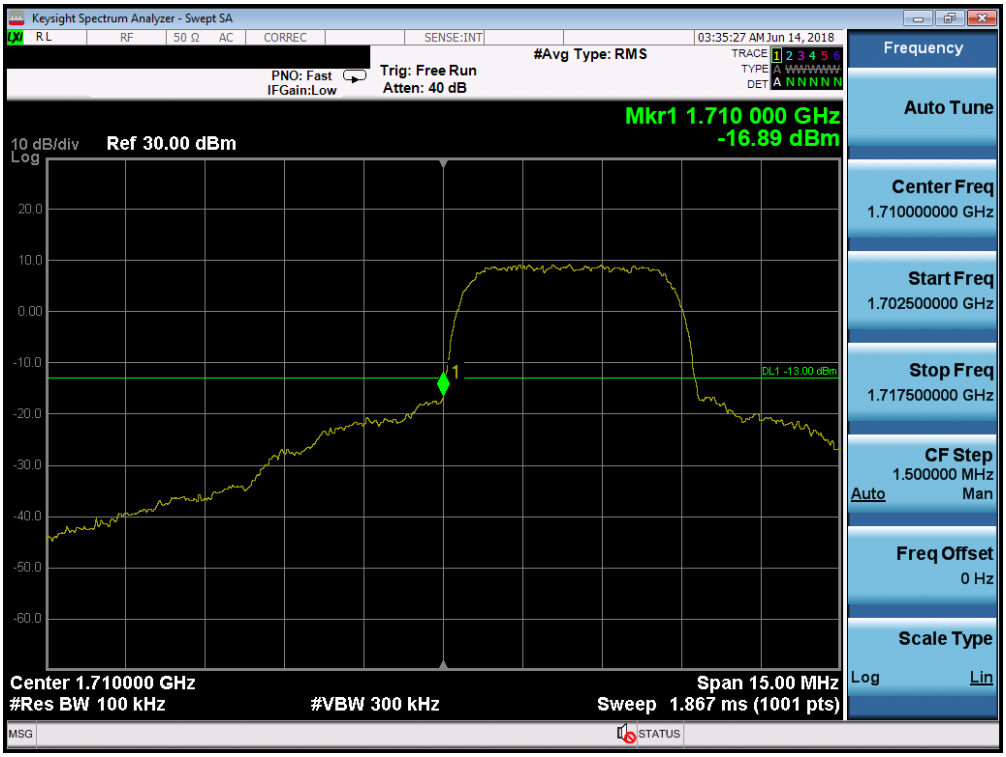
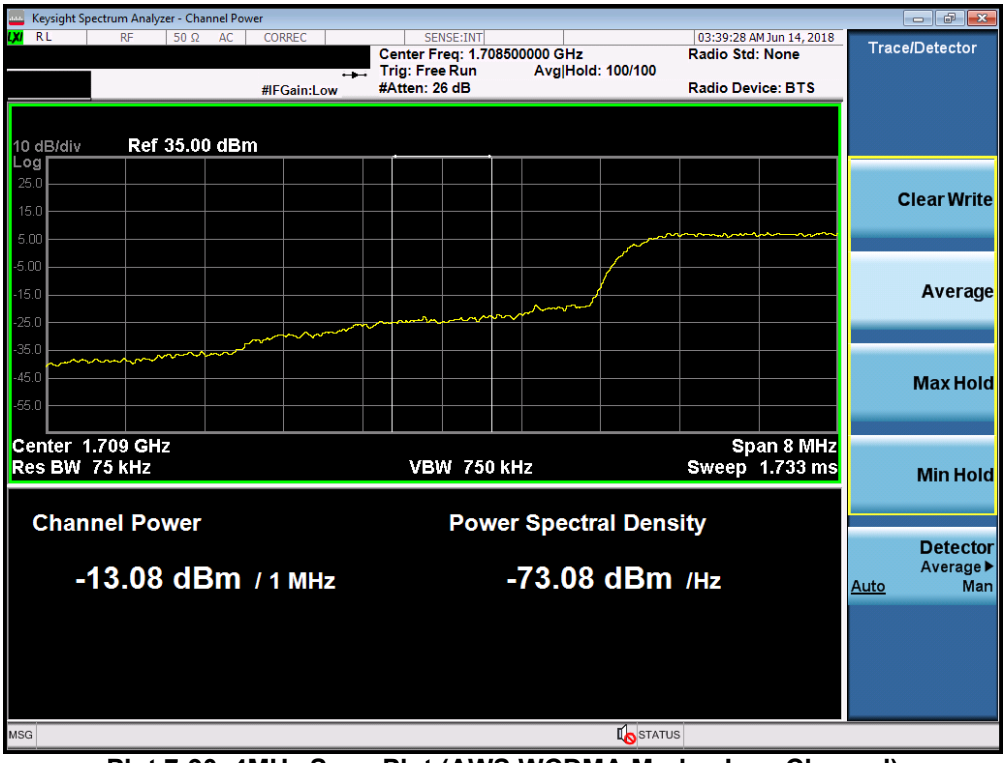
AWS WCDMA Mode



Plot 7-89. Band Edge Plot (AWS WCDMA Mode - Low Channel)



Plot 7-90. 4MHz Span Plot (AWS WCDMA Mode - Low Channel)

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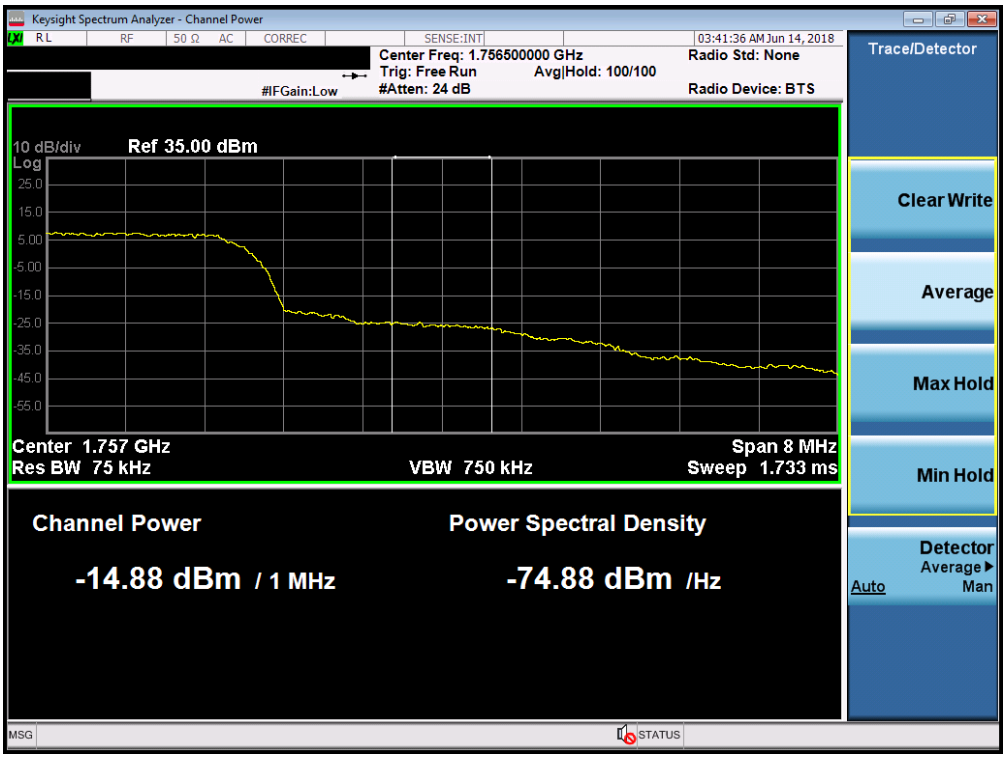
Plot 7-91. Band Edge Plot (AWS WCDMA Mode - High Channel)



Plot 7-92. 4MHz Span Plot (AWS WCDMA Mode - High Channel)

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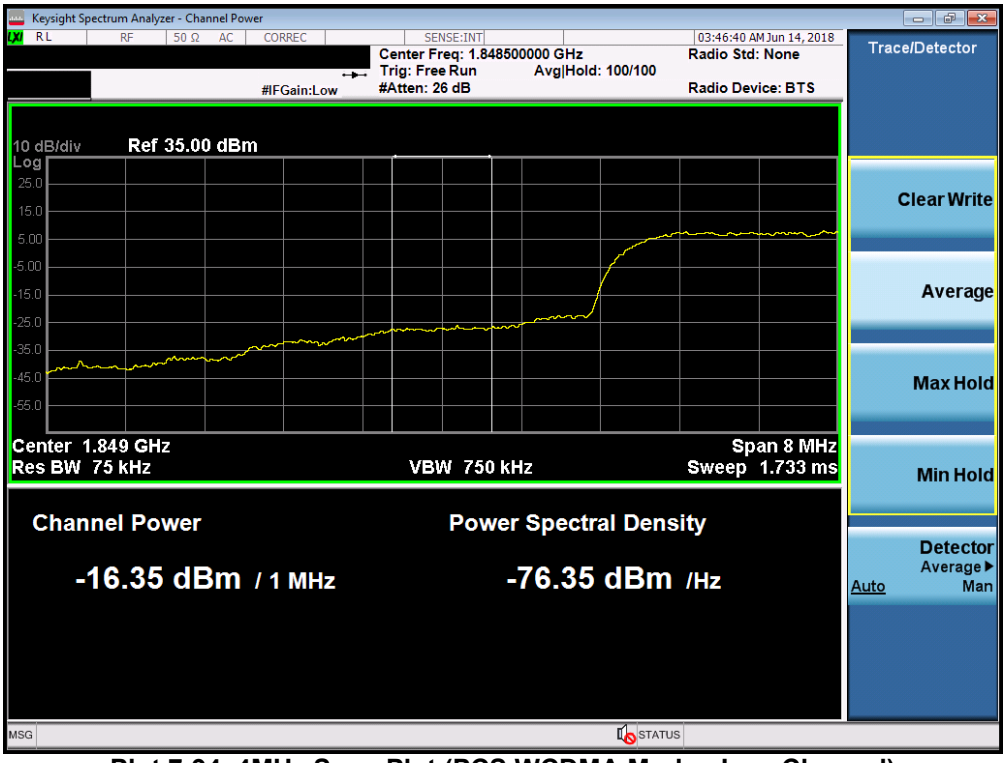
PCS WCDMA Mode

Plot 7-93. Band Edge Plot (PCS WCDMA Mode - Low Channel)



Plot 7-94. 4MHz Span Plot (PCS WCDMA Mode - Low Channel)

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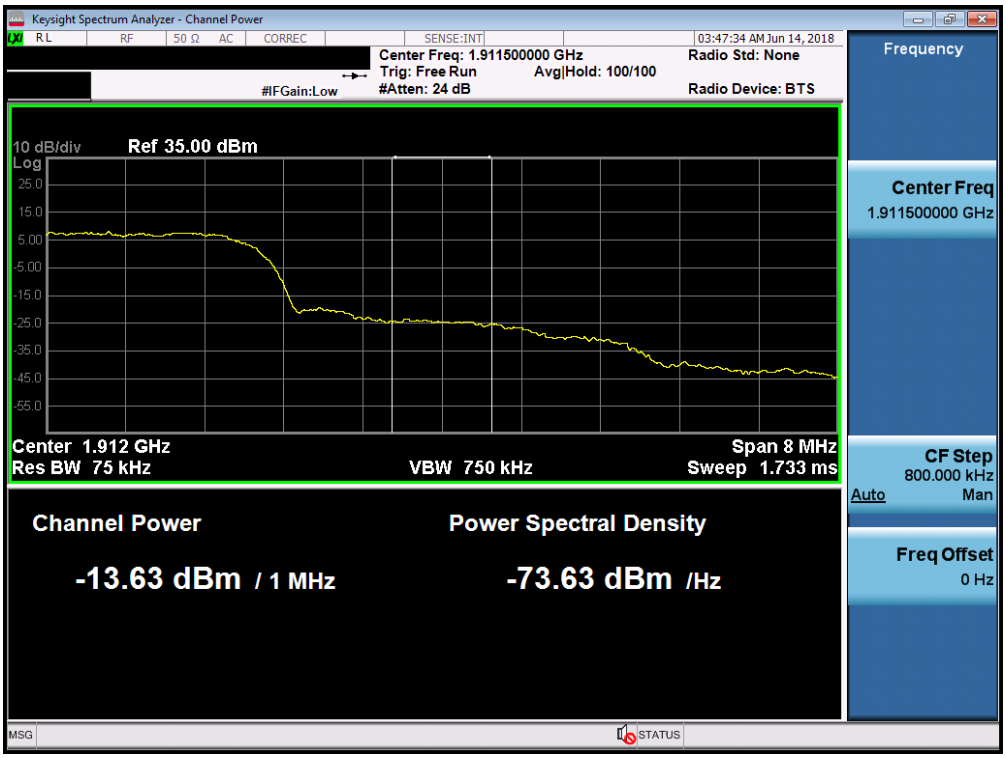
Plot 7-95. Band Edge Plot (PCS WCDMA Mode - High Channel)



Plot 7-96. 4MHz Span Plot (PCS WCDMA Mode - High Channel)

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7.5 Peak-Average Ratio

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 v03r01 – 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.

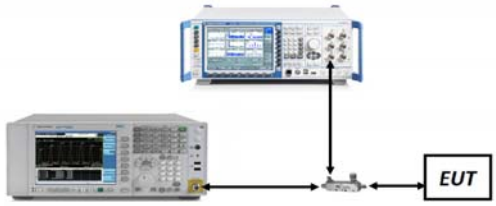

Figure 7-4. Test Instrument & Measurement Setup

Test Notes

None

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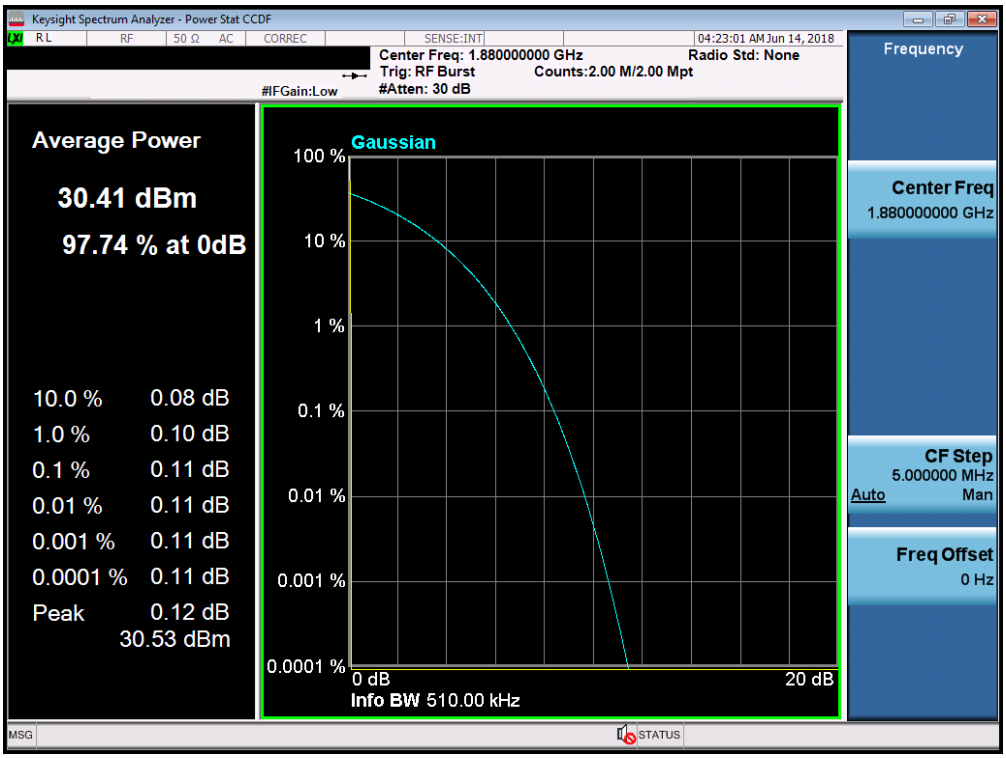
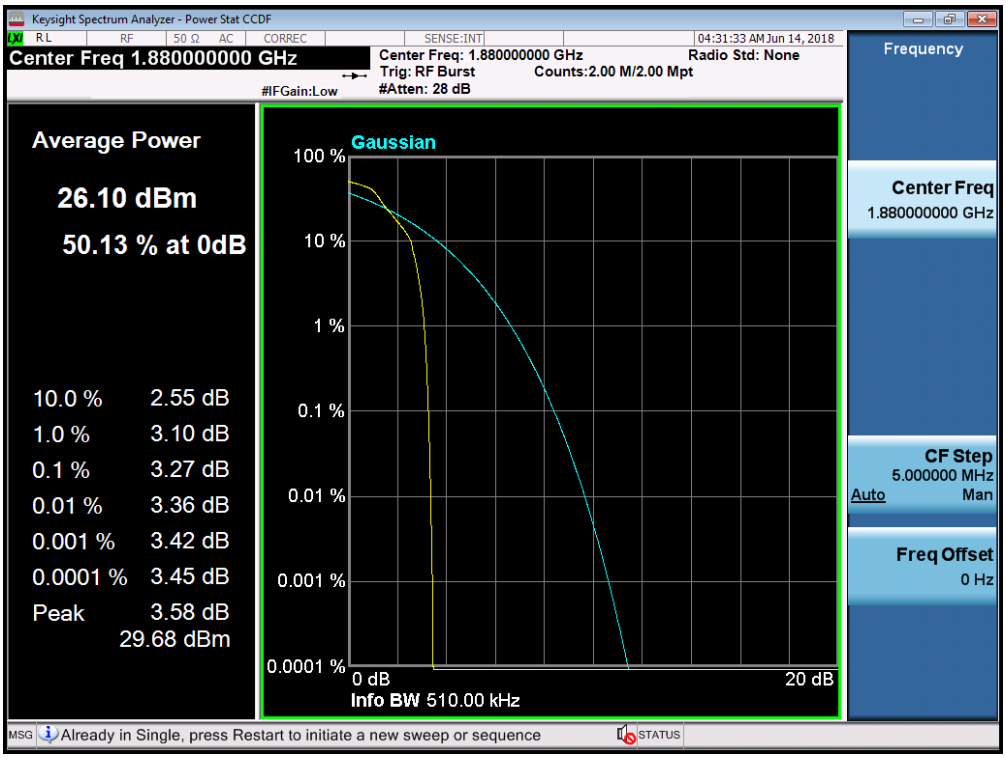


Plot 7-97. Peak-Average Ratio Plot (PCS GPRS Mode)



Plot 7-98. Peak-Average Ratio Plot (EDGE1900 Mode)

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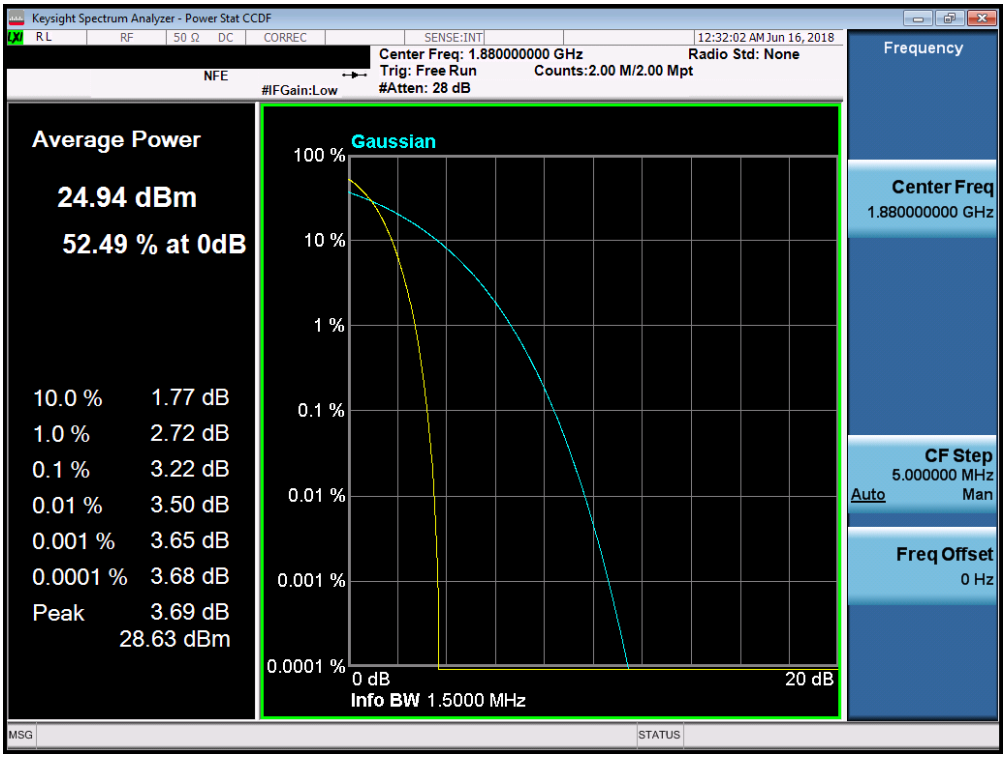
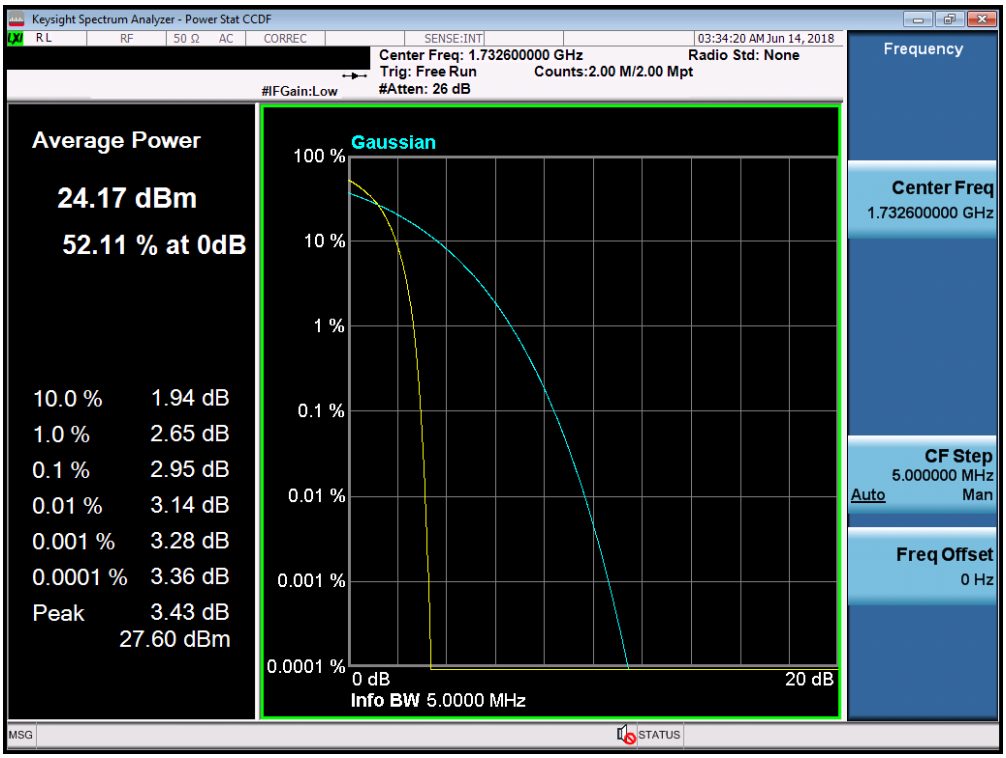


Plot 7-99. Peak-Average Ratio Plot (PCS CDMA Mode)



Plot 7-100. Peak-Average Ratio Plot (AWS WCDMA Mode)

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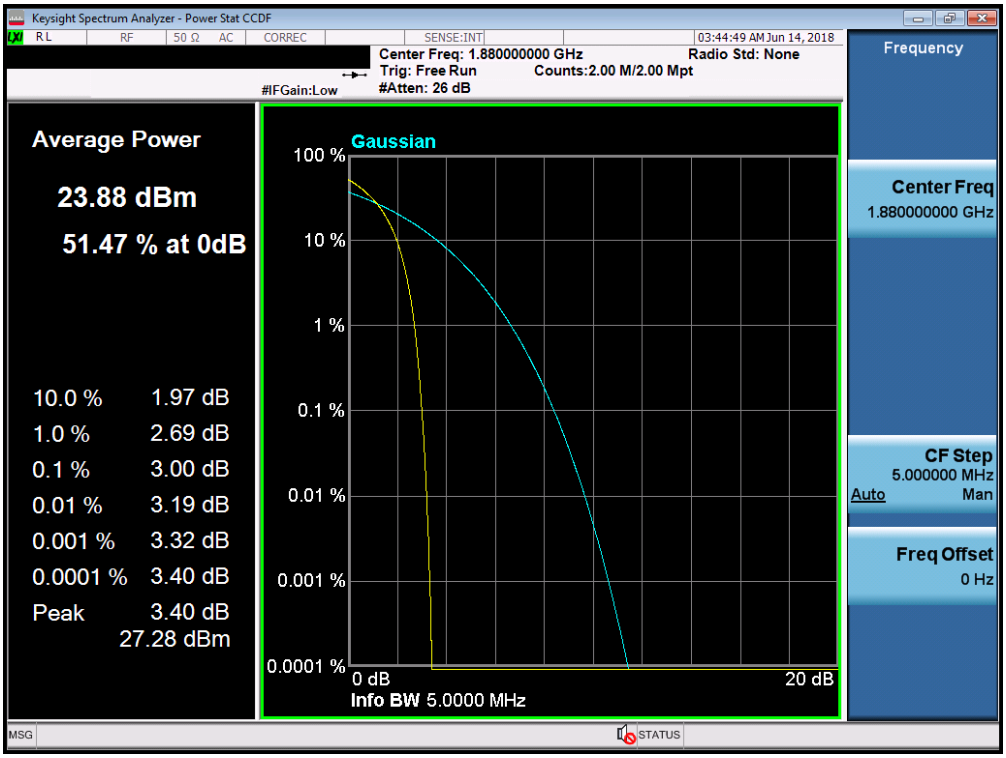

Plot 7-101. Peak-Average Ratio Plot (PCS WCDMA Mode)

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7.6 Radiated Power (ERP/EIRP)

Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation. For signals with burst transmission, the signal analyzer's "time domain power" measurement capability is used
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto". Trigger is set to enable triggering only on full power bursts with the sweep time set less than or equal to the transmission burst duration
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signals with burst transmission, the "gating" function was enabled to ensure that measurements are performed during times in which the transmitter is operating at its maximum power
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

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Test Setup

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

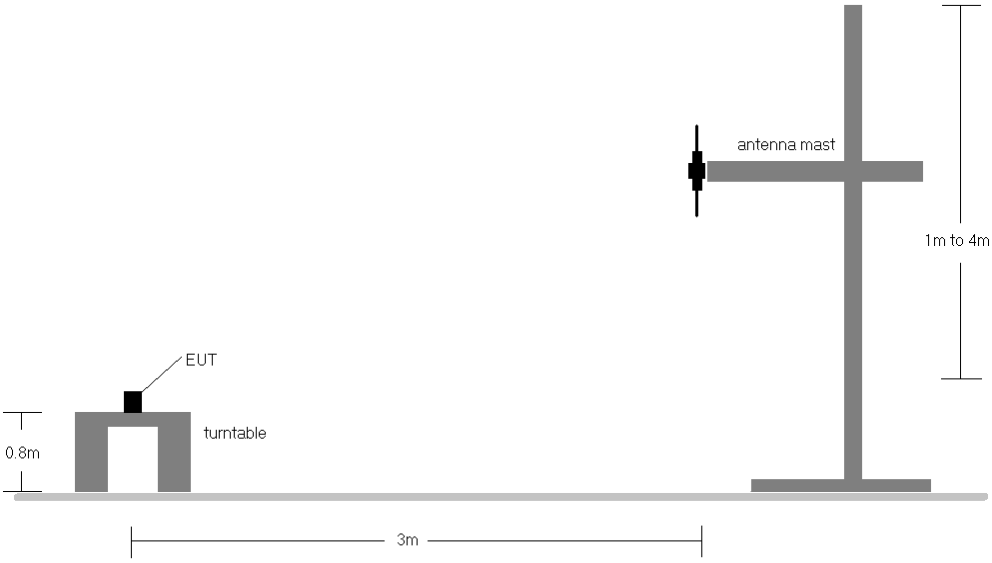

Figure 7-5. Radiated Test Setup <1GHz

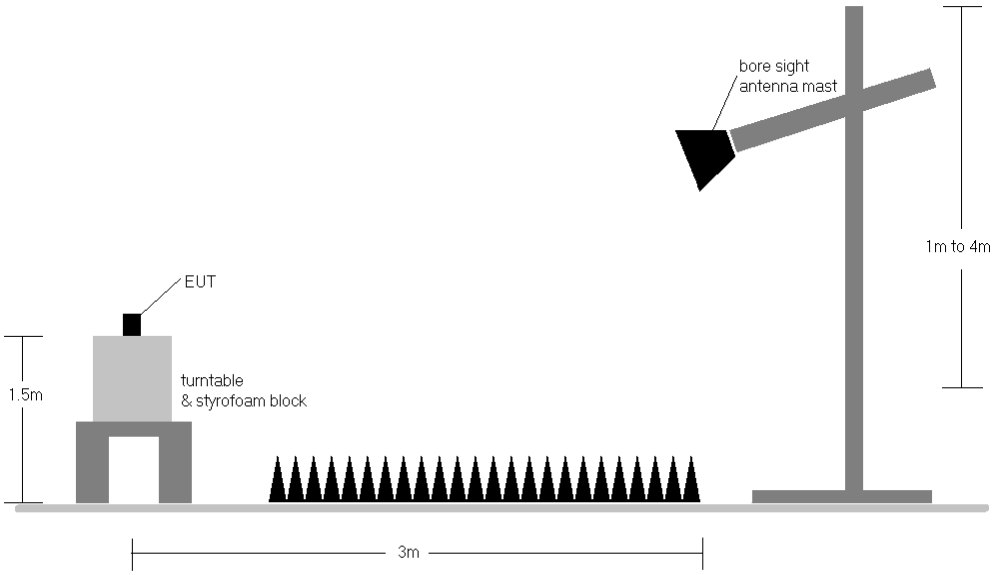

Figure 7-6. Radiated Test Setup >1GHz

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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) The device employs CDMA and 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.

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Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
824.20	GPRS850	H	150	5	30.13	1.50	29.48	38.45	-8.97	31.63	40.61	-8.98
836.60	GPRS850	H	150	4	31.51	1.50	**30.86**	38.45	-7.59	**33.01**	40.61	-7.60
848.80	GPRS850	H	150	5	31.31	1.50	30.66	38.45	-7.79	32.81	40.61	-7.80
836.60	GPRS850	V	150	256	30.81	1.50	30.16	38.45	-8.29	32.31	40.61	-8.30
836.60	EDGE850	H	150	4	24.59	1.50	**23.94**	38.45	-14.51	**26.09**	40.61	-14.52

Table 7-2. ERP/EIRP (Cellular GPRS)

Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
824.70	CDMA850	H	150	15	22.67	1.50	22.02	38.45	-16.43	24.17	40.61	-16.44
836.52	CDMA850	H	150	11	22.91	1.50	22.26	38.45	-16.19	24.41	40.61	-16.20
848.31	CDMA850	H	150	12	23.06	1.50	**22.41**	38.45	-16.04	**24.56**	40.61	-16.05
848.31	CDMA850	V	150	252	22.41	1.50	21.76	38.45	-16.69	23.91	40.61	-16.70

Table 7-3. ERP/EIRP (Cellular CDMA)

Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
826.40	WCDMA850	H	150	15	23.97	1.50	23.32	38.45	-15.13	25.47	40.61	-15.14
836.60	WCDMA850	H	150	12	24.23	1.50	23.58	38.45	-14.87	25.73	40.61	-14.88
846.60	WCDMA850	H	150	11	24.35	1.50	**23.70**	38.45	-14.75	**25.85**	40.61	-14.76
846.60	WCDMA850	V	150	256	23.24	1.50	22.59	38.45	-15.86	24.74	40.61	-15.87

Table 7-4. ERP/EIRP (Cellular WCDMA)

Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
1712.40	WCDMA1700	H	150	12	18.09	5.55	**23.64**	30.00	-6.36
1732.60	WCDMA1700	H	150	16	18.20	5.41	23.61	30.00	-6.39
1752.60	WCDMA1700	H	150	15	18.31	5.27	23.58	30.00	-6.42
1712.40	WCDMA1700	V	150	235	17.22	5.41	22.63	30.00	-7.37

Table 7-5. 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 Limit [dBm]	Margin [dB]
1850.20	GPRS1900	H	150	351	26.12	4.82	30.94	33.01	-2.07
1880.00	GPRS1900	H	150	355	26.33	4.74	**31.07**	33.01	-1.94
1909.80	GPRS1900	H	150	358	25.60	4.68	30.28	33.01	-2.73
1880.00	GPRS1900	V	150	358	25.10	4.74	29.84	33.01	-3.17
1880.00	EDGE1900	H	150	355	21.12	4.74	**25.86**	33.01	-7.15

Table 7-6. 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 Limit [dBm]	Margin [dB]
1851.25	CDMA1900	H	150	351	20.76	4.82	25.58	33.01	-7.43
1880.00	CDMA1900	H	150	355	21.14	4.74	25.88	33.01	-7.13
1908.75	CDMA1900	H	150	358	21.97	4.68	**26.65**	33.01	-6.36
1908.75	CDMA1900	V	150	71	19.46	4.68	24.14	33.01	-8.87

Table 7-7. EIRP (PCS CDMA)

Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
1852.40	WCDMA1900	H	150	355	21.33	4.81	**26.14**	33.01	-6.87
1880.00	WCDMA1900	H	150	358	21.11	4.74	25.85	33.01	-7.16
1907.60	WCDMA1900	H	150	359	21.16	4.68	25.84	33.01	-7.17
1852.40	WCDMA1900	V	150	35	18.75	4.81	23.56	33.01	-9.45

Table 7-8. EIRP (PCS WCDMA)

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7.7 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – 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.

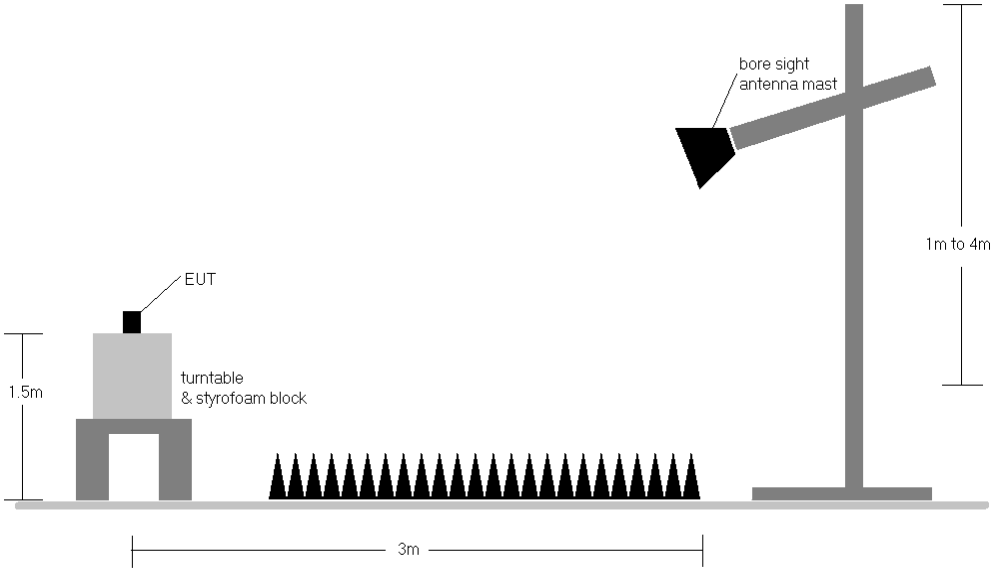

Figure 7-7. Test Instrument & Measurement Setup

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 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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Cellular GPRS Mode

OPERATING FREQUENCY: 824.20 MHz
CHANNEL: 128
MODULATION SIGNAL: GPRS (GMSK)
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1648.40	H	150	359	-46.21	4.81	-41.40	-28.4
2472.60	H	150	201	-51.56	4.99	-46.57	-33.6
3296.80	H	150	222	-48.71	6.24	-42.47	-29.5
4121.00	H	150	101	-55.98	7.57	-48.41	-35.4
4945.20	H	150	129	-53.99	8.37	-45.62	-32.6

Table 7-9. Radiated Spurious Data (Cellular GPRS Mode – Ch. 128)

OPERATING FREQUENCY: 836.60 MHz
CHANNEL: 190
MODULATION SIGNAL: GPRS (GMSK)
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1673.20	H	150	5	-44.98	4.86	-40.12	-27.1
2509.80	H	150	168	-46.82	5.10	-41.72	-28.7
3346.40	H	150	232	-45.76	6.25	-39.51	-26.5
4183.00	H	150	67	-53.94	7.68	-46.27	-33.3
5019.60	H	150	179	-54.70	8.35	-46.35	-33.4
5856.20	H	150	16	-56.16	8.74	-47.42	-34.4

Table 7-10. Radiated Spurious Data (Cellular GPRS Mode – Ch. 190)

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OPERATING FREQUENCY: 848.80 MHz
CHANNEL: 251
MODULATION SIGNAL: GPRS (GMSK)
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1697.60	H	150	7	-43.33	4.91	-38.42	-25.4
2546.40	H	150	207	-46.53	5.28	-41.26	-28.3
3395.20	H	150	10	-47.93	6.39	-41.54	-28.5
4244.00	H	150	168	-54.50	7.75	-46.75	-33.8
5092.80	H	150	41	-56.63	8.41	-48.22	-35.2
5941.60	H	150	82	-54.47	8.76	-45.71	-32.7

Table 7-11. Radiated Spurious Data (Cellular GPRS Mode – Ch. 251)

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Cellular CDMA Mode

OPERATING FREQUENCY: 824.70 MHz
CHANNEL: 1013
MODULATION SIGNAL: CDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1649.40	H	352	13	-72.38	8.95	-63.43	-50.4
2474.10	H	400	334	-65.73	9.65	-56.08	-43.1
3298.80	H	-	-	-73.77	9.58	-64.20	-51.2

Table 7-12. Radiated Spurious Data (Cellular CDMA Mode – Ch. 1013)

OPERATING FREQUENCY: 836.52 MHz
CHANNEL: 384
MODULATION SIGNAL: CDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1673.04	H	-	-	-79.47	8.95	-70.52	-57.5
2509.56	H	166	299	-71.01	9.75	-61.26	-48.3
3346.08	H	-	-	-73.59	9.60	-63.98	-51.0

Table 7-13. Radiated Spurious Data (Cellular CDMA Mode – Ch. 384)

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OPERATING FREQUENCY:	848.31	MHz
CHANNEL:	777	
MODULATION SIGNAL:	CDMA	
DISTANCE:	3	meters
LIMIT:	-13	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1696.62	H	-	-	-78.81	8.95	-69.86	-56.9
2544.93	H	151	358	-75.27	9.74	-65.53	-52.5
3393.24	H	-	-	-73.80	9.77	-64.03	-51.0

Table 7-14. Radiated Spurious Data (Cellular CDMA Mode – Ch. 777)

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Cellular WCDMA Mode

OPERATING FREQUENCY: 826.40 MHz
CHANNEL: 4132
MODULATION SIGNAL: WCDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1652.80	V	310	315	-71.28	8.95	-62.33	-49.3
2479.20	V	119	85	-67.98	9.67	-58.31	-45.3
3305.60	V	-	-	-73.48	9.58	-63.89	-50.9
4132.00	V	-	-	-72.13	10.19	-61.94	-48.9

Table 7-15. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4132)

OPERATING FREQUENCY: 836.60 MHz
CHANNEL: 4183
MODULATION SIGNAL: WCDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1673.20	V	316	309	-72.09	8.95	-63.14	-50.1
2509.80	V	113	83	-65.66	9.75	-55.91	-42.9
3346.40	V	-	-	-72.50	9.60	-62.89	-49.9
4183.00	V	-	-	-73.11	10.35	-62.76	-49.8

Table 7-16. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4183)

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OPERATING FREQUENCY: 846.60 MHz
CHANNEL: 4233
MODULATION SIGNAL: WCDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1693.20	V	312	305	-70.29	8.95	-61.34	-48.3
2539.80	V	111	81	-67.03	9.74	-57.28	-44.3
3386.40	V	-	-	-73.32	9.75	-63.57	-50.6
4233.00	V	-	-	-73.73	10.53	-63.20	-50.2

Table 7-17. Radiated Spurious Data (Cellular WCDMA Mode – Ch. 4233)

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AWS WCDMA Mode

OPERATING FREQUENCY: 1712.40 MHz
CHANNEL: 1312
MODULATION SIGNAL: WCDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3424.80	V	391	0	-72.19	9.83	-62.36	-49.4
5137.20	V	151	225	-63.79	10.69	-53.10	-40.1
6849.60	V	-	-	-70.79	11.64	-59.15	-46.1
8562.00	V	-	-	-66.66	11.14	-55.52	-42.5

Table 7-18. Radiated Spurious Data (AWS WCDMA Mode – Ch. 1312)

OPERATING FREQUENCY: 1732.60 MHz
CHANNEL: 1413
MODULATION SIGNAL: WCDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3465.20	V	397	0	-71.30	9.88	-61.43	-48.4
5197.80	V	155	226	-62.94	10.76	-52.18	-39.2
6930.40	V	-	-	-69.88	11.74	-58.14	-45.1
8663.00	V	-	-	-65.77	11.02	-54.75	-41.8

Table 7-19. Radiated Spurious Data (AWS WCDMA Mode – Ch. 1413)

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OPERATING FREQUENCY:	1752.60	MHz
CHANNEL:	1513	
MODULATION SIGNAL:	WCDMA	
DISTANCE:	3	meters
LIMIT:	-13	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3505.20	V	395	3	-71.94	9.92	-62.02	-49.0
5257.80	V	154	220	-65.52	10.72	-54.81	-41.8
7010.40	V	-	-	-70.56	11.86	-58.70	-45.7

Table 7-20. Radiated Spurious Data (AWS WCDMA Mode – Ch. 1513)

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PCS GPRS Mode

OPERATING FREQUENCY: 1850.20 MHz
CHANNEL: 512
MODULATION SIGNAL: GPRS (GMSK)
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3700.40	V	131	315	-40.14	9.58	-30.56	-17.6
5550.60	V	117	110	-34.71	10.94	-23.77	-10.8
7400.80	V	114	344	-39.95	10.96	-29.00	-16.0
9251.00	V	333	100	-52.84	11.63	-41.21	-28.2
11101.20	V	115	351	-48.02	12.74	-35.28	-22.3
12951.40	V	286	352	-48.87	13.30	-35.57	-22.6
14801.60	V	-	-	-50.88	12.45	-38.43	-25.4

Table 7-21. Radiated Spurious Data (PCS GPRS Mode – Ch. 512)

OPERATING FREQUENCY: 1880.00 MHz
CHANNEL: 661
MODULATION SIGNAL: GPRS (GMSK)
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3760.00	V	111	319	-35.05	9.37	-25.69	-12.7
5640.00	V	112	40	-38.12	11.17	-26.95	-14.0
7520.00	V	375	285	-41.72	11.11	-30.61	-17.6
9400.00	V	306	248	-52.26	11.57	-40.69	-27.7
11280.00	V	307	349	-45.49	12.72	-32.78	-19.8
13160.00	V	394	62	-46.69	13.15	-33.54	-20.5
15040.00	V	-	-	-52.92	13.52	-39.41	-26.4

Table 7-22. Radiated Spurious Data (PCS GPRS Mode – Ch. 661)

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OPERATING FREQUENCY:	1909.80	MHz
CHANNEL:	810	
MODULATION SIGNAL:	GPRS (GMSK)	
DISTANCE:	3	meters
LIMIT:	-13	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3819.60	V	115	317	-32.08	9.30	-22.78	-9.8
5729.40	V	115	308	-39.24	11.39	-27.85	-14.9
7639.20	V	339	196	-43.59	11.33	-32.25	-19.3
9549.00	V	317	247	-49.29	11.79	-37.50	-24.5
11458.80	V	292	270	-46.67	12.82	-33.85	-20.8
13368.60	V	326	63	-44.18	12.78	-31.39	-18.4
15278.40	V	-	-	-55.43	14.90	-40.53	-27.5

Table 7-23. Radiated Spurious Data (PCS GPRS Mode – Ch. 810)

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PCS CDMA Mode

OPERATING FREQUENCY: 1851.25 MHz
CHANNEL: 25
MODULATION SIGNAL: CDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3702.50	H	-	-	-72.35	9.58	-62.77	-49.8
5553.75	H	-	-	-70.98	10.95	-60.03	-47.0

Table 7-24. Radiated Spurious Data (PCS CDMA Mode – Ch. 25)

OPERATING FREQUENCY: 1880.00 MHz
CHANNEL: 600
MODULATION SIGNAL: CDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3760.00	H	130	242	-69.03	9.37	-59.67	-46.7
5640.00	H	111	218	-66.84	11.17	-55.67	-42.7
7520.00	H	-	-	-67.68	11.11	-56.57	-43.6

Table 7-25. Radiated Spurious Data (PCS CDMA Mode – Ch. 600)

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OPERATING FREQUENCY: 1908.75 MHz

CHANNEL: 1175

MODULATION SIGNAL: CDMA

DISTANCE: 3 meters

LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3817.50	H	-	-	-71.66	9.30	-62.36	-49.4
5726.25	H	142	16	-69.43	11.38	-58.05	-45.0
7635.00	H	-	-	-67.25	11.32	-55.93	-42.9

Table 7-26. Radiated Spurious Data (PCS CDMA Mode – Ch. 1175)

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PCS WCDMA Mode

OPERATING FREQUENCY: 1852.40 MHz
CHANNEL: 9262
MODULATION SIGNAL: WCDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3704.80	V	381	190	-71.73	9.57	-62.16	-49.2
5557.20	V	395	351	-67.83	10.95	-56.88	-43.9
7409.60	V	-	-	-68.18	10.96	-57.21	-44.2
9262.00	V	-	-	-67.21	11.63	-55.58	-42.6

Table 7-27. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9262)

OPERATING FREQUENCY: 1880.00 MHz
CHANNEL: 9400
MODULATION SIGNAL: WCDMA
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3760.00	V	384	187	-68.90	9.37	-59.54	-46.5
5640.00	V	398	260	-63.29	11.17	-52.12	-39.1
7520.00	V	-	-	-67.97	11.11	-56.86	-43.9
9400.00	V	-	-	-66.65	11.57	-55.08	-42.1

Table 7-28. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9400)

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OPERATING FREQUENCY: 1907.60 MHz

CHANNEL: 9538

MODULATION SIGNAL: WCDMA

DISTANCE: 3 meters

LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
3815.20	V	-	-	-71.60	9.30	-62.30	-49.3
5722.80	V	-	-	-71.16	11.37	-59.79	-46.8

Table 7-29. Radiated Spurious Data (PCS WCDMA Mode – Ch. 9538)

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7.8 Frequency Stability / Temperature Variation

Test Overview and Limit

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

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

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

For Part 22, RSS-132, and RSS-133, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency. For Part 24, Part 27, and RSS-139, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI/TIA-603-E-2016

Test Settings

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

Test Setup

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

Test Notes

None

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Frequency Stability / Temperature Variation

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)	836,599,983	-17	-0.0000020
100 %		- 30	836,599,934	-66	-0.0000079
100 %		- 20	836,599,789	-211	-0.0000252
100 %		- 10	836,600,221	221	0.0000264
100 %		0	836,600,015	15	0.0000018
100 %		+ 10	836,599,971	-29	-0.0000035
100 %		+ 20	836,599,984	-16	-0.0000019
100 %		+ 30	836,600,232	232	0.0000277
100 %		+ 40	836,600,025	25	0.0000030
100 %		+ 50	836,599,799	-201	-0.0000240
BATT. ENDPOINT	3.40	+ 20	836,600,423	423	0.0000506

Table 7-30. Frequency Stability Data (Cellular GPRS Mode – Ch. 190)

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Frequency Stability / Temperature Variation

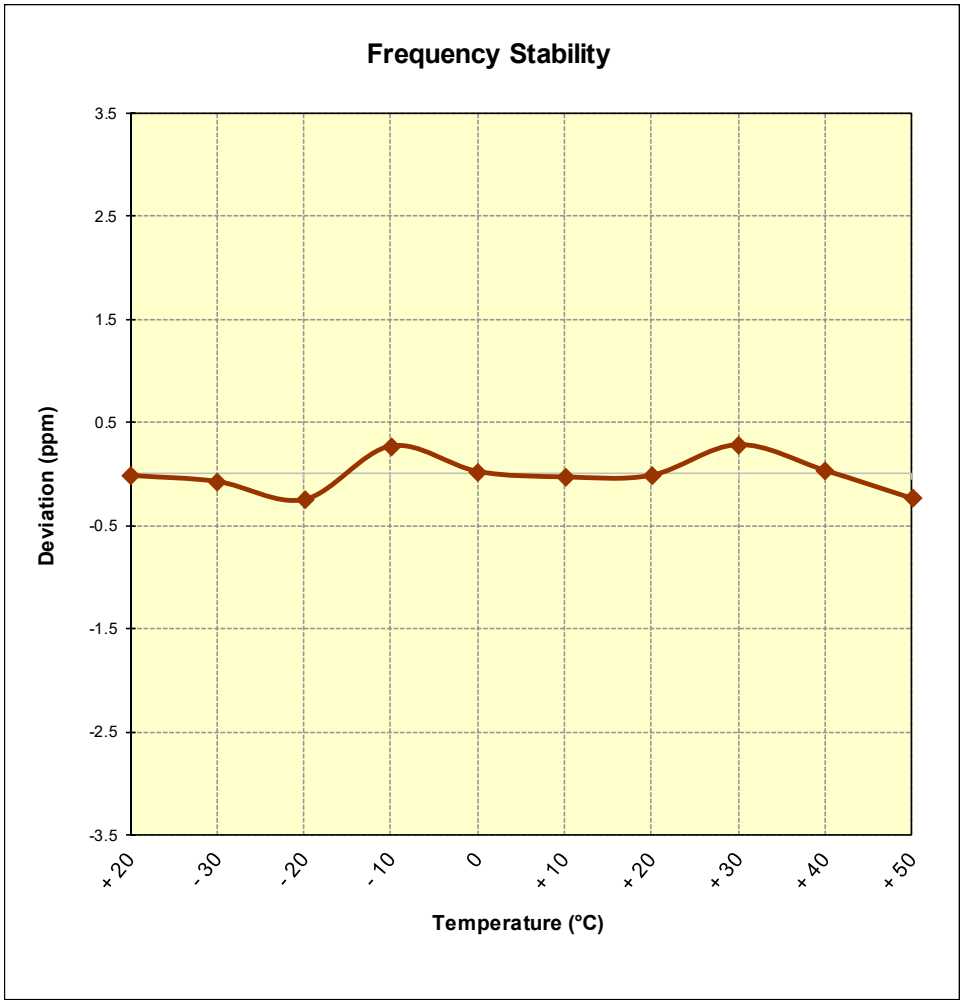

Figure 7-8. Frequency Stability Graph (Cellular GPRS Mode – Ch. 190)

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Frequency Stability / Temperature Variation

OPERATING FREQUENCY:	836,520,000	Hz
CHANNEL:	384	
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)	836,520,292	292	0.0000349
100 %		- 30	836,519,979	-21	-0.0000025
100 %		- 20	836,519,850	-150	-0.0000179
100 %		- 10	836,520,005	5	0.0000006
100 %		0	836,520,103	103	0.0000123
100 %		+ 10	836,520,239	239	0.0000286
100 %		+ 20	836,520,179	179	0.0000214
100 %		+ 30	836,519,933	-67	-0.0000080
100 %		+ 40	836,519,963	-37	-0.0000044
100 %		+ 50	836,520,183	183	0.0000219
BATT. ENDPOINT	3.40	+ 20	836,520,358	358	0.0000428

Table 7-31. Frequency Stability Data (Cellular CDMA Mode – Ch. 384)

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Frequency Stability / Temperature Variation

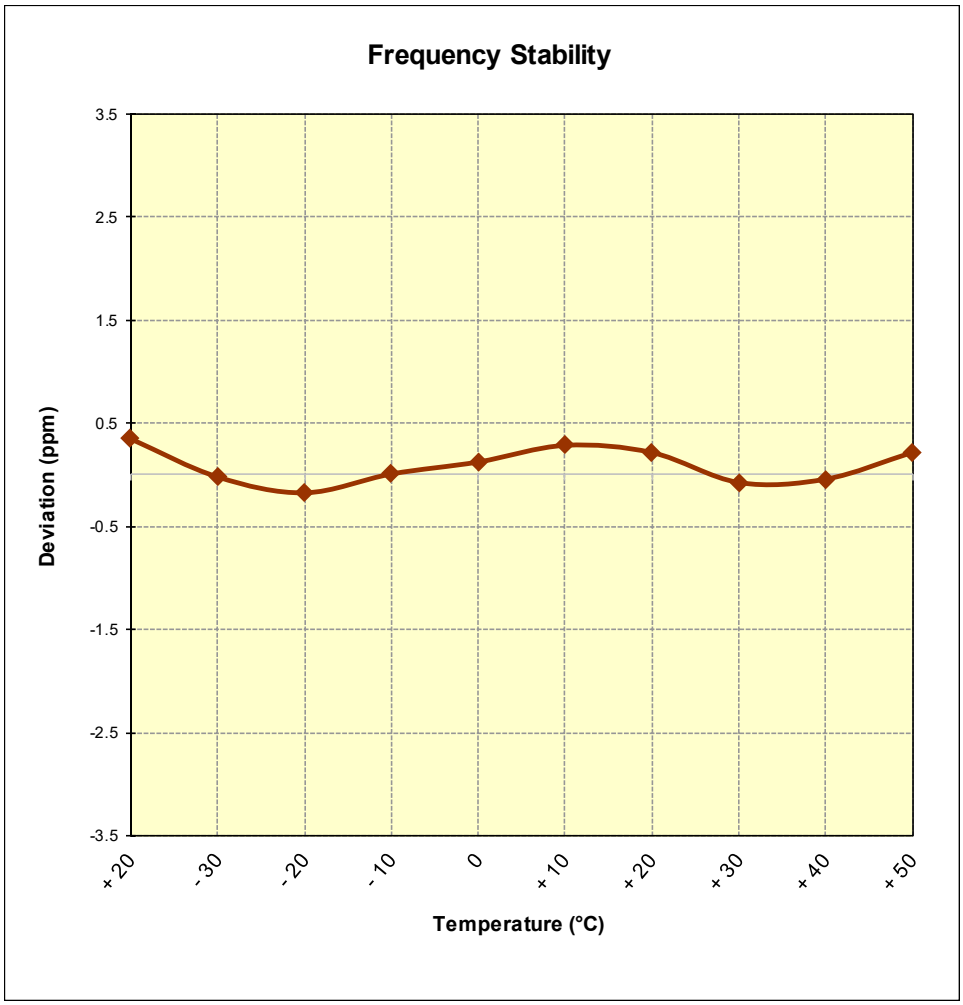

Figure 7-9. Frequency Stability Graph (Cellular CDMA Mode – Ch. 384)

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Frequency Stability / Temperature Variation

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)	836,599,935	-65	-0.0000078
100 %		- 30	836,599,967	-33	-0.0000039
100 %		- 20	836,599,568	-432	-0.0000516
100 %		- 10	836,599,789	-211	-0.0000252
100 %		0	836,599,998	-2	-0.0000002
100 %		+ 10	836,599,753	-247	-0.0000295
100 %		+ 20	836,600,278	278	0.0000332
100 %		+ 30	836,600,049	49	0.0000059
100 %		+ 40	836,599,990	-10	-0.0000012
100 %		+ 50	836,599,744	-256	-0.0000306
BATT. ENDPOINT	3.40	+ 20	836,599,865	-135	-0.0000161

Table 7-32. Frequency Stability Data (Cellular WCDMA Mode – Ch. 4183)

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Frequency Stability / Temperature Variation

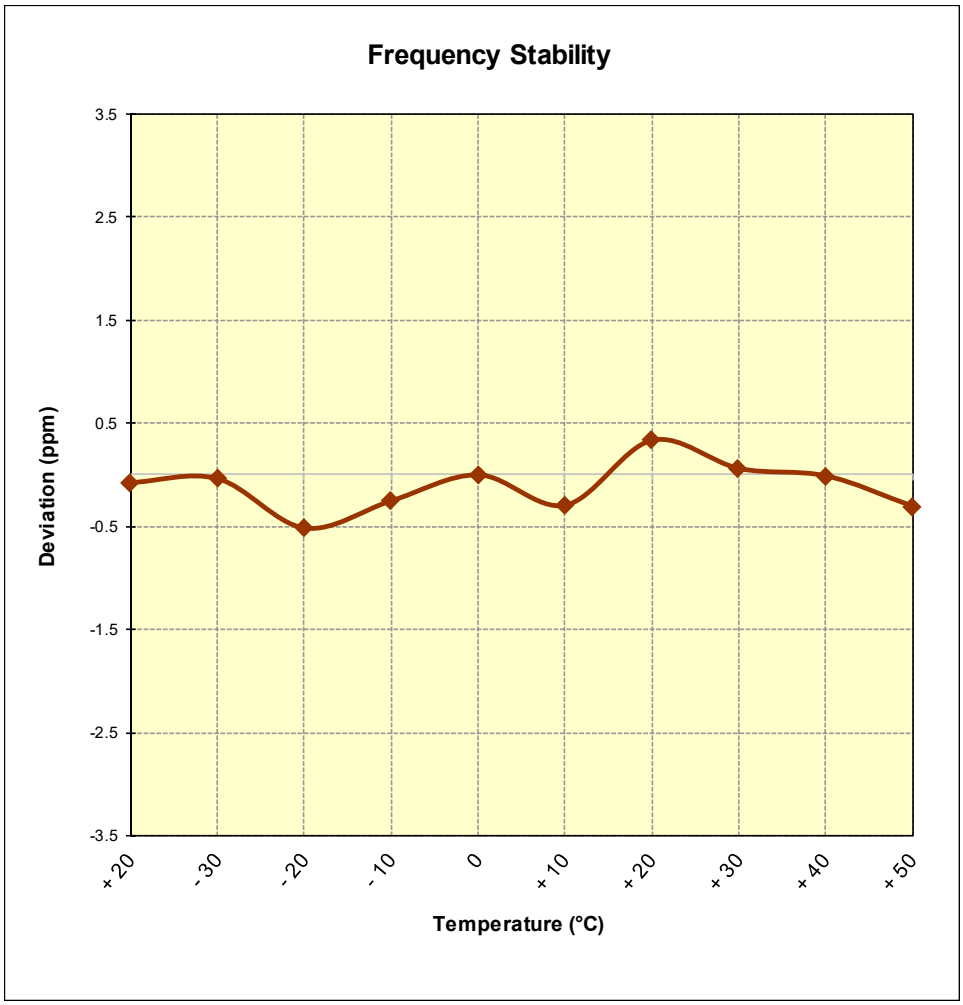

Figure 7-10. Frequency Stability Graph (Cellular WCDMA Mode – Ch. 4183)

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Frequency Stability / Temperature Variation

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)	1,732,599,987	-13	-0.0000008
100 %		- 30	1,732,600,335	335	0.0000193
100 %		- 20	1,732,600,211	211	0.0000122
100 %		- 10	1,732,599,662	-338	-0.0000195
100 %		0	1,732,599,876	-124	-0.0000072
100 %		+ 10	1,732,600,244	244	0.0000141
100 %		+ 20	1,732,599,629	-371	-0.0000214
100 %		+ 30	1,732,599,758	-242	-0.0000140
100 %		+ 40	1,732,599,938	-62	-0.0000036
100 %		+ 50	1,732,600,002	2	0.0000001
BATT. ENDPOINT	3.40	+ 20	1,732,600,086	86	0.0000050

Table 7-33. Frequency Stability Data (AWS WCDMA Mode – Ch. 1413)

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

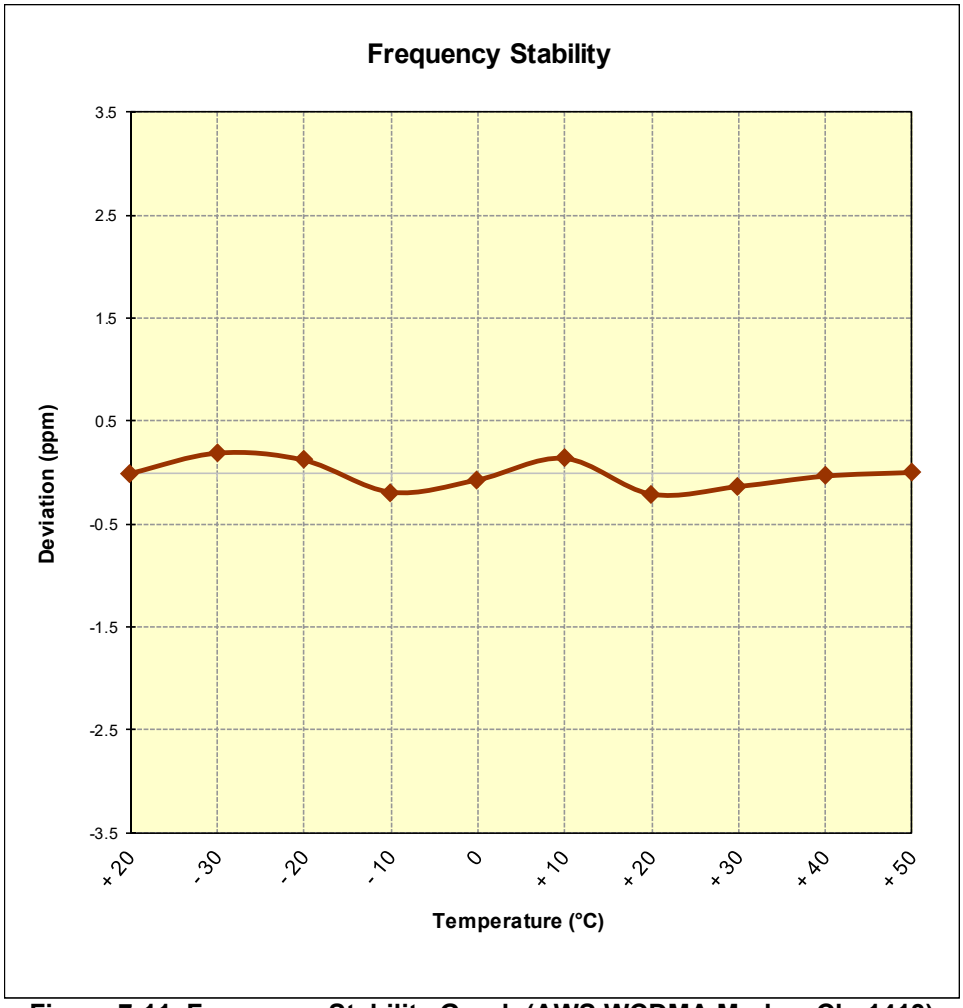

Figure 7-11. Frequency Stability Graph (AWS WCDMA Mode – Ch. 1413)

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Frequency Stability / Temperature Variation

OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	661	
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)	1,879,999,916	-84	-0.0000045
100 %		- 30	1,879,999,845	-155	-0.0000082
100 %		- 20	1,879,999,849	-151	-0.0000080
100 %		- 10	1,880,000,077	77	0.0000041
100 %		0	1,879,999,815	-185	-0.0000098
100 %		+ 10	1,879,999,774	-226	-0.0000120
100 %		+ 20	1,880,000,226	226	0.0000120
100 %		+ 30	1,879,999,516	-484	-0.0000257
100 %		+ 40	1,879,999,816	-184	-0.0000098
100 %		+ 50	1,879,999,992	-8	-0.0000004
BATT. ENDPOINT	3.40	+ 20	1,879,999,673	-327	-0.0000174

Table 7-34. Frequency Stability Data (PCS GPRS Mode – Ch. 661)

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Frequency Stability / Temperature Variation

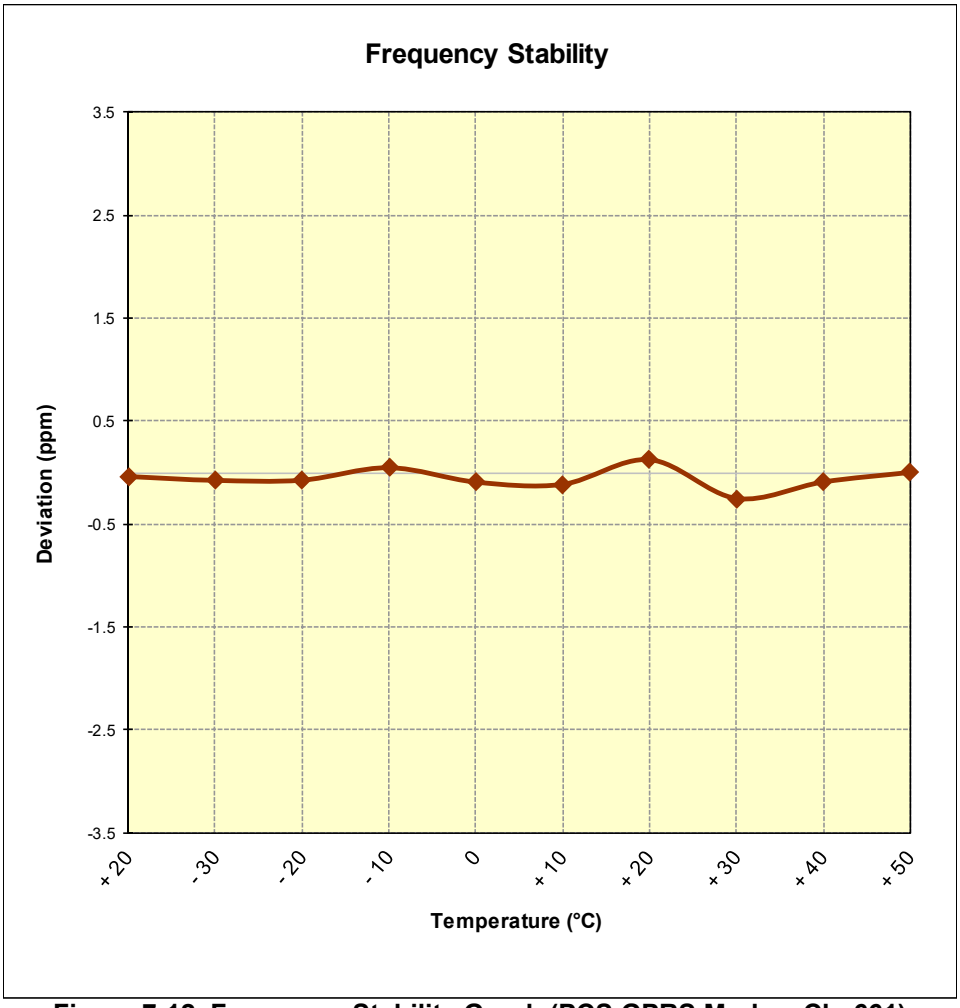

Figure 7-12. Frequency Stability Graph (PCS GPRS Mode – Ch. 661)

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Frequency Stability / Temperature Variation

OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	600	
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)	1,879,999,833	-167	-0.0000089
100 %		- 30	1,879,999,990	-10	-0.0000005
100 %		- 20	1,880,000,222	222	0.0000118
100 %		- 10	1,880,000,018	18	0.0000010
100 %		0	1,880,000,026	26	0.0000014
100 %		+ 10	1,879,999,868	-132	-0.0000070
100 %		+ 20	1,880,000,145	145	0.0000077
100 %		+ 30	1,880,000,173	173	0.0000092
100 %		+ 40	1,879,999,953	-47	-0.0000025
100 %		+ 50	1,879,999,883	-117	-0.0000062
BATT. ENDPOINT	3.40	+ 20	1,879,999,960	-40	-0.0000021

Table 7-35. Frequency Stability Data (PCS CDMA Mode – Ch. 600)

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Frequency Stability / Temperature Variation

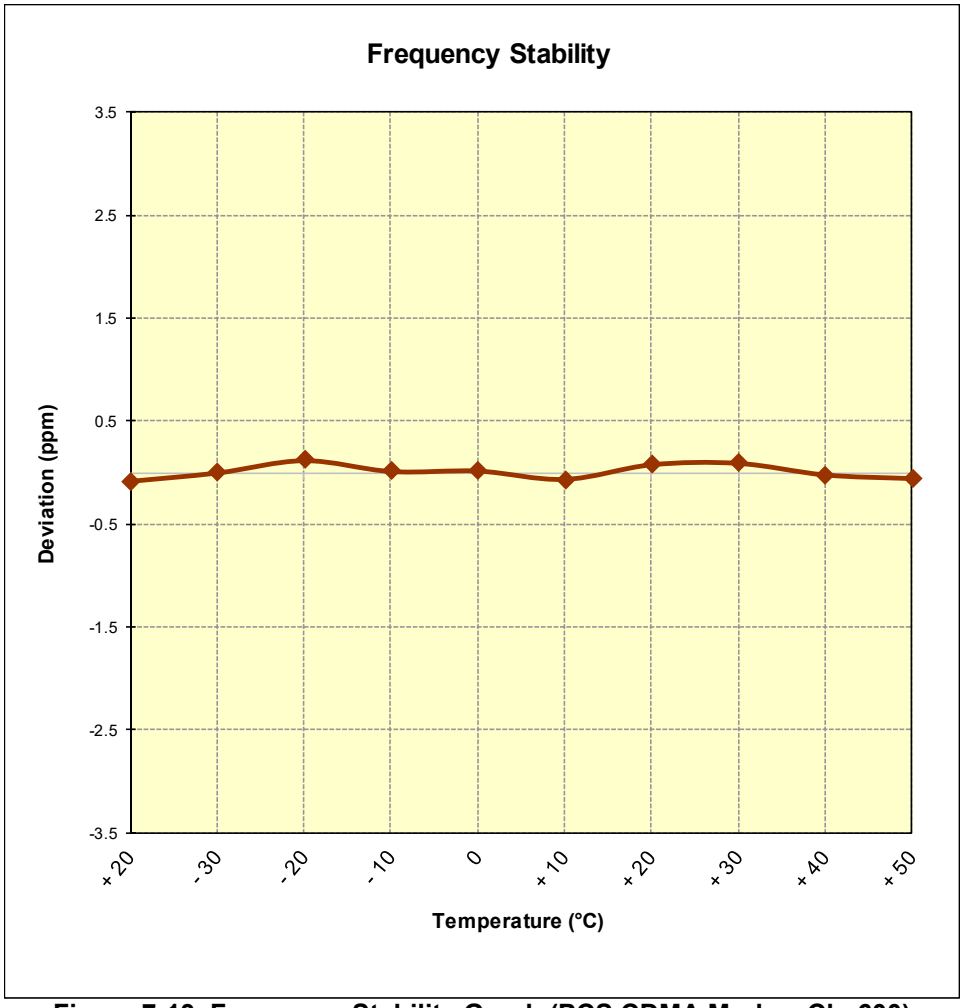

Figure 7-13. Frequency Stability Graph (PCS CDMA Mode – Ch. 600)

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Frequency Stability / Temperature Variation

OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	9400	
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)	1,880,000,021	21	0.0000011
100 %		- 30	1,880,000,002	2	0.0000001
100 %		- 20	1,880,000,052	52	0.0000028
100 %		- 10	1,880,000,069	69	0.0000037
100 %		0	1,879,999,868	-132	-0.0000070
100 %		+ 10	1,880,000,147	147	0.0000078
100 %		+ 20	1,880,000,100	100	0.0000053
100 %		+ 30	1,880,000,029	29	0.0000015
100 %		+ 40	1,880,000,148	148	0.0000079
100 %		+ 50	1,879,999,927	-73	-0.0000039
BATT. ENDPOINT	3.40	+ 20	1,879,999,858	-142	-0.0000076

Table 7-36. Frequency Stability Data (PCS WCDMA Mode – Ch. 9400)

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Frequency Stability / Temperature Variation

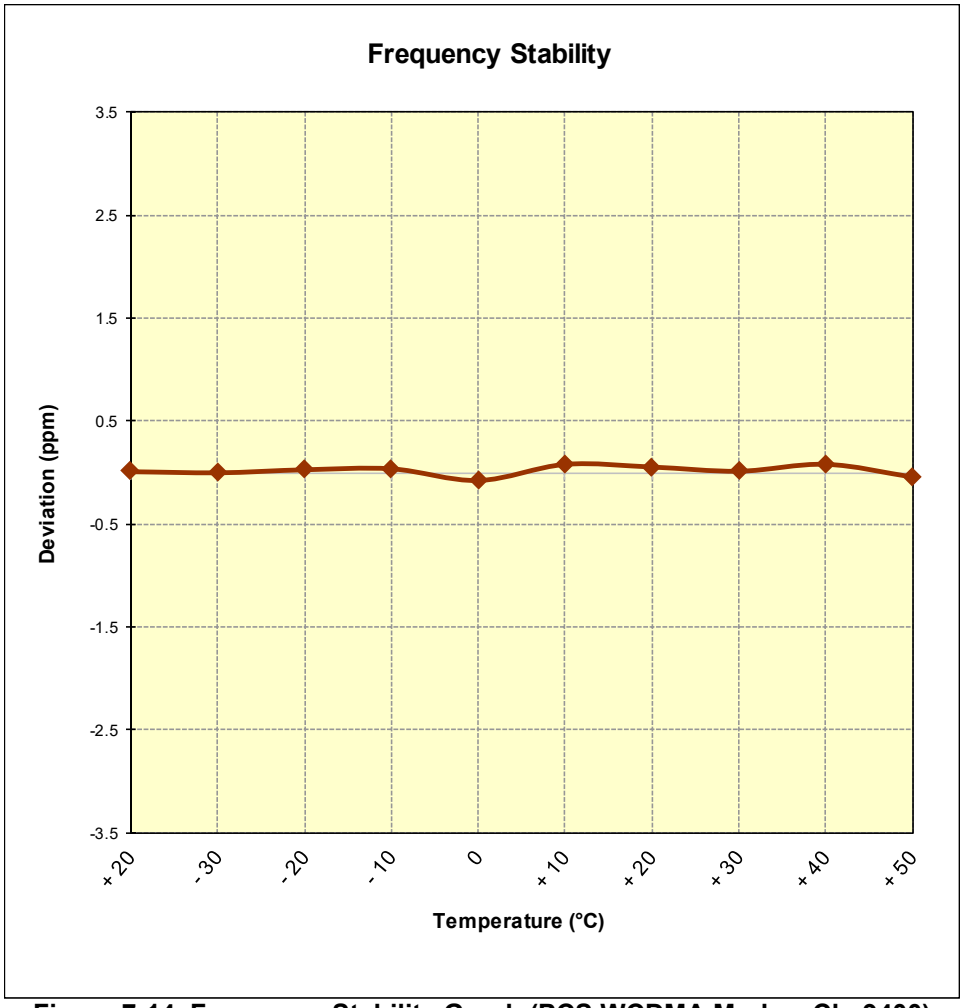

Figure 7-14. Frequency Stability Graph (PCS WCDMA Mode – Ch. 9400)

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8.0 CONCLUSION

The data collected relate only to the items tested and show that the **LG Portable Handset FCC ID: ZNFX410PM** complies with all the requirements of Part 22, 24, & 27 of the FCC Rules.

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