

# **RF TEST REPORT**

:	Cellular/PCS GSM/GPRS/EDGE Phone with Bluetooth and WLAN
:	LG-D160, D160, LGD160
:	DEMC1401-00120
:	2014-01-13
:	2014-01-17 ~ 2014-01-27
:	2014-01-29
:	FCC Original Grant
	: : :

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

Test laboratory : Digital EMC Co., Ltd. 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	§22(H), §24(E)	
Test environment	:	See appended to	est report
Test result	:	🛛 Pass	🗌 Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DIGITAL EMC CO., LTD.

Tested by:

Witnessed by:

Reviewed by:

Engineer JaeJin Lee N/A

**General Manager** Geunki Son

# **Test Report Version**

Test Report No.	Date	Description
DRTFCC1401-0114	Jan. 29, 2013	Initial issue

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## **1. GENERAL INFORMATION**

Applicant Name:	LG Elec	G Electronics MobileComm U.S.A., Inc.					
Address:	1000 Sy	lvan Avenue, Eng	glewood Cliffs NJ 07632				
FCC ID	:	ZNFD160					
FCC Classification	:	Licensed Portable	Transmitter Held to Ear (PCE)				
EUT	:		I/GPRS/EDGE Phone with Bluetooth and WLAN				
Model Name	•	LG-D160					
Add Model Name	:		ame mechanical, electrical and functional. ence is the model name, which are changed purpose.				
Supplying power	:	Standard Battery - Type: Li-ion Bat - M/N: BL-44JR - Rating: DC 3.7	tery V & 1540 mAh / 5.7 Wh				
Antenna Information	:	Internal Antenna - Type: Built-In ty	pe				
Tx Frequency	:	GSM850: GSM1900: EDGE850: EDGE1900:	824.20 ~ 848.80 MHz 1850.20 ~ 1909.80 MHz 824.20 ~ 848.80 MHz 1850.20 ~ 1909.80 MHz				
Rx Frequency	:	GSM850: GSM1900: EDGE850: EDGE1900:	869.20 ~ 893.80 MHz 1930.20 ~ 1989.80 MHz 869.20 ~ 893.80 MHz 1930.20 ~ 1989.80 MHz				
Max. RF Output Pow	er :	GSM850: GSM1900: EDGE850: EDGE1900:	1.002 W ERP(30.01 dBm) 1.174 W EIRP(30.70 dBm) 0.323 W ERP(25.09 dBm) 0.297 W EIRP(24.73 dBm)				
Emission Designato	r(s) :	GSM850: GSM1900: EDGE850: EDGE1900:	245KGXW 248KGXW 248KG7W 246KG7W				

### 2. INTRODUCTION

#### 2.1. EUT DESCRIPTION

The Equipment Under Test(EUT) supports a dual band(Cellular/PCS) with GSM/GPRS/EDGE, Bluetooth and WLAN.

#### 2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

#### 2.3. TEST FACILITY

The 3 & 10m test site and conducted measurement facility used to collect the radiated data are located at the 38, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

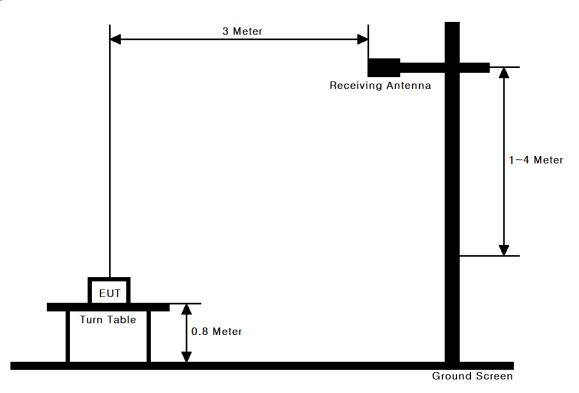
- 3 &10m test site registration Number: 678747

### **3. DESCRIPTION OF TESTS**

#### 3.1 ERP&EIRP

(Effective Radiated Power & Equivalent Isotropic Radiated Power)

#### Test Set-up



#### Test Procedure

These measurements were performed at 3 & 10m test site. The equipment under test is placed on a wooden turntable 0.8-meters above the ground plane and 3-meters from the receive antenna.

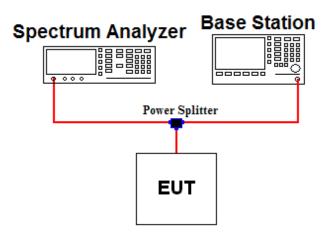
The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading.

For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

### **3.2 PEAK TO AVERAGE RATIO**

#### Test set-up



#### Test Procedure

A peak to average ratio measurement is performed using the following procedure.

#### CCDF Procedure

- 1. Set resolution/measurement bandwidth ≥ signal`s occupied bandwidth
- 2. Set the number of counts to a value that stabilizes the measured CCDF curve
- 3. Set the measurement interval as follows:
  - 1) For continuous transmissions, set to 1 ms
  - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
- 4. Record the maximum PAPR level associated with a probability of 0.1%

#### Alternate Procedure

Use one of the measurement procedures of the peak power and record as  $P_{Pk}$ . Use one of the measurement procedures of the average power and record as  $P_{Avg}$ . Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

PAPR (dB) =  $P_{Pk}$  (dBm) -  $P_{Avg}$  (dBm).

#### - Peak Power Measurement

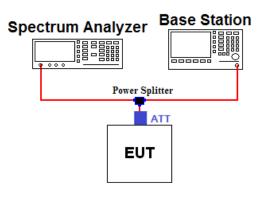
- 1. Set the RBW  $\geq$  OBW
- 2. Set VBW  $\ge$  3 × RBW
- 3. Set span ≥ 2 x RBW
- 4. Sweep time = auto couple
- 5. Detector = peak
- 6. Ensure that the number of measurement points  $\geq$  span/RBW.
- 7. Trace mode = max hold
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the peak amplitude level.

#### - Average Power Measurement

- 1. Set span to at least 1.5 times the OBW.
- 2. Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- 3. Set VBW  $\geq$  3 x RBW.
- 4. Set number of points in sweep  $\geq$  2 × span / RBW.
- 5. Sweep time = auto-couple.
- 6. Detector = RMS (power averaging).
- 7. If the EUT can be configured to transmit continuously (i.e., burst duty cycle ≥ 98%), then set the trigger to free run.
- 8. If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98 %), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.</p>
- 9. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- 10. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

#### 3.3 OCCUPIED BANDWIDTH.

#### Test set-up



#### Offset value information

Frequency (MHz)	Offset Value (dB)	Frequency (MHz)	Offset Value (dB)
824.2	19.12	1850.2	19.77
836.6	19.16	1880.0	19.84
848.8	19.20	1909.8	19.86

Note. 1: The offset values from EUT to Spectrum analyzer were measured and used for test. Offset value = Cable A + Splitter + ATT + Cable B

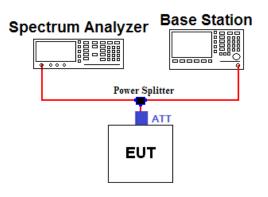
#### Test Procedure

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 of a given emission.

- 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 & VBW  $\ge$  3 X RBW
- 3. Detector = Peak
- 4. Trance mode = Max hold
- 5. Sweep = Auto couple
- 6. The trace was allowed to stabilize
- 7. If necessary, step 2 ~ 7 were repeated after changing the RBW such that it would be within  $1 \sim 5\%$  of the 99% occupied bandwidth observed in step 7.

### 3.4 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL.

#### Test set-up



#### Offset value information

Frequency (MHz)	Offset Value (dB)	Frequency (MHz)	Offset Value (dB)	Frequency (MHz)	Offset Value (dB)
824.0	19.12	1850.0	19.76	5000.0	21.04
849.0	19.21	1910.0	19.86	10000.0	21.69
-	-	-	-	15000.0	22.10
_	-	-	-	20000.0	23.08

Note. 1: The offset value from EUT to Spectrum analyzer was measured and used for test. Offset value = Cable A + Splitter + Cable B

#### Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer.

The EUT was setup to maximum output power at its lowest channel. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic.

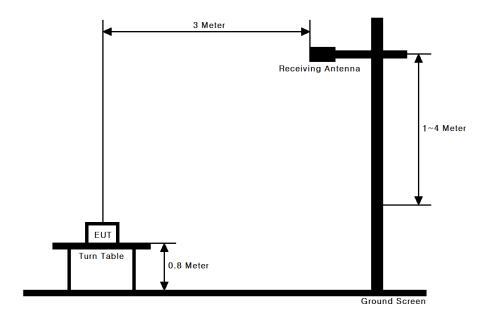
- 1. RBW = 1MHz & VBW  $\ge$  3MHz
- 2. Detector = Positive peak
- 3. Trace mode = Max hold
- 4. Sweep time = Auto
- 5. The trace was allowed to stabilize

The highest, lowest and a middle channel were tested for out of band measurements. The minimum permissible attenuation level of any spurious emission is 43 + log10(P[Watts]), where P is the transmitter power in Watts.

- Note 1: In the 1MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter was employed to measure the out of band Emissions.
- Note 2: Compliance with the applicable limits is based on the use of measurement instrumentation employing a RBW of 100 KHz or greater for Part 22 and 1 MHz or greater for Part 24.

#### 3.5 RADIATED SPURIOUS EMISSIONS

#### Test Set-up



#### Test Procedure

This measurement was performed at 3-meter test range. The equipment under test is placed on a wooden turntable 0.8-meters above the ground plane and 3-meters from the receive antenna.

The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

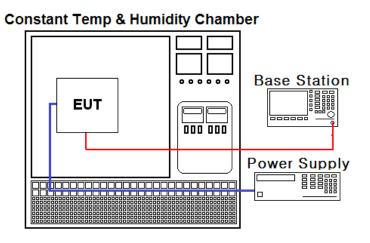
For radiated power measurements below 1GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

For radiated power measurements above 1GHz, a Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. The difference between the gain of the horn and an isotropic antenna are taken into consideration.

This measurement was performed with the EUT oriented in 3 orthogonal axis.

#### 3.6 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

#### Test Set-up



#### Test Procedure

The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from 30 °C to + 50 °C using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.
- Specification the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 0.000 25 %(± 2.5 ppm) of the center frequency.

#### Time Period and Procedure:

- 1. The carrier frequency of the transmitter is measured at room temperature. (25°C to provide a reference).
- 2. The equipment is turned on in a "standby" condition for one minute 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.
- 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.

#### NOTE: The EUT is tested down to the battery endpoint.

## 4. LIST OF TEST EQUIPMENT

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	N9030A	13/10/29	14/10/29	MY53310140
Spectrum Analyzer	Agilent	N9020A	13/03/28	14/03/28	MY50510026
Multimeter	H.P	34401A	13/02/27	14/02/27	3146A13475
DC Power Supply	H.P	6622A	13/02/27	14/02/27	3448A03760
Temp & Humi Test Chamber	SJ Science	TEMI2500	13/10/22	14/10/22	SJ-TH-S50-130930
Power Splitter	Anritsu	K241B	13/10/22	14/10/22	1701099
Attenuator(3dB)	SMAJK	SMAJK-2-3	13/10/22	14/10/22	3
Attenuator(10dB)	SMAJK	SMAJK-50-10	13/10/23	14/10/23	2-50-10
Thermo hygrometer	BODYCOM	BJ5478	13/06/01	14/06/01	120612-2
Dipole Antenna	Schwarzbeck	VHA9103	12/03/12	14/03/12	2116
Dipole Antenna	Schwarzbeck	VHA9103	12/03/22	14/03/22	2117
Dipole Antenna	Schwarzbeck	UHA9105	12/03/12	14/03/12	2261
Dipole Antenna	Schwarzbeck	UHA9105	12/03/22	14/03/22	2262
Bilog Antenna	SCHAFFNER	CBL6112B	12/11/06	14/11/06	2737
HORN ANT	ETS	3115	12/02/20	14/02/20	6419
HORN ANT	ETS	3115	13/02/28	15/02/28	00021097
HORN ANT	A.H.Systems	SAS-574	13/03/20	15/03/20	154
HORN ANT	A.H.Systems	SAS-574	13/05/27	15/05/27	155
Amplifier (22dB)	H.P	8447E	14/01/07	15/01/07	2945A02865
Amplifier (30dB)	Agilent	8449B	13/02/27	14/02/27	3008A00370
High-pass filter	Wainwright	WHKX1.0	13/09/12	14/09/12	9
High-Pass Filter	Wainwright	WHNX2.1	13/09/12	14/09/12	1
8960 Series 10 Wireless Comms Test Set	Agilent	E5515C	13/02/28	14/02/28	GB43461134
Universal Radio Communication Tester	Rohde Schwarz	CMU200	13/02/28	14/02/28	106760
Vector Signal Generator	Rohde Schwarz	SMJ100A	14/01/07	15/01/07	100148
Signal Generator	Rohde Schwarz	SMF100A	13/07/22	14/07/22	102341
Amplifier	EMPOWER	BBS3Q7ELU	13/09/12	14/09/12	1020

### **5. SUMMARY OF TEST RESULTS**

FCC Part Section(s)	RSS Section(s)	Parameter	Status Note 1
2.1046	RSS-132 (4.4) RSS-133 (4.1)	Conducted Output Power	С
22.913(a) 24.232(c)	RSS-132 (4.4) [SRSP-503(5.1.3)] RSS-133 (6.4) [SRSP-510(5.1.2)]	Effective Radiated Power Equivalent Isotropic Radiated Power	С
22.917(a) 24.238(a) 2.1049	RSS-Gen (4.6.1) RSS-133 (2.3)	Occupied Bandwidth	С
22.917(a) 24.238(a) 2.1051	RSS-132 (4.5.1) RSS-133 (6.5.1)	Band Edge Spurious and Harmonic Emissions at Antenna Terminal	С
24.232(d)	RSS-133 (6.4)	Peak to Average Ratio	С
22.917(a) 24.238(a) 2.1053	RSS-132 (4.5.1) RSS-133 (6.5.1)	Radiated Spurious and Harmonic Emissions	С
22.355 24.235 2.1055	RSS-132 (4.3) RSS-133 (6.3)	Frequency Stability	С
Note 1: C=Com	nply NC=Not Comply	NT=Not Tested NA=Not Applicable	

The sample was tested according to the following specification: ANSI/TIA/EIA-603-C-2004 and KDB 971168 D01 v02r01

# 6. SAMPLE CALCULATION

## A. Emission Designator

### **GSM850 Emission Designator**

Emission Designator = 245KGXW GSM OBW = 245.21 kHz (Measured at the 99.75 % power bandwidth) G = Phase Modulation X = Cases not otherwise covered W = Combination (Audio/Data)

### EDGE850 Emission Designator

Emission Designator = 248KG7W GSM OBW = 247.50 kHz (Measured at the 99.75 % power bandwidth) G = Phase Modulation X = Cases not otherwise covered W = Combination (Audio/Data)

### **GSM1900** Emission Designator

Emission Designator = 248KGXW GSM OBW = 247.90 kHz (Measured at the 99.75 % power bandwidth) G = Phase Modulation X = Cases not otherwise covered W = Combination (Audio/Data)

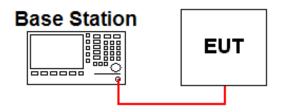
### EDGE1900 Emission Designator

Emission Designator = 246KG7W GSM OBW = 245.87 kHz (Measured at the 99.75 % power bandwidth) G = Phase Modulation X = Cases not otherwise covered W = Combination (Audio/Data)

# 7. TEST DATA

#### 7.1 CONDUCTED OUTPUT POWER

A base station simulator was used to establish communication with the EUT. The base station simulator parameters were set to produce the maximum power from the EUT. This device was tested under all configurations and the highest power is reported. Conducted Output Powers of EUT are reported below.



#### GSM / GPRS / EDGE

Band Channe		hannel Frequency (MHz)	Test Result(dBm)								
	Channel		GSM	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
	128	824.2	32.60	32.60	30.40	28.30	27.40	26.40	25.80	24.80	23.80
Cellular	190	836.6	32.60	32.60	30.40	28.30	27.40	26.50	25.90	24.90	23.80
	251	848.8	32.60	32.60	30.40	28.30	27.40	26.50	25.90	24.90	23.80
	512	1850.2	30.20	30.20	27.10	25.10	23.90	25.00	24.20	23.10	21.90
PCS	661	1880.0	30.20	30.20	27.10	25.10	24.10	25.00	24.30	23.00	21.90
	810	1909.8	30.10	30.10	27.00	25.10	24.10	25.20	24.40	23.20	22.10

The output power was measured using the Agilent E5515C

### 7.2 PEAK TO AVERAGE RATIO

- Plots of the EUT's Peak- to- Average Ratio are shown in Clause 8.1

#### 7.3 OCCUPIED BANDWIDTH

Band	Channel	Frequency (MHz)	Test Result(KHz)
	128	824.2	240.32
GSM850	190	836.6	245.21
	251	848.8	244.69
	512	1850.2	244.49
GSM1900	661	1880.0	247.68
	810	1909.8	247.90
	128	824.2	247.50
EDGE850	190	836.6	242.35
	251	848.8	245.10
	512	1850.2	242.50
EDGE1900	661	1880.0	245.87
	810	1909.8	239.96

- Plots of the EUT's Occupied Bandwidth are shown in Clause 8.2

#### 7.4 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL

- Plots of the EUT's Conducted Spurious Emissions are shown in Clause 8.3

#### 7.5 BAND EDGE

- Plots of the EUT's Band Edge are shown in Clause 8.4

#### 7.6 EFFECTIVE RADIATED POWER

#### - GSM850 data

	EUT	Test Conditions(Power Step: 5)								
Freq.(MHz) CH PC	Position (Axis)	Reading Value (dBm)	Pol. (H/V)	Level at Substitute Antenna Terminal (dBm)	Substitute Antenna Gain (dBd)	ERP (dBm)	ERP (W)	Power Supply	Note.	
824.2 128 CH	х	-4.27	Н	28.44	1.20	29.64	0.920	DC 3.7V	GSM	
836.6 190 CH	x	-5.14	н	28.86	1.15	30.01	1.002	DC 3.7V	GSM	
848.8 251 CH	х	-4.89	н	28.71	1.05	29.76	0.946	DC 3.7V	GSM	
836.6 190 CH	х	-10.06	Н	23.94	1.15	25.09	0.323	DC 3.7V	EDGE	

#### NOTES:

# Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT is placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation is adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For WCDMA signals, a peak detector is used, with RBW = VBW = 5MHz. For AMPS, GSM, and TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz

A half-wave dipole is substituted in place of the EUT. This dipole antenna is driven by a signal generator and the level of the signal generator is adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

This EUT was tested under all configurations and the highest power is reported in GSM mode. The GSM mode using a Power Control Level of "0" in PCS Band and "5" in the Cellular Band. This EUT was tested with the fully charged battery. Also, we have done x, y, z planes in EUT and horizontal and vertical polarization of detecting antenna.

#### 7.7 EQUIVALENT ISOTROPIC RADIATED POWER

#### - GSM1900 data

	EUT			TE	ST CONDITIO	ONS(Power S	tep: 0)		
Freq.(MHz) CH.	EUT Position (Axis)	Reading Value (dBm)	Pol. (H/V)	Level at Substitute Antenna Terminal (dBm)	Substitute Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	Power Supply	Note.
1850.2 512 CH	x	- 5.42	н	22.64	8.06	30.70	1.174	DC 3.7 V	GSM
1880.0 661 CH	х	-7.21	Н	21.38	8.12	29.50	0.891	DC 3.7 V	GSM
1909.8 810 CH	Y	- 9.22	V	21.57	8.18	29.75	0.944	DC 3.7 V	GSM
1850.2 512 CH	х	- 11.39	Н	16.67	8.06	24.73	0.297	DC 3.7 V	EDGE

#### NOTES:

Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT is placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation is adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For WCDMA signals, a peak detector is used, with RBW = VBW = 5MHz. For AMPS, GSM, and TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz.

A half-wave dipole is substituted in place of the EUT. This dipole antenna is driven by a signal generator and the level of the signal generator is adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

This EUT was tested under all configurations and the highest power is reported in GSM mode. The GSM mode using a Power Control Level of "0" in PCS Band and "5" in the Cellular Band. This EUT was tested with the fully charged battery. Also, we have done x, y, z planes in EUT and horizontal and vertical polarization of detecting antenna.

Limit (dBc)

42.64

43.01

42.76

### 7.8 RADIATED SPURIOUS EMISSIONS

Channel (ERP)	<b>Freq.</b> (MHz)	EUT Position (Axis)	POL (H/V)	Level at Substitute Antenna Terminal (dBm)	Substitute Antenna Gain (dBd)	Correct Generator Level (dBm)	Result (dBc)
100	1648.44	Х	Н	-59.69	5.48	-54.21	83.85
128 (0.920 W)	2472.57	Z	Н	-56.21	6.89	-49.32	78.96
(0.920 VV)	-	-	-	-	-	-	-
100	1673.18	Х	Н	-59.28	5.53	-53.75	83.76
190 (1.002 M/)	2509.61	Z	Н	-59.31	6.94	-52.37	82.38
(1.002 W)	-	-	-	-	-	-	-
054	1697.61	Х	Н	-60.14	5.58	-54.56	84.32
251	2546.30	Z	Н	-59.45	7.00	-52.45	82.21
(0.946 W)	-	-	-	-	-	-	-

#### 7.8.1 RADIATED SPURIOUS EMISSIONS (GSM850)

- Limit Calculation= 43 + 10 log<sub>10</sub>( ERP [W] ) [dBc]

- No other spurious and harmonic emissions were reported greater than listed emissions above table.

#### NOTES:

Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT is placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation is adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

This EUT was tested under all configurations and the highest power is reported in GSM mode. The GSM mode using a Power Control Level of "0" in PCS Band and "5" in the Cellular Band. This EUT was tested with the fully charged battery. Also, we have done x, y, z planes in EUT and horizontal and vertical polarization of detecting antenna.

#### 7.8.2 RADIATED SPURIOUS EMISSIONS (GSM1900)

Channel (EIRP)	<b>Freq.</b> (MHz)	EUT Position (Axis)	POL (H/V)	Level at Substitute Antenna Terminal (dBm)	Substitute Antenna Gain (dBi)	Correct Generator Level (dBm)	Result (dBc)	Limit (dBc)
	3700.69	Х	Н	-57.63	9.90	-47.73	78.43	
512	5550.61	Z	Н	-54.52	11.35	-43.17	73.87	43.70
(1.174 W)	7400.65	Z	Н	-52.49	11.64	-40.85	71.55	43.70
	9250.70	Z	Н	-48.67	11.65	-37.02	67.71	
	3760.03	Х	Н	-58.82	9.90	-48.92	78.41	
661	5640.20	Z	Н	-54.96	11.42	-43.54	73.04	40.50
(0.891 W)	7520.17	Z	Н	-50.81	11.59	-39.22	68.72	42.50
	9399.60	Z	Н	-47.72	11.75	-35.97	65.47	
	3819.61	Х	Н	-56.34	9.91	-46.43	76.18	
810	5729.34	Z	Н	-56.42	11.48	-44.94	74.69	40.75
(0.944 W)	7639.82	Z	Н	-52.84	11.54	-41.30	71.05	42.75
	9549.20	Z	Н	-48.95	11.84	-37.11	66.86	

- Limit Calculation = 43 + 10 log<sub>10</sub>( ERP [W] ) [dBc]

- No other spurious and harmonic emissions were reported greater than listed emissions above table.

#### NOTES:

Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT is placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation is adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

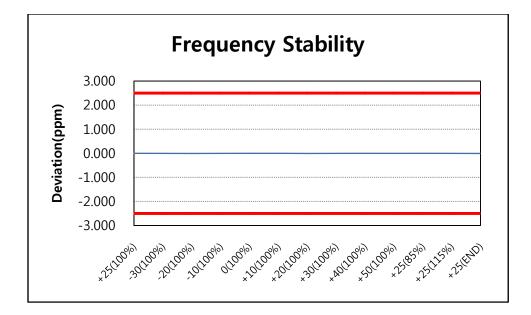
This EUT was tested under all configurations and the highest power is reported in GSM mode. The GSM mode using a Power Control Level of "0" in PCS Band and "5" in the Cellular Band. This EUT was tested with the fully charged battery. Also, we have done x, y, z planes in EUT and horizontal and vertical polarization of detecting antenna.

### 7.9 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

#### 7.9.1 FREQUENCY STABILITY (GSM850)

OPERATING FREQUENCY	:	836,599,992	Hz	
CHANNEL	:	190(Mid)		
REFERENCE VOLTAGE	:	3.700	V DC	
DEVIATION LIMIT	:	± 0.00025	_% or	<u>2.5</u> ppm

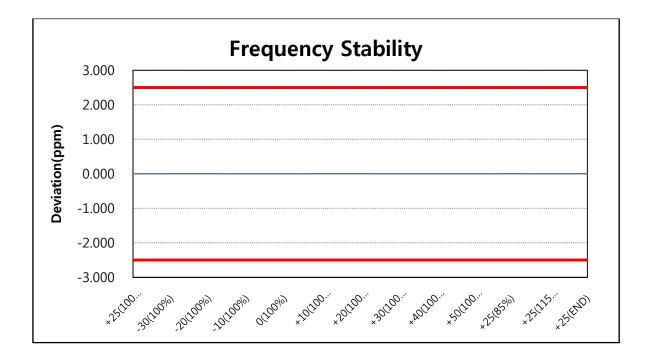
VOLTAGE	POWER	TEMP	FREQ	Dev	viation
(%)	(V DC)	(°C)	(Hz)	(ppm)	(%)
100 %	3.700	+ 25(Ref)	836,599,992	0.000	0.00000000
100 %		- 30	836,599,988	- 0.005	- 0.00000048
100 %		- 20	836,599,987	- 0.006	- 0.0000060
100 %		- 10	836,599,990	- 0.002	- 0.0000024
100 %		0	836,599,993	0.001	0.00000012
100 %		+ 10	836,599,992	0.000	0.00000000
100 %		+ 20	836,599,986	- 0.007	- 0.00000072
100 %		+ 30	836,599,988	- 0.005	- 0.00000048
100 %		+ 40	836,599,991	- 0.001	- 0.00000012
100 %		+ 50	836,599,988	- 0.005	- 0.00000048
85 %	3.145	+ 25	836,599,991	- 0.001	- 0.00000012
115 %	4.255	+ 25	836,599,990	- 0.002	- 0.0000024
BATT.ENDPOINT	2.650	+ 25	836,599,985	- 0.008	- 0.0000084



#### 7.9.2 FREQUENCY STABILITY (GSM1900)

OPERATING FREQUENCY	:	1,879,999,982	Hz			
CHANNEL	:	661(Mid)				
REFERENCE VOLTAGE	:	3.700	V	DC		
DEVIATION LIMIT	:	$\pm0.00025$	_%	or	2.5	_ppm

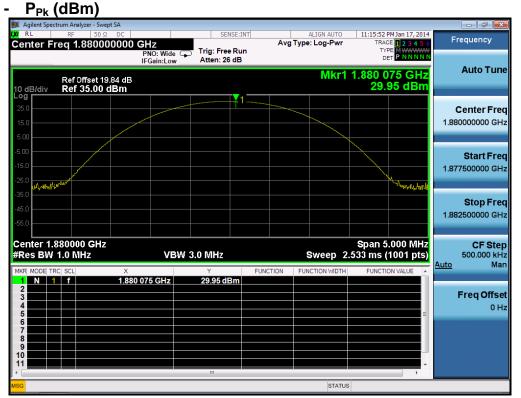
VOLTAGE	POWER	TEMP	FREQ	Dev	riation
(%)	(V DC)	(°C)	(Hz)	(ppm)	(%)
100 %	3.700	+ 25(Ref)	1,879,999,982	0.000	0.00000000
100 %		- 30	1,879,999,988	0.003	0.0000032
100 %		- 20	1,879,999,990	0.004	0.00000043
100 %		- 10	1,879,999,986	0.002	0.00000021
100 %		0	1,879,999,984	0.001	0.00000011
100 %		+ 10	1,879,999,990	0.004	0.00000043
100 %		+ 20	1,879,999,987	0.003	0.00000027
100 %		+ 30	1,879,999,983	0.001	0.00000005
100 %		+ 40	1,879,999,983	0.001	0.00000005
100 %		+ 50	1,879,999,986	0.002	0.00000021
85 %	3.145	+ 25	1,879,999,987	0.003	0.00000027
115 %	4.255	+ 25	1,879,999,984	0.001	0.00000011
BATT.ENDPOINT	2.650	+ 25	1,879,999,988	0.003	0.00000032



GSM1900 & Channel: 661

### 8. TEST PLOTS

#### 8.1 Peak to Average Ratio

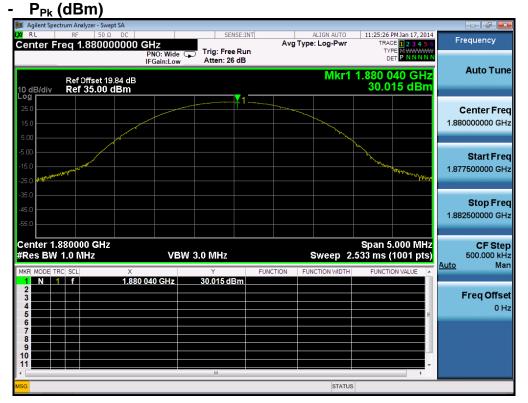


### GSM1900 & Channel: 661



PAPR (dB) =  $P_{Pk}$  (dBm) -  $P_{Avg}$  (dBm) = 29.950 dBm - 29.700 dBm = 0.250 dB

#### EDGE1900 & Channel: 661



### EDGE1900 & Channel: 661



PAPR (dB) =  $P_{Pk}$  (dBm) -  $P_{Avg}$  (dBm) = 30.015 dBm - 25.320 dBm = 4.695 dB

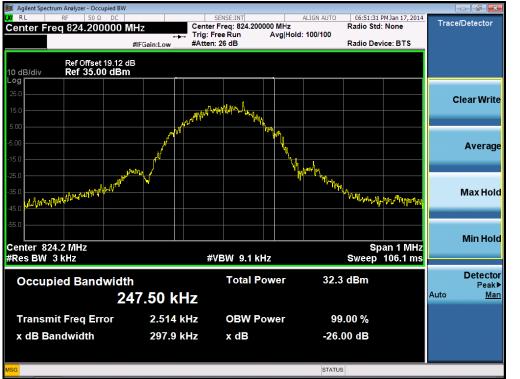
#### 8.2 Occupied Bandwidth 99 % Bandwidth

GSM850 & Channel: 128









#### EDGE 850 & Channel: 128

#### EDGE 850 & Channel: 190





#### EDGE 850 & Channel: 251



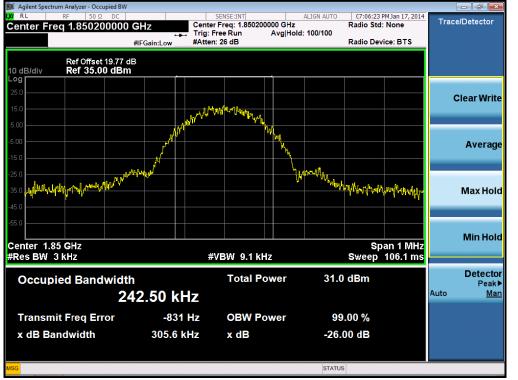
#### GSM 1900 & Channel: 512

#### GSM 1900 & Channel: 661





#### GSM 1900 & Channel: 810



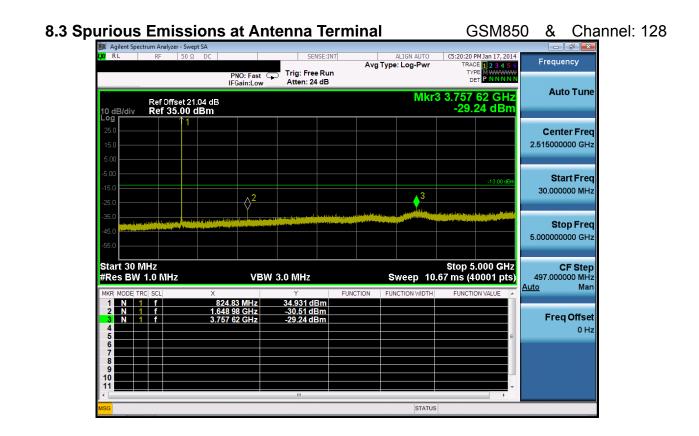
#### EDGE 1900 & Channel: 512

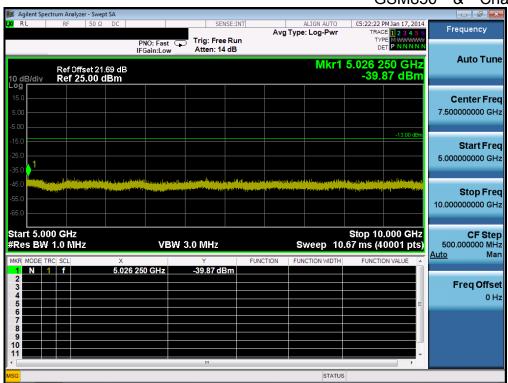
### EDGE 1900 & Channel: 661



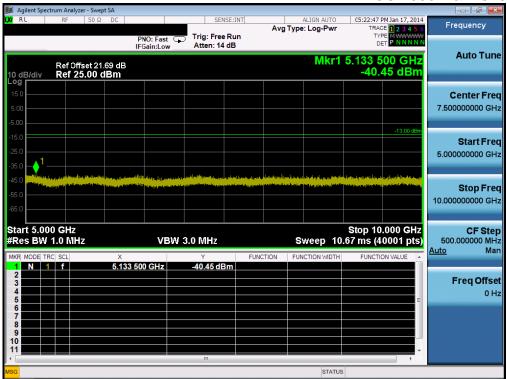


#### EDGE 1900 & Channel: 810

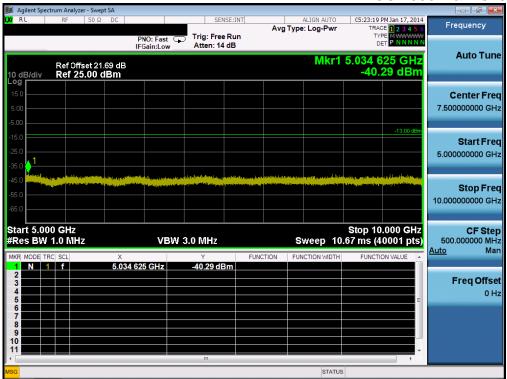




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	trum Analyzer - Swept SA						
RL	RF 50 Ω DC		SENSE:IN		ALIGN AUTO	(5:19:36 PM Jan 17, 2014	Frequency
		PNO: Fast 🖵 IFGain:Low	Trig: Free Run Atten: 24 dB	Avg	Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN	
) dB/div	Ref Offset 21.04 ( Ref 35.00 dBn	dB n			Mkr3	3.745 94 GHz -29.93 dBm	Auto Tune
5.0 <b></b>	<u>1</u>						Center Freq
5.0 <b></b> 00 <b></b>							2.515000000 GHz
						-13.00 dBm	Start Freq
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art 30 N Res BW	1.0 MHz	VBW ( × 837.13 MHz	3.0 MHz	FUNCTION	Sweep 10.	Stop 5.000 GHz 67 ms (40001 pts) FUNCTION VALUE	<b>CF Step</b> 497.000000 MHz <u>Auto</u> Man
2 N 1 3 N 1	f	837.13 MHZ 1.673 83 GHz 3.745 94 GHz	34.873 dBm -30.72 dBm -29.93 dBm				Freq Offset
						E	0 Hz
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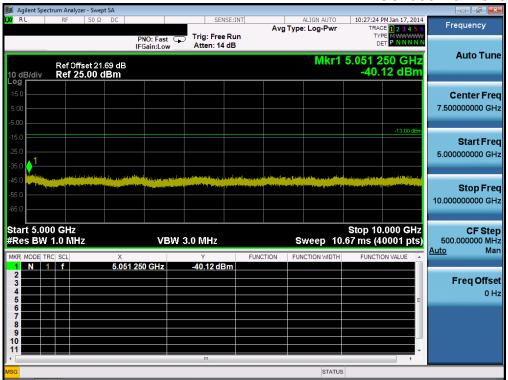


					031003	
Agilent Spectrum Analyzer - Swept	SA					
RL RF 50 Ω	DC	SENSE:II		ALIGN AUTO	05:18:58 PM Jan 17, 2014	Frequency
				Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWWW	riequency
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						Center Freq
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15.0					-13.00 dBm	
				▲3		30.000000 MHz
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tart 30 MHz			I		Stop 5.000 GHz	CF Step
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Rea Day 1.0 Miliz	¥ D	44 J.V 141112		Sweep To.	.07 ms (4000 i pts)	Auto Mar
KR MODE TRC SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mui
1 N 1 f	849.43 MHz	34.941 dBm				
2 N 1 f	1.698 30 GHz	-32.43 dBm				Freq Offset
3 N 1 f	3.725 32 GHz	-29.93 dBm				
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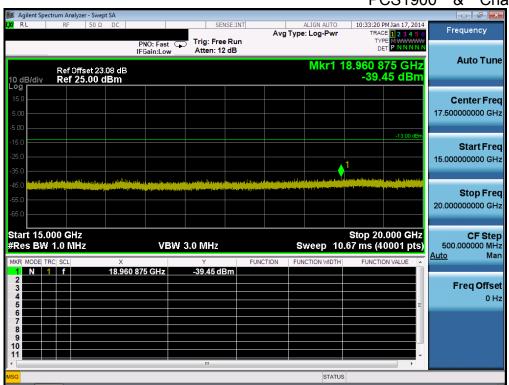
#### SENSE:INT 10:26:27 PM Jan 17, 201 ALIGN AUTO Avg Type: Log-Pwr Frequency TRACE 1 2 3 4 5 Trig: Free Run Atten: 24 dB TYPE PNO: Fast 🖵 IFGain:Low DET Auto Tune Mkr2 3.803 85 GHz -29.66 dBm Ref Offset 21.04 dB Ref 35.00 dBm 0 dB/ **Center Freq** 2.515000000 GHz Start Freq 30.000000 MHz ▲2 Stop Freq 5.00000000 GHz Start 30 MHz #Res BW 1.0 MHz Stop 5.000 GHz Sweep 10.67 ms (40001 pts) CF Step 497.000000 MHz VBW 3.0 MHz <u>Auto</u> Man FUNCTION FUN 1.850 26 GHz 3.803 85 GHz N 1 f N 1 f 31.37 dBm -29.66 dBm **Freq Offset** 3 0 Hz STATUS

### PCS1900 & Channel: 512



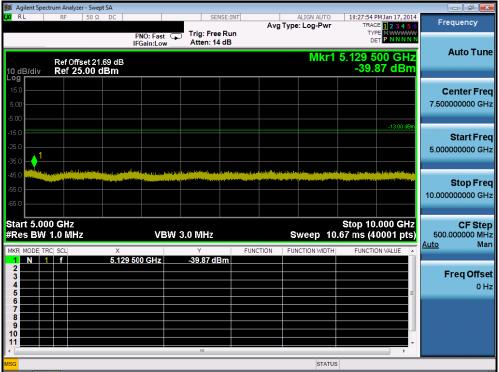
#### SENSE:INT 10:32:23 PM Jan 17, 201 Frequency Avg Type: Log-Pwr TRACE 1 2 3 4 Trig: Free Run Atten: 14 dB TYP PNO: Fast 🖵 IFGain:Low DET Auto Tune Mkr1 14.628 375 GHz -39.72 dBm Ref Offset 22.1 dB Ref 25.00 dBm 0 dB/ **Center Freq** 12.50000000 GHz Start Freq 10.000000000 GHz 1 Stop Freq 15.00000000 GHz Start 10.000 GHz #Res BW 1.0 MHz Stop 15.000 GHz Sweep 10.67 ms (40001 pts) CF Step 500.000000 MHz VBW 3.0 MHz <u>Auto</u> Man FUNCTION FUN 14.628 375 GHz -39.72 dBm N 1 f 2 **Freq Offset** 0 Hz STATUS

### PCS1900 & Channel: 512



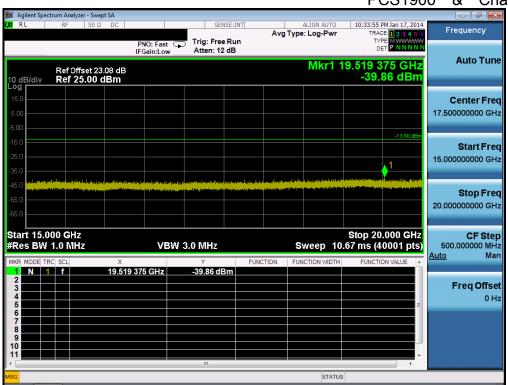
			1 00130	
Agilent Spectrum Analyzer - Swept SA				- ē 💌
RL RF 50 Ω DC	PNO: Fast IFGain:Low Atten: 24 dl	Avg Type: Log-Pwr un	10:25:52 PM Jan 17, 2014 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N	Frequency
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00 5.0 5.0		\$ <sup>2</sup>	-13.00 dBm	Start Free 30.000000 MH
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art 30 MHz Res BW 1.0 MHz	VBW 3.0 MHz	Sweep 10	Stop 5.000 GHz .67 ms (40001 pts)	<b>CF Ste</b> j 497.000000 MH <u>Auto</u> Ma
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6 6 7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9				
	III	STATUS	3	

### PCS1900 & Channel: 661



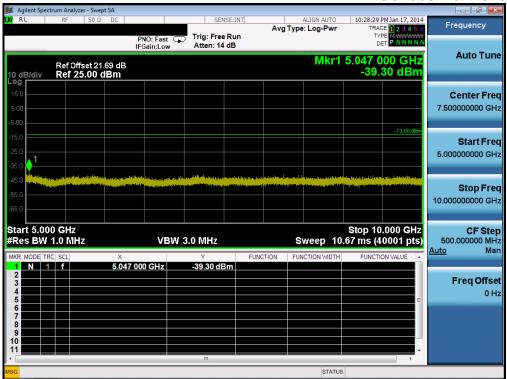
#### SENSE:INT 10:31:53 PM Jan 17, 2014 Frequency Avg Type: Log-Pwr TRACE 1 2 3 4 5 Trig: Free Run Atten: 14 dB TYP PNO: Fast 🖵 IFGain:Low DET Auto Tune Mkr1 14.526 250 GHz -38.88 dBm Ref Offset 22.1 dB Ref 25.00 dBm 0 dB/ **Center Freq** 12.50000000 GHz Start Freq 10.000000000 GHz 1 Stop Freq 15.00000000 GHz Start 10.000 GHz #Res BW 1.0 MHz Stop 15.000 GHz Sweep 10.67 ms (40001 pts) CF Step 500.000000 MHz VBW 3.0 MHz <u>Auto</u> Man FUNCTION FUN 14.526 250 GHz -38.88 dBm N 1 f 2 **Freq Offset** 0 Hz STATUS

### PCS1900 & Channel: 661



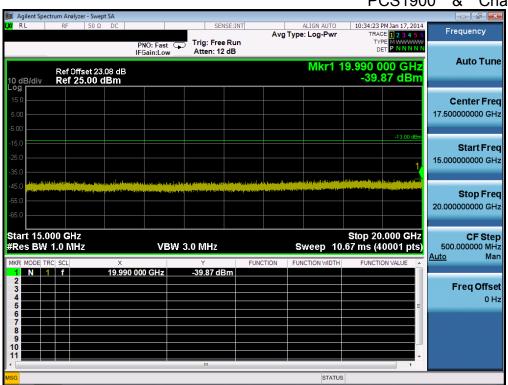
Agilent Spectrum Analyzer - Swept SA       Image: Sense::INT       ALIGN AUTO       10::25::21 PM Jan 17, 2014         RL       RF       5 Ω       DC       SENSE::INT       ALIGN AUTO       10::25::21 PM Jan 17, 2014         PNO: Fast       Trig: Free Run       Avg Type: Log-Pwr       Trace       12::34::55       Frequency         Ref Offset 21.04 dB       Mkr2 3.751 54 GHz       GHz       Center F         25:0       1       -       -       -       -       -       -       Auto Tu         26:0       1       -
Avg Type: Log-Pwr       TRACE       2 3 4 5 6       Frequency         PN0: Fast       Trig: Free Run       Mkr2 3.751 54 GHz       Auto Tr         0 dB/div       Ref Offset 21.04 dB       Mkr2 3.751 54 GHz       Auto Tr         0 dB/div       Ref 35.00 dBm       -29.39 dBm       -29.39 dBm       Center F         250       1       1       1       1       1       1         500       1
PNO: Fast IFGein:Low         Trig: Free Run Atten: 24 dB         Mkr2 3.751 54 GHz -29.39 dBm         Auto Tu           0 dB/div         Ref Offset 21.04 dB         1         2         2         2         2         2         2         2         2         2         2         2         2         30.000000         3
Ref Offset 21.04 dB         MKr2 3.731 54 GHz           0 dB/div         Ref 35.00 dBm         -29.39 dBm           250         -         -         -           250         -         -         -         -           250         -         -         -         -         -           250         -         -         -         -         -         -           250         -         -         -         -         -         -         -         2.515000000 (         -           250         -         -         -         -         -         -         -         -         3.000000 f           250         -         -         -         -         -         -         -         -         3.000000 f           250         -
50       Center F         50
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art 30 MHz Stop 5.000 GHz CF s
50       2       30.000000 r         50       2       30.00000 r         50       2       30.00000 r         50       50
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Res BW 1.0 MHz VBW 3.0 MHz Sweep 10.67 ms (40001 pts) 497.00000 n
RI MODE TRCI SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
N 1 f 1.909 65 GHz 31.440 dBm
2 N 1 f 3.751 54 GHz -29.39 dBm Freq Off
5
3 STATUS

### PCS1900 & Channel: 810



#### SENSE:INT 10:29:30 PM Jan 17, 2014 Avg Type: Log-Pwr Frequency TRACE 1 2 3 4 5 Trig: Free Run Atten: 14 dB TYP PNO: Fast 🖵 IFGain:Low DET Auto Tune Mkr1 14.814 625 GHz -39.48 dBm Ref Offset 22.1 dB Ref 25.00 dBm 0 dB/ **Center Freq** 12.50000000 GHz Start Freq 10.000000000 GHz Stop Freq 15.00000000 GHz Start 10.000 GHz #Res BW 1.0 MHz Stop 15.000 GHz Sweep 10.67 ms (40001 pts) CF Step 500.000000 MHz VBW 3.0 MHz <u>Auto</u> Man FUNCTION FUN 14.814 625 GHz -39.48 dBm N 1 f 2 **Freq Offset** 0 Hz 11 Alignment Completed STATUS

### PCS1900 & Channel: 810



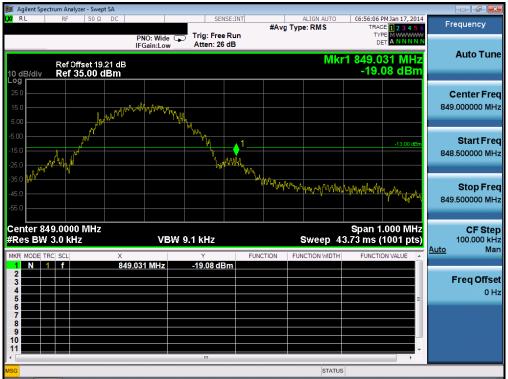


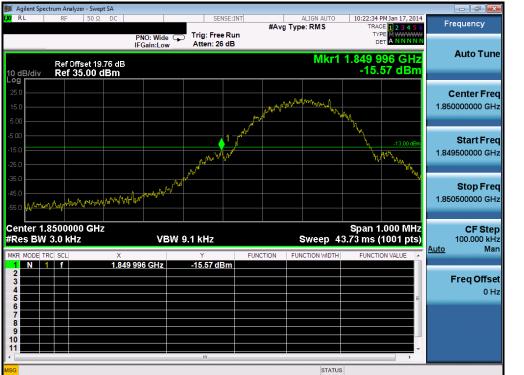


#### 📕 Agilent Spectrum Analyzer - Swept SA 🗶 RL RF 50 Ω D SENSE:INT 06:57:19 PM Jan 17, 2014 ALIGN AUTO #Avg Type: RMS Frequency TRACE 1 2 3 4 Trig: Free Run Atten: 26 dB TYPE PNO: Wide 😱 IFGain:Low DET Auto Tune Mkr1 823.990 MHz -20.86 dBm Ref Offset 19.12 dB Ref 35.00 dBm 0 dBi **Center Freq** 824.000000 MHz V~Uvr NW Start Freq 823.500000 MHz 1 pr wythey Stop Freq wymy - John Mar Mi 824.500000 MHz Center 824.0000 MHz #Res BW 3.0 kHz Span 1.000 MHz Sweep 43.73 ms (1001 pts) CF Step 100.000 kHz VBW 9.1 kHz <u>Auto</u> Man FUN 823.990 MHz -20.86 dBm Ν Freq Offset 0 Hz STATUS

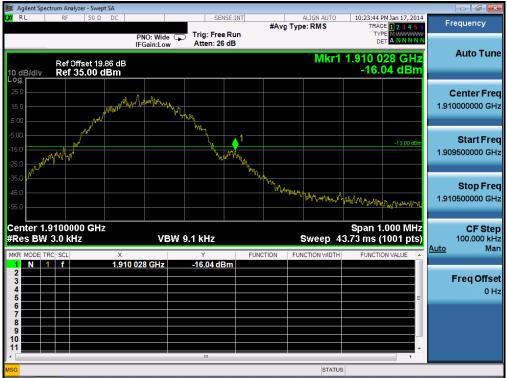
### EDGE 850 & Channel: 128

### EDGE 850 & Channel: 251





### PCS1900 & Channel: 512



#### 📕 Agilent Spectrum Analyzer - Swept SA 🗶 RL RF 50 Ω D SENSE:INT 07:02:51 PM Jan 17, 2014 ALIGN AUTO #Avg Type: RMS Frequency CE 1 2 3 4 Trig: Free Run Atten: 26 dB TYP PNO: Wide 😱 IFGain:Low DE Auto Tune Mkr1 1.849 969 GHz -22.12 dBm Ref Offset 19.76 dB Ref 35.00 dBm 0 dB/ **Center Freq** 1.850000000 GHz Mary Way When the way Start Freq 1.849500000 GHz Wm lut wanyory and When markinghan Stop Freq 1.850500000 GHz Center 1.8500000 GHz #Res BW 3.0 kHz Span 1.000 MHz Sweep 43.73 ms (1001 pts) CF Step 100.000 kHz VBW 9.1 kHz <u>Auto</u> Man FUN 1.849 969 GHz -22.12 dBm N 1 f Freq Offset 0 Hz STATUS

### EDGE 1900 & Channel: 512

### EDGE 1900 & Channel: 810

