



## HCT. CO., LTD.

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### CERTIFICATE OF COMPLIANCE (ERM EVALUATION)

**Manufacture: GS Instruments Co., Ltd.**

1385-14, Juan-Dong, Nam-Ku, Incheon,,402-200 Korea

**Date of Issue : November 10, 2008**

**Test Report No.: HCT-R08-205**

**Test Site: HCT CO., LTD.**

**FCC ID :**

**U88-COVERCELL25K**

**APPLICANT :**

**GS Instruments Co., Ltd.**

**EUT Type:** In-Building RF Repeater

**MODEL :** CoverCell25K

**Frequency Ranges:** Uplink : 1850 - 1910 MHz (PCS)

824 – 849 MHz (Cellular)

Downlink : 1930 - 1990 MHz (PCS)

869 – 894 MHz (Cellular)

**RF Output Power:** Downlink : 19.5 dBm (PCS), 16.5 dBm (Cellular)

Uplink : 6.5 dBm (PCS), 11.5 dBm (Cellular)

**FCC Rules Part(s):** Title 47 of CFR, Part 22 Subpart H (PCS)

Part 24 Subpart E (Cellular)

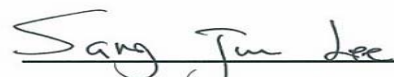
#### Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 Subpart E of the FCC Rules under normal use and maintenance.



Report prepared by : Chang-Seok Choi

Engineer of RF Tech. Part



Report prepared by : Sang-Jun Lee

Manager of RF Tech. Part

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## 1. CLIENT INFORMATION

The EUT has been tested by request of

Company	GS Instruments Co., Ltd
Contact Point	1385-14, Juan-Dong, Nam-Ku, Incheon,,402-200 Korea

- EUT Type: In-Building RF Repeater
- FCC ID: U88-COVERCELL25K
- Frequency Ranges: Uplink : 1850 - 1910 MHz (PCS)  
824 – 849 MHz (Cellular)  
Downlink : 1930 - 1990 MHz (PCS)  
869 – 894 MHz (Cellular)
- RF Output Power: Downlink : 19.5 dBm (PCS), 16.5 dBm (Cellular)  
Uplink : 6.5 dBm (PCS), 11.5 dBm (Cellular)
- FCC Rules Part(s): Title 47 of CFR, Part 22 Subpart H (PCS)  
Part 24 Subpart E (Cellular)
- Emission Designators: F9W
- Modulation : QPSK

## 2. TEST SPECIFICATIONS

### 2.1 Standards

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance With  
**Part 22 Subpart H, Part 24 Subpart E.**

Reference	Description	Results
§2.1046; §22.913, §24.232	RF Power Output	Compliant
§2.1047	Modulation Characteristics	N/A
§2.1049	Occupied Bandwidth	Compliant
§2.1051, §22.917, §24.238	Spurious Emissions at Antenna Terminals	Compliant
§2.1053, §22.917, §24.238	Radiated Spurious Emissions	Compliant
§2.1055; §22.355, §24.235	Frequency Stability	N/A

### 3. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	+ 15 °C to + 35 °C
Relative humidity:	30 % to 60 %
Air pressure	860 mbar to 1060 mbar

## 4. TEST EQUIPMENT

Manufacturer	Model / Equipment	Cal Interval	Calibration Due	Serial No.
Agilent	E4438C /Signal Generator	Annual	01/22/2009	MY42082646
Agilent	E4416A /Power Meter	Annual	01/22/2009	GB41291412
WEINSCHL	67-30-33/ATTENUATOR	Annual	05/02/2009	BR0530
Agilent	E7405A /EMC Analyzer	Annual	12/29/2008	US40240290
Schwarzbeck	VULB 9160/ TRILOG Antenna	Annual	01/24/2009	9160-3150
HD	MA240/ Antenna Position Tower	N/A	N/A	556
EMCO	1050/ Turn Table	N/A	N/A	114
HD GmbH	HD 100/ Controller	N/A	N/A	13
HD GmbH	KMS 560/ SlideBar	N/A	N/A	12
MITEQ	AMF-60-0010 1800-35-20P	Annual	01/24/2009	1200937
MITEQ	AMF-6D-01180-35-20P	Annual	02/24/2009	990893
Schwarzbeck	BBHA 9120D/ Horn Antenna	Annual	03/30/2009	147
Schwarzbeck	BBHA 9120D/ Horn Antenna	Annual	03/30/2009	296
Schwarzbeck	BBHA9170/SHF-EHF Horn Antenna	Annual	03/20/2009	BBHA9170342
Agilent	E4440A/Spectrum Analyzer	Annual	01/18/2009	US45303008

## 5. RF OUTPUT POWER

### 5.1 Test Procedure

#### Test Requirements:

##### **§ 2.1046 Measurements required: RF power output:**

**§ 2.1046 (a)** For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

**§ 2.1046 (b)** For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

**§ 2.1046 (c)** For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

##### **§ 22.913 Effective radiated power limits.**

The effective radiated power (ERP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

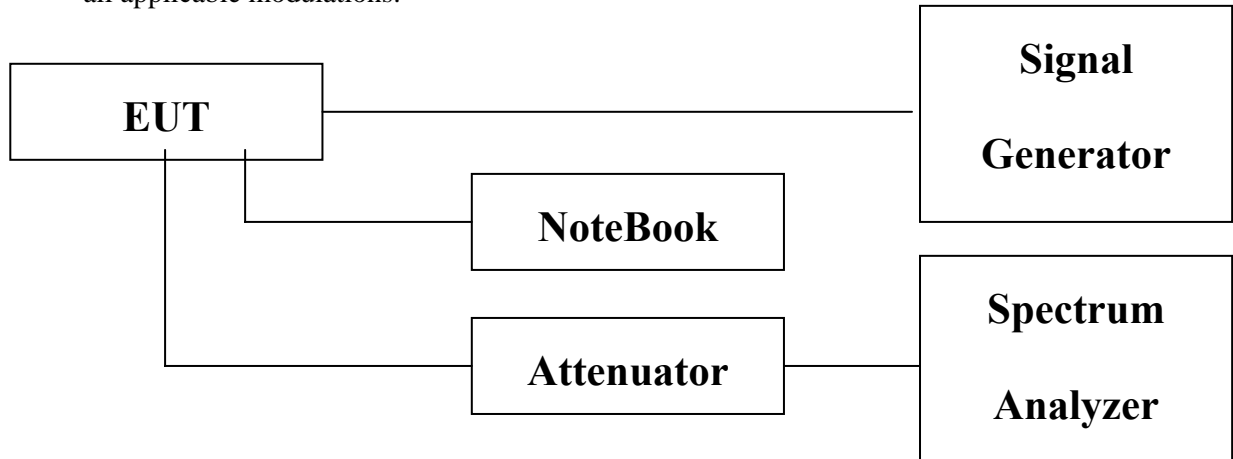
(a) Maximum ERP. In general, the effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts.

##### **§ 24.232 Power and antenna height limits.**

(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

**Test Procedures:**

As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer or power meter. This test was performed in all applicable modulations.



**Block Diagram 1. RF Power Output Test Setup**



## 5.2 Test Results

(Cellular)

CARRIER CHANNEL	DOWNLINK		UPLINK	
	Frequency (MHz)	Measured Power (dBm)	Frequency (MHz)	Measured Power (dBm)
Low	869.7	16.50	824.7	11.28
Mid	881.5	16.47	836.5	11.38
High	893.3	16.27	848.3	11.23

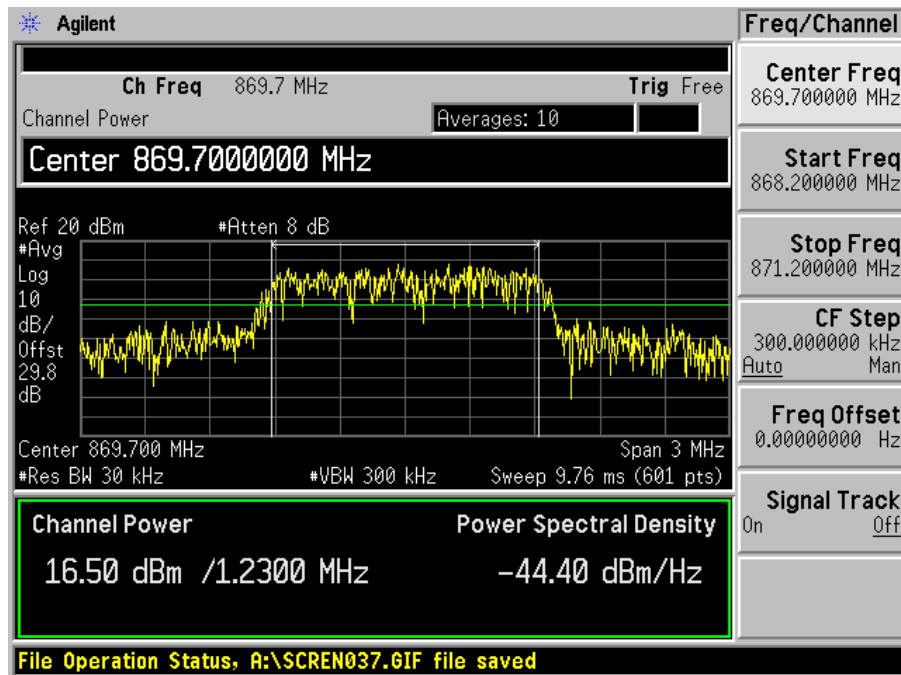
INPUT SIGNAL	DOWNLINK	UPLINK
Source	Real-time CDMA Forward	Real-time CDMA Reverse
Power Level	- 48.5 dBm	- 55 dBm
Amplitude offset	29.8 dB	29.8 dB

(PCS)

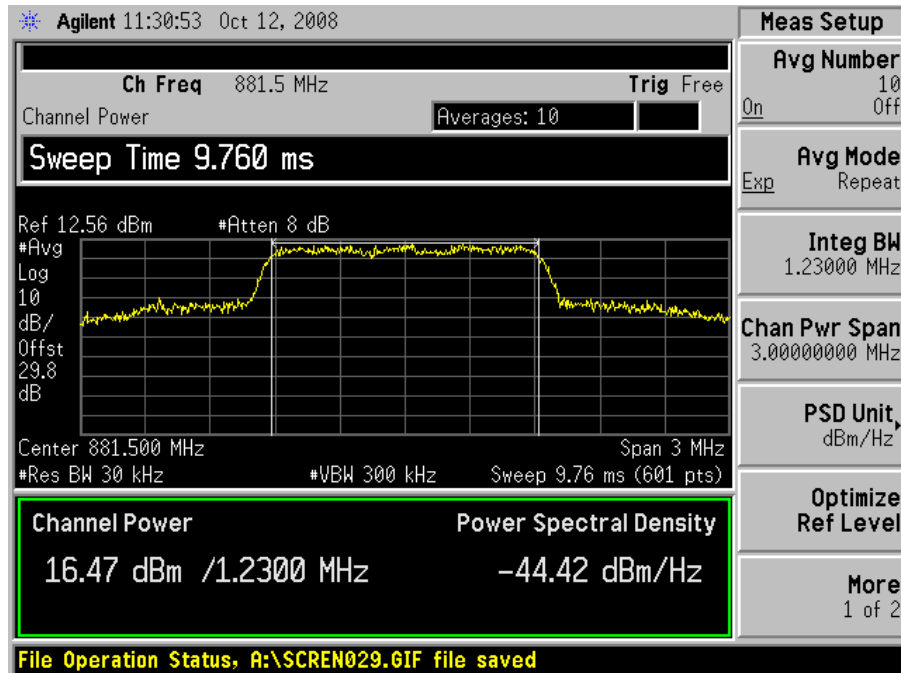
CARRIER CHANNEL	DOWNLINK		UPLINK	
	Frequency (MHz)	Measured Power (dBm)	Frequency (MHz)	Measured Power (dBm)
Low	1931.25	19.34	1851.25	6.44
Mid	1960.00	19.32	1880.00	6.23
High	1988.75	19.30	1908.75	6.45

INPUT SIGNAL	DOWNLINK	UPLINK
Source	Real-time CDMA Forward	Real-time CDMA Reverse
Power Level	- 63.5 dBm	- 41 dBm
Amplitude offset	31.2 dB	31.2 dB

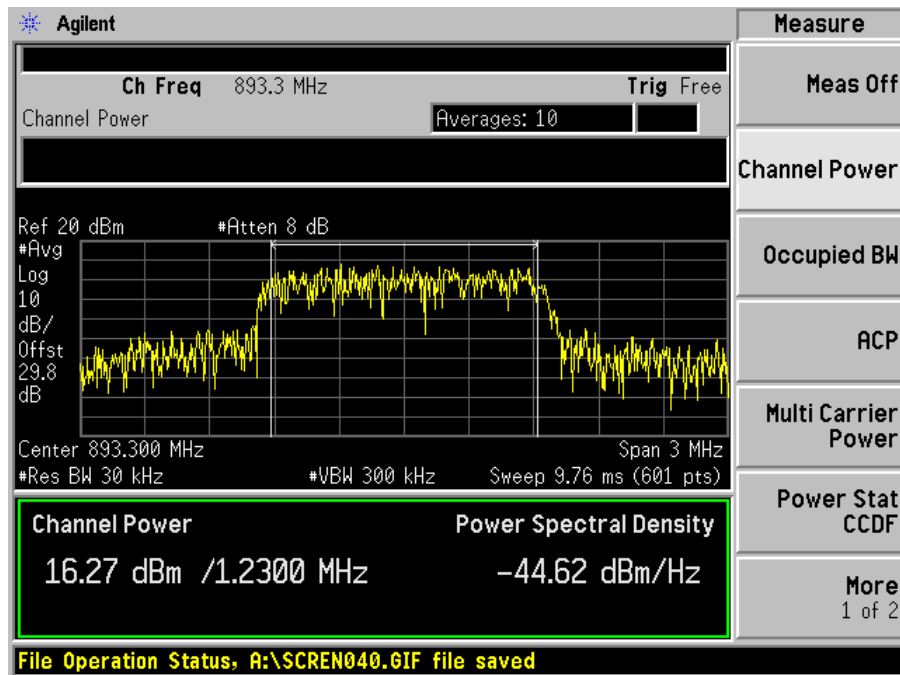
## Plots of RF Output Power



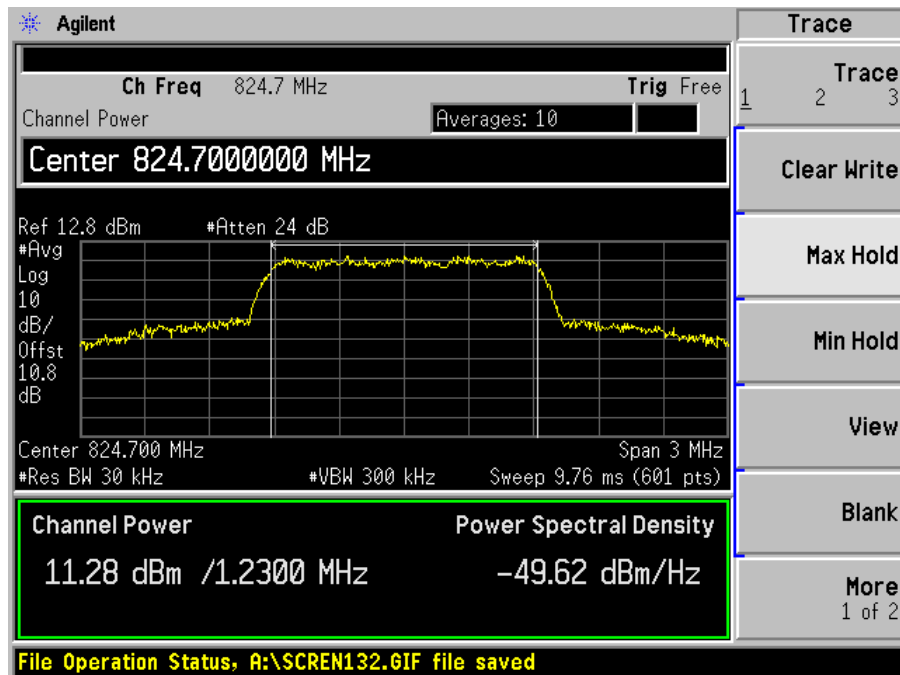
Downlink Low CH (Cellular)



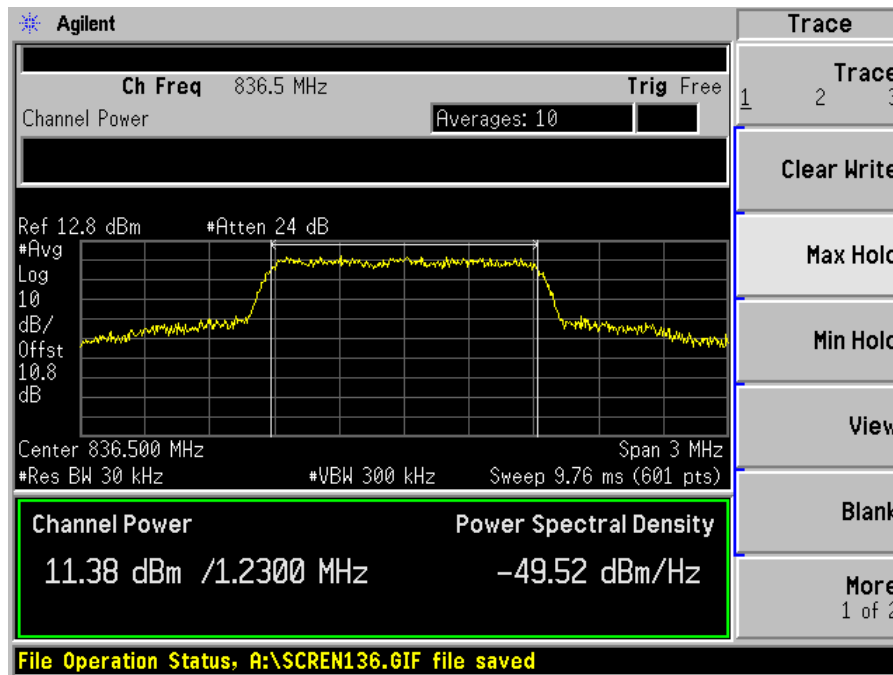
Downlink Middle CH (Cellular)



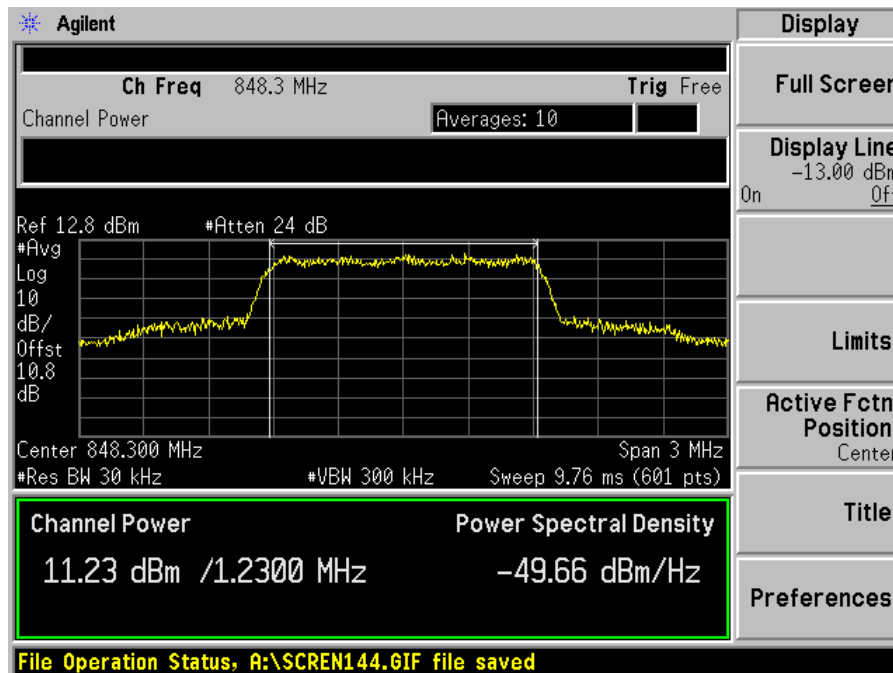
Downlink High CH (Cellular)



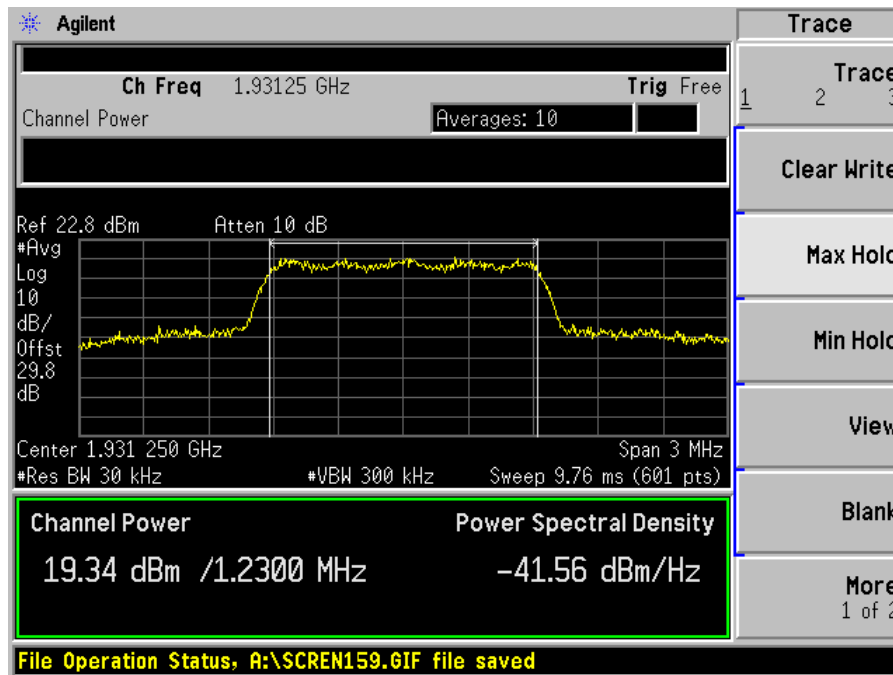
Uplink Low CH (Cellular)



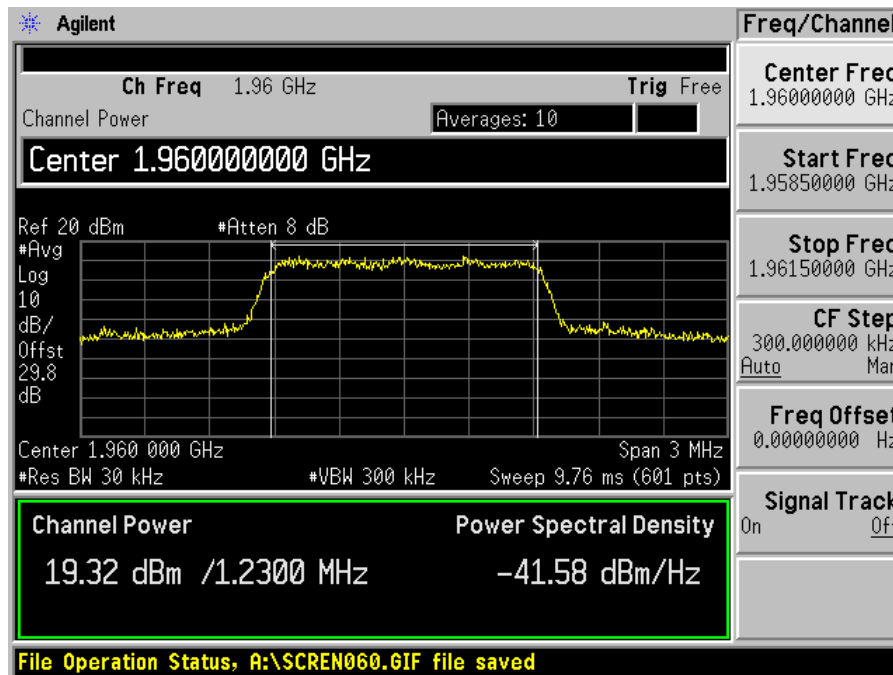
Uplink Middle CH (Cellular)



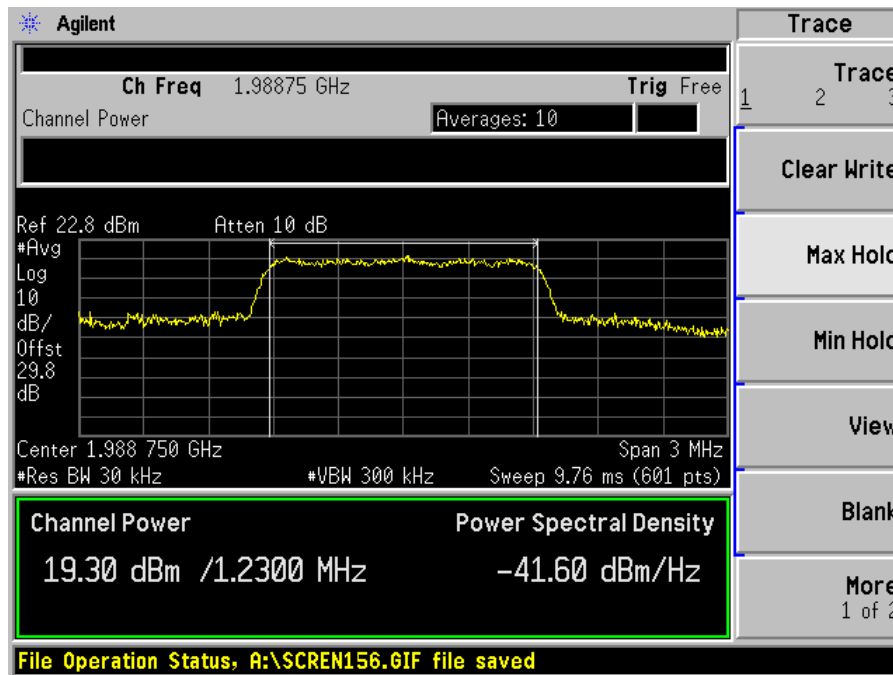
Uplink High CH (Cellular)



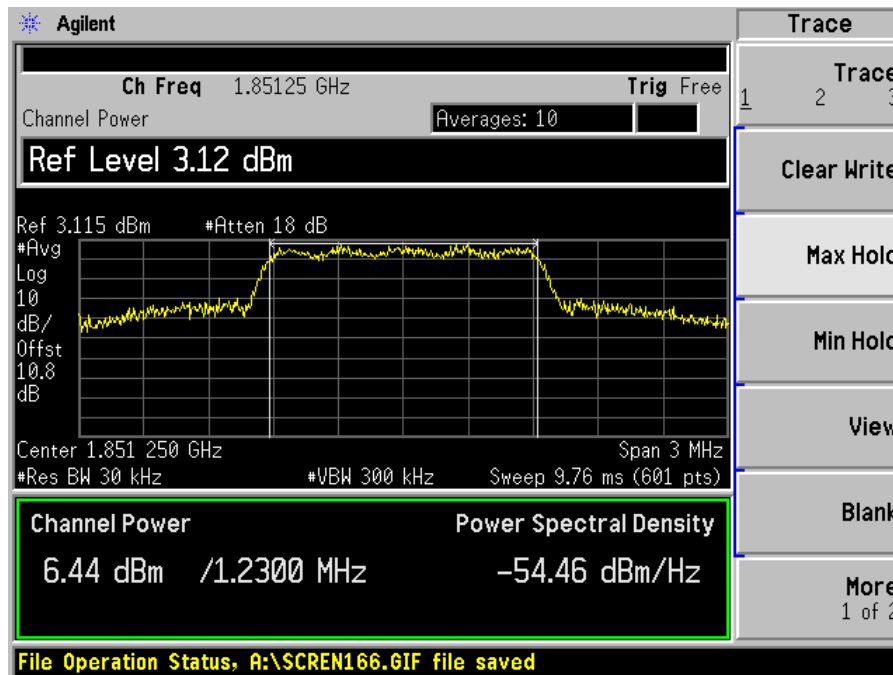
Downlink Low CH (PCS)



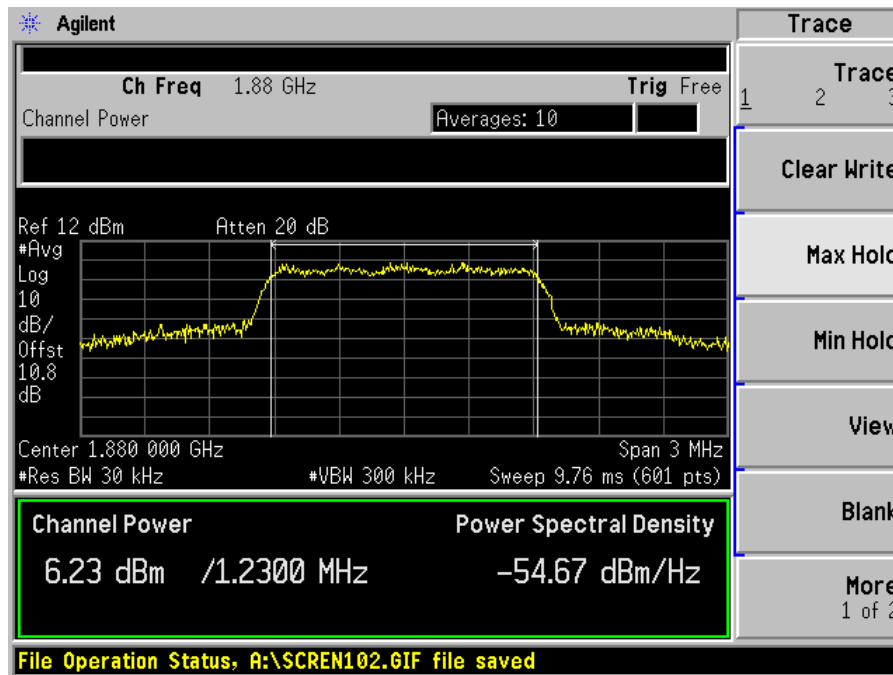
Downlink Middle CH (PCS)



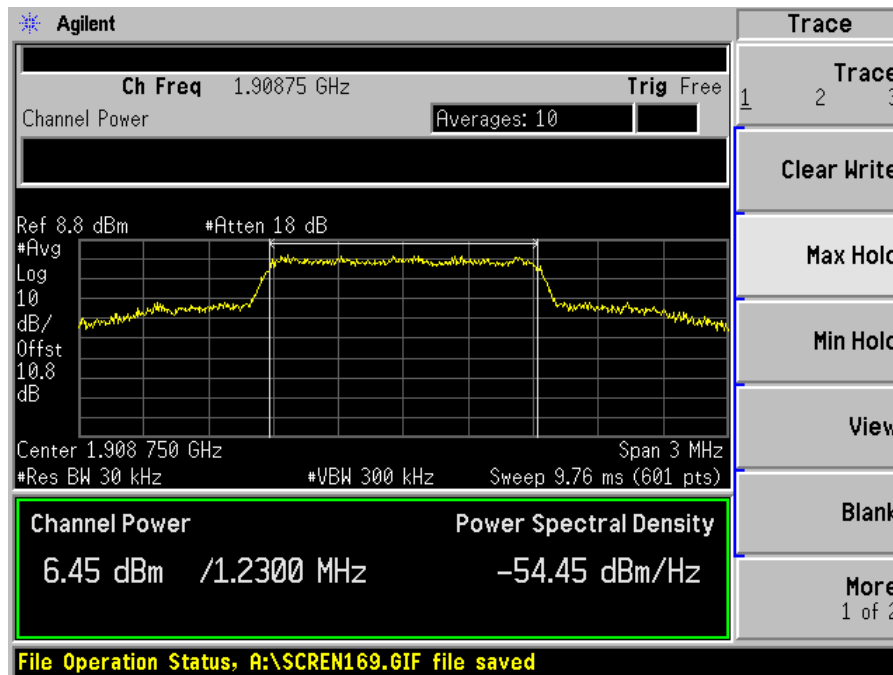
Downlink High CH (PCS)



Uplink Low CH (PCS)



Uplink Middle CH (PCS)



Uplink High CH (PCS)

## 6. OCCUPIED BANDWIDTH

### 6.1 Test Procedure

**Test Requirement(s): § 2.1049 Measurements required: Occupied bandwidth:**

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 under the specified conditions of § 2.1049 (a) through (i) as applicable.

**Test Procedures:** As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made with a Spectrum Analyzer connected to the RF ports for both Uplink and Downlink. The modulation characteristics of signal generator's carrier was measured first at a maximum RF level prescribed by the OEM. The signal generator was then connected to either the Uplink or Downlink input at the appropriate RF level. The resulting modulated signal through the EUT was measured and compared against the original signal.



**Test Results:** The EUT complies with the requirements of this section.

**(Cellular)**

CARRIER CHANNEL	DOWNLINK		UPLINK	
	Frequency (MHz)	Occupied Bandwidth (MHz)	Frequency (MHz)	Occupied Bandwidth (dBm)
Low	869.7	1.2870	824.7	1.2744
Mid	881.5	1.2770	836.5	1.2545
High	893.3	1.2667	848.3	1.2765

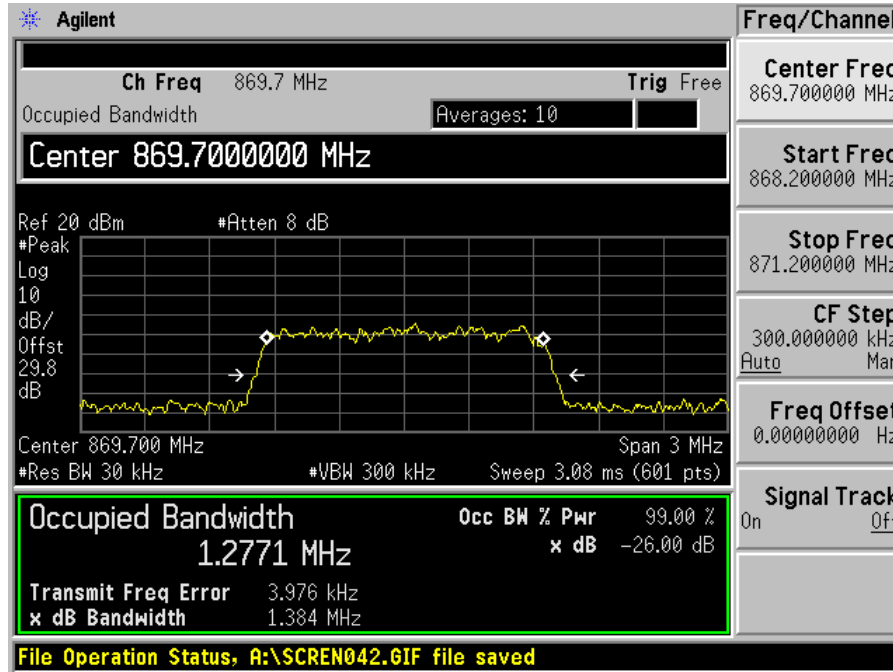
INPUT SIGNAL	DOWNLINK	UPLINK
Source	Real-time CDMA Forward	Real-time CDMA Reverse
Power Level	- 48.5 dBm	- 55 dBm
Amplitude offset	29.8 dB	29.8 dB

**(PCS)**

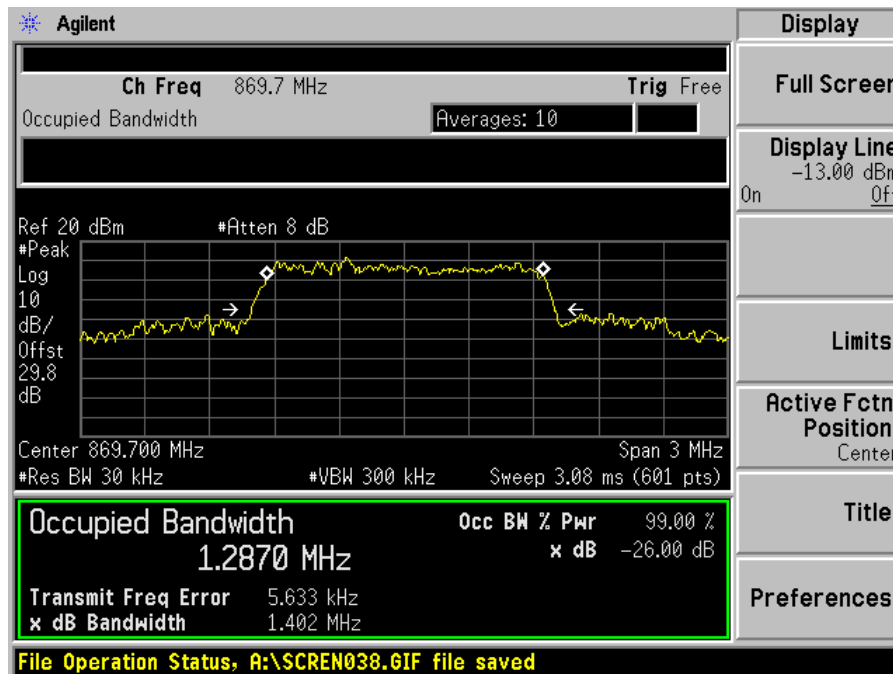
CARRIER CHANNEL	DOWNLINK		UPLINK	
	Frequency (MHz)	Occupied Bandwidth (dBm)	Frequency (MHz)	Occupied Bandwidth (dBm)
Low	1931.25	1.2611	1851.25	1.2675
Mid	1960.00	1.2584	1880.00	1.2673
High	1988.75	1.2576	1908.75	1.2838

INPUT SIGNAL	DOWNLINK	UPLINK
Source	Real-time CDMA Forward	Real-time CDMA Reverse
Power Level	- 63.5 dBm	- 41 dBm
Amplitude offset	31.2 dB	31.2 dB

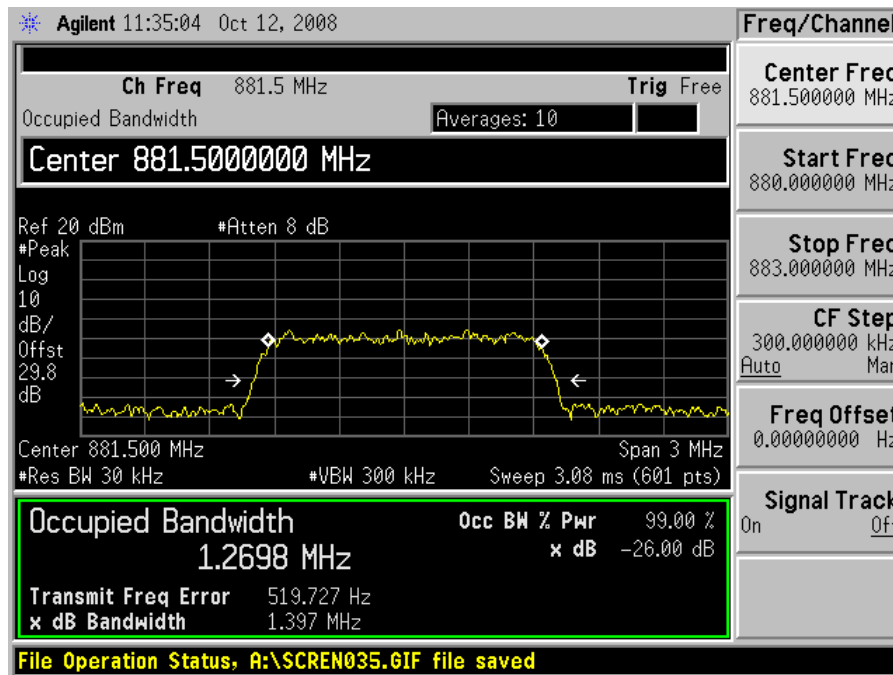
## Plots of RF Output Power



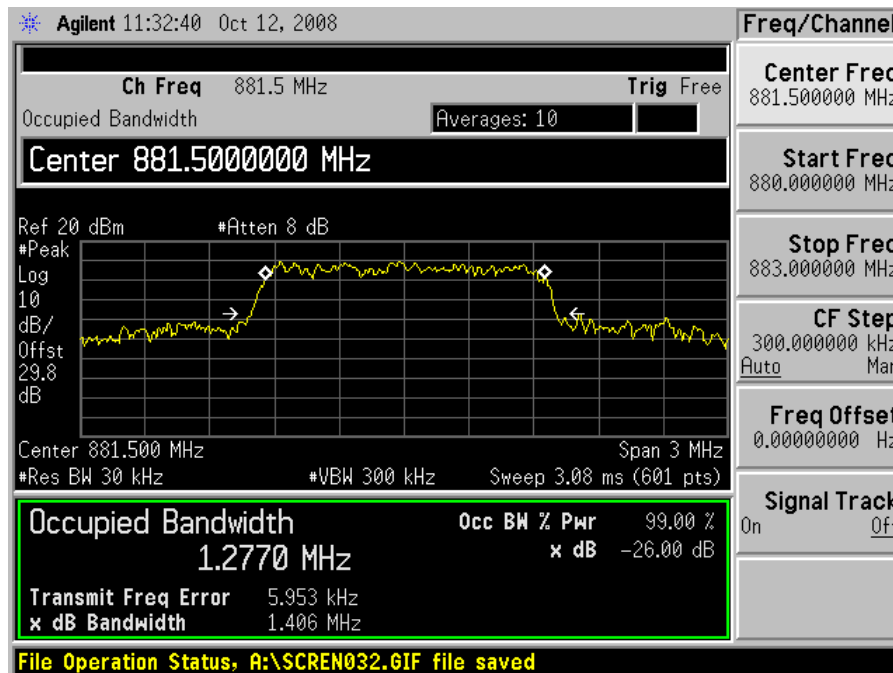
Downlink Low CH (Cellular) Input Signal



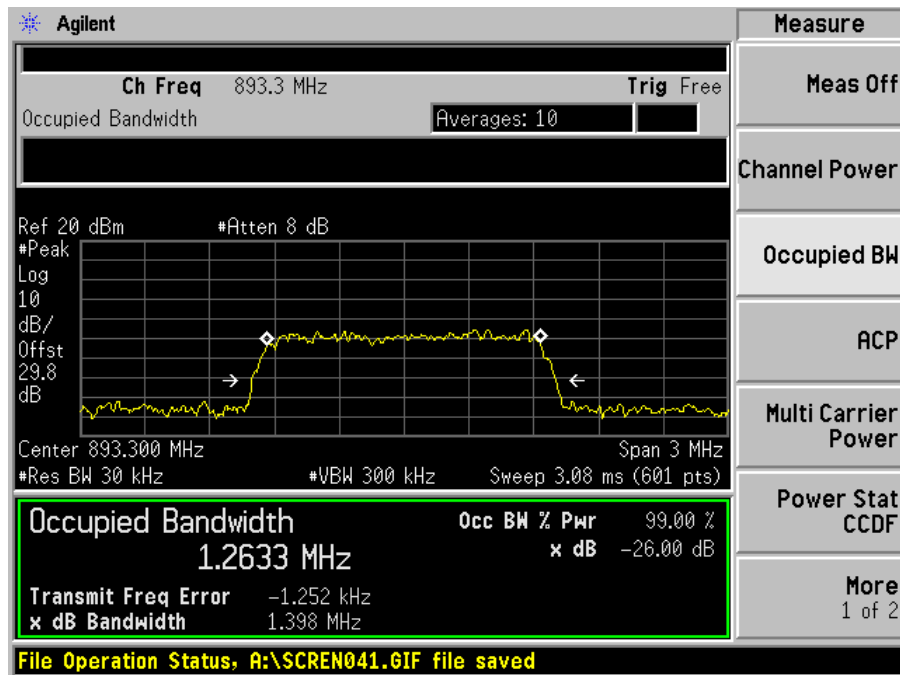
Downlink Low CH (Cellular) Output Signal



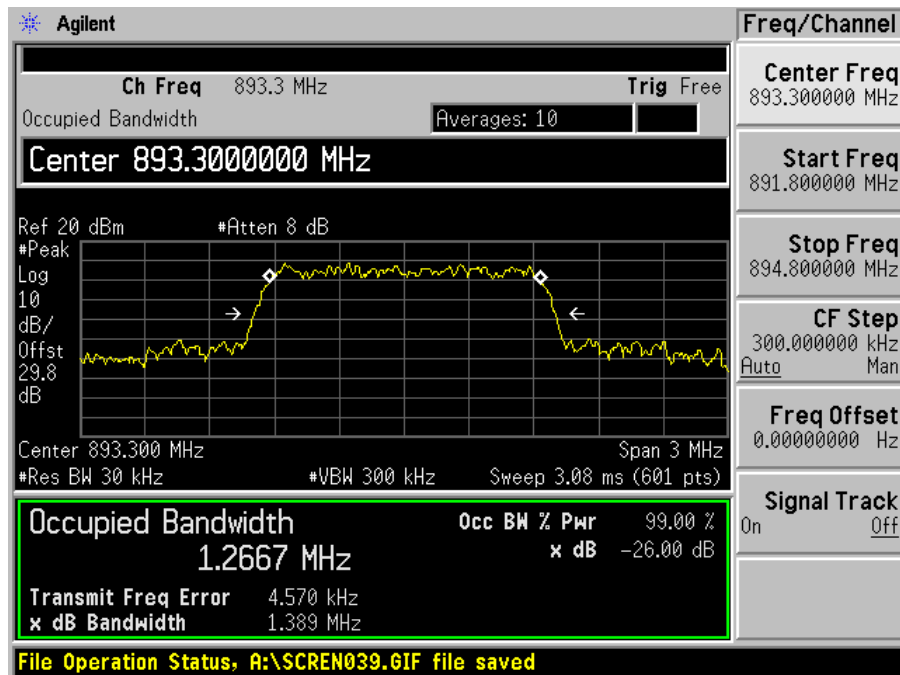
Downlink Mid CH (Cellular) Input Signal



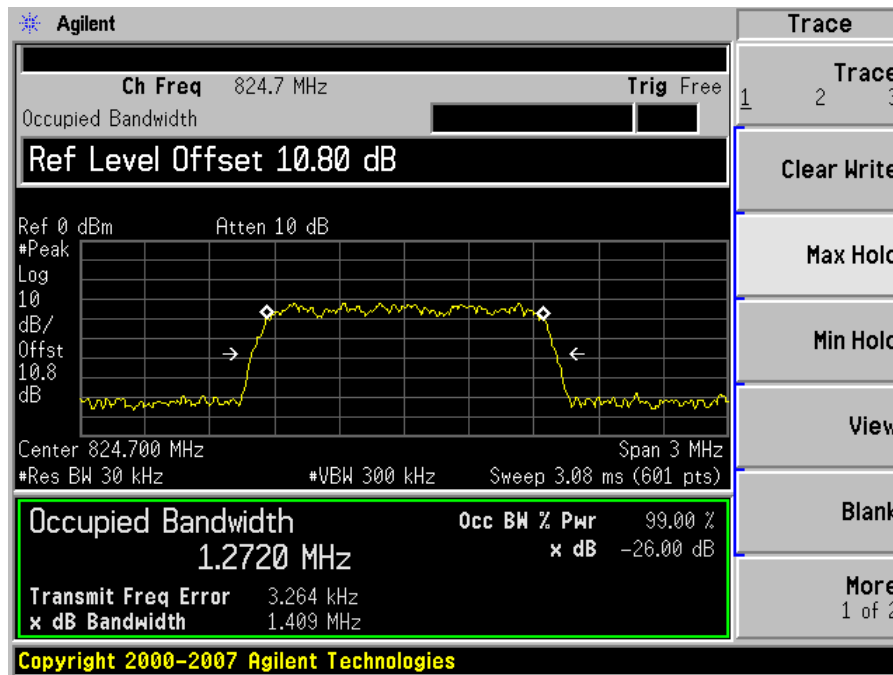
Downlink Mid CH (Cellular) Output Signal



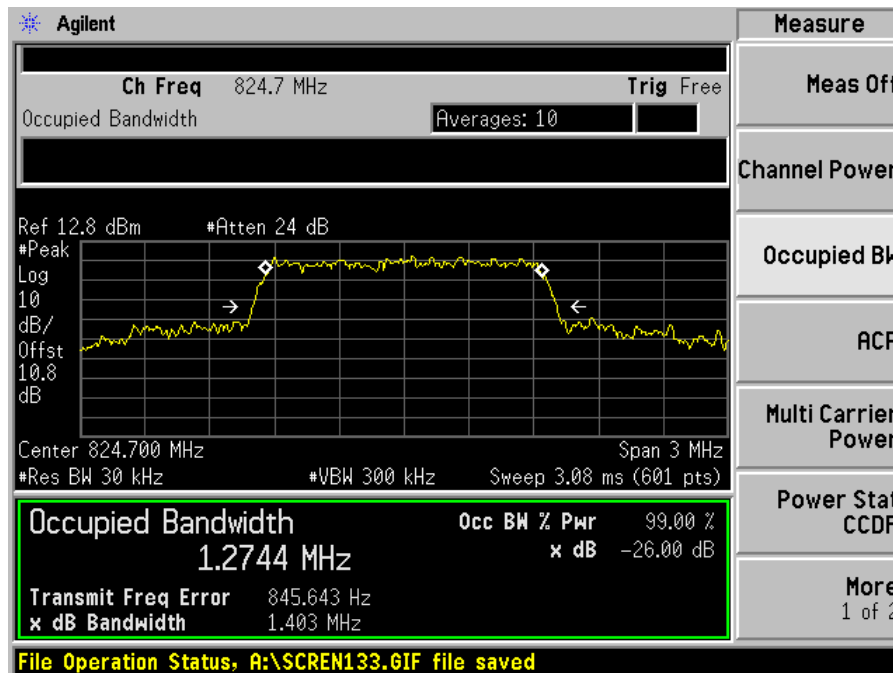
Downlink High CH (Cellular) Input Signal



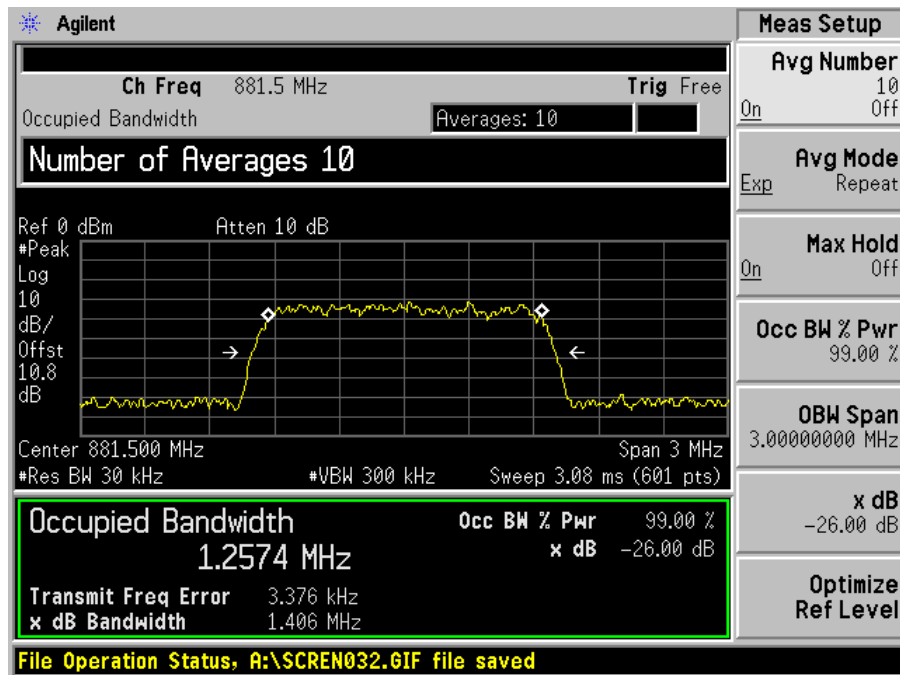
Downlink High CH (Cellular) Output Signal



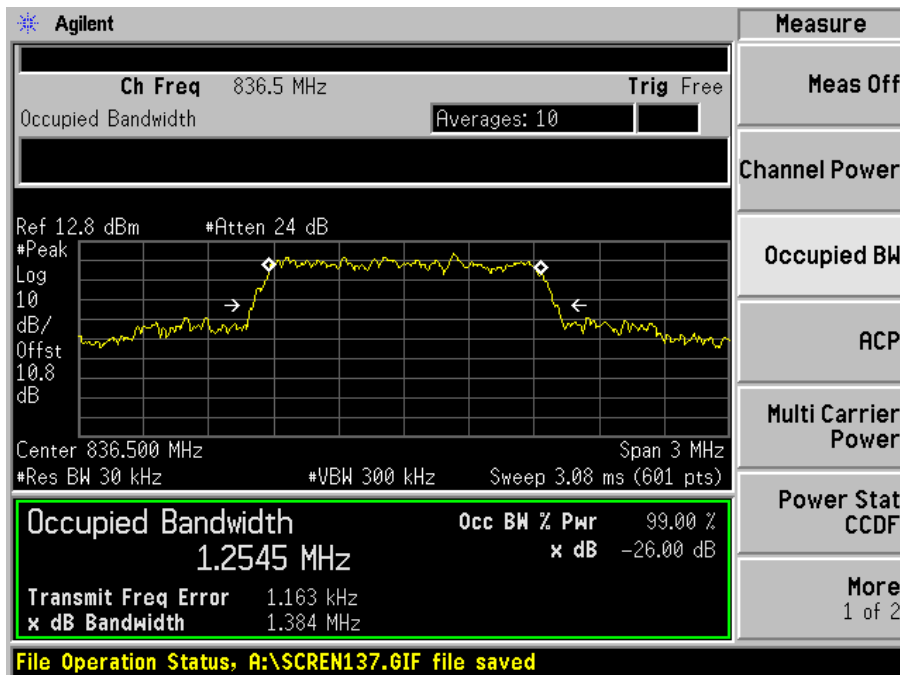
Uplink Low CH (Cellular) Input Signal



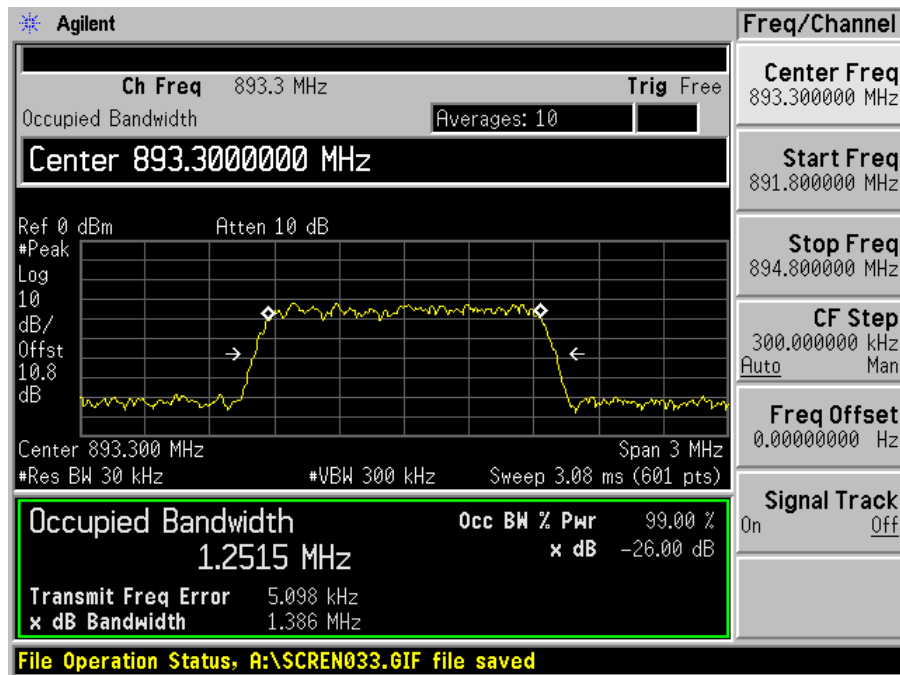
Uplink Low CH (Cellular) Output Signal



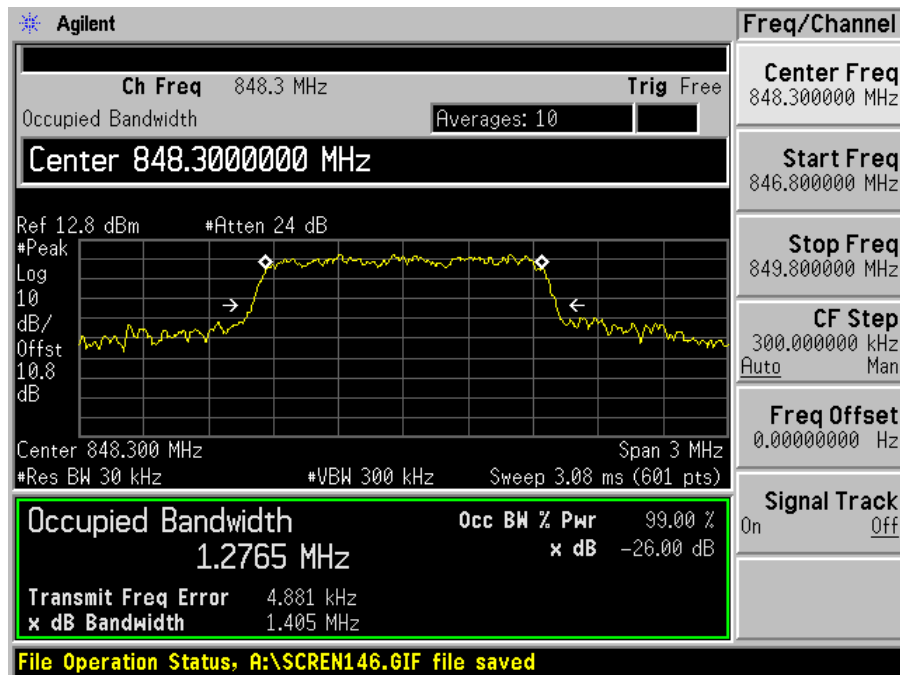
Uplink Mid CH (Cellular) Input Signal



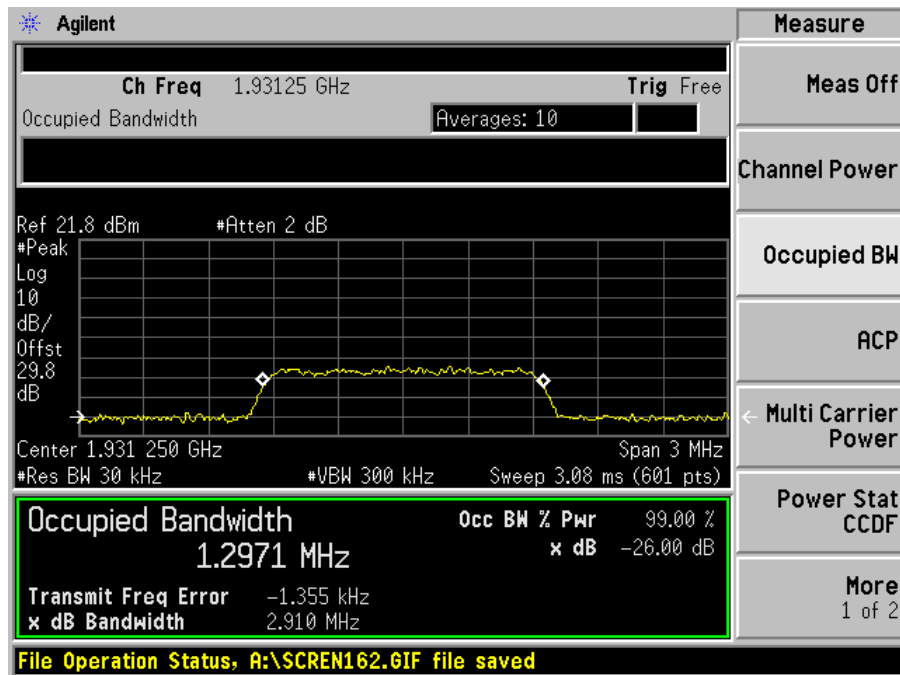
Uplink Mid CH (Cellular) Output Signal



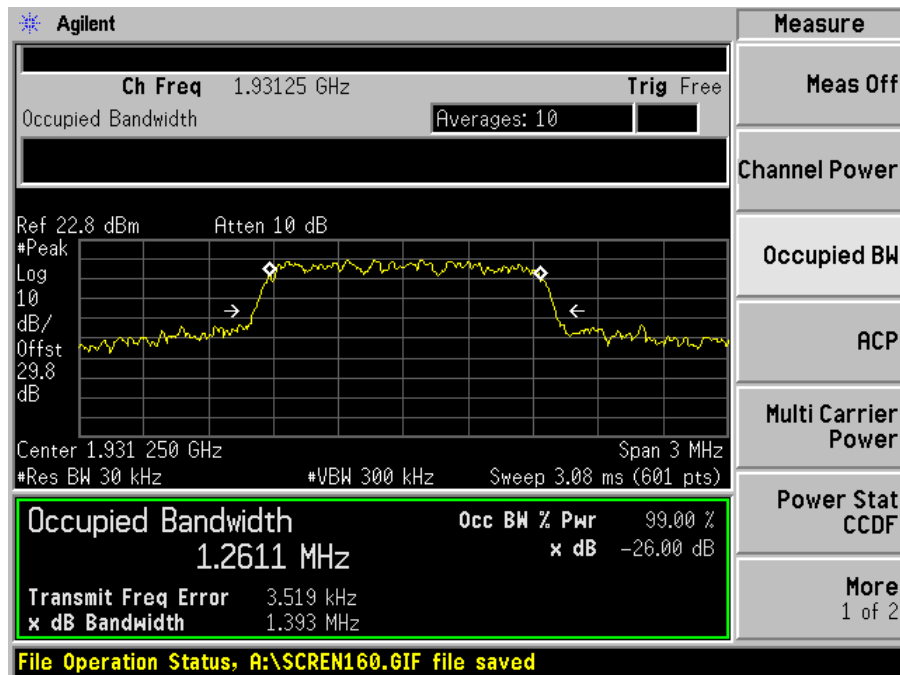
**Uplink High CH (Cellular) Input Signal**



**Uplink High CH (Cellular) Output Signal**

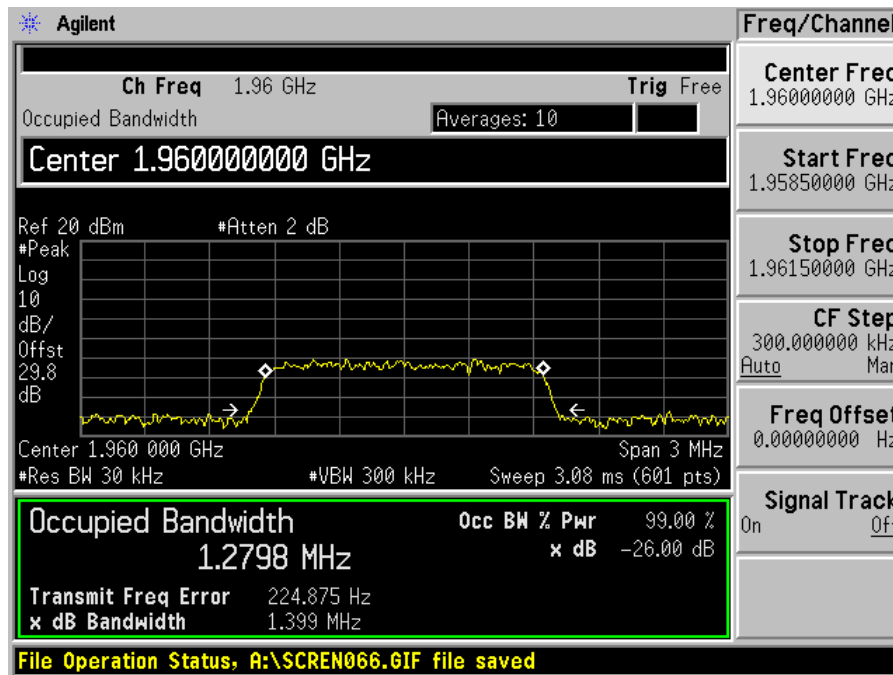


Downlink Low CH (PCS) Input Signal

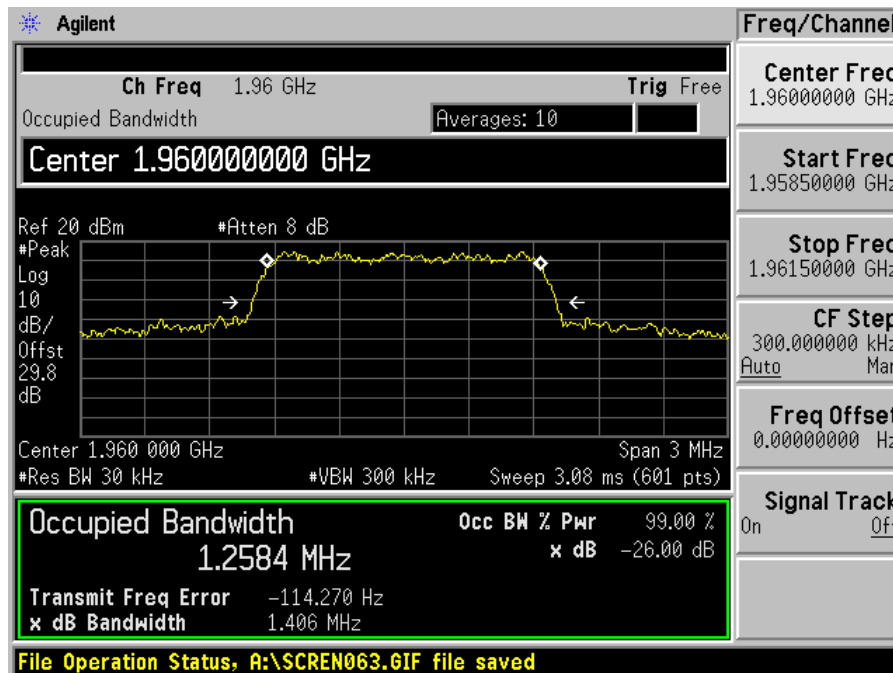


Downlink Low CH (PCS) Output Signal

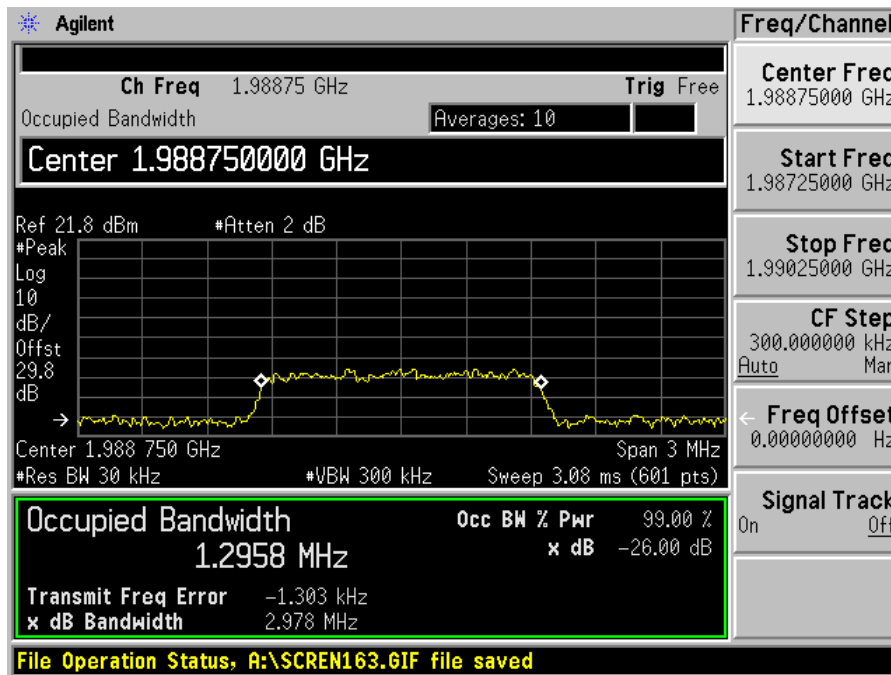




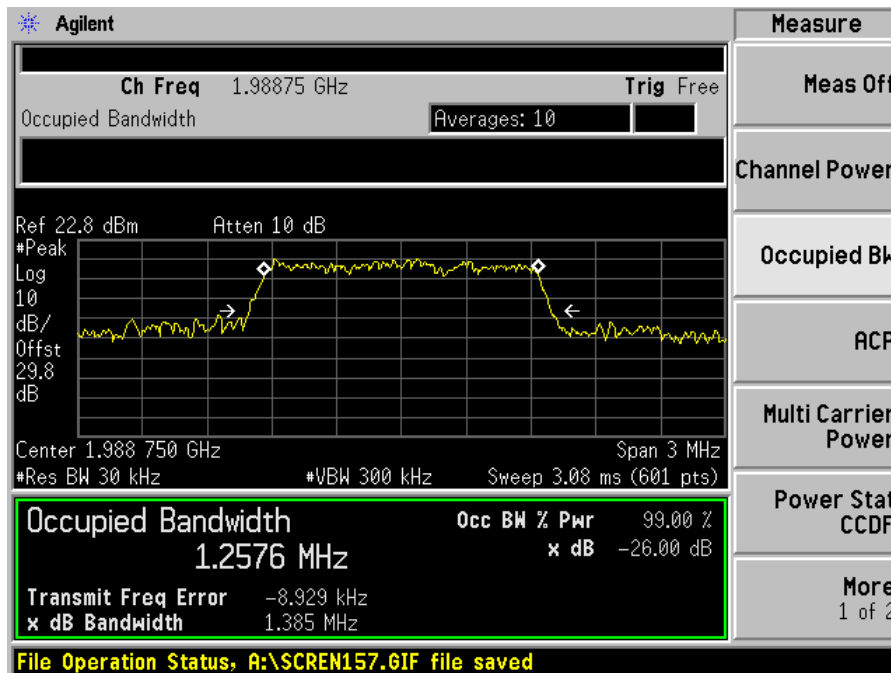
Downlink Mid CH (PCS) Input Signal



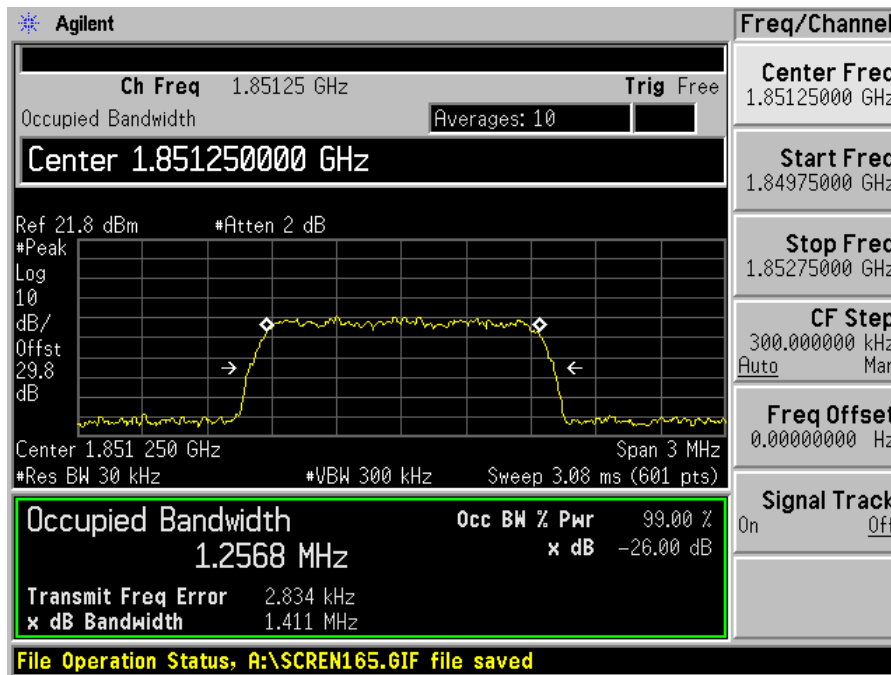
Downlink Mid CH (PCS) Output Signal



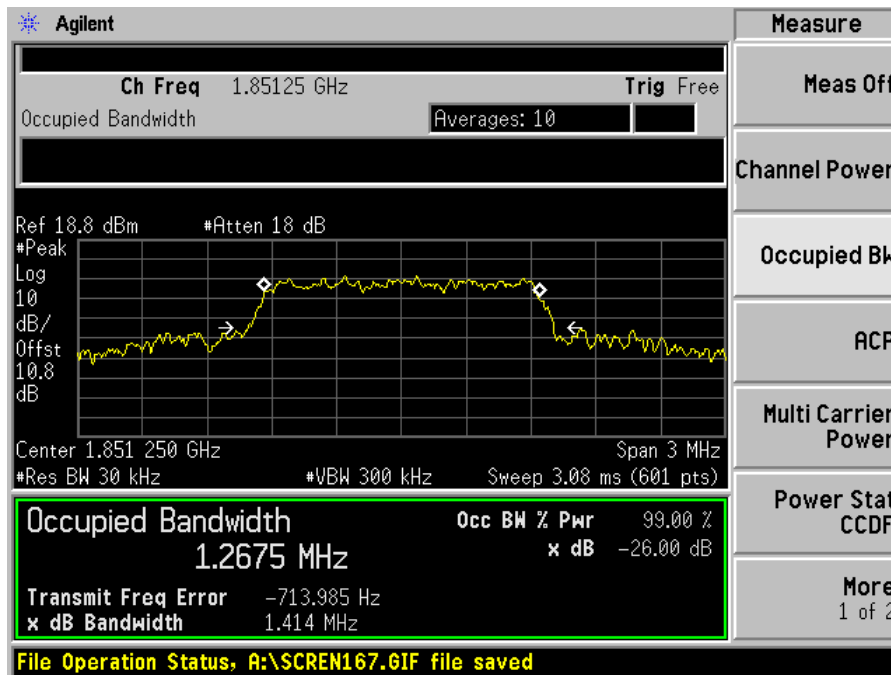
Downlink High CH (PCS) Input Signal



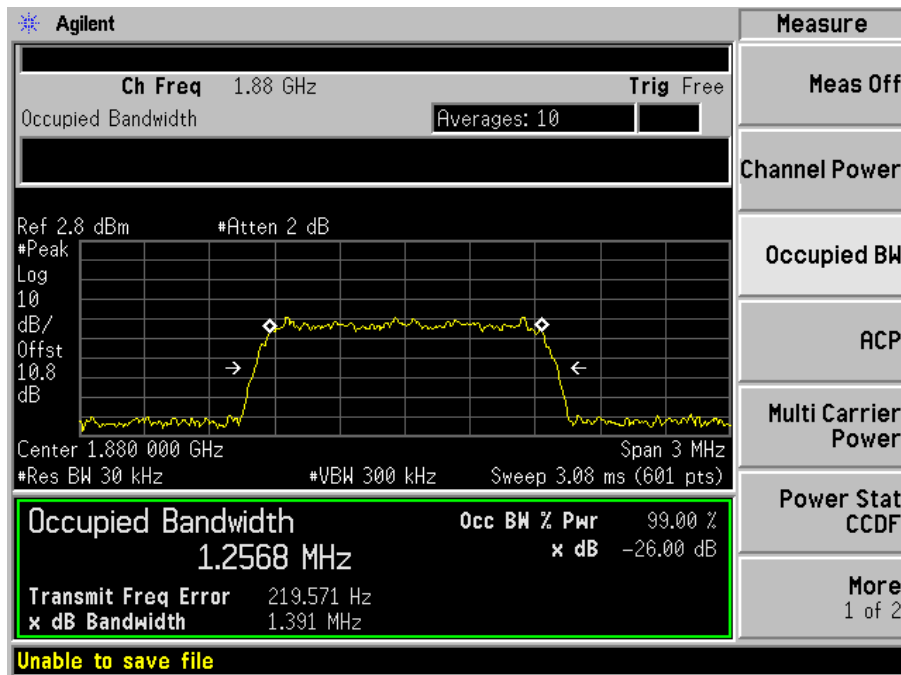
Downlink High CH (PCS) Output Signal



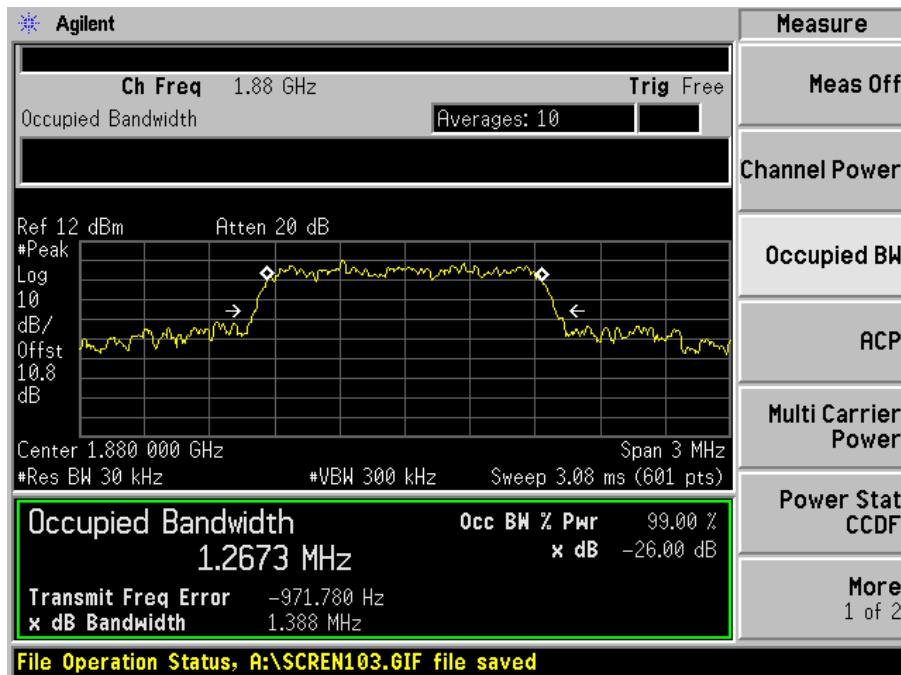
Uplink Low CH (PCS) Input Signal



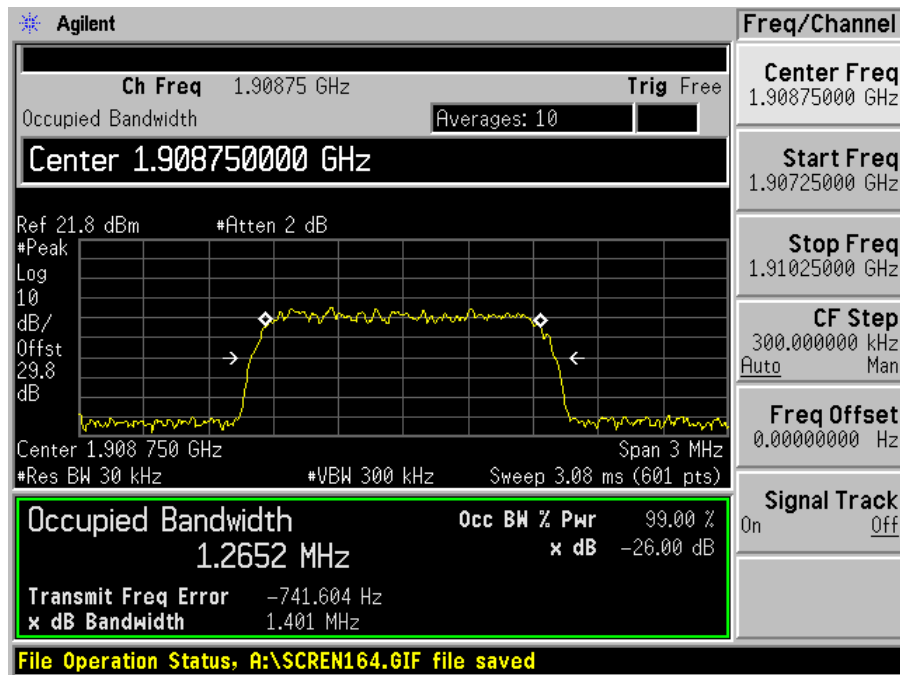
Uplink Low CH (PCS) Output Signal



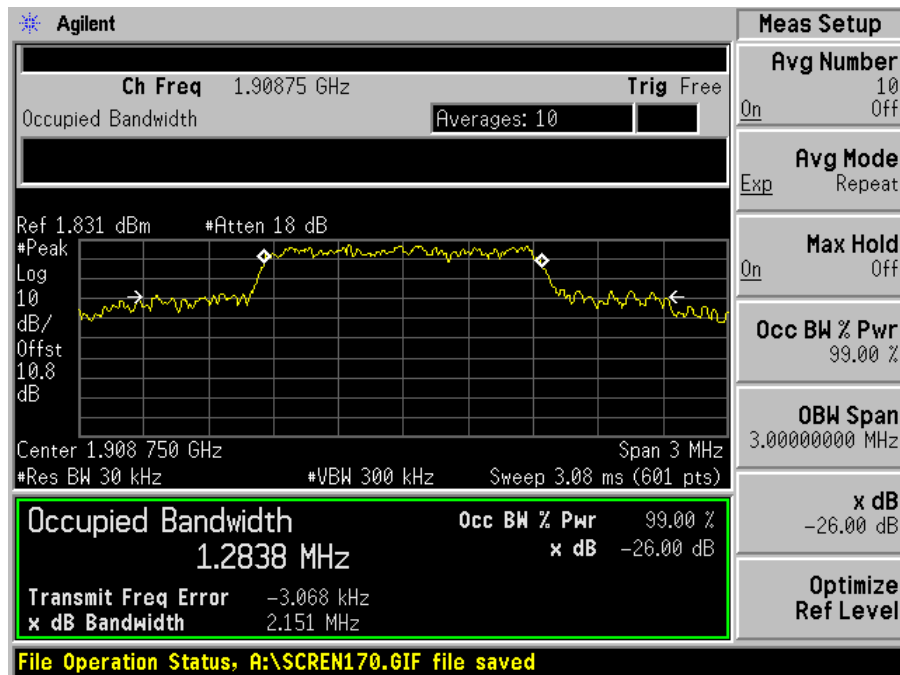
Uplink Mid CH (PCS) Input Signal



Uplink Mid CH (PCS) Output Signal



Uplink High CH (PCS) Input Signal



Uplink High CH (PCS) Output Signal

## 7. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

### Test Requirement(s): § 2.1051 Measurements required: Spurious emissions at antenna terminals:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

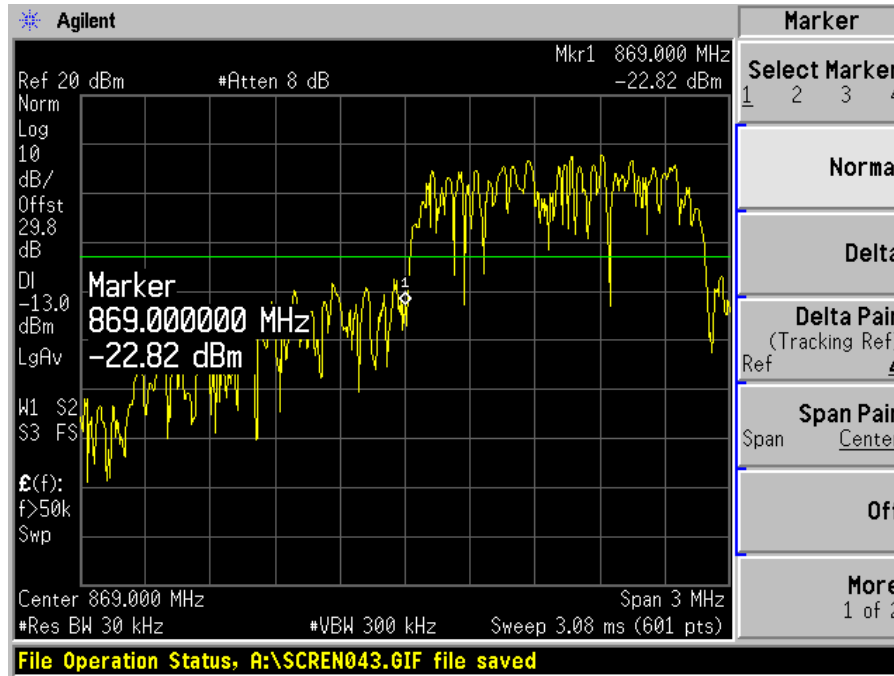
**§ 22.917, §24.238 Emission limitations for Broadband PCS equipment:** The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service. § 22.917 (a), § 24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

**Test Procedures:** A modulated carrier generated by the signal generator carrier was connected to either the Uplink or Downlink RF port at a maximum level as determined by the OEM. A spectrum analyzer was connected to either the Uplink or Downlink port depending on the circuitry being measured. The spectrum was investigated from 30 MHz to the 26.5 GHz of the carrier.

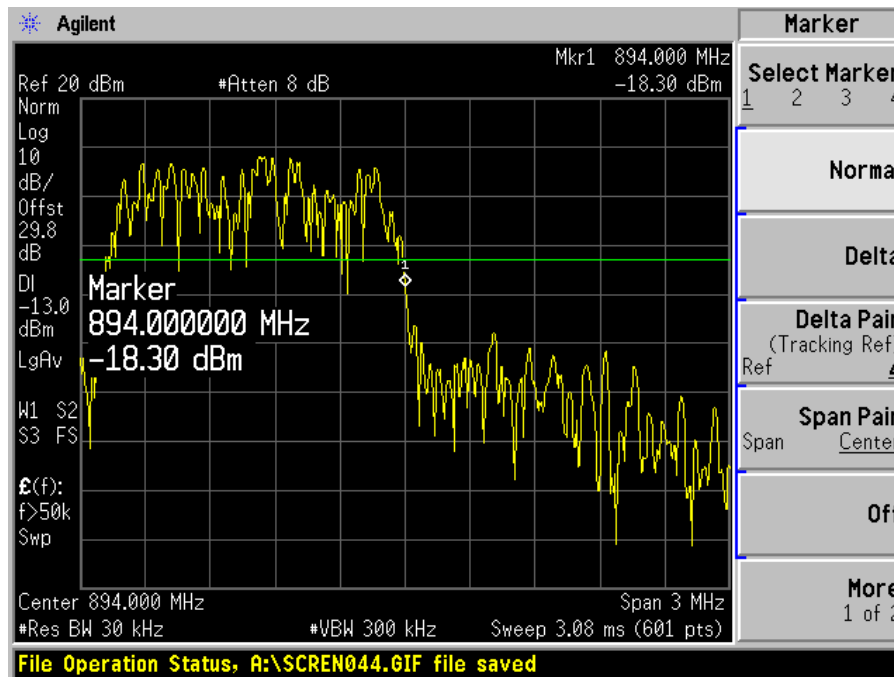
**Test Results:** The EUT complies with the requirements of this section. There were no detectable spurious emissions for this EUT.

**Test Results:** The EUT complies with the requirements of this section. There were no detectable spurious emissions for this EUT.

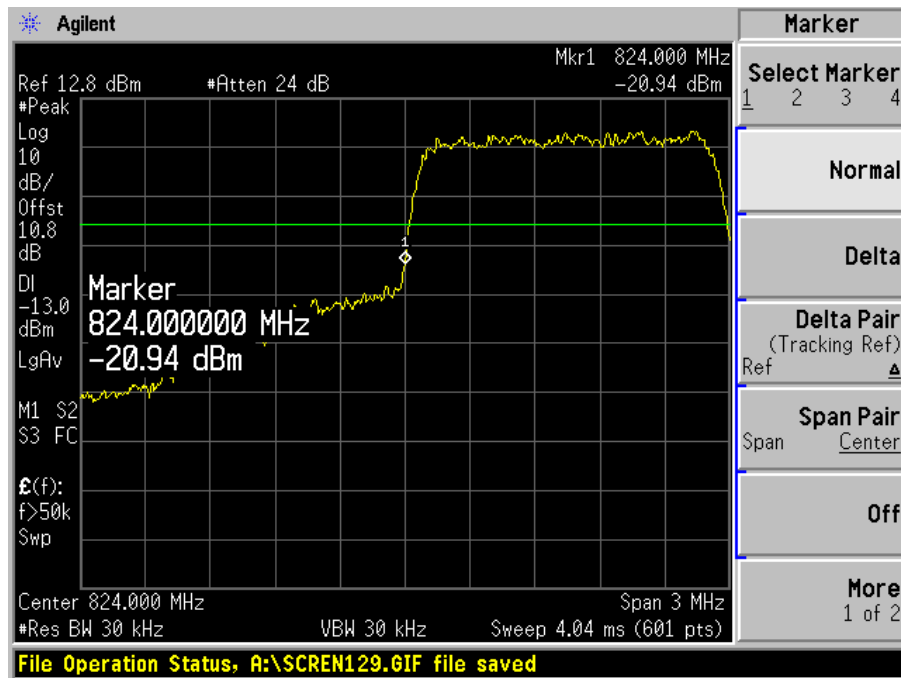
## Plots of BAND EDGE



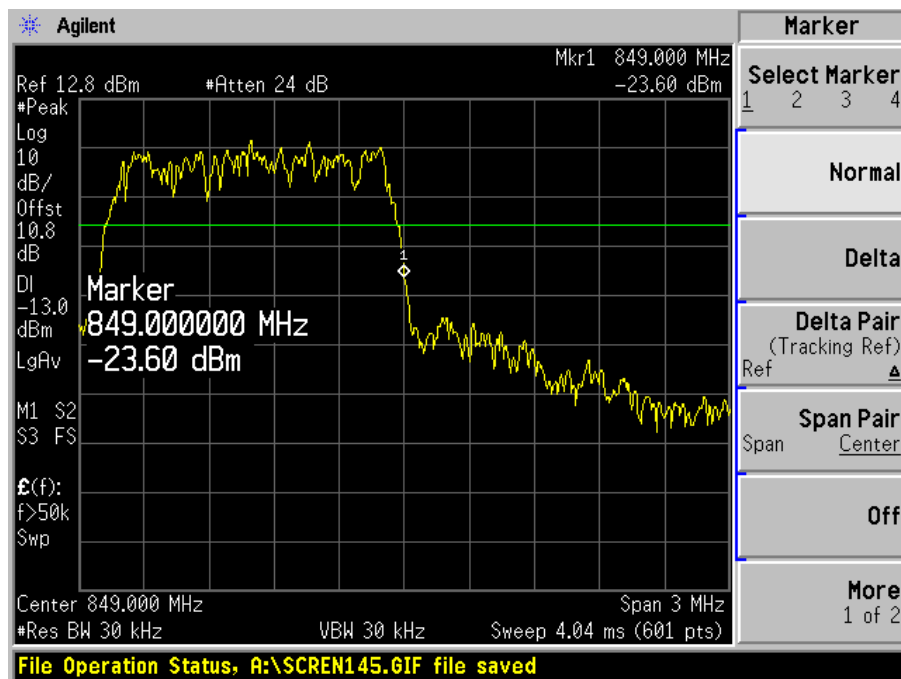
(Downlink Low CH-Cellular)



(Downlink High CH-Cellular)

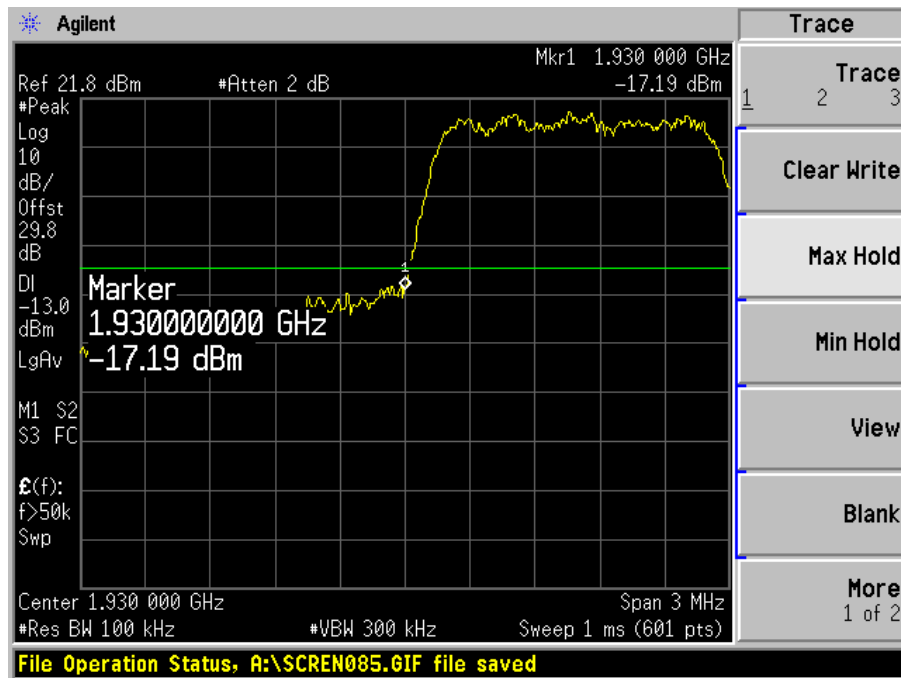


(Uplink Low CH-Cellular)

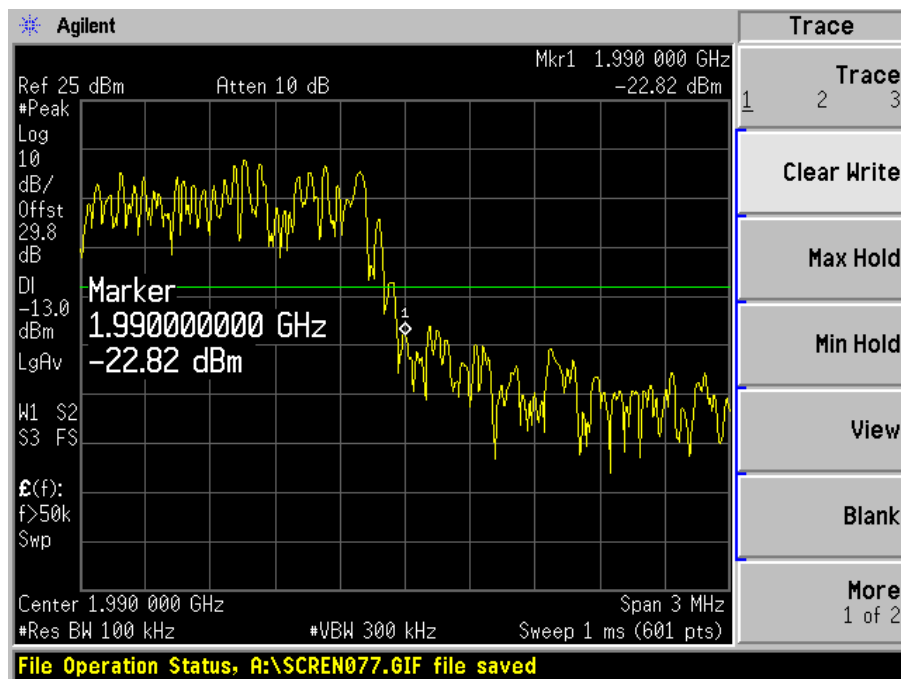


(Uplink High CH-Cellular)

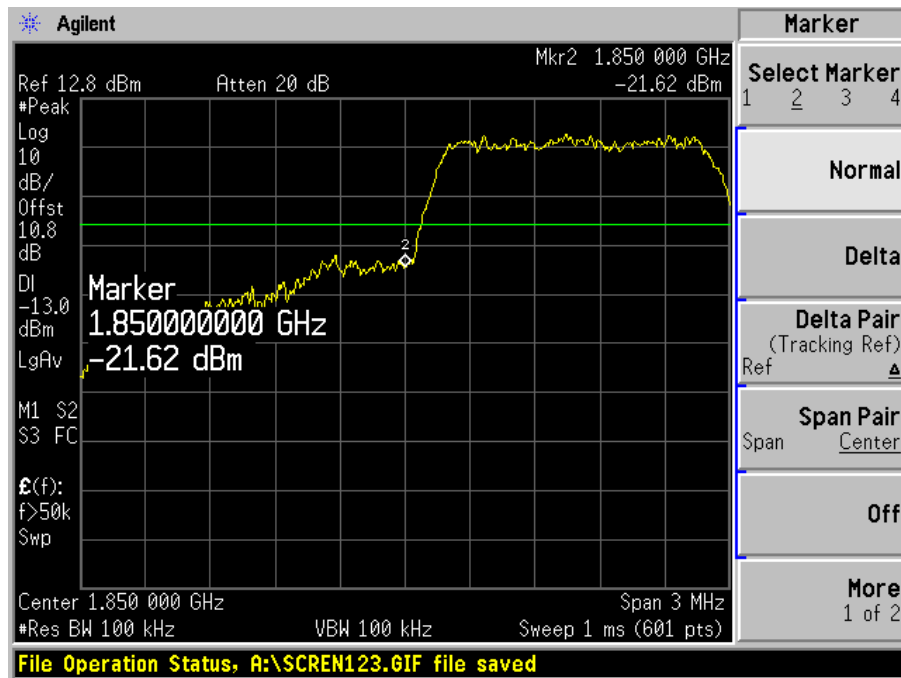




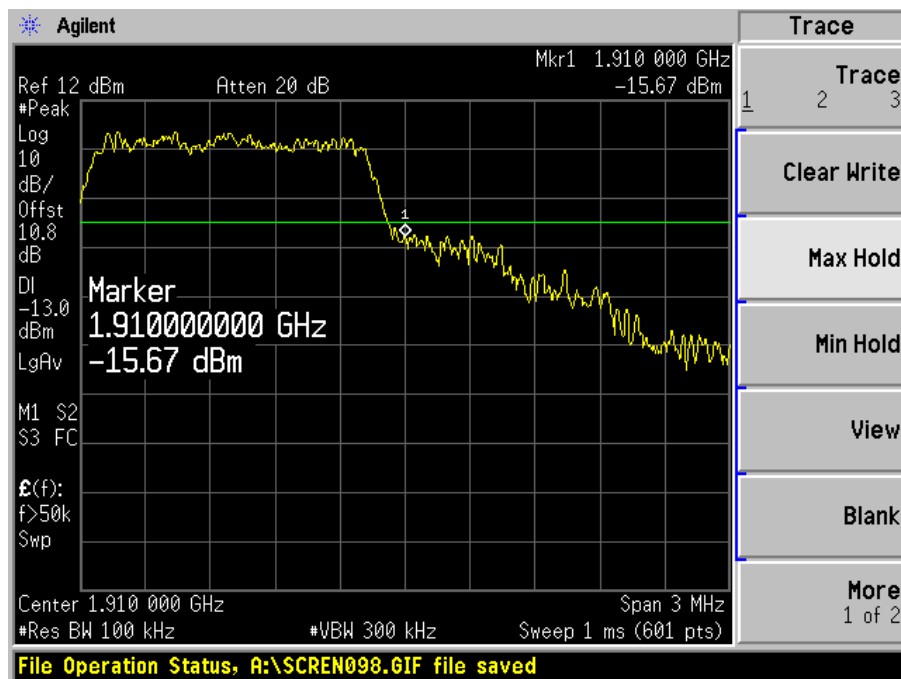
(Downlink Low CH-PCS)



(Downlink High CH-PCS)

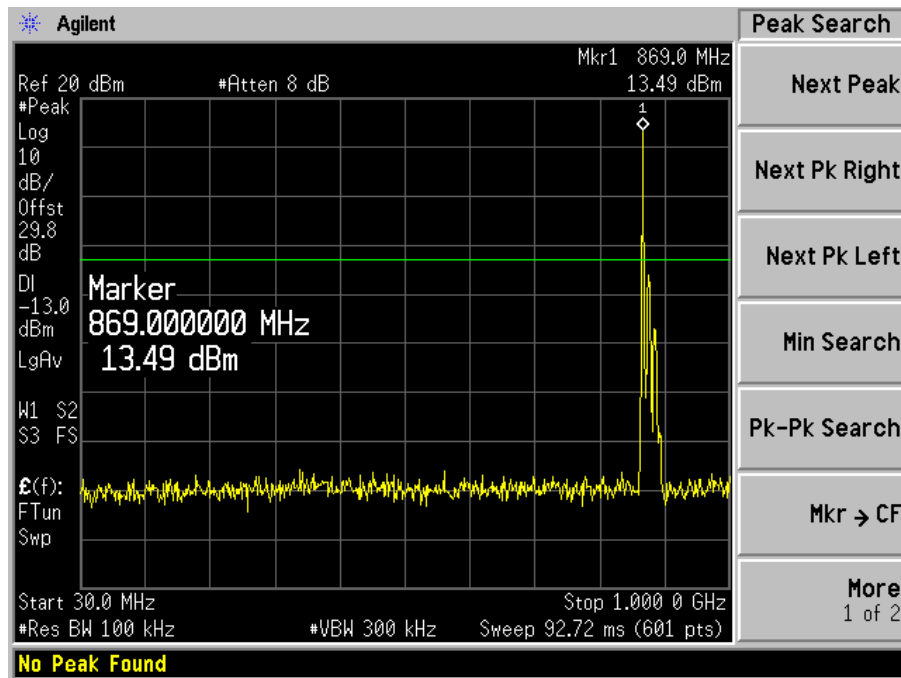


(Uplink Low CH-PCS)

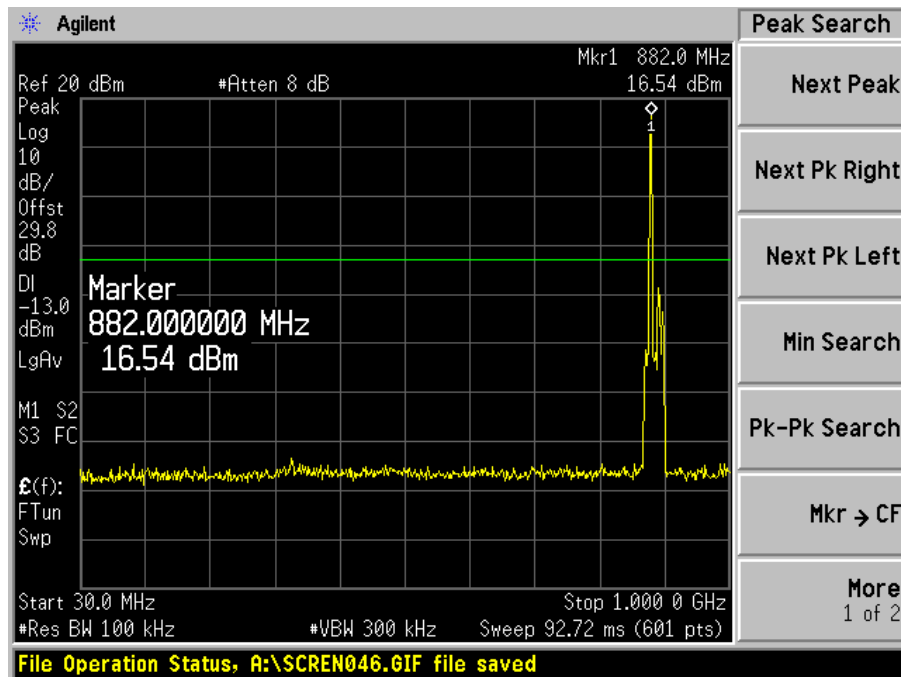


(Uplink High CH-PCS)

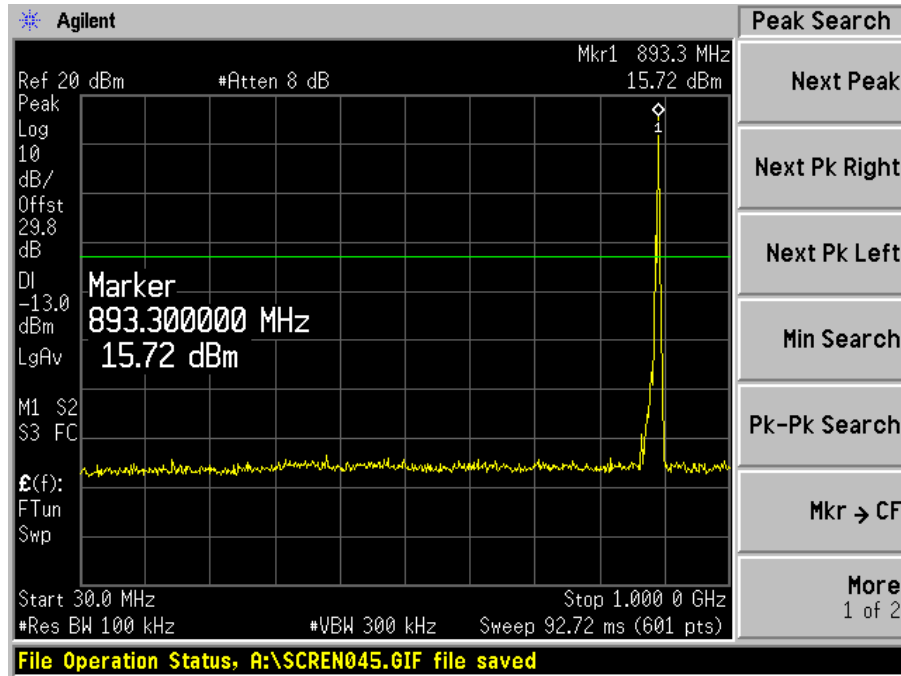
## Plots of Spurious Emission



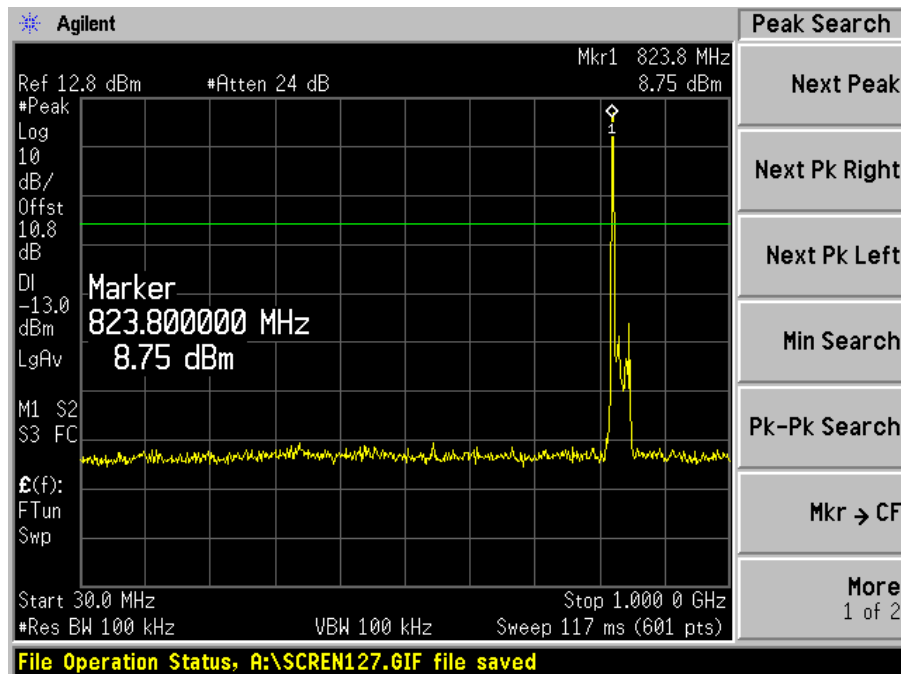
Conducted Spurious Emissions Downlink Low CH (30 MHz – 1 GHz-Cellular)



Conducted Spurious Emissions Downlink Mid CH (30 MHz – 1 GHz-Cellular)



**Conducted Spurious Emissions Downlink High CH (30 MHz – 1 GHz-Cellular)**



**Conducted Spurious Emissions Uplink Low CH (30 MHz – 1 GHz-Cellular)**

**HCT Co., Ltd.**

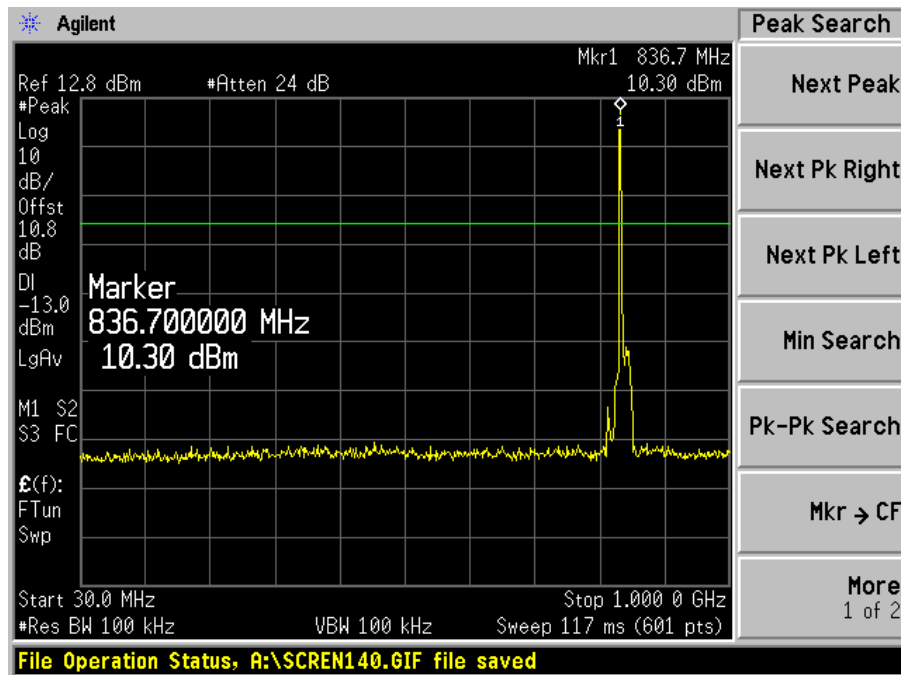
San 136-1, Ami-ri , Bubal-eup, Icheon-si, Kyounki-do, 467-701,Korea

TEL : +82 31 639 8518

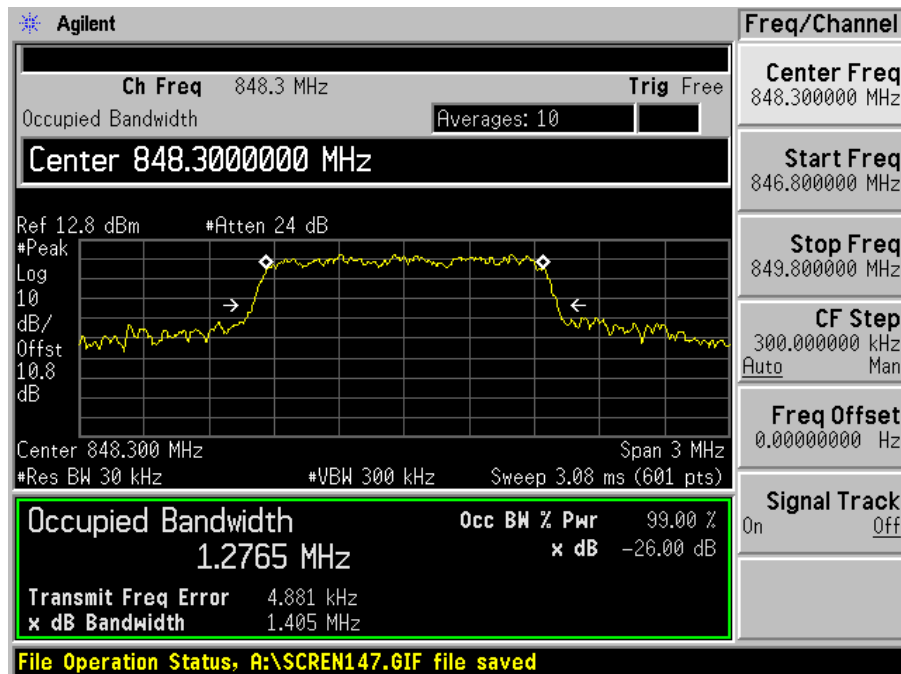
FAX : +82 31 639 8525

[www.hct.co.kr](http://www.hct.co.kr)

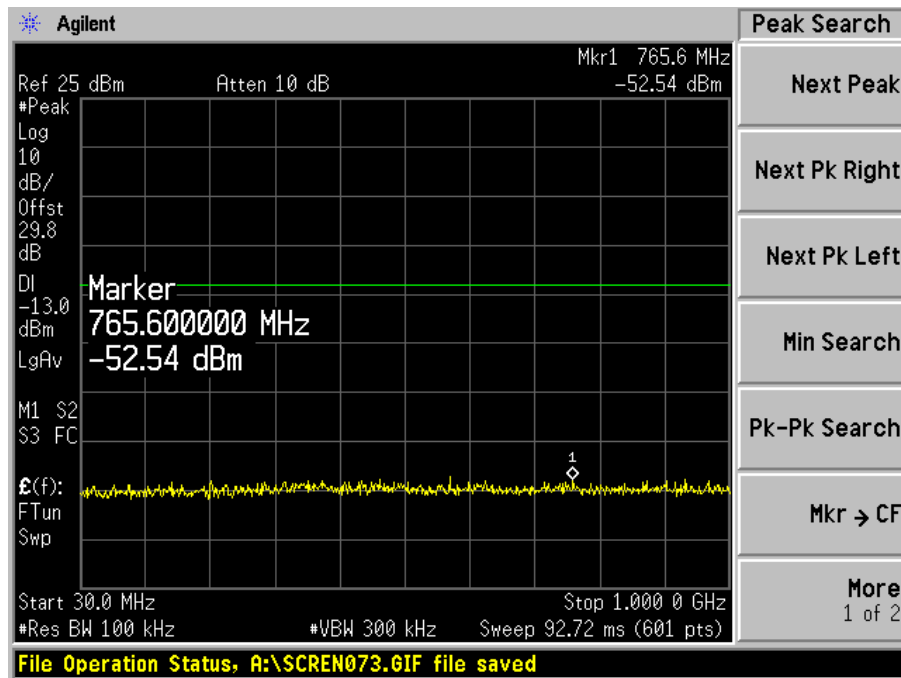
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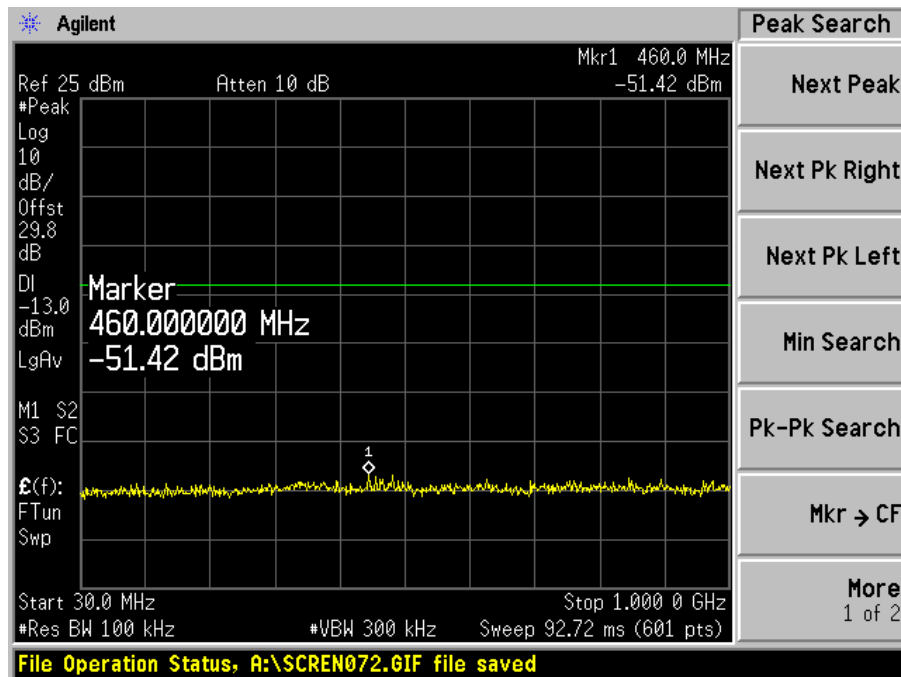
Conducted Spurious Emissions Uplink Mid CH (30 MHz – 1 GHz-Cellular)



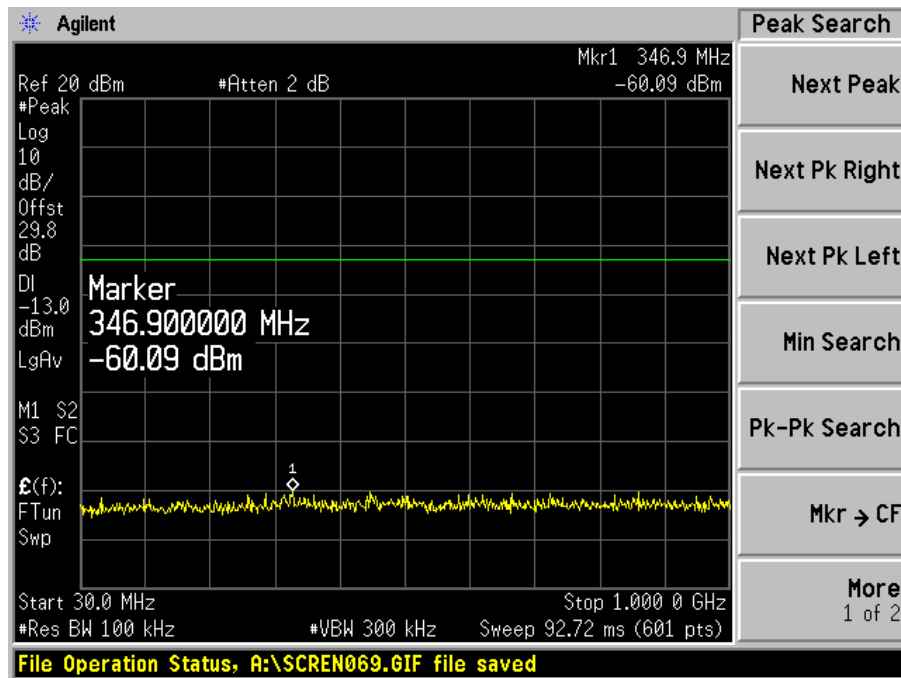
Conducted Spurious Emissions Uplink HighCH (30 MHz – 1 GHz-Cellular)



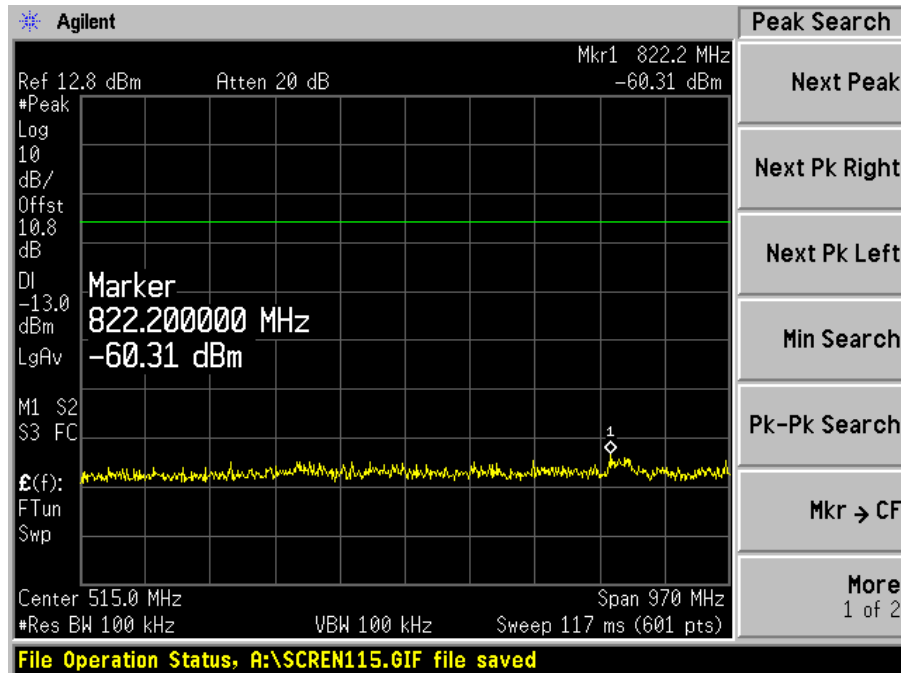
Conducted Spurious Emissions Downlink Low CH (30 MHz – 1 GHz-PCS)



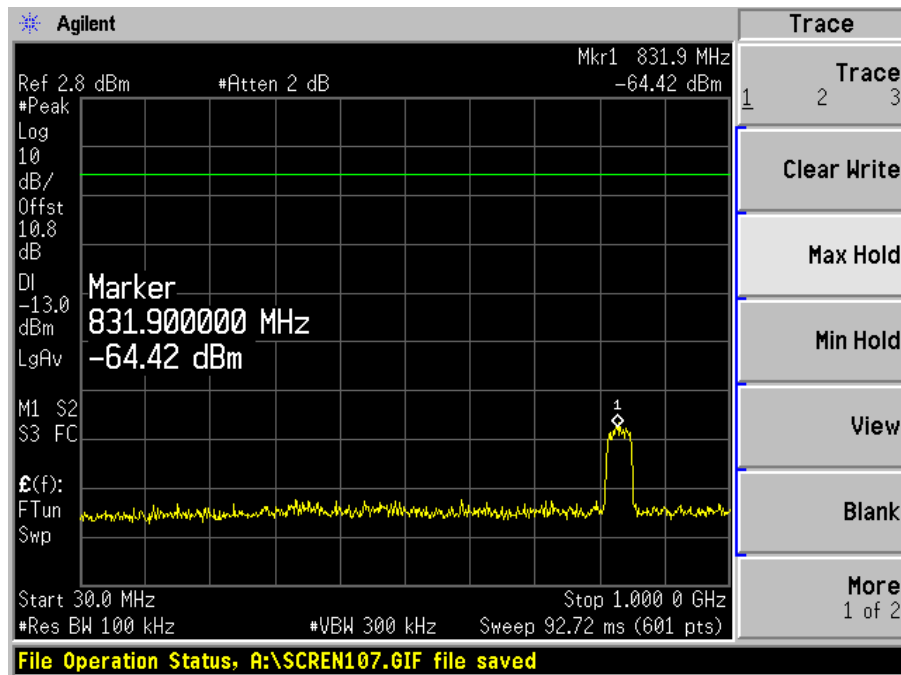
Conducted Spurious Emissions Downlink Mid CH(30 MHz – 1 GHz-PCS)



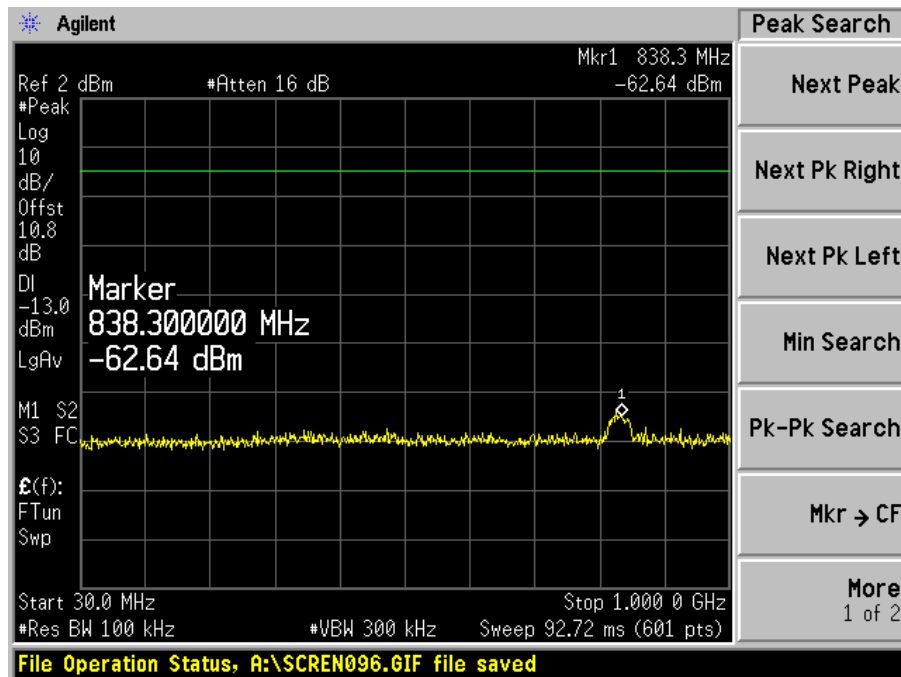
Conducted Spurious Emissions Downlink High CH (30 MHz – 1 GHz-PCS)



Conducted Spurious Emissions Uplink Low CH(30 MHz – 1 GHz-PCS)

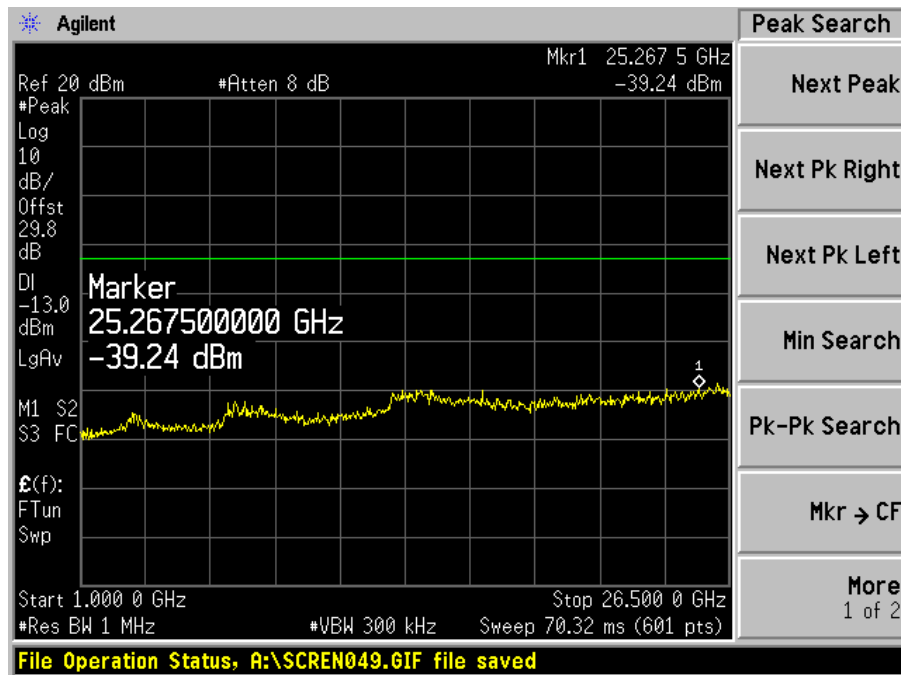


Conducted Spurious Emissions Uplink Mid CH (30 MHz – 1 GHz-PCS)

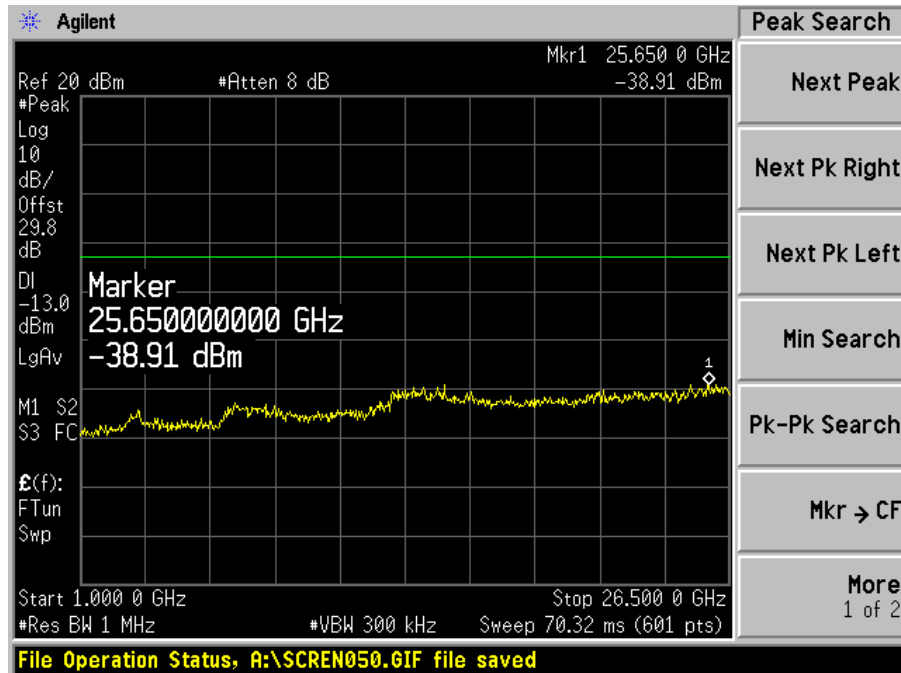


Conducted Spurious Emissions Uplink High CH (30 MHz – 1 GHz-PCS)

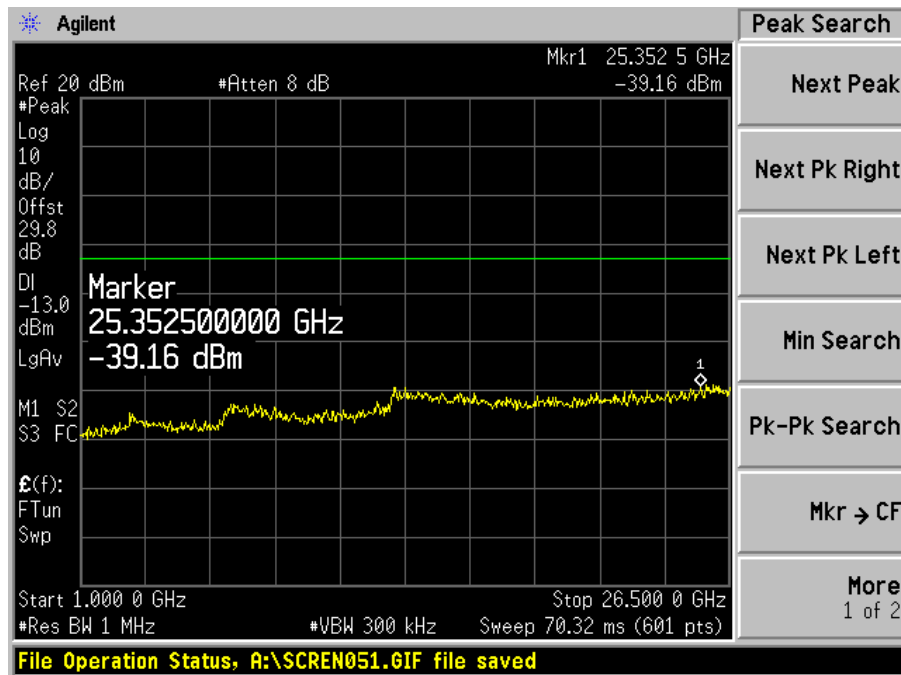




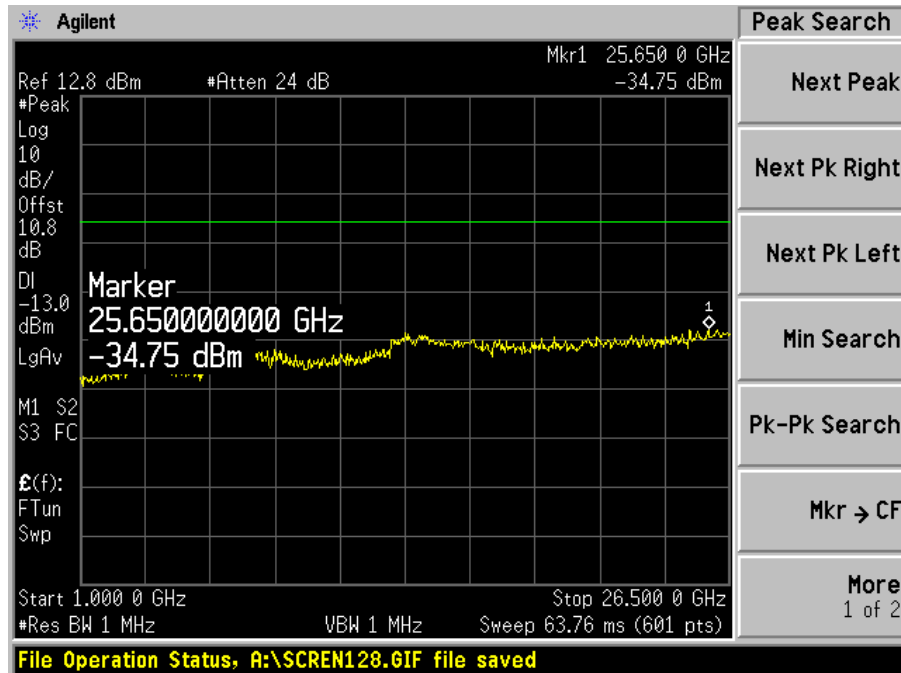
Conducted Spurious Emissions Downlink Low CH (1 GHz – 26.5 GHz-Cellular)



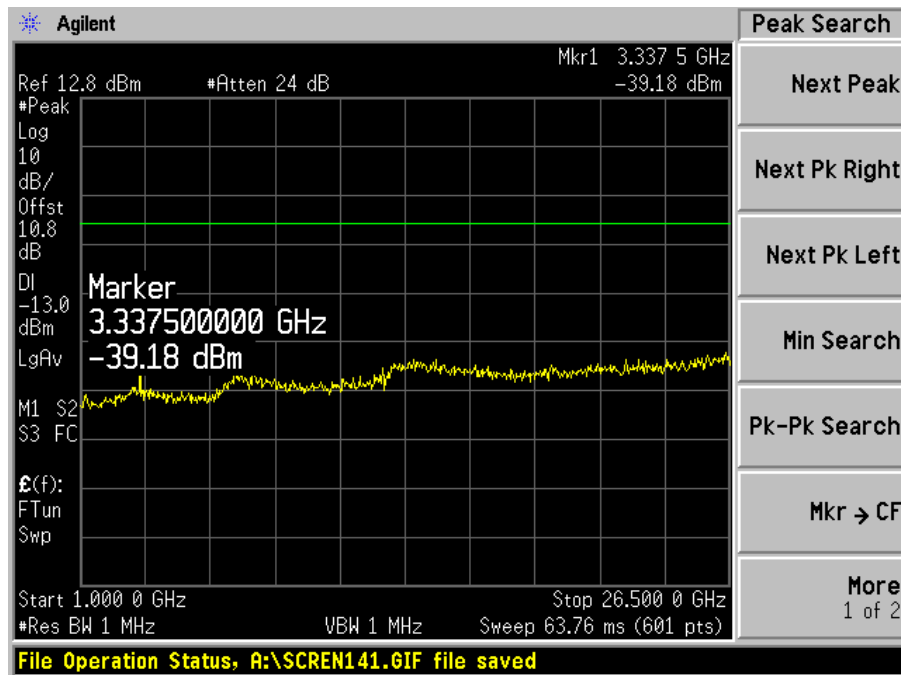
Conducted Spurious Emissions Downlink Low CH (1 GHz – 26.5 GHz-Cellular)



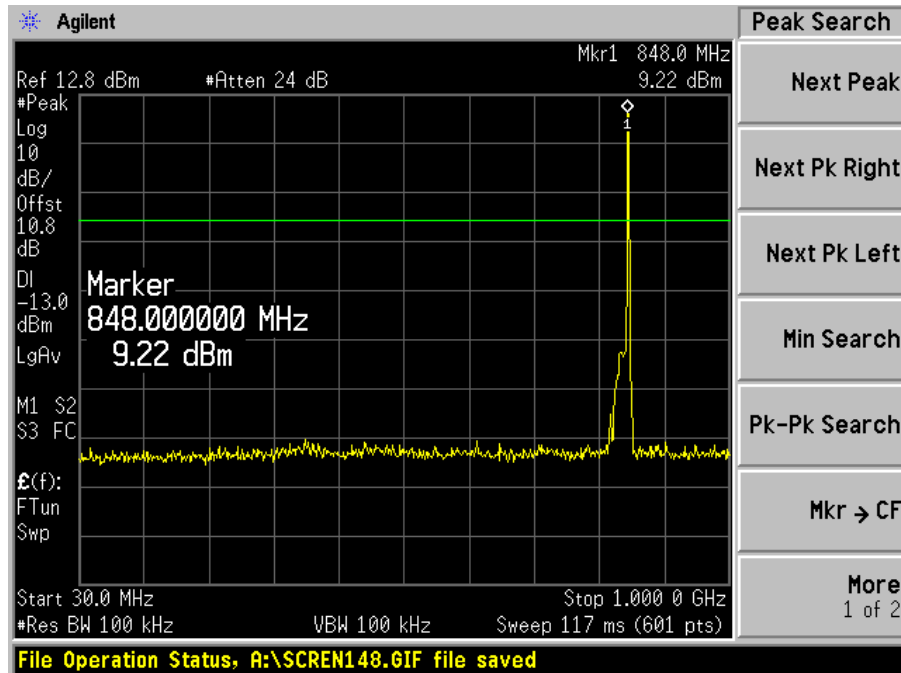
Conducted Spurious Emissions Downlink High CH (1 GHz – 26.5 GHz-Cellular)



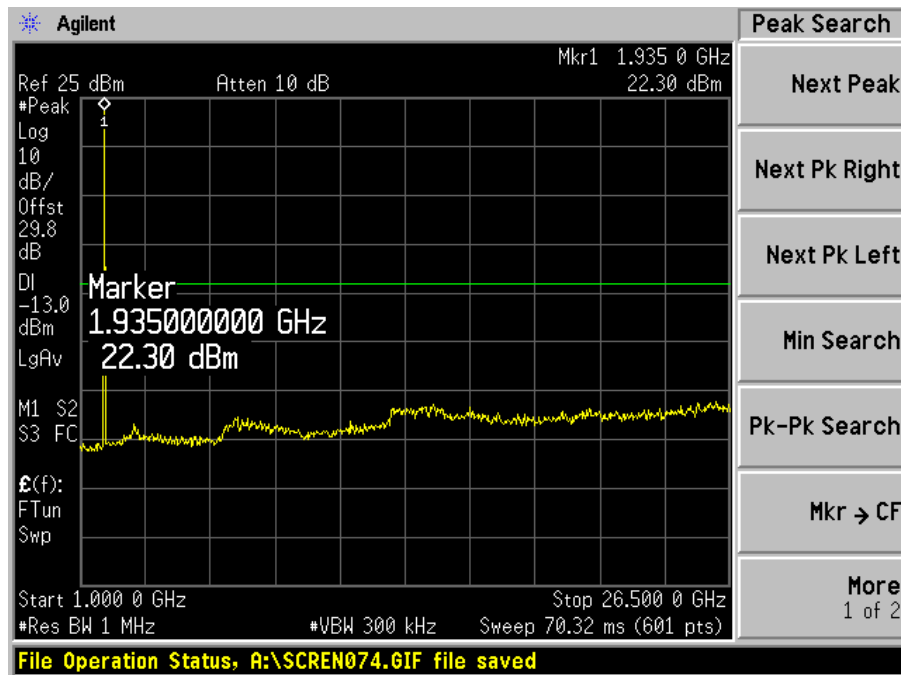
Conducted Spurious Emissions Uplink Low CH (1 GHz – 26.5 GHz-Cellular)



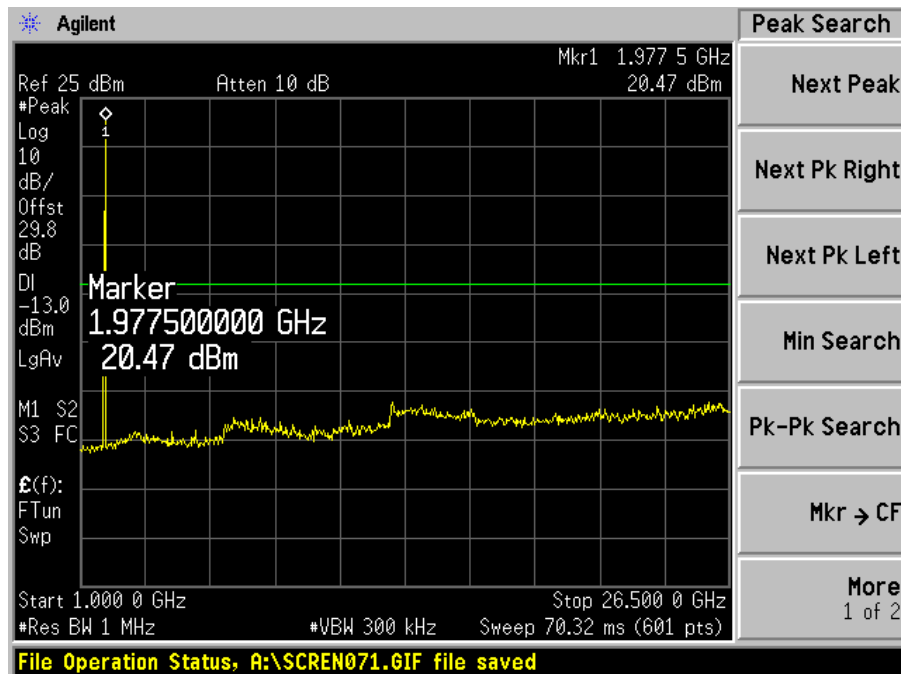
Conducted Spurious Emissions Uplink Mid CH (1 GHz – 26.5 GHz-Cellular)



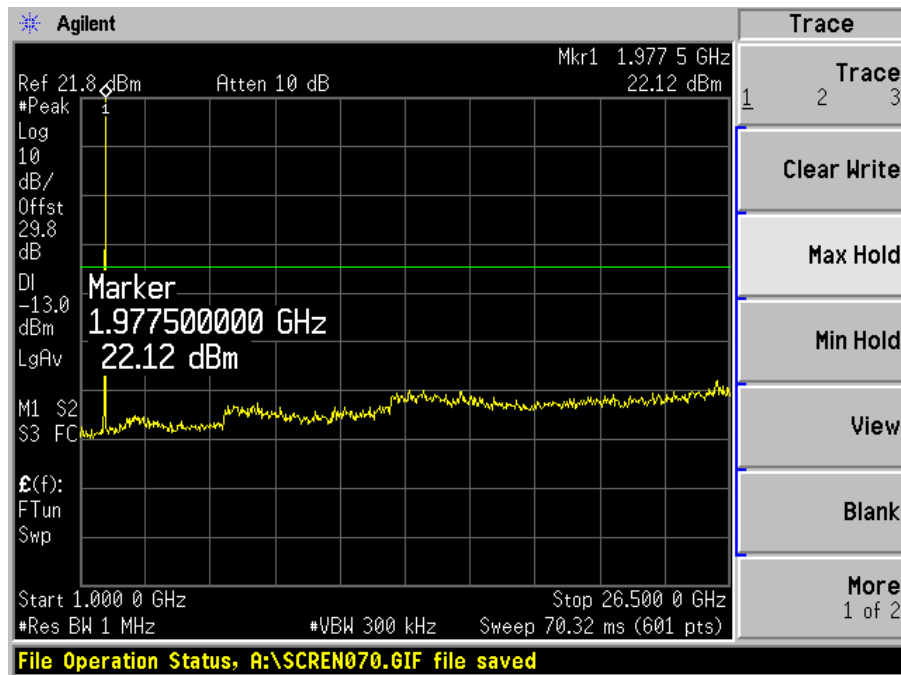
Conducted Spurious Emissions Uplink High CH (1 GHz – 26.5 GHz-Cellular)



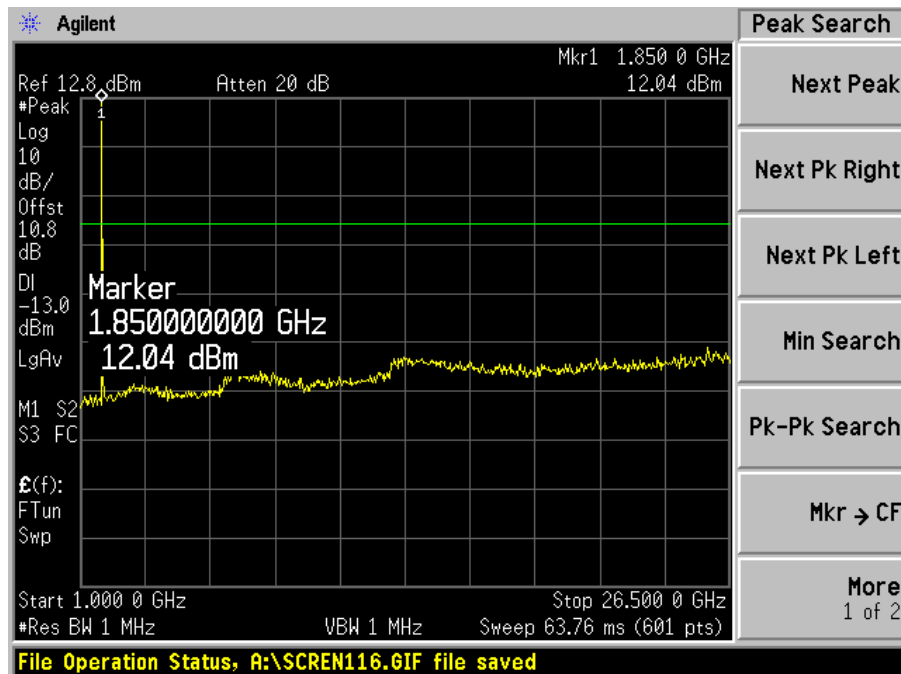
Conducted Spurious Emissions Downlink Low CH (1 GHz – 26.5 GHz-PCS)



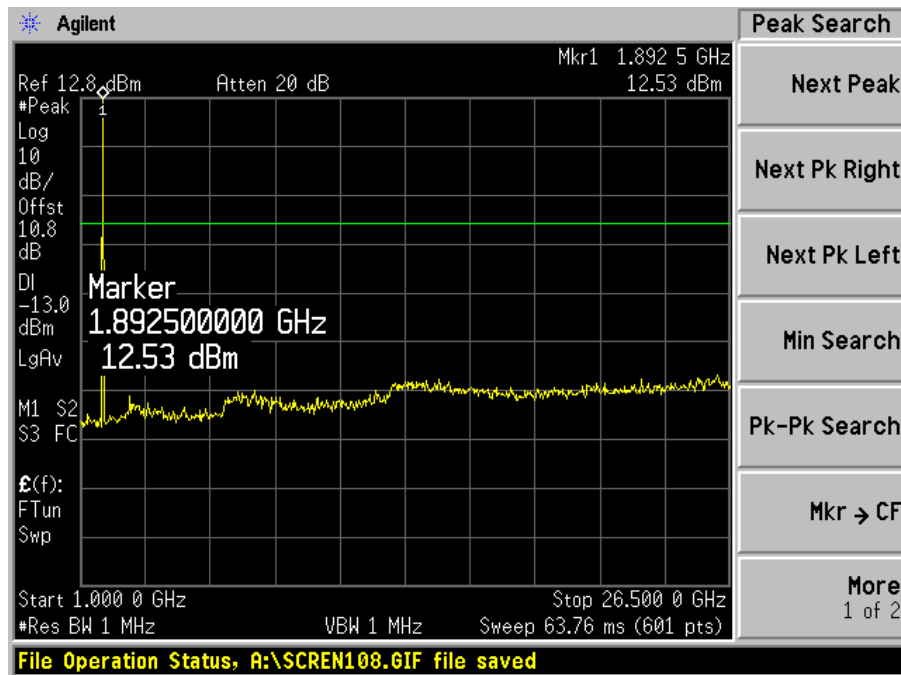
Conducted Spurious Emissions Downlink Mid CH(1 GHz – 26.5 GHz-PCS)



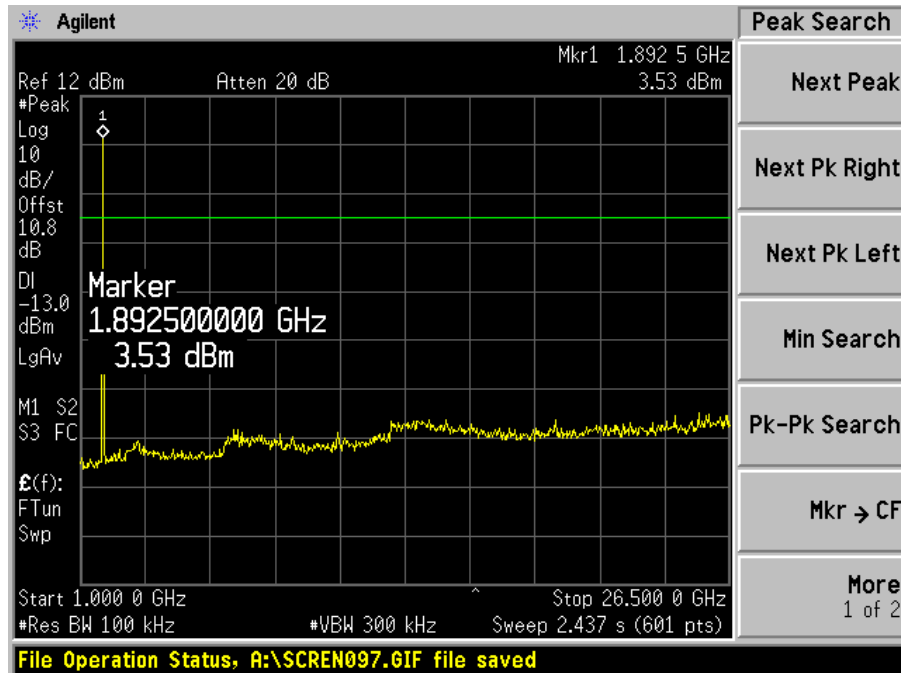
Conducted Spurious Emissions Downlink High CH (1 GHz – 26.5 GHz-PCS)



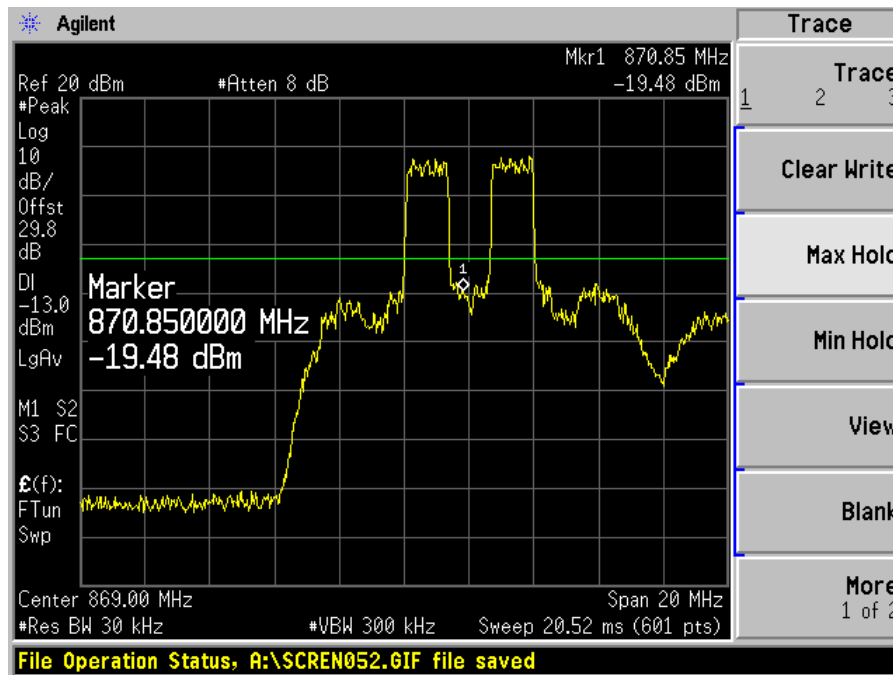
Conducted Spurious Emissions Uplink Low CH(1 GHz – 26.5 GHz-PCS)



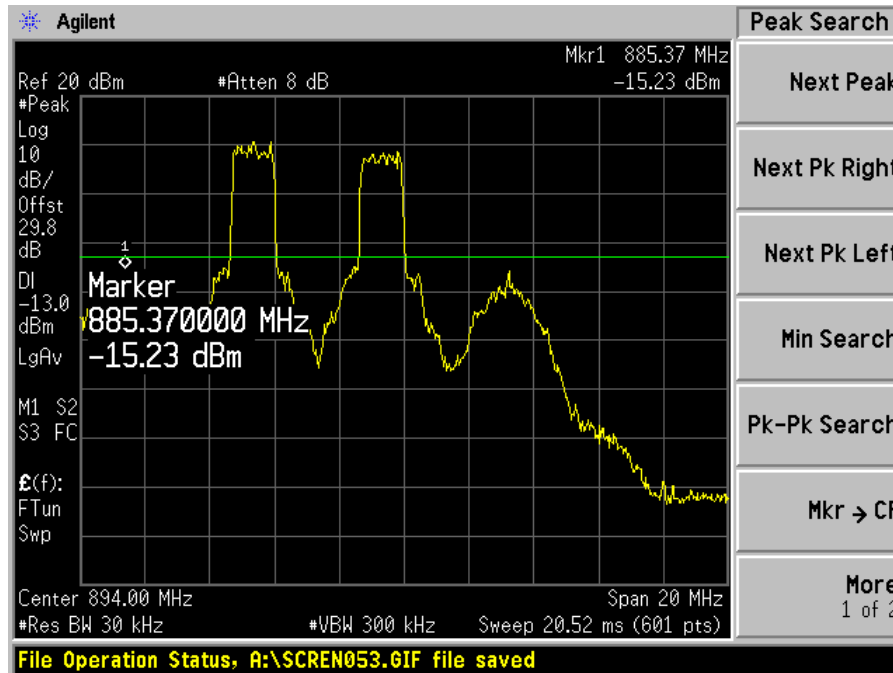
Conducted Spurious Emissions Uplink Mid CH (1 GHz – 26.5 GHz-PCS)



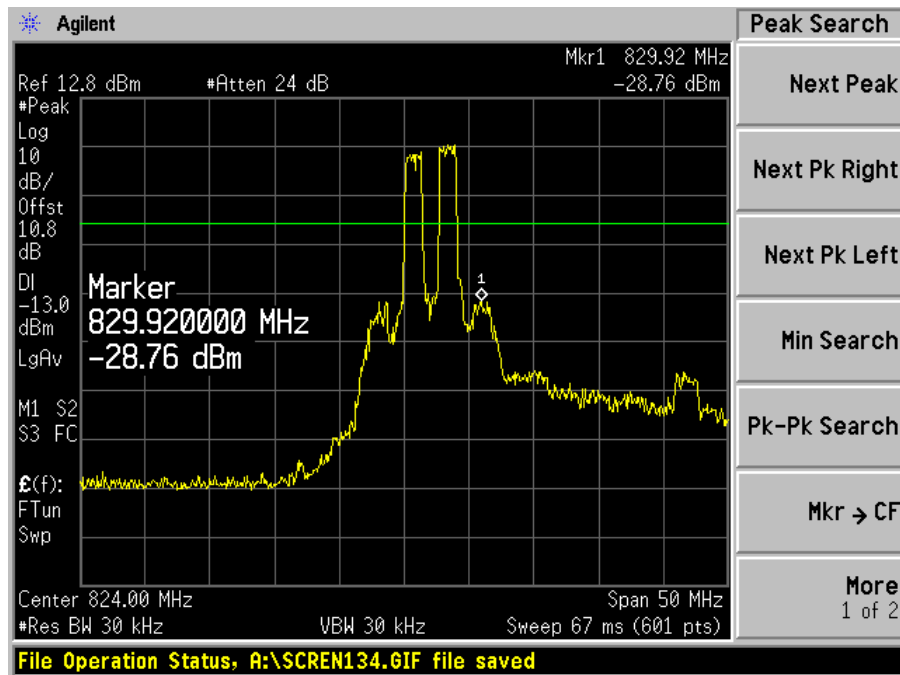
Conducted Spurious Emissions Uplink High CH (1 GHz – 26.5 GHz-PCS)



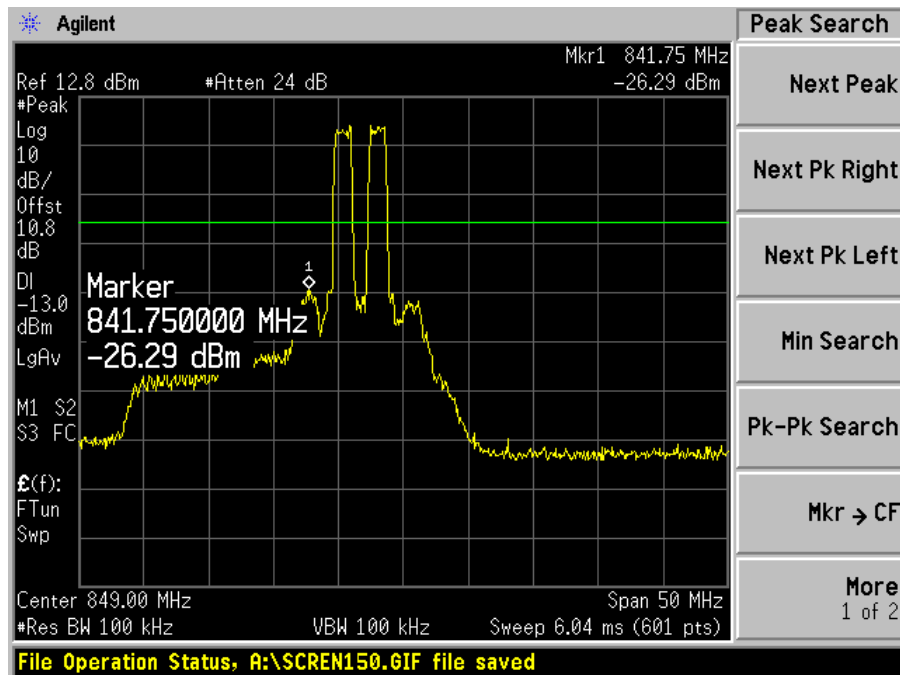
Intermodulation Downlink Low CH (Cellular)



Intermodulation Downlink High CH (Cellular)

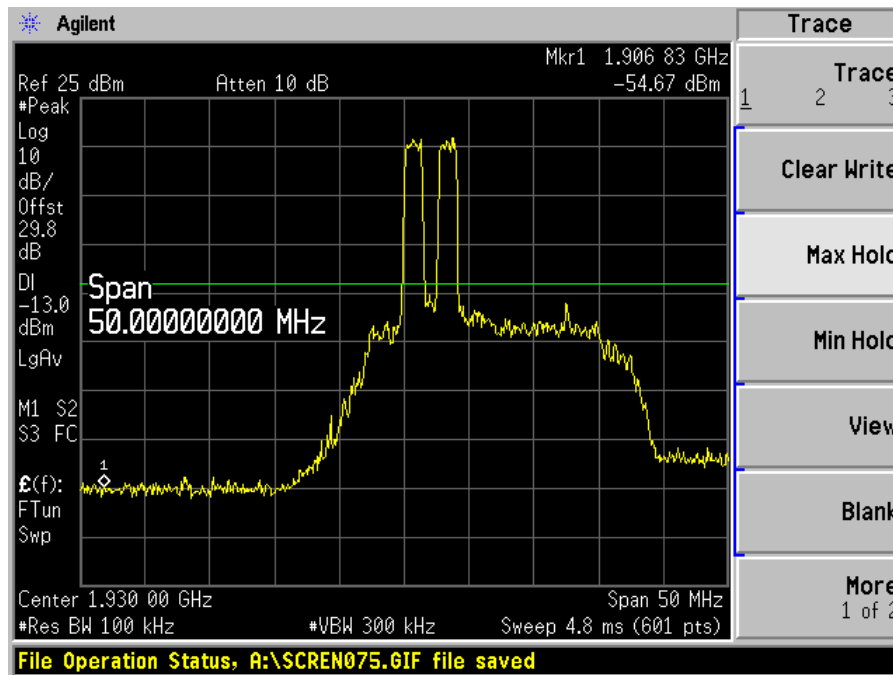


Intermodulation Uplink Low CH (Cellular)

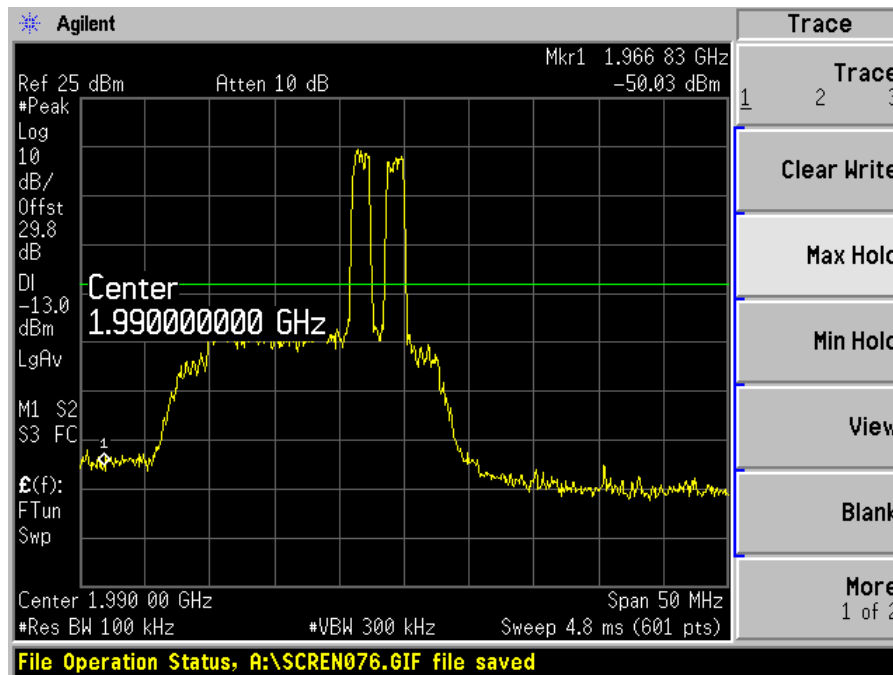


Intermodulation Uplink High CH (Cellular)

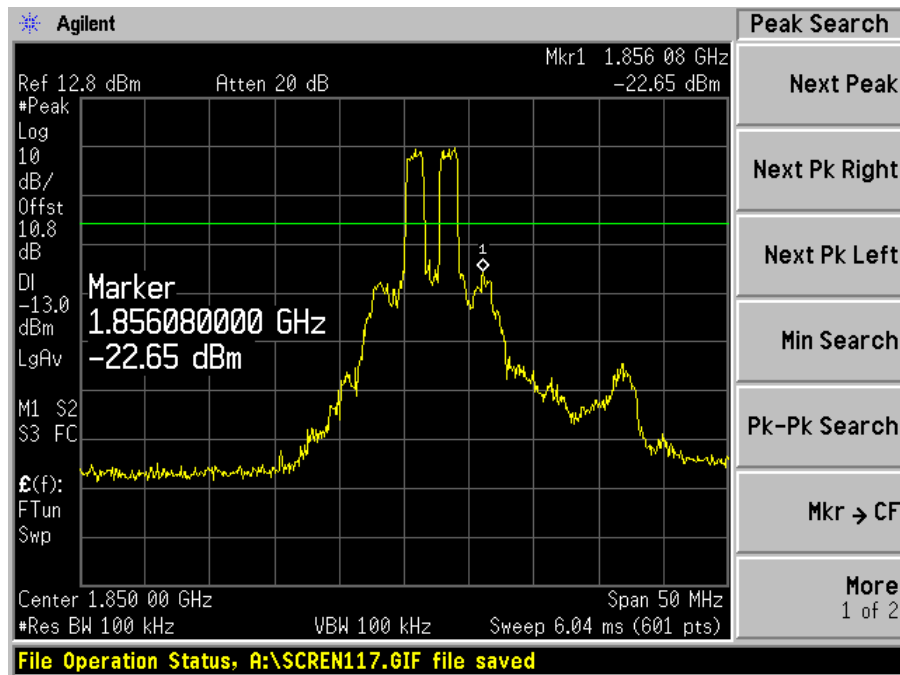




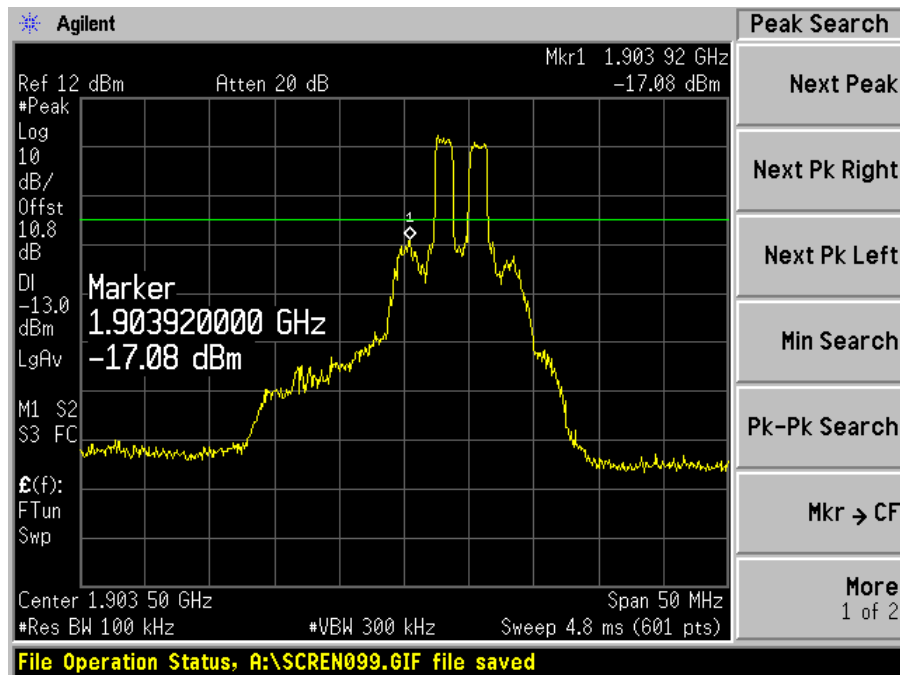
Intermodulation Downlink Low CH (PCS)



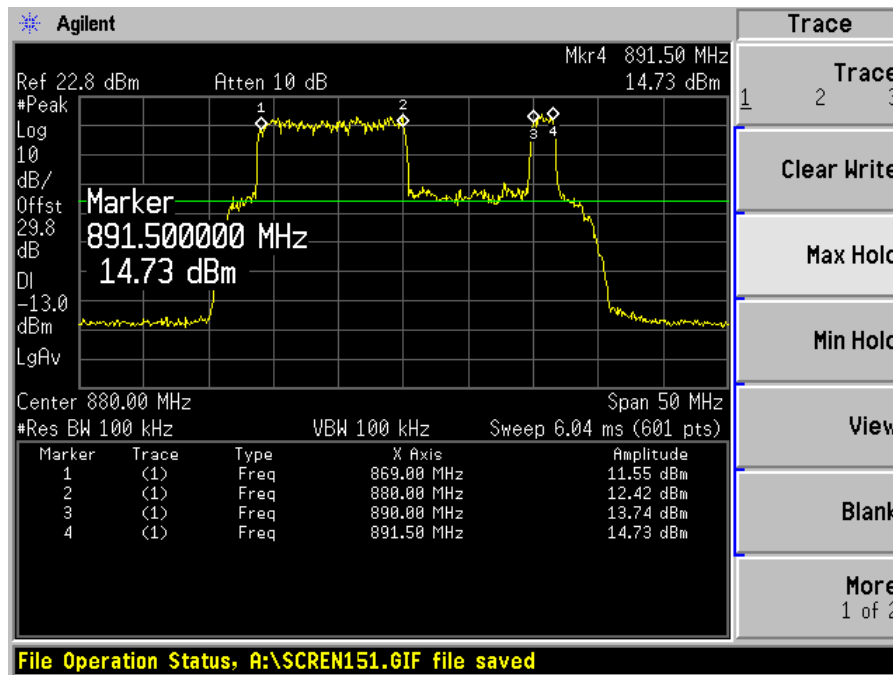
Intermodulation Downlink High CH (PCS)



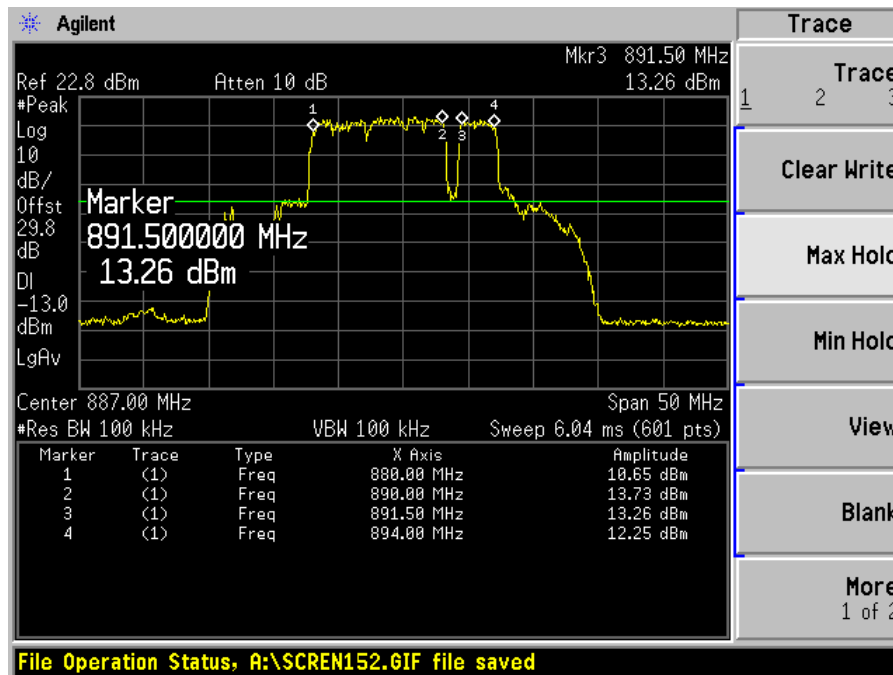
Intermodulation Uplink Low CH (PCS)



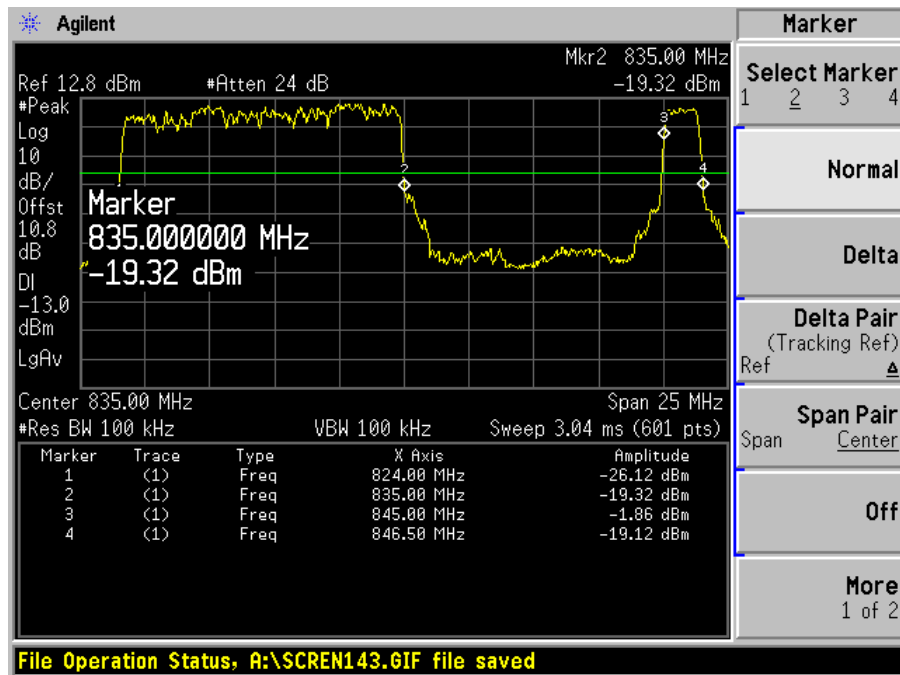
Intermodulation Uplink High CH (PCS)



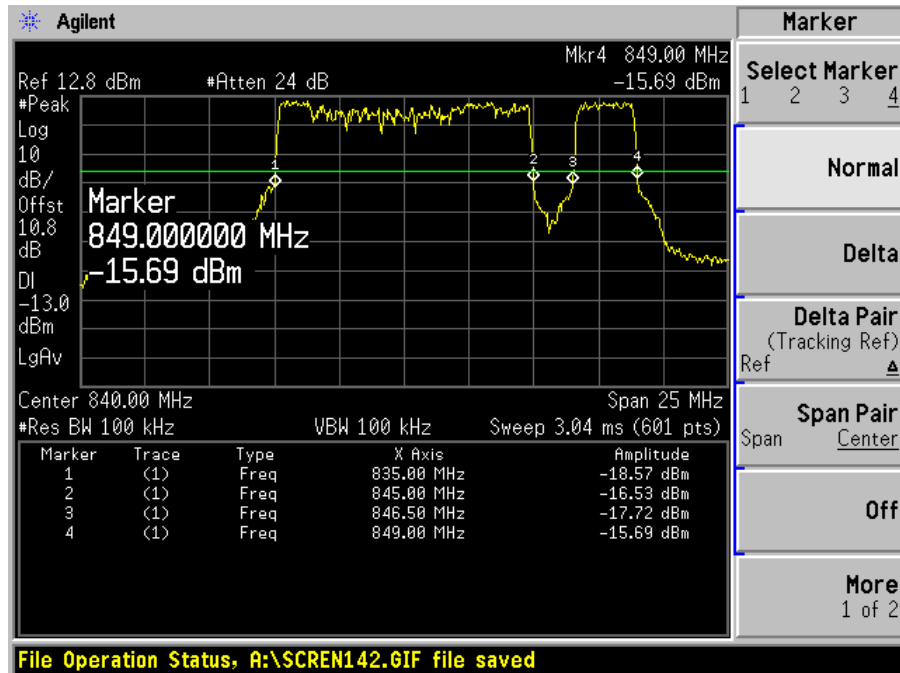
Out of Band Rejection Downlink (Cellular A Band)



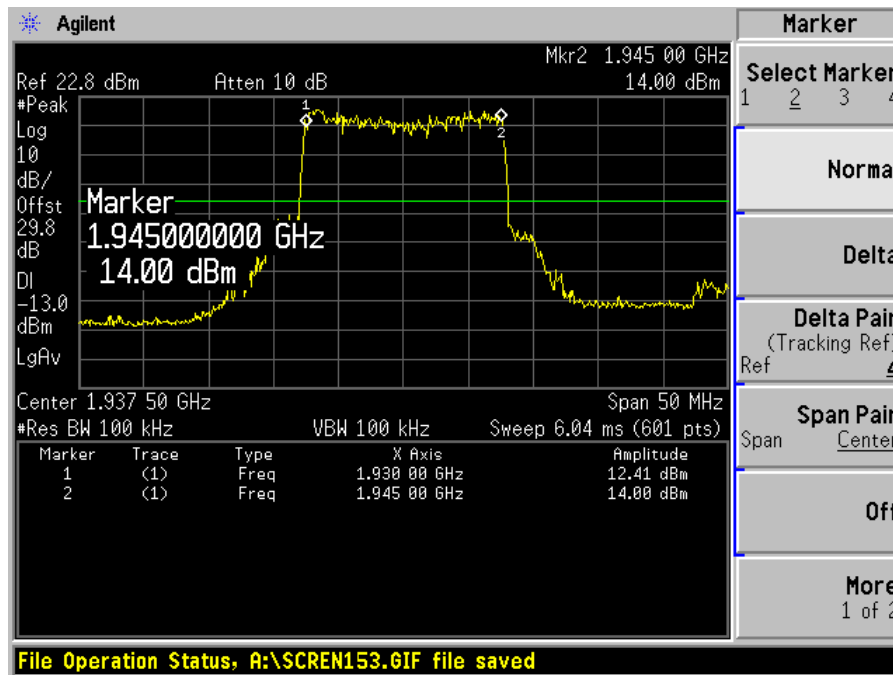
Out of Band Rejection Downlink (Cellular B Band)



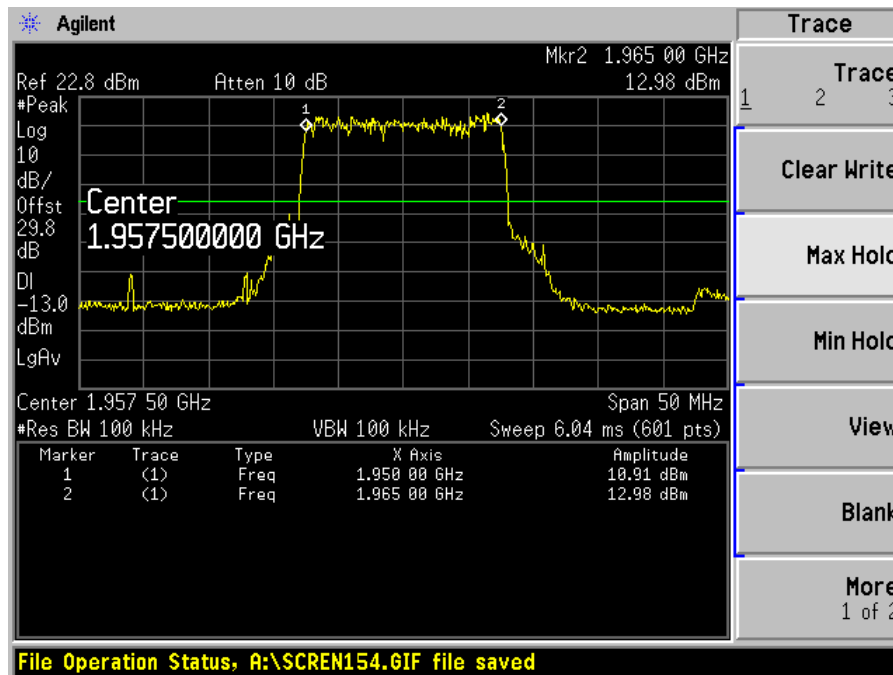
Out of Band Rejection Uplink (Cellular A Band)



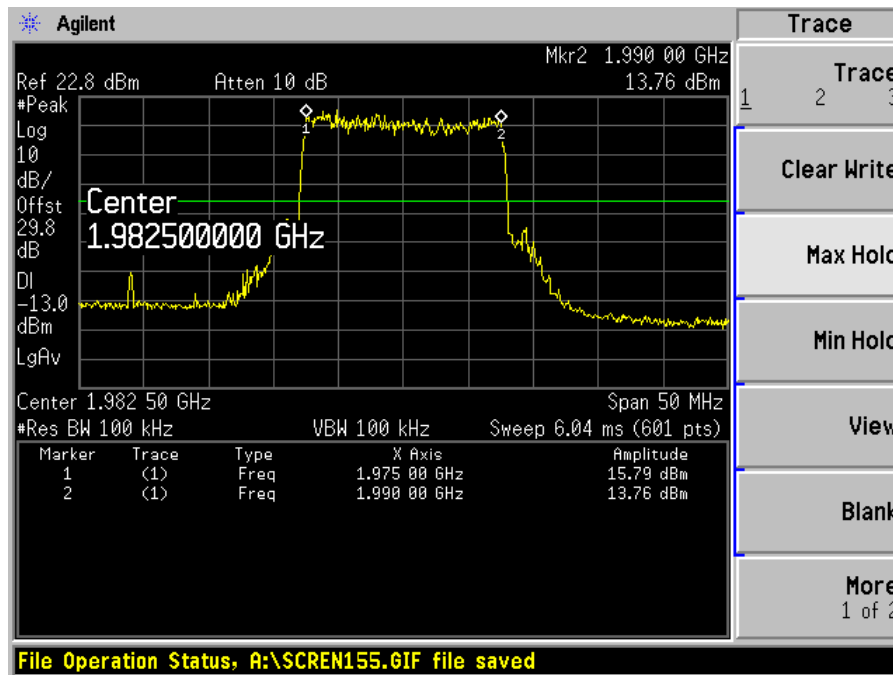
Out of Band Rejection Uplink (Cellular B Band)



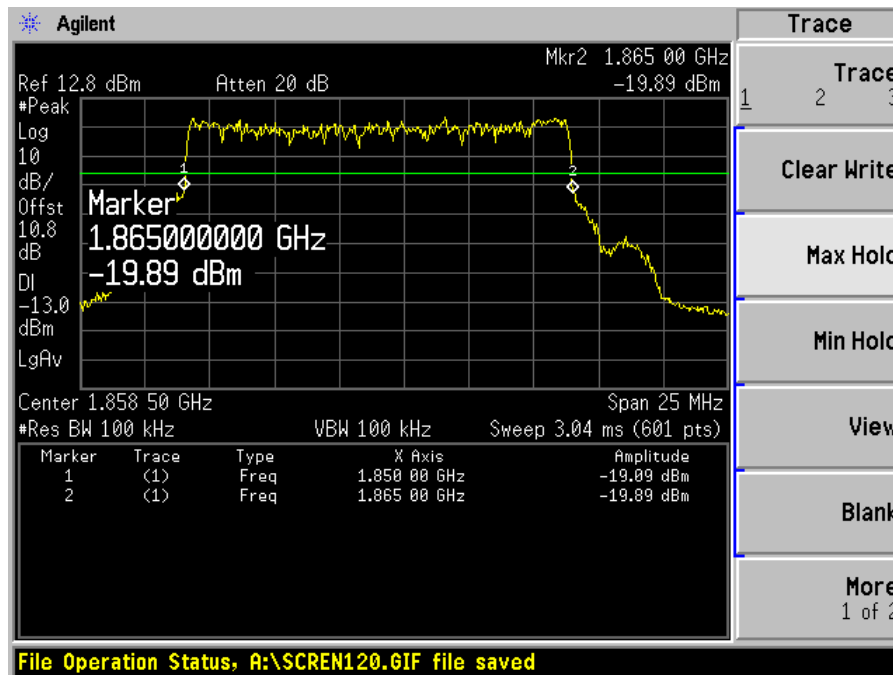
Out of Band Rejection Downlink (PCS A Band)



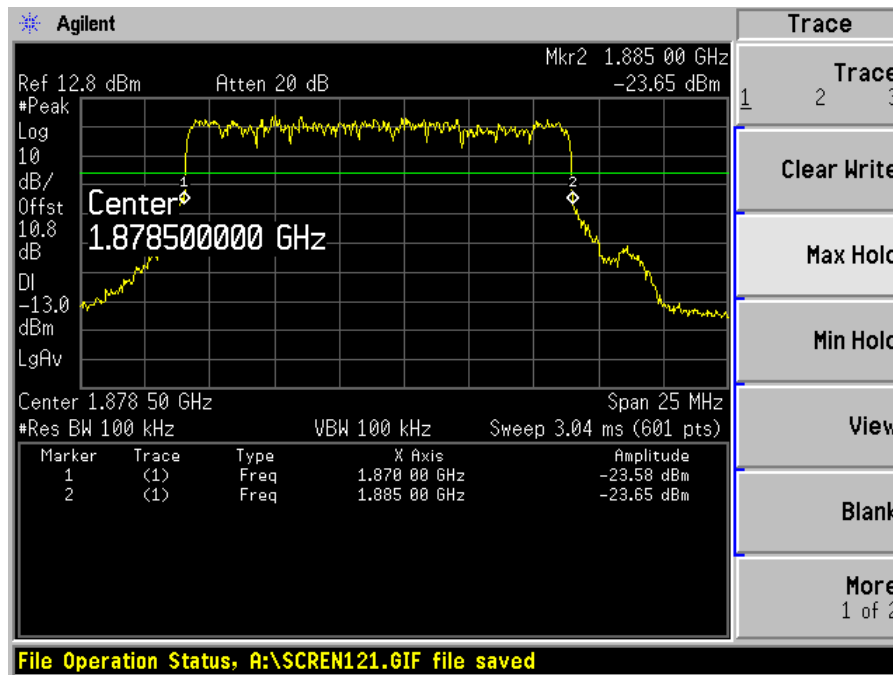
Out of Band Rejection Downlink (PCS B Band)



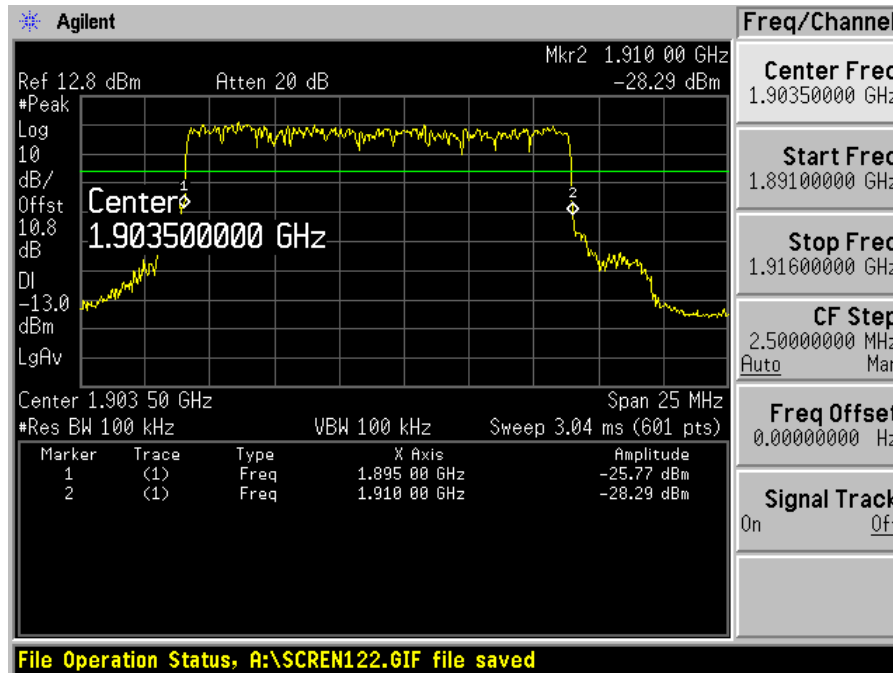
Out of Band Rejection Downlink (PCS C Band)



Out of Band Rejection Uplink (PCS A Band)



Out of Band Rejection Uplink (PCS B Band)



Out of Band Rejection Uplink (PCS C Band)

## 8. FIELD STRENGTH OF SPURIOUS RADIATION

### Test Requirement(s): § 2.1053 Measurements required: Field strength of spurious radiation.

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

**Test Procedures:** As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of TIA/EIA-603-C-2004 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber.

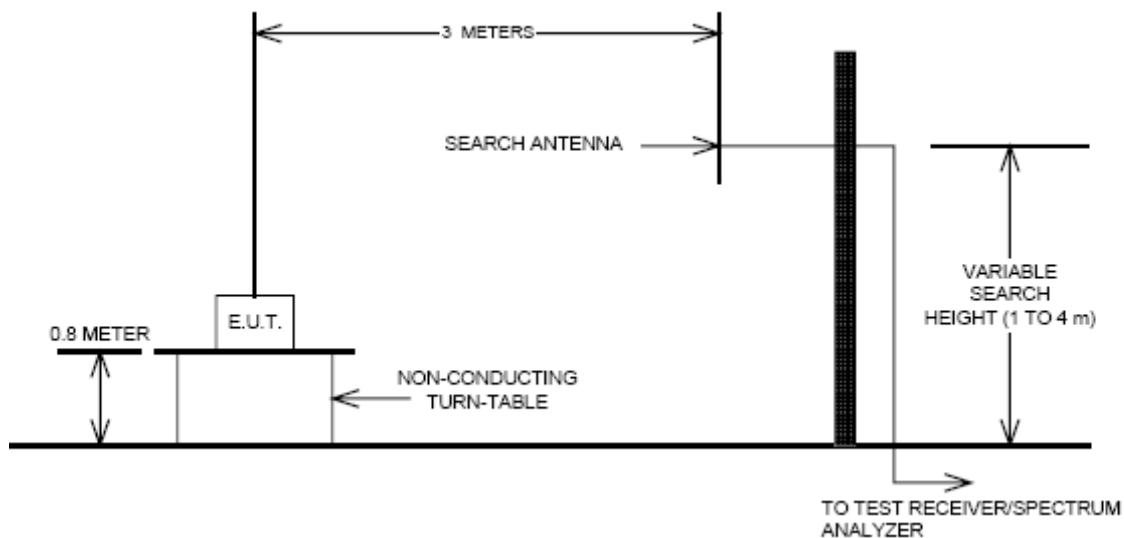
The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360 and the receiving antenna scanned from 1-3m in order to capture the maximum emission. A



calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

**Test Results:** There were no emissions detected above the noise floor which was at least 20 dB below the limit.

## Radiated Spurious Emissions Test Setup



## 10. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

### Test Requirement(s):

§2.1055(a)(1) §22.355, §24.235

### Test Procedures:

As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber.

A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option

on the Spectrum Analyzer was used to measure frequency deviations.

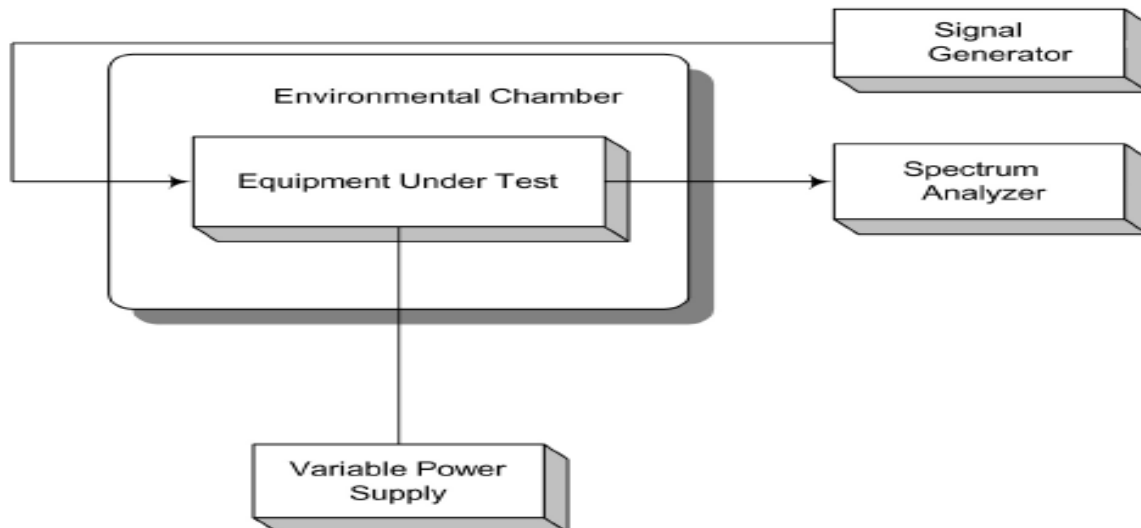
The frequency drift was investigated for every 10 °C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50 °C.

Voltage supplied to EUT is 120 Vac reference temperature was done at 20°C. The voltage was varied by  $\pm 15$  % of nominal

### Test Results:

The E.U.T was found in compliance for Frequency Stability and Voltage Test

### Test Setup:



## Frequency Stability and Voltage Test Results

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	+20(Ref)	881 500 012	12	0.000 001	0.014
100%	-30	881 500 052	52	0.000 006	0.062
100%	-20	881 500 032	32	0.000 004	0.038
100%	-10	881 500 047	47	0.000 005	0.056
100%	0	881 500 023	23	0.000 003	0.027
100%	+10	881 500 026	26	0.000 003	0.031
100%	+30	881 500 012	12	0.000 001	0.014
100%	+40	881 500 063	63	0.000 007	0.075
100%	+50	881 500 028	28	0.000 003	0.033
115%	+20	881 500 037	37	0.000 004	0.044
85%	+20	881 500 031	31	0.000 004	0.037

(Cellular Downlink Mid CH)

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	+20(Ref)	1960 000 021	21	0.000 001	0.025
100%	-30	1960 000 044	44	0.000 002	0.053
100%	-20	1960 000 032	32	0.000 002	0.038
100%	-10	1960 000 028	28	0.000 001	0.033
100%	0	1960 000 016	16	0.000 001	0.019
100%	+10	1960 000 048	48	0.000 002	0.057
100%	+30	1960 000 069	69	0.000 004	0.082
100%	+40	1960 000 051	51	0.000 003	0.061
100%	+50	1960 000 075	75	0.000 004	0.090
115%	+20	1960 000 039	39	0.000 002	0.047
85%	+20	1960 000 074	74	0.000 004	0.088

(PCS Downlink Mid CH)

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Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	+20(Ref)	836 500 098	98	0.000 117	0.117
100%	-30	836 500 068	68	0.000 081	0.081
100%	-20	836 500 056	56	0.000 067	0.067
100%	-10	836 500 087	87	0.000 104	0.104
100%	0	836 500 062	62	0.000 074	0.074
100%	+10	836 500 097	97	0.000 116	0.116
100%	+30	836 500 058	58	0.000 069	0.069
100%	+40	836 500 052	52	0.000 062	0.062
100%	+50	836 500 010	10	0.000 012	0.012
115%	+20	836 500 029	29	0.000 035	0.035
85%	+20	836 500 053	53	0.000 063	0.063

(Cellular Uplink Mid CH)

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	+20(Ref)	1880 000 052	52	0.000003	0.062
100%	-30	1880 000 063	63	0.000003	0.075
100%	-20	1880 000 073	73	0.000004	0.087
100%	-10	1880 000 064	64	0.000003	0.077
100%	0	1880 000 038	38	0.000002	0.045
100%	+10	1880 000 049	49	0.000003	0.059
100%	+30	1880 000 050	50	0.000003	0.060
100%	+40	1880 000 062	62	0.000003	0.074
100%	+50	1880 000 039	39	0.000002	0.047
115%	+20	1880 000 052	52	0.000003	0.062
85%	+20	1880 000 064	64	0.000003	0.077

(PCS Uplink Mid CH)

## 9. RF Exposure Statement

### 1. LIMITS

According to §1.1310 and §2.1091 RF exposure is calculated.

#### (B) Limits for General Population/Uncontrolled Exposures

Frequency range (MHz)	Electric field Strength (V/m)	Magnetic field Strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
0.3 - 1.34.....	614	1.63	*(100)	30
1.34 - 30.....	824/f	2.19/f	*(180/ f <sup>2</sup> )	30
30 - 300.....	27.5	0.073	0.2	30
300 - 1500.....	.....	.....	f/1500	30
1500 - 100.000.....	.....	.....	1.0	30

F = frequency in MHz

\* = Plane-wave equivalent power density

### 2. MAXIMUM PERMISSIBLE EXPOSURE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

2-1. Cellular Downlink

Max Peak output Power at antenna input terminal	16.500	dBm
Max Peak output Power at antenna input terminal	44.668	mW
Prediction distance	20.000	cm
Prediction frequency	869.700	MHz
Antenna Gain(typical)	7.000	dBi
Antenna Gain(numeric)	5.012	–
Power density at prediction frequency( S)	0.045	mW/cm <sup>2</sup>
MPE limit for uncontrolled exposure at prediction frequency	0.580	mW/cm <sup>2</sup>

2-2. PCS Downlink

Max Peak output Power at antenna input terminal	19.49000	dBm
Max Peak output Power at antenna input terminal	88.92011	mW
Prediction distance	20.00000	cm
Prediction frequency	1931.25000	MHz
Antenna Gain(typical)	12.00000	dBi
Antenna Gain(numeric)	15.84893	–
Power density at prediction frequency( S)	0.28037	mW/cm <sup>2</sup>
MPE limit for uncontrolled exposure at prediction frequency	1.00000	mW/cm <sup>2</sup>

### 2-3. Cellular Uplink

Max Peak output Power at antenna input terminal	11.380	dBm
Max Peak output Power at antenna input terminal	13.740	mW
Prediction distance	20.000	cm
Prediction frequency	836.500	MHz
Antenna Gain(typical)	2.000	dBi
Antenna Gain(numeric)	1.585	–
Power density at prediction frequency( S)	0.004	mW/cm <sup>2</sup>
MPE limit for uncontrolled exposure at prediction frequency	0.558	mW/cm <sup>2</sup>

### 2-4. PCS Uplink

Max Peak output Power at antenna input terminal	6.47000	dBm
Max Peak output Power at antenna input terminal	4.43609	mW
Prediction distance	20.00000	cm
Prediction frequency	1851.25000	MHz
Antenna Gain(typical)	2.00000	dBi
Antenna Gain(numeric)	1.58489	–
Power density at prediction frequency (S)	0.00140	mW/cm <sup>2</sup>
MPE limit for uncontrolled exposure at prediction frequency	1.00000	mW/cm <sup>2</sup>

## 3. RESULTS

The power density level at 20 cm is 0.045 mW/cm<sup>2</sup>(Cellular), 0.28037 mW/cm<sup>2</sup>(PCS), which is below the uncontrolled exposure limit for Cellular & PCS band.

**Warning:** In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, it must also have a minimum distance of 20 cm from the body during normal operation.