

# FCC GSM/WCDMA REPORT

## FCC Certification

**Applicant Name:**  
SAMSUNG Electronics Co., Ltd.**Address:**  
129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do,  
443-742 Rep. of Korea**Date of Issue:**

July 03, 2015

**Test Site/Location:**HCT CO., LTD., 74, Seoicheon-ro 578beon-gil,  
Majang-myeon, Icheon-si, Gyeonggi-do, Korea**Report No.:** HCT-R-1507-F007**HCT FRN:** 0005866421**FCC ID:** A3LSMJ500Y**APPLICANT:** SAMSUNG Electronics Co., Ltd.**FCC Model(s):** SM-J500Y  
**EUT Type:** Mobile Phone  
**FCC Classification:** Licensed Portable Transmitter Held to Ear (PCE)  
**FCC Rule Part(s):** §22, §24, §27, §2

| Mode        | Tx Frequency (MHz) | Rx Frequency (MHz) | Emission Designator | ERP            |                  |
|-------------|--------------------|--------------------|---------------------|----------------|------------------|
|             |                    |                    |                     | Max. Power (W) | Max. Power (dBm) |
| GSM850      | 824.2 – 848.8      | 869.2 – 893.8      | 247 KGXW            | 0.399          | 26.02            |
| GSM850 EDGE |                    |                    | 245 KG7W            | 0.132          | 21.22            |
| WCDMA850    | 826.4 – 846.6      | 871.4 – 891.6      | 4M17F9W             | 0.039          | 15.89            |

| Mode         | Tx Frequency (MHz) | Rx Frequency (MHz) | Emission Designator | EIRP           |                  |
|--------------|--------------------|--------------------|---------------------|----------------|------------------|
|              |                    |                    |                     | Max. Power (W) | Max. Power (dBm) |
| GSM1900      | 1850.2 – 1909.8    | 1930.2 – 1989.8    | 248 KGXW            | 0.562          | 27.50            |
| GSM1900 EDGE |                    |                    | 254 KG7W            | 0.267          | 24.27            |
| WCDMA1900    | 1852.4 – 1907.6    | 1932.4 – 1987.6    | 4M18F9W             | 0.127          | 21.02            |
| WCDMA1700    | 1712.4 – 1752.6    | 2112.4 – 2152.6    | 4M19F9W             | 0.125          | 20.95            |

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 853(a)

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**Manager of RF Team**

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## Version

| TEST REPORT NO. | DATE          | DESCRIPTION             |
|-----------------|---------------|-------------------------|
| HCT-R-1507-F007 | July 03, 2015 | - First Approval Report |
|                 |               |                         |
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# MEASUREMENT REPORT

## 1. GENERAL INFORMATION

**Applicant Name:** SAMSUNG Electronics Co., Ltd.

**Address:** 129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 Rep. of Korea

**FCC ID:** A3LSMJ500Y

**Application Type:** Certification

**FCC Classification:** Licensed Portable Transmitter Held to Ear (PCE)

**FCC Rule Part(s):** §22, §24, §27, §2

**EUT Type:** Mobile Phone

**FCC Model(s):** SM-J500Y

**Tx Frequency:** 824.20 - 848.80 MHz (GSM850)  
826.40 - 846.60 MHz (WCDMA850)  
1 850.20 - 1 909.80 MHz (GSM1900)  
1 852.4 - 1 907.6 MHz (WCDMA1900)  
1 712.4 - 1 752.6 MHz (WCDMA1700)

**Rx Frequency:** 869.20 - 893.80 MHz (GSM850)  
871.40 - 891.60 MHz (WCDMA850)  
1 930.20 - 1 989.80 MHz (GSM1900)  
1 932.4 - 1 987.6 MHz (WCDMA1900)  
2 112.4 - 2 152.6 MHz (WCDMA1700)

**Max. RF Output Power:** 0.399 W GSM850 (26.02 dBm) / 0.562 W GSM1900 (27.50 dBm)  
0.132 W GSM850 EDGE (21.22 dBm) / 0.267 W GSM1900 EDGE (24.27 dBm)  
0.039 W WCDMA850 (15.89 dBm) / 0.127 W WCDMA1900 (21.02 dBm)  
0.125 W WCDMA1700 (20.95 dBm)

**Emission Designator(s):** 247 KGXW (GSM850) 248 KGXW (GSM1900)  
245 KG7W (GSM850 EDGE) 254 KG7W (GSM1900 EDGE)  
4M17F9W (WCDMA850) 4M18F9W (WCDMA1900)  
4M19F9W (WCDMA1700)

**Date(s) of Tests:** May 29, 2015 ~ June 18, 2015

**Antenna Specification** Manufacturer: TE Connectivity  
Antenna type: Internal Antenna  
Peak Gain: GSM850/ WCDMA850 : -1.72 dBi  
GSM1900/ WCDMA1900 : 0.01 dBi  
WCDMA1700 : -0.92 dBi

## **2. INTRODUCTION**

### **2.1. EUT DESCRIPTION**

The SAMSUNG Electronics Co., Ltd. SM-J500Y Mobile Phone consists of GPRS Class33, EDGE33, GSM850, GSM1900, WCDMA850, WCDMA1900, WCDMA1700, HSDPA, HSUPA, HSPA Release 8 and HSPA+.

### **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 Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea.**

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

#### **3.1 ERP/EIRP RADIATED POWER AND RADIATED SPURIOUS EMISSIONS**

Note: ERP(Effective Radiated Power), EIRP(Effective Isotropic Radiated Power)

##### Test Procedure

Radiated emission measurements are performed in the Fully-anechoic chamber. The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-D-2010 Clause 2.2.17. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission. The level and position of the maximized emission is recorded with the spectrum analyzer using RMS detector.

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 and the previously recorded signal was duplicated.

The power is calculated by the following formula;

$$P_{d(dBm)} = P_{g(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dB)}$$

Where:  $P_d$  is the dipole equivalent power and  $P_g$  is the generator output power into the substitution antenna.

The maximum EIRP is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

##### **Radiated spurious emissions**

1. Frequency Range : 30 MHz ~ 10<sup>th</sup> Harmonics of highest channel fundamental frequency.
2. The EUT was setup to maximum output power. The 100 kHz RBW was used to scan from 30 MHz to 1 GHz. Also, the 1 MHz RBW was used to scan from 1 GHz to 10 GHz(GSM850/WCDMA850 ) or 20 GHz(GSM1900/WCDMA1900/WCDMA1700). The high, low and a middle channel were tested for out of band measurements.

### 3.2 PEAK- TO- AVERAGE RATIO

#### Test Procedure

Peak to Average Power Ratio is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v02r02, October 17, 2014, Section 5.7.

#### - Section 5.7.1 CCDF Procedure for PAPR

- a) Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
- b) Set the number of counts to a value that stabilizes the measured CCDF curve;
- c) 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.
- d) Record the maximum PAPR level associated with a probability of 0.1%.

#### - Section 5.7.2 Alternate Procedure for PAPR

Use one of the procedures presented in 5.1 to measure the total peak power and record as  $P_{Pk}$ . Use one of the applicable procedures presented 5.2 to measure the total average power and record as  $P_{Avg}$ . Determine the P.A.R. from:  $P.A.R_{(dB)} = P_{Pk (dBm)} - P_{Avg (dBm)}$  ( $P_{Avg}$  = Average Power + Duty cycle Factor)

#### 5.1.1 Peak power measurements with a spectrum/signal analyzer or EMI receiver

The following procedure can be used to determine the total peak output power.

- a) Set the RBW  $\geq$  OBW.
- b) Set VBW  $\geq 3 \times$  RBW.
- c) Set span  $\geq 2 \times$  RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Ensure that the number of measurement points  $\geq$  span/RBW.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the peak amplitude level.

### **5.2.2 Procedures for use with a spectrum/signal analyzer when EUT cannot be configured to transmit continuously and sweep triggering/signal gating cannot be properly implemented**

If the EUT cannot be configured to transmit continuously (burst duty cycle < 98%), then one of the following procedures can be used. The selection of the applicable procedure will depend on the characteristics of the measured burst duty cycle.

Measure the burst duty cycle with a spectrum/signal analyzer or EMC receiver can be used in zero-span mode if the response time and spacing between bins on the sweep are sufficient to permit accurate measurement of the burst on/off time of the transmitted signal.

#### **5.2.2.2 Constant burst duty cycle**

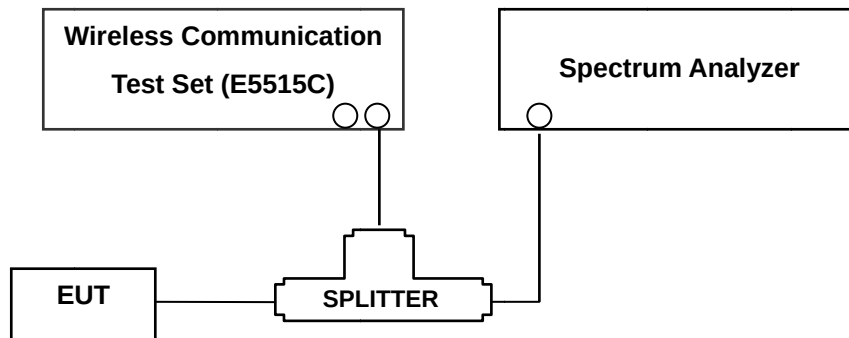
If the measured burst duty cycle is constant (i.e., duty cycle variations are less than  $\pm 2$  percent), then:

- a) Set span to at least 1.5 times the OBW.
- b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- c) Set VBW  $\geq 3 \times$  RBW.
- d) Number of points in sweep  $\geq 2 \times$  span / RBW. (This gives bin-to-bin spacing  $\leq$  RBW/2, so that narrowband signals are not lost between frequency bins.)
- e) Sweep time = auto.
- f) Detector = RMS (power averaging).
- g) Set sweep trigger to "free run".
- h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
- j) Add  $10 \log (1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission).

For example, add  $10 \log (1/0.25) = 6$  dB if the duty cycle is a constant 25%.

### 3.3 OCCUPIED BANDWIDTH.

Test set-up



(Configuration of conducted Emission measurement)

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

#### Test Procedure

OBW is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v02r02, October 17, 2014, Section 4.2.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels(low, middle and high operational range.)

The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

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

#### Test Procedure

Spurious and harmonic emissions at antenna terminal is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v02r02, October 17, 2014, Section 6.0.

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

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. The RBW settings used in the testing are greater than 1 % of the occupied bw. The 1 MHz RBW was used to scan from 10 MHz to 10 GHz. (GSM1900 Mode: 10 MHz to 20 GHz). A display line was placed at - 13 dBm to show compliance. The high, lowest and a middle channel were tested for out of band measurements.

Measurements of all out of band are made on RBW = 1MHz and VBW  $\geq$  3 MHz in the worst case despite RBW = 100 kHz and VBW  $\geq$  300 kHz upon 1 GHz.

- RBW = 1 MHz
- VBW  $\geq$  3 MHz
- Detector = Peak
- Trace Mode = max hold
- Sweep time = auto
- Number of points in sweep  $\geq 2 * \text{Span} / \text{RBW}$

- Band Edge Requirement : According to FCC 22.917, 24.238 specified that 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. 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.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

In GSM mode, the center frequency of spectrum set to the band edge frequency. The span is 1MHz (RBW = at least 1 % of the EBW, VBW  $\geq 3*RBW$ , Detector = Average).

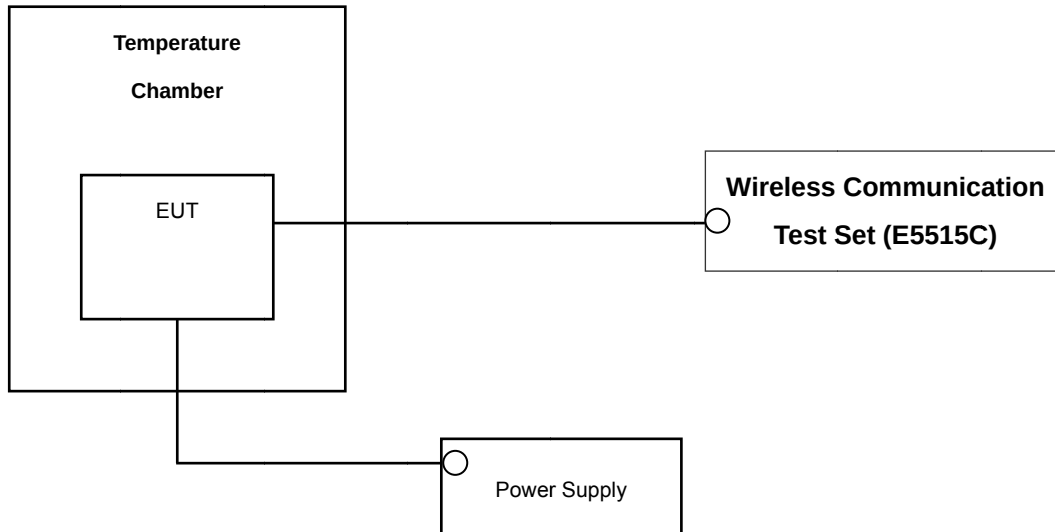
In WCDMA mode, the center frequency of spectrum set to the band edge frequency. The span is 7MHz (RBW = at least 1% of the EBW,  $\geq 3*RBW$ , Detector = Average).

**NOTES:** The analyzer plot offsets were determined by below conditions.

- For GSM850 and WCDMA850, total offset 27.0 dB = 20 dB attenuator + 6 dB Splitter + 1.0 dB RF cables.
- For GSM1900 and WCDMA1900, total offset 27.9 dB = 20 dB attenuator + 6 dB Splitter + 1.9 dB RF cables.
- For WCDMA1700, total offset 27.6 dB = 20 dB attenuator + 6 dB Splitter + 1.6 dB RF cables.

### 3.5 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

#### Test Set-up



\* Nominal Operating Voltage

#### Test Procedure

Frequency stability is tested in accordance with ANSI/TIA-603-D-2010 section 2.2.2.

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 100 % 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(GSM1900/WCDMA1900/WCDMA1700). The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm) of the center frequency(GSM850/WCDMA850).

#### Time Period and Procedure:

The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).

1. 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.
2. 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

| Manufacture       | Model/ Equipment                            | Serial Number          | Calibration Interval | Calibration Due |
|-------------------|---------------------------------------------|------------------------|----------------------|-----------------|
| Agilent           | N1921A/ Power Sensor                        | MY45241059             | Annual               | 07/09/2015      |
| Agilent           | N1911A/ Power Meter                         | MY45100523             | Annual               | 01/15/2016      |
| MITEQ             | AMF-6D-001180-35-20P/AMP                    | 1081666                | Annual               | 09/04/2015      |
| Wainwright        | WHK1.2/15G-10EF/H.P.F                       | 4                      | Annual               | 04/27/2016      |
| Wainwright        | WHK3.3/18G-10EF/H.P.F                       | 2                      | Annual               | 04/27/2016      |
| Hewlett Packard   | 11667B / Power Splitter                     | 10545                  | Annual               | 02/22/2016      |
| Hewlett Packard   | 11667B / Power Splitter                     | 11275                  | Annual               | 04/29/2016      |
| Digital           | EP-3010/ Power Supply                       | 3110117                | Annual               | 10/29/2015      |
| Schwarzbeck       | UHAP/ Dipole Antenna                        | 557                    | Biennial             | 03/23/2017      |
| Schwarzbeck       | UHAP/ Dipole Antenna                        | 558                    | Biennial             | 03/23/2017      |
| Korea Engineering | KR-1005L / Chamber                          | KRAC05063-3CH          | Annual               | 10/29/2015      |
| Schwarzbeck       | BBHA 9120D/ Horn Antenna                    | 147                    | Biennial             | 09/01/2016      |
| Schwarzbeck       | BBHA 9120D/ Horn Antenna                    | 1151                   | Biennial             | 07/05/2015      |
| Schwarzbeck       | BBHA 9170/ Horn Antenna(15~40GHz)           | BBHA9170541            | Biennial             | 07/05/2015      |
| Agilent           | E4440A/Spectrum Analyzer                    | US45303008             | Annual               | 03/18/2016      |
| WEINSCHL          | ATTENUATOR                                  | BR0592                 | Annual               | 10/22/2015      |
| REOHDE&SCHWARZ    | FSV40/Spectrum Analyzer                     | 1307.9002K40-100931-NK | Annual               | 06/04/2016      |
| Agilent           | 8960 (E5515C)/ Base Station                 | MY48360222             | Annual               | 08/26/2015      |
| Anritsu Corp.     | MT8820C/Wideband Radio Communication Tester | 6200863156             | Annual               | 03/24/2016      |
| ROHDE&schwarz     | ESIB 26/ EMI TEST RECEIVER                  | 100298                 | Annual               | 02/27/2016      |

## 5. SUMMARY OF TEST RESULTS

| FCC Part Section(s)                       | Test Description                                                       | Test Limit                                                                     | Test Condition | Test Result |
|-------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------|-------------|
| 2.1049                                    | Occupied Bandwidth                                                     | N/A                                                                            | CONDUCTED      | PASS        |
| 2.1051, 22.917(a),<br>24.238(a), 27.53(h) | Band Edge / Spurious and<br>Harmonic Emissions at<br>Antenna Terminal. | < 43 + 10log10 (P[Watts]) at Band<br>Edge and for all out-of-band<br>emissions |                | PASS        |
| * 2.1046                                  | Conducted Output Power                                                 | -                                                                              |                | PASS        |
| 24.232(d)<br>27.50(d)(5)                  | Peak- to- Average Ratio                                                | < 13 dB                                                                        |                | PASS        |
| 2.1055, 22.355                            | Frequency stability / variation of<br>ambient temperature              | < 2.5 ppm (Part22)                                                             |                | PASS        |
| 24.235, 27.54                             |                                                                        | Emission must remain in band<br>(Part24, 27)                                   |                | PASS        |
| 22.913(a)(2)                              | Effective Radiated Power                                               | < 7 Watts max. ERP                                                             | RADIATED       | PASS        |
| 24.232(c)                                 | Equivalent Isotropic Radiated<br>Power                                 | < 2 Watts max. EIRP                                                            |                | PASS        |
| 27.50(d)(4)                               | Equivalent Isotropic Radiated<br>Power                                 | < 1 Watts max. EIRP                                                            |                |             |
| 2.1053, 22.917(a),<br>24.238(a), 27.53(h) | Radiated Spurious and<br>Harmonic Emissions                            | < 43 + 10log10 (P[Watts]) for<br>all out-of band emissions                     |                | PASS        |

\*: See SAR Report

## 6. SAMPLE CALCULATION

### A. ERP Sample Calculation

| Mode   | Ch./ Freq. |            | Measured<br>Level(dBm) | Substitute<br>LEVEL(dBm) | Ant. Gain<br>(dBd) | C.L  | Pol. | ERP   |       |
|--------|------------|------------|------------------------|--------------------------|--------------------|------|------|-------|-------|
|        | channel    | Freq.(MHz) |                        |                          |                    |      |      | W     | dBm   |
| GSM850 | 128        | 824.20     | -21.37                 | 38.40                    | -10.61             | 0.95 | H    | 0.483 | 26.84 |

$$\text{ERP} = \text{SubstituteLEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power (ERP).

### B. Emission Designator

#### GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

#### EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

#### WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

## 7. TEST DATA

### 7.1 EFFECTIVE RADIATED POWER

#### (GSM850 Mode)

| Ch./ Freq. |            | Measured   | Substitute  | Ant. Gain | C.L  | Pol. | ERP   |       |
|------------|------------|------------|-------------|-----------|------|------|-------|-------|
| channel    | Freq.(MHz) | Level(dBm) | LEVEL (dBm) | (dBd)     |      |      | W     | dBm   |
| 128        | 824.20     | -24.45     | 37.49       | -10.59    | 0.88 | H    | 0.399 | 26.02 |
| 190        | 836.60     | -25.90     | 35.75       | -10.53    | 0.89 | H    | 0.271 | 24.33 |
| 251        | 848.80     | -26.54     | 34.41       | -10.48    | 0.89 | H    | 0.202 | 23.04 |
| EDGE 128   | 824.20     | -29.25     | 32.69       | -10.59    | 0.88 | H    | 0.132 | 21.22 |

#### (WCDMA850 Mode)

| Ch./ Freq. |            | Measured   | Substitute  | Ant. Gain | C.L  | Pol. | ERP   |       |
|------------|------------|------------|-------------|-----------|------|------|-------|-------|
| channel    | Freq.(MHz) | Level(dBm) | LEVEL (dBm) | (dBd)     |      |      | W     | dBm   |
| 4132       | 826.40     | -34.77     | 27.35       | -10.58    | 0.88 | H    | 0.039 | 15.89 |
| 4183       | 836.60     | -35.39     | 26.26       | -10.53    | 0.89 | H    | 0.031 | 14.84 |
| 4233       | 846.60     | -34.82     | 26.22       | -10.49    | 0.89 | H    | 0.030 | 14.84 |

Note: Standard batteries are the only options for this phone.

#### NOTES:

##### Effective Radiated Power Output Measurements by Substitution Method

according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. Turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For WCDMA, GSM signals, a peak detector is used, with  $RBW \geq OBW$ ,  $VBW \geq 3 \times RBW$ . 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. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

This device was tested under all configurations and the highest power is reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to "1" and in GSM mode using a Power Control Level of "0" in the PCS Band and "5" in the Cellular Band. This unit was tested with its standard battery. Also, we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna. The worst case of the EUT is z plane in GSM850 and WCDMA850 mode. Also worst case of detecting Antenna is in horizontal polarization in GSM850 and WCDMA850 mode.

The EDGE mode testing were performed using 1Tx because 1Tx is highest power in EDGE mode.

## 7.2 EQUIVALENT ISOTROPIC RADIATED POWER

### (GSM1900 Mode)

| Ch./ Freq. |            | Measured   | Substitute  | Ant. Gain | C.L  | Pol. | EIRP  |       |
|------------|------------|------------|-------------|-----------|------|------|-------|-------|
| channel    | Freq.(MHz) | Level(dBm) | LEVEL (dBm) | (dBi)     |      |      | W     | dBm   |
| 512        | 1,850.20   | -13.87     | 18.82       | 10.04     | 1.36 | H    | 0.562 | 27.50 |
| 661        | 1,880.00   | -14.91     | 18.05       | 10.05     | 1.37 | H    | 0.471 | 26.73 |
| 810        | 1,909.80   | -15.11     | 18.11       | 10.06     | 1.38 | H    | 0.478 | 26.79 |
| EDGE 512   | 1850.20    | -17.10     | 15.59       | 10.04     | 1.36 | H    | 0.267 | 24.27 |

Note: Standard batteries are the only options for this phone.

#### NOTES:

Equivalent Isotropic Radiated Power Measurements by Substitution Method

according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. Turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For GSM signals, a peak detector is used, with RBW  $\geq$  OBW, VBW  $\geq$  3 x RBW. 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 receive spectrum analyzer reading. The conducted power at the terminals of the Horn antenna is measured. The difference between the gain of the horn and an isotropic antenna is taken into consideration and the EIRP is recorded.

This device was tested under all configurations and the highest power is reported in GSM mode using a Power Control Level of "0" in the PCS Band and "5" in the Cellular Band. This unit was tested with its standard battery. Also, we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna. The worst case of the EUT is x plane in GSM1900 mode. Also worst case of detecting Antenna is in horizontal polarization in GSM1900 mode.

The EDGE mode testing were performed using 1Tx because 1Tx is highest power in EDGE mode.

**(WCDMA1900 Mode)**

| Ch./ Freq. |            | Measured   | Substitute  | Ant. Gain | C.L  | Pol. | EIRP  |       |
|------------|------------|------------|-------------|-----------|------|------|-------|-------|
| channel    | Freq.(MHz) | Level(dBm) | LEVEL (dBm) | (dBi)     |      |      | W     | dBm   |
| 9262       | 1,852.40   | -20.36     | 12.34       | 10.04     | 1.36 | H    | 0.127 | 21.02 |
| 9400       | 1,880.00   | -20.98     | 11.98       | 10.05     | 1.37 | H    | 0.117 | 20.66 |
| 9538       | 1,907.60   | -21.53     | 11.65       | 10.06     | 1.38 | H    | 0.108 | 20.33 |

**(WCDMA1700 Mode)**

| Ch./ Freq. |            | Measured   | Substitute  | Ant. Gain | C.L  | Pol. | EIRP  |       |
|------------|------------|------------|-------------|-----------|------|------|-------|-------|
| channel    | Freq.(MHz) | Level(dBm) | LEVEL (dBm) | (dBi)     |      |      | W     | dBm   |
| 1312       | 1,712.40   | -20.10     | 12.38       | 9.88      | 1.31 | H    | 0.125 | 20.95 |
| 1412       | 1,732.40   | -20.23     | 12.26       | 9.96      | 1.32 | H    | 0.123 | 20.90 |
| 1513       | 1,752.60   | -20.66     | 11.78       | 10.01     | 1.33 | H    | 0.111 | 20.46 |

Note: Standard batteries are the only options for this phone.

**NOTES:**
Equivalent Isotropic Radiated Power Measurements by Substitution Method

according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. Turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For WCDMA signals, a peak detector is used, with  $RBW \geq OBW$ ,  $VBW \geq 3 \times RBW$ . 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 receive spectrum analyzer reading. The conducted power at the terminals of the Horn antenna is measured. The difference between the gain of the horn and an isotropic antenna is taken into consideration and the EIRP is recorded.

This device was tested under all configurations and the highest power is reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to "1". This unit was tested with its standard battery. Also, we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna. The worst case of the EUT is x plane in WCDMA1900 and WCDMA1700 mode. Also worst case of detecting Antenna is in horizontal polarization in WCDMA1900 and WCDMA1700 mode.

## 7.3 RADIATED SPURIOUS EMISSIONS

### 7.3.1 RADIATED SPURIOUS EMISSIONS (GSM850)

■ MEASURED OUTPUT POWER: 26.02 dBm = 0.399 W  
 ■ MODULATION SIGNAL: GSM850  
 ■ DISTANCE: 3 meters  
 ■ LIMIT:  $43 + 10 \log_{10}(W) =$  39.02 dBc

| Ch.            | Freq.(MHz) | Measured Level<br>[dBm] | Ant. Gain<br>(dBd) | Substitute<br>Level<br>[dBm] | C.L  | Pol. | ERP<br>(dBm) | dBc   |
|----------------|------------|-------------------------|--------------------|------------------------------|------|------|--------------|-------|
| 128<br>(824.2) | 1,648.40   | -46.07                  | 9.71               | -54.11                       | 1.29 | H    | -45.69       | 71.71 |
|                | 2,472.60   | -47.54                  | 10.54              | -52.72                       | 1.60 | H    | -43.78       | 69.80 |
|                | 3,296.80   | -56.76                  | 12.21              | -61.82                       | 1.85 | H    | -51.46       | 77.48 |
| 190<br>(836.6) | 1,673.20   | -40.51                  | 9.77               | -48.69                       | 1.28 | H    | -40.20       | 66.22 |
|                | 2,509.80   | -47.86                  | 10.65              | -52.85                       | 1.61 | V    | -43.81       | 69.83 |
|                | 3,346.40   | -57.72                  | 12.41              | -63.21                       | 1.86 | V    | -52.66       | 78.68 |
| 251<br>(848.8) | 1,697.60   | -39.71                  | 9.85               | -47.91                       | 1.30 | H    | -39.36       | 65.38 |
|                | 2,546.40   | -40.00                  | 10.72              | -44.88                       | 1.64 | V    | -35.80       | 61.82 |
|                | 3,395.20   | -57.04                  | 12.39              | -62.36                       | 1.88 | H    | -51.85       | 77.87 |

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:
  2. We are performed all frequency to 10<sup>th</sup> harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
  3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

### 7.3.2 RADIATED SPURIOUS EMISSIONS (GSM1900)

☒ MEASURED OUTPUT POWER: 27.50 dBm = 0.562 W  
☒ MODULATION SIGNAL: GSM1900  
☒ DISTANCE: 3 meters  
☒ LIMIT:  $43 + 10 \log_{10}(W) =$  40.50 dBc

| Ch.             | Freq.(MHz) | Measured Level<br>[dBm] | Ant. Gain<br>(dBi) | Substitute<br>Level<br>[dBm] | C.L  | Pol. | EIRP<br>(dBm) | dBc   |
|-----------------|------------|-------------------------|--------------------|------------------------------|------|------|---------------|-------|
| 512<br>(1850.2) | 3,700.40   | -49.10                  | 12.32              | -52.76                       | 2.03 | H    | -42.47        | 69.97 |
|                 | 5,550.60   | -57.93                  | 13.02              | -56.82                       | 2.52 | H    | -46.32        | 73.82 |
|                 | 7,400.80   | -56.84                  | 11.06              | -47.51                       | 2.91 | V    | -39.36        | 66.86 |
| 661<br>(1880.0) | 3,760.00   | -50.08                  | 12.29              | -53.69                       | 1.93 | H    | -43.33        | 70.83 |
|                 | 5,640.00   | -57.91                  | 13.12              | -56.97                       | 2.57 | V    | -46.42        | 73.92 |
|                 | 7,520.00   | -57.81                  | 11.09              | -48.97                       | 3.03 | H    | -40.91        | 68.41 |
| 810<br>(1909.8) | 3,819.60   | -50.03                  | 12.28              | -53.00                       | 2.04 | H    | -42.76        | 70.26 |
|                 | 5,729.40   | -58.91                  | 13.06              | -57.72                       | 2.55 | V    | -47.21        | 74.71 |
|                 | 7,639.20   | -55.98                  | 11.38              | -46.56                       | 3.11 | H    | -38.29        | 65.79 |

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:
  2. We are performed all frequency to 10<sup>th</sup> harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
  3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

### 7.3.3 RADIATED SPURIOUS EMISSIONS (WCDMA850)

■ MEASURED OUTPUT POWER: 15.89 dBm = 0.039 W  
 ■ MODULATION SIGNAL: WCDMA850  
 ■ DISTANCE: 3 meters  
 ■ LIMIT:  $43 + 10 \log_{10}(W) =$  28.89 dBc

| Ch.              | Freq.(MHz) | Measured Level<br>[dBm] | Ant. Gain<br>(dBd) | Substitute<br>Level<br>[dBm] | C.L  | Pol. | ERP<br>(dBm) | dBc   |
|------------------|------------|-------------------------|--------------------|------------------------------|------|------|--------------|-------|
| 4,132<br>(826.4) | 1,652.80   | -56.92                  | 9.71               | -64.96                       | 1.29 | V    | -56.54       | 72.43 |
|                  | 2,479.20   | -58.20                  | 10.54              | -63.21                       | 1.61 | V    | -54.28       | 70.17 |
|                  | 3,305.60   | -57.10                  | 12.26              | -62.28                       | 1.86 | V    | -51.88       | 67.77 |
| 4,183<br>(836.6) | 1,673.20   | -57.83                  | 9.77               | -66.02                       | 1.28 | H    | -57.53       | 73.42 |
|                  | 2,509.80   | -57.97                  | 10.65              | -62.95                       | 1.61 | V    | -53.91       | 69.80 |
|                  | 3,346.40   | -58.54                  | 12.41              | -64.03                       | 1.86 | V    | -53.48       | 69.37 |
| 4,233<br>(846.6) | 1,693.20   | -57.31                  | 9.83               | -65.56                       | 1.30 | H    | -57.03       | 72.92 |
|                  | 2,539.80   | -58.20                  | 10.71              | -63.02                       | 1.63 | V    | -53.94       | 69.83 |
|                  | 3,386.40   | -57.74                  | 12.40              | -63.19                       | 1.84 | H    | -52.63       | 68.52 |

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:
  2. We are performed all frequency to 10<sup>th</sup> harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
  3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

### 7.3.4 RADIATED SPURIOUS EMISSIONS (WCDMA1900)

☒ MEASURED OUTPUT POWER: 21.02 dBm = 0.127 W  
☒ MODULATION SIGNAL: WCDMA1900  
☒ DISTANCE: 3 meters  
☒ LIMIT:  $43 + 10 \log_{10}(W) =$  34.02 dBc

| Ch.              | Freq.(MHz) | Measured Level<br>[dBm] | Ant. Gain<br>(dBi) | Substitute<br>Level<br>[dBm] | C.L  | Pol. | EIRP<br>(dBm) | dBc   |
|------------------|------------|-------------------------|--------------------|------------------------------|------|------|---------------|-------|
| 9262<br>(1852.4) | 3,704.80   | -54.08                  | 12.32              | -57.69                       | 2.01 | H    | -47.39        | 68.41 |
|                  | 5,557.20   | -57.32                  | 13.03              | -56.20                       | 2.53 | H    | -45.70        | 66.72 |
|                  | 7,409.60   | -56.19                  | 11.05              | -46.69                       | 2.92 | H    | -38.56        | 59.58 |
| 9400<br>(1880.0) | 3,760.00   | -53.77                  | 12.29              | -57.38                       | 1.93 | H    | -47.02        | 68.04 |
|                  | 5,640.00   | -56.08                  | 13.12              | -55.14                       | 2.57 | H    | -44.59        | 65.61 |
|                  | 7,520.00   | -57.84                  | 11.09              | -49.00                       | 3.03 | H    | -40.94        | 61.96 |
| 9538<br>(1907.6) | 3,815.20   | -53.83                  | 12.28              | -57.03                       | 2.04 | V    | -46.79        | 67.81 |
|                  | 5,722.80   | -55.36                  | 13.80              | -54.89                       | 2.57 | H    | -43.66        | 64.68 |
|                  | 7,630.40   | -57.06                  | 11.36              | -47.59                       | 3.19 | H    | -39.42        | 60.44 |

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:
  2. We are performed all frequency to 10<sup>th</sup> harmonics from 30 MHz. Measurements above show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
  3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

### 7.3.5 RADIATED SPURIOUS EMISSIONS (WCDMA1700)

■ MEASURED OUTPUT POWER: 20.95 dBm = 0.125 W  
 ■ MODULATION SIGNAL: WCDMA1700  
 ■ DISTANCE: 3 meters  
 ■ LIMIT:  $43 + 10 \log_{10}(W) =$  33.95 dBc

| Ch.              | Freq.(MHz) | Measured Level<br>[dBm] | Ant. Gain<br>(dBi) | Substitute<br>Level<br>[dBm] | C.L  | Pol. | EIRP<br>(dBm) | dBc   |
|------------------|------------|-------------------------|--------------------|------------------------------|------|------|---------------|-------|
| 1312<br>(1712.4) | 3,424.80   | -57.68                  | 12.36              | -62.84                       | 1.94 | V    | -52.42        | 73.37 |
|                  | 5,137.20   | -58.45                  | 12.35              | -56.50                       | 2.38 | V    | -46.53        | 67.48 |
|                  | 6,849.60   | -58.48                  | 12.15              | -52.00                       | 2.80 | V    | -42.65        | 63.60 |
| 1412<br>(1732.4) | 3,464.80   | -56.70                  | 12.27              | -61.27                       | 1.86 | H    | -50.86        | 71.81 |
|                  | 5,197.20   | -58.96                  | 12.62              | -57.27                       | 2.44 | H    | -47.09        | 68.04 |
|                  | 6,929.60   | -57.31                  | 11.87              | -49.72                       | 2.84 | V    | -40.69        | 61.64 |
| 1513<br>(1752.6) | 3,505.20   | -58.85                  | 12.15              | -62.98                       | 1.98 | H    | -52.81        | 73.76 |
|                  | 5,257.80   | -58.42                  | 12.89              | -57.59                       | 2.41 | H    | -47.11        | 68.06 |
|                  | 7,010.40   | -58.76                  | 11.61              | -51.48                       | 2.91 | V    | -42.78        | 63.73 |

**NOTES:** 1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method  
according to ANSI/TIA/EIA-603-D-2010 June 24, 2010:  
 2. We are performed all frequency to 10<sup>th</sup> harmonics from 30 MHz. Measurements above show only up to 3.  
maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie:  
margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.  
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

## 7.4 PEAK-TO-AVERAGE RATIO

| Band            | Ch.  | Measured<br>P <sub>Pk</sub> (dBm) | Measured<br>P <sub>Avg</sub> (dBm) | P <sub>Avg</sub> (Duty Cycle) |                          |                | P.A.R.<br>= P <sub>Pk</sub> - P <sub>Avg</sub><br>(dB) | Limit<br>(dB) | Pass<br>/ Fail |  |
|-----------------|------|-----------------------------------|------------------------------------|-------------------------------|--------------------------|----------------|--------------------------------------------------------|---------------|----------------|--|
|                 |      |                                   |                                    | Tx <sub>Total</sub><br>(ms)   | Tx <sub>On</sub><br>(ms) | Factor<br>(dB) |                                                        |               |                |  |
| GSM1900         | 661  | 28.81                             | 19.14                              | 4.6232                        | 0.5507                   | 9.24           | 0.43                                                   | 13            | Pass           |  |
| GSM1900<br>EDGE | 661  | 28.86                             | 16.16                              |                               |                          |                | 3.46                                                   |               |                |  |
| WCDMA1900       | 9400 | CCDF Procedure                    |                                    |                               |                          |                | 2.80                                                   |               |                |  |
| WCDMA1700       | 1412 |                                   |                                    |                               |                          |                | 3.19                                                   |               |                |  |

- Plots of the EUT's Peak- to- Average Ratio are shown Page 40 ~ 43.

### NOTES:

Peak to Average Power Ratio was tested in accordance with KDB971168 D01 Power Meas License Digital Systems v02r02, October 17, 2014, Section 5.7.

Only GSM(include EDGE) Mode was tested by Section 5.7.2 Alternate Procedure

$P.A.R_{(dB)} = P_{PK (dBm)} - P_{Avg (dBm)}$  (P<sub>Avg</sub> = Average Power + Duty cycle Factor)

Duty cycle Factor =  $10 \log (1/x)$ ,  $x = Tx_{On} / Tx_{Total}$

## 7.5 OCCUPIED BANDWIDTH

| Band         | Channel | Frequency(MHz) | Data (GSM: kHz /<br>WCDMA : MHz) |
|--------------|---------|----------------|----------------------------------|
| GSM850       | 128     | 824.20         | 242.5398                         |
|              | 190     | 836.60         | 244.6923                         |
|              | 251     | 848.80         | 247.0118                         |
| GSM850 EDGE  | 251     | 848.80         | 245.0944                         |
| GSM1900      | 512     | 1,850.20       | 245.6833                         |
|              | 661     | 1,880.00       | 246.5277                         |
|              | 810     | 1,909.80       | 247.9202                         |
| GSM1900 EDGE | 810     | 1,909.80       | 253.6336                         |
| WCDMA850     | 4132    | 826.40         | 4.1673                           |
|              | 4183    | 836.60         | 4.1410                           |
|              | 4233    | 846.60         | 4.1692                           |
| WCDMA1900    | 9262    | 1852.40        | 4.1614                           |
|              | 9400    | 1880.00        | 4.1847                           |
|              | 9538    | 1907.60        | 4.1763                           |
| WCDMA1700    | 1312    | 1712.40        | 4.1752                           |
|              | 1412    | 1732.40        | 4.1829                           |
|              | 1513    | 1752.60        | 4.1924                           |

- Plots of the EUT's Occupied Bandwidth are shown Page 32 ~ 40.

## 7.6 CONDUCTED SPURIOUS EMISSIONS

| Band      | Channel | Frequency of Maximum Harmonic (GHz) | Maximum Data (dBm) |
|-----------|---------|-------------------------------------|--------------------|
| GSM850    | 128     | 4.848170                            | -30.33             |
|           | 190     | 4.839220                            | -30.90             |
|           | 251     | 4.824810                            | -29.86             |
| GSM1900   | 512     | 6.987810                            | -28.84             |
|           | 661     | 5.593010                            | -28.42             |
|           | 810     | 6.895590                            | -28.45             |
| WCDMA850  | 4132    | 4.243810                            | -30.18             |
|           | 4183    | 4.605630                            | -30.97             |
|           | 4233    | 4.248290                            | -30.60             |
| WCDMA1900 | 9262    | 6.580540                            | -28.15             |
|           | 9400    | 6.973860                            | -27.87             |
|           | 9538    | 6.708650                            | -28.34             |
| WCDMA1700 | 1312    | 6.973860                            | -28.65             |
|           | 1412    | 6.592000                            | -29.10             |
|           | 1513    | 6.942950                            | -28.38             |

- Plots of the EUT's Conducted Spurious Emissions are shown Page 62 ~ 76.

### 7.6.1 BAND EDGE

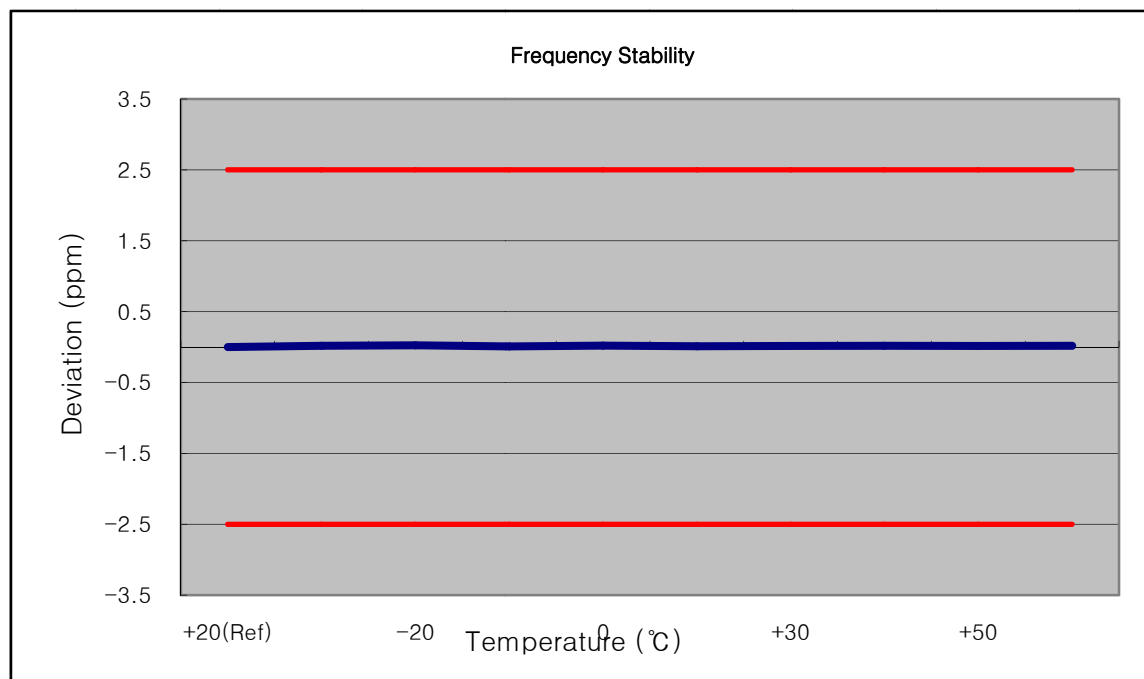
- Plots of the EUT's Band Edge are shown Page 44 ~ 61.

## 7.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

### 7.7.1 FREQUENCY STABILITY (GSM850)

■ OPERATING FREQUENCY: 836,600,000 Hz  
 ■ CHANNEL: 190  
 ■ REFERENCE VOLTAGE: 3.8 VDC  
 ■ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

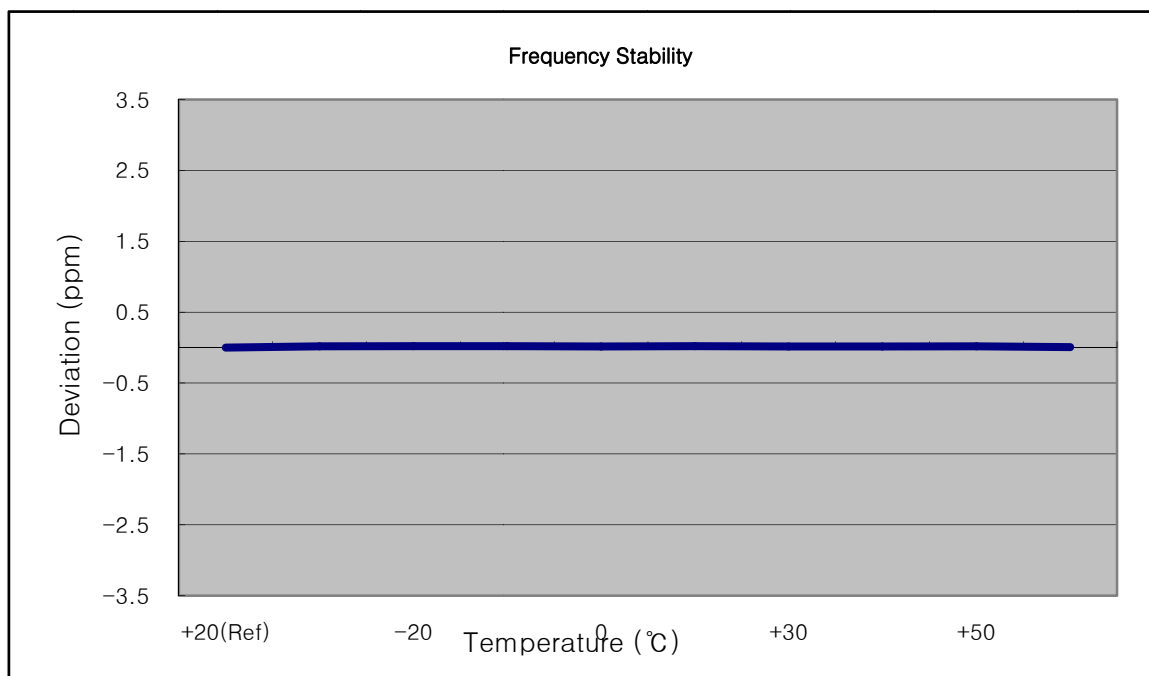
| Voltage<br>(%) | Power<br>(VDC) | Temp.<br>(°C) | Frequency<br>(Hz) | Frequency<br>Error (Hz) | Deviation<br>(%) | ppm   |
|----------------|----------------|---------------|-------------------|-------------------------|------------------|-------|
| 100%           | 3.80           | +20(Ref)      | 836 600 016       | 0                       | 0.000 000        | 0.000 |
| 100%           |                | -30           | 836 600 031       | 15.24                   | 0.000 002        | 0.018 |
| 100%           |                | -20           | 836 600 037       | 21.32                   | 0.000 003        | 0.025 |
| 100%           |                | -10           | 836 600 023       | 7.36                    | 0.000 001        | 0.009 |
| 100%           |                | 0             | 836 600 033       | 17.27                   | 0.000 002        | 0.021 |
| 100%           |                | +10           | 836 600 024       | 8.77                    | 0.000 001        | 0.010 |
| 100%           |                | +30           | 836 600 029       | 13.57                   | 0.000 002        | 0.016 |
| 100%           |                | +40           | 836 600 030       | 14.52                   | 0.000 002        | 0.017 |
| 100%           |                | +50           | 836 600 029       | 13.68                   | 0.000 002        | 0.016 |
| Batt. Endpoint | 3.23           | +20           | 836 600 030       | 14.2                    | 0.000 002        | 0.017 |



## 7.7.2 FREQUENCY STABILITY (GSM1900)

☒ OPERATING FREQUENCY: 1880,000,000 Hz  
☒ CHANNEL: 661  
☒ REFERENCE VOLTAGE: 3.8 VDC  
☒ DEVIATION LIMIT: -

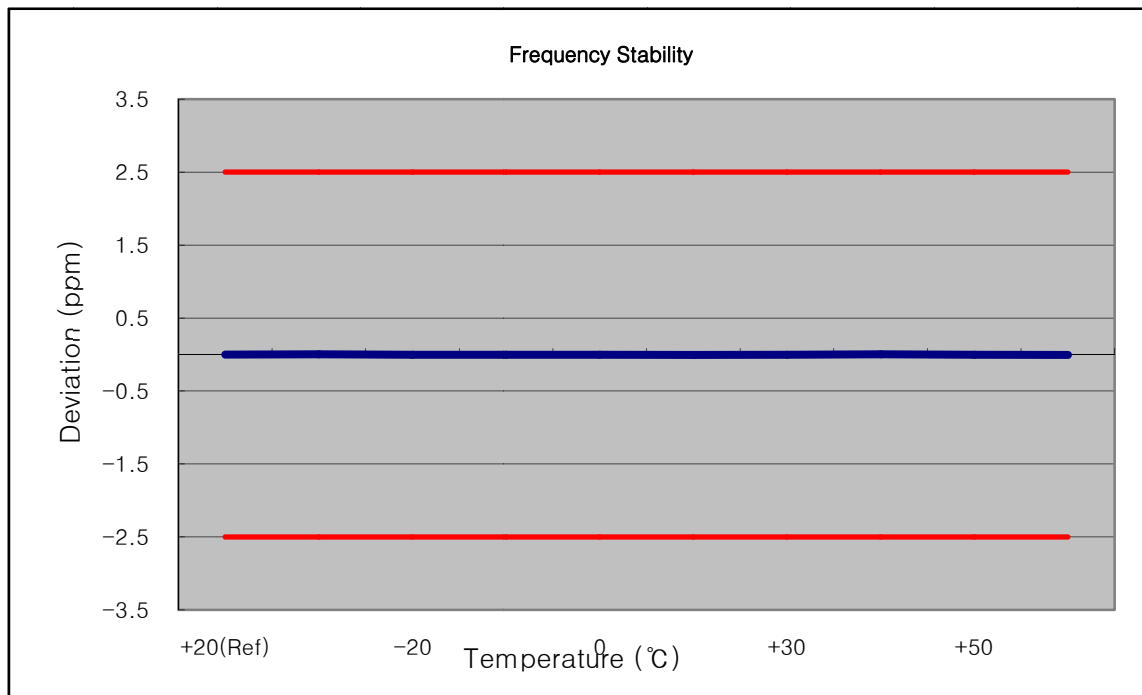
| Voltage (%)    | Power (VDC) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm   |
|----------------|-------------|------------|----------------|----------------------|---------------|-------|
| 100%           | 3.80        | +20(Ref)   | 1880 000 039   | 0                    | 0.000 000     | 0.000 |
| 100%           |             | -30        | 1880 000 073   | 34.08                | 0.000 002     | 0.018 |
| 100%           |             | -20        | 1880 000 076   | 36.34                | 0.000 002     | 0.019 |
| 100%           |             | -10        | 1880 000 079   | 39.86                | 0.000 002     | 0.021 |
| 100%           |             | 0          | 1880 000 070   | 30.78                | 0.000 002     | 0.016 |
| 100%           |             | +10        | 1880 000 076   | 36.43                | 0.000 002     | 0.019 |
| 100%           |             | +30        | 1880 000 069   | 29.95                | 0.000 002     | 0.016 |
| 100%           |             | +40        | 1880 000 071   | 31.29                | 0.000 002     | 0.017 |
| 100%           |             | +50        | 1880 000 073   | 33.30                | 0.000 002     | 0.018 |
| Batt. Endpoint | 3.23        | +20        | 1880 000 053   | 13.41                | 0.000 001     | 0.007 |



### 7.7.3 FREQUENCY STABILITY (WCDMA850)

☒ OPERATING FREQUENCY: 836,600,000 Hz  
☒ CHANNEL: 4183  
☒ REFERENCE VOLTAGE: 3.8 VDC  
☒ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

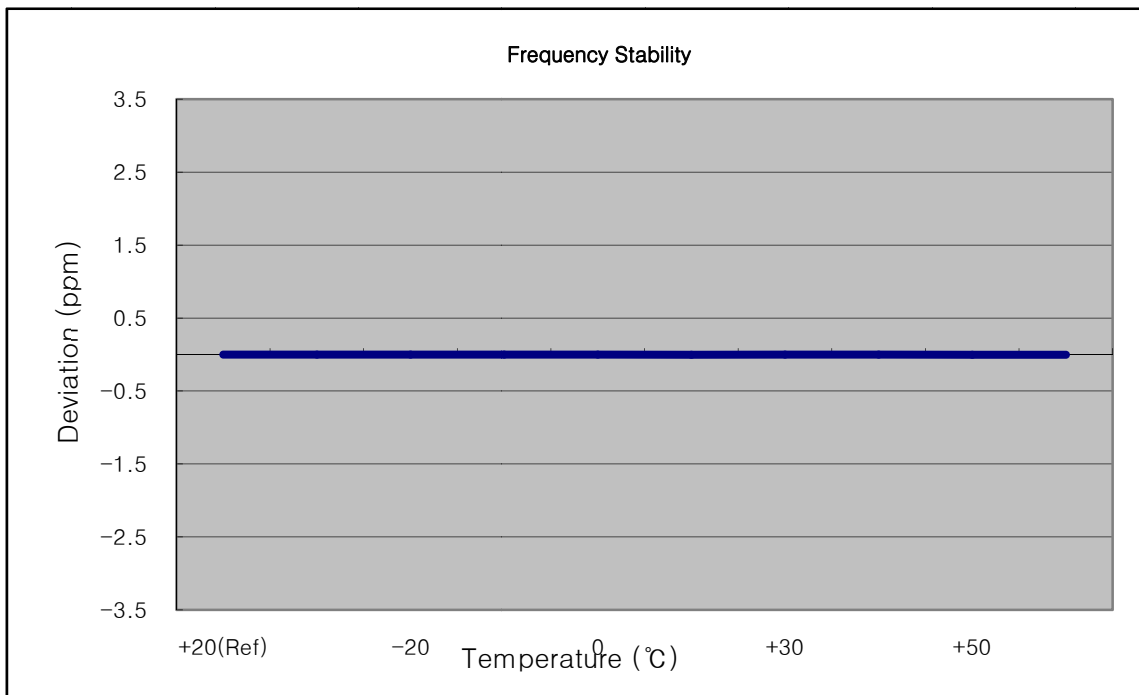
| Voltage (%)    | Power (VDC) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm    |
|----------------|-------------|------------|----------------|----------------------|---------------|--------|
| 100%           | 3.80        | +20(Ref)   | 836 600 003    | 0                    | 0.000 000     | 0.000  |
| 100%           |             | -30        | 836 600 003    | 2.83                 | 0.000 000     | 0.003  |
| 100%           |             | -20        | 836 599 998    | -2.32                | 0.000 000     | -0.003 |
| 100%           |             | -10        | 836 599 997    | -3.00                | 0.000 000     | -0.004 |
| 100%           |             | 0          | 836 599 998    | -2.43                | 0.000 000     | -0.003 |
| 100%           |             | +10        | 836 599 996    | -3.97                | 0.000 000     | -0.005 |
| 100%           |             | +30        | 836 599 997    | -2.55                | 0.000 000     | -0.003 |
| 100%           |             | +40        | 836 600 003    | 3.10                 | 0.000 000     | 0.004  |
| 100%           |             | +50        | 836 599 997    | -2.67                | 0.000 000     | -0.003 |
| Batt. Endpoint | 3.23        | +20        | 836 599 996    | -4.04                | 0.000 000     | -0.005 |



### 7.7.4 FREQUENCY STABILITY (WCDMA1900)

☒ OPERATING FREQUENCY: 1,880,000,000 Hz  
☒ CHANNEL: 9400  
☒ REFERENCE VOLTAGE: 3.8 VDC  
☒ DEVIATION LIMIT: -

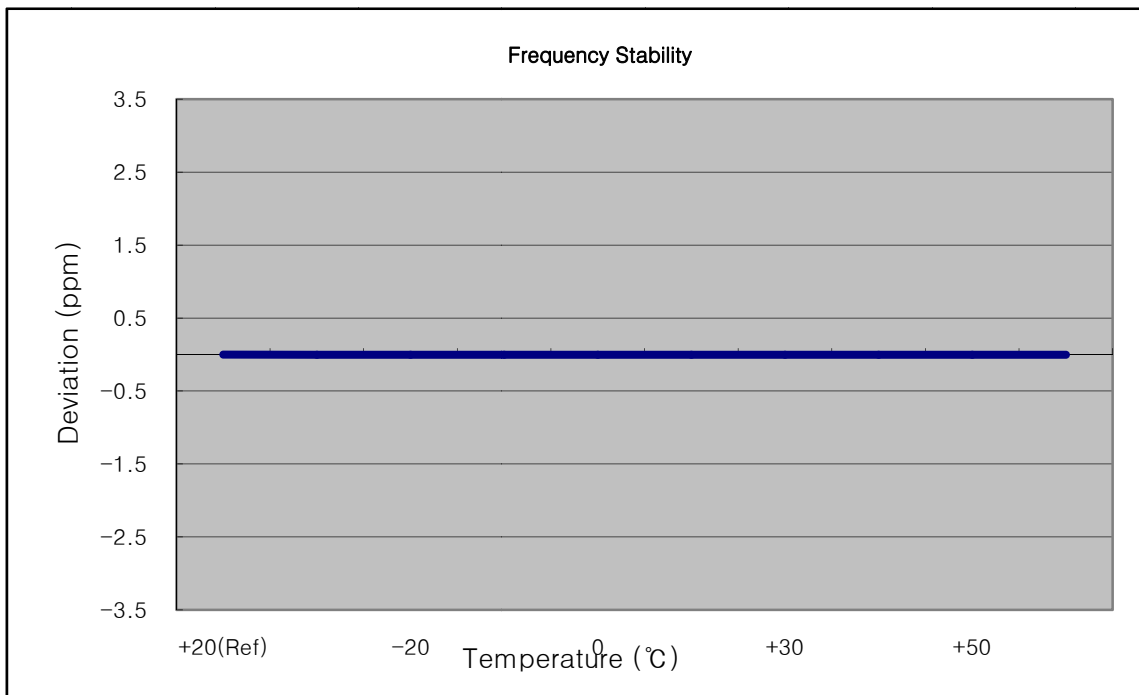
| Voltage (%)    | Power (VDC) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm    |
|----------------|-------------|------------|----------------|----------------------|---------------|--------|
| 100%           | 3.80        | +20(Ref)   | 1880 000 003   | 0                    | 0.000 000     | 0.000  |
| 100%           |             | -30        | 1879 999 997   | -2.93                | 0.000 000     | -0.002 |
| 100%           |             | -20        | 1879 999 996   | -3.58                | 0.000 000     | -0.002 |
| 100%           |             | -10        | 1879 999 996   | -3.69                | 0.000 000     | -0.002 |
| 100%           |             | 0          | 1879 999 996   | -3.75                | 0.000 000     | -0.002 |
| 100%           |             | +10        | 1879 999 996   | -3.85                | 0.000 000     | -0.002 |
| 100%           |             | +30        | 1879 999 997   | -2.98                | 0.000 000     | -0.002 |
| 100%           |             | +40        | 1879 999 997   | -3.38                | 0.000 000     | -0.002 |
| 100%           |             | +50        | 1879 999 996   | -4.50                | 0.000 000     | -0.002 |
| Batt. Endpoint | 3.23        | +20        | 1879 999 996   | -4.22                | 0.000 000     | -0.002 |



### 7.7.5 FREQUENCY STABILITY (WCDMA1700)

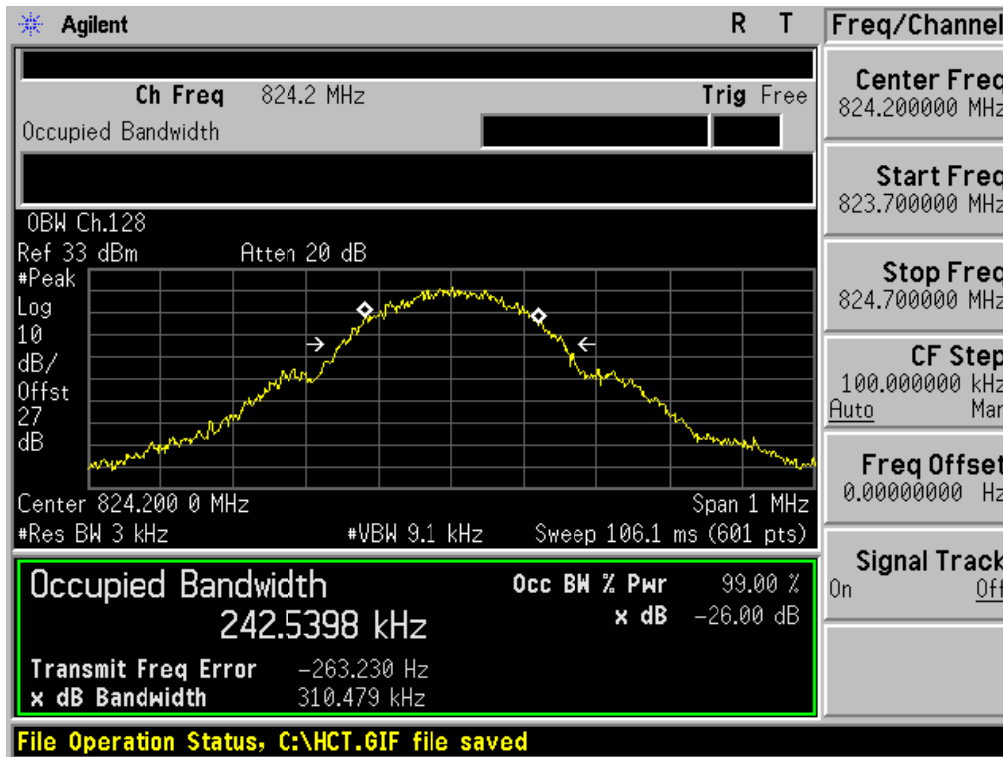
☒ OPERATING FREQUENCY: 1,732,400,000 Hz  
☒ CHANNEL: 1412  
☒ REFERENCE VOLTAGE: 3.8 VDC  
☒ DEVIATION LIMIT: -

| Voltage<br>(%) | Power<br>(VDC) | Temp.<br>(°C) | Frequency<br>(Hz) | Frequency<br>Error (Hz) | Deviation<br>(%) | ppm    |
|----------------|----------------|---------------|-------------------|-------------------------|------------------|--------|
| 100%           | 3.80           | +20(Ref)      | 1732 400 005      | 0                       | 0.000 000        | 0.000  |
| 100%           |                | -30           | 1732 399 996      | -4.33                   | 0.000 000        | -0.002 |
| 100%           |                | -20           | 1732 399 995      | -5.15                   | 0.000 000        | -0.003 |
| 100%           |                | -10           | 1732 399 995      | -5.26                   | 0.000 000        | -0.003 |
| 100%           |                | 0             | 1732 399 995      | -4.53                   | 0.000 000        | -0.003 |
| 100%           |                | +10           | 1732 399 995      | -4.52                   | 0.000 000        | -0.003 |
| 100%           |                | +30           | 1732 399 995      | -4.62                   | 0.000 000        | -0.003 |
| 100%           |                | +40           | 1732 399 994      | -5.67                   | 0.000 000        | -0.003 |
| 100%           |                | +50           | 1732 399 995      | -4.78                   | 0.000 000        | -0.003 |
| Batt. Endpoint | 3.23           | +20           | 1732 399 996      | -4.41                   | 0.000 000        | -0.003 |

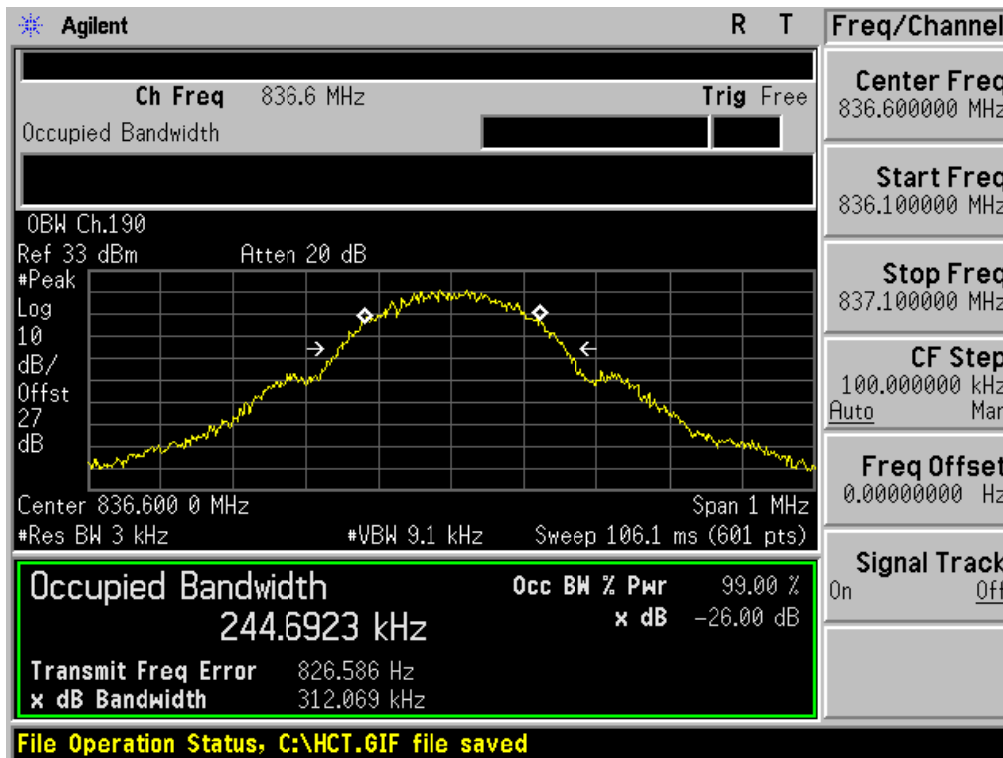


## **8. TEST PLOTS**

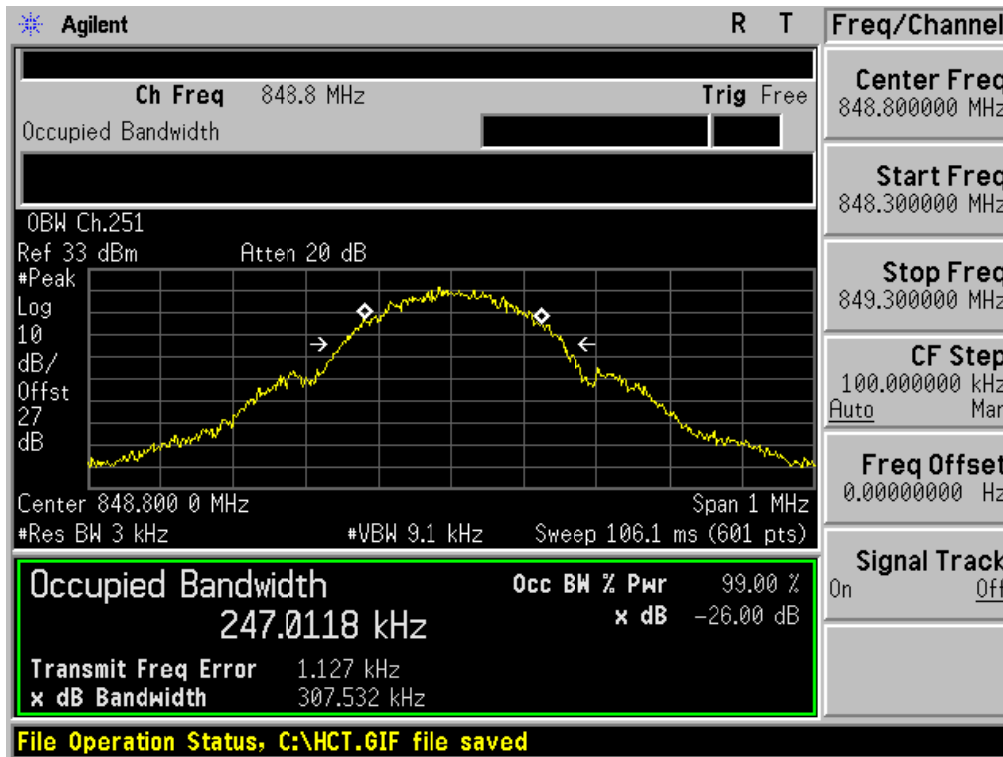
■ GSM850 MODE (128 CH.) Occupied Bandwidth



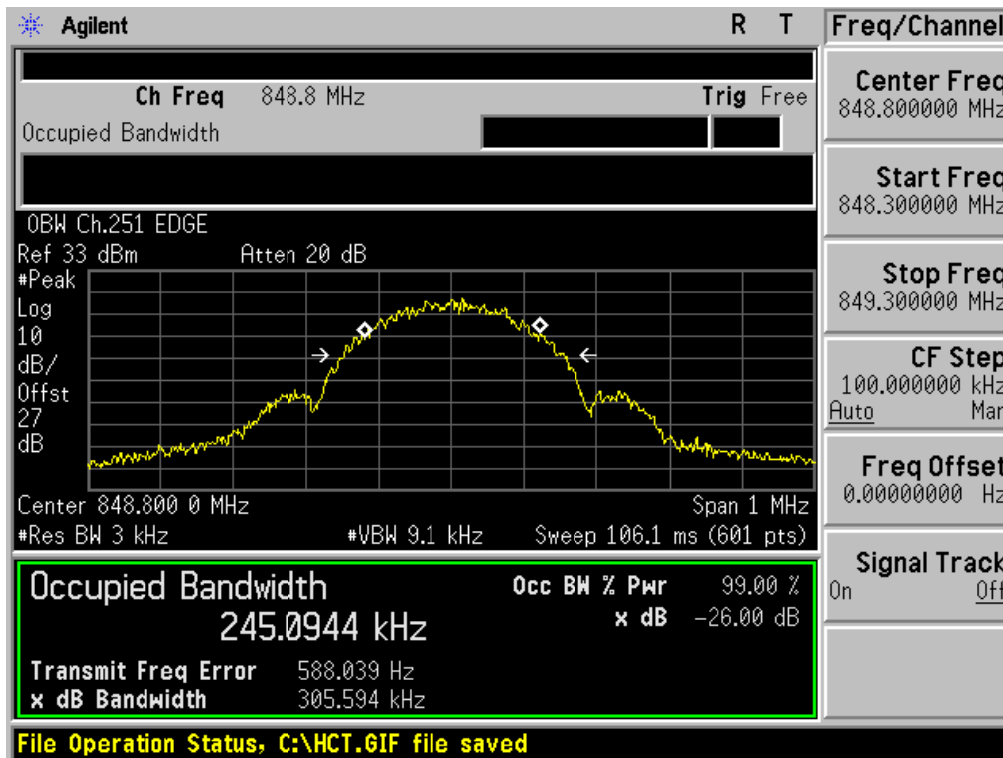
■ GSM850 MODE (190 CH.) Occupied Bandwidth



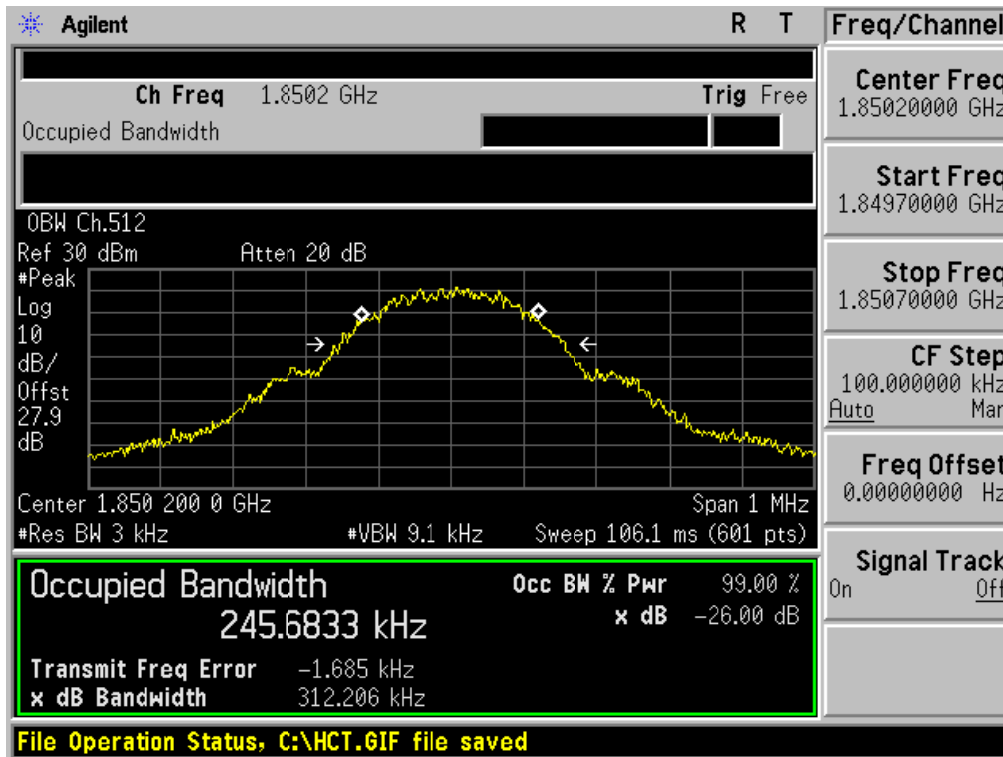
■ GSM850 MODE (251 CH.) Occupied Bandwidth



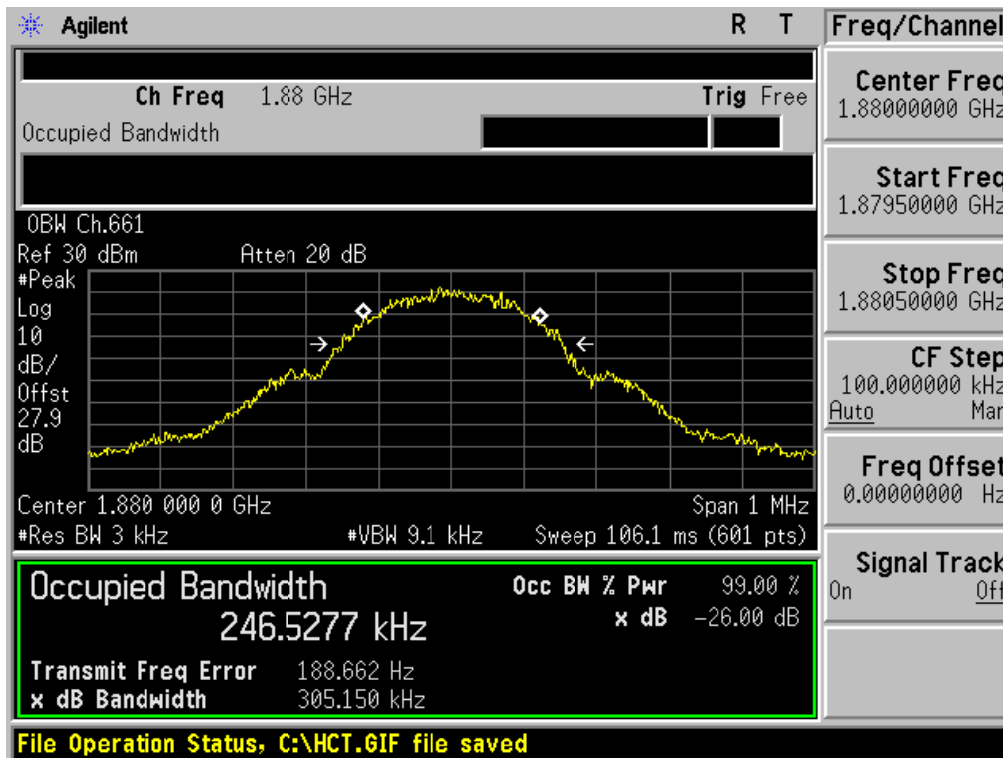
■ GSM850 EDGE (251 CH.) Occupied Bandwidth



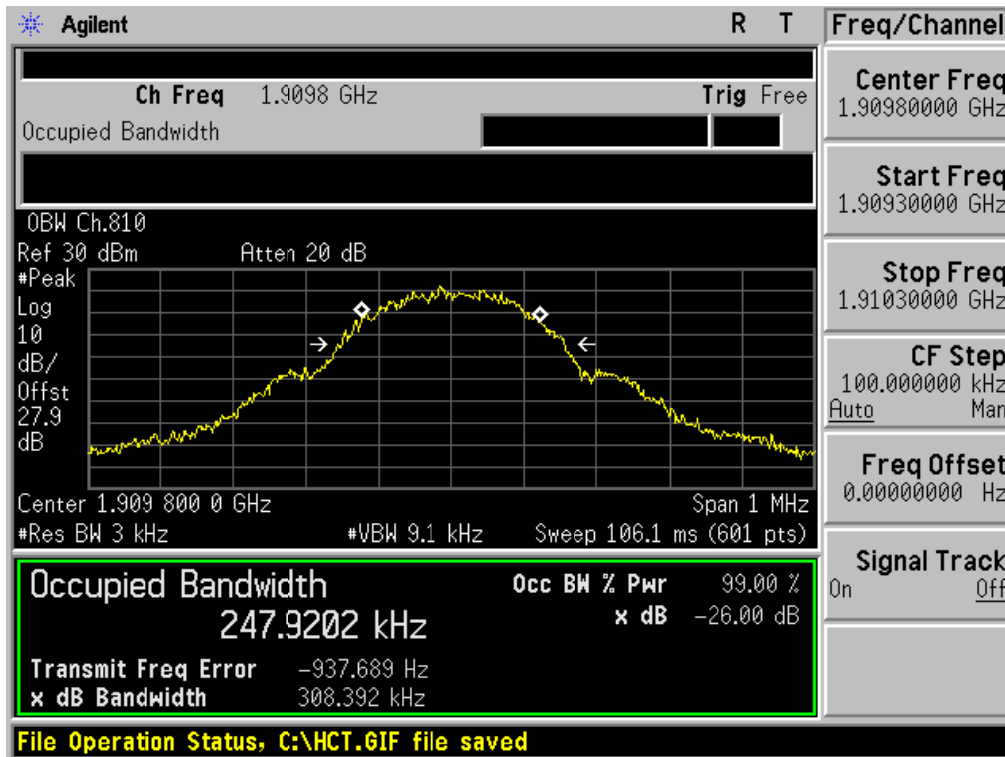
■ GSM1900 MODE (512 CH.) Occupied Bandwidth



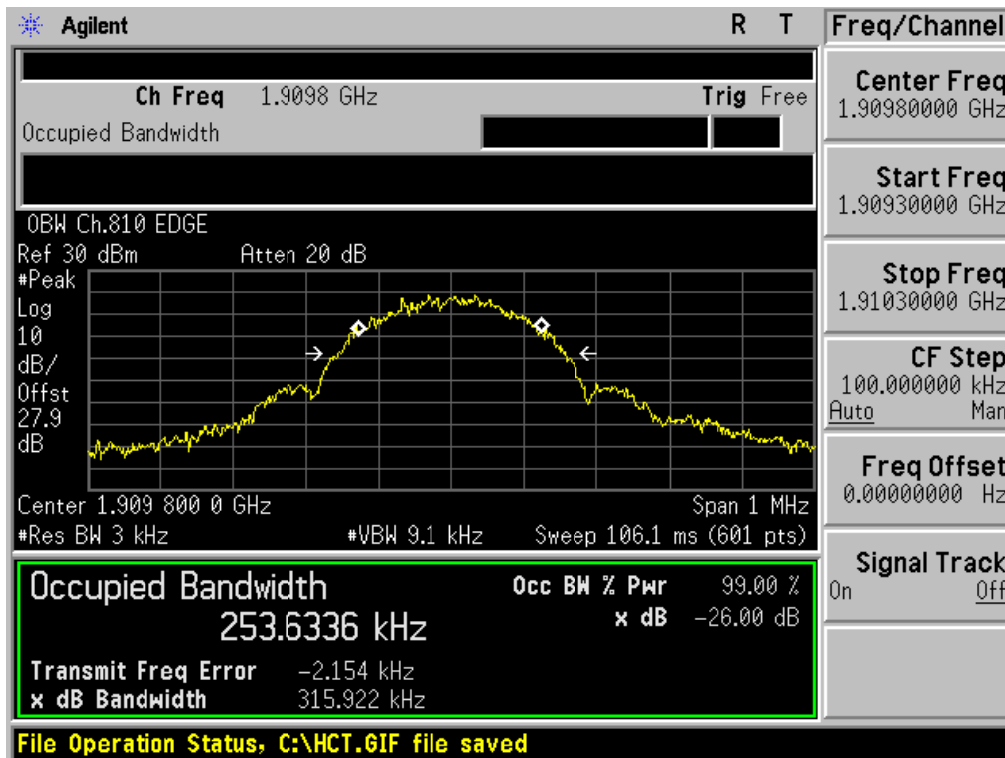
■ GSM1900 MODE (661 CH.) Occupied Bandwidth



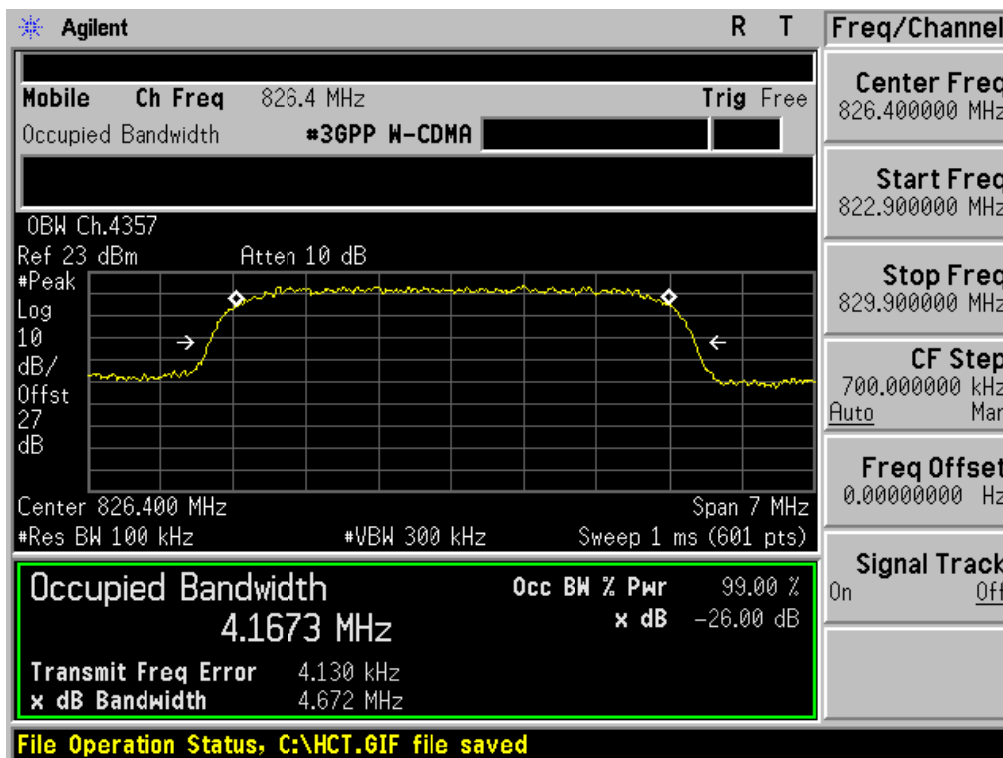
■ GSM1900 MODE (810 CH.) Occupied Bandwidth



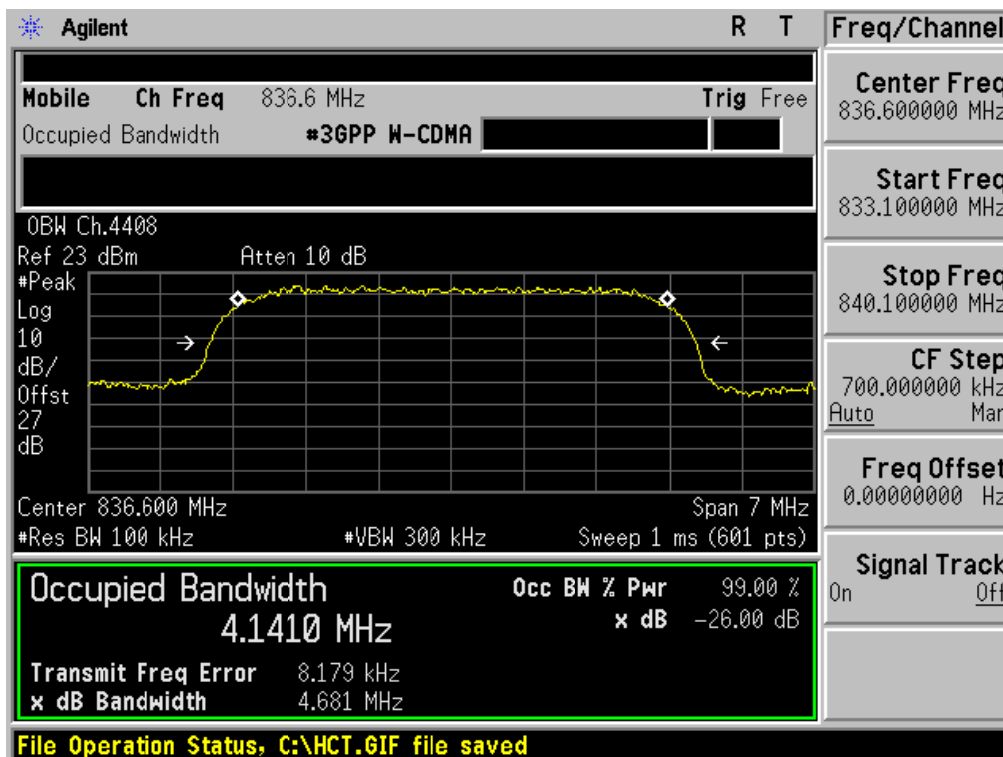
■ GSM1900 EDGE (810 CH.) Occupied Bandwidth



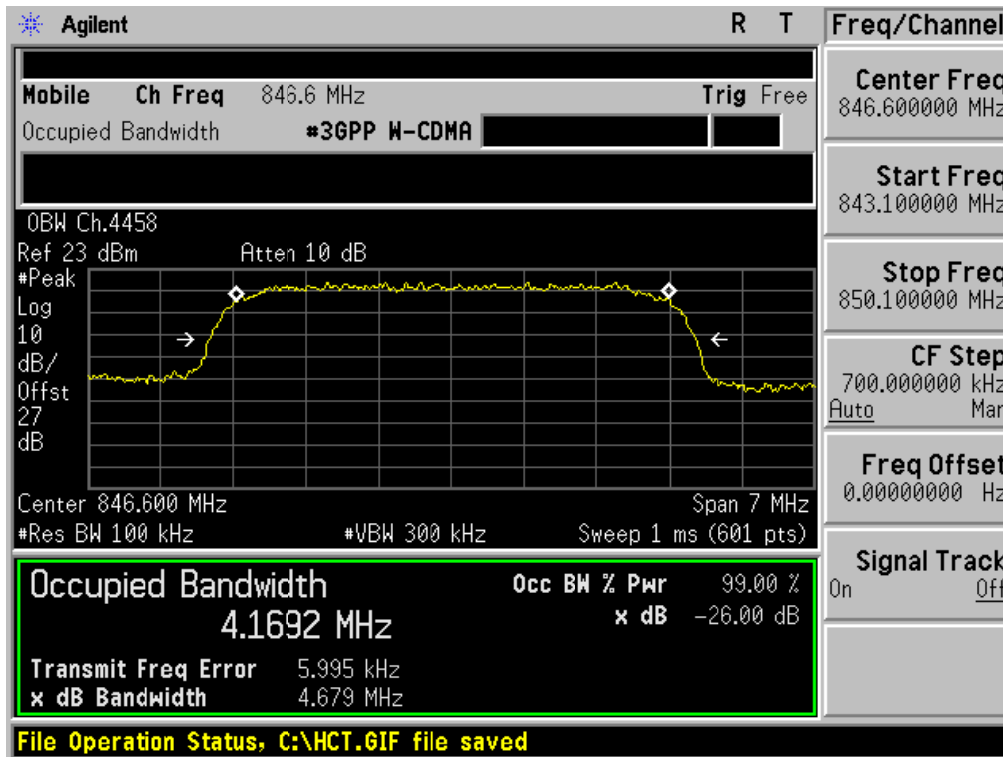
### ■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



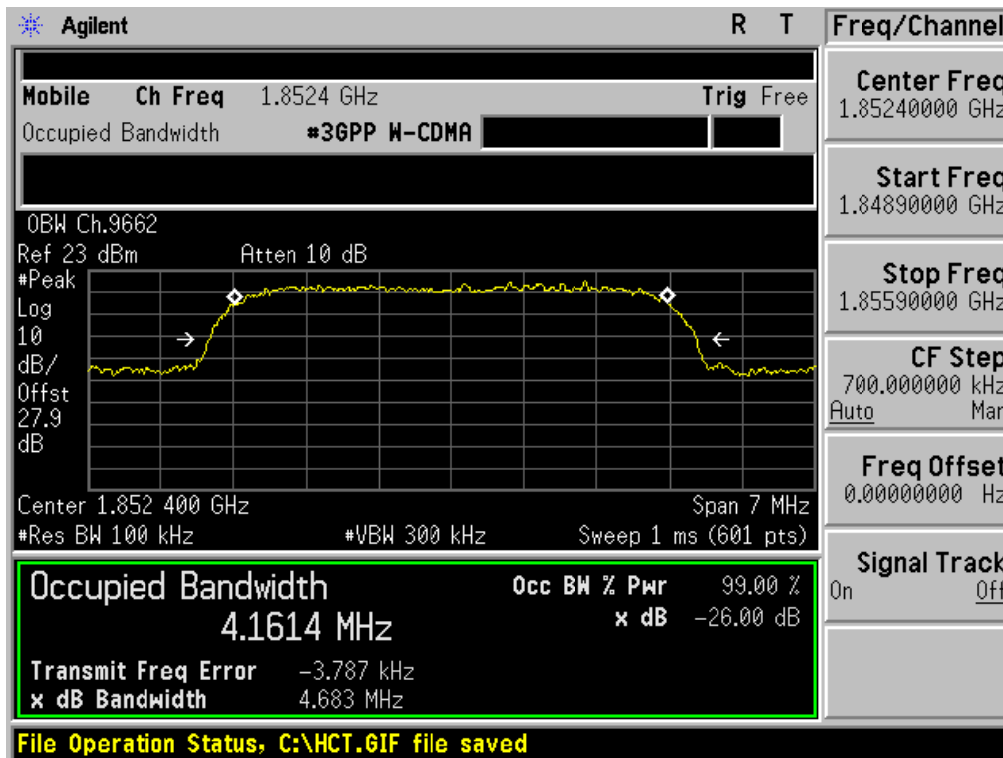
### ■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



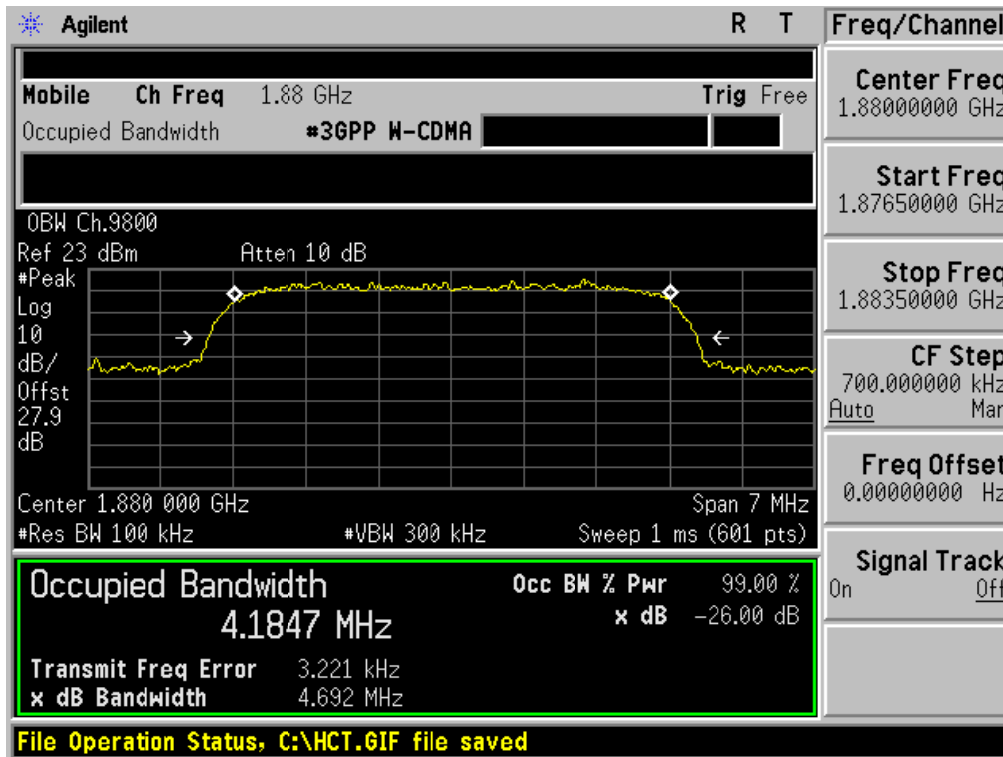
■ WCDMA850MODE (4233 CH.) Occupied Bandwidth



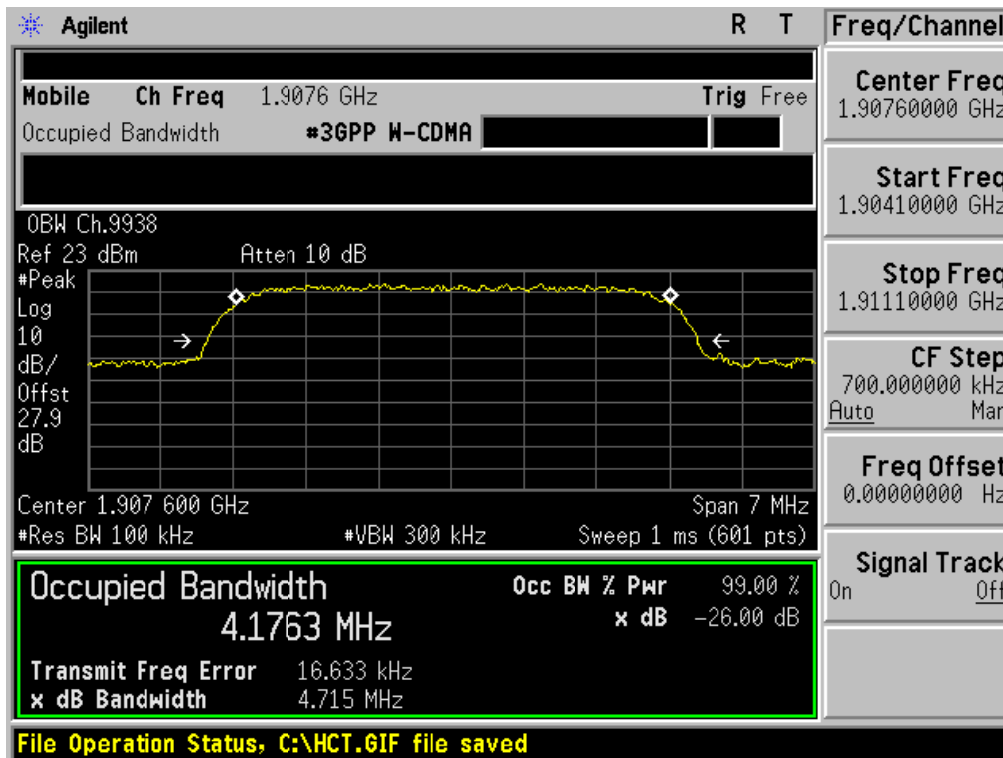
■ WCDMA1900 MODE (9262 CH.) Occupied Bandwidth



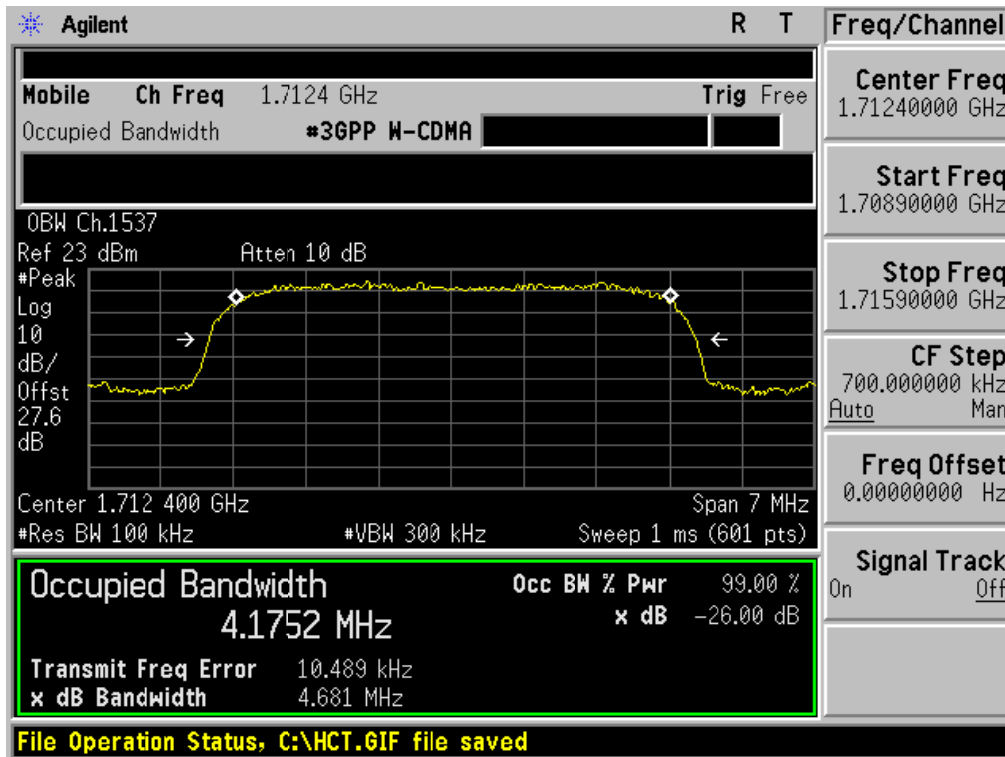
■ WCDMA1900 MODE (9400 CH.) Occupied Bandwidth



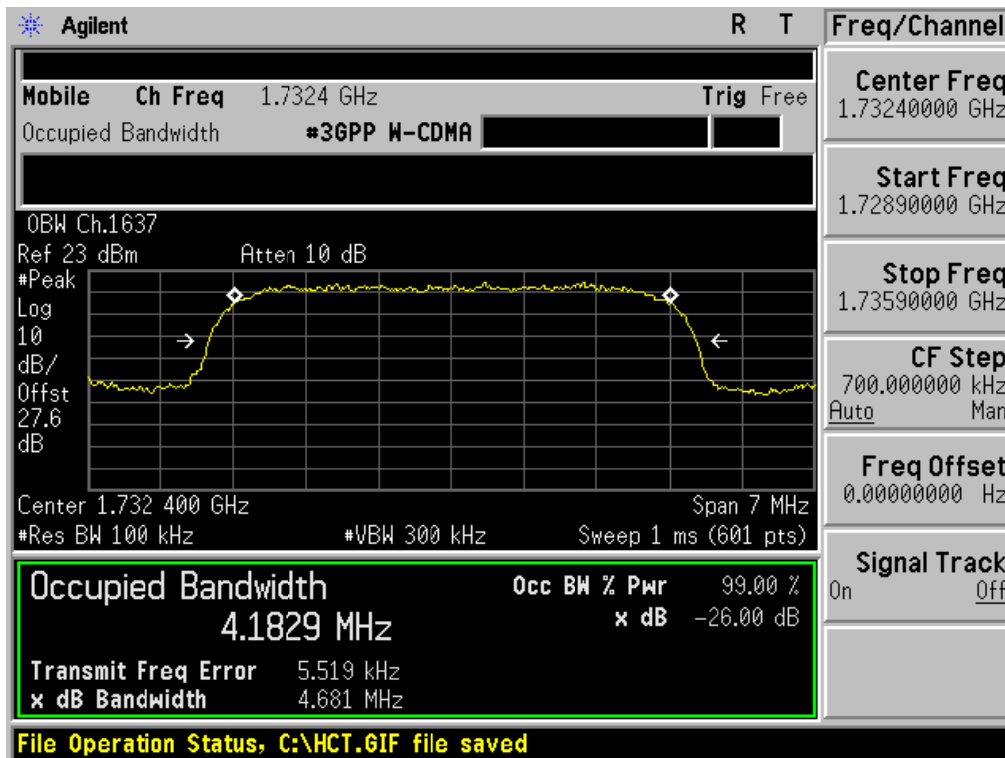
■ WCDMA1900 MODE (9538 CH.) Occupied Bandwidth



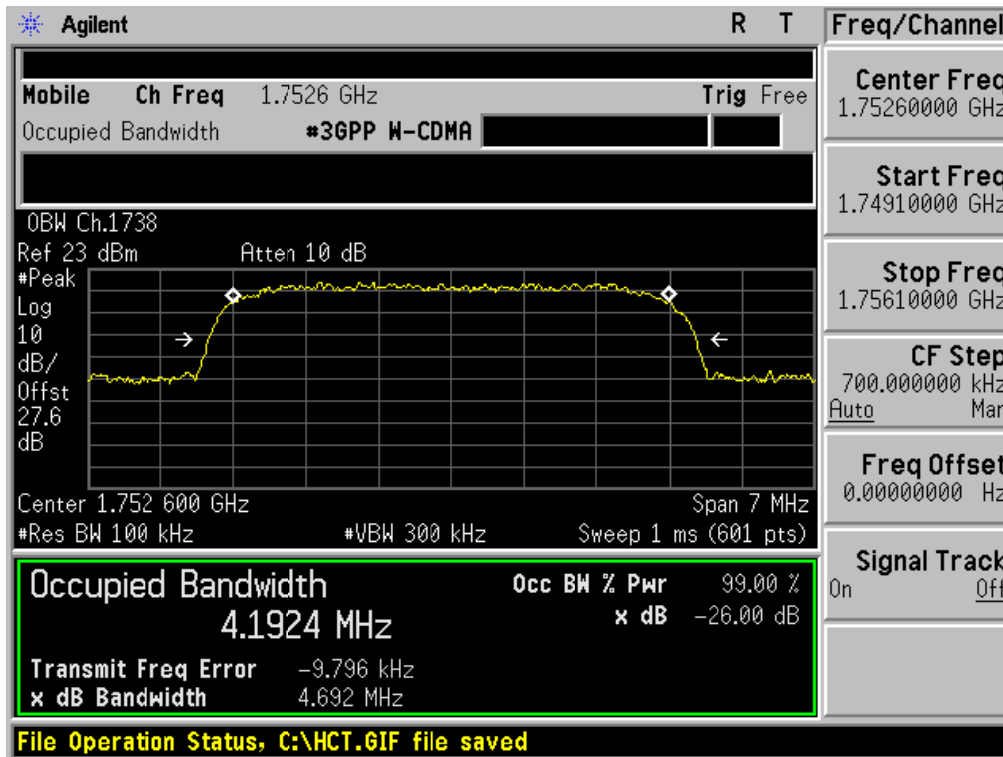
■ WCDMA1700 MODE (1312 CH.) Occupied Bandwidth



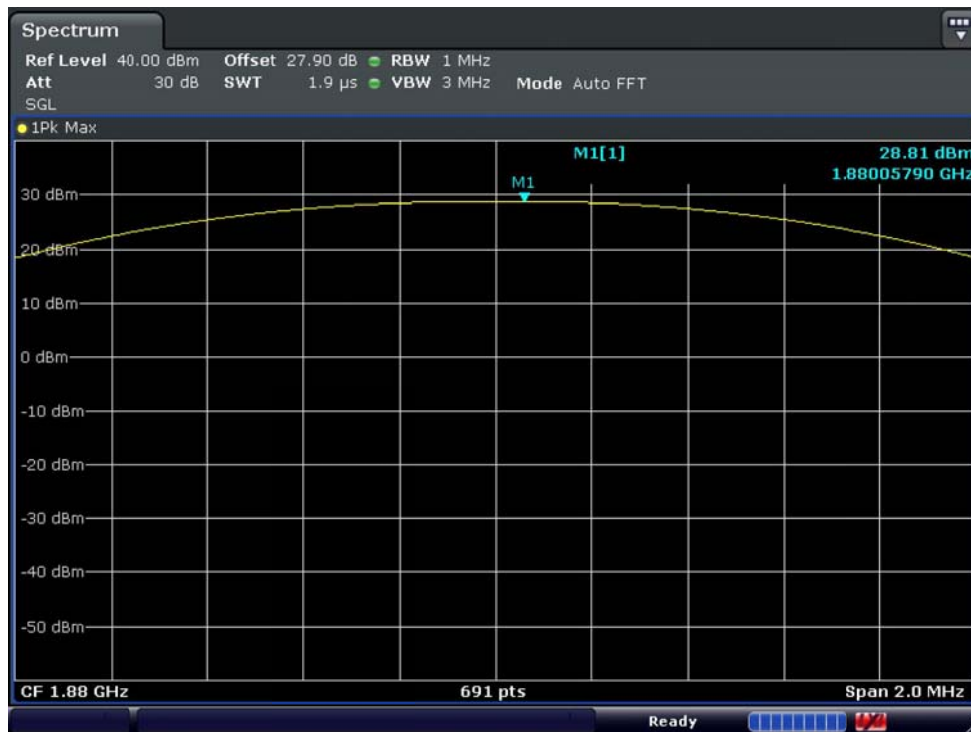
■ WCDMA1700 MODE (1412 CH.) Occupied Bandwidth



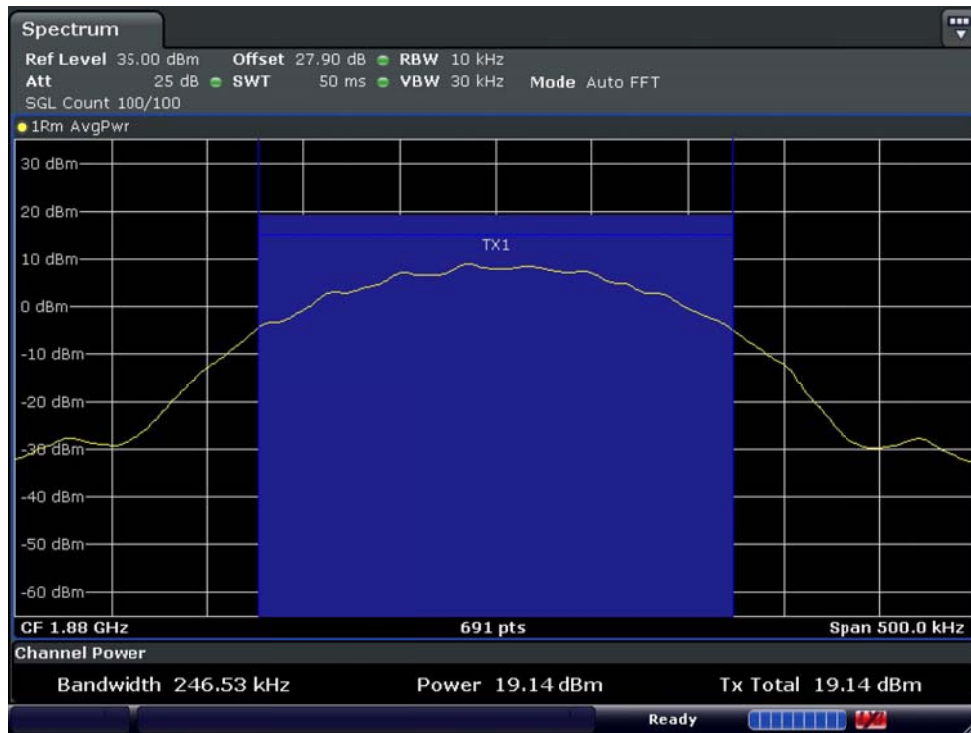
■ WCDMA1700 MODE (1513 CH.) Occupied Bandwidth



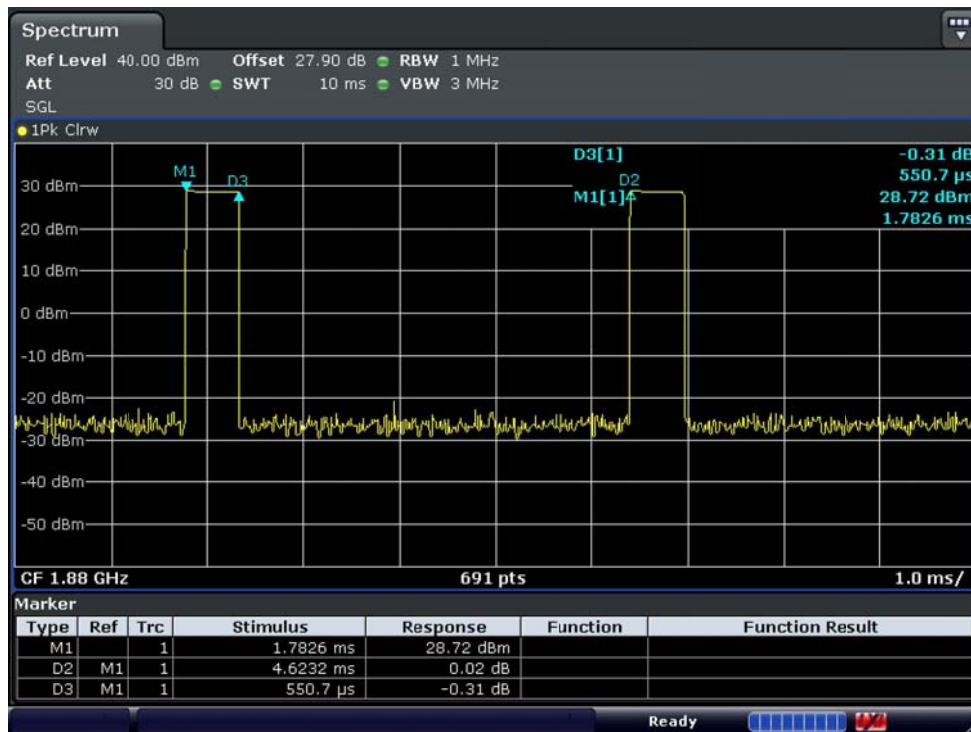
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P<sub>pk</sub>



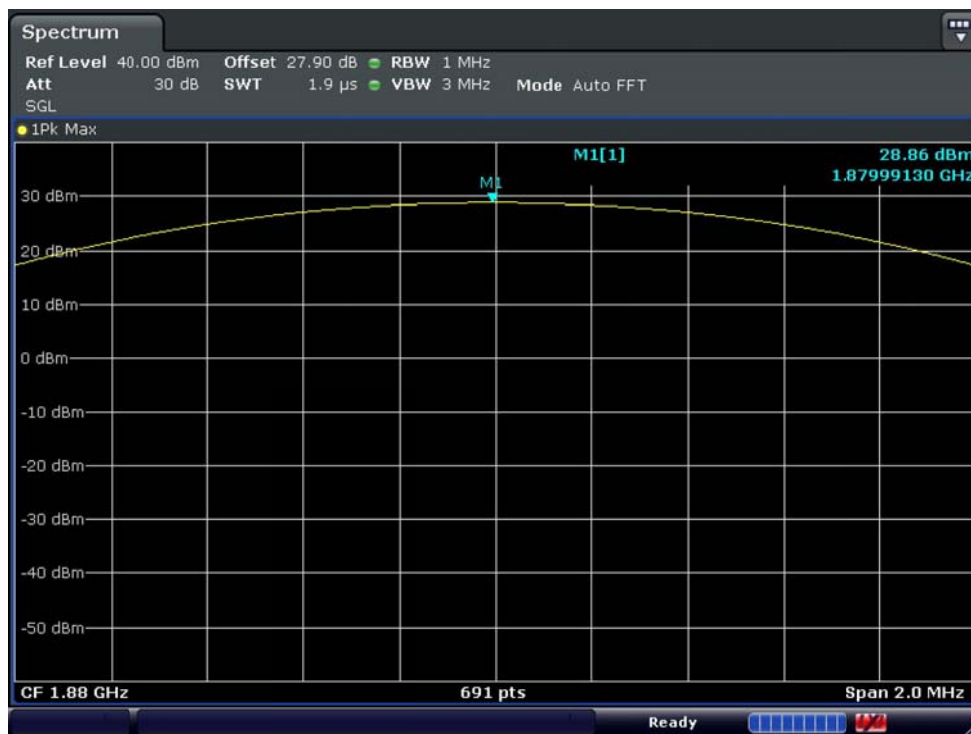
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio  $P_{Avg}$



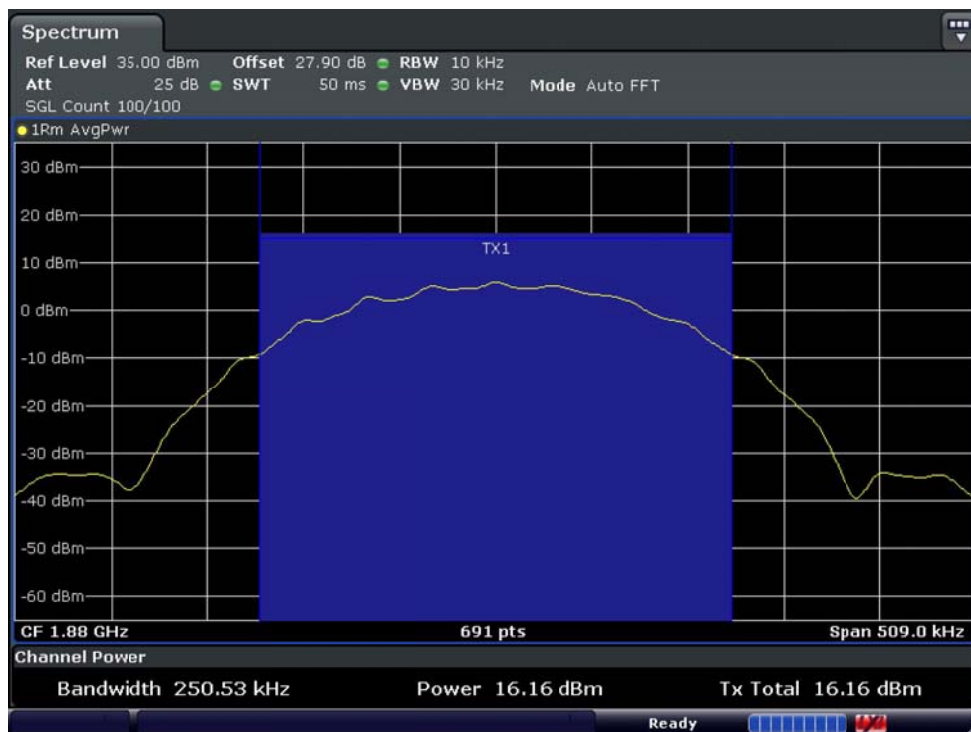
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio  $P_{Avg}$



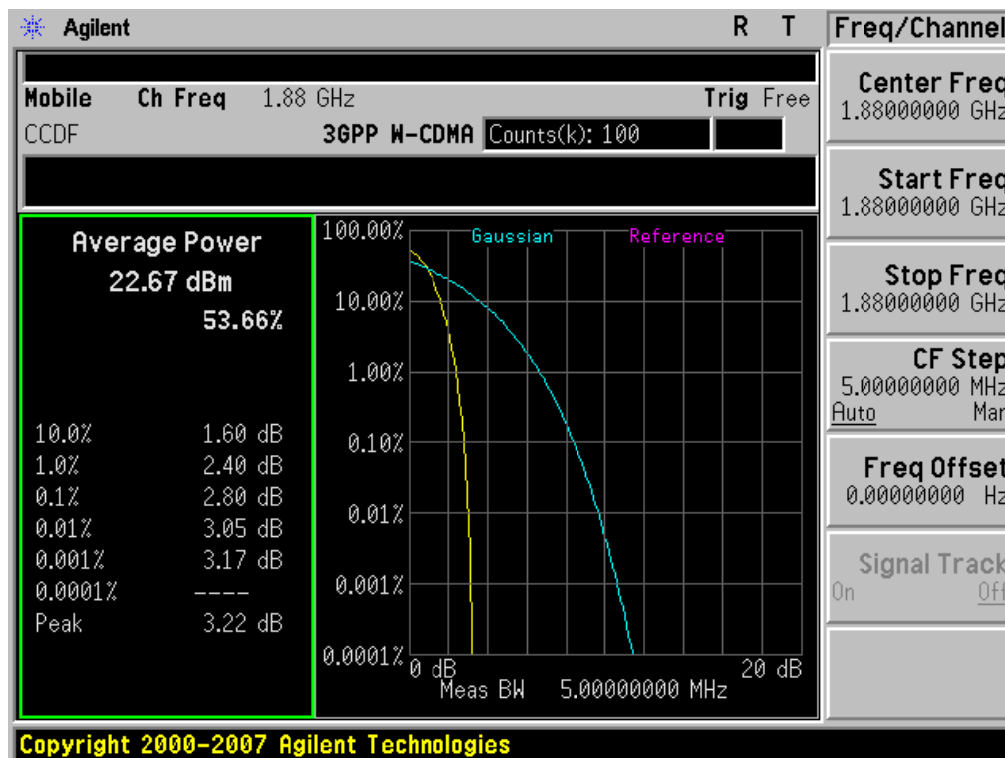
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio  $P_{Pk}$



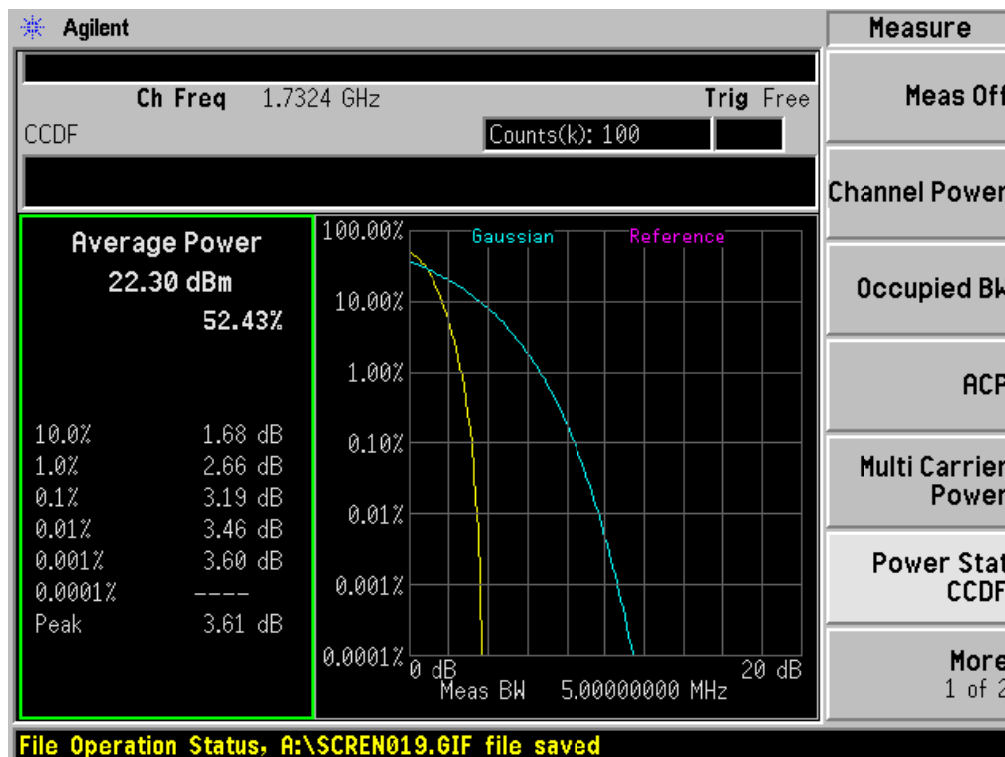
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio  $P_{Avg}$



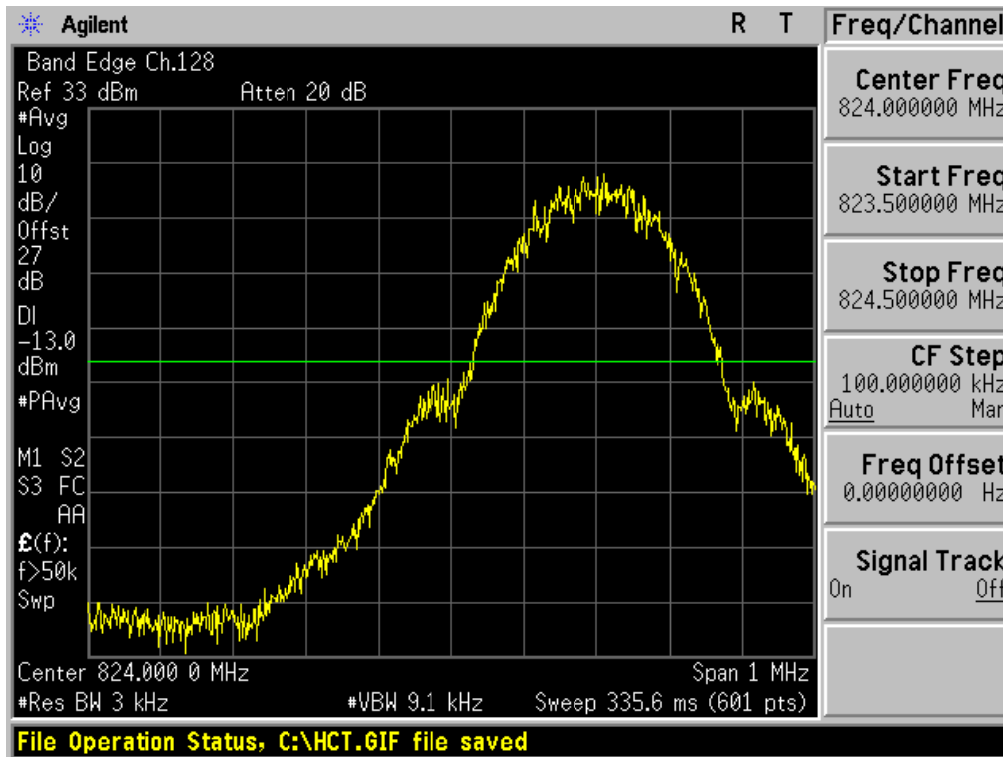
■ WCDMA1900 MODE (9400 CH.) Peak-to-Average Ratio



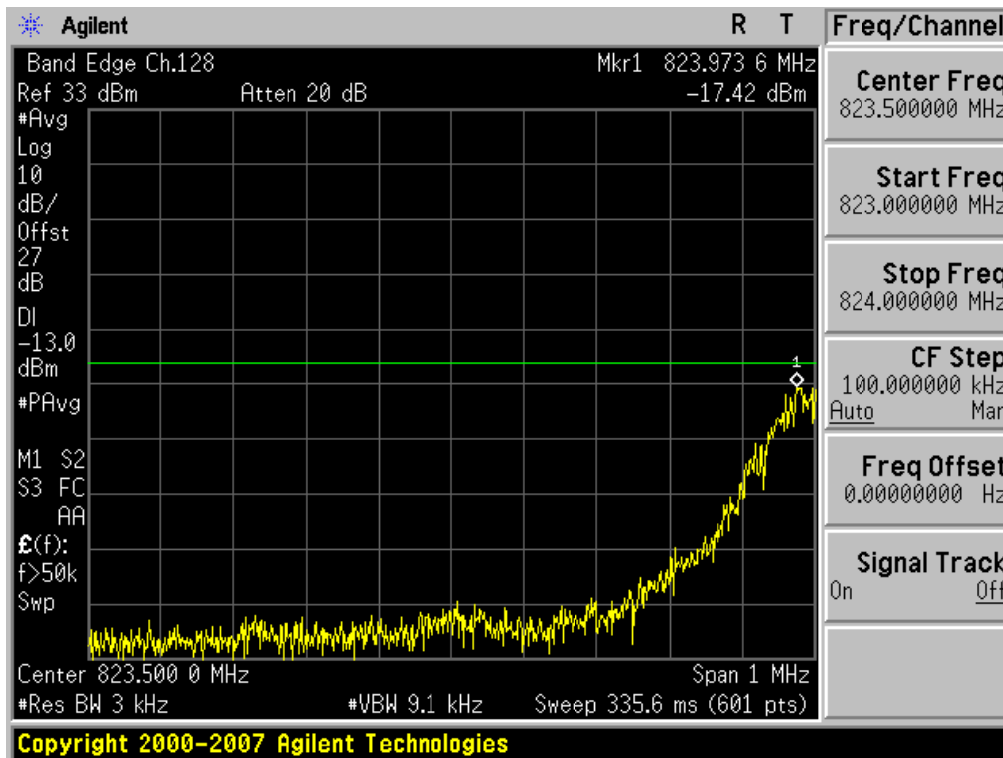
■ WCDMA1700 MODE (1412 CH.) Peak-to-Average Ratio



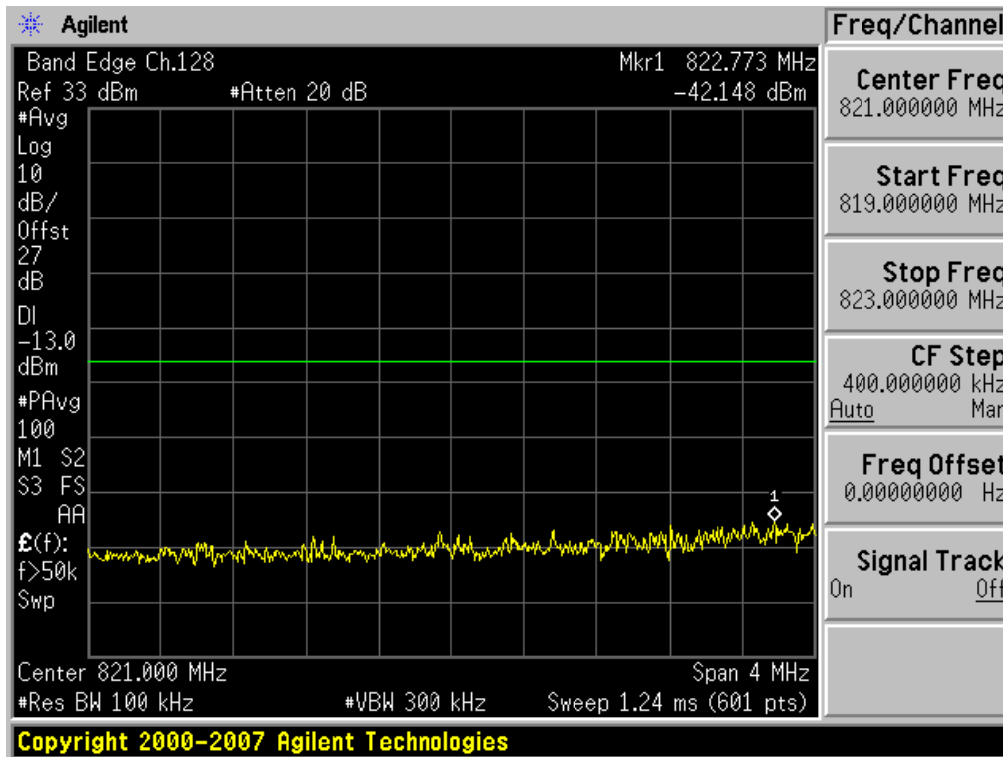
■ GSM850 MODE (128 CH.) Block Edge 1



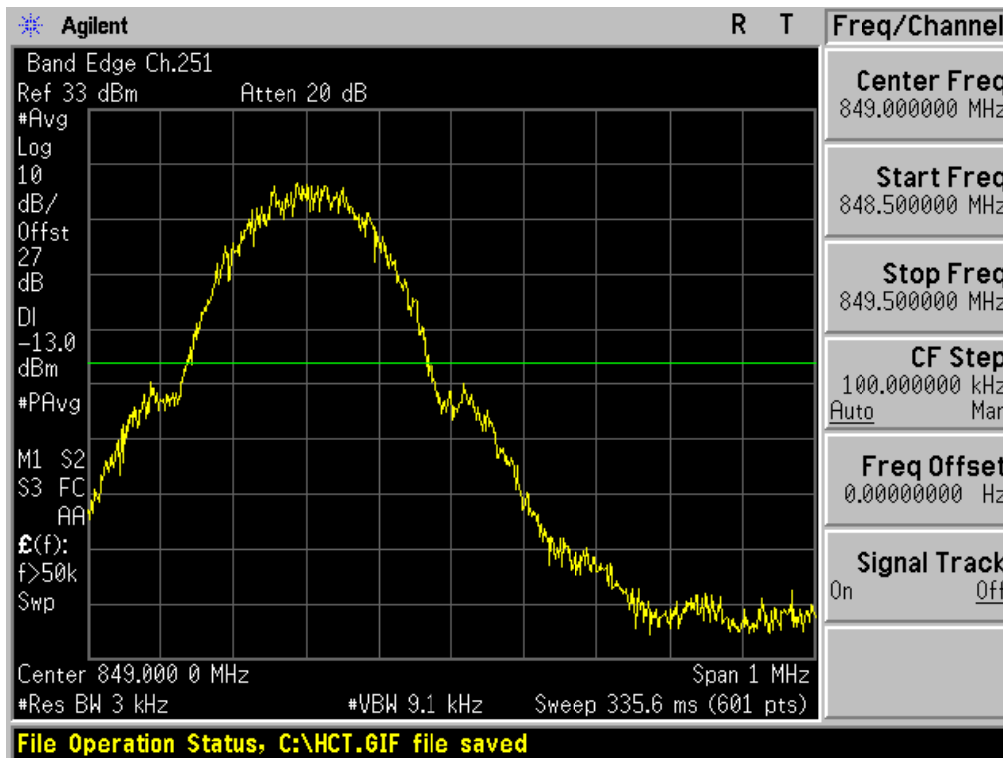
■ GSM850 MODE (128 CH.) Block Edge 2



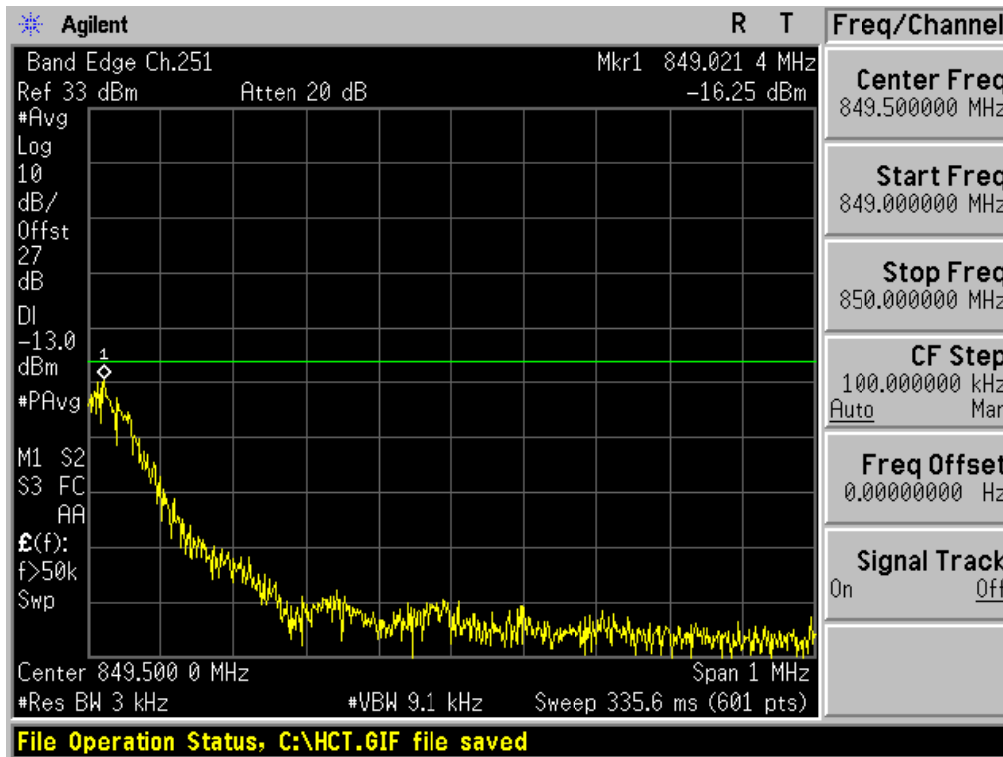
■ GSM850 MODE (128 CH.) Block Edge 3



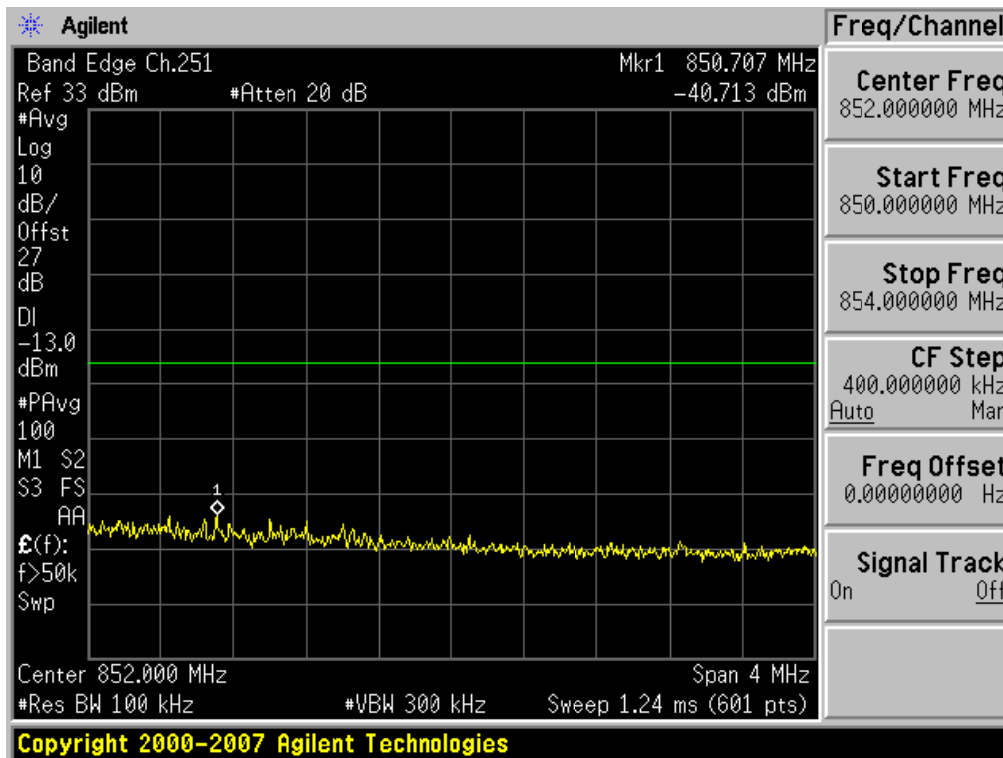
■ GSM850 MODE (251 CH.) Block Edge 1



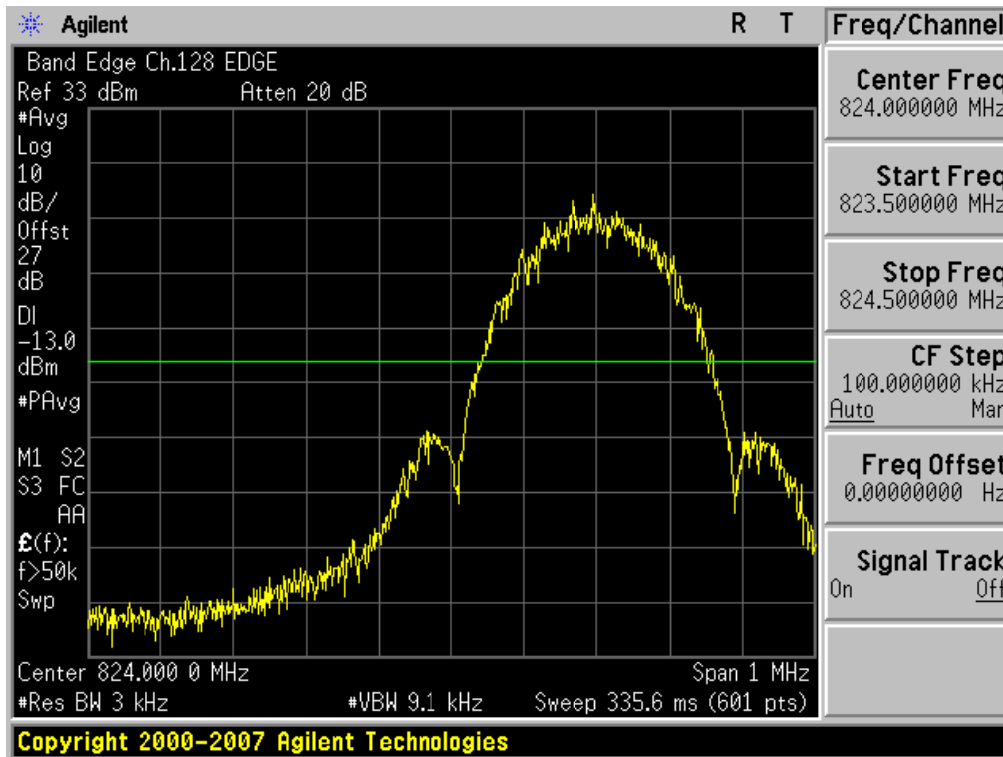
■ GSM850 MODE (251 CH.) Block Edge 2



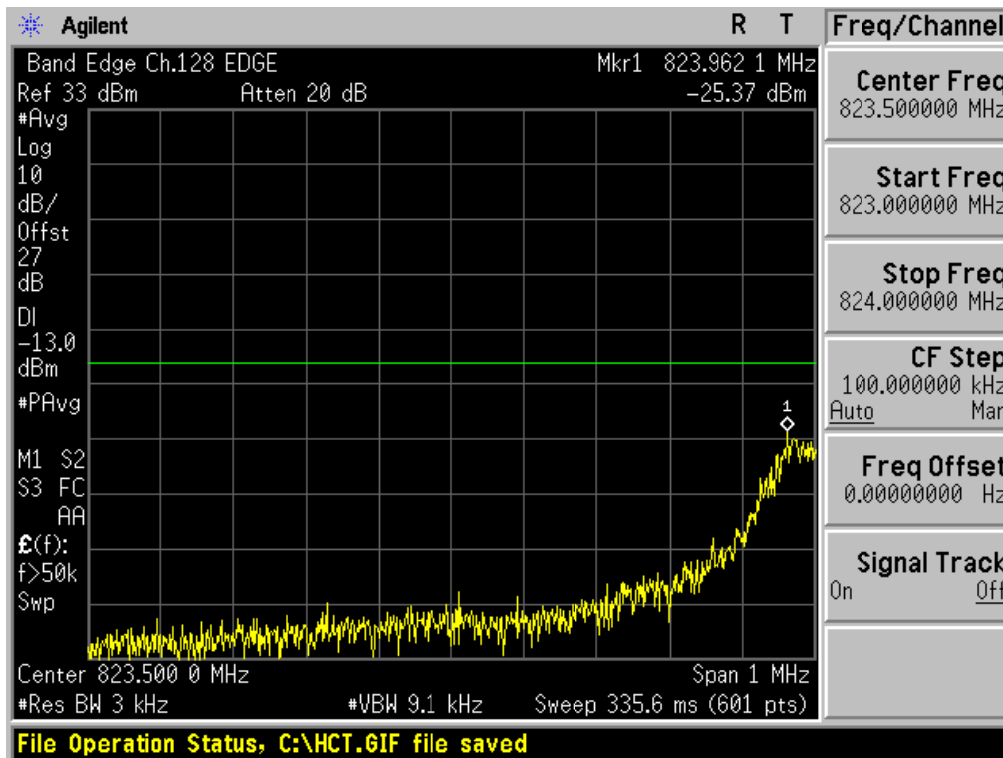
■ GSM850 MODE (251 CH.) Block Edge 3



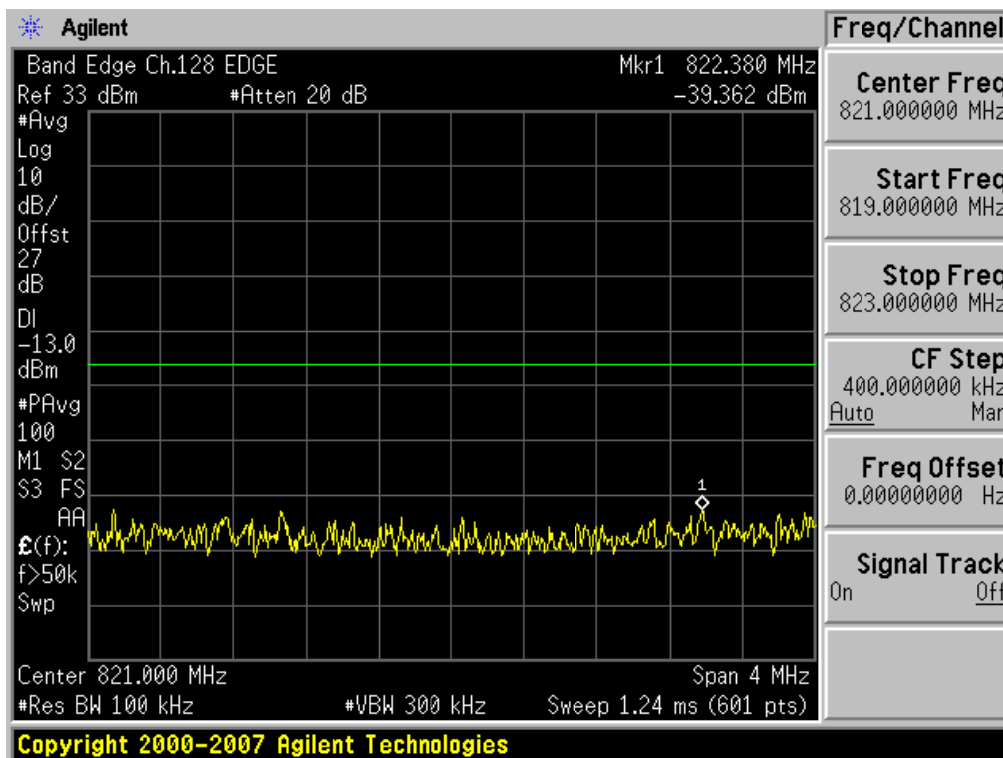
■ EDGE MODE (128 CH.) Block Edge 1



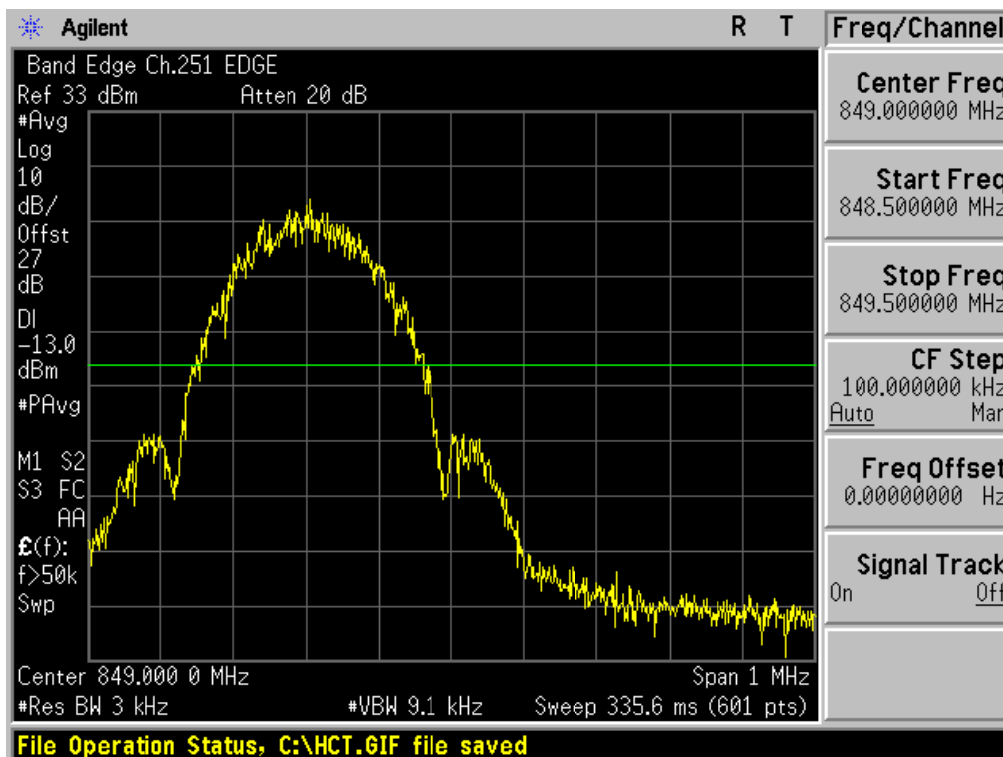
■ EDGE MODE (128 CH.) Block Edge 2



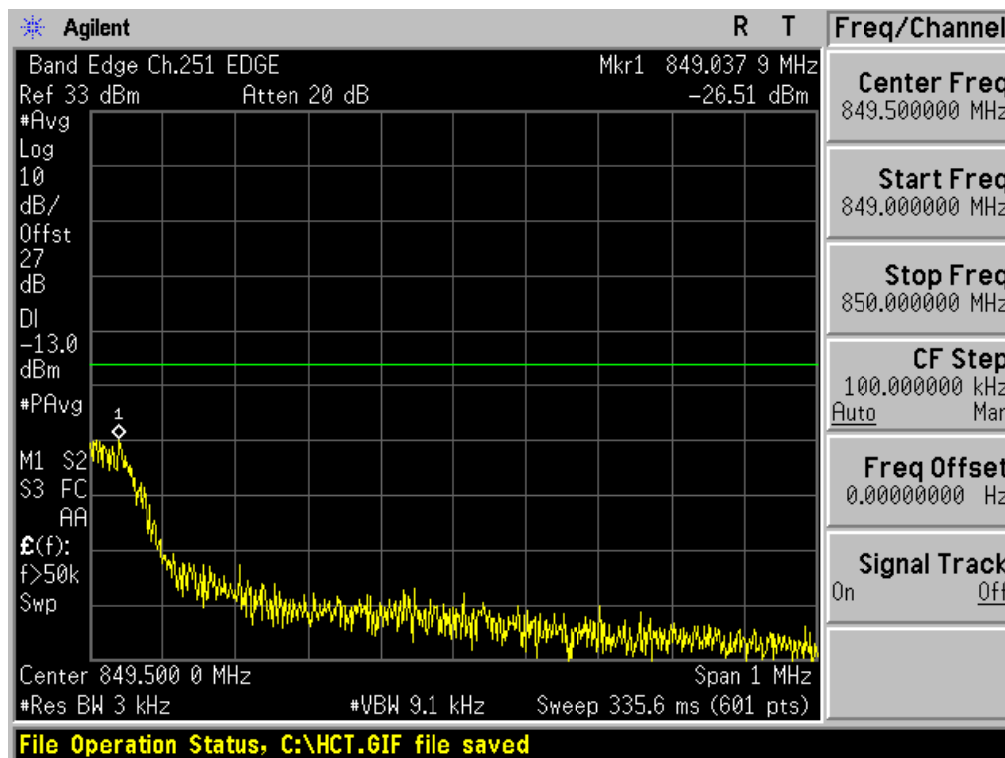
■ EDGE MODE (128 CH.) Block Edge 3



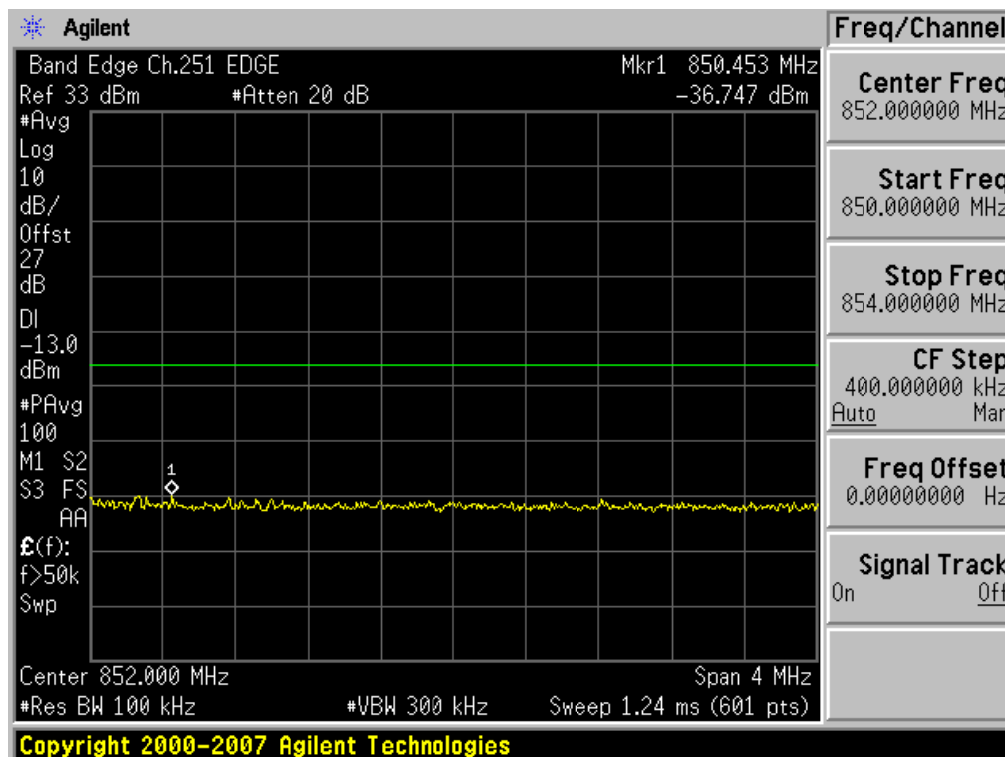
■ EDGE MODE (251 CH.) Block Edge 1



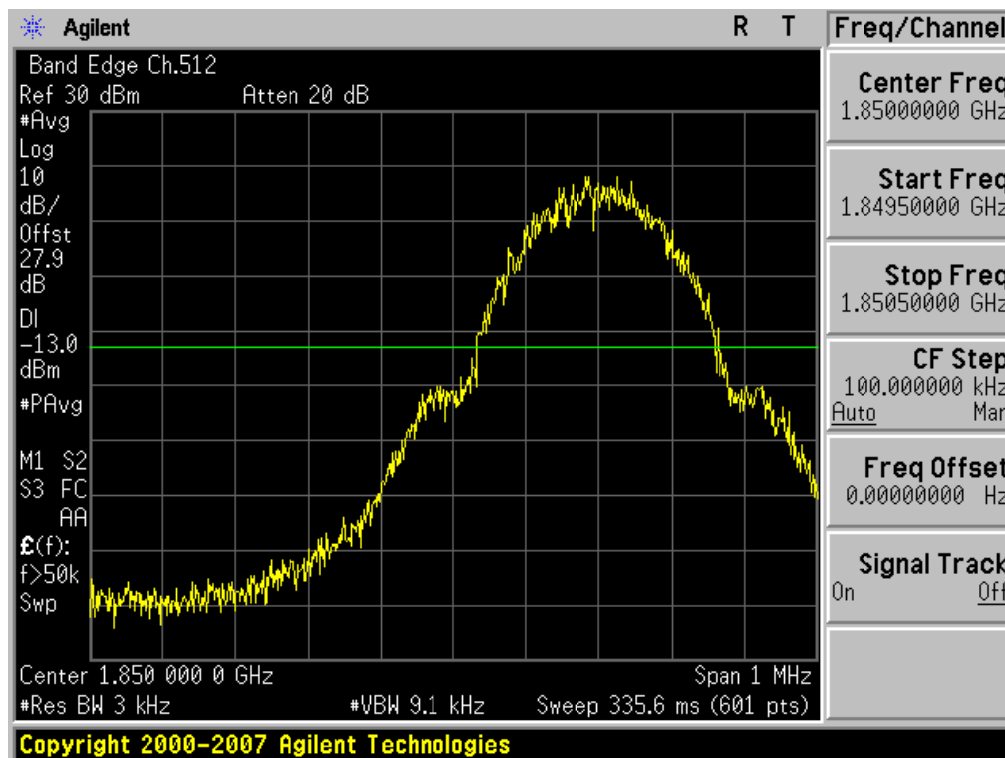
■ EDGE MODE (251 CH.) Block Edge 2



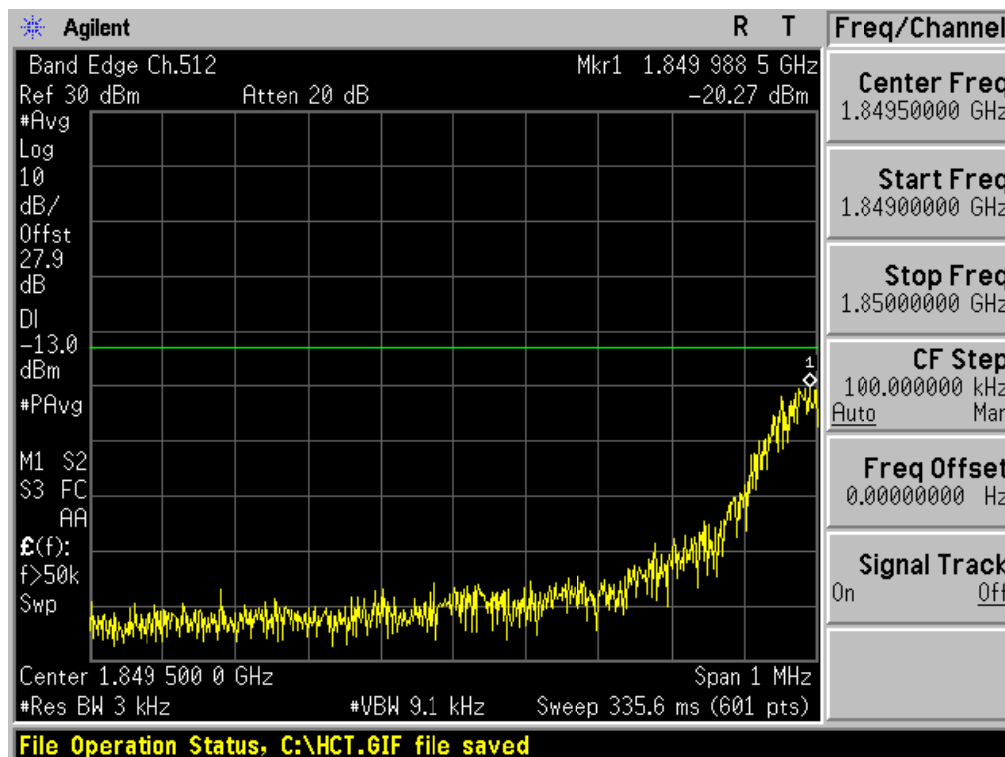
■ EDGE MODE (251 CH.) Block Edge 3



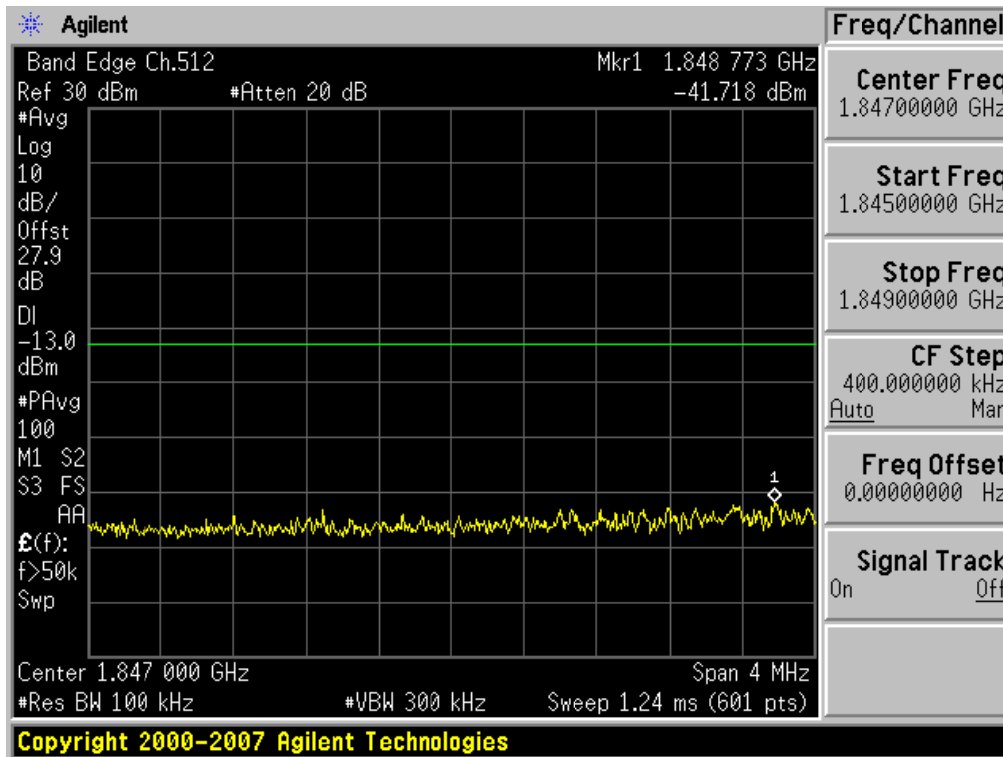
■ GSM1900 MODE (512 CH.) Block Edge 1



■ GSM1900 MODE (512 CH.) Block Edge 2



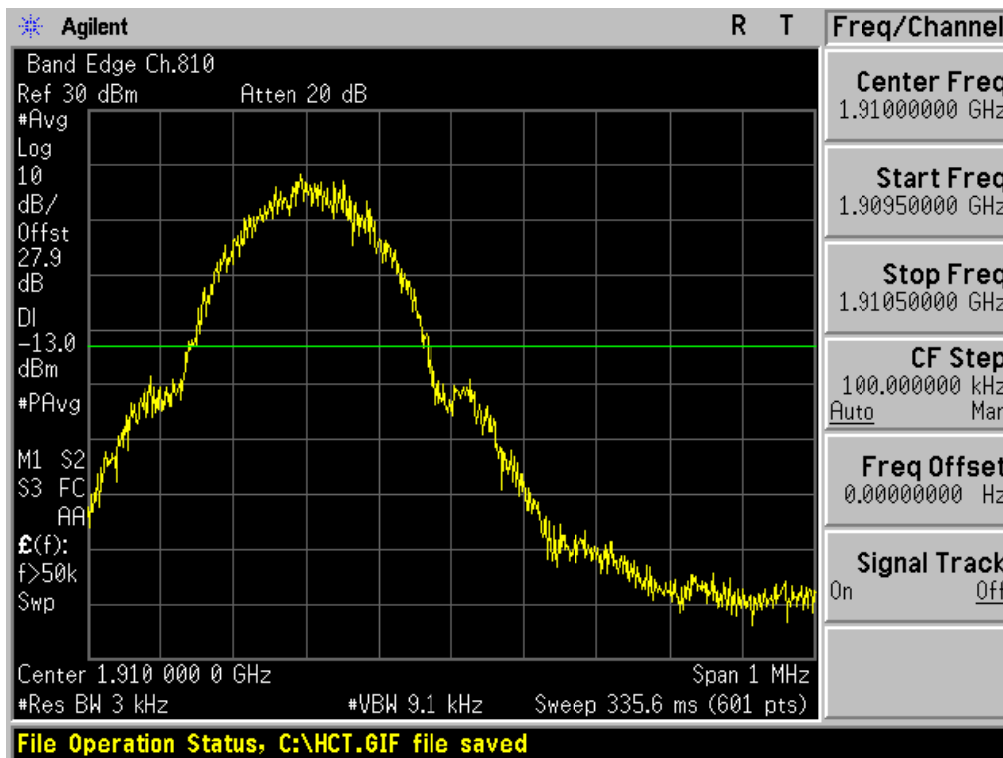
■ GSM1900 MODE (512 CH.) Block Edge 3



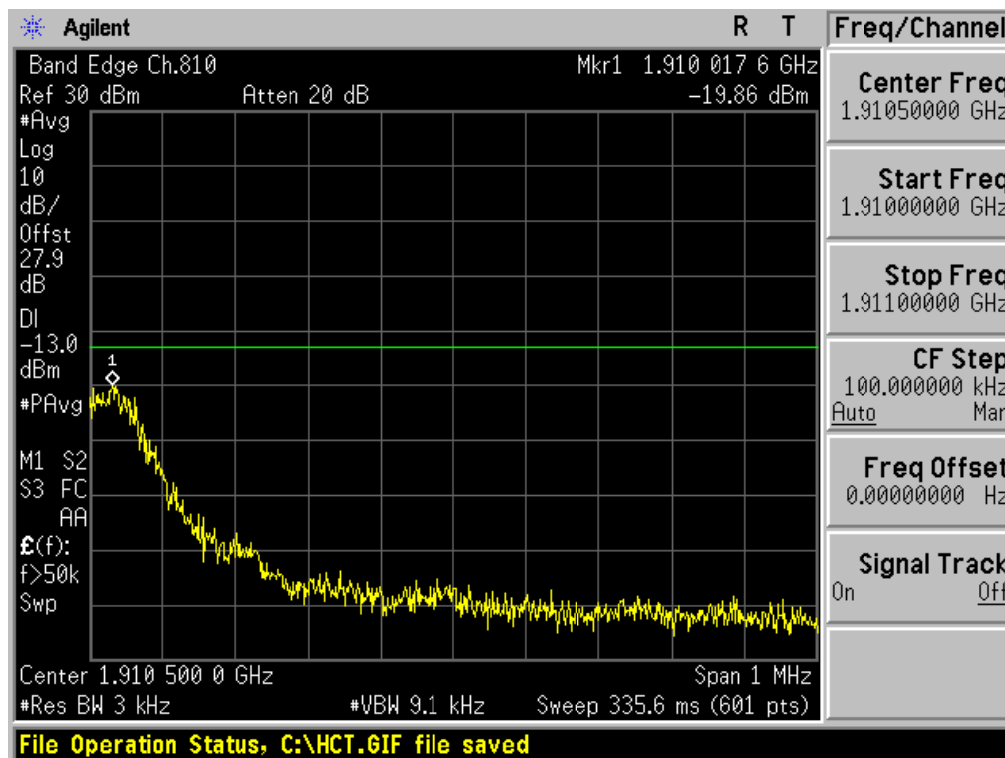
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value +  $10 \cdot \log(1 \text{ MHz}/100 \text{ kHz}) \text{ dB} = -41.718 \text{ dBm} + 10 \text{ dB} = -31.718 \text{ dBm}$

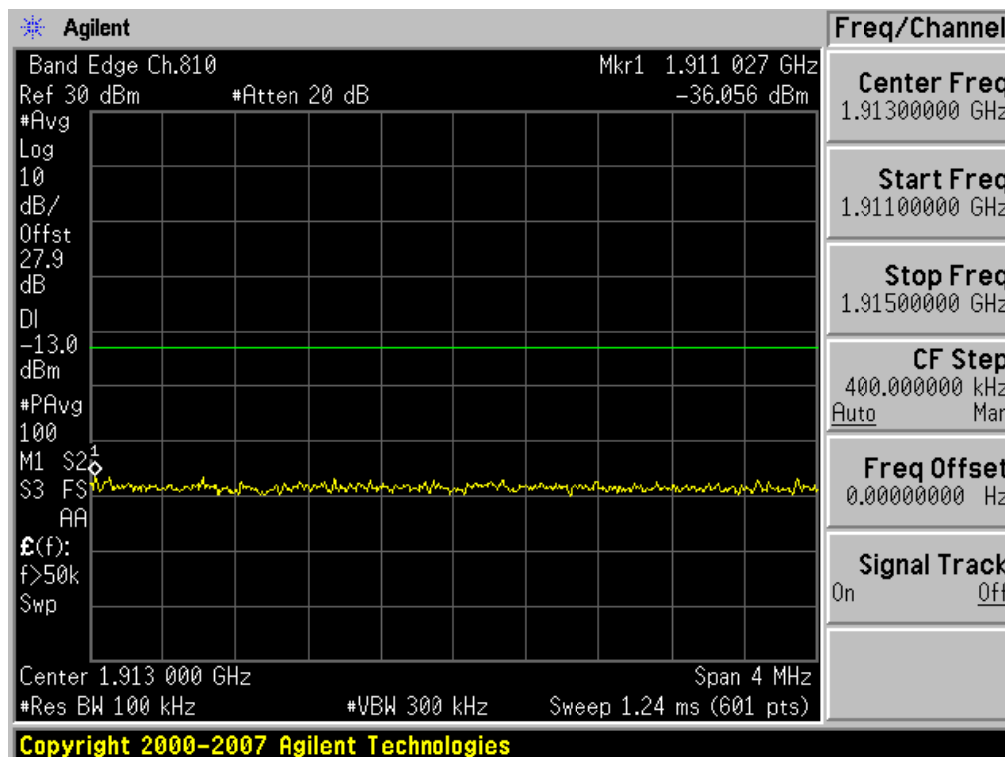
■ GSM1900 MODE (810 CH.) Block Edge 1



■ GSM1900 MODE (810 CH.) Block Edge 2



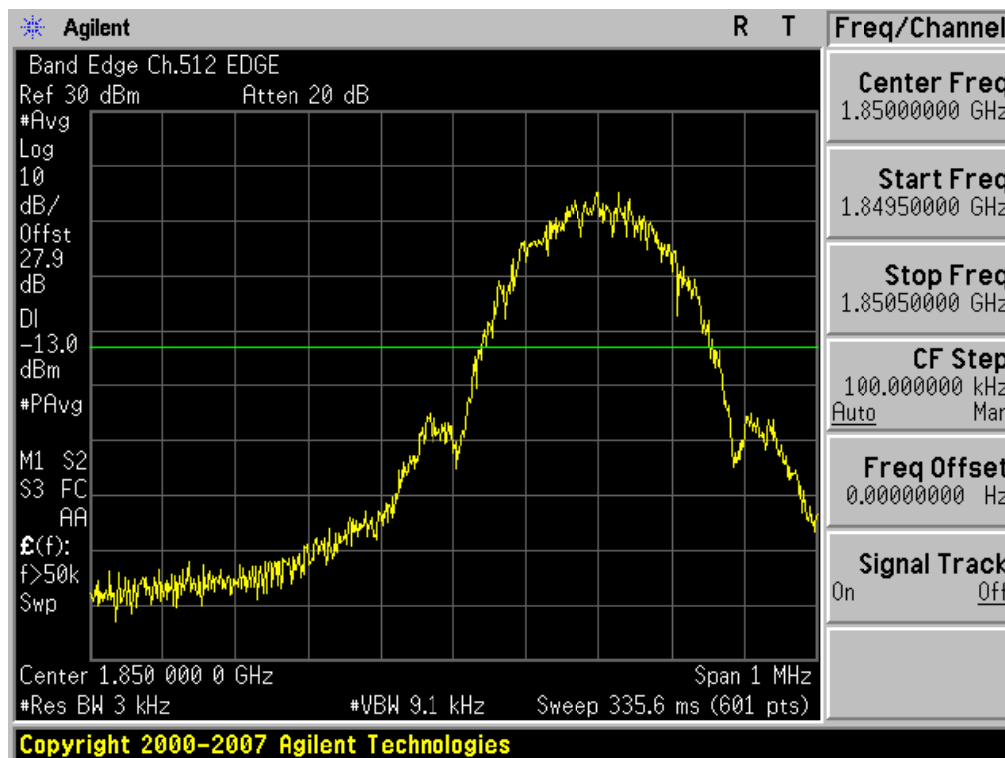
■ GSM1900 MODE (810 CH.) Block Edge 3



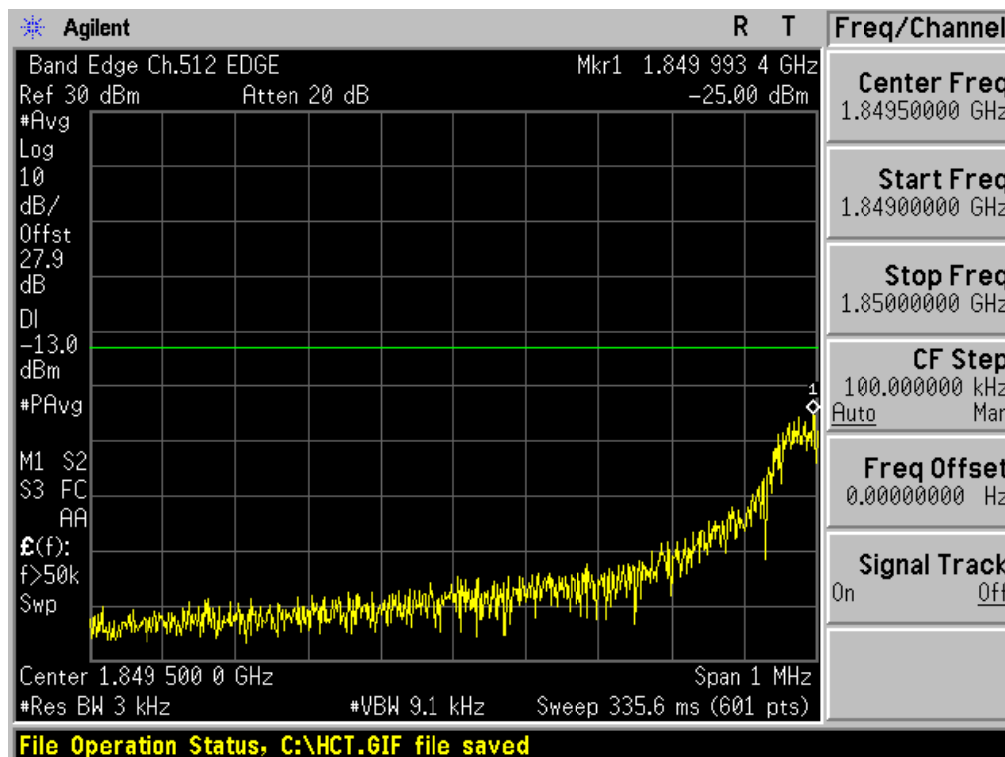
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10\*log(1 MHz/100 kHz) dB = -36.056 dBm + 10 dB = **-26.056 dBm**

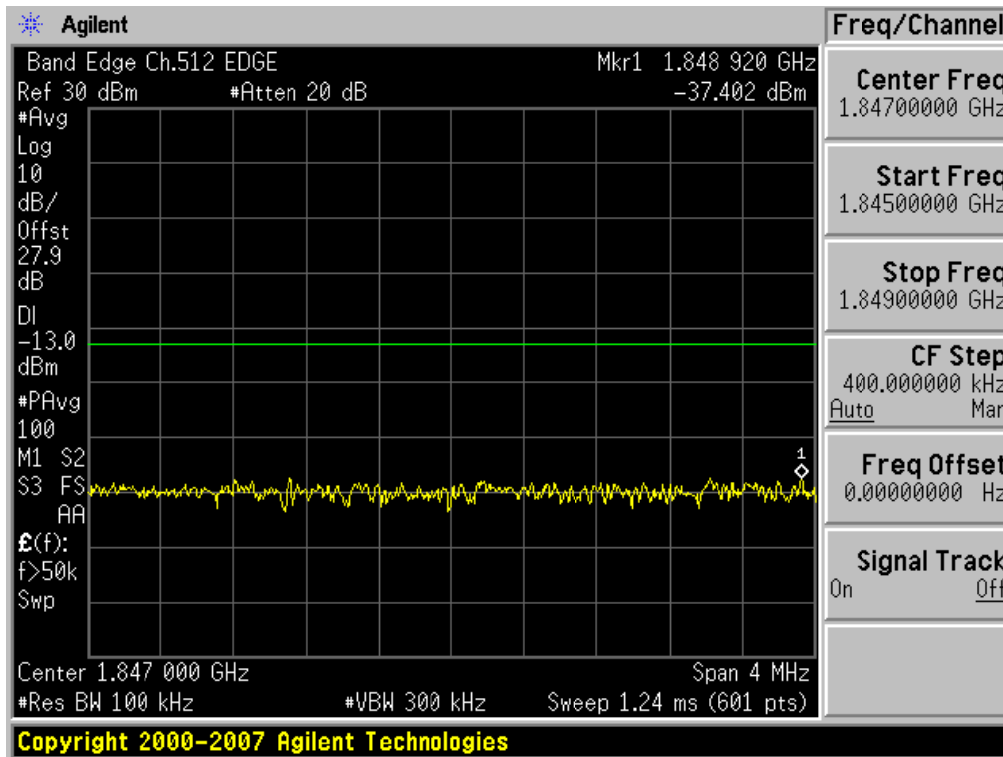
■ EDGE MODE (512 CH.) Block Edge 1



■ EDGE MODE (512 CH.) Block Edge 2



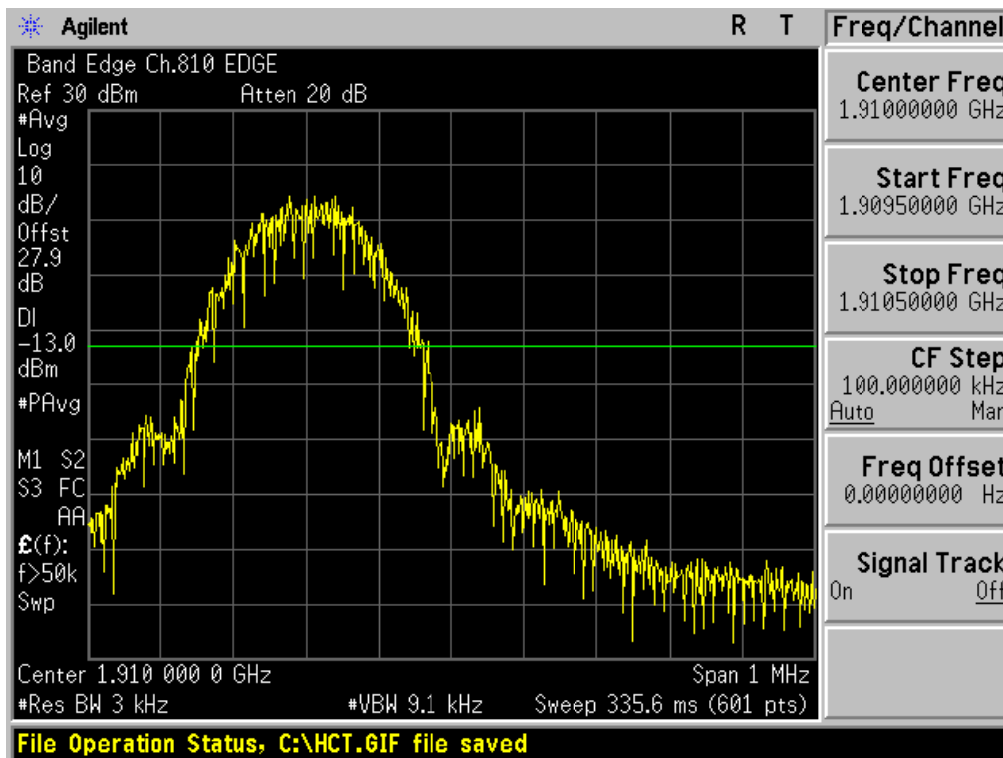
■ EDGE MODE (512 CH.) Block Edge 3



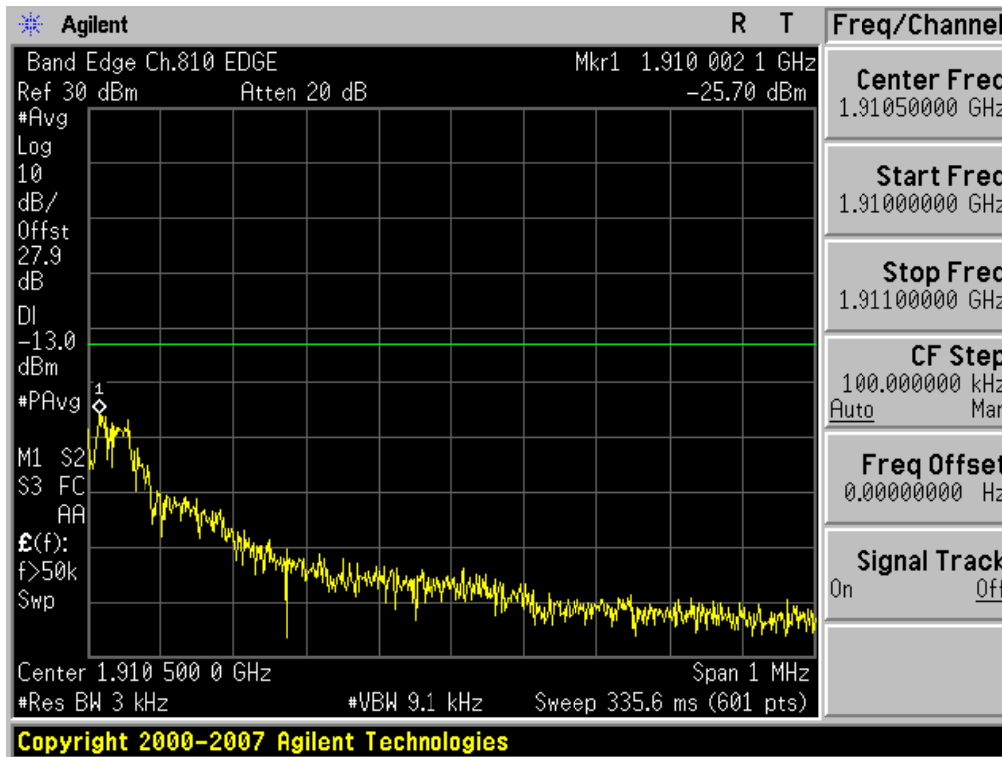
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value +  $10 \cdot \log(1 \text{ MHz}/100 \text{ kHz}) \text{ dB} = -37.402 \text{ dBm} + 10 \text{ dB} = -27.402 \text{ dBm}$

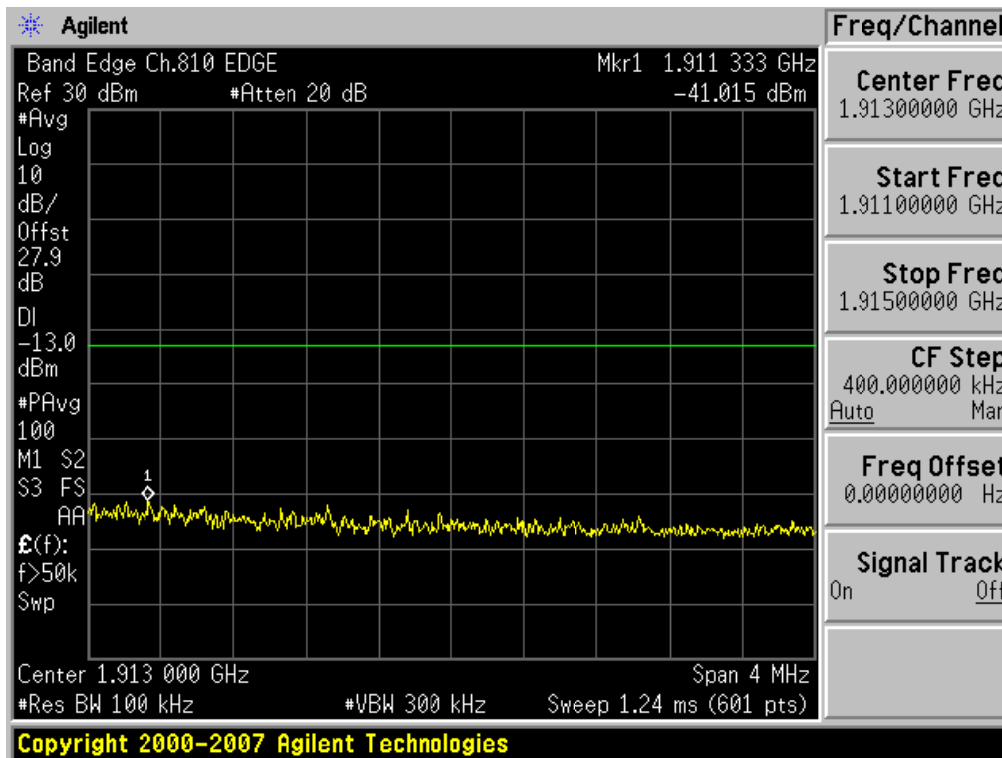
■ EDGE MODE (810 CH.) Block Edge 1



■ EDGE MODE (810 CH.) Block Edge 2



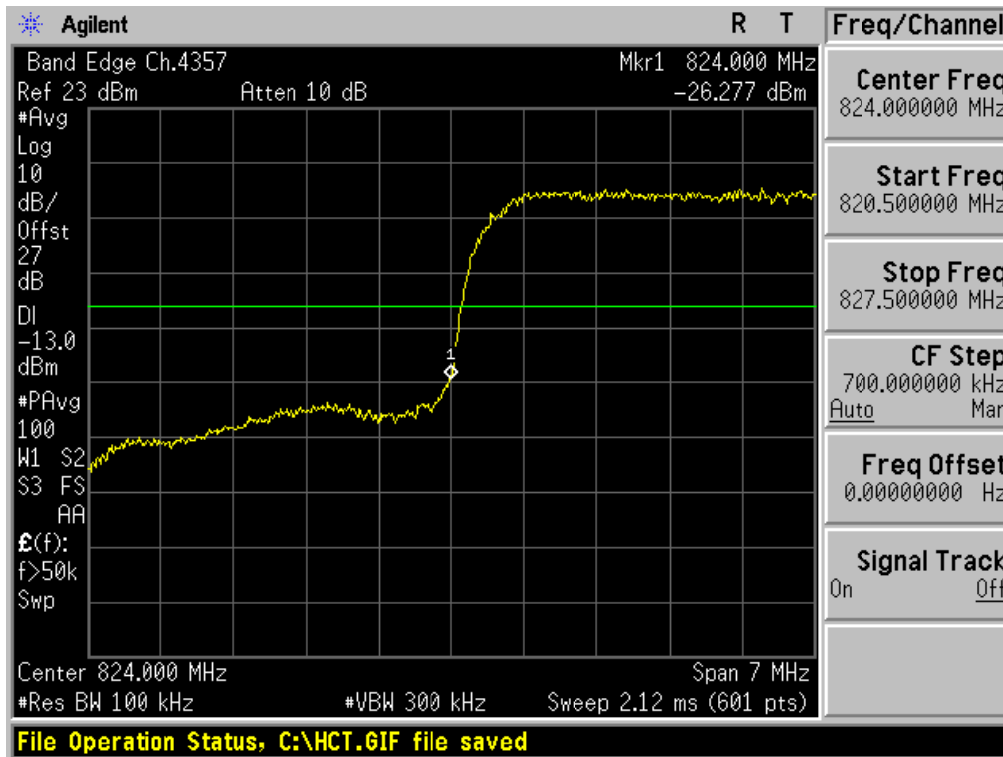
■ EDGE MODE (810 CH.) Block Edge 3



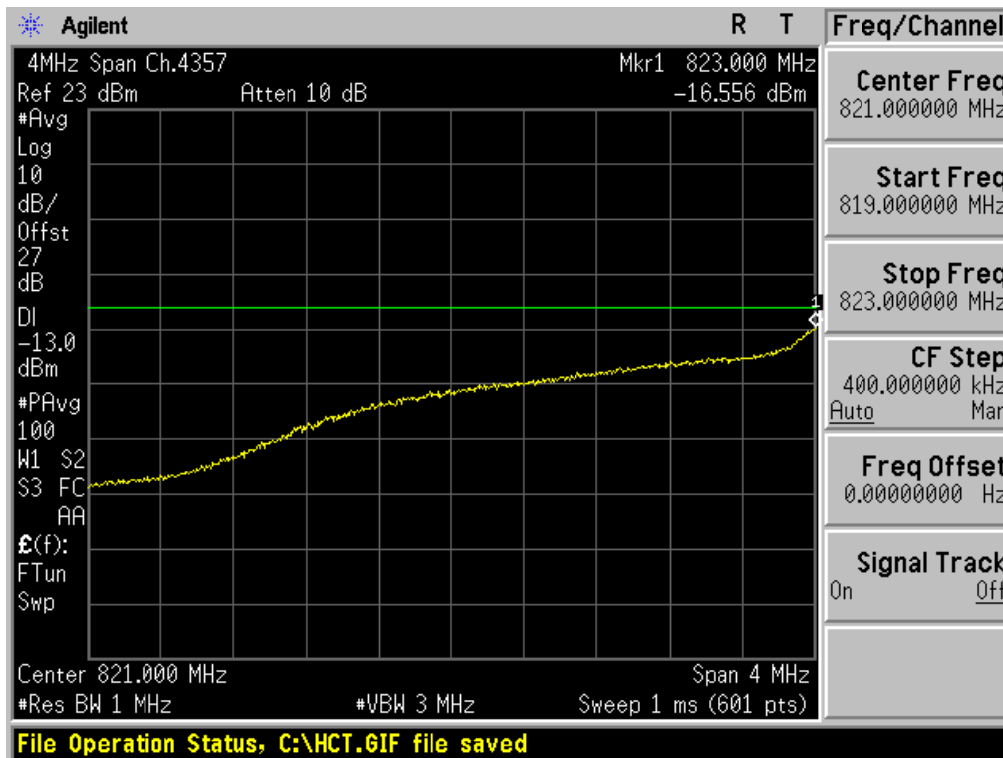
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value +  $10 \cdot \log(1 \text{ MHz}/100 \text{ kHz}) \text{ dB} = -41.015 \text{ dBm} + 10 \text{ dB} = -31.015 \text{ dBm}$

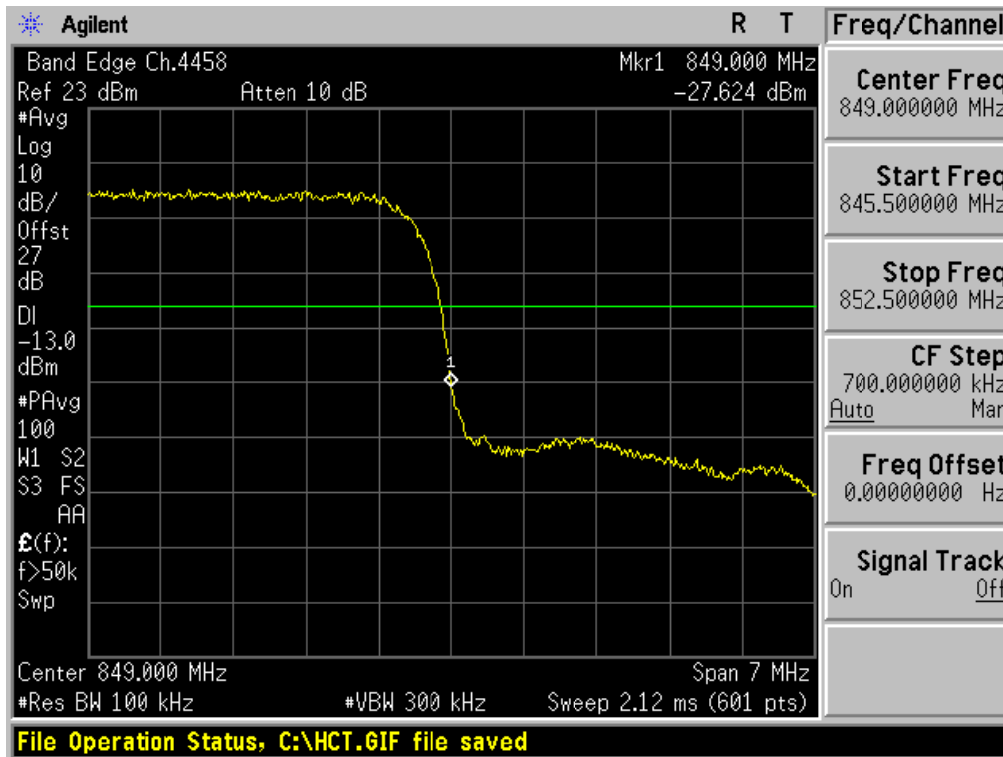
■ WCDMA850 MODE (4132 CH.) Block Edge



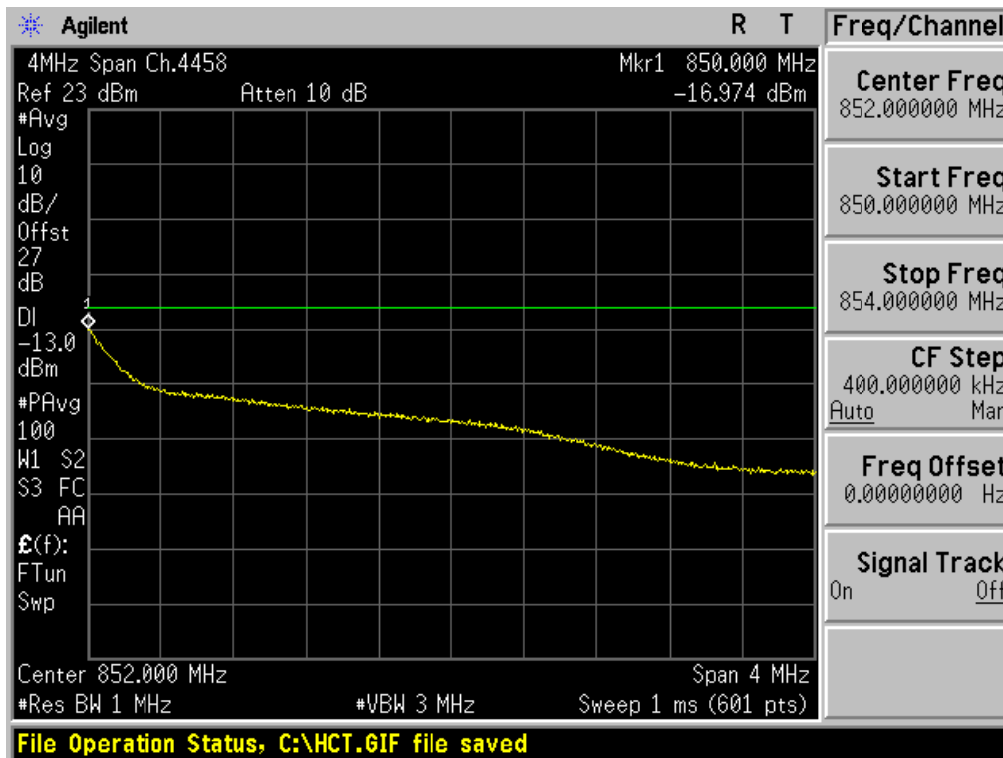
■ WCDMA850 MODE (4132 CH.) – 4 MHz Span



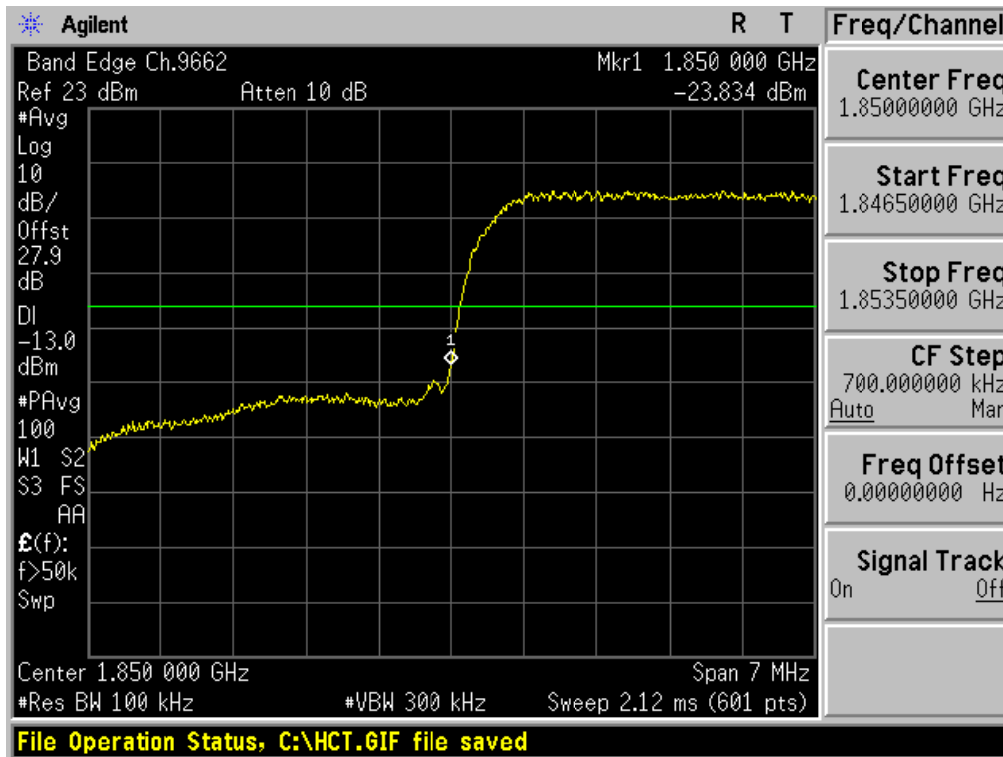
■ WCDMA850MODE (4233 CH.) Block Edge



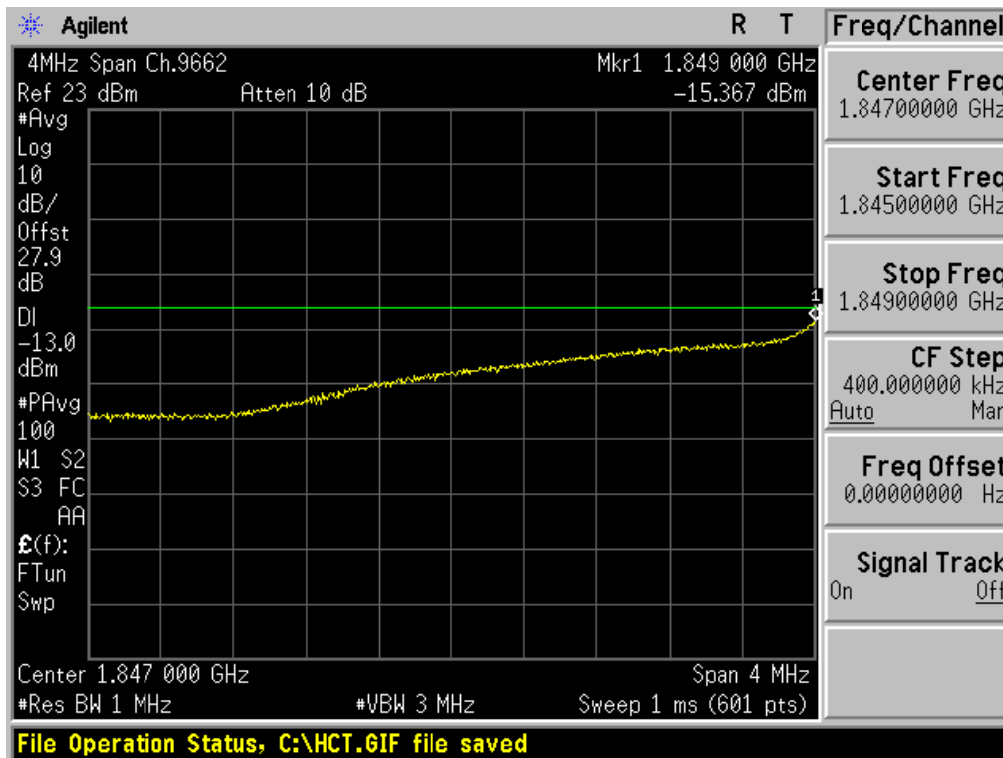
■ WCDMA850MODE (4233 CH.) – 4 MHz Span



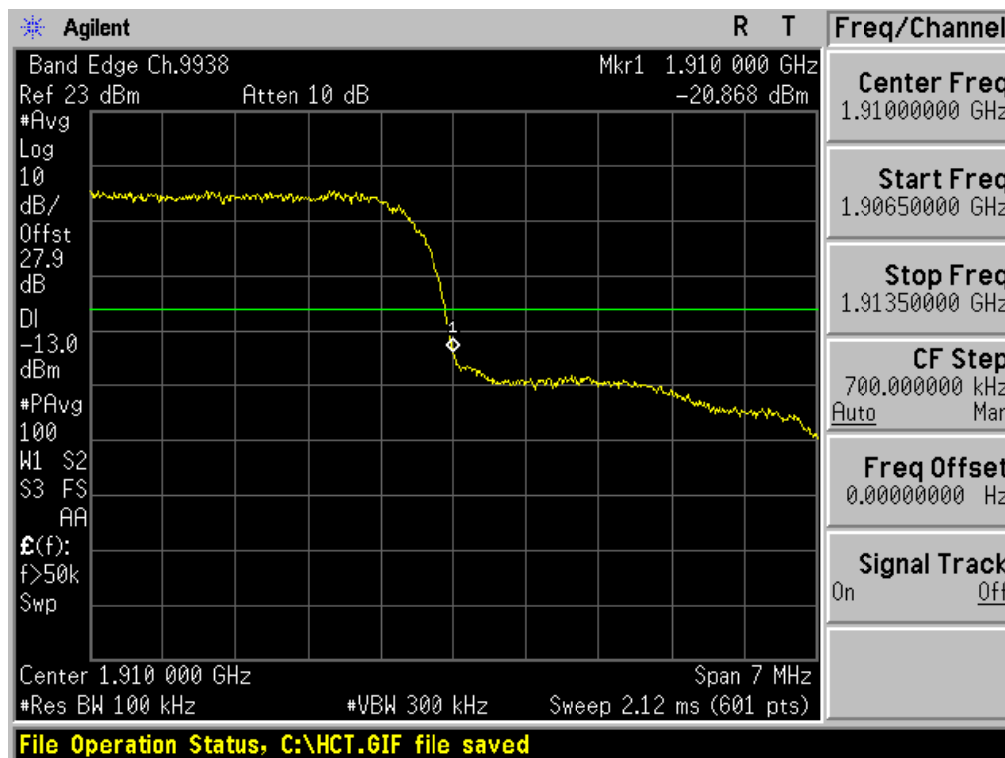
■ WCDMA1900 MODE (9262 CH.) Block Edge



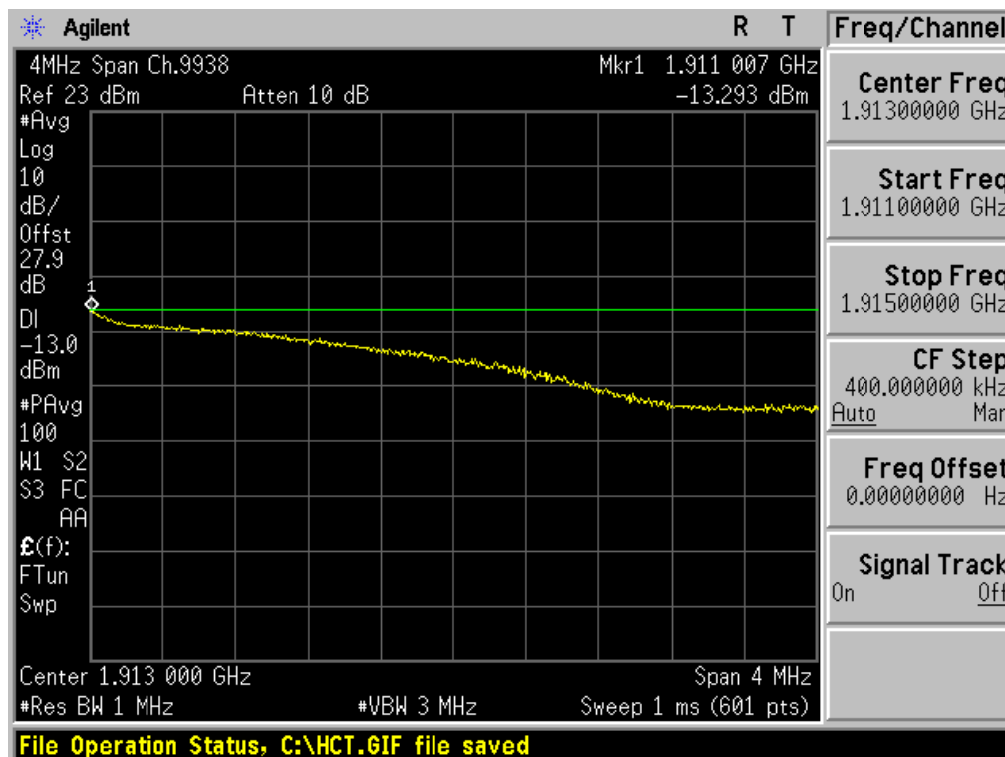
■ WCDMA1900 MODE (9262 CH.) – 4 MHz Span



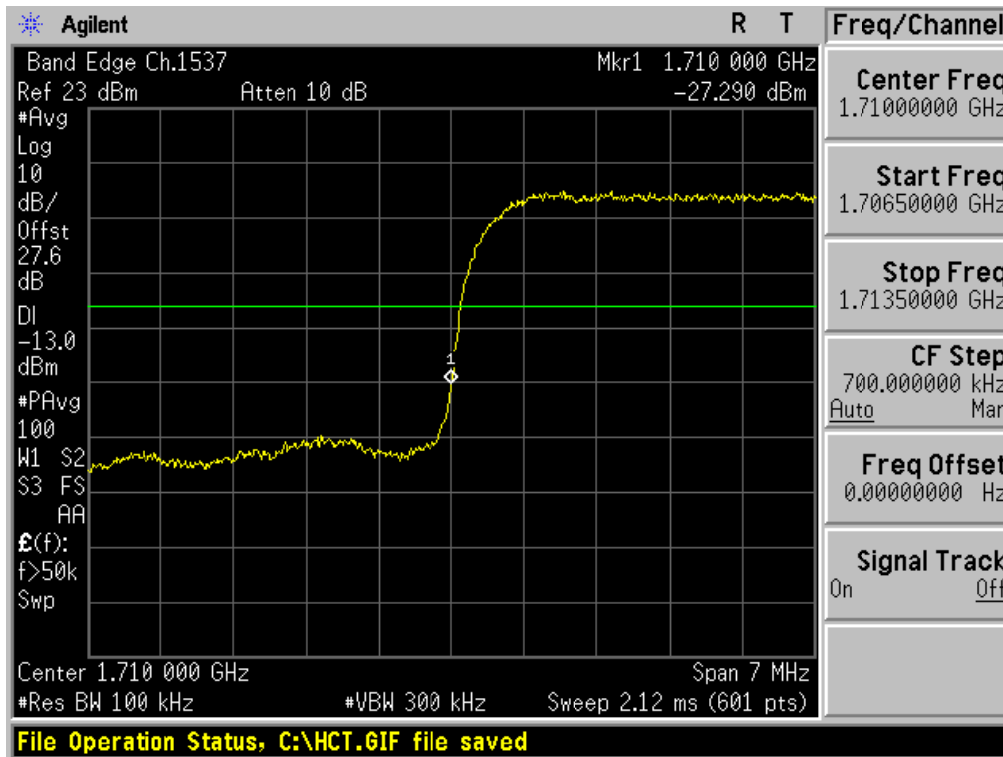
■ WCDMA1900 MODE (9538 CH.) Block Edge



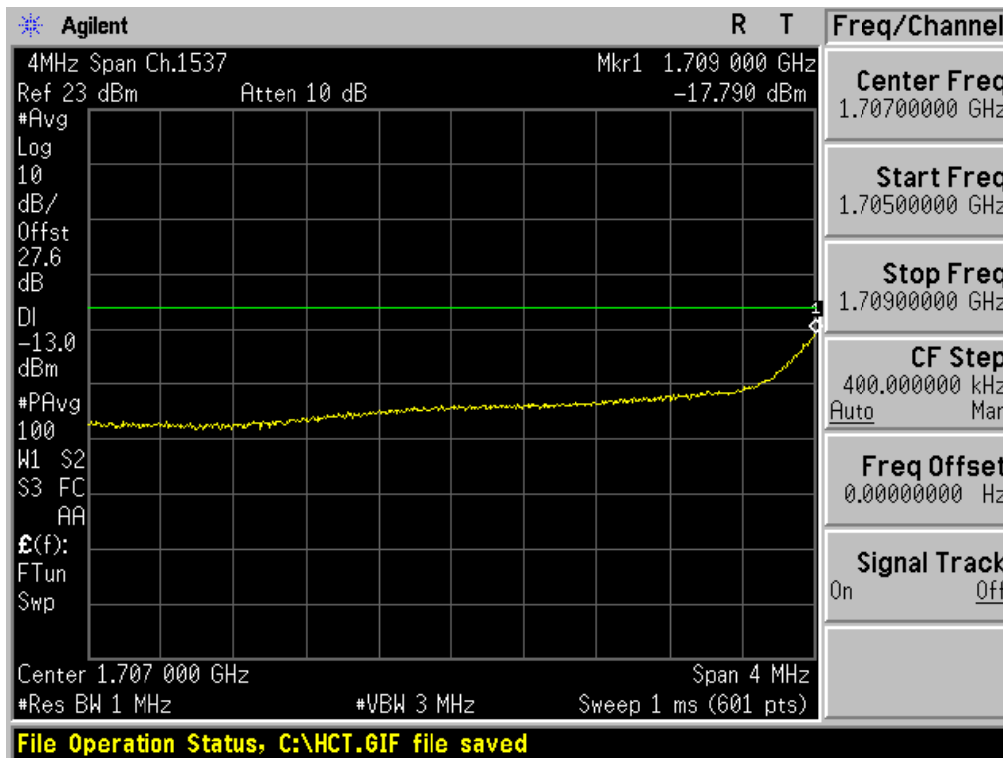
■ WCDMA1900 MODE (9538 CH.) – 4 MHz Span



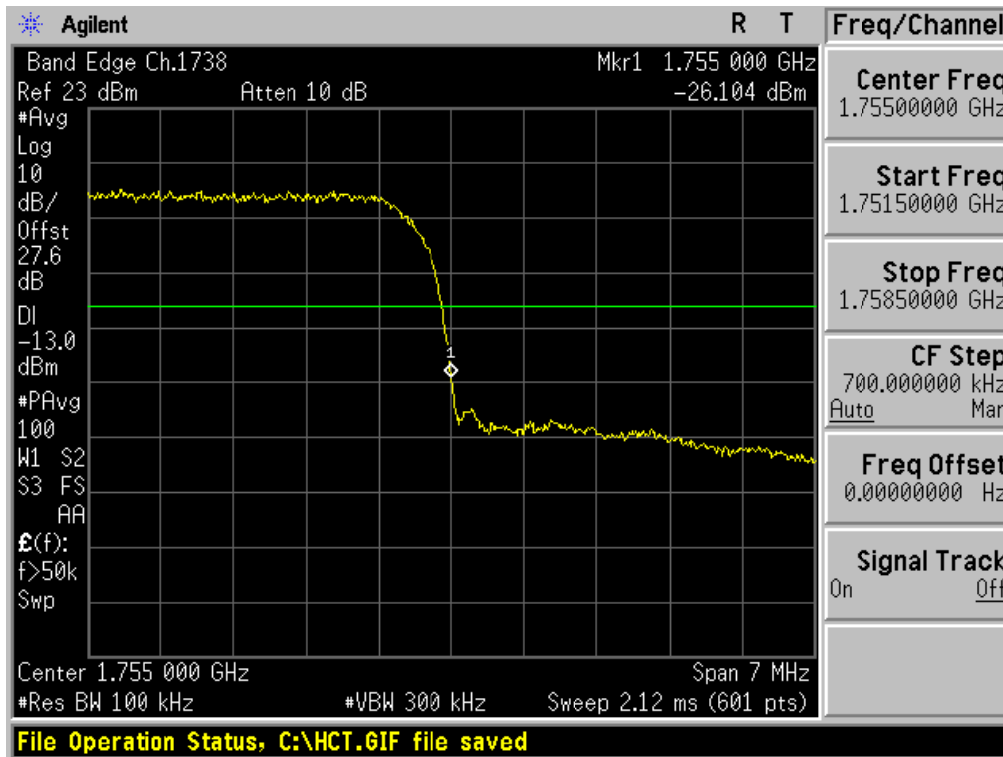
■ WCDMA1700 MODE (1312 CH.) Block Edge



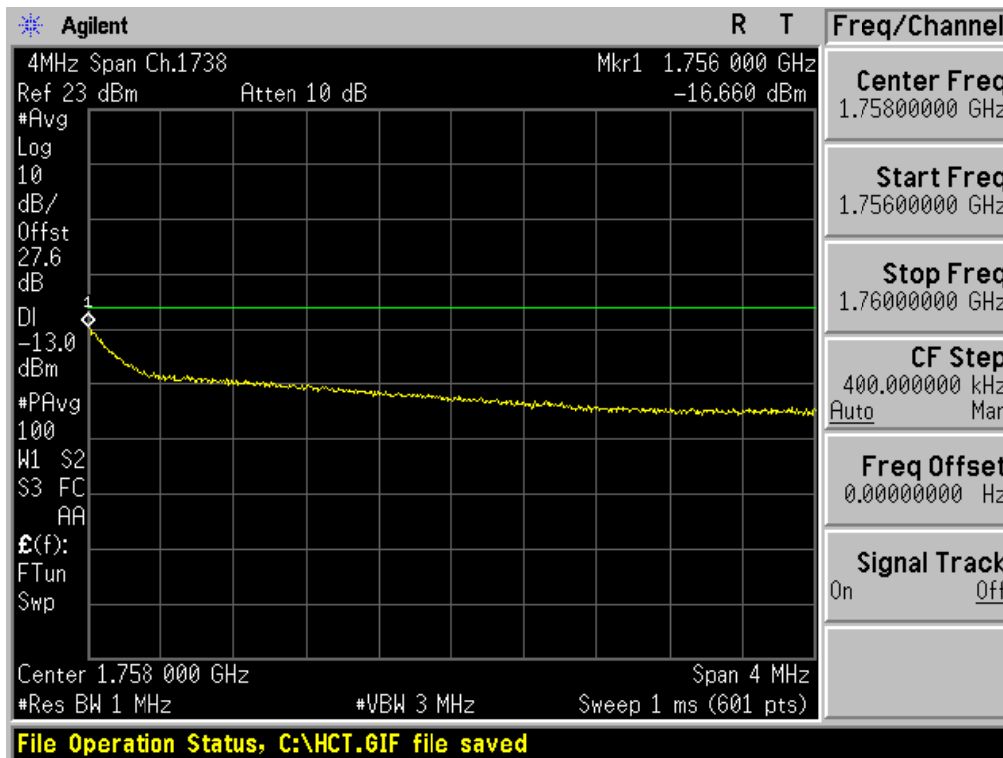
■ WCDMA1700 MODE (1312 CH.) – 4 MHz Span



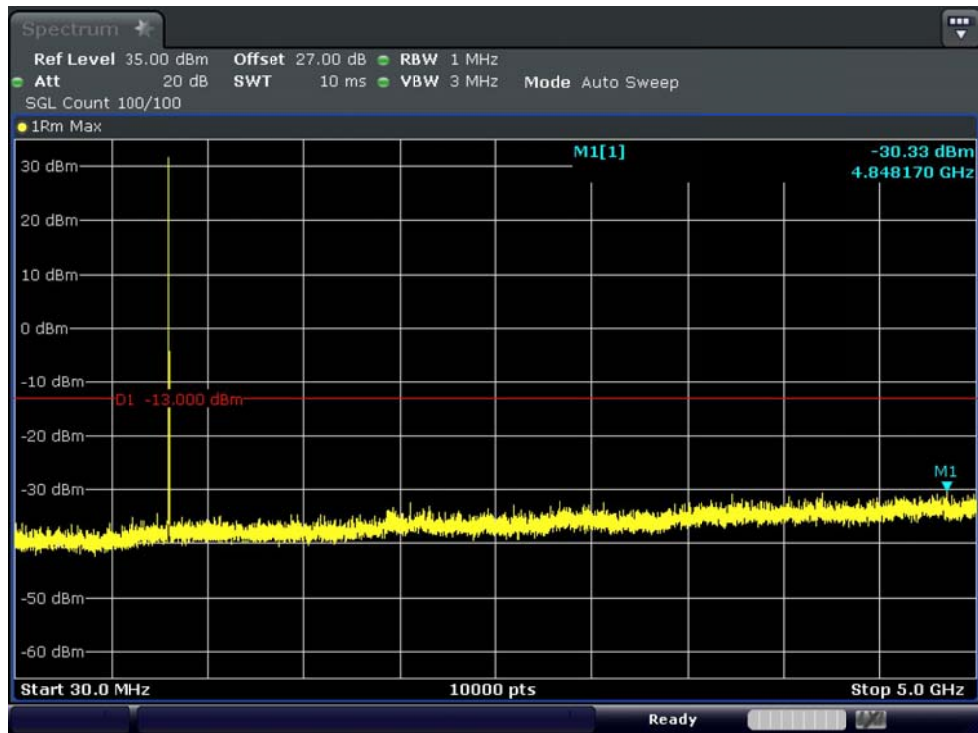
■ WCDMA1700 MODE (1513 CH.) Block Edge



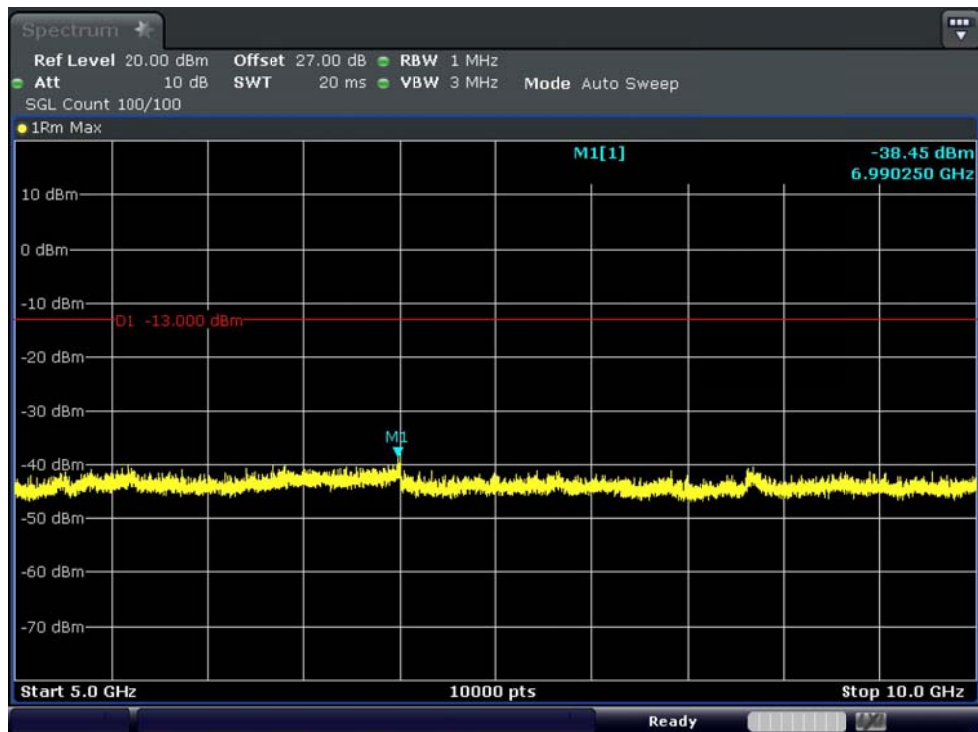
■ WCDMA1700 MODE (1513 CH.) – 4 MHz Span



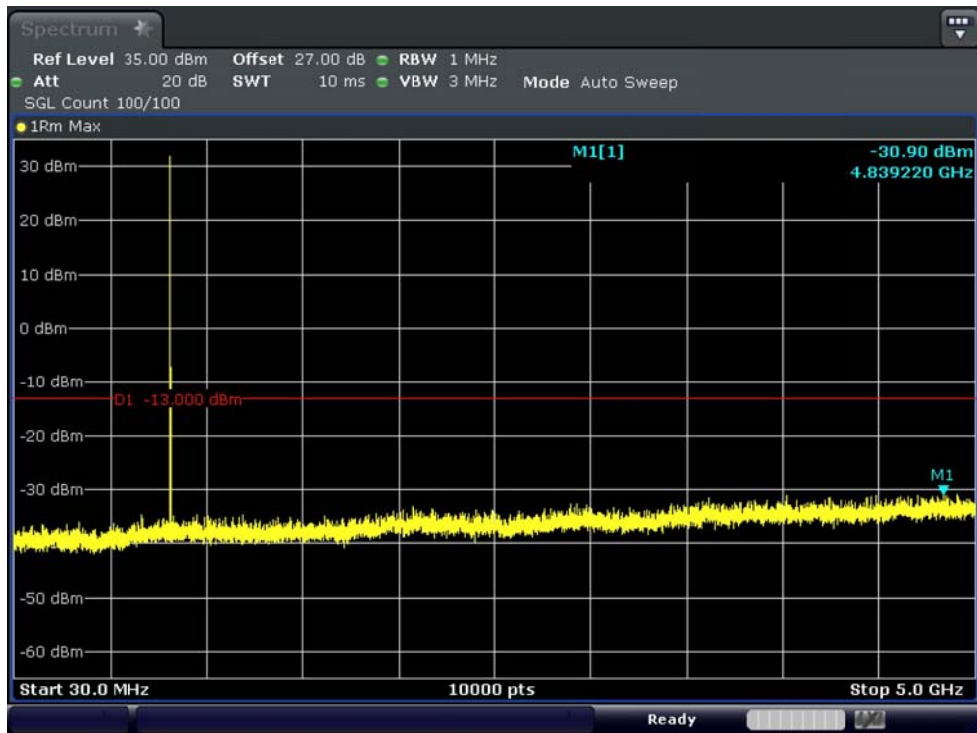
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions1



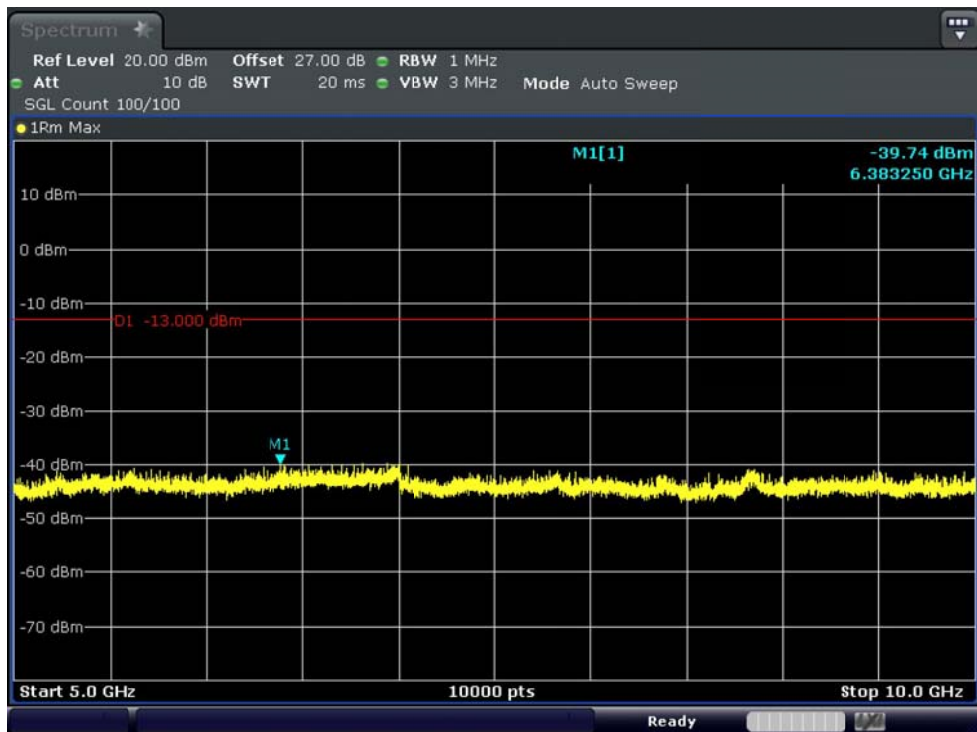
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions2



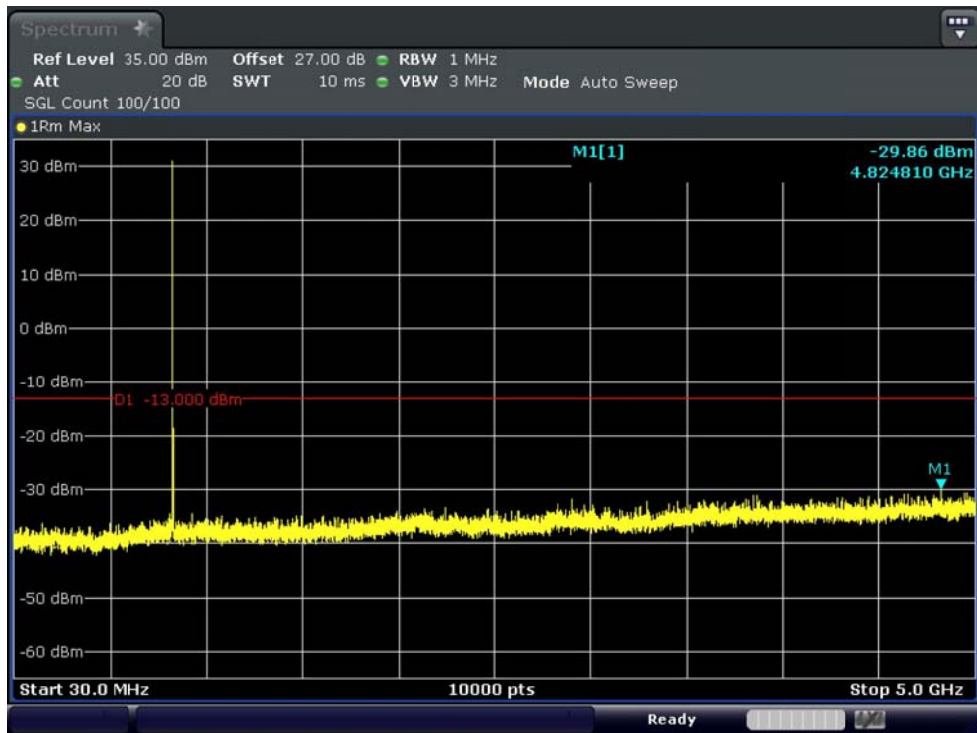
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions1



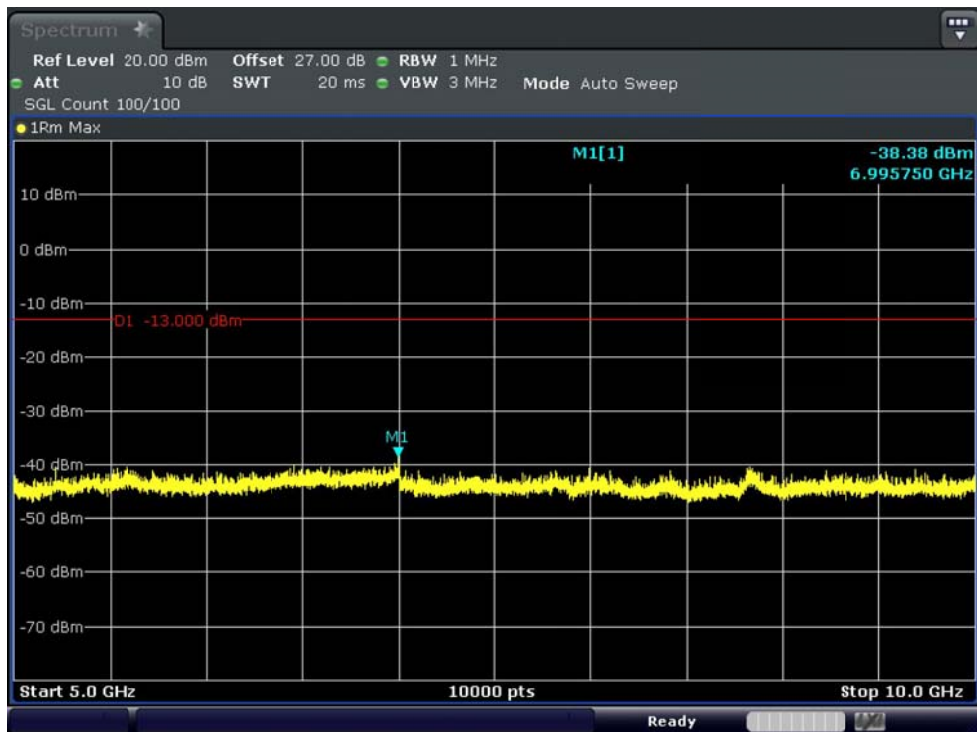
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions2



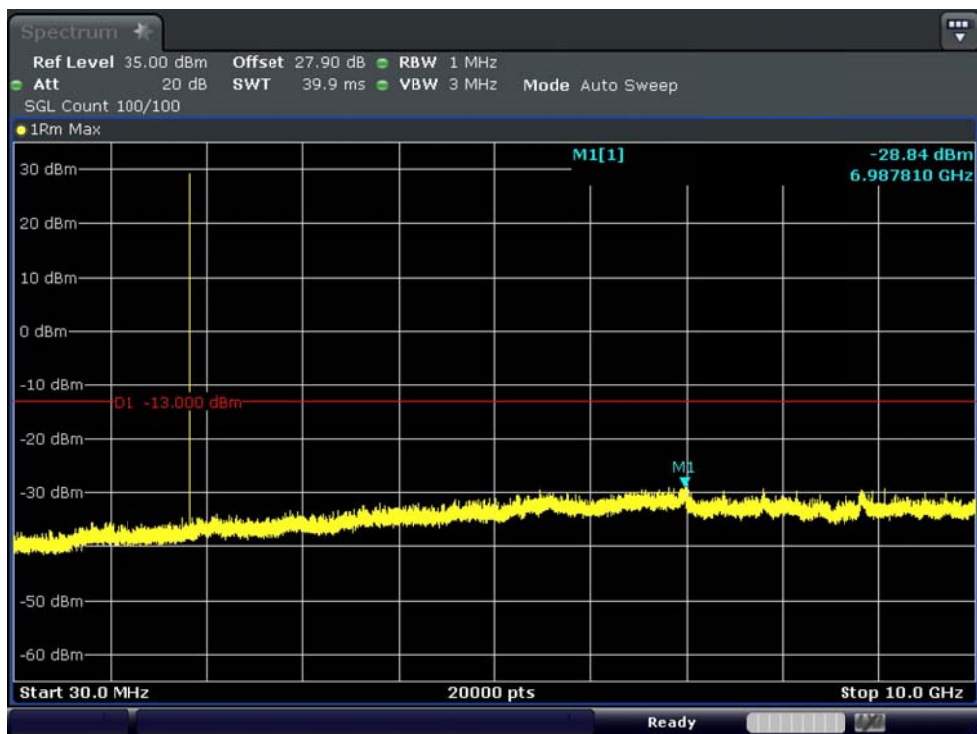
■ GSM850 MODE (251 CH.) Conducted Spurious Emissions1



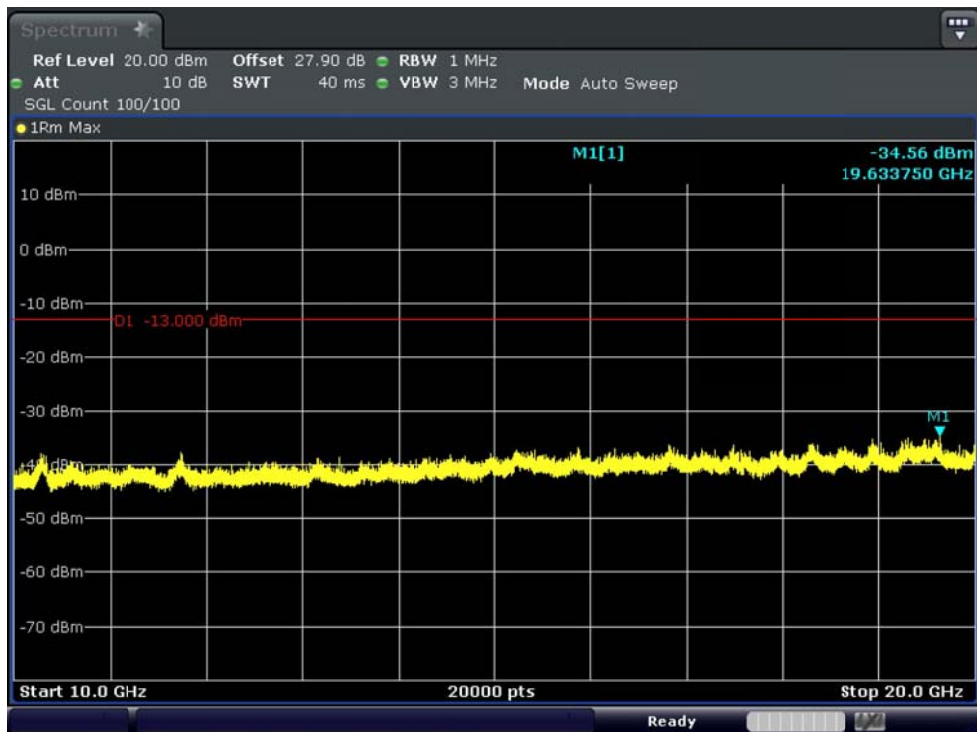
■ GSM850 MODE (251 CH.) Conducted Spurious Emissions2



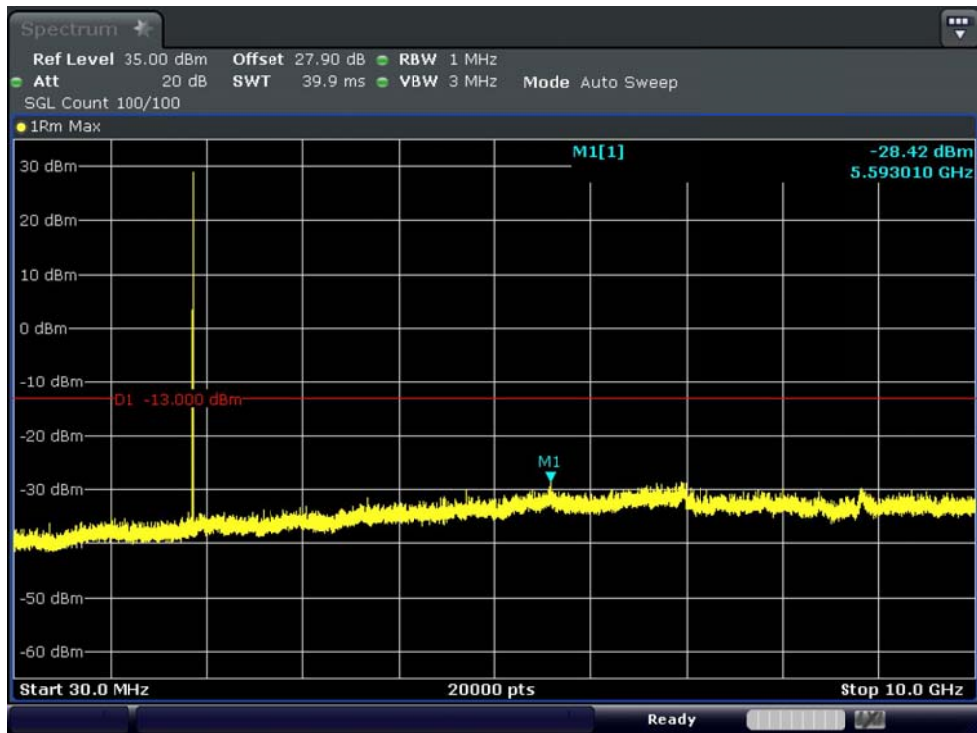
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions1



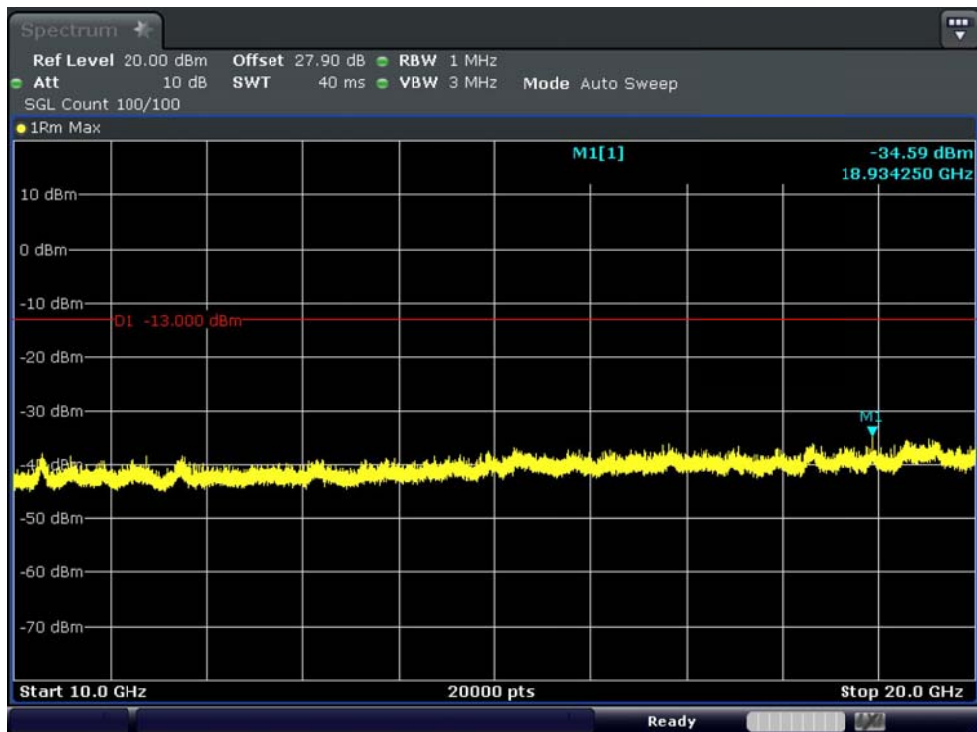
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions2



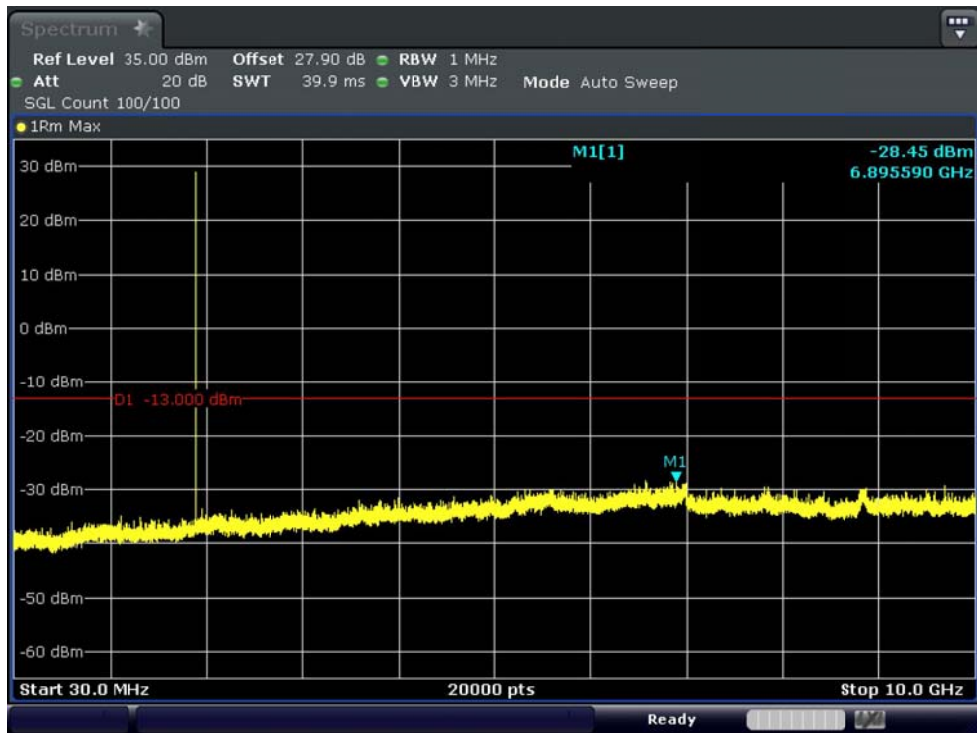
■ GSM1900 MODE (661 CH) Conducted Spurious Emissions1



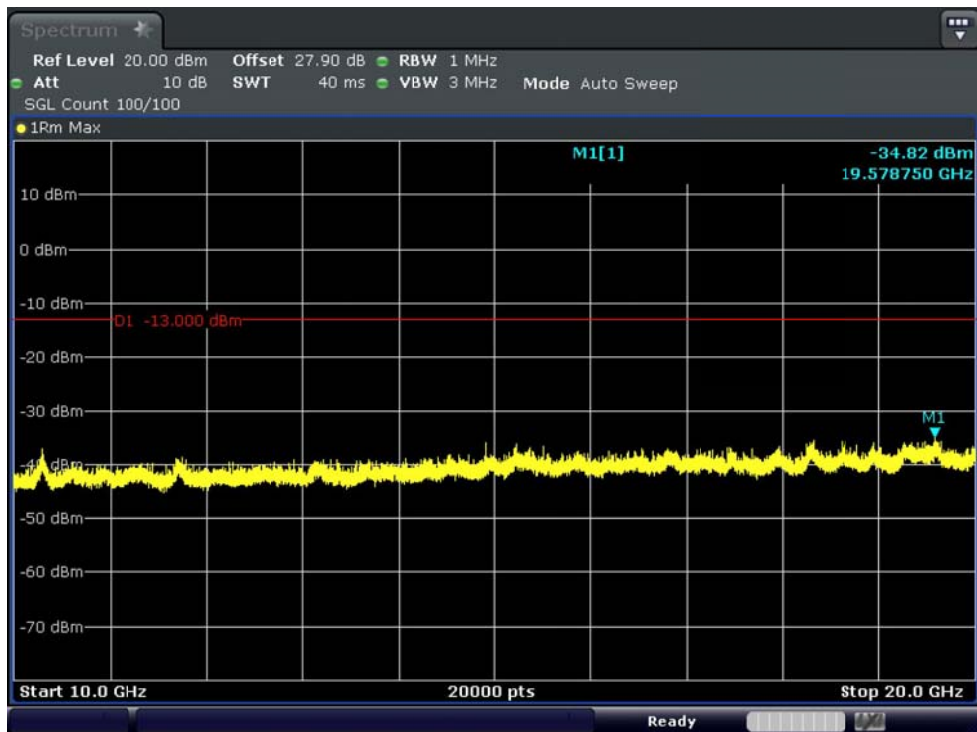
■ GSM1900 MODE (661 CH.) Conducted Spurious Emissions2



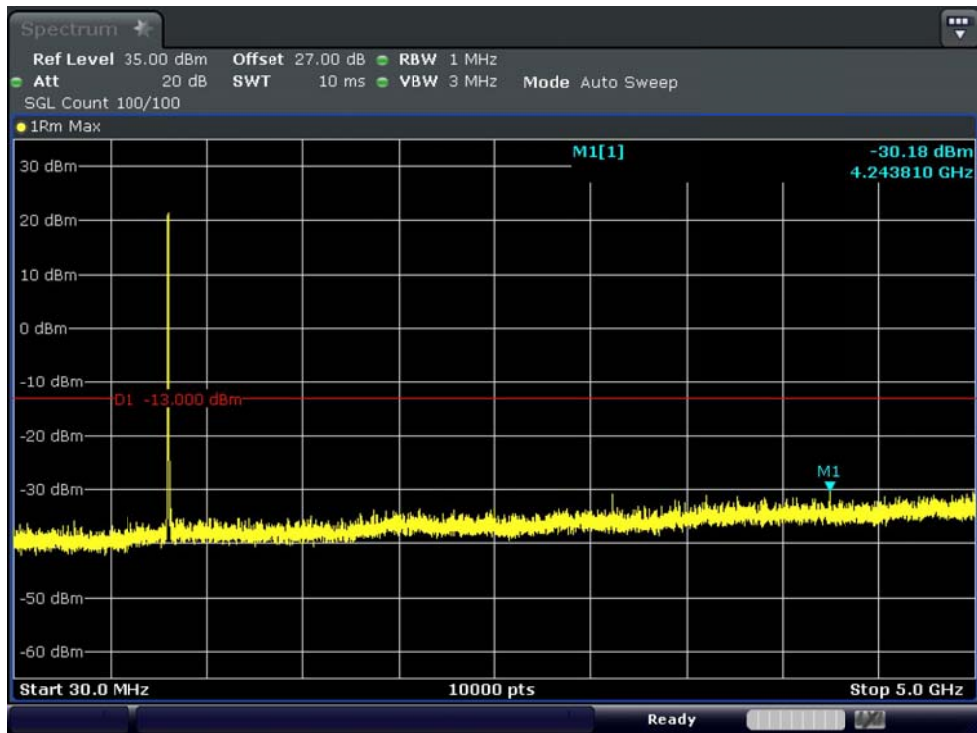
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions1



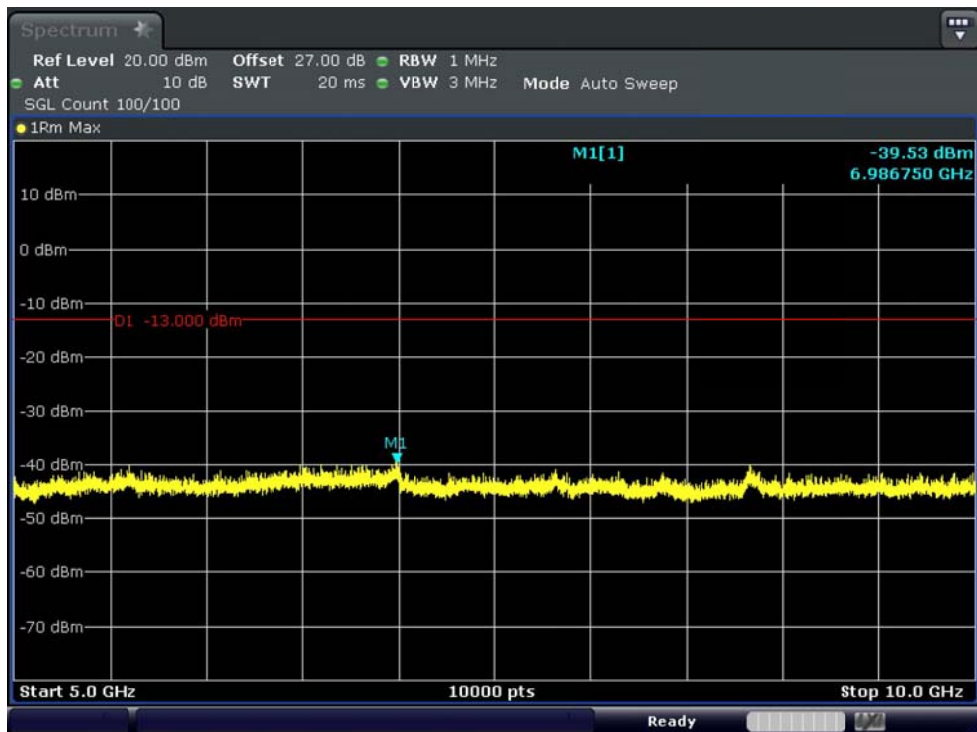
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions2



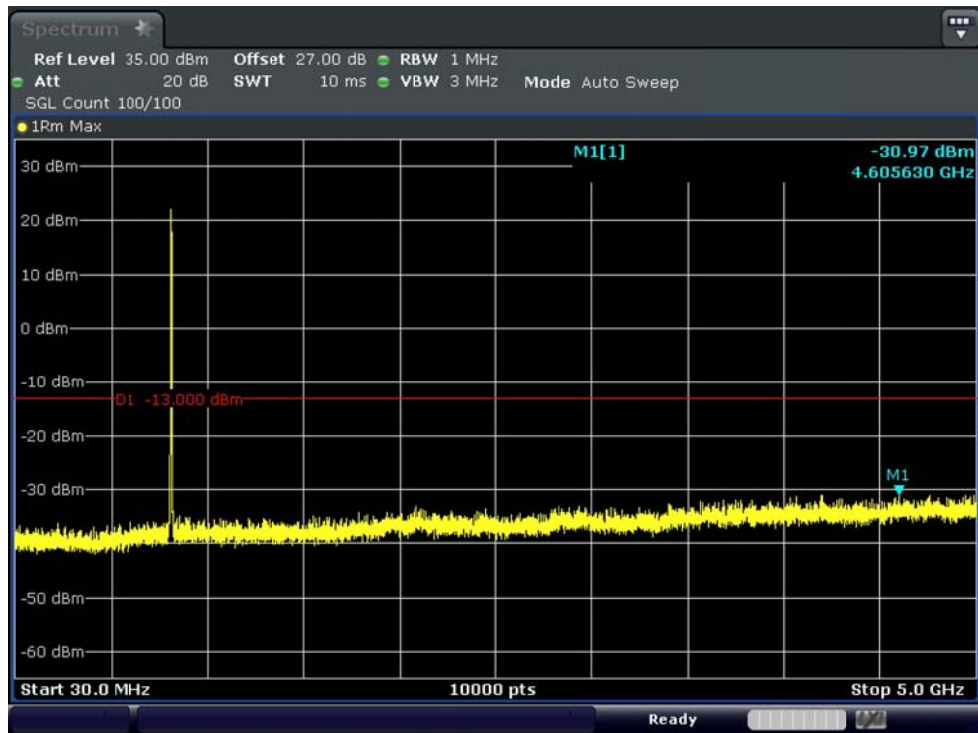
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions1



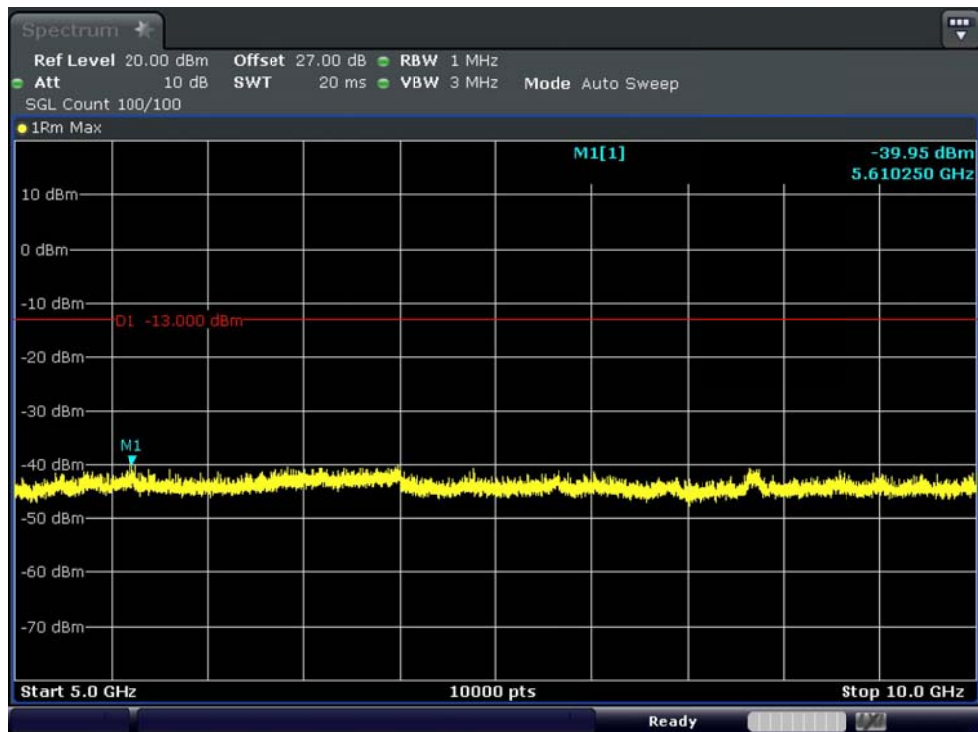
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions2



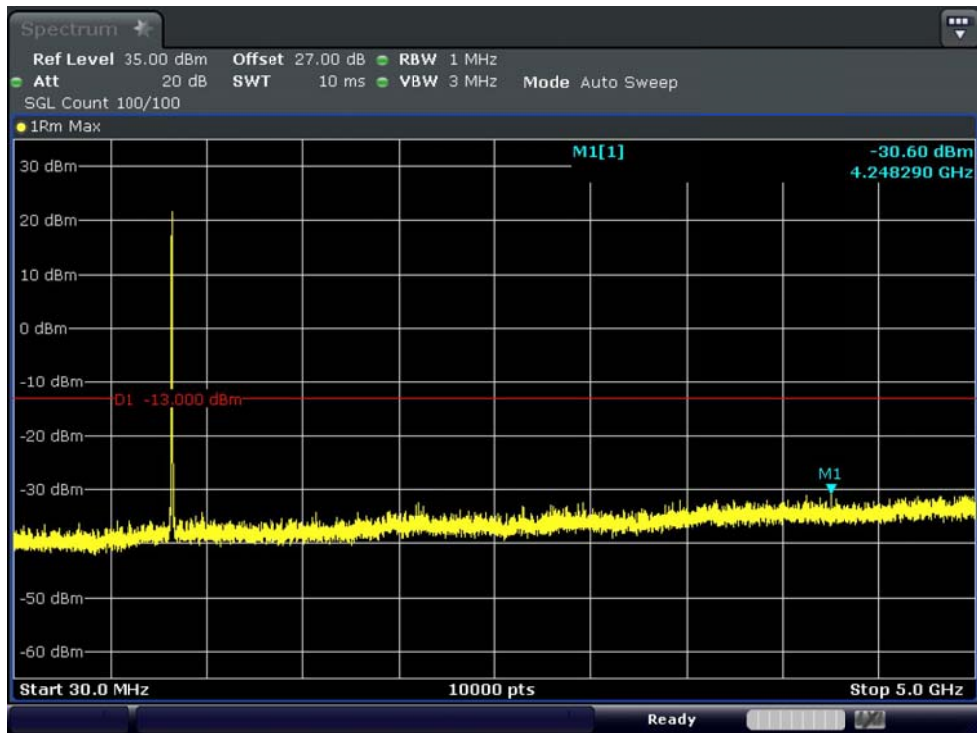
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions1



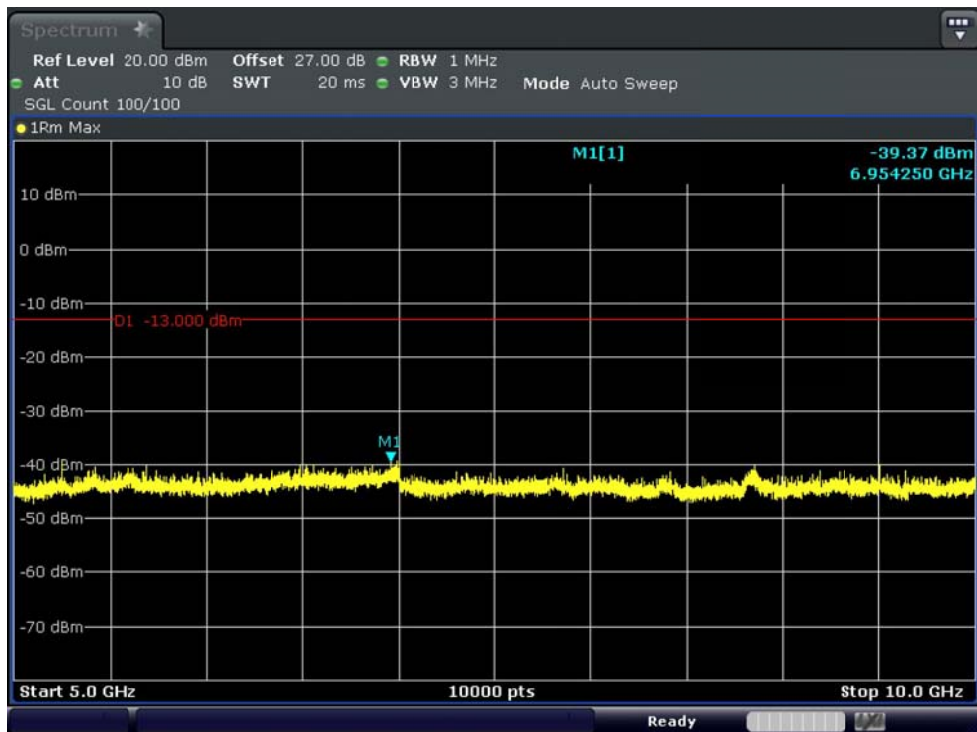
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions2



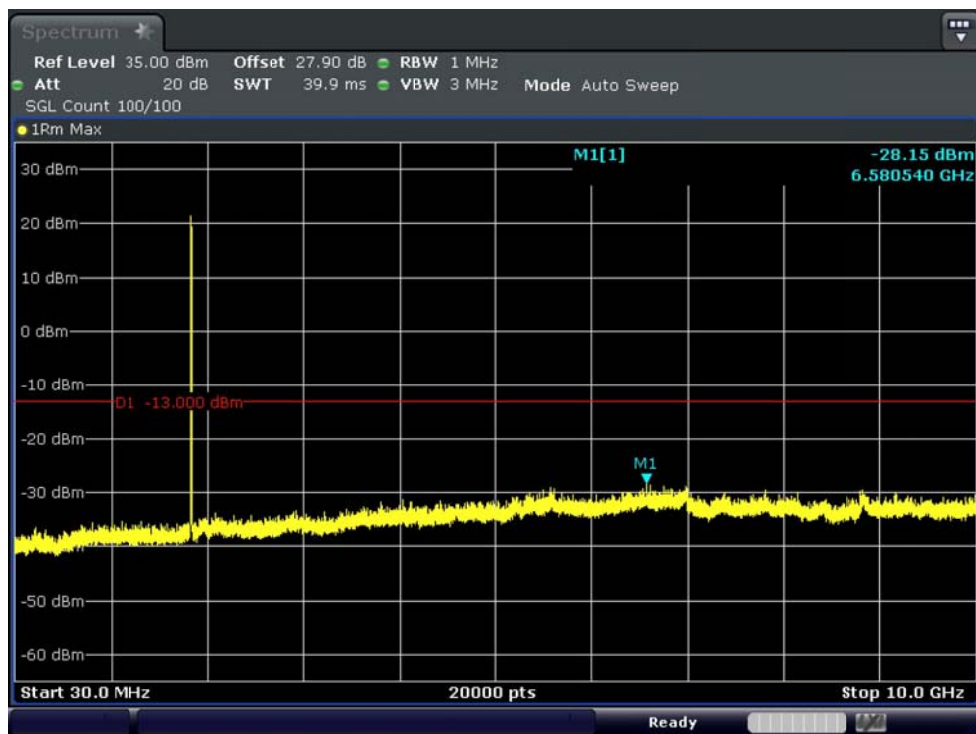
■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions1



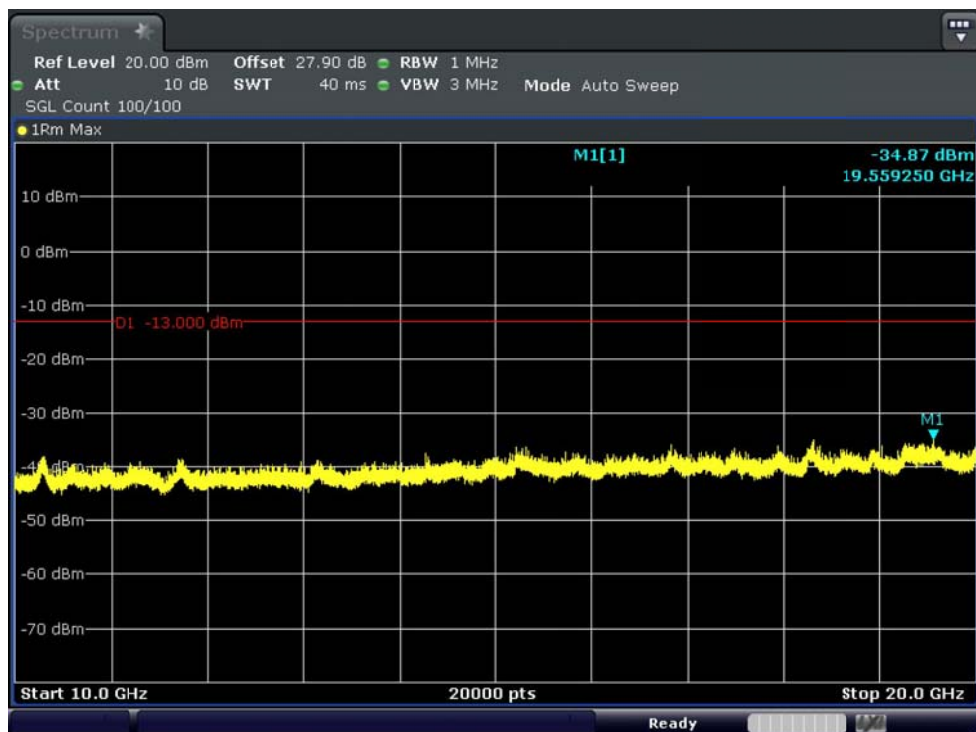
■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions2



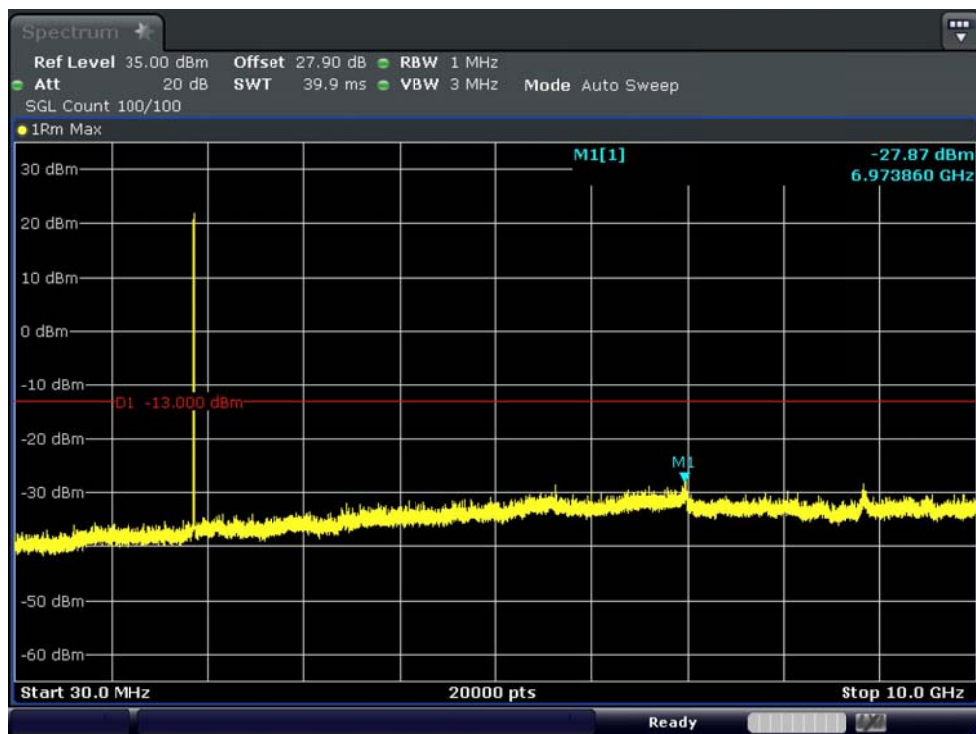
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions1



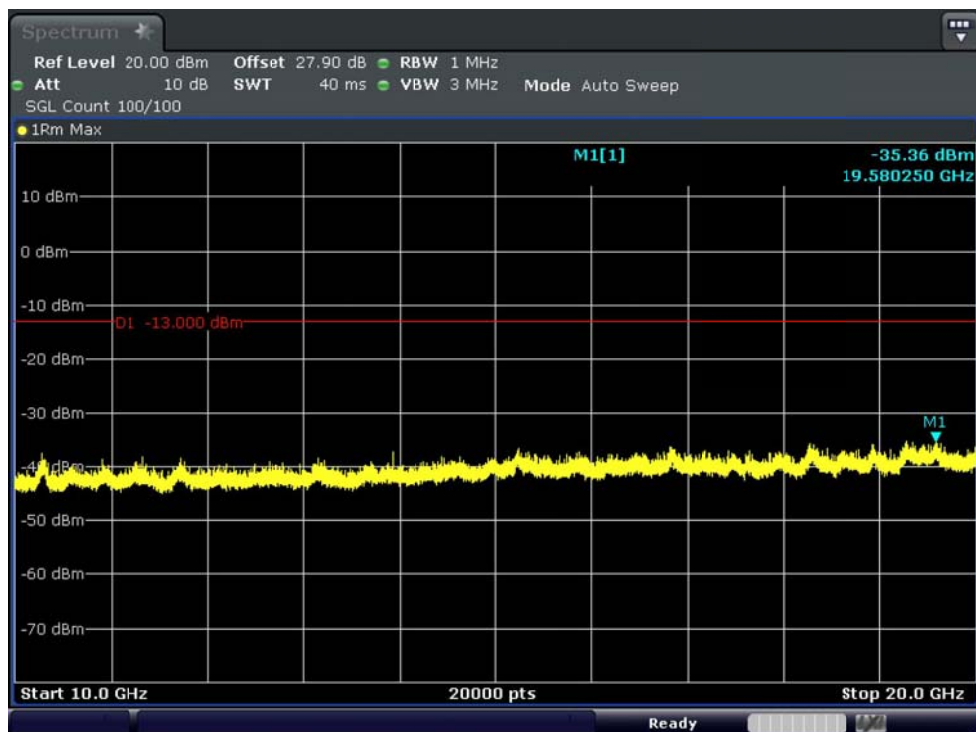
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions2



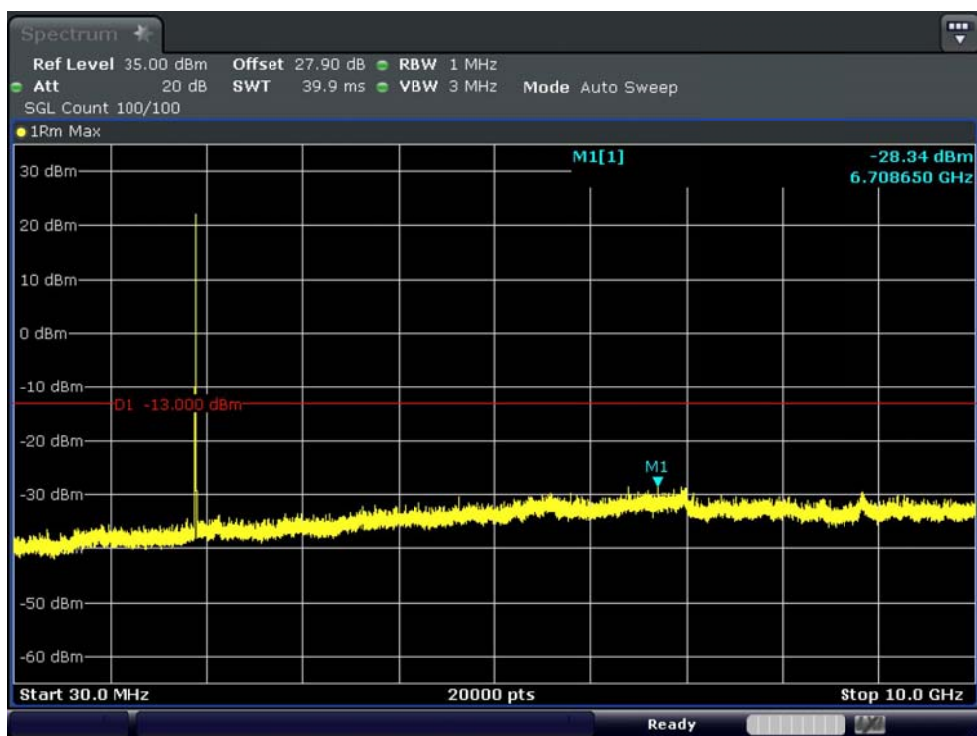
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions1



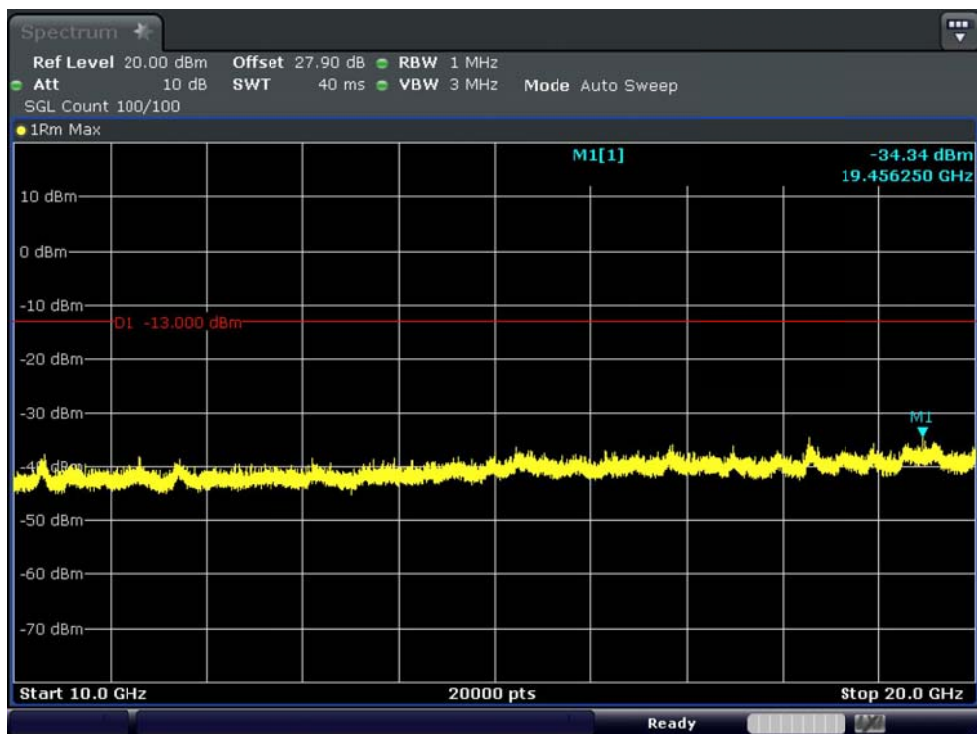
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions2



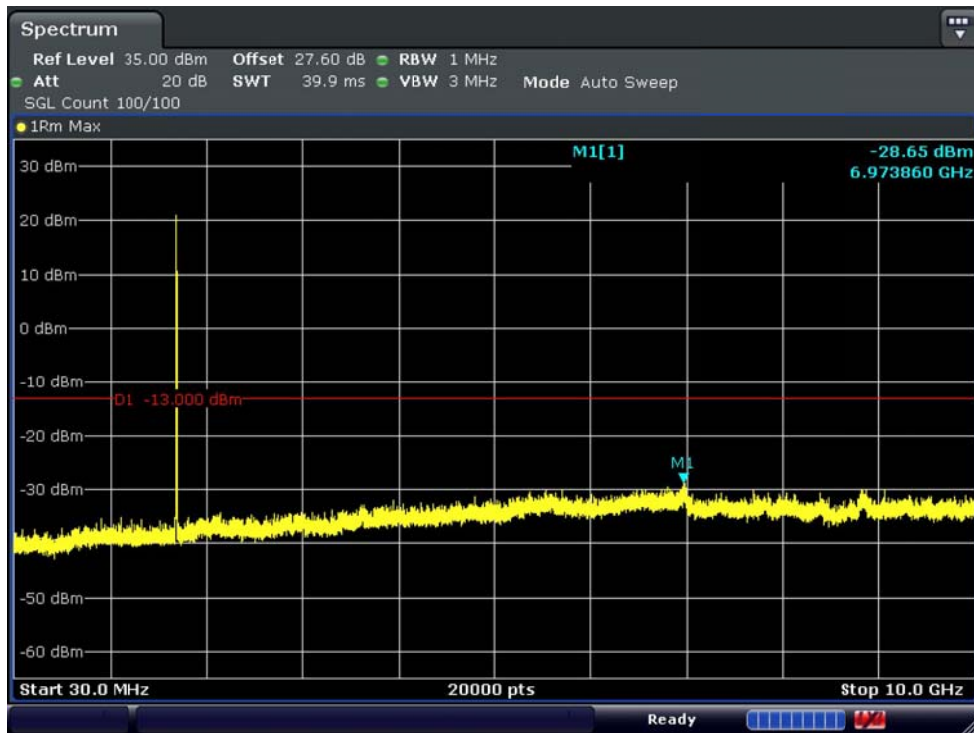
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions1



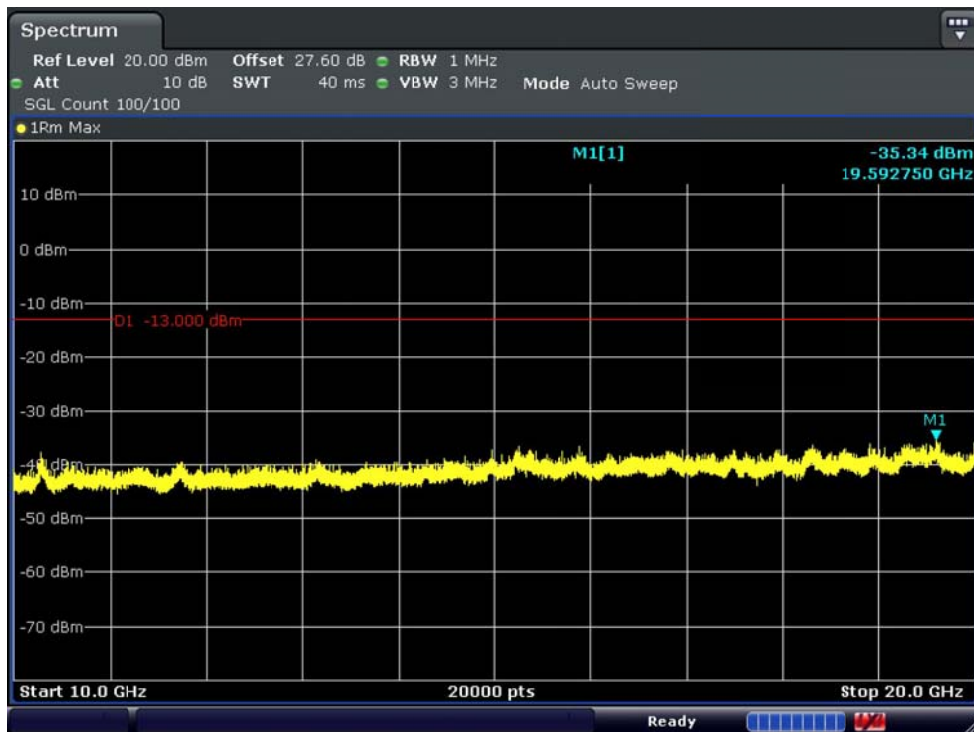
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions2



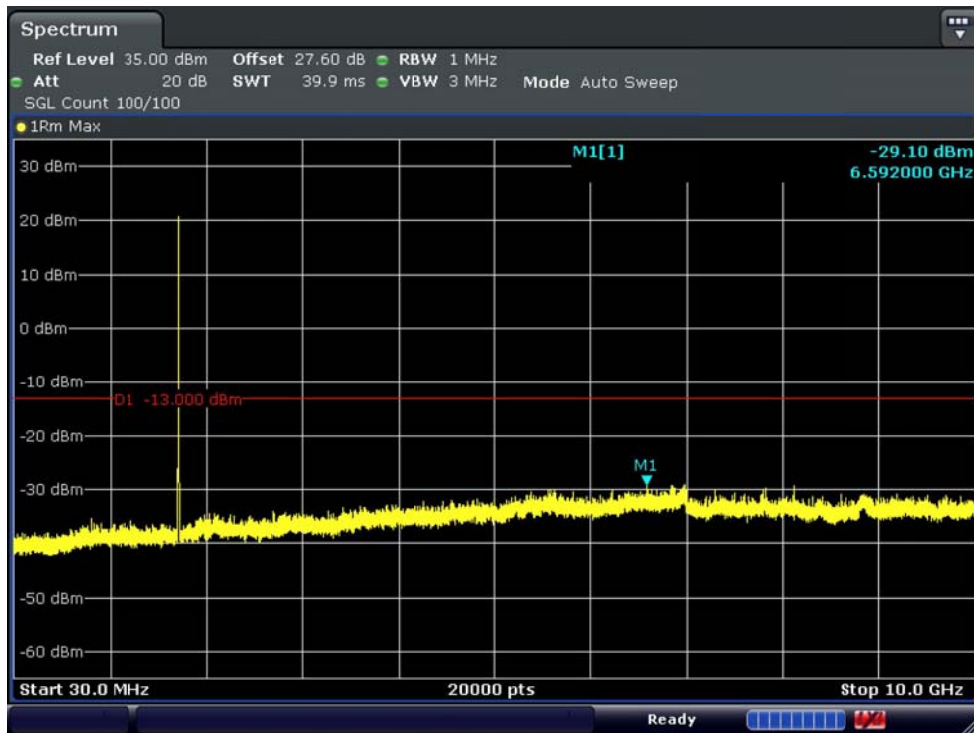
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions1



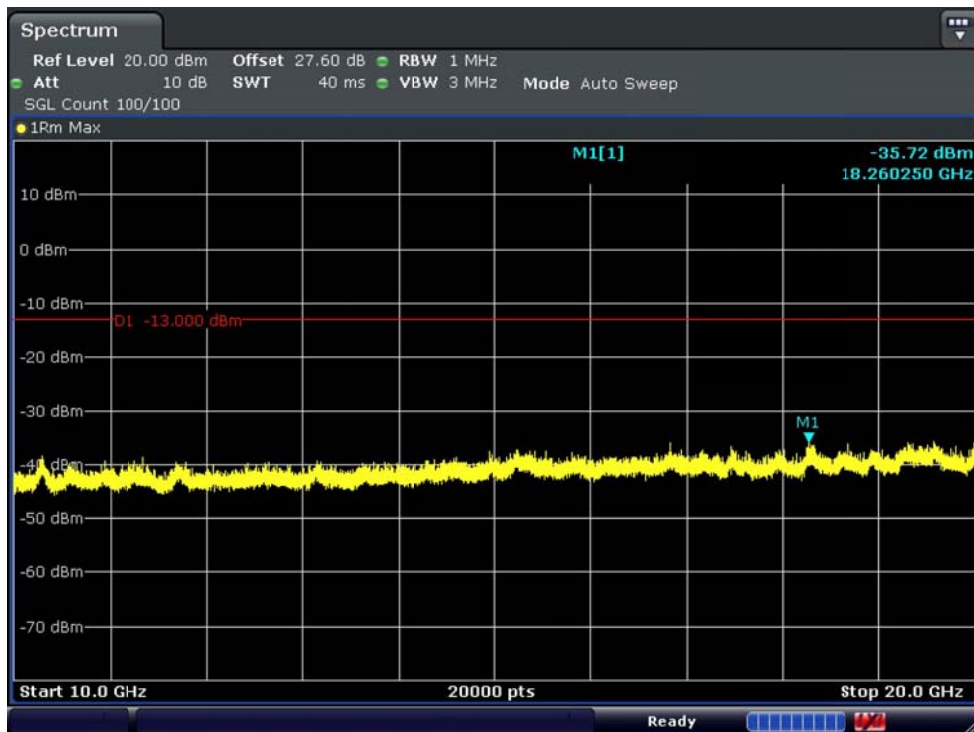
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions2



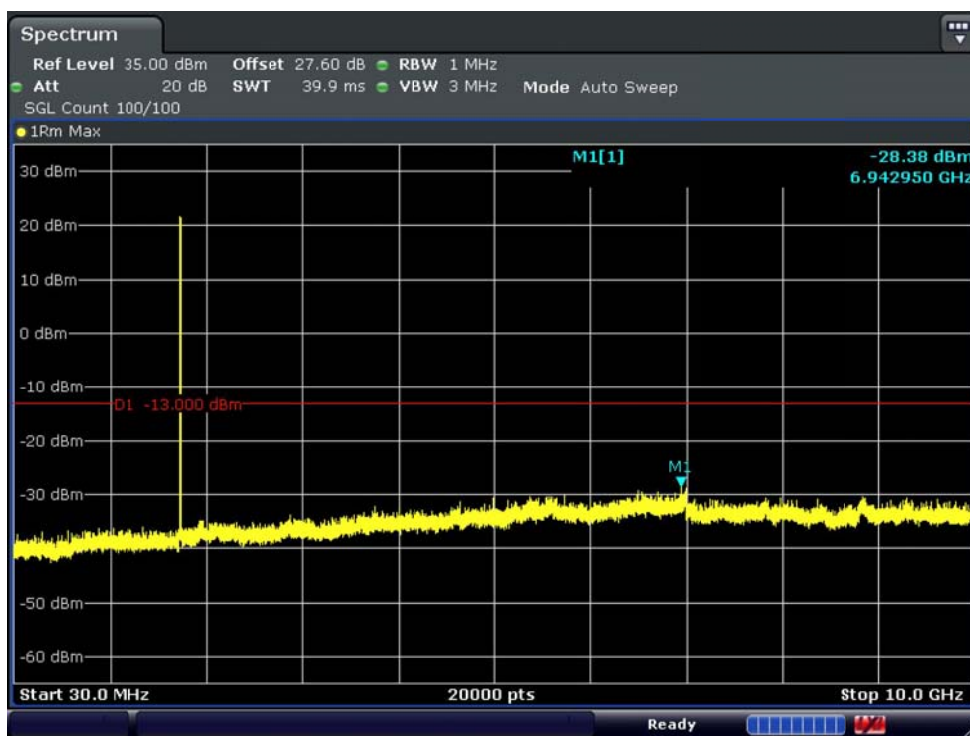
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions1



■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions2



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions1



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions2

