

# HCT CO., LTD.

## CERTIFICATE OF COMPLIANCE FCC Certification

|                                                                  |                                                                                                              |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Applicant Name:</b><br>LG Electronics MobileComm U.S.A., Inc. | <b>Date of Issue:</b><br>November 19, 2012                                                                   |
| <b>Address:</b><br>1000 Sylvan Avenue, Englewood Cliffs NJ 07632 | <b>Test Site/Location:</b><br>HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon,<br>Icheon-si, Kyunggi-Do, Korea |
|                                                                  | <b>Report No.:</b> HCTR1211FR03                                                                              |
|                                                                  | <b>HCT FRN:</b> 0005866421                                                                                   |

**FCC ID:** ZNFE615F

**APPLICANT:** LG Electronics MobileComm U.S.A., Inc.

|                                 |                                                                                                          |
|---------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>FCC Model(s):</b>            | LG-E615f                                                                                                 |
| <b>Additional FCC Model(s):</b> | LG-E615F, E615f, E615F, LGE615f, LGE615F                                                                 |
| <b>EUT Type:</b>                | Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN                      |
| <b>FCC Classification:</b>      | Licensed Portable Transmitter Held to Ear (PCE)                                                          |
| <b>FCC Rule Part(s):</b>        | §22, §24, §2                                                                                             |
| <b>Tx Frequency:</b>            | 824.20 - 848.80 MHz (GSM850)<br>826.40 - 846.60 MHz (WCDMA850)<br>1 850.20 - 1 909.80 MHz (GSM1900)      |
| <b>Rx Frequency:</b>            | 869.20 - 893.80 MHz (GSM850)<br>871.40 - 891.60 (WCDMA850)<br>1 930.20 - 1 989.80 MHz (GSM1900)          |
| <b>Max. RF Output Power:</b>    | 0.570 W ERP GSM850 (27.56 dBm)/<br>1.178 W EIRP GSM1900 (30.71 dBm)/<br>0.092 W ERP WCDMA850 (19.66 dBm) |
| <b>Emission Designator(s):</b>  | 250 KGXW (GSM850),<br>248 KGXW (GSM1900),<br>4M17F9W (WCDMA850)                                          |

The measurements shown in this report were made in accordance with the procedures specified in §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)

  
**Report prepared by**  
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**Test engineer of RF Team**

  
**Approved by**  
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**Manager of RF Team**

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| FCC CERTIFICATION REPORT        |                                     |                                                                                                  | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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| Test Report No.<br>HCTR1211FR03 | Date of Issue:<br>November 19, 2012 | EUT Type:<br>Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN | FCC ID:<br>ZNFE615F                              |

## Version

| TEST REPORT NO. | DATE              | DESCRIPTION           |
|-----------------|-------------------|-----------------------|
| HCTR1211FR03    | November 19, 2012 | First Approval Report |
|                 |                   |                       |
|                 |                   |                       |
|                 |                   |                       |
|                 |                   |                       |

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# MEASUREMENT REPORT

## 1. GENERAL INFORMATION

**Applicant Name:** LG Electronics MobileComm U.S.A., Inc.  
**Address:** 1000 Sylvan Avenue, Englewood Cliffs NJ 07632  
**FCC ID:** ZNFE615F  
**Application Type:** Certification  
**FCC Classification:** Licensed Portable Transmitter Held to Ear (PCE)  
**FCC Rule Part(s):** §22, §24, §2  
**EUT Type:** Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN  
**FCC Model(s):** LG-E615f  
**Additional FCC Model(s):** LG-E615F, E615f, E615F, LGE615f, LGE615F  
**Tx Frequency:** 824.20 - 848.80 MHz (GSM850),  
826.40 - 846.60 MHz (WCDMA850),  
1 850.20 - 1 909.80 MHz (GSM1900)  
**Rx Frequency:** 869.20 - 893.80 MHz (GSM850),  
871.40 - 891.60 (WCDMA850),  
1 930.20 - 1 989.80 MHz (GSM1900)  
**Max. RF Output Power:** 0.570 W ERP GSM850 (27.56 dBm)/  
1.178 W EIRP GSM1900 (30.71 dBm)/  
0.092 W ERP WCDMA850 (19.66 dBm)  
**Emission Designator(s):** 250 KGXW (GSM850),  
248 KGXW (GSM1900),  
4M17F9W (WCDMA850)  
**Date(s) of Tests:** November 12, 2012 ~ November 19, 2012  
**Antenna Specification** Manufacturer: E.M.W. Antenna Co. Ltd.  
Antenna type: INTERNAL Antenna  
Peak Gain: GSM850/WCDMA850 : -3.49 dBi  
GSM1900 : -0.68 dBi

## **2. INTRODUCTION**

### **2.1. EUT DESCRIPTION**

The LG Electronics MobileComm U.S.A., Inc. LG-E615f Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN consists of GSM850, GSM1900, WCDMA850, GPRS Class12 and HSDPA.

### **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**

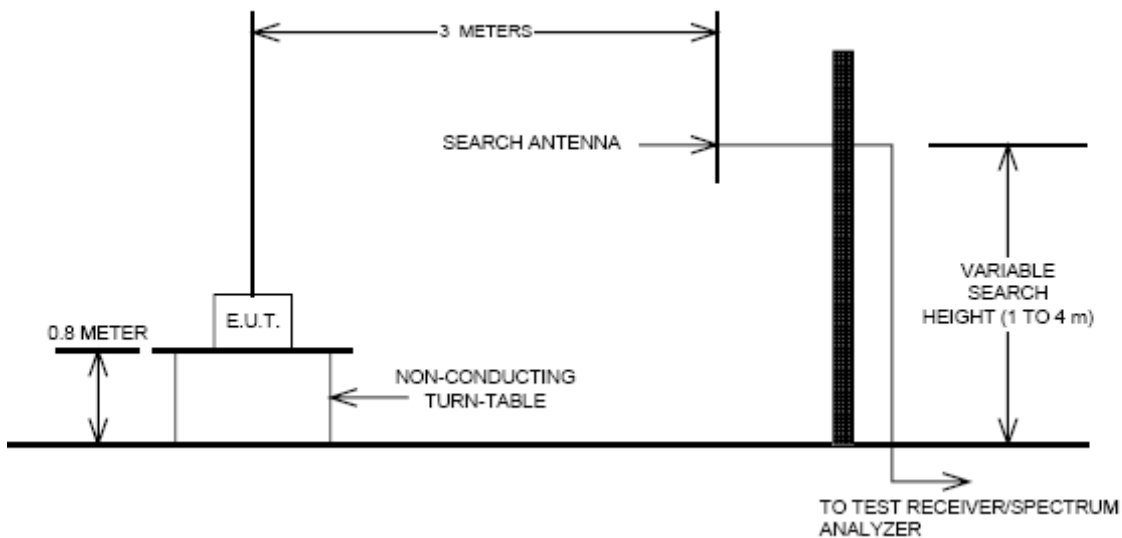
The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the 105-1, Jangam-ri , Majang-Myeon, Icheon-si, 467-811, KOREA.

The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated March 02, 2011 (Registration Number: 90661)

### 3. DESCRIPTION OF TESTS

#### 3.1 EFFECTIVE RADIATED POWER/EQUIVALENT ISOTROPIC RADIATED POWER

##### Test Set-up



Radiated emission measurements were performed at an Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters from the receive antenna. A turntable was rotated 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A half wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the previously recorded signal was duplicated.

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

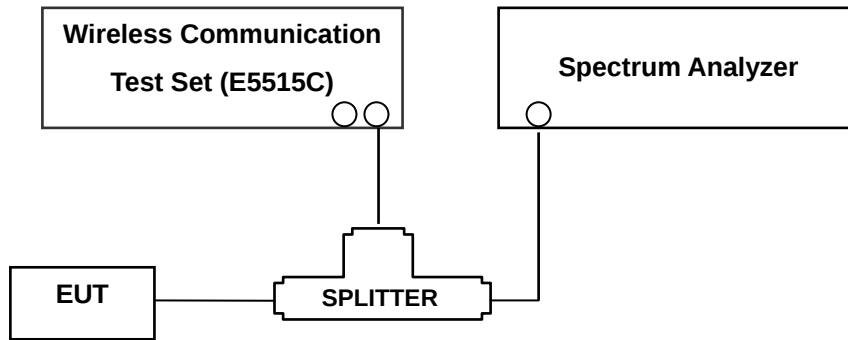
### 3.2 PEAK- TO- AVERAGE RATIO

A peak to average ratio measurement is performed at the conducted port of the EUT. For CDMA and WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function ( CCDF ) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. Plots of the EUT's Peak- to- Average Ratio are shown herein.

| FCC CERTIFICATION REPORT        |                                     |                                                                                                  | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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### 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

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

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.

- Band Edge Requirement : According to FCC 22.917 , 24.238(a) 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.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. 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.

The center frequency of spectrum is the band edge frequency and span is 1MHz RB of the spectrum is 3KHz and VB of the spectrum is 3KHz (GSM)

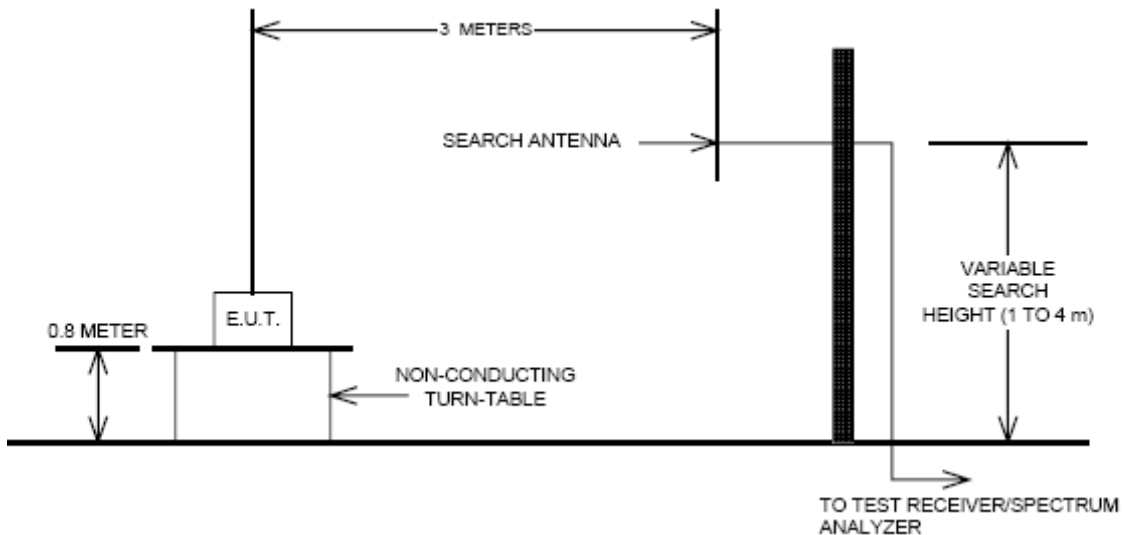
The center frequency of spectrum is the band edge frequency and span is 5MHz RB of the spectrum is 100KHz and VB of the spectrum is 100KHz(WCDMA)

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

- For GSM850/WCDMA850, total offset 27 dBm  
= 20 dBm attenuator + 6 dBm Divider + 1 dBm RF cables.
- For GSM1900, total offset 28 dBm = 20 dBm attenuator + 6 dBm Divider + 2 dBm RF cables.

### 3.5 RADIATED SPURIOUS AND HARMONIC EMISSIONS

#### Test Set-up



The measurement facilities used for this test have been documented in previous filings with the commission pursuant to section § 2.948. The Fully-anechoic chamber meets requirements in ANSI C63.4 –2003. A mast capable of lifting the receiving antenna from a height of one to four meters is used together with a rotatable platform mounted at three from the antenna mast.

- 1) The unit mounted on a turntable 1.5 m × 1.0 m × 0.80 m is 0.8 meter above test site ground level.
- 2) During the emission test, the turntable is rotated and the EUT is manipulated to find the configuration resulting in maximum emission under normal condition of installation and operation.
- 3) The antenna height and polarization are also varied from 1 to 4 meters until the maximum signal is found.
- 4) The spectrum shall be scanned up to the 10<sup>th</sup> harmonic of the fundamental frequency.

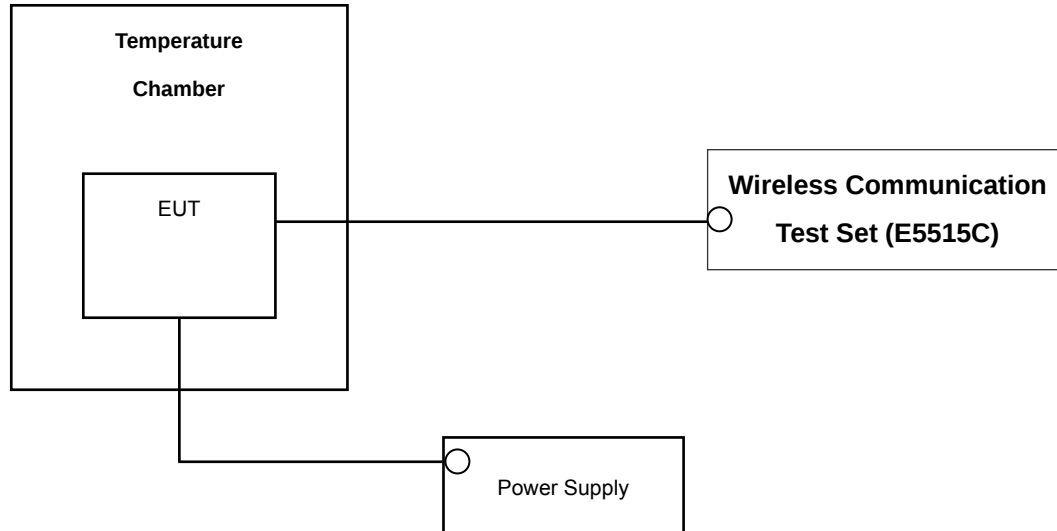
#### Test Procedure

The equipment under test is placed on a non-conductive table 3-meters from the receive antenna. A turntable was rotated 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A half wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the previously recorded signal was duplicated.

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

### 3.6 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

#### Test Set-up



\* Nominal Operating Voltage

#### Test Procedure

The frequency stability of the transmitter is measured by:

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

b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification — the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm) of the center frequency.

#### 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           | E9327A/ Power Sensor        | MY4442009              | Annual               | 05/02/2013      |
| R&S               | CMW500/ Base Station        | 1201.0002K50_116858    | Annual               | 01/17/2013      |
| MITEQ             | AMF-6D-001180-35-20P/AMP    | 1081666                | Annual               | 09/11/2013      |
| Wainwright        | WHK1.2/15G-10EF/H.P.F       | 2                      | Annual               | 05/02/2013      |
| Wainwright        | WHK3.3/18G-10EF/H.P.F       | 1                      | Annual               | 05/02/2013      |
| Hewlett Packard   | 11667B / Power Splitter     | 10126                  | Annual               | 11/07/2013      |
| Digital           | EP-3010/ Power Supply       | 3110117                | Annual               | 11/07/2013      |
| Schwarzbeck       | UHAP/ Dipole Antenna        | 557                    | Biennial             | 03/11/2013      |
| Schwarzbeck       | UHAP/ Dipole Antenna        | 558                    | Biennial             | 03/11/2013      |
| Korea Engineering | KR-1005L / Chamber          | KRAC05063-3CH          | Annual               | 11/07/2013      |
| Schwarzbeck       | BBHA 9120D/ Horn Antenna    | 296                    | Biennial             | 02/20/2014      |
| Agilent           | E4440A/Spectrum Analyzer    | US45303008             | Annual               | 05/02/2013      |
| WEINSCHTEL        | ATTENUATOR                  | BR0592                 | Annual               | 11/07/2013      |
| REOHDE&SCHWARZ    | FSV40/Spectrum Analyzer     | 1307.9002K40-100931-NK | Annual               | 06/11/2013      |
| Agilent           | 8960 (E5515C)/ Base Station | GB44400269             | Annual               | 02/10/2013      |

## 5. SUMMARY OF TEST RESULTS

| FCC Part Section(s)             | Test Description                                                       | Test Limit                                                                     | Test Condition | Test Result |
|---------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------|-------------|
| 2.1049, 22.917(a),<br>24.238(a) | Occupied Bandwidth                                                     | N/A                                                                            | CONDUCTED      | PASS        |
| 2.1051, 22.917(a),<br>24.238(a) | 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)                       | Peak- to- Average Ratio                                                | < 13 dB                                                                        |                | PASS        |
| 2.1055, 22.355, 24.235          | Frequency stability / variation of<br>ambient temperature              | < 2.5 ppm                                                                      |                | PASS        |
| 22.913(a)(2)<br>24.232(c)       | Effective Radiated Power                                               | < 7 Watts max. ERP                                                             | RADIATED       | PASS        |
|                                 | Equivalent Isotropic Radiated<br>Power                                 | < 2 Watts max. EIRP                                                            |                | PASS        |
| 2.1053, 22.917(a),<br>24.238(a) | Radiated Spurious and<br>Harmonic Emissions                            | < 43 + 10log10 (P[Watts]) for<br>all out-of band emissions                     |                | PASS        |

## 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 |

**ERP = SubstituteLEVEL(dBm) + Ant. Gain – CL(Cable Loss)**

- 1) The EUT mounted on a non-conductive turntable is 0.8 meter above test site ground level.
- 2) During the test , the turn table is rotated and the antenna height is also varied from 1 to 4 meters 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)

#### WCDMA Emission Designator

**Emission Designator = 4M17F9W**

WCDMA BW = 4.17 MHz

F = Frequency Modulation

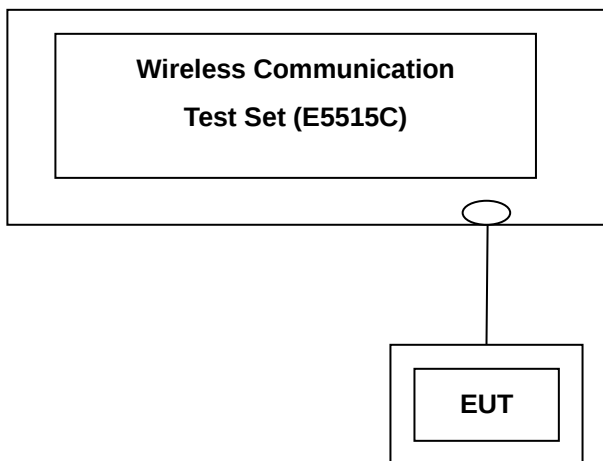
9 = Composite Digital Info

W = Combination (Audio/Data)

## 7. TEST DATA

### 7.1 CONDUCTED OUTPUT POWER

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



Test Result

| Band     | Channel | Voice     | GPRS Data            |                      |                      |                      |
|----------|---------|-----------|----------------------|----------------------|----------------------|----------------------|
|          |         | GSM (dBm) | GPRS 1 TX Slot (dBm) | GPRS 2 TX Slot (dBm) | GPRS 3 TX Slot (dBm) | GPRS 4 TX Slot (dBm) |
| GSM 850  | 128     | 32.81     | 32.80                | 31.15                | 28.69                | 27.66                |
|          | 190     | 32.81     | 32.80                | 31.14                | 28.64                | 27.65                |
|          | 251     | 32.81     | 32.81                | 31.15                | 28.66                | 27.64                |
| GSM 1900 | 512     | 30.05     | 30.04                | 28.41                | 26.90                | 25.42                |
|          | 661     | 30.13     | 30.13                | 28.48                | 26.96                | 25.49                |
|          | 810     | 30.19     | 30.19                | 28.54                | 27.03                | 25.56                |

(GSM Conducted Maximum Output Powers)

| 3GPP<br>Release<br>Version | Mode  | 3GPP 34.121   | Cellular Band [dBm] |                    |                    | MPR |
|----------------------------|-------|---------------|---------------------|--------------------|--------------------|-----|
|                            |       | Subtest       | UL 4132<br>(826.4)  | UL 4183<br>(836.6) | UL 4233<br>(846.6) |     |
|                            |       |               | DL 4357             | DL 4408            | DL 4458            |     |
| 99                         | WCDMA | 12.2 kbps RMC | 22.95               | 23.02              | 22.98              | -   |
| 99                         | WCDMA | 12.2 kbps AMR | 22.96               | 23.05              | 23.02              | -   |
| 5                          | HSDPA | Subtest 1     | 22.80               | 22.88              | 22.82              | 0   |

(WCDMA Conducted Output Powers)

Note : Detecting mode is average.

## 7.2 PEAK-TO-AVERAGE RATIO

- Plots of the EUT's Peak- to- Average Ratio are shown Page 31.

### 7.3 OCCUPIED BANDWIDTH

| Band     | Channel | Frequency(MHz) | Data (GSM: kHz /<br>WCDMA : MHz) |
|----------|---------|----------------|----------------------------------|
| GSM850   | 128     | 824.20         | 249.7744                         |
|          | 190     | 836.60         | 246.7523                         |
|          | 251     | 848.80         | 248.2561                         |
| GSM1900  | 512     | 1850.20        | 247.6499                         |
|          | 661     | 1880.00        | 247.5490                         |
|          | 810     | 1909.80        | 243.1456                         |
| WCDMA850 | 4132    | 826.40         | 4.1591                           |
|          | 4183    | 836.60         | 4.1733                           |
|          | 4233    | 846.60         | 4.1663                           |

- Plots of the EUT's Occupied Bandwidth are shown Page 28 ~ 30, 31 ~ 32.

## 7.4 CONDUCTED SPURIOUS EMISSIONS

| Band     | Channel | Frequency of Maximum Harmonic (GHz) | Maximum Data (dBm) |
|----------|---------|-------------------------------------|--------------------|
| GSM850   | 128     | 6.9625                              | -30.06             |
|          | 190     | 8.0125                              | -30.39             |
|          | 251     | 7.0500                              | -30.11             |
| GSM1900  | 512     | 14.320                              | -27.15             |
|          | 661     | 13.680                              | -27.09             |
|          | 810     | 13.733                              | -27.61             |
| WCDMA850 | 4132    | 8.000                               | -40.61             |
|          | 4183    | 7.500                               | -40.77             |
|          | 4233    | 7.100                               | -40.93             |

- Plots of the EUT's Conducted Spurious Emissions are shown Page 39 ~ 47.

### 7.4.1 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 33 ~ 38.

## 7.5 EFFECTIVE RADIATED POWER OUTPUT (GSM / WCDMA)

### (GSM850 Mode)

| Ch./ Freq. |            | Measured<br>Level(dBm) | Substitute<br>LEVEL (dBm) | Ant. Gain<br>(dBd) | C.L  | Pol. | ERP   |       |
|------------|------------|------------------------|---------------------------|--------------------|------|------|-------|-------|
| channel    | Freq.(MHz) |                        |                           |                    |      |      | W     | dBm   |
| 128        | 824.20     | -22.91                 | 36.86                     | -10.61             | 0.95 | H    | 0.339 | 25.30 |
| 190        | 836.60     | -22.33                 | 37.85                     | -10.54             | 0.96 | H    | 0.432 | 26.35 |
| 251        | 848.80     | -21.29                 | 39.13                     | -10.47             | 1.10 | V    | 0.570 | 27.56 |

### (WCDMA850 Mode)

| Ch./ Freq. |            | Measured<br>Level(dBm) | Substitute<br>LEVEL (dBm) | Ant. Gain<br>(dBd) | C.L  | Pol. | ERP   |       |
|------------|------------|------------------------|---------------------------|--------------------|------|------|-------|-------|
| channel    | Freq.(MHz) |                        |                           |                    |      |      | W     | dBm   |
| 4132       | 826.40     | -28.55                 | 31.20                     | -10.59             | 0.95 | H    | 0.092 | 19.66 |
| 4183       | 836.60     | -30.38                 | 29.80                     | -10.54             | 0.96 | H    | 0.068 | 18.30 |
| 4233       | 846.60     | -30.02                 | 30.33                     | -10.48             | 1.11 | V    | 0.075 | 18.74 |

Note: Standard batteries are the only options for this phone. And a peak detector is used.

#### NOTES:

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

according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For WCDMA signals, a peak detector is used, with RBW = VBW = 5MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. 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 and 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 (y plane ch 251) and WCDMA850 (y plane ch 4233) mode. Also worst case of detecting Antenna is horizontal polarization in GSM850 (vertical polarization) and WCDMA850 (vertical polarization) mode.

## 7.6 EQUIVALENT ISOTROPIC RADIATED POWER (GSM)

(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   | -10.17     | 19.15       | 10.02     | -1.41 | H    | 1.143 | 30.58 |
| 661        | 1,880.00   | -10.19     | 19.22       | 10.04     | -1.45 | H    | 1.178 | 30.71 |
| 810        | 1,909.80   | -10.78     | 18.75       | 10.05     | -1.44 | H    | 1.057 | 30.24 |

Note: Standard batteries are the only options for this phone. And a peak detector is used.

### NOTES:

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

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For WCDMA signals, a peak detector is used, with RBW = VBW = 5MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. 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 and 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 in x plane in GSM1900 mode. Also worst case of detecting Antenna is in horizontal polarization in GSM1900 mode.

## 7.7 RADIATED SPURIOUS EMISSIONS

### 7.7.1 RADIATED SPURIOUS EMISSIONS (GSM850)

☐ MEASURED OUTPUT POWER: 27.56 dBm = 0.570 W  
☐ MODULATION SIGNAL: GSM850  
☐ DISTANCE: 3 meters  
☐ LIMIT: - (43 + 10 log<sub>10</sub> (W)) = - 40.56 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   | -44.76                  | 7.05               | -53.96                       | -1.18 | V    | -45.73       | -73.29 |
|                | 2,472.60   | -43.88                  | 7.90               | -50.77                       | -1.57 | H    | -41.30       | -68.86 |
|                | 3,296.80   | -52.12                  | 9.91               | -59.98                       | -1.99 | H    | -48.08       | -75.64 |
| 190<br>(836.6) | 1,673.20   | -42.35                  | 7.22               | -51.75                       | -1.20 | V    | -43.33       | -70.89 |
|                | 2,509.80   | -45.38                  | 8.51               | -52.47                       | -1.65 | H    | -42.31       | -69.87 |
|                | 3,346.40   | -                       | -                  | -                            | -     | -    | -            | -      |
| 251<br>(848.8) | 1,697.60   | -44.15                  | 7.34               | -53.57                       | -1.20 | V    | -45.03       | -72.59 |
|                | 2,546.40   | -52.55                  | 8.61               | -59.39                       | -1.65 | V    | -49.13       | -76.69 |
|                | 3,395.20   | -51.77                  | 10.22              | -60.28                       | -1.99 | H    | -48.07       | -75.63 |

**NOTES:** 1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:  
2. The magnitude of spurious emissions attenuated more than 20dB below the limit above 5<sup>th</sup> Harmonic for all channel.  
3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

## 7.7.2 RADIATED SPURIOUS EMISSIONS (GSM1900)

☐ MEASURED OUTPUT POWER: 30.71 dBm = 1.178 W  
☐ MODULATION SIGNAL: GSM1900  
☐ DISTANCE: 3 meters  
☐ LIMIT:  $-(43 + 10 \log_{10}(W)) =$  - 43.71 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   | -56.01                  | 12.27              | -65.13                       | -2.19 | V    | -50.67        | -81.38 |
|                 | 5,550.60   | -56.27                  | 13.40              | -61.70                       | -2.88 | V    | -45.42        | -76.13 |
|                 | 7,400.80   | -                       | -                  | -                            | -     | -    | -             | -      |
| 661<br>(1880.0) | 3,760.00   | -54.83                  | 12.31              | -63.60                       | -2.11 | V    | -49.18        | -79.89 |
|                 | 5,640.00   | -54.63                  | 13.41              | -59.80                       | -2.92 | H    | -43.47        | -74.18 |
|                 | 7,520.00   | -                       | -                  | -                            | -     | -    | -             | -      |
| 810<br>(1909.8) | 3,819.60   | -57.09                  | 12.37              | -65.85                       | -2.14 | V    | -51.34        | -82.05 |
|                 | 5,729.40   | -52.66                  | 13.42              | -57.26                       | -3.02 | H    | -40.82        | -71.53 |
|                 | 7,639.20   | -                       | -                  | -                            | -     | -    | -             | -      |

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
  2. The magnitude of spurious emissions attenuated more than 20dB below the limit above 5<sup>th</sup> Harmonic for all channel.
  3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

### 7.7.3 RADIATED SPURIOUS EMISSIONS (WCDMA850)

☐ MEASURED OUTPUT POWER: 19.66 dBm = 0.092 W  
☐ MODULATION SIGNAL: WCDMA850  
☐ DISTANCE: 3 meters  
☐ LIMIT: - (43 + 10 log<sub>10</sub> (W)) = - 32.66 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   | -54.48                  | 7.11               | -63.81                       | -1.20 | V    | -55.50       | -75.16 |
|                  | 2,479.20   | -                       | -                  | -                            | -     | -    | -            | -      |
|                  | 3,305.60   | -                       | -                  | -                            | -     | -    | -            | -      |
| 4,183<br>(836.6) | 1,673.20   | -52.52                  | 7.22               | -61.92                       | -1.20 | V    | -53.50       | -73.16 |
|                  | 2,509.80   | -                       | -                  | -                            | -     | -    | -            | -      |
|                  | 3,346.40   | -                       | -                  | -                            | -     | -    | -            | -      |
| 4,233<br>(846.6) | 1,693.20   | -50.53                  | 7.34               | -59.95                       | -1.20 | V    | -51.41       | -71.07 |
|                  | 2,539.80   | -                       | -                  | -                            | -     | -    | -            | -      |
|                  | 3,386.40   | -                       | -                  | -                            | -     | -    | -            | -      |

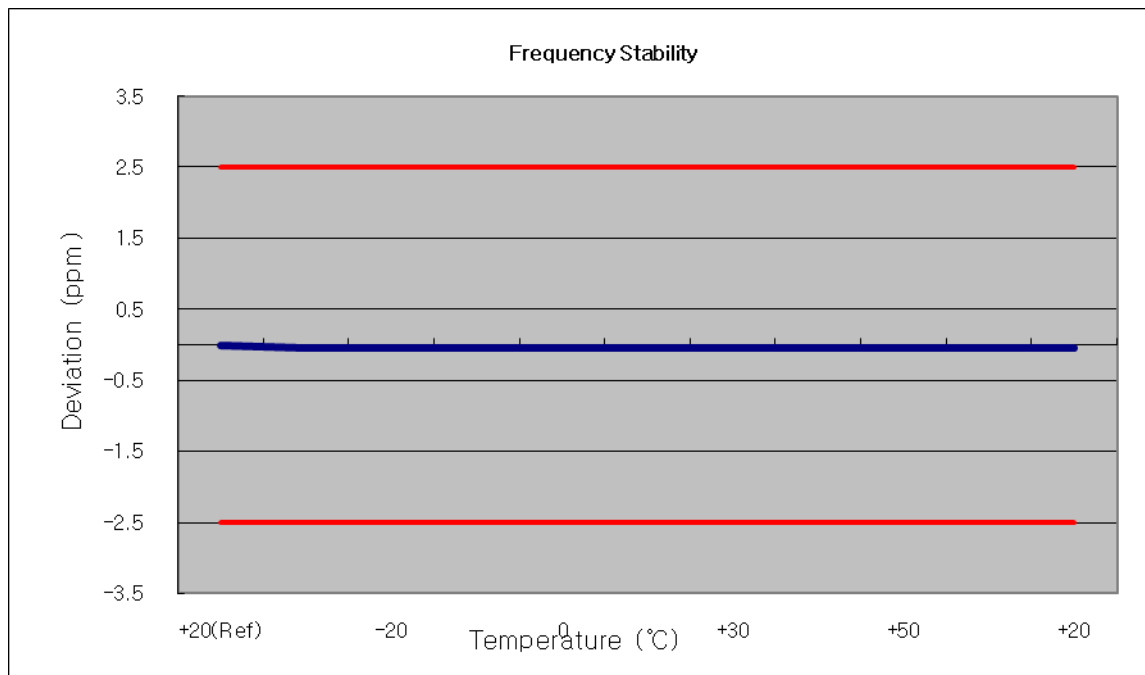
- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
  2. The magnitude of spurious emissions attenuated more than 20dB below the limit above 5<sup>th</sup> Harmonic for all channel.
  3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

## 7.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

### 7.8.1 FREQUENCY STABILITY (GSM850)

- ☐ OPERATING FREQUENCY: 836,600,000 Hz  
☐ CHANNEL: 190  
☐ REFERENCE VOLTAGE: 3.7 VDC  
☐ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

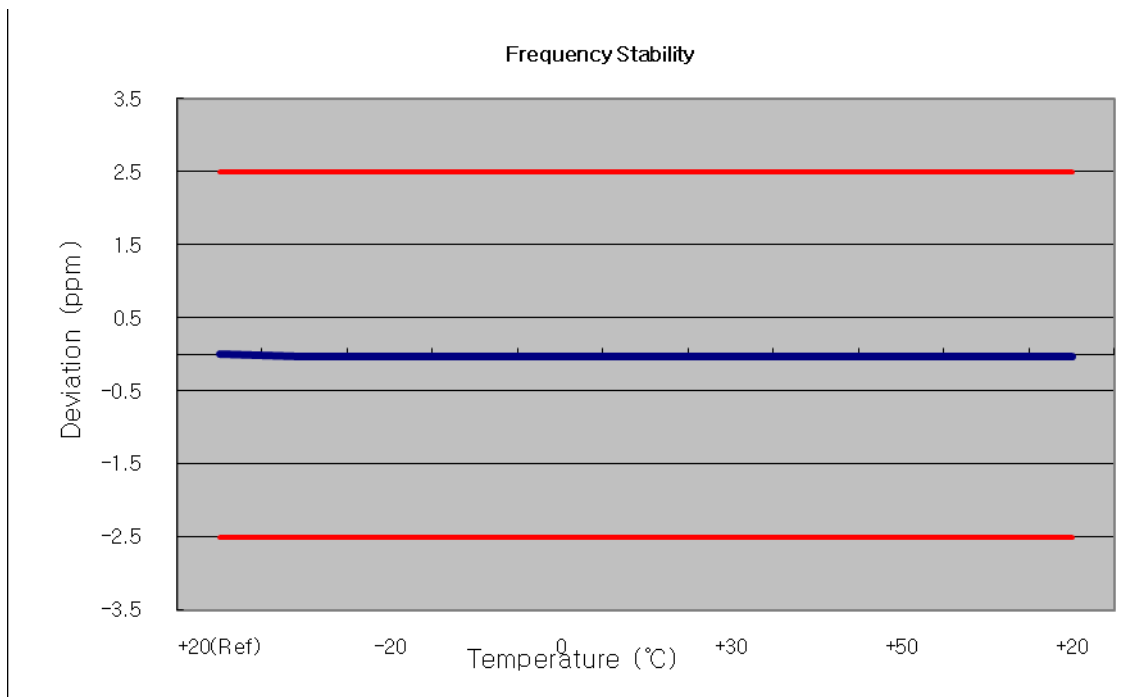
| Voltage (%)    | Power (VDC) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm    |
|----------------|-------------|------------|----------------|----------------------|---------------|--------|
| 100%           | 3.700       | +20(Ref)   | 836 600 034    | 0                    | 0.000 000     | 0.000  |
| 100%           |             | -30        | 836 600 001    | -32.66               | -0.000 004    | -0.039 |
| 100%           |             | -20        | 836 600 001    | -32.36               | -0.000 004    | -0.039 |
| 100%           |             | -10        | 836 600 000    | -33.61               | -0.000 004    | -0.040 |
| 100%           |             | 0          | 836 600 002    | -31.81               | -0.000 004    | -0.038 |
| 100%           |             | +10        | 836 600 001    | -33.27               | -0.000 004    | -0.040 |
| 100%           |             | +30        | 836 600 003    | -31.30               | -0.000 004    | -0.037 |
| 100%           |             | +40        | 836 600 002    | -32.08               | -0.000 004    | -0.038 |
| 100%           |             | +50        | 836 600 001    | -33.13               | -0.000 004    | -0.040 |
| 115%           | 4.255       | +20        | 836 600 002    | -31.83               | -0.000 004    | -0.038 |
| Batt. Endpoint | 3.500       | +20        | 836 600 001    | -32.65               | -0.000 004    | -0.039 |



## 7.8.2 FREQUENCY STABILITY (GSM1900)

☐ OPERATING FREQUENCY: 1880,000,000 Hz  
☐ CHANNEL: 661  
☐ REFERENCE VOLTAGE: 3.7 VDC  
☐ DEVIATION LIM IT: ± 0.000 25 % or 2.5 ppm

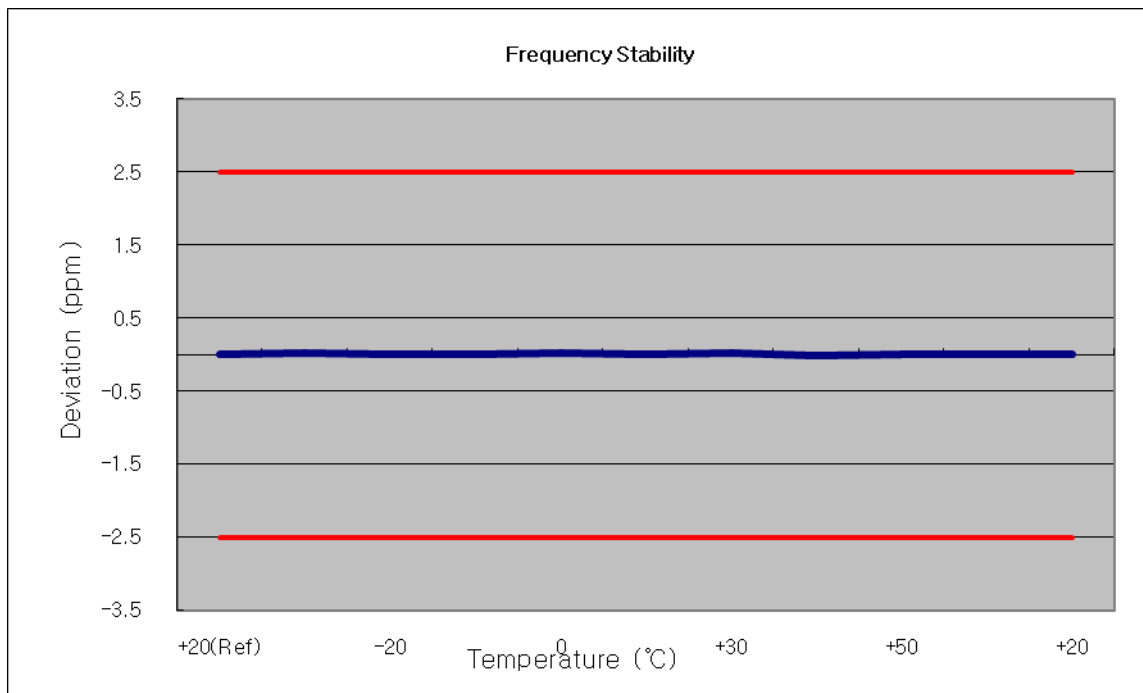
| Voltage (%)    | Power (VDC) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm    |
|----------------|-------------|------------|----------------|----------------------|---------------|--------|
| 100%           | 3.700       | +20(Ref)   | 1880 000 056   | 0                    | 0.000 000     | 0.000  |
| 100%           |             | -30        | 1880 000 000   | -55.14               | -0.000 003    | -0.029 |
| 100%           |             | -20        | 1879 999 999   | -56.90               | -0.000 003    | -0.030 |
| 100%           |             | -10        | 1879 999 999   | -56.88               | -0.000 003    | -0.030 |
| 100%           |             | 0          | 1879 999 997   | -58.38               | -0.000 003    | -0.031 |
| 100%           |             | +10        | 1879 999 996   | -59.65               | -0.000 003    | -0.032 |
| 100%           |             | +30        | 1879 999 997   | -58.08               | -0.000 003    | -0.031 |
| 100%           |             | +40        | 1879 999 997   | -58.29               | -0.000 003    | -0.031 |
| 100%           |             | +50        | 1879 999 994   | -61.51               | -0.000 003    | -0.033 |
| 115%           | 4.255       | +20        | 1879 999 998   | -57.59               | -0.000 003    | -0.031 |
| Batt. Endpoint | 3.500       | +20        | 1879 999 996   | -59.15               | -0.000 003    | -0.031 |



### 7.8.3 FREQUENCY STABILITY (WCDMA850)

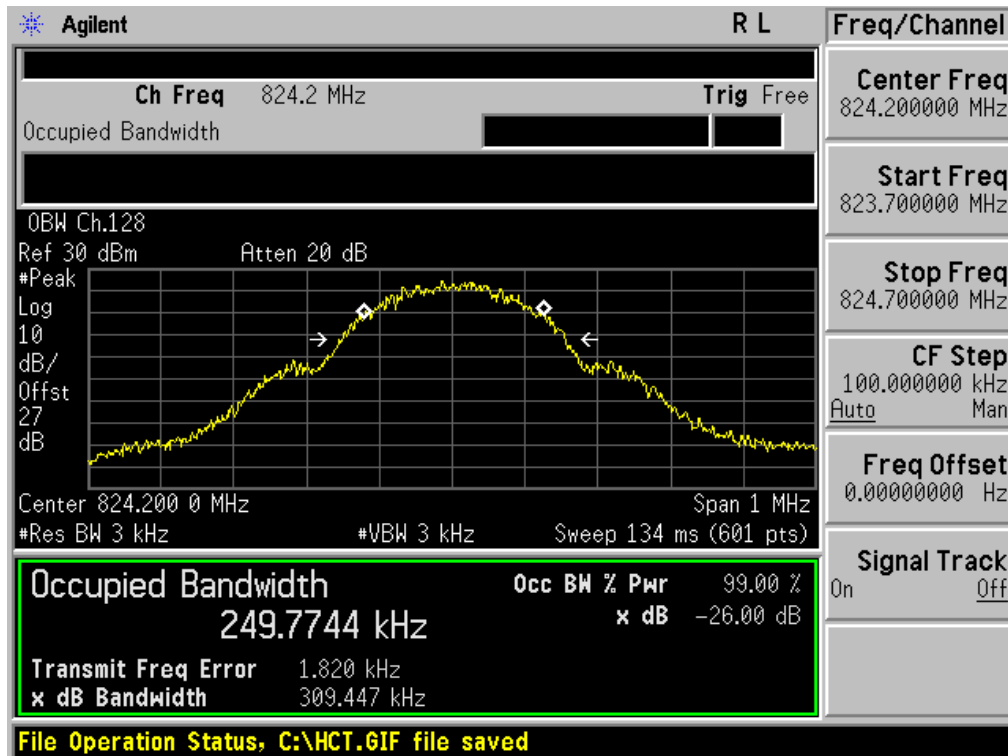
☐ OPERATING FREQUENCY: 836,600,000 Hz  
☐ CHANNEL: 4183  
☐ REFERENCE VOLTAGE: 3.7 VDC  
☐ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

| Voltage (%)    | Power (VDC) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm    |
|----------------|-------------|------------|----------------|----------------------|---------------|--------|
| 100%           | 3.700       | +20(Ref)   | 836 600 010    | 0                    | 0.000 000     | 0.000  |
| 100%           |             | -30        | 836 600 011    | 11.22                | 0.000 001     | 0.013  |
| 100%           |             | -20        | 836 600 008    | 8.37                 | 0.000 001     | 0.010  |
| 100%           |             | -10        | 836 600 007    | 7.21                 | 0.000 001     | 0.009  |
| 100%           |             | 0          | 836 600 013    | 12.68                | 0.000 002     | 0.015  |
| 100%           |             | +10        | 836 600 009    | 8.91                 | 0.000 001     | 0.011  |
| 100%           |             | +30        | 836 600 011    | 11.31                | 0.000 001     | 0.014  |
| 100%           |             | +40        | 836 599 985    | -14.62               | -0.000 002    | -0.017 |
| 100%           |             | +50        | 836 600 009    | 9.04                 | 0.000 001     | 0.011  |
| 115%           | 4.255       | +20        | 836 600 008    | 8.39                 | 0.000 001     | 0.010  |
| Batt. Endpoint | 3.500       | +20        | 836 600 007    | 7.34                 | 0.000 001     | 0.009  |

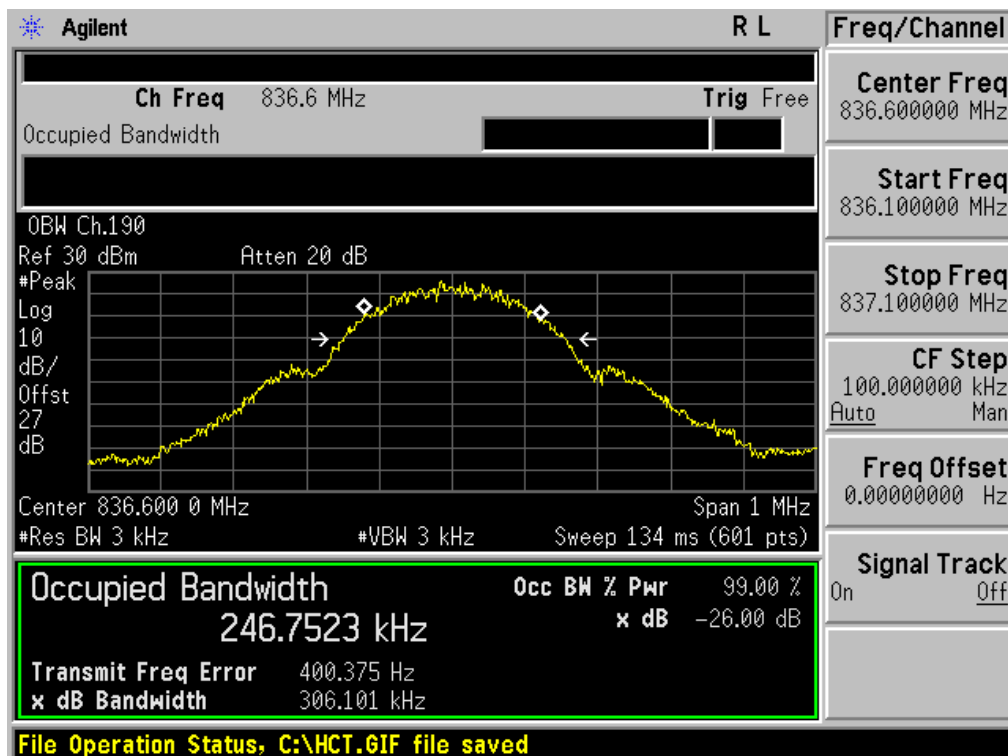


## 8. TEST PLOTS

■ GSM850 MODE (128 CH.) Occupied Bandwidth



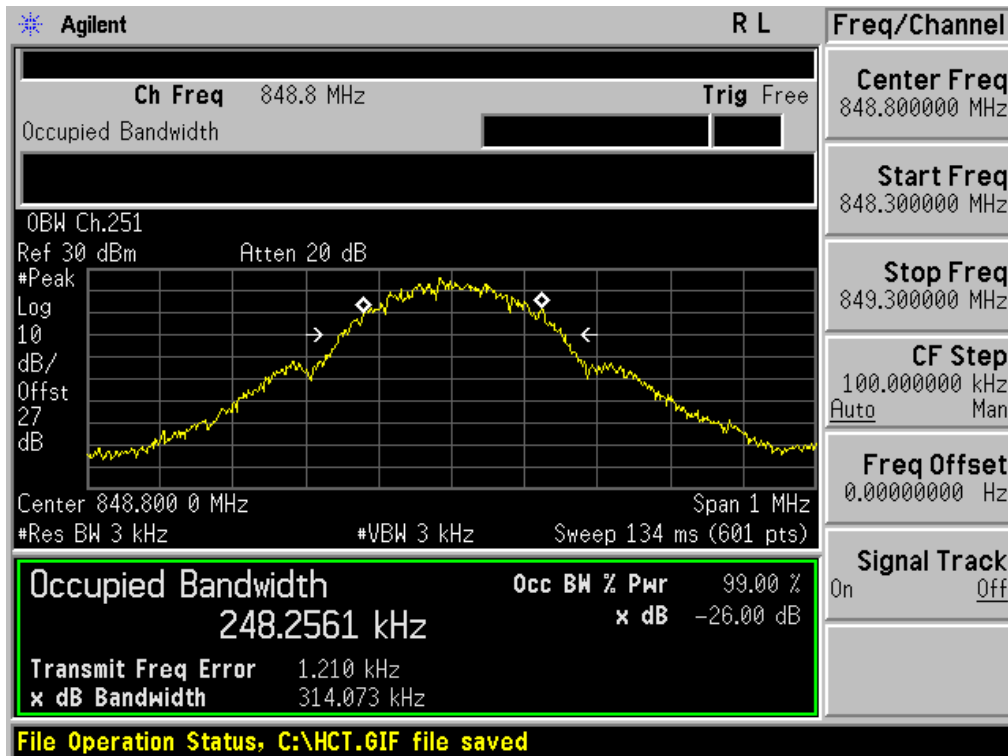
■ GSM850 MODE (190 CH.) Occupied Bandwidth



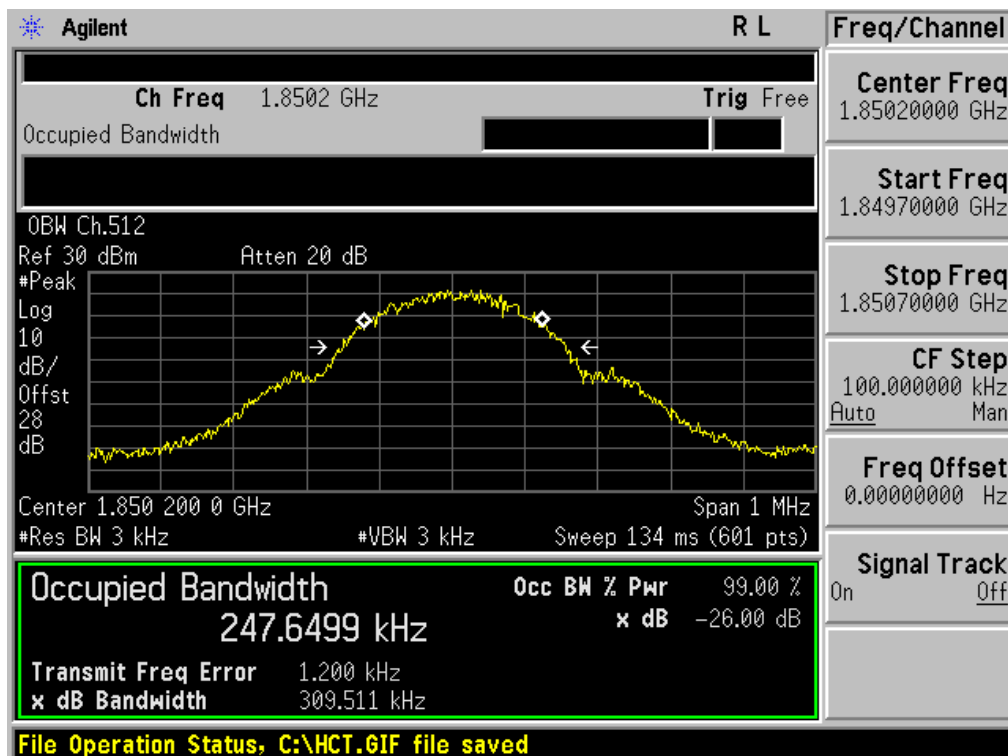
FCC CERTIFICATION REPORT

|                                 |                                     |                                                                                                  |                                                                         |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Test Report No.<br>HCTR1211FR03 | Date of Issue:<br>November 19, 2012 | EUT Type:<br>Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN | <a href="http://www.hct.co.kr">www.hct.co.kr</a><br>FCC ID:<br>ZNFE615F |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|

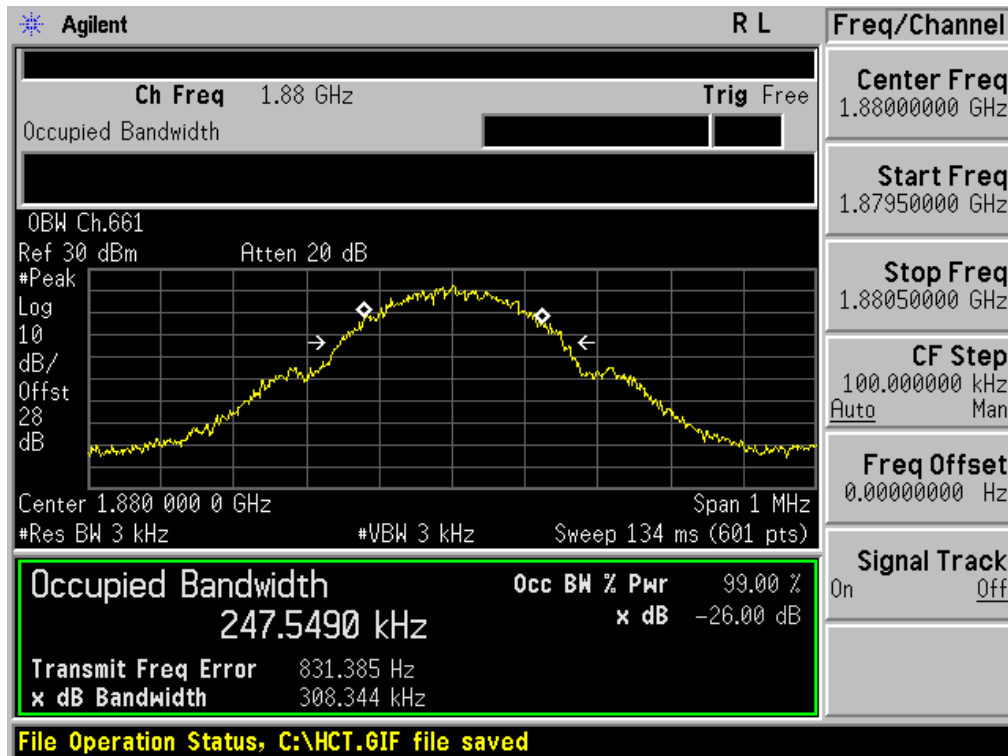
■ GSM850 MODE (251 CH.) Occupied Bandwidth



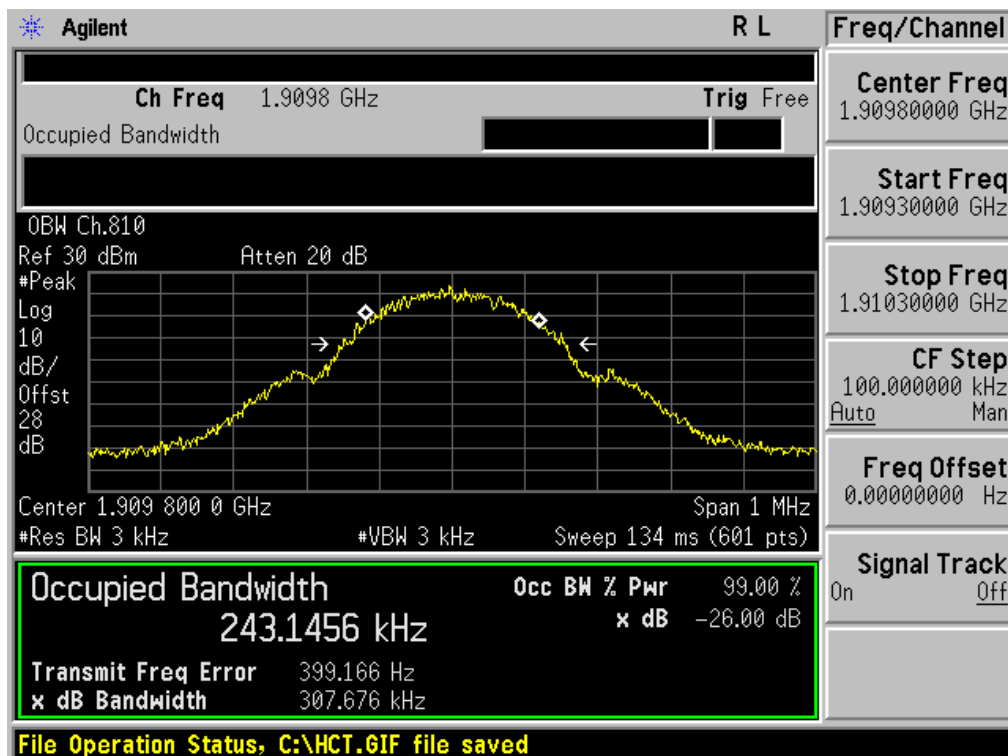
■ GSM1900 MODE (512 CH.) Occupied Bandwidth



■ GSM1900 MODE (661 CH.) Occupied Bandwidth



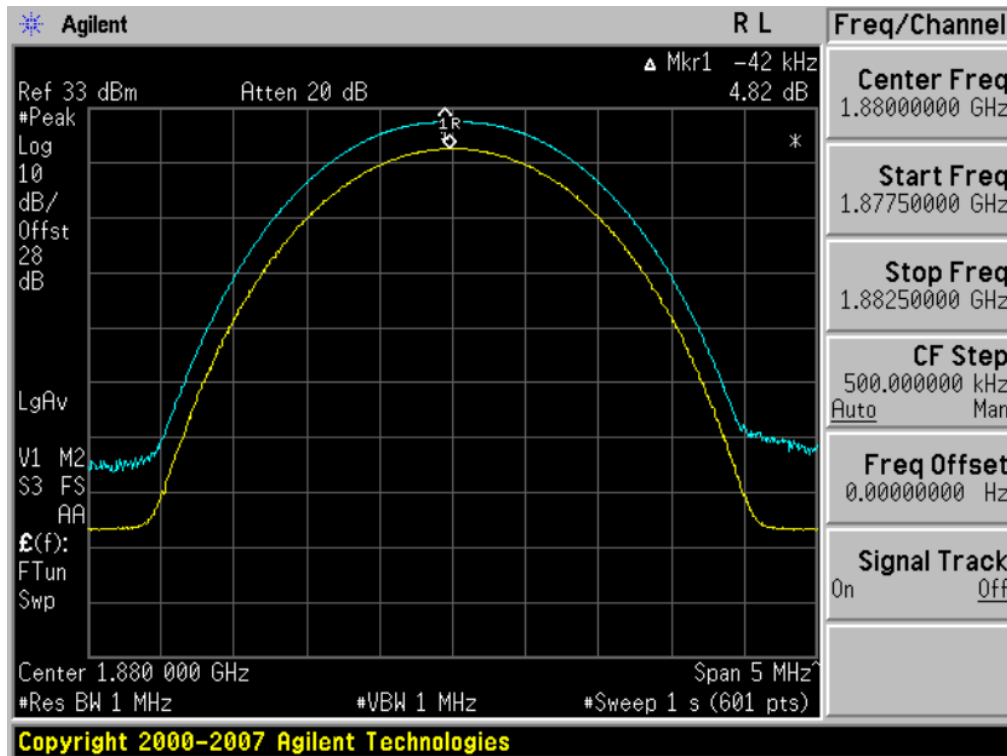
■ GSM1900 MODE (810 CH.) Occupied Bandwidth



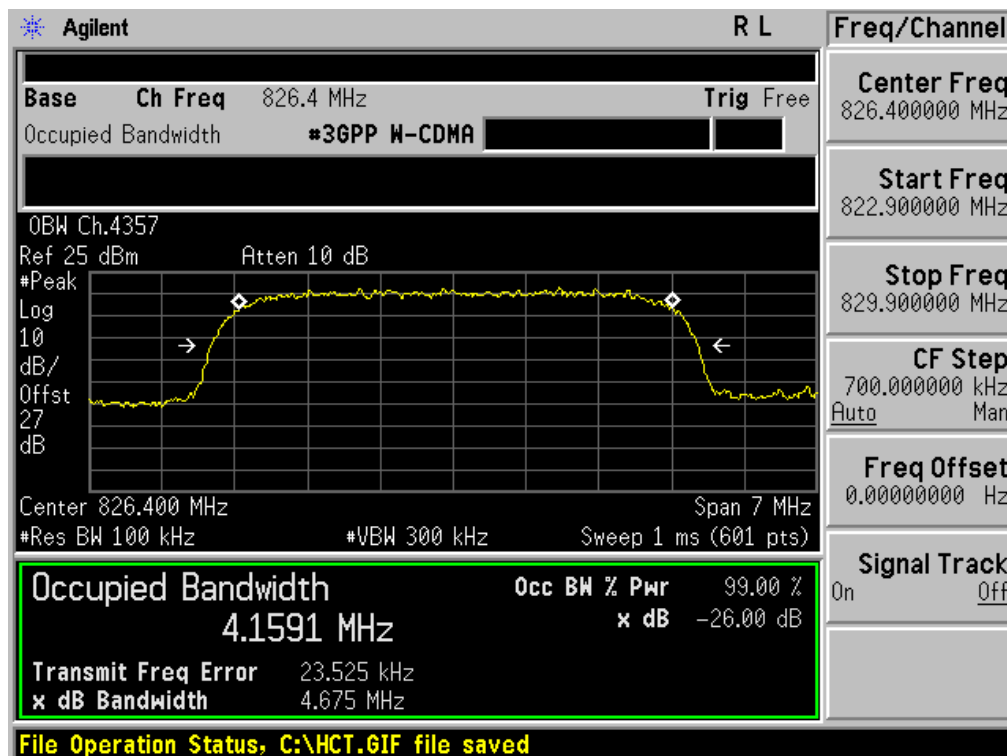
FCC CERTIFICATION REPORT

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|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Test Report No.<br>HCTR1211FR03 | Date of Issue:<br>November 19, 2012 | EUT Type:<br>Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN | <a href="http://www.hct.co.kr">www.hct.co.kr</a><br>FCC ID:<br>ZNFE615F |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|

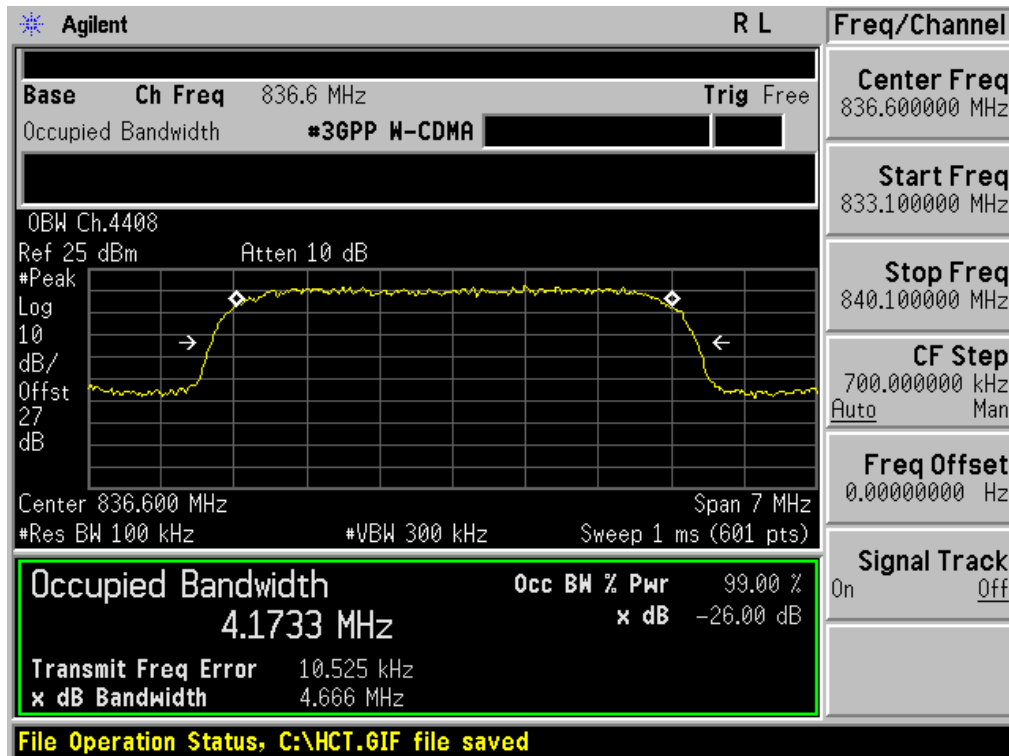
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio



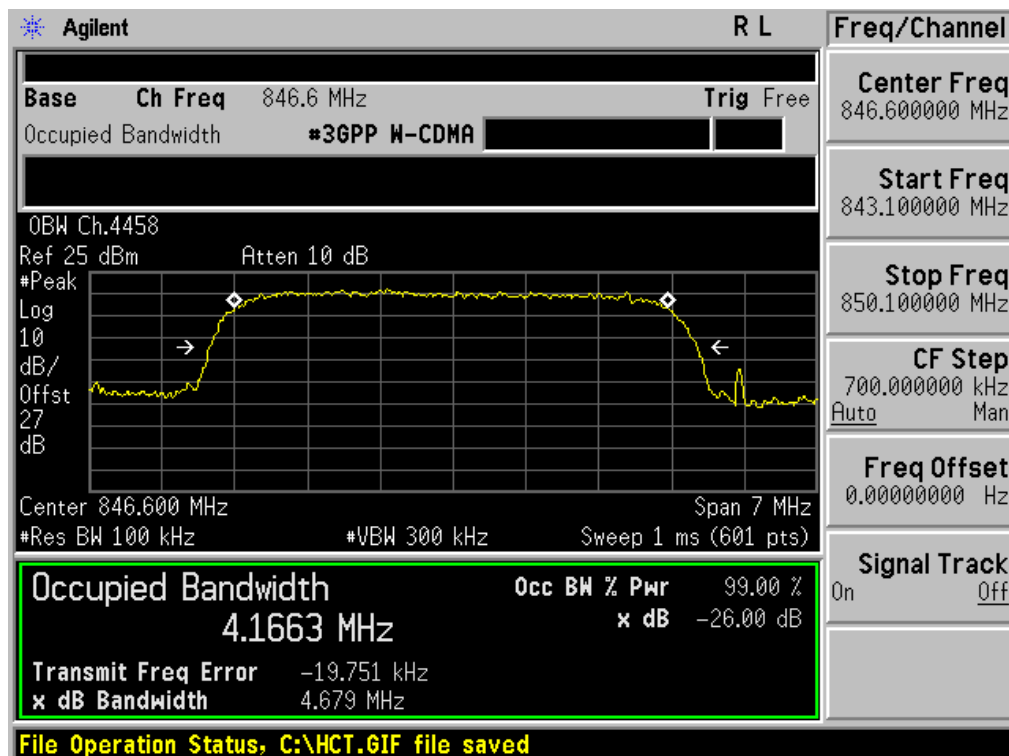
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



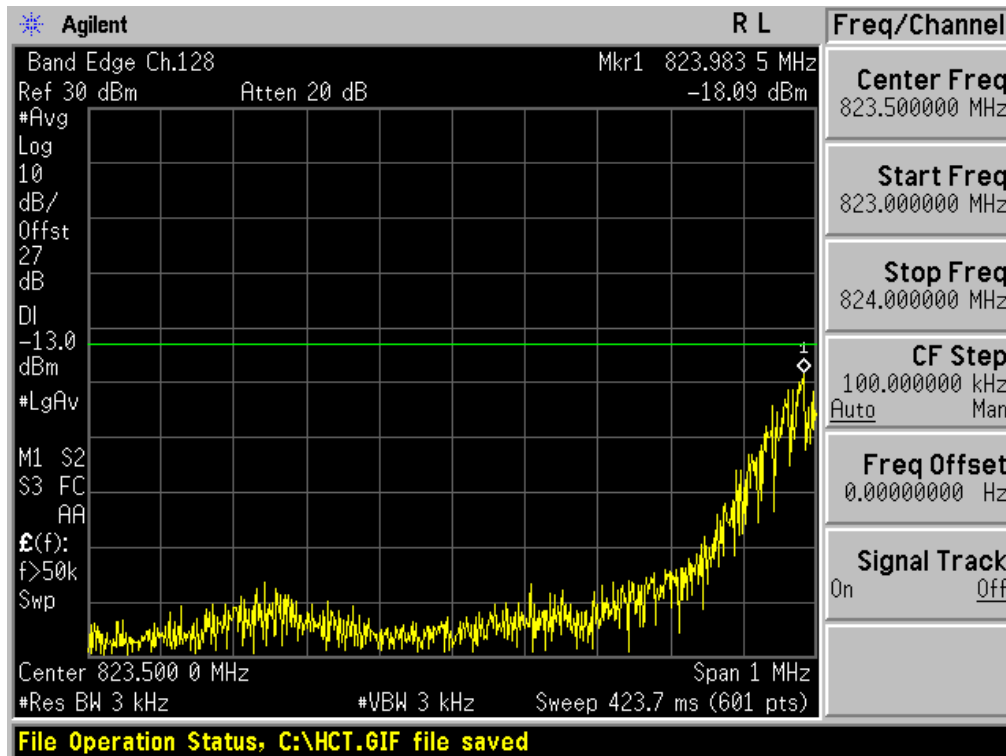
■ WCDMA850MODE (4233 CH.) Occupied Bandwidth



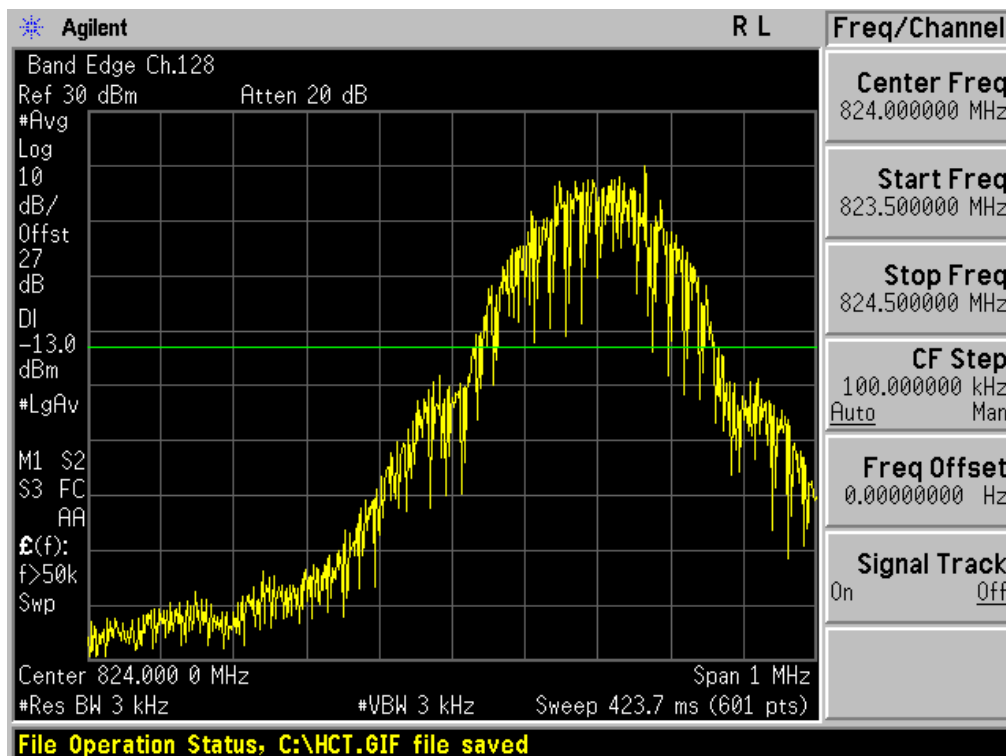
FCC CERTIFICATION REPORT

|                                 |                                     |                                                                                                  |                                                                         |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Test Report No.<br>HCTR1211FR03 | Date of Issue:<br>November 19, 2012 | EUT Type:<br>Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN | <a href="http://www.hct.co.kr">www.hct.co.kr</a><br>FCC ID:<br>ZNFE615F |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|

■ GSM850 MODE (128 CH.) Block Edge 1



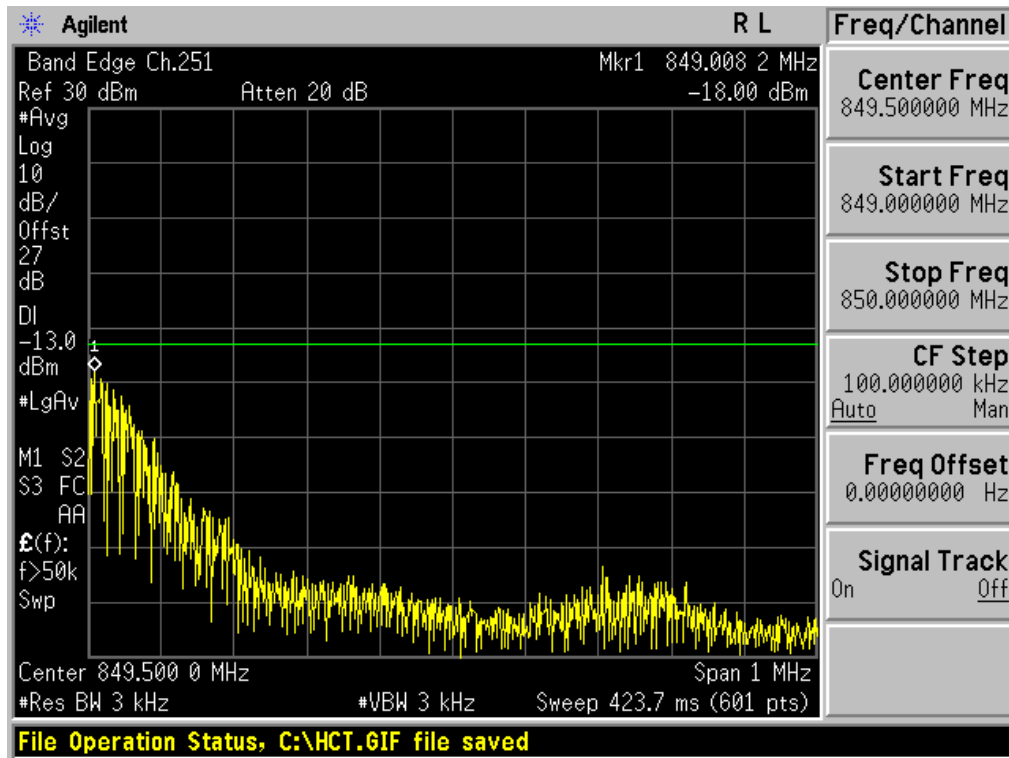
■ GSM850 MODE (128 CH.) Block Edge 2



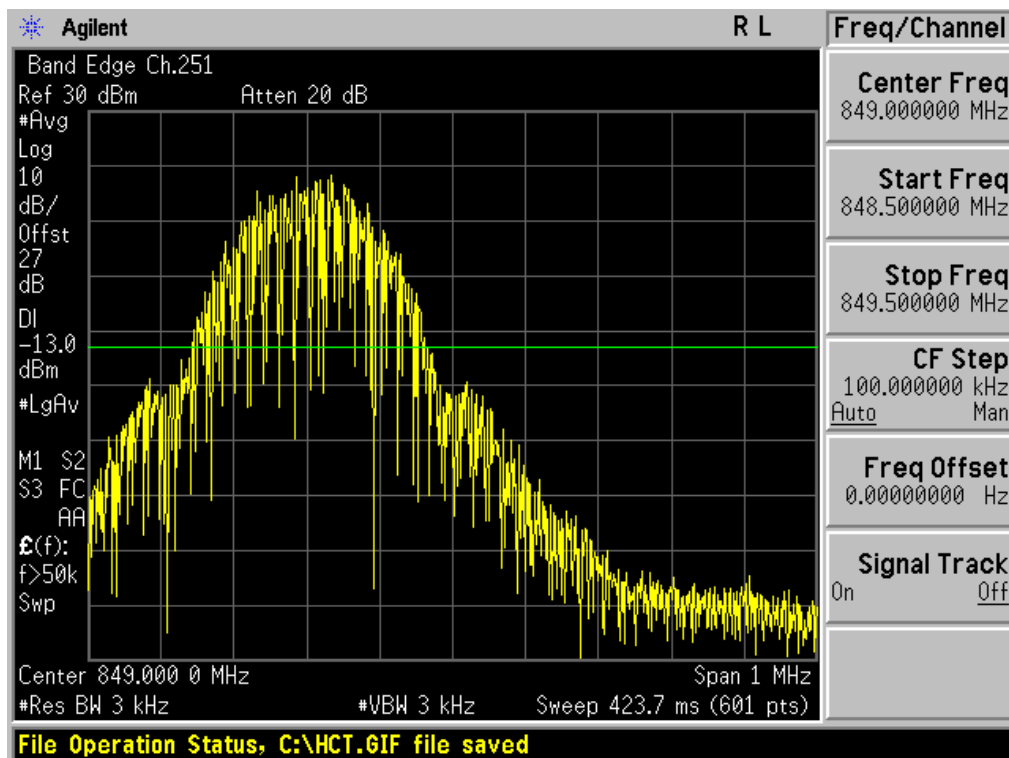
FCC CERTIFICATION REPORT

|                                 |                                     |                                                                                                  |                                                                         |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Test Report No.<br>HCTR1211FR03 | Date of Issue:<br>November 19, 2012 | EUT Type:<br>Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN | <a href="http://www.hct.co.kr">www.hct.co.kr</a><br>FCC ID:<br>ZNFE615F |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|

■ GSM850 MODE (251 CH.) Block Edge 1



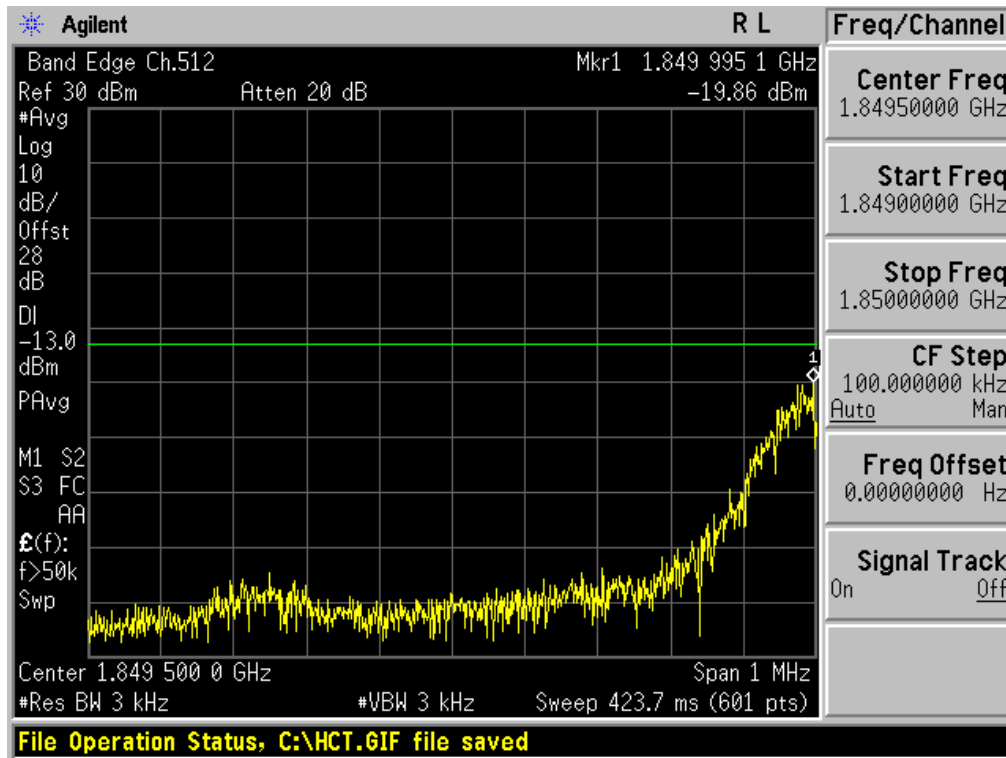
■ GSM850 MODE (251 CH.) Block Edge 2



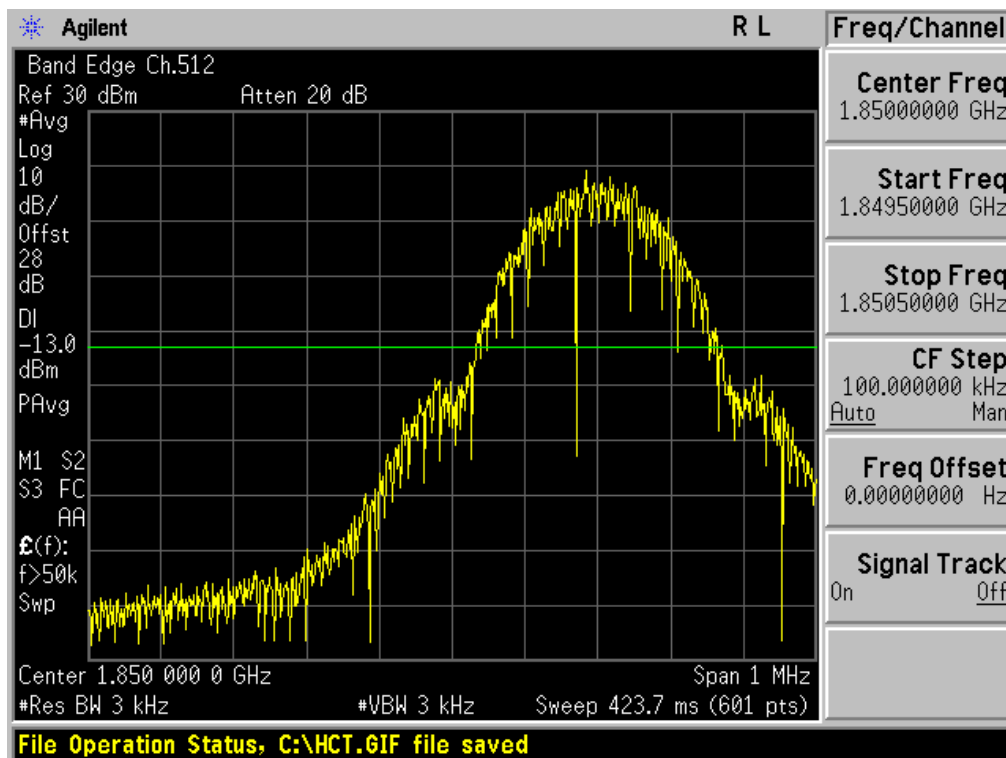
FCC CERTIFICATION REPORT

|                                 |                                     |                                                                                                  |                                                                         |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Test Report No.<br>HCTR1211FR03 | Date of Issue:<br>November 19, 2012 | EUT Type:<br>Cellular/PCS GSM/GPRS/EDGE(RX Only) Cellular/WCDMA/HSDPA Phone with Bluetooth, WLAN | <a href="http://www.hct.co.kr">www.hct.co.kr</a><br>FCC ID:<br>ZNFE615F |
|---------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|

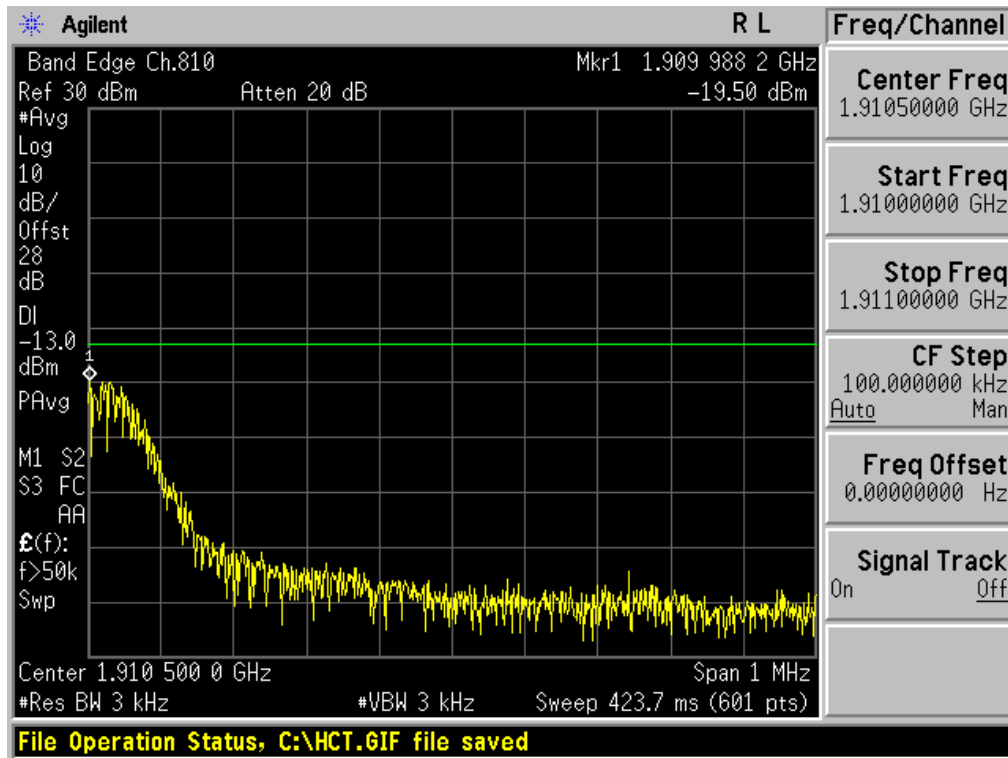
■ GSM1900 MODE (512 CH.) Block Edge 1



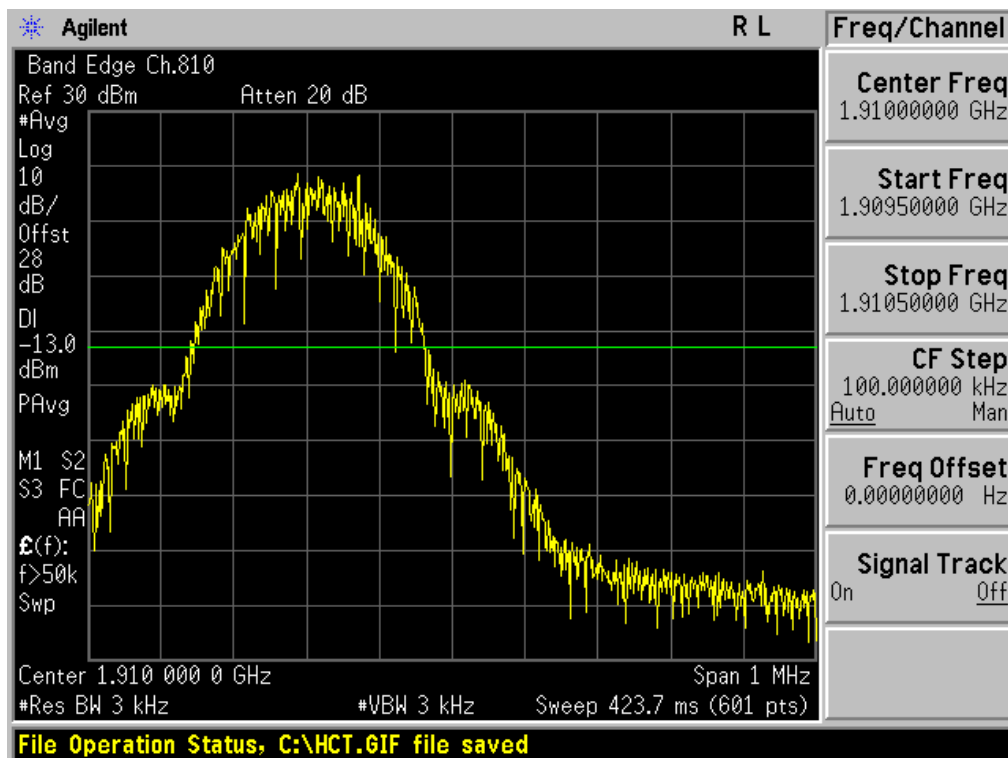
■ GSM1900 MODE (512 CH.) Block Edge 2



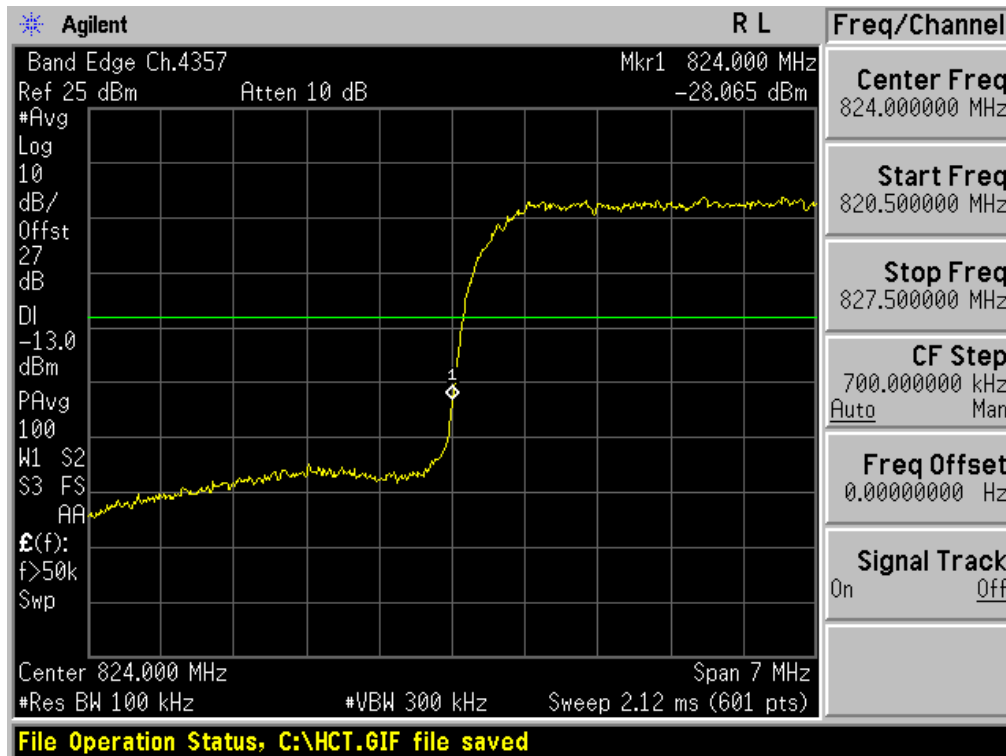
■ GSM1900 MODE (810 CH.) Block Edge 1



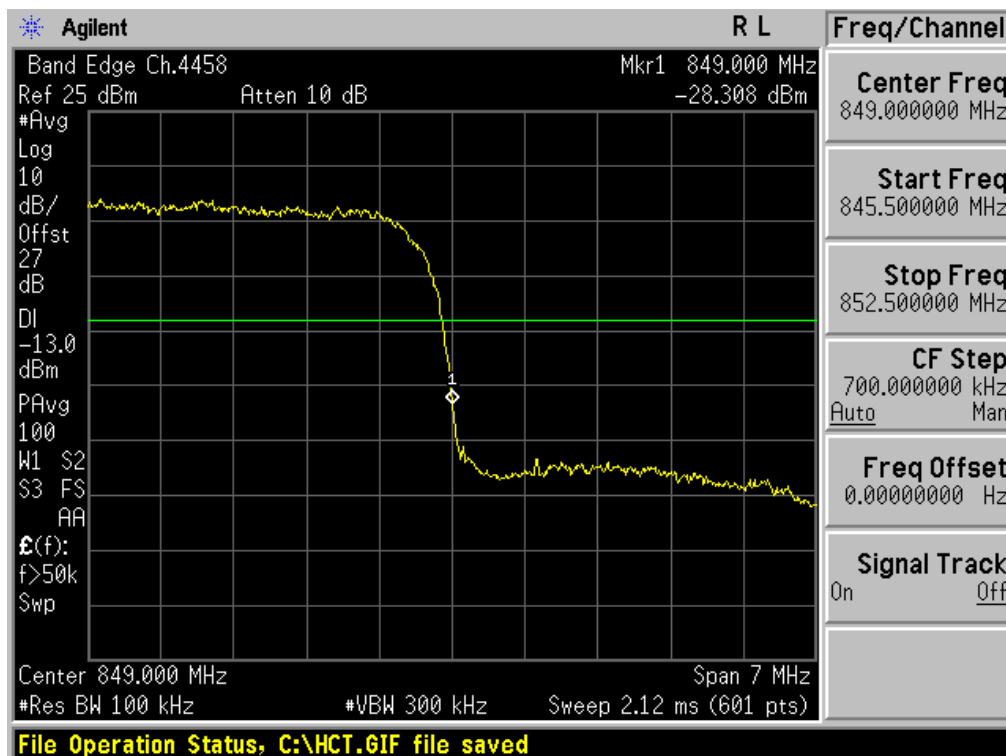
■ GSM1900 MODE (810 CH.) Block Edge 2



■ WCDMA850 MODE (4132 CH.) Block Edge



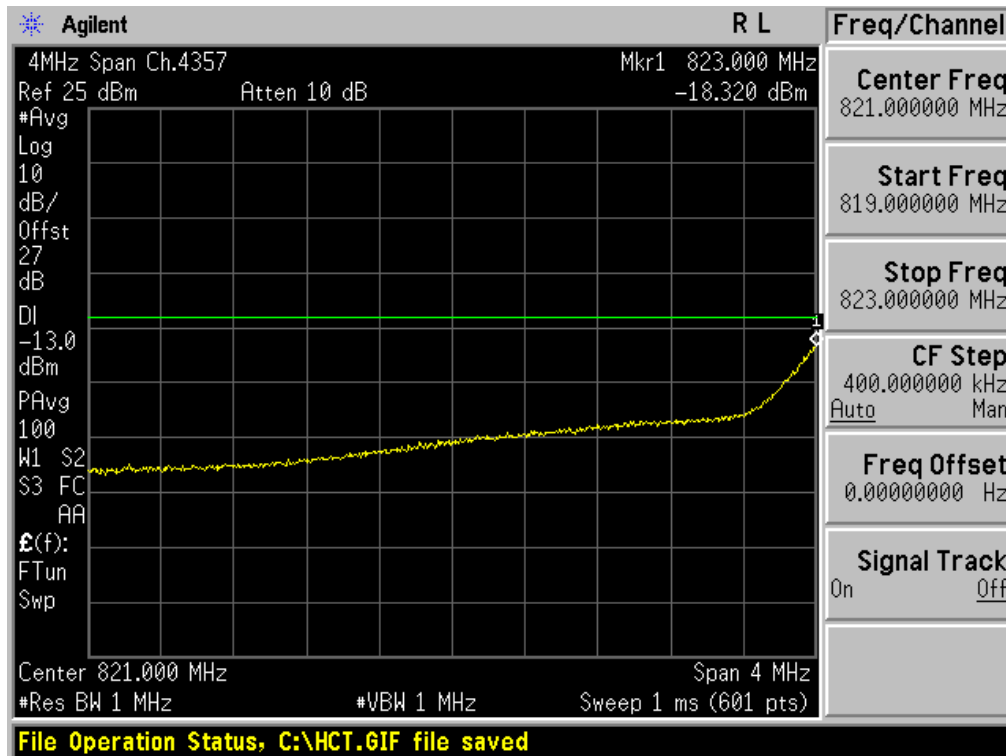
■ WCDMA850MODE (4233 CH.) Block Edge



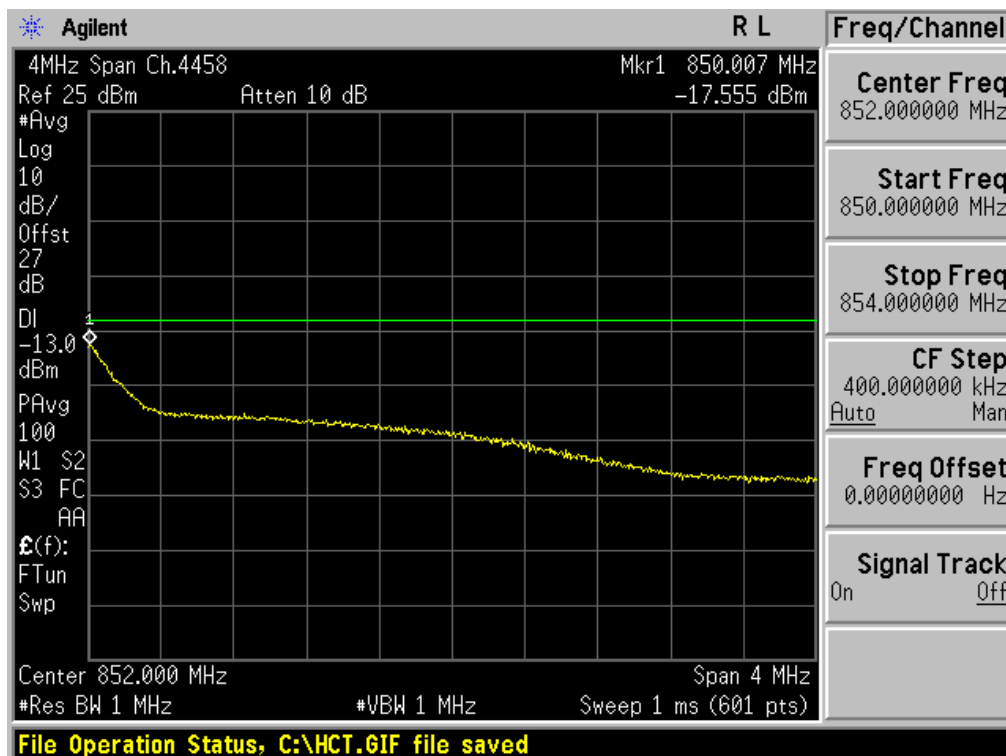
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■ WCDMA850 MODE (4132 CH.) – 4 MHz Span



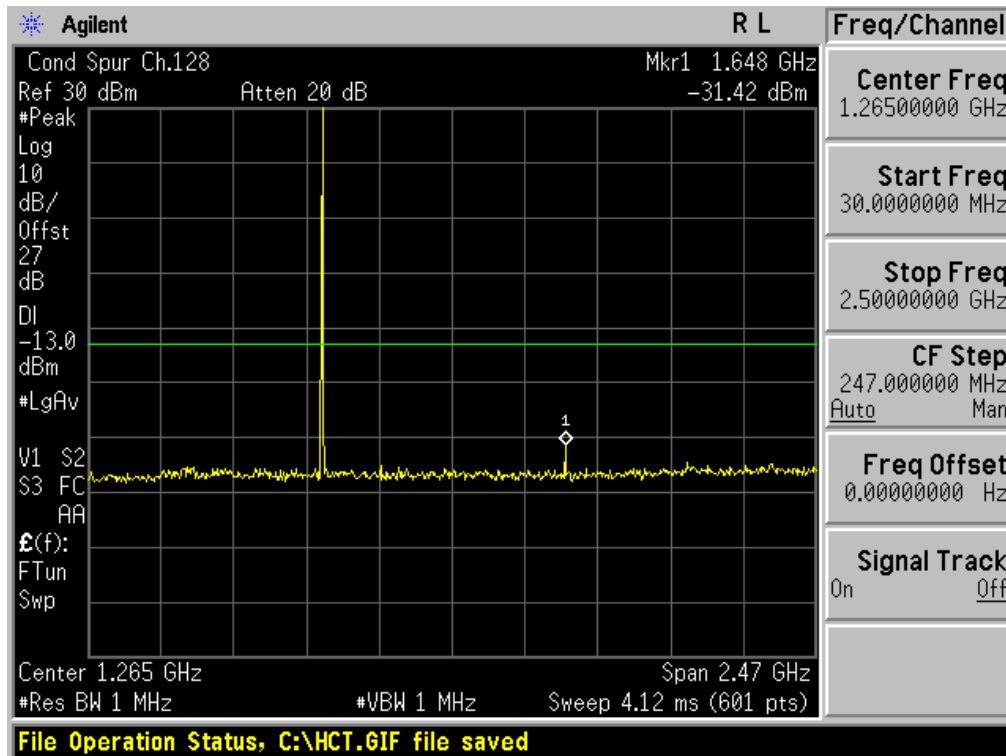
■ WCDMA850MODE (4233 CH.) – 4 MHz Span



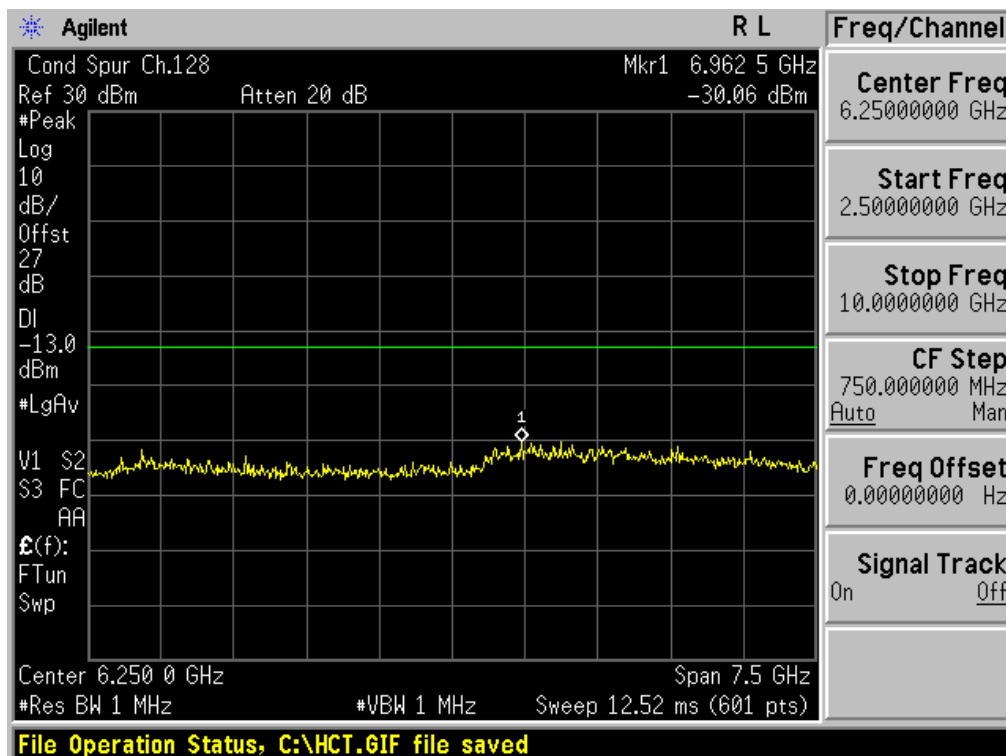
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■ GSM850 MODE (128 CH.) Conducted Spurious Emissions1



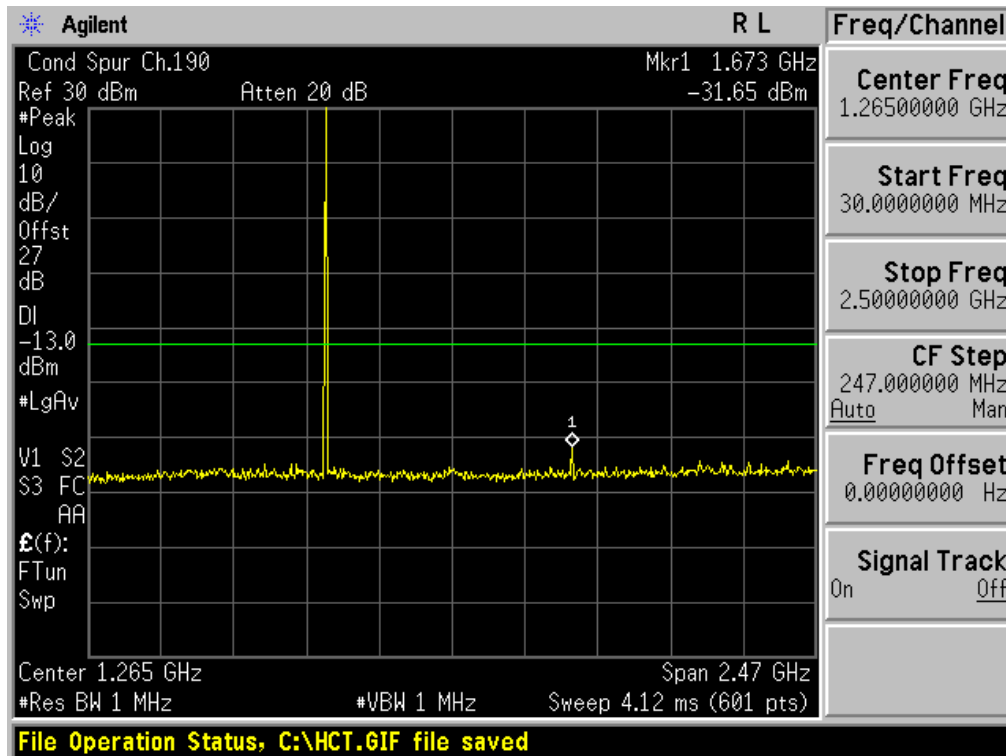
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions2



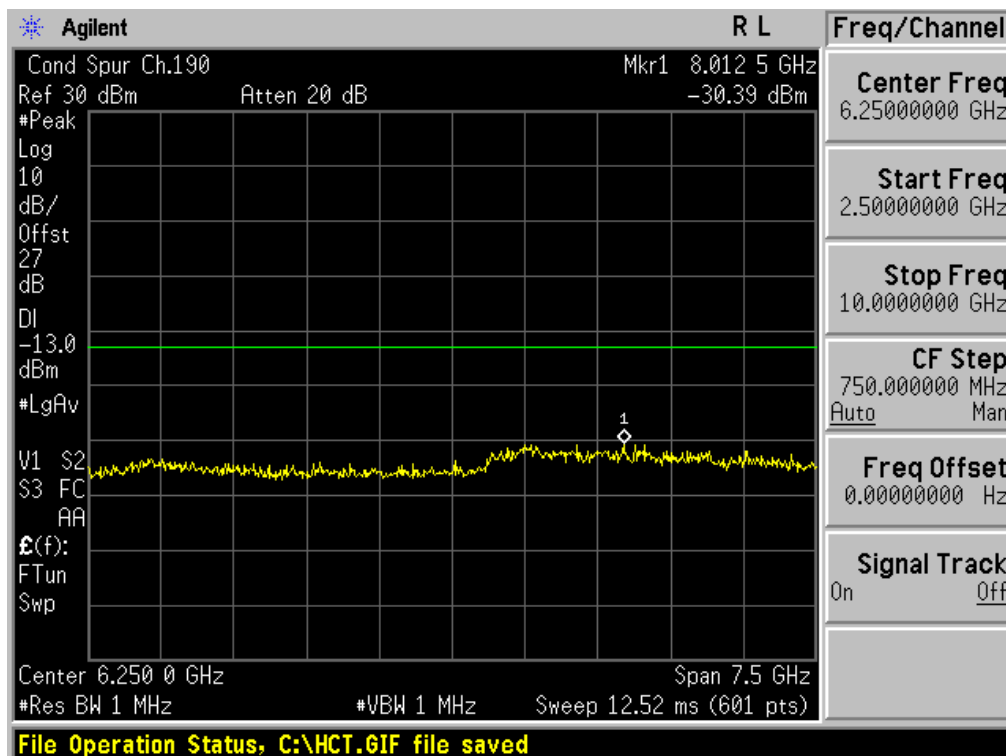
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■ GSM850 MODE (190 CH.) Conducted Spurious Emissions1



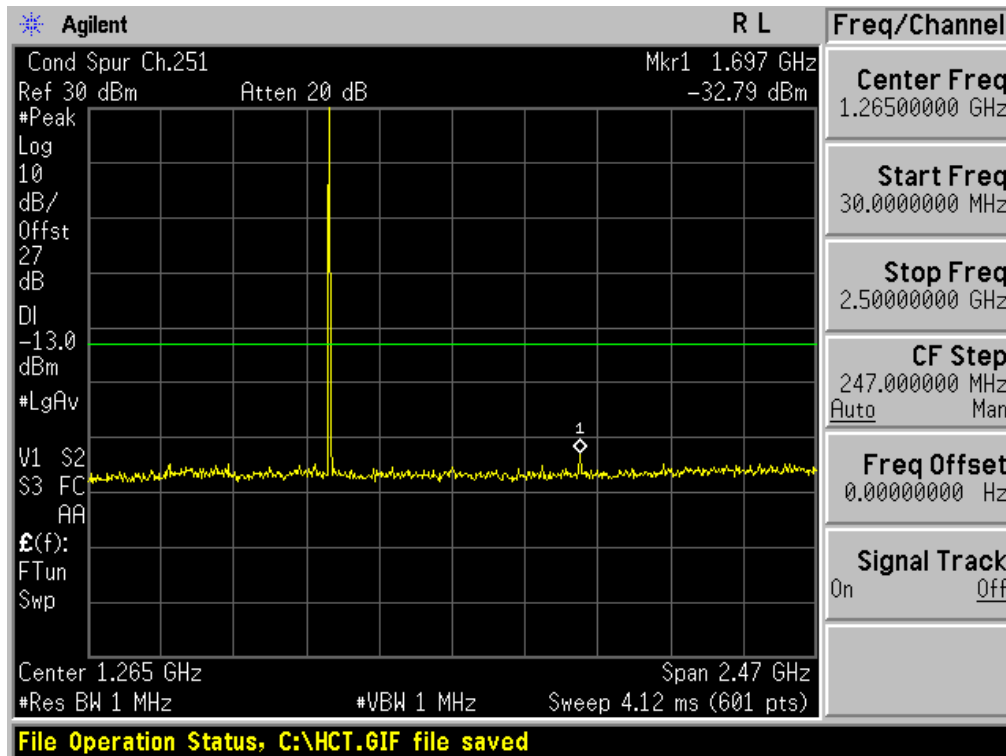
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions2



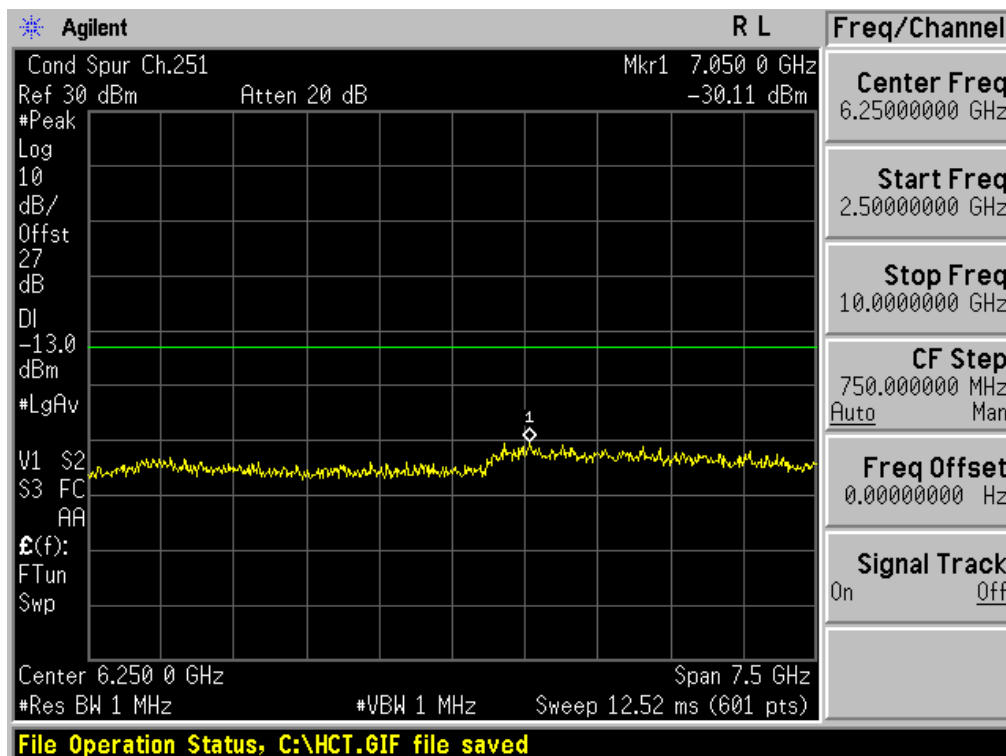
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■ GSM850 MODE (251 CH.) Conducted Spurious Emissions1



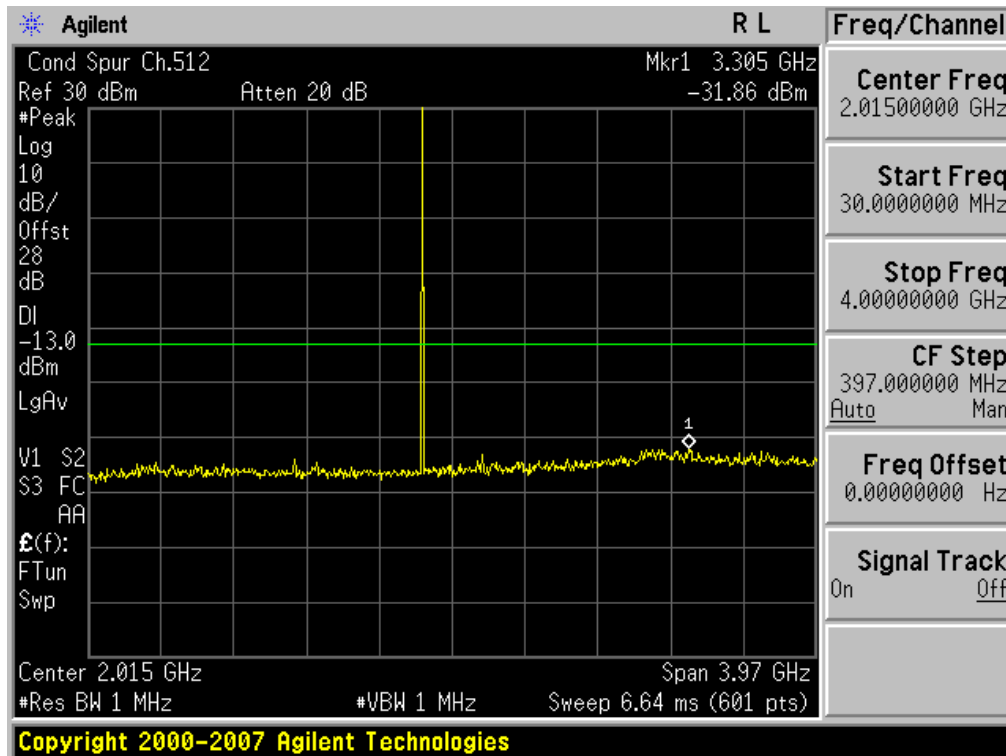
■ GSM850 MODE (251 CH.) Conducted Spurious Emissions2



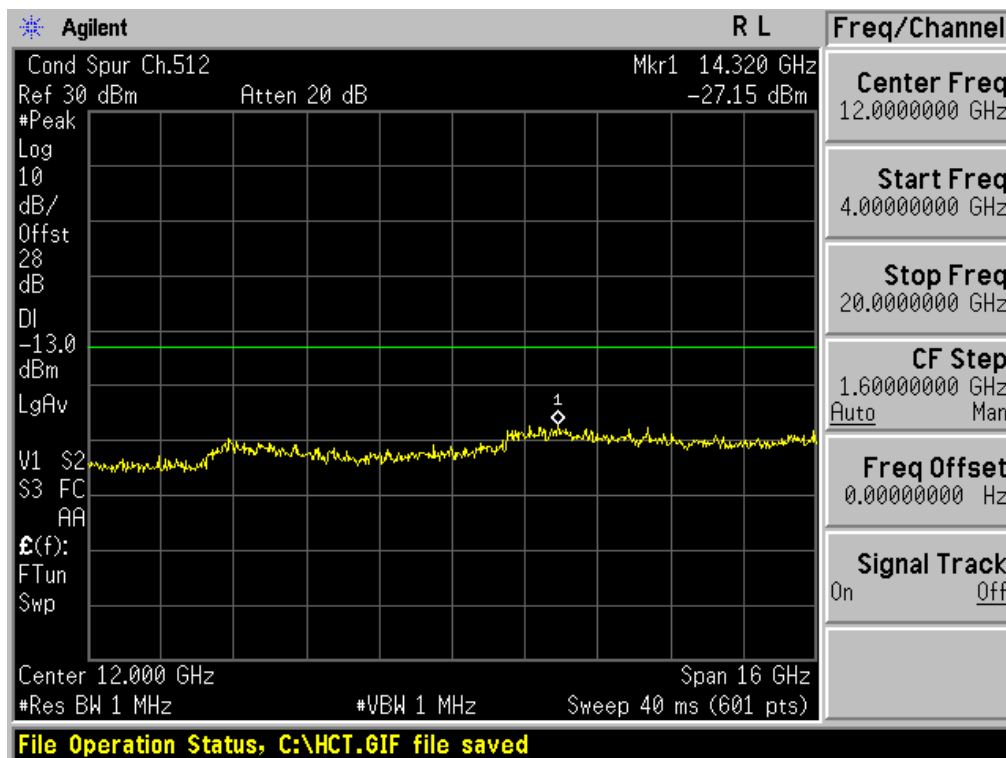
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■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions1



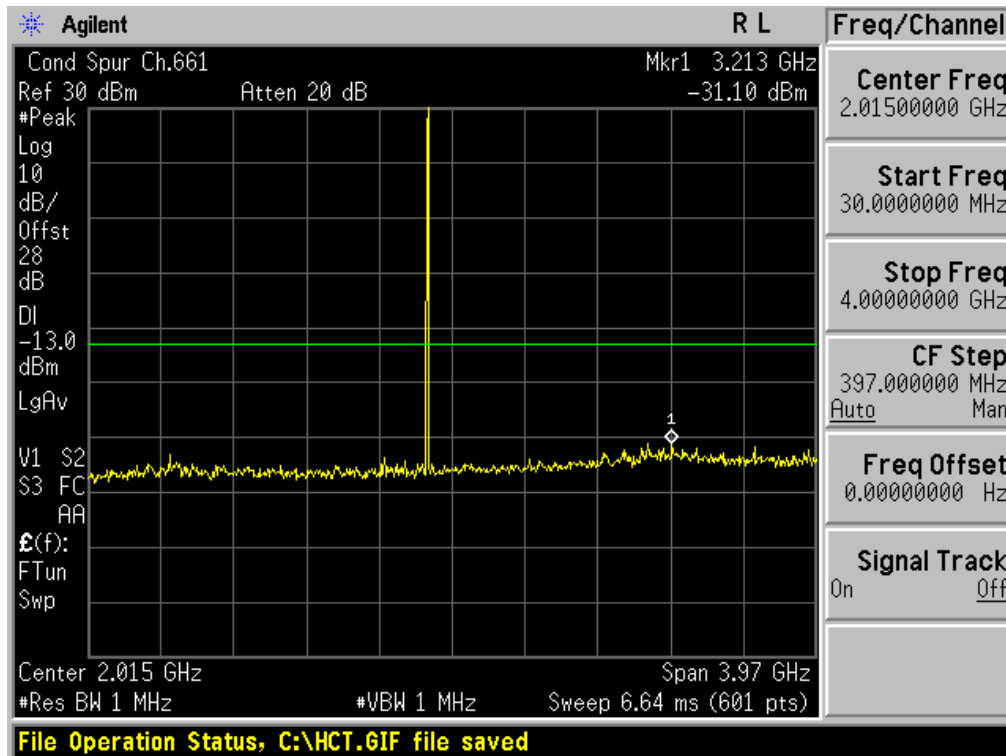
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions2



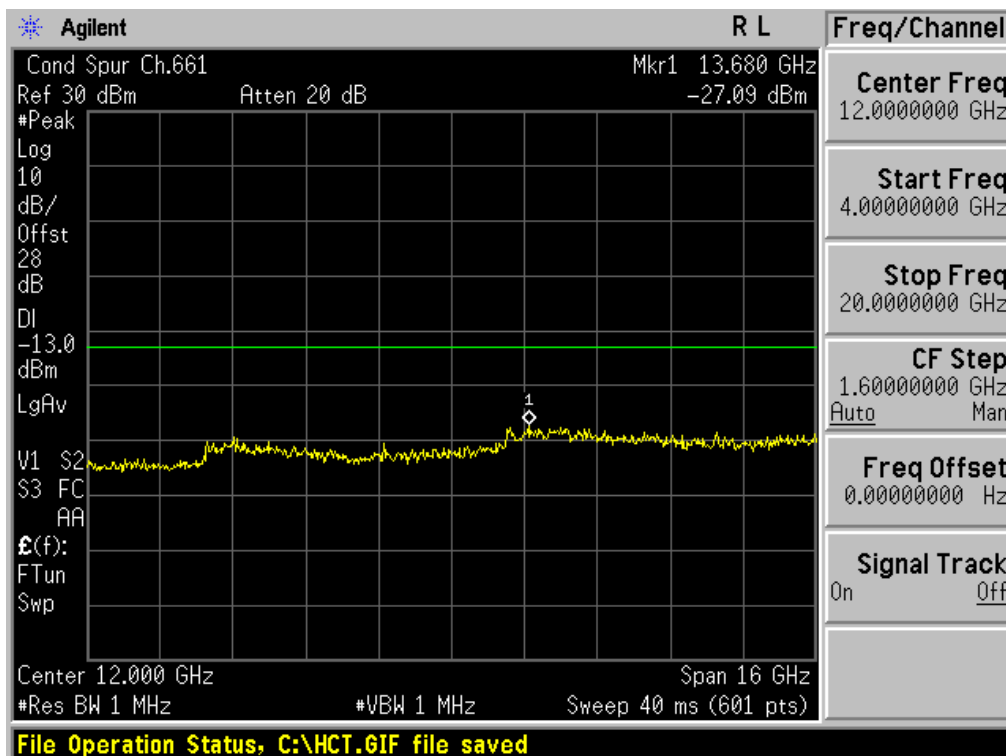
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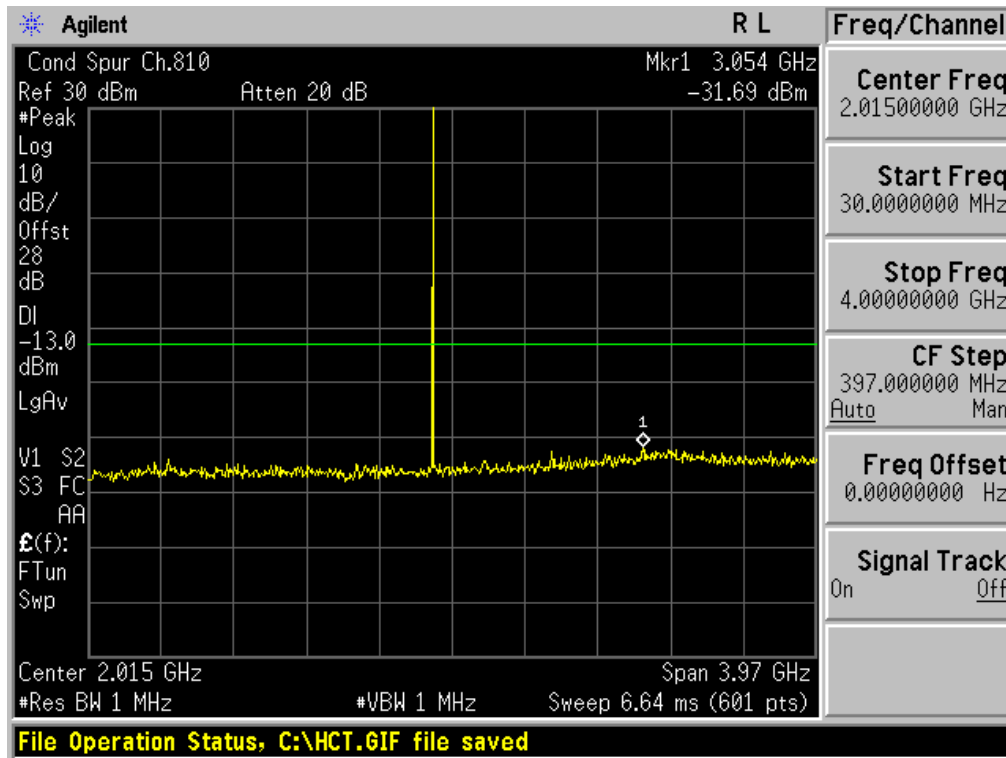
■ GSM1900 MODE (661 CH) Conducted Spurious Emissions1



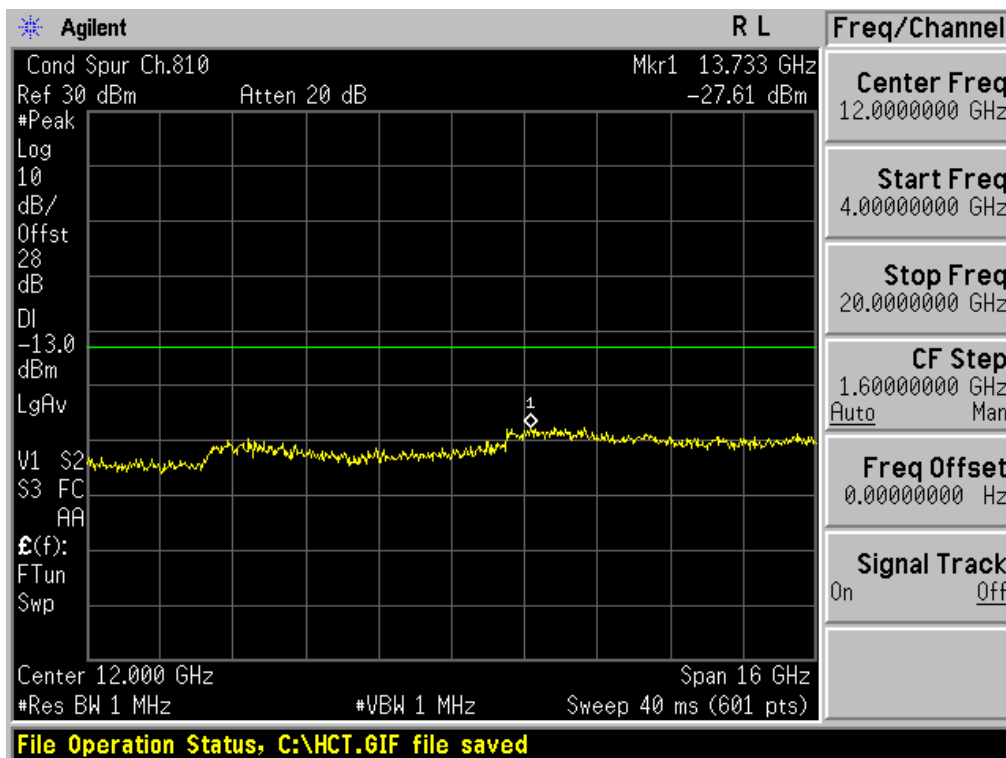
■ GSM1900 MODE (661 CH.) Conducted Spurious Emissions2



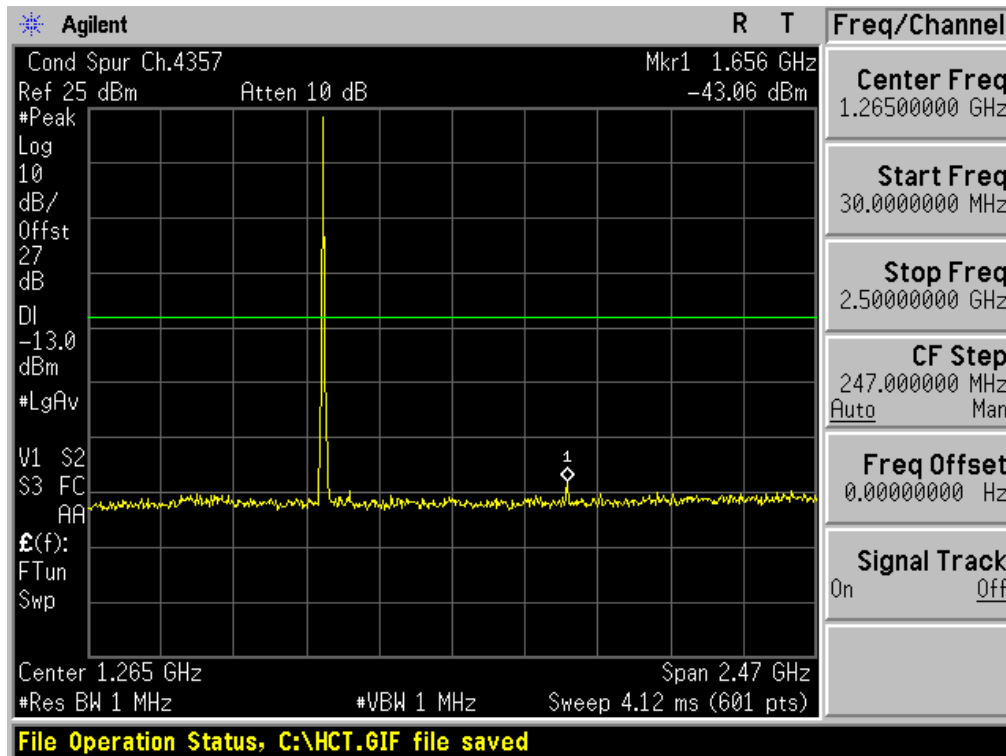
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions1



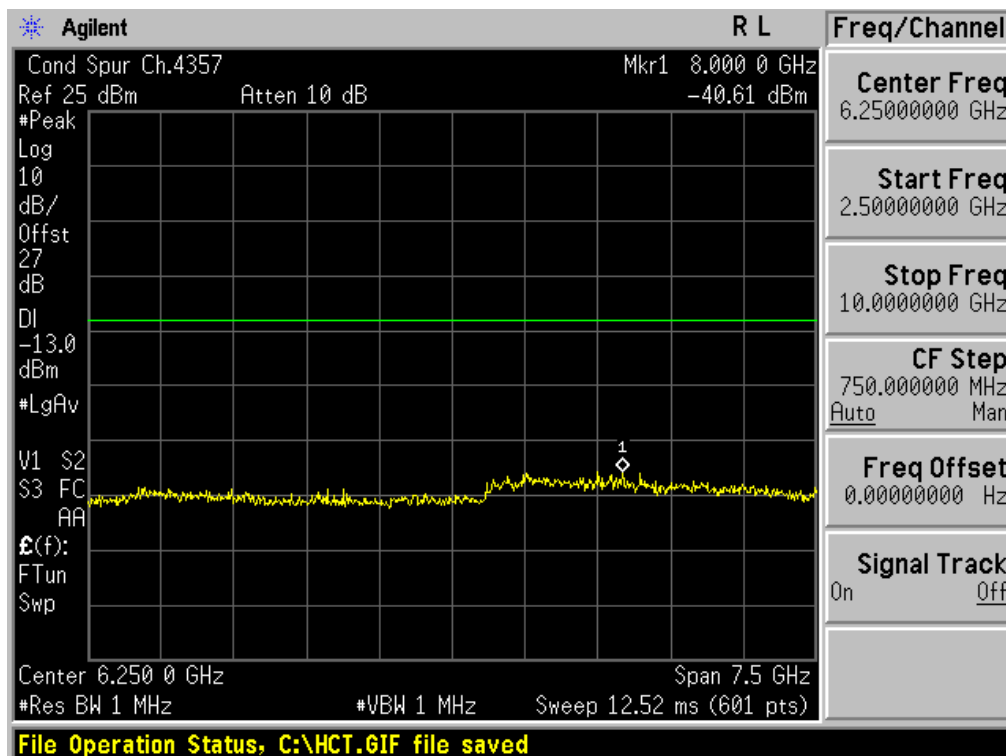
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions2



■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions1



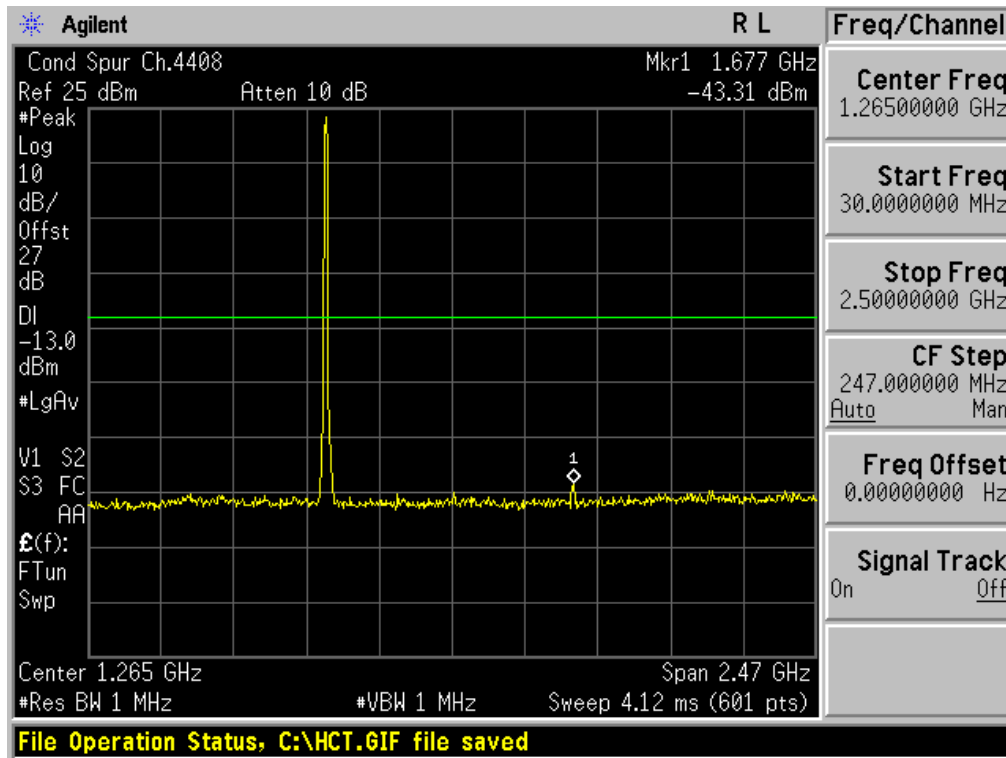
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions2



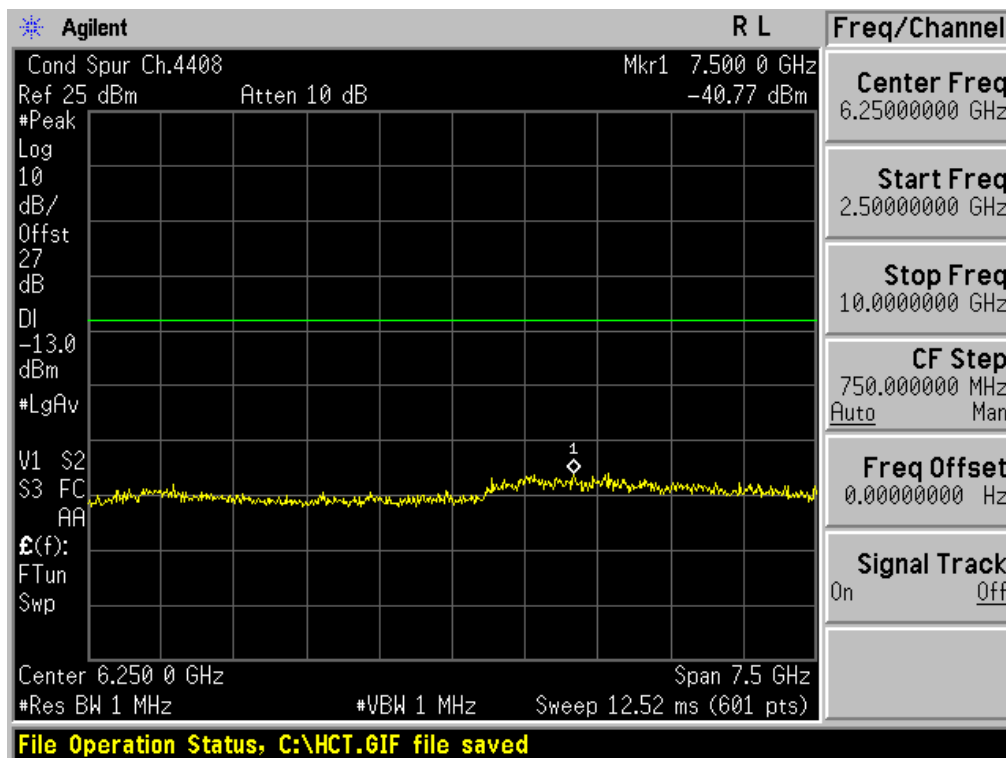
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■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions1



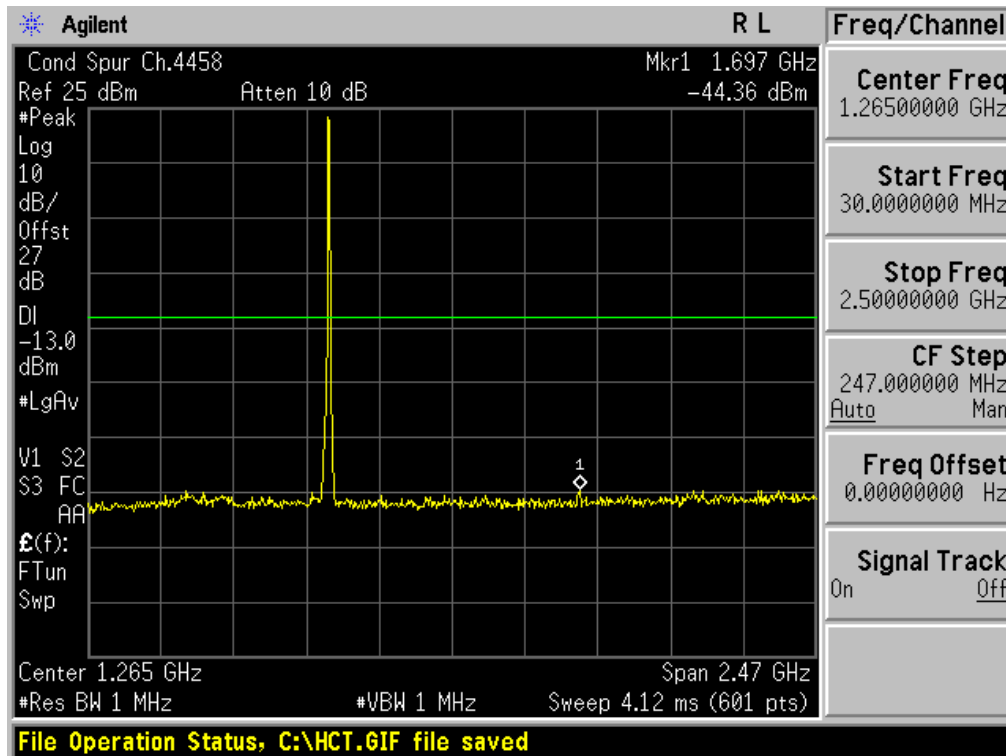
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions2



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■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions1



■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions2

