



**FCC CFR47 PART 22 SUBPART H  
AND PART 24 SUBPART E  
CERTIFICATION**

**TEST REPORT  
FOR**

**EMBEDDED WIRELESS RADIO MODEM**

**MODEL NUMBER: EM5625D**

**FCC ID: N7N-EM5625D**

**REPORT NUMBER: 04U3076-1**

**ISSUE DATE: FEBRUARY 02, 2005**

*Prepared for*  
**SIERRA WIRELESS  
2290 COSMOS CT.  
CARLSBAD CALIFORNIA 92009  
U.S.A**

*Prepared by*  
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**NVLAP<sup>®</sup>**  
**LAB CODE:200065-0**

Revision History

| <u>Rev.</u> | <u>Revisions</u>                                                                                     | <u>Revised By</u> |
|-------------|------------------------------------------------------------------------------------------------------|-------------------|
| 1           | Revised user manual to allow max antenna's gain of 5.1dBi in Cellular bands and 3.9dBi in PCS bands. | Client            |
| 2           | Revised report in MPE section based on max antenna's gain                                            | Thu               |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SIERRA WIRELESS  
2290 COSMOS CT.  
CARLSBAD CALIFORNIA 92009  
U.S.A

**EUT DESCRIPTION:** EMBEDDED WIRELESS RADIO MODEM

**MODEL:** EM5625D

**SERIAL NUMBER:** 12224500027

**DATE TESTED:** JANUARY 30 - FEBRUARY 01, 2005

| APPLICABLE STANDARDS  |                         |
|-----------------------|-------------------------|
| STANDARD              | TEST RESULTS            |
| FCC PART 22 SUBPART H | NO NON-COMPLIANCE NOTED |
| FCC PART 24 SUBPART E | NO NON-COMPLIANCE NOTED |

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Tested By:



THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

CHIN PANG AND VIEN TRAN  
EMC TECHNICAINS  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA/EIA 603A (2001), ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15 and FCC CFR 47 Part 22H and 24E.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER                           | UNCERTAINTY    |
|-------------------------------------|----------------|
| Radiated Emission, 30 to 200 MHz    | +/- 3.3 dB     |
| Radiated Emission, 200 to 1000 MHz  | +4.5 / -2.9 dB |
| Radiated Emission, 1000 to 2000 MHz | +4.5 / -2.9 dB |
| Power Line Conducted Emission       | +/- 2.9 dB     |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a dual band with diversity 800 / 1900MHz CDMA Module

The module is manufactured by Sierra Wireless.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted average and peak output powers as follows:

824 to 849 MHz Authorized Band

| Frequency Range<br>(MHz) | Modulation | Conducted<br>Average Power<br>(dBm) | Conducted<br>Average Power<br>(mW) | Conducted<br>Peak Power<br>(dBm) | Conducted<br>Peak Power<br>(mW) |
|--------------------------|------------|-------------------------------------|------------------------------------|----------------------------------|---------------------------------|
| 824.7 - 848.31           | CDMA       | 25.13                               | 325.84                             | 28.99                            | 792.50                          |

1850 to 1910 MHz Authorized Band

| Frequency Range<br>(MHz) | Modulation | Conducted<br>Average Power<br>(dBm) | Conducted<br>Average Power<br>(mW) | Conducted<br>Peak Power<br>(dBm) | Conducted<br>Peak Power<br>(mW) |
|--------------------------|------------|-------------------------------------|------------------------------------|----------------------------------|---------------------------------|
| 1851.25 - 1908.75        | CDMA       | 25.5                                | 354.81                             | 28.60                            | 724.44                          |

NOTE: RBW=VBW=3MHz.

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a monopole antenna, with a maximum allowed gain of 5.1dBi for Cellular bands and 3.9dBi for PCS bands.

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was SPR  
The test utility software used during testing was rev 2.00.3

### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at mid channel 836.5 MHz and 1880 MHz.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| PERIPHERAL SUPPORT EQUIPMENT LIST |              |        |               |        |
|-----------------------------------|--------------|--------|---------------|--------|
| Description                       | Manufacturer | Model  | Serial Number | FCC ID |
| DC Power Supply                   | HP           | E3610A | NA            | NA     |

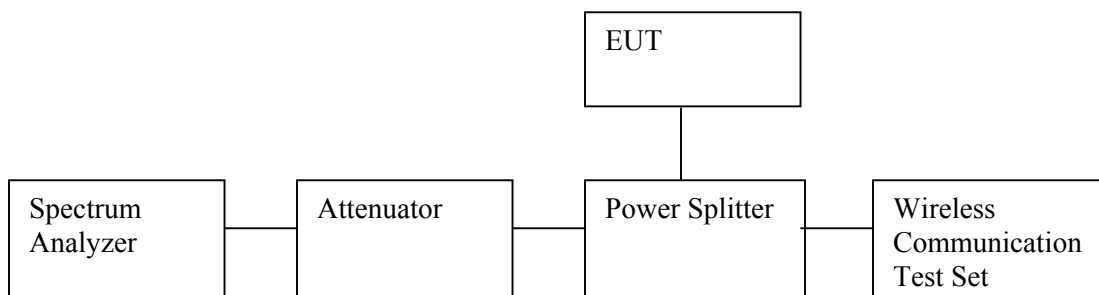
### I/O CABLES

| I/O CABLE LIST |      |                      |                |             |              |         |
|----------------|------|----------------------|----------------|-------------|--------------|---------|
| Cable No.      | Port | # of Identical Ports | Connector Type | Cable Type  | Cable Length | Remarks |
| 1              | AC   | 1                    | US 115V        | Un-shielded | 2m           | NA      |
| 2              | DC   | 1                    | DC             | Un-shielded | 0.5m         | NA      |

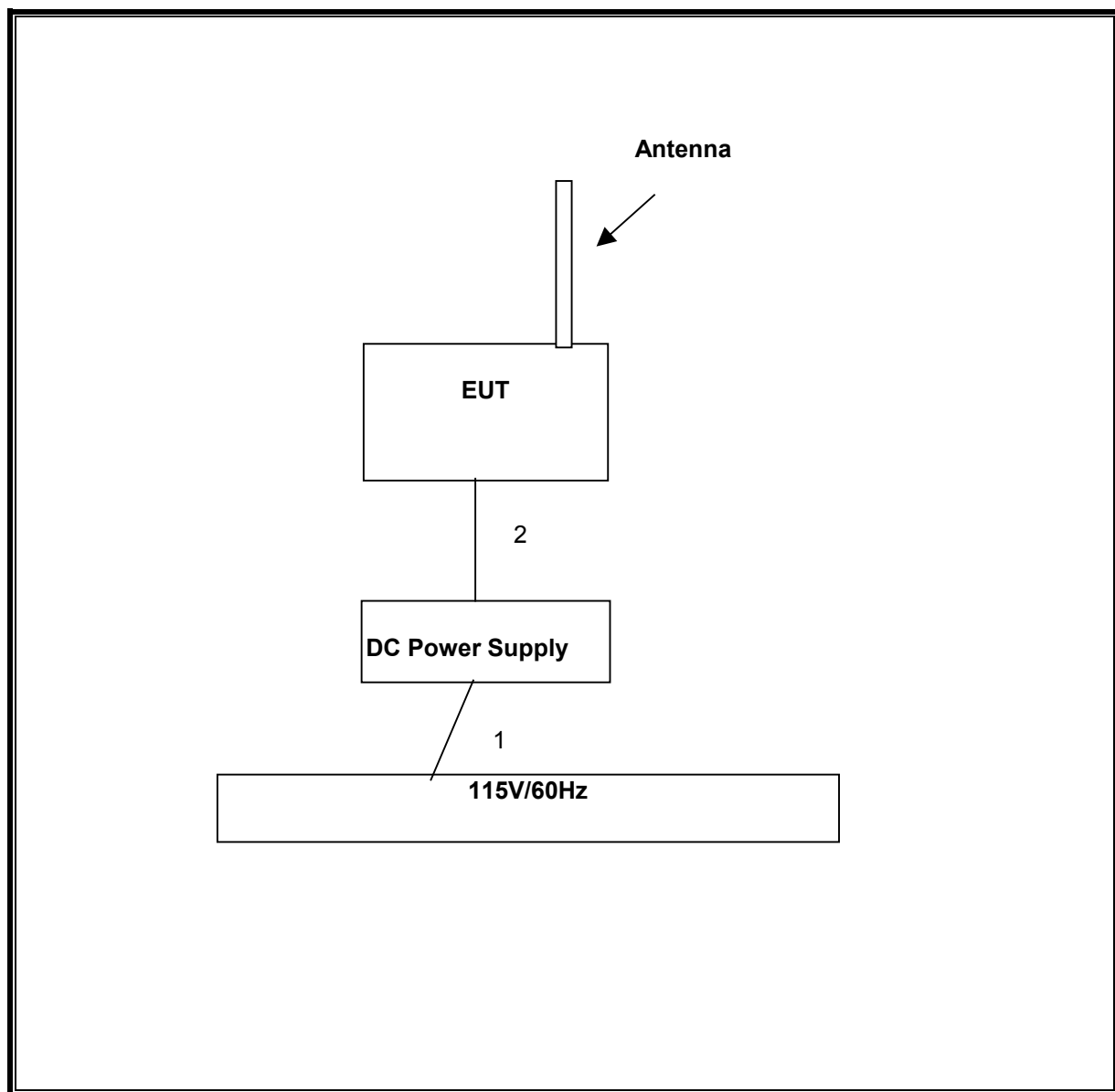
### TEST SETUP

The EUT is installed as a stand-alone device during the tests. The Wireless Communication test set exercised the EUT.

### CONDUCTED TEST SETUP DIAGRAM



**RADIATED TEST SETUP DIAGRAM**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST             |                |                    |               |            |
|---------------------------------|----------------|--------------------|---------------|------------|
| Description                     | Manufacture    | Model              | Serial Number | Cal Due    |
| SA Display Section 2            | HP             | 85662A             | 2816A16696    | 05/24/2005 |
| Quasi-Peak Adaptor              | HP             | 85650A             | 2811A01155    | 5/24/05    |
| SA RF Section, 1.5 GHz          | HP             | 85680B             | 2814A04227    | 2/22/05    |
| Preamplifier, 1300MHz           | HP             | 8447D              | 2944A06833    | 8/17/05    |
| 30MHz---- 2Ghz                  | Sunol Sciences | JB1 Antenna        | A121003       | 9/22/05    |
| Antenna, Horn 1 ~ 18 GHz        | EMCO           | 3117               | 29301         | 9/12/05    |
| Antenna, Horn 1 ~ 18 GHz        | EMCO           | 3115               | 6717          | 9/12/05    |
| Amplifier 1-26GHz               | MITEQ          | NSP2600-SP         | 924341        | 8/17/05    |
| Wireless Communication Test Set | Agilent        | 8960 Series10      | GB43344480    | 9/3/05     |
| Spectrum Analyzer, 26.5 GHz     | HP             | 8593EM             | 3710A00205    | 1/6/06     |
| Dipole                          | EMCO           | 3121C-DB2          | 22435         | 3/25/05    |
| Signal Generator 2 -40 GHz      | R & S          | SMP04              | DE 34210      | 5/2/05     |
| Signal Generator, 1024 MHz      | R & S          | SMY01              | DE 12311      | 4/11/06    |
| Peak Power Meter                | Agilent        | E4416A             | GB41291160    | 2/9/06     |
| Peak / Average Power Sensor     | Agilent        | E9327A             | US40440755    | 2/10/06    |
| DC Power Supply                 | Kenwood        | PA-36-3A           | N/A           | NCR        |
| Power Splitter                  | HP             | 11667B             | N/A           | N/A        |
| Notch Filter                    | K & L          | 3TNF-500/1000-N/N  | 469           | N/A        |
| Notch Filter                    | K & L          | 3TNF-1000/2000-N/N | 517           | N/A        |

## 7. LIMITS AND RESULTS

### 7.1. OCCUPIED BANDWIDTH

#### LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the -26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal -26 dB bandwidth function is utilized.

#### RESULTS

No non-compliance noted:

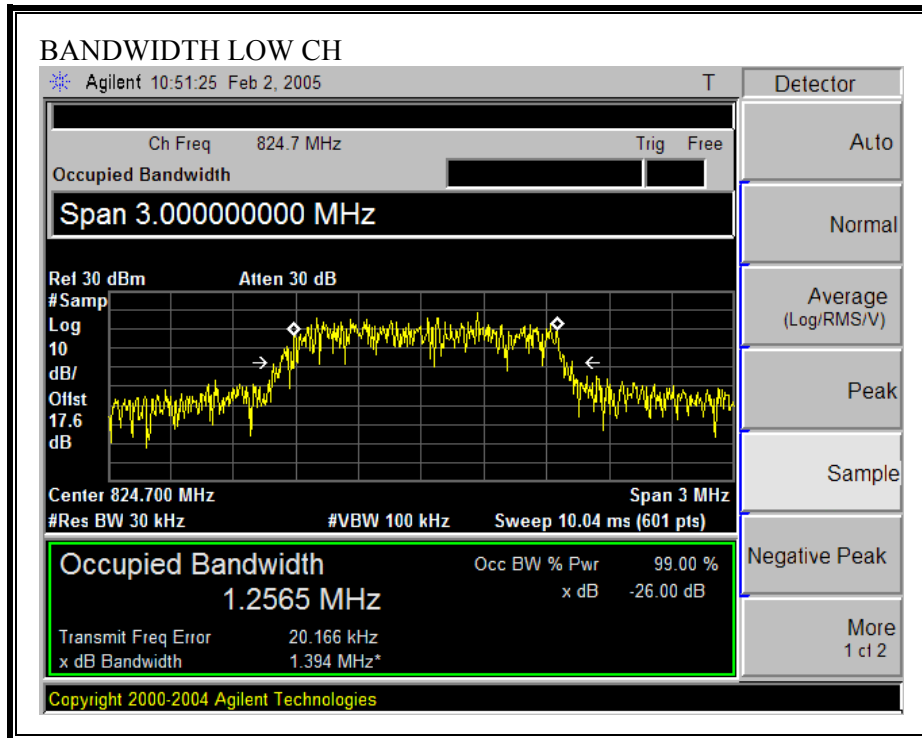
##### 800MHZ CELL CDMA Modulation

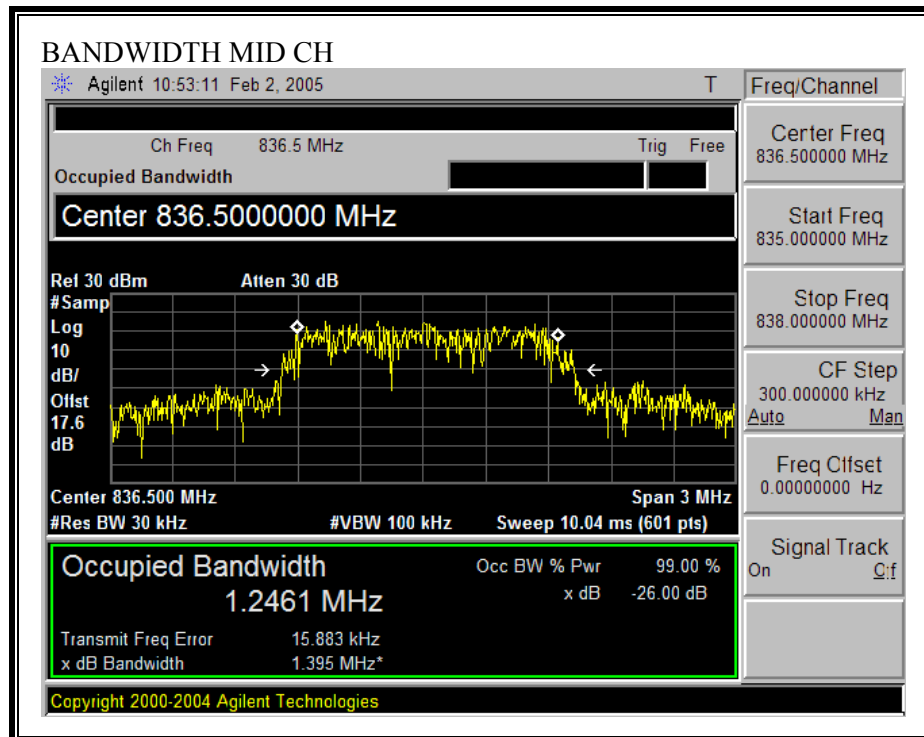
| Channel | Frequency<br>(MHz) | Bandwidth<br>(MHz) |
|---------|--------------------|--------------------|
| Low     | 824.7              | 1.394              |
| Middle  | 836.5              | 1.395              |
| High    | 848.3              | 1.396              |

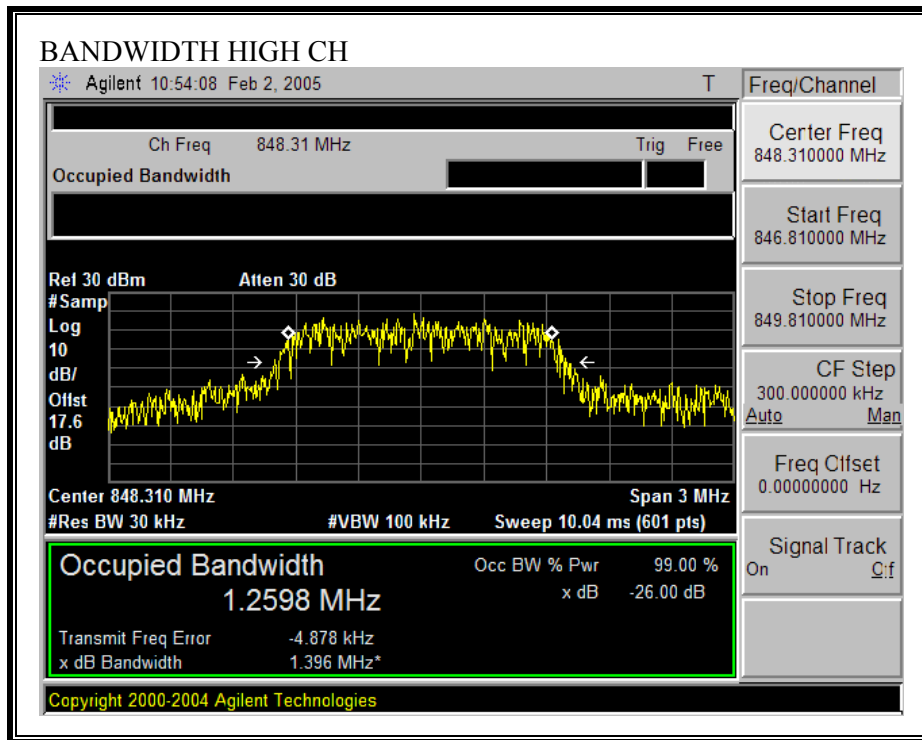
##### 1900MHz PCS Modulation

| Channel | Frequency<br>(MHz) | Bandwidth<br>(MHz) |
|---------|--------------------|--------------------|
| Low     | 1851.25            | 1.427              |
| Middle  | 1880               | 1.406              |
| High    | 1908.75            | 1.433              |

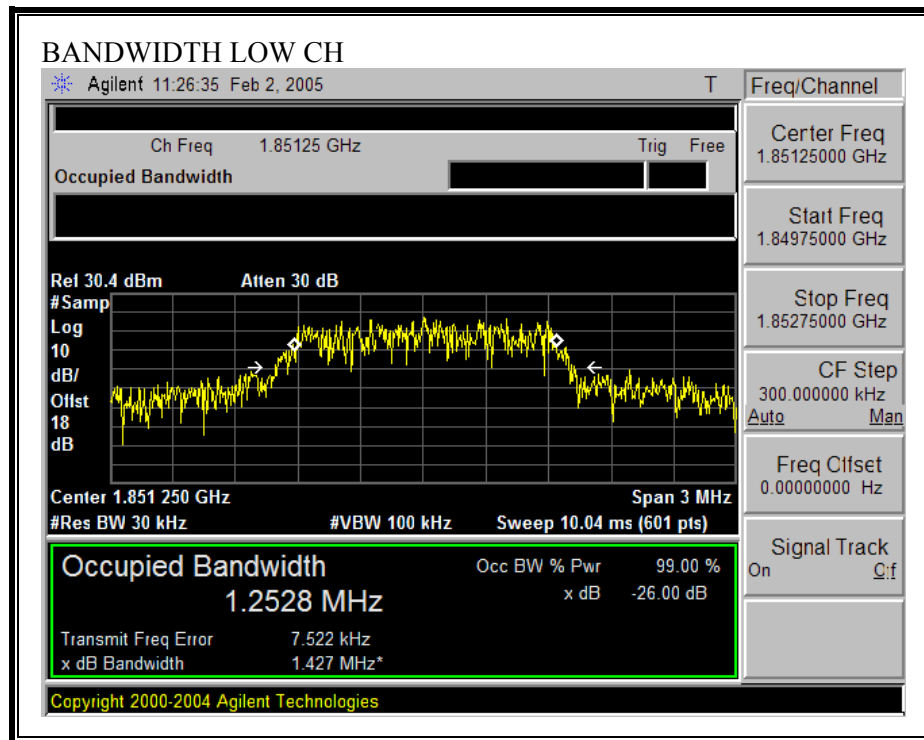
**800MHz CELL CDMA 26 dB BANDWIDTH**

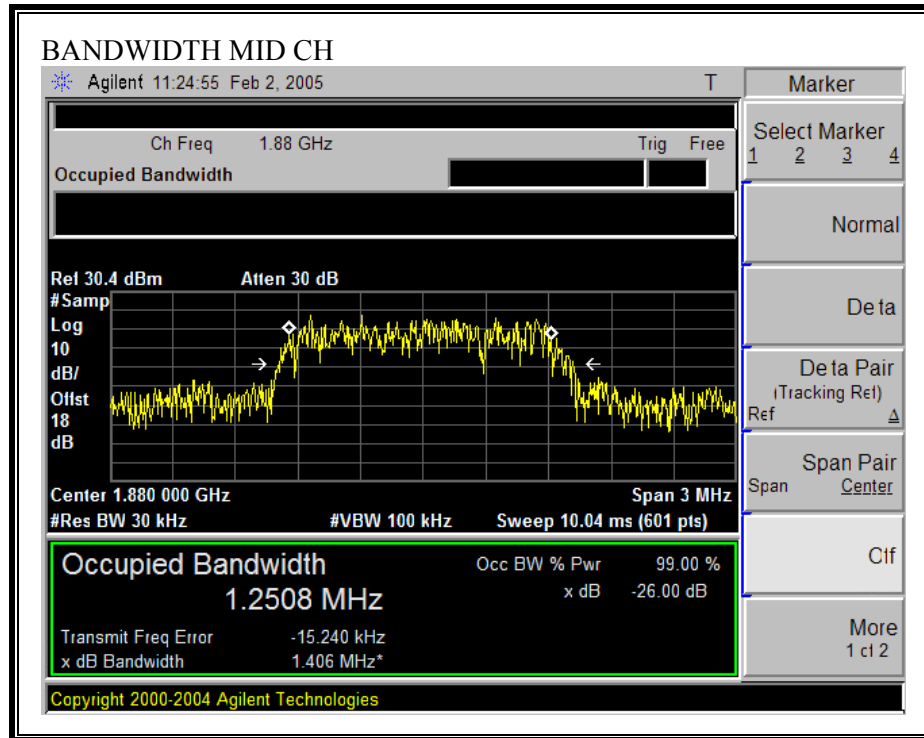


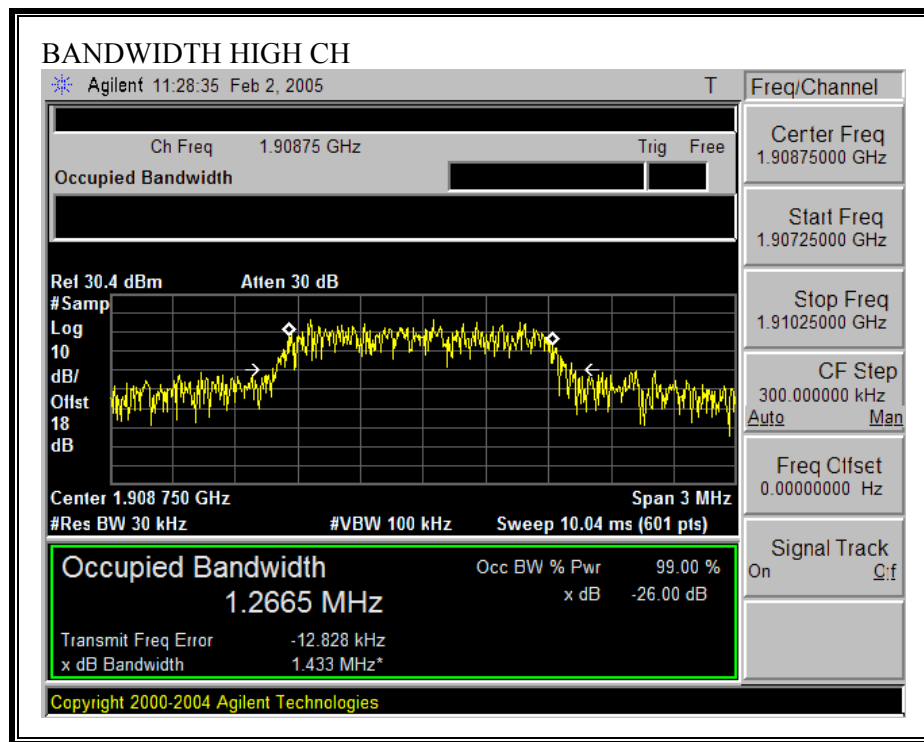




**1900MHz PCS CDMA 26 dB BANDWIDTH**







## 7.2. RF POWER OUTPUT

### LIMIT

22.913(a) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.  
24.232(b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

### TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.2.17

### RESULTS

No non-compliance noted.

#### 800MHZ CELL CDMA Modulation

| Channel | Frequency<br>(MHz) | Conducted<br>Peak Power<br>(dBm) | Conducted<br>Peak Power<br>(mW) |
|---------|--------------------|----------------------------------|---------------------------------|
| Low     | 824.7              | 28.99                            | 792.50                          |
| Middle  | 836.5              | 28.79                            | 756.83                          |
| High    | 848.3              | 28.90                            | 776.25                          |

#### 1900MHz PCS Modulation

| Channel | Frequency<br>(MHz) | Conducted<br>Peak Power<br>(dBm) | Conducted<br>Peak Power<br>(mW) |
|---------|--------------------|----------------------------------|---------------------------------|
| Low     | 1851.25            | 28.31                            | 677.64                          |
| Middle  | 1880               | 28.60                            | 724.44                          |
| High    | 1908.75            | 27.15                            | 518.80                          |

NOTE: RBW=VBW=3MHz.

**CDMA Output Power (ERP)**

| f<br>MHz       | SA reading<br>(dBuV/m) | Ant. Pol.<br>(H/V) | SG reading<br>(dBm) | CL<br>(dB) | Gain<br>(dBd) | ERP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Notes |
|----------------|------------------------|--------------------|---------------------|------------|---------------|--------------|----------------|----------------|-------|
| <b>Low Ch</b>  |                        |                    |                     |            |               |              |                |                |       |
| 824.70         | 101.2                  | V                  | 25.5                | 0.8        | 0.0           | 24.7         | 38.5           | -13.8          |       |
| 824.70         | 101.5                  | H                  | 26.6                | 0.8        | 0.0           | 25.8         | 38.5           | -12.7          |       |
| <b>Mid Ch</b>  |                        |                    |                     |            |               |              |                |                |       |
| 836.50         | 101.8                  | V                  | 26.9                | 0.8        | 0.0           | 26.1         | 38.5           | -12.4          |       |
| 836.50         | 100.0                  | H                  | 24.8                | 0.8        | 0.0           | 24.0         | 38.5           | -14.5          |       |
| <b>High Ch</b> |                        |                    |                     |            |               |              |                |                |       |
| 848.30         | 102.0                  | V                  | 27.6                | 0.8        | 0.0           | 26.8         | 38.5           | -11.7          |       |
| 848.30         | 99.6                   | H                  | 24.7                | 0.8        | 0.0           | 23.9         | 38.5           | -14.6          |       |
|                |                        |                    |                     |            |               |              |                |                |       |
|                |                        |                    |                     |            |               |              |                |                |       |

NOTE: EUT tested at worst antenna position with 0dBi reference dipole antenna, RBW=VBW=3MHz

**PCS Output Power (EIRP)**

| f<br>GHz | SA reading<br>(dBuV/m) | Ant. Pol.<br>(H/V) | SG reading<br>(dBm) | CL<br>(dB) | Gain<br>(dBi) | Gain<br>(dBd) | EIRP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Notes |
|----------|------------------------|--------------------|---------------------|------------|---------------|---------------|---------------|----------------|----------------|-------|
| Low Ch   |                        |                    |                     |            |               |               |               |                |                |       |
| 1.851    | 95.8                   | V                  | 22.7                | 1.4        | 4.1           | 2.0           | 25.5          | 33.0           | -7.5           |       |
| 1.851    | 97.0                   | H                  | 24.0                | 1.4        | 4.1           | 2.0           | 26.8          | 33.0           | -6.2           |       |
| Mid Ch   |                        |                    |                     |            |               |               |               |                |                |       |
| 1.880    | 96.2                   | V                  | 24.6                | 1.4        | 4.1           | 1.9           | 27.3          | 33.0           | -5.7           |       |
| 1.880    | 98.5                   | H                  | 26.5                | 1.4        | 4.1           | 1.9           | 29.3          | 33.0           | -3.7           |       |
| High Ch  |                        |                    |                     |            |               |               |               |                |                |       |
| 1.909    | 95.2                   | V                  | 24.2                | 1.4        | 4.0           | 1.9           | 26.9          | 33.0           | -6.1           |       |
| 1.909    | 97.3                   | H                  | 25.1                | 1.4        | 4.0           | 1.9           | 27.7          | 33.0           | -5.3           |       |
|          |                        |                    |                     |            |               |               |               |                |                |       |
|          |                        |                    |                     |            |               |               |               |                |                |       |
|          |                        |                    |                     |            |               |               |               |                |                |       |

NOTE: EUT tested at worst antenna position with 0dBi reference dipole antenna, RBW=VBW=3MHz

### **7.3. SPURIOUS EMISSION AT ANTENNA TERMINAL**

#### **LIMIT**

§22.917 (e) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

#### **TEST PROCEDURE**

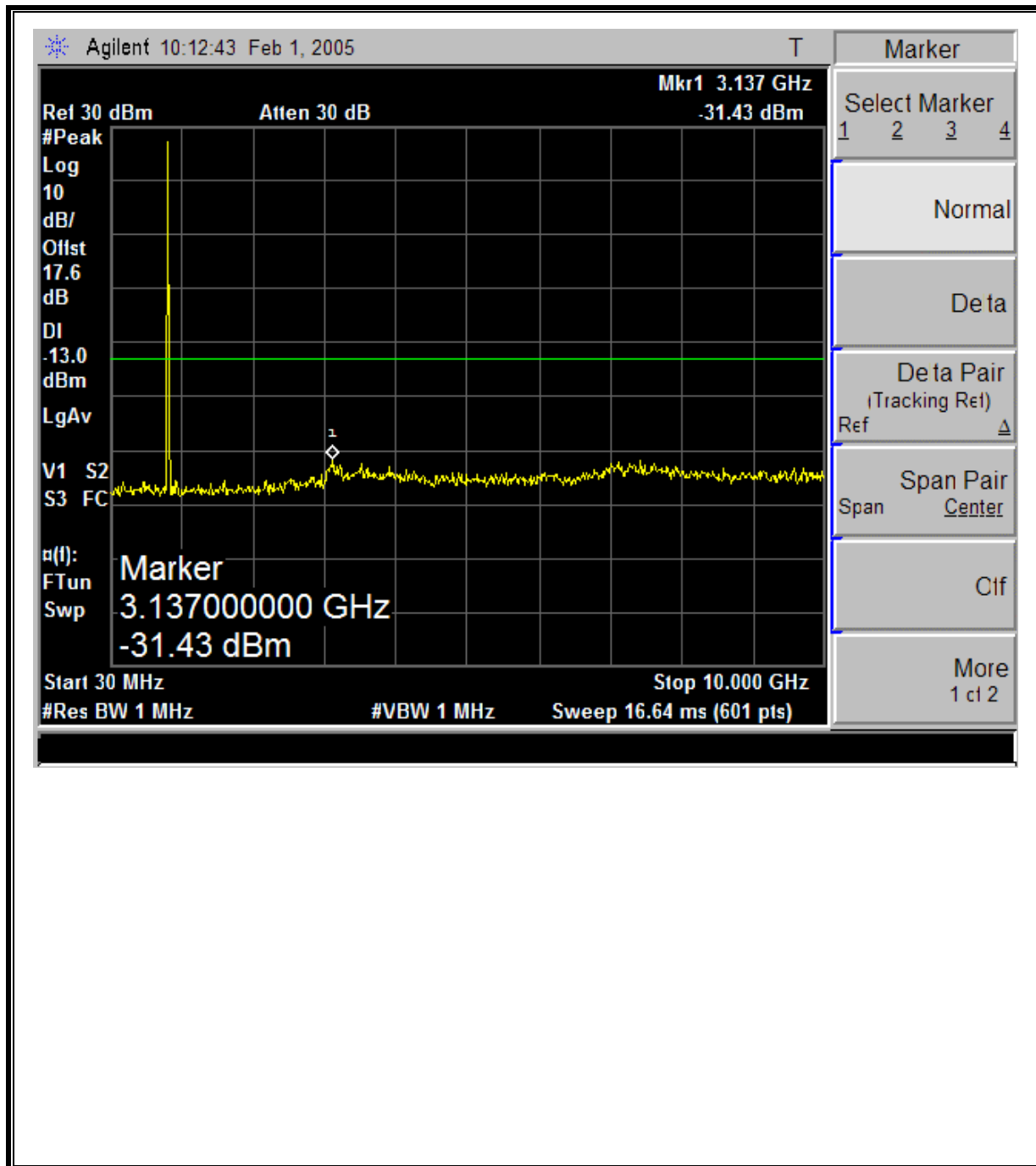
ANSI / TIA / EIA 603 Clause 3.2.12, FCC 22.917 (h), & FCC 24.238 (b)

#### **RESULTS**

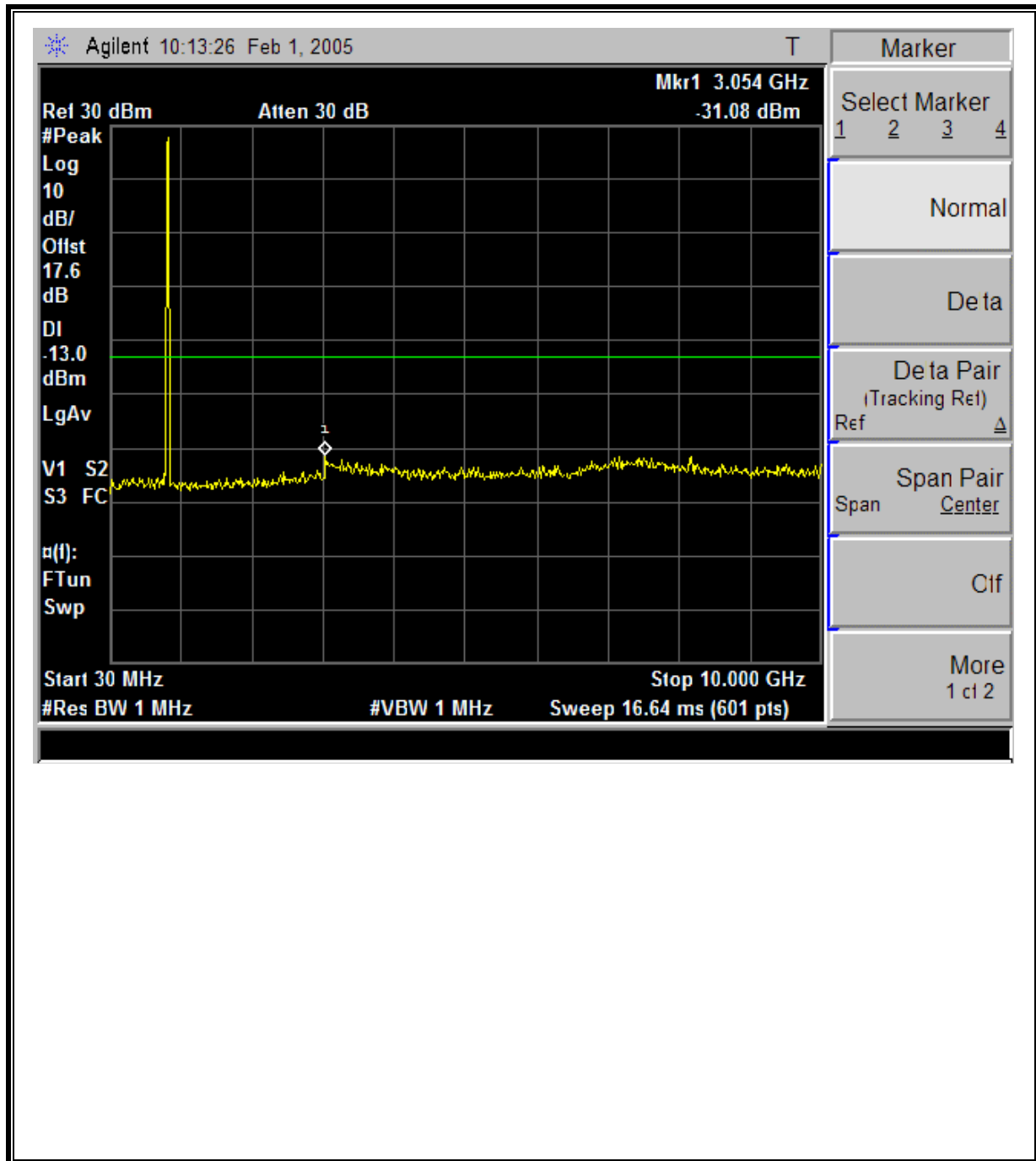
No non-compliance noted.

## 800MHz CELL CDMA MODULATION RESULTS

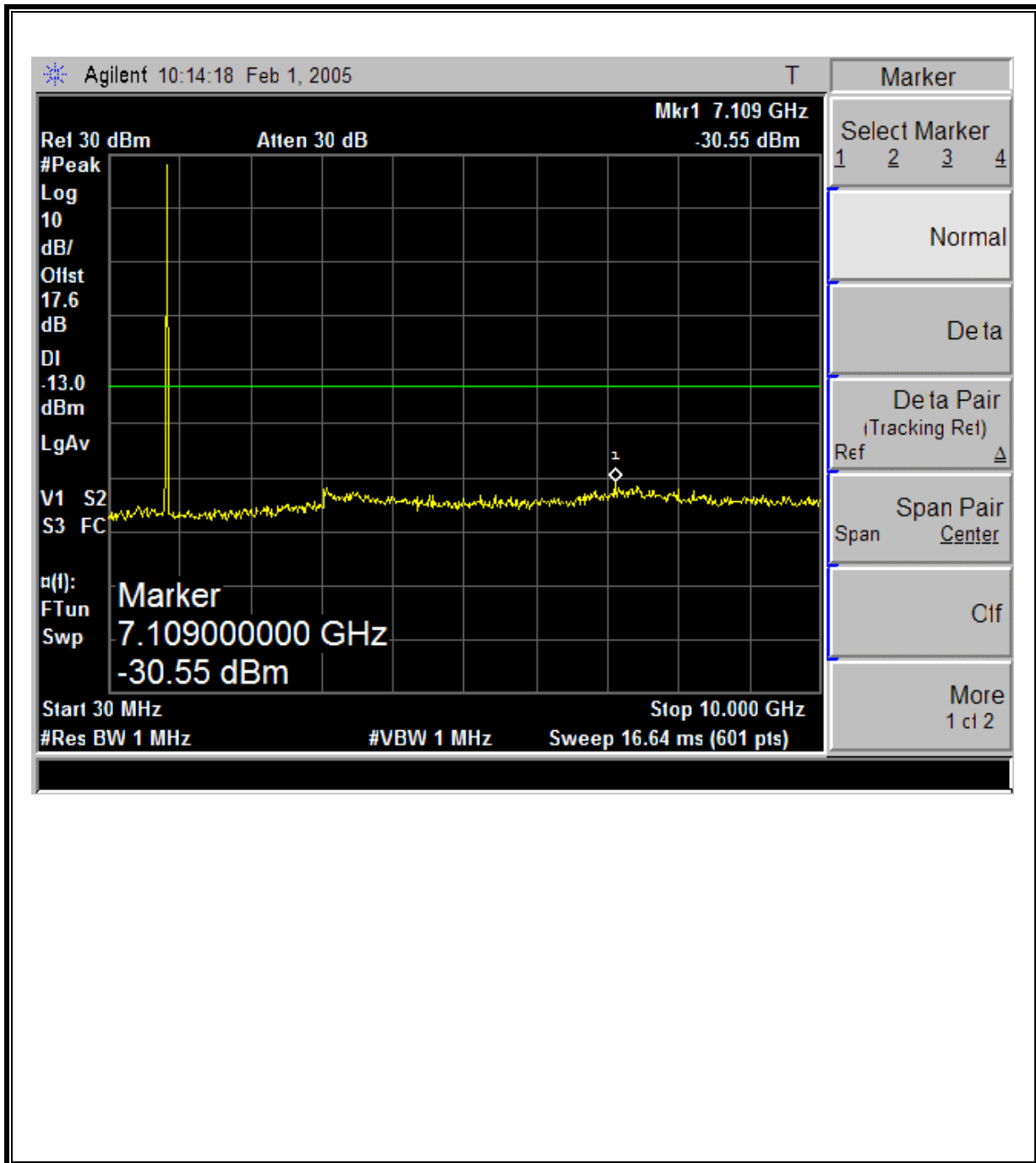
### CDMA Modulation: Low Channel, Out-Of-Band Emissions



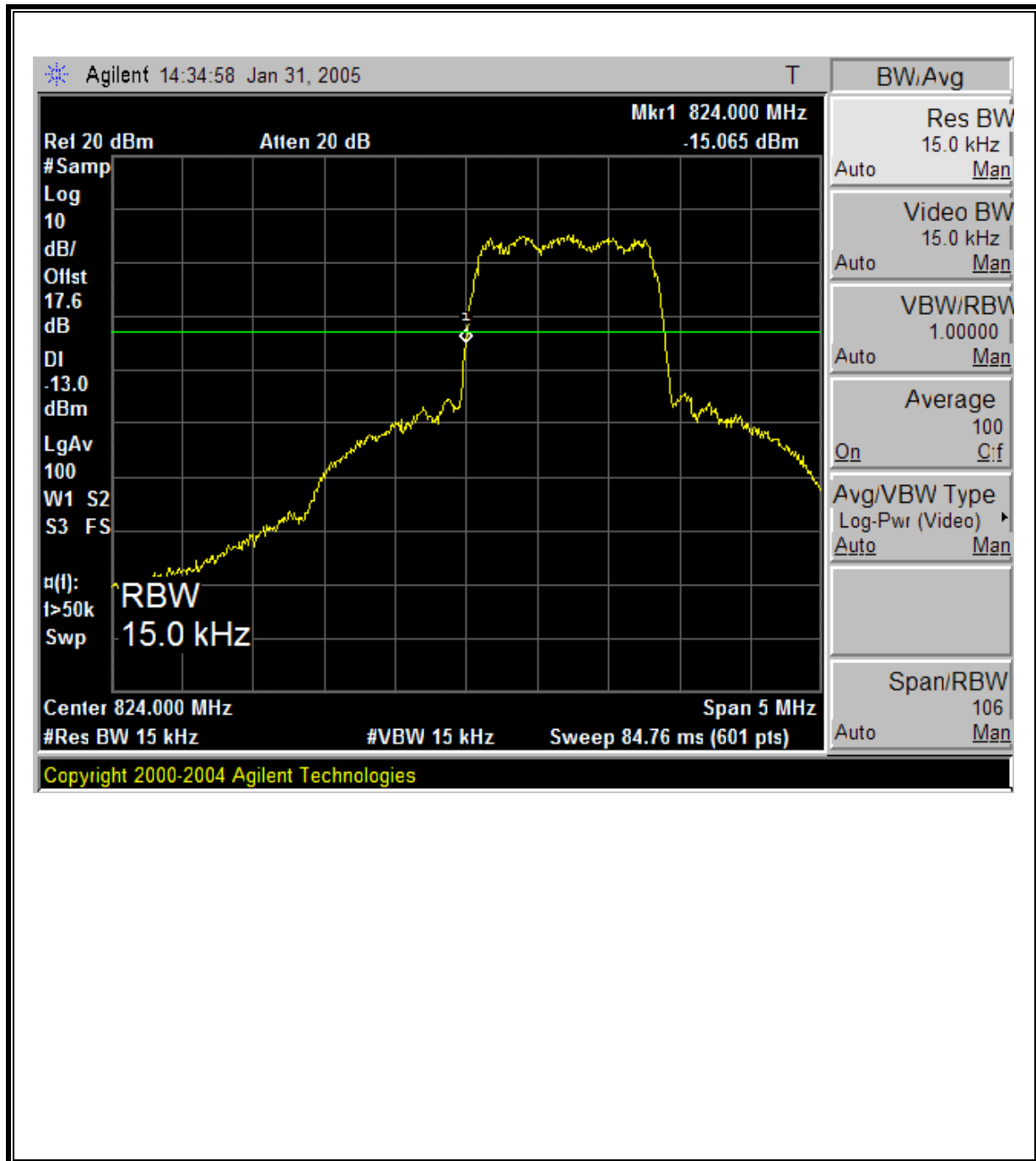
**CDMA Modulation: Mid Channel, Out-Of-Band Emissions**



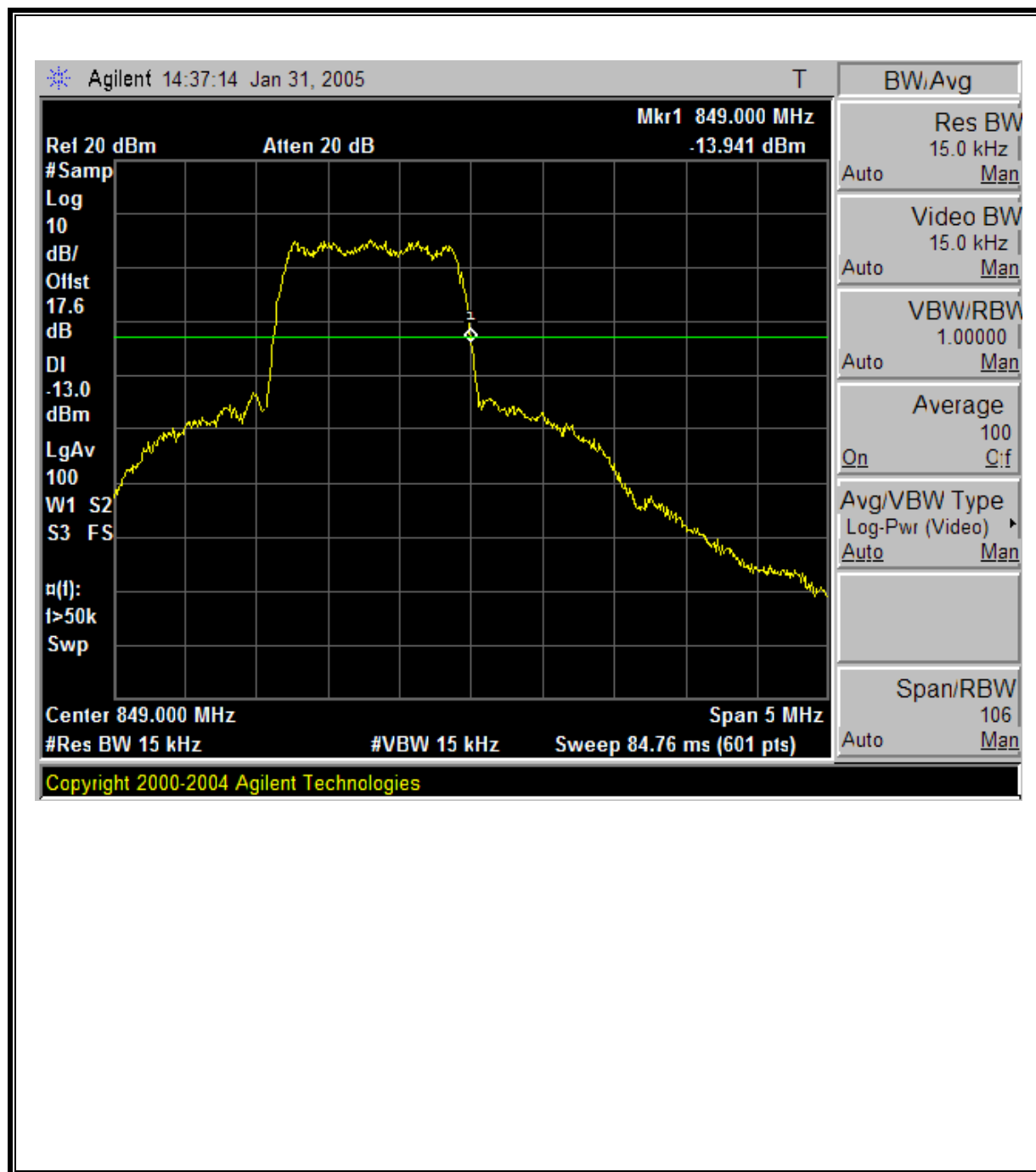
**CDMA Modulation: High Channel, Out-Of-Band Emissions**



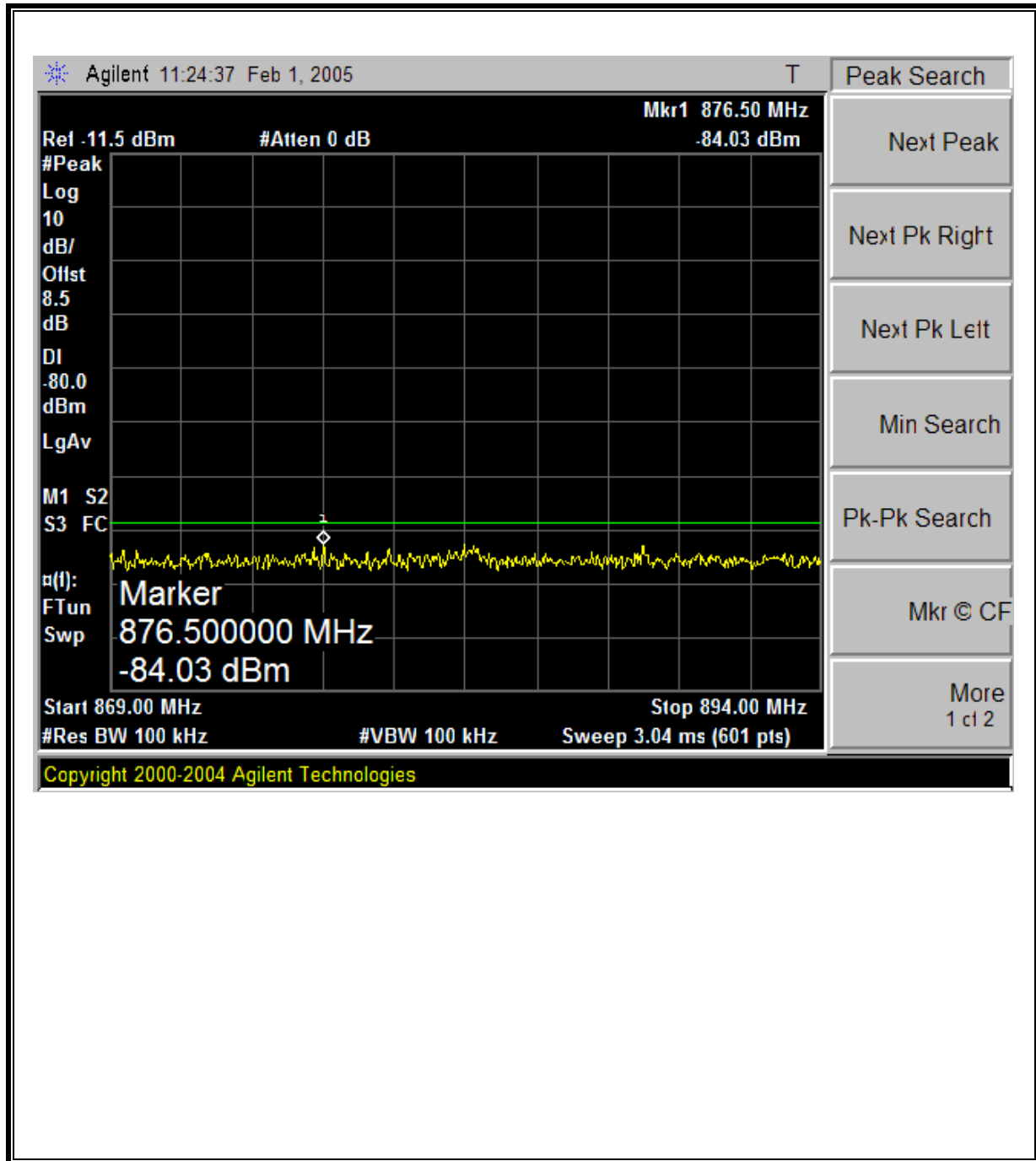
**800MHz CELL CDMA Modulation: Low Channel Band Edge**



**800MHZ CELL CDMA Modulation: High Channel Band Edge**

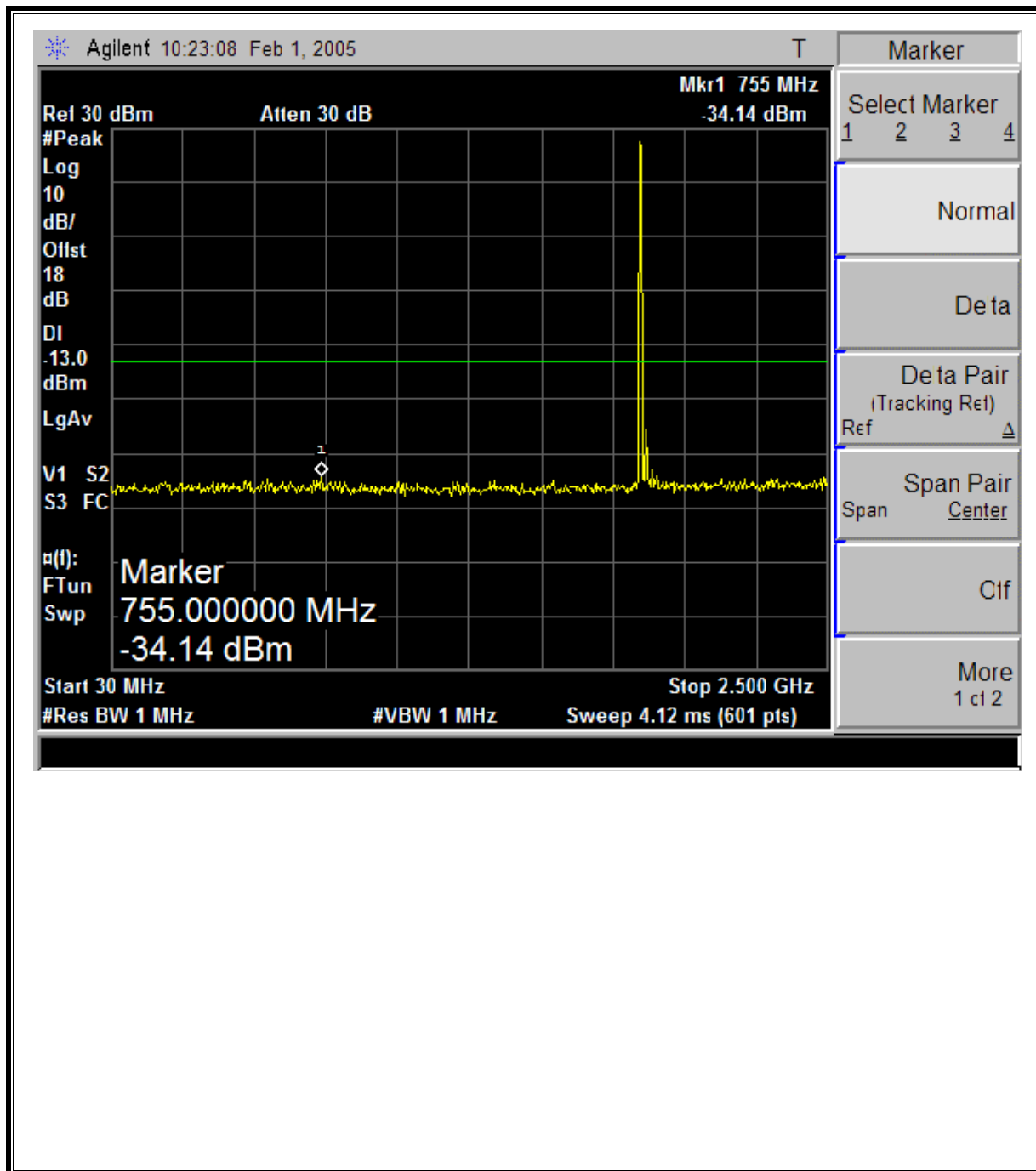


**800MHZ CELL CDMA Mobile Emissions in Base Frequency Range**



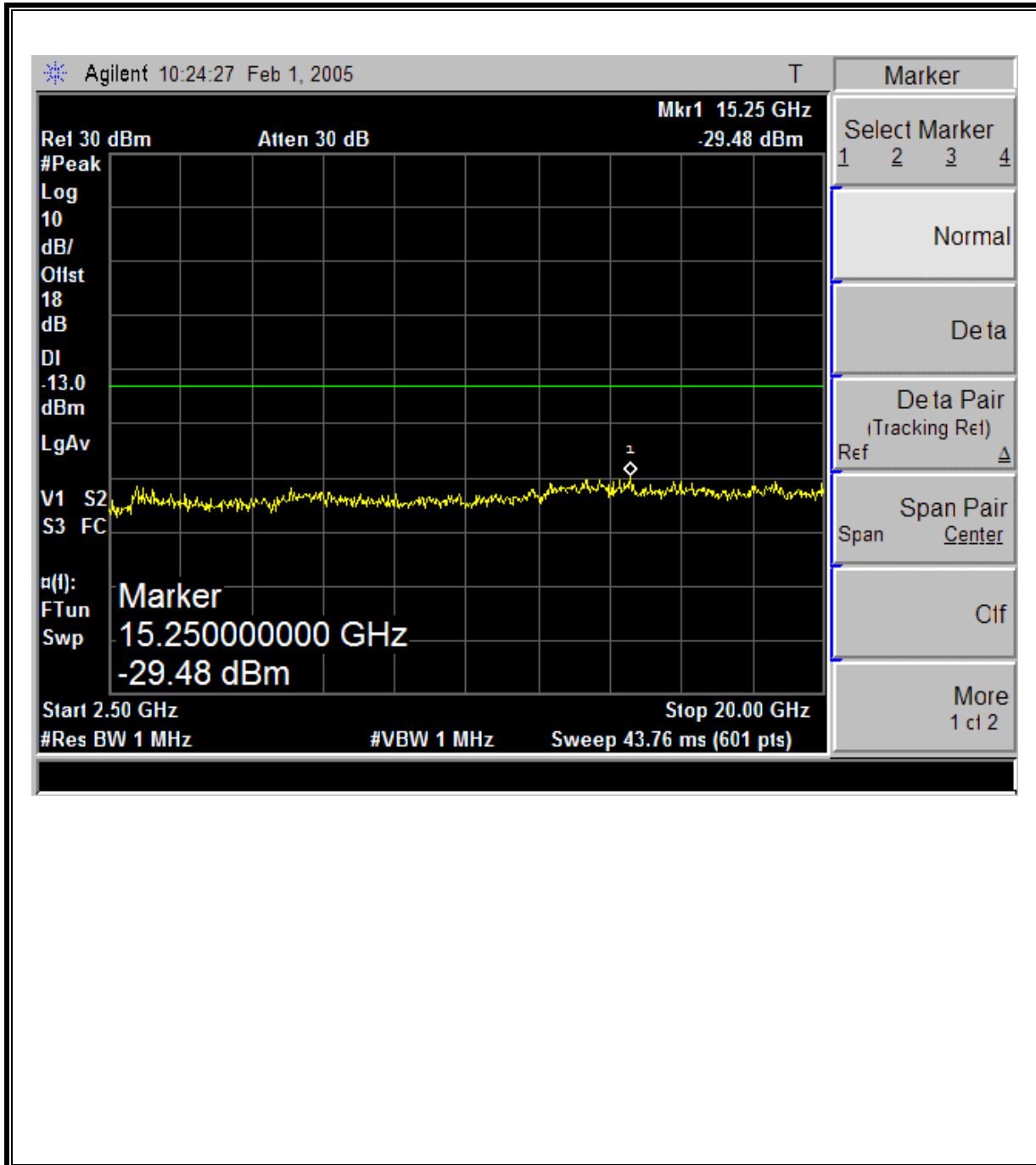
## 1900MHZ PCS CDMA MODULATION RESULTS

### PCS CDMA Modulation: Low Channel Out-Of-Band Emissions

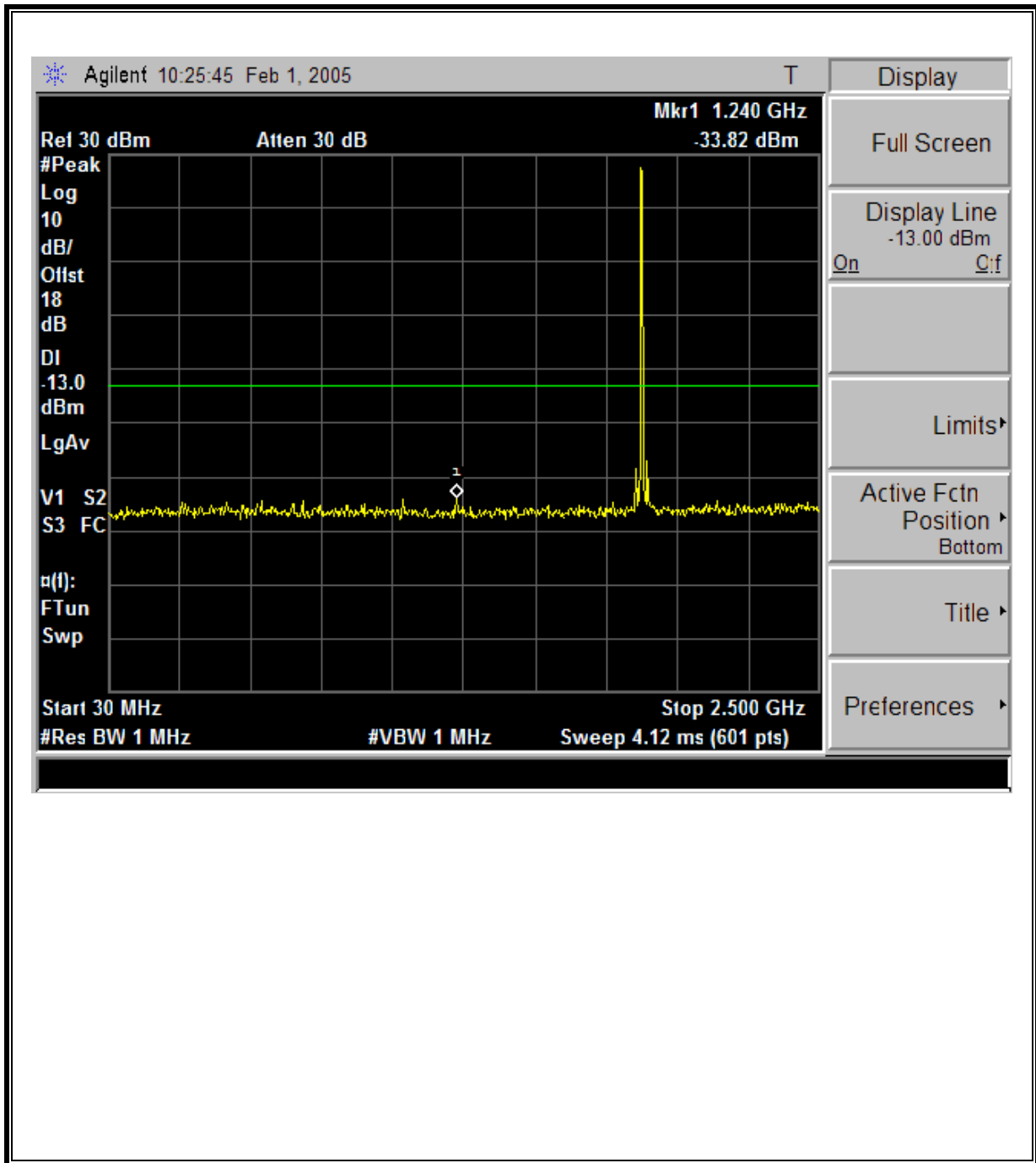


## 1900MHZ PCS CDMA MODULATION RESULTS

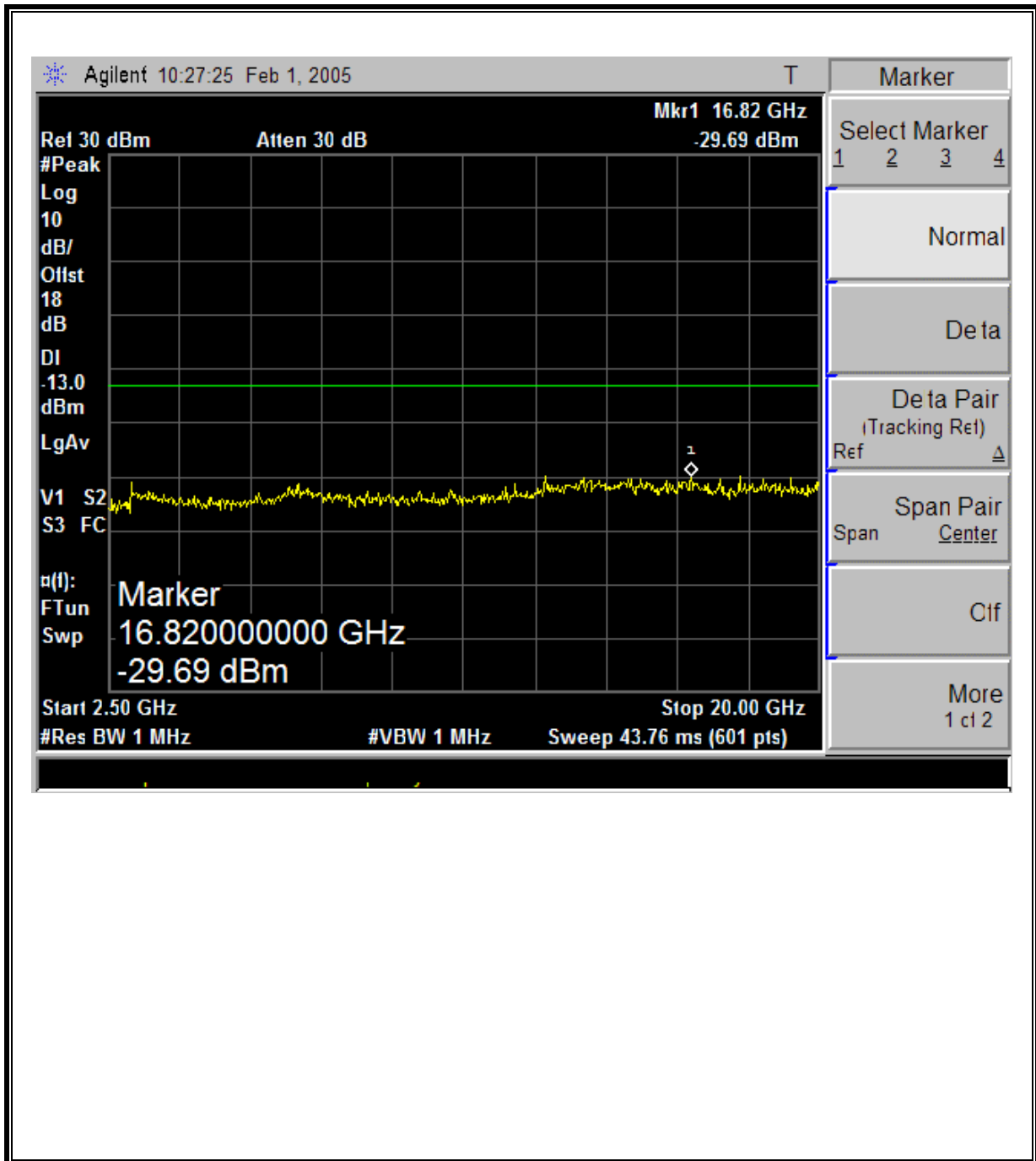
### PCS CDMA Modulation: Low Channel Out-Of-Band Emissions



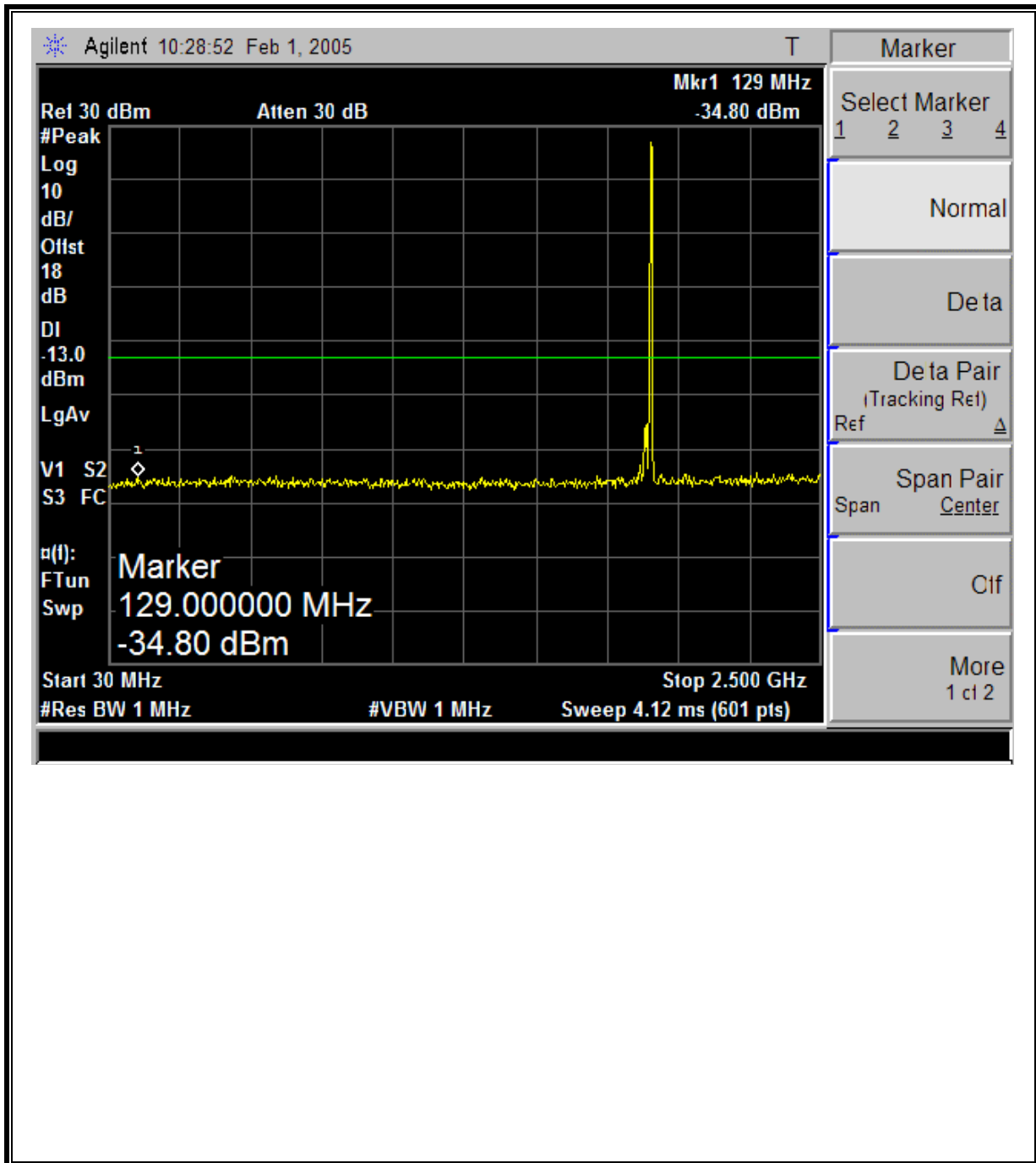
**PCS CDMA Modulation: Mid Channel Out-Of-Band Emissions**



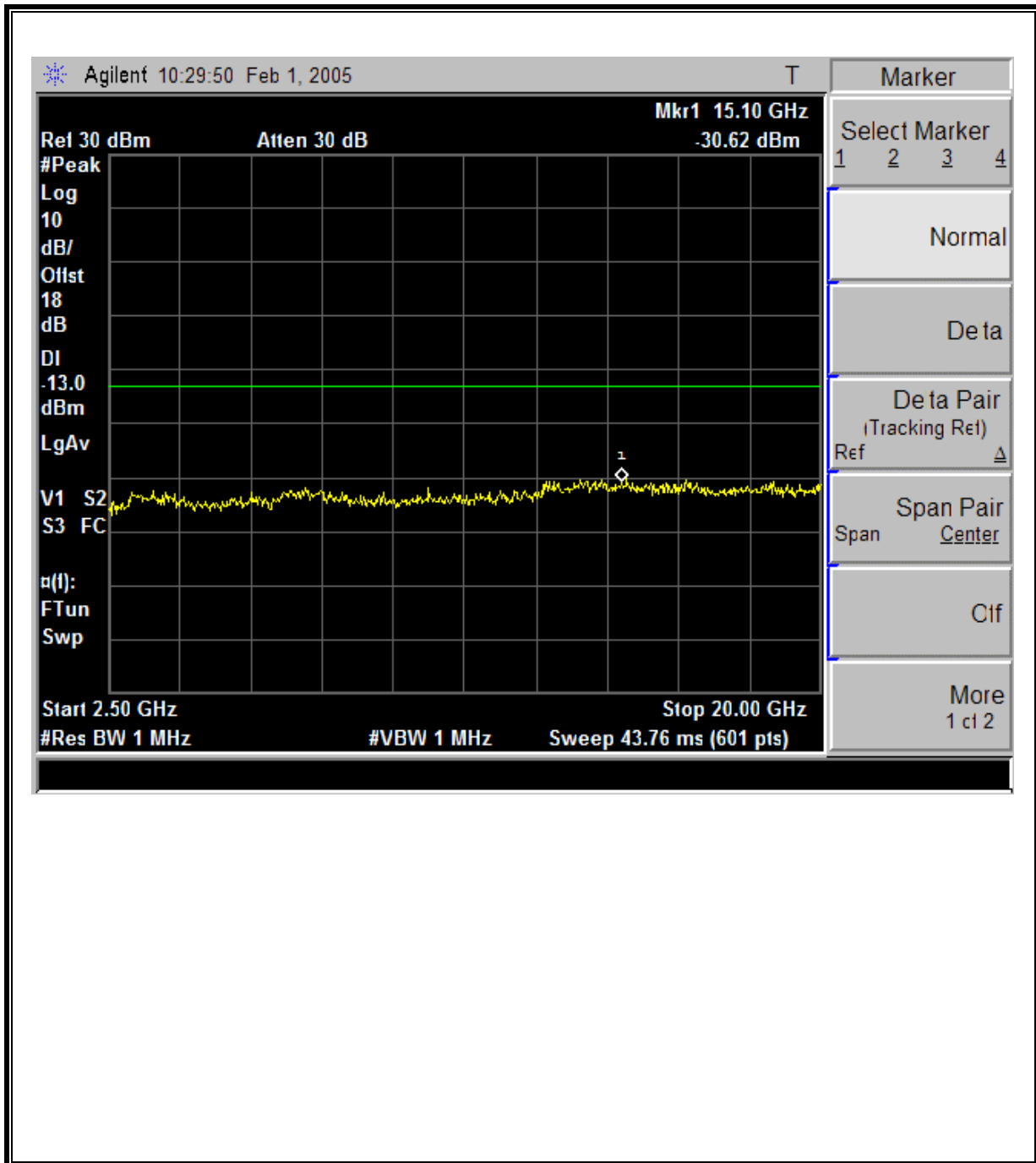
**PCS CDMA Modulation: Mid Channel Out-Of-Band Emissions**



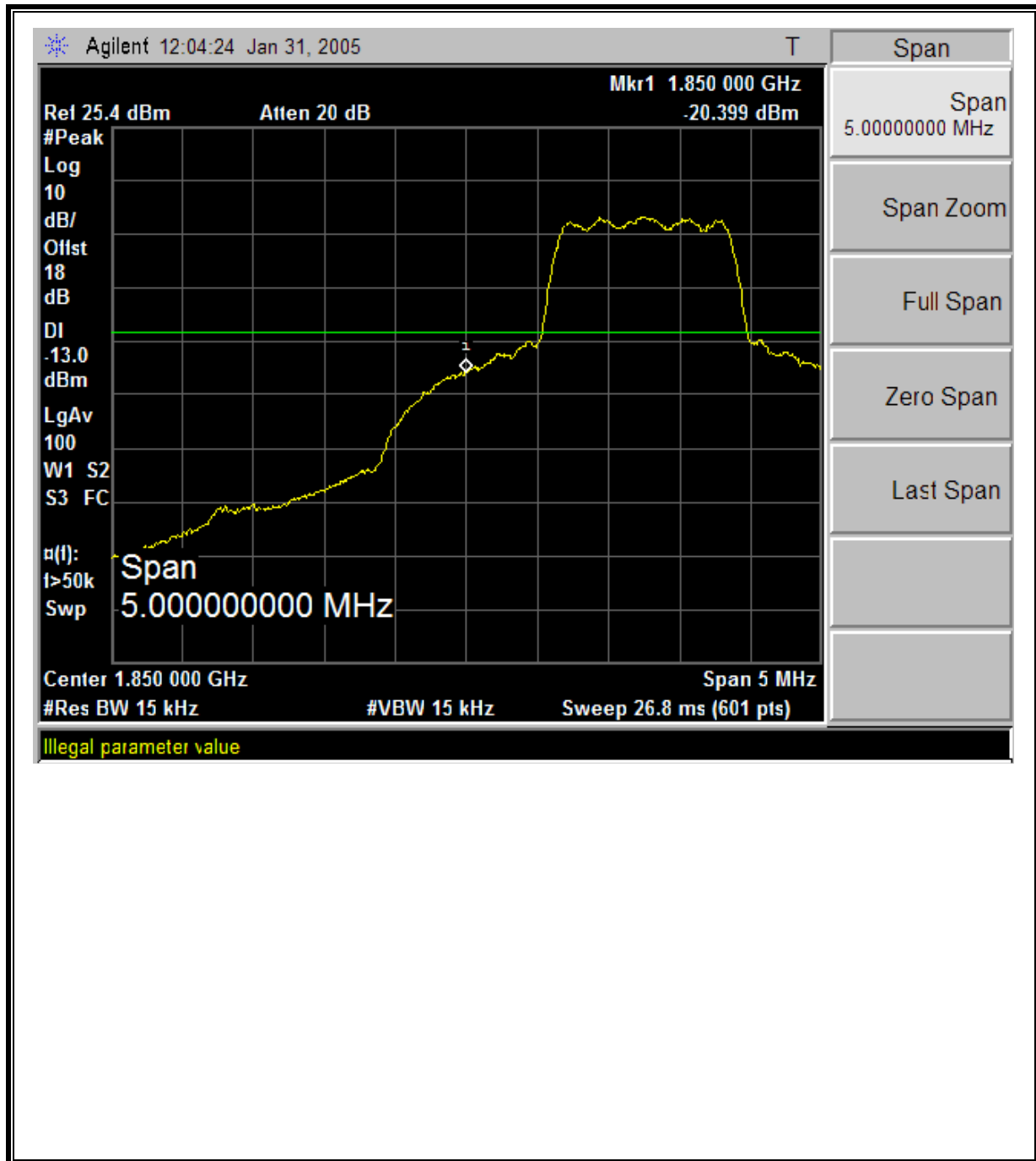
**PCS CDMA Modulation: High Channel Out-Of-Band Emissions**



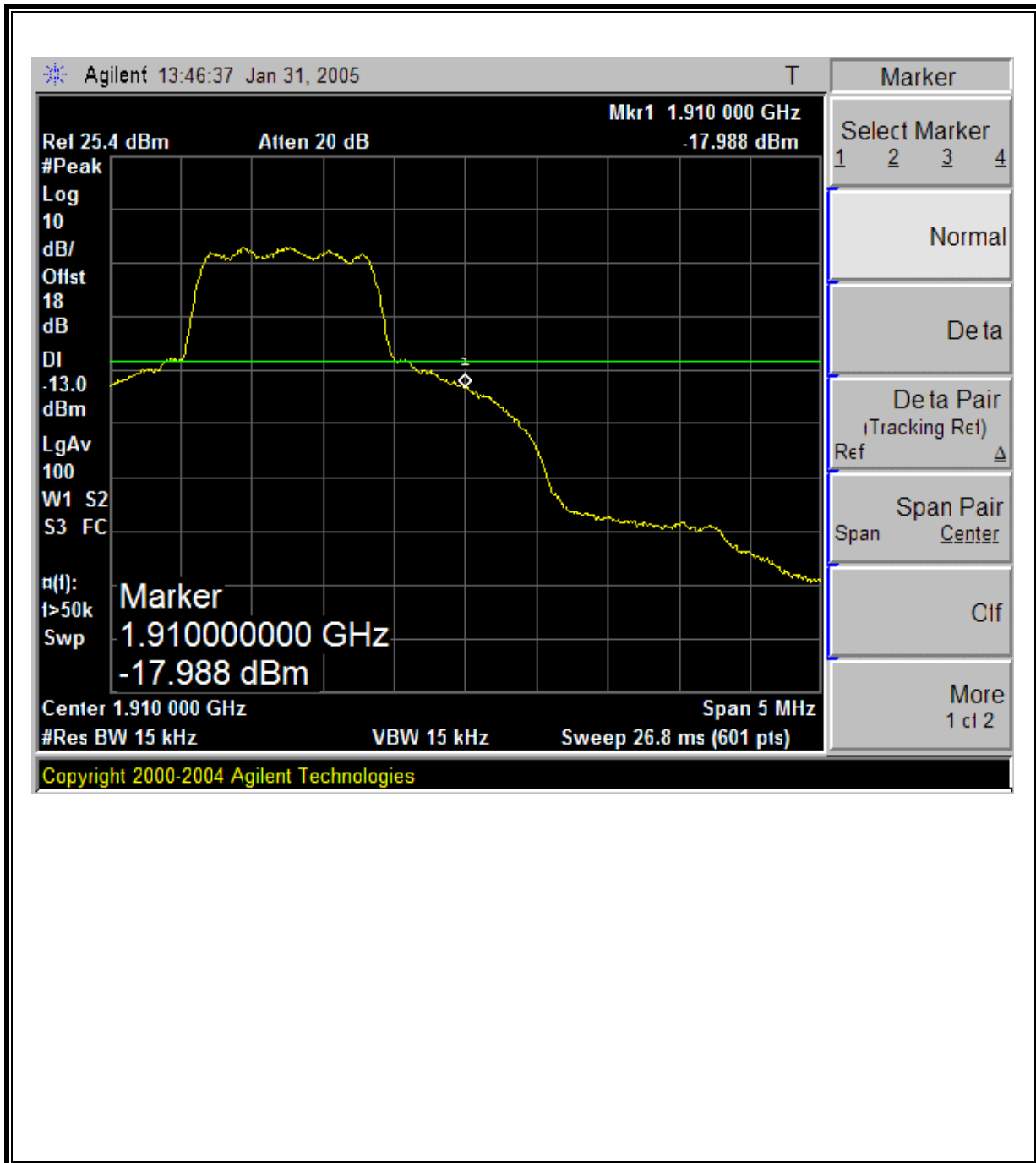
**PCS CDMA Modulation: High Channel Out-Of-Band Emissions**



**PCS CDMA Modulation: Low Channel Band Edge**



**PCS CDMA Modulation: High Channel Band Edge**



## **7.4. FIELD STRENGTH OF SPURIOUS EMISSION**

### **LIMIT**

§22.917 (e) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

### **TEST PROCEDURE**

ANSI / TIA / EIA 603 Clause 3.2.12, FCC 22.917 (h), & FCC 24.238 (b)

### **RESULTS**

No non-compliance noted.

**800MHz Band CDMA Spurious & Harmonic (ERP), 30-1000MHz**

| 02/02/05 <b>High Frequency Measurement</b>                     |                        |                    |                     |                    |               |               |              |                |                |       |
|----------------------------------------------------------------|------------------------|--------------------|---------------------|--------------------|---------------|---------------|--------------|----------------|----------------|-------|
| Compliance Certification Services, Morgan Hill Open Field Site |                        |                    |                     |                    |               |               |              |                |                |       |
| Test Engr:Chin Pang                                            |                        |                    |                     |                    |               |               |              |                |                |       |
| Project #:04U3076-2                                            |                        |                    |                     |                    |               |               |              |                |                |       |
| Company:Sierra Wireless                                        |                        |                    |                     |                    |               |               |              |                |                |       |
| EUT Descrip.:Dual Band with diversity 800/1900MHz CDMA Module  |                        |                    |                     |                    |               |               |              |                |                |       |
| EUT M/N:EM5625D                                                |                        |                    |                     |                    |               |               |              |                |                |       |
| Test Target: FCC 22 / RSS-129                                  |                        |                    |                     |                    |               |               |              |                |                |       |
| Mode Oper:800MHz Band, TX Mode                                 |                        |                    |                     |                    |               |               |              |                |                |       |
| Test Equipment:                                                |                        |                    |                     |                    |               |               |              |                |                |       |
| Bilog Antenna                                                  |                        | Cable              |                     | Pre-amplifer 8447D |               | Limit         |              |                |                |       |
| 5m Chamber Sunol Bilog                                         |                        | 5m Chamber Cable   |                     | TS 8447D           |               | ERP           |              |                |                |       |
| f<br>MHz                                                       | SA reading<br>(dBuV/m) | Ant. Pol.<br>(H/V) | SG reading<br>(dBm) | CL<br>(dB)         | Gain<br>(dBi) | Gain<br>(dBd) | ERP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Notes |
| 80.00                                                          | 66.8                   | H                  | -47.9               | 1.2                | -0.5          | -2.7          | -51.8        | -13.0          | -38.8          |       |
| 229.00                                                         | 66.4                   | H                  | -43.5               | 1.9                | 5.9           | 3.7           | -41.6        | -13.0          | -28.6          |       |
| 305.70                                                         | 53.0                   | H                  | -53.2               | 2.1                | 6.0           | 3.9           | -51.5        | -13.0          | -38.5          |       |
| 647.00                                                         | 55.0                   | H                  | -47.0               | 3.0                | 6.8           | 4.7           | -45.3        | -13.0          | -32.3          |       |
| 82.70                                                          | 56.0                   | V                  | -55.4               | 1.2                | -0.5          | -2.6          | -59.2        | -13.0          | -46.2          |       |
| 229.20                                                         | 63.6                   | V                  | -46.2               | 1.9                | 5.9           | 3.8           | -44.4        | -13.0          | -31.4          |       |
| 306.40                                                         | 65.0                   | V                  | -42.1               | 2.1                | 6.0           | 3.9           | -40.4        | -13.0          | -27.4          |       |
| 817.34                                                         | 50.8                   | V                  | -41.4               | 3.4                | 6.7           | 4.6           | -40.3        | -13.0          | -27.3          |       |
| 881.00                                                         | 49.9                   | V                  | -47.5               | 3.6                | 6.7           | 4.6           | -46.5        | -13.0          | -33.5          |       |

**800MHz Band CDMA Spurious & Harmonic (ERP)**

01/31/05 High Frequency Substitution Measurement  
Compliance Certification Services, Morgan Hill 5m Chamber Site

Test Engr: Chin Pang  
Project #:04U3076-1  
Company:Sierra Wireless  
EUT Descrip.:Dual Band with diversity 800/1900MHz CDMA Module  
EUT M/N:EM5625D  
Test Target:FCC Part 22  
Mode Oper:Tx, 800MHz Band

Test Equipment:

|                                                                                                                                                                                       |              |                        |                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------|------------------------------------------------------|
| EMCO Horn 1-18GHz<br>T73; S/N: 6717 @3m                                                                                                                                               | Horn > 18GHz | Limit<br>FCC 22        | <input checked="" type="checkbox"/> High Pass Filter |
| Hi Frequency Cables<br><input type="checkbox"/> (2 ft) <input checked="" type="checkbox"/> (2 ~ 3 ft) <input type="checkbox"/> (4 ~ 6 ft) <input checked="" type="checkbox"/> (12 ft) |              |                        |                                                      |
| Pre-amplifier 1-26GHz<br>T86 Miteq 924341                                                                                                                                             |              | Pre-amplifier 26-40GHz |                                                      |

| f<br>GHz                                                             | SA reading<br>(dBuV/m) | Ant. Pol.<br>(H/V) | SG reading<br>(dBm) | CL<br>(dB) | Gain<br>(dBi) | Gain<br>(dBd) | ERP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Notes |
|----------------------------------------------------------------------|------------------------|--------------------|---------------------|------------|---------------|---------------|--------------|----------------|----------------|-------|
| Low Ch                                                               |                        |                    |                     |            |               |               |              |                |                |       |
| 1.649                                                                | 63.8                   | V                  | -48.2               | 1.6        | 7.5           | 5.4           | -44.4        | -13.0          | -31.4          |       |
| 2.474                                                                | 65.2                   | V                  | -43.5               | 1.9        | 8.6           | 6.4           | -39.0        | -13.0          | -26.0          |       |
| 3.299                                                                | 58.5                   | V                  | -48.1               | 2.3        | 9.3           | 7.2           | -43.2        | -13.0          | -30.2          |       |
| 4.124                                                                | 55.0                   | V                  | -50.1               | 2.6        | 9.9           | 7.7           | -45.1        | -13.0          | -32.1          |       |
| 1.649                                                                | 61.5                   | H                  | -49.8               | 1.6        | 7.5           | 5.4           | -46.0        | -13.0          | -33.0          |       |
| 2.474                                                                | 66.0                   | H                  | -42.5               | 1.9        | 8.6           | 6.4           | -38.0        | -13.0          | -25.0          |       |
| 3.299                                                                | 58.6                   | H                  | -47.9               | 2.3        | 9.3           | 7.2           | -43.0        | -13.0          | -30.0          |       |
| 4.124                                                                | 54.8                   | H                  | -50.0               | 2.6        | 9.9           | 7.7           | -44.9        | -13.0          | -31.9          |       |
| Mid Ch                                                               |                        |                    |                     |            |               |               |              |                |                |       |
| 1.673                                                                | 60.8                   | V                  | -51.1               | 1.6        | 7.6           | 5.4           | -47.3        | -13.0          | -34.3          |       |
| 2.510                                                                | 64.1                   | V                  | -44.5               | 1.9        | 8.6           | 6.4           | -40.0        | -13.0          | -27.0          |       |
| 3.346                                                                | 59.0                   | V                  | -47.5               | 2.3        | 9.3           | 7.2           | -42.6        | -13.0          | -29.6          |       |
| 4.183                                                                | 54.0                   | V                  | -51.1               | 2.6        | 9.9           | 7.8           | -46.0        | -13.0          | -33.0          |       |
| 1.673                                                                | 65.0                   | H                  | -46.1               | 1.6        | 7.6           | 5.4           | -42.3        | -13.0          | -29.3          |       |
| 2.510                                                                | 67.4                   | H                  | -41.0               | 1.9        | 8.6           | 6.4           | -36.5        | -13.0          | -23.5          |       |
| 3.346                                                                | 58.0                   | H                  | -48.4               | 2.3        | 9.3           | 7.2           | -43.5        | -13.0          | -30.5          |       |
| 4.183                                                                | 54.7                   | H                  | -50.1               | 2.6        | 9.9           | 7.8           | -45.0        | -13.0          | -32.0          |       |
| High Ch                                                              |                        |                    |                     |            |               |               |              |                |                |       |
| 1.697                                                                | 62.0                   | V                  | -49.7               | 1.6        | 7.6           | 5.5           | -45.9        | -13.0          | -32.9          |       |
| 2.545                                                                | 66.2                   | V                  | -42.3               | 2.0        | 8.6           | 6.5           | -37.7        | -13.0          | -24.7          |       |
| 3.393                                                                | 60.0                   | V                  | -46.4               | 2.3        | 9.4           | 7.2           | -41.5        | -13.0          | -28.5          |       |
| 4.242                                                                | 54.5                   | V                  | -50.6               | 2.7        | 10.0          | 7.8           | -45.4        | -13.0          | -32.4          |       |
| 1.697                                                                | 61.5                   | H                  | -49.5               | 1.6        | 7.6           | 5.5           | -45.7        | -13.0          | -32.7          |       |
| 2.545                                                                | 65.3                   | H                  | -43.0               | 2.0        | 8.6           | 6.5           | -38.4        | -13.0          | -25.4          |       |
| 3.393                                                                | 59.1                   | H                  | -47.2               | 2.3        | 9.4           | 7.2           | -42.3        | -13.0          | -29.3          |       |
| 4.242                                                                | 54.0                   | H                  | -50.8               | 2.7        | 10.0          | 7.8           | -45.6        | -13.0          | -32.6          |       |
| Note: No other emissions were detected above the system noise floor. |                        |                    |                     |            |               |               |              |                |                |       |

PCS Spurious & Harmonic (EIRP): 30-1000MHz

| 02/02/05 <b>High Frequency Measurement</b>                            |                        |                    |                     |                     |               |               |               |                |                |       |
|-----------------------------------------------------------------------|------------------------|--------------------|---------------------|---------------------|---------------|---------------|---------------|----------------|----------------|-------|
| <b>Compliance Certification Services, Morgan Hill Open Field Site</b> |                        |                    |                     |                     |               |               |               |                |                |       |
| Test Engr:Chin Pang                                                   |                        |                    |                     |                     |               |               |               |                |                |       |
| Project #:04U3076-2                                                   |                        |                    |                     |                     |               |               |               |                |                |       |
| Company:Sierra Wireless                                               |                        |                    |                     |                     |               |               |               |                |                |       |
| EUT Descrip.:Dual Band with diversity 800/1900MHz CDMA Module         |                        |                    |                     |                     |               |               |               |                |                |       |
| EUT M/N:EM5625D                                                       |                        |                    |                     |                     |               |               |               |                |                |       |
| Test Target: FCC 24 / RSS-133                                         |                        |                    |                     |                     |               |               |               |                |                |       |
| Mode Oper:1900MHz Band, TX Mode                                       |                        |                    |                     |                     |               |               |               |                |                |       |
| <b>Test Equipment:</b>                                                |                        |                    |                     |                     |               |               |               |                |                |       |
| Bilog Antenna                                                         |                        | Cable              |                     | Pre-amplifier 8447D |               | Limit         |               |                |                |       |
| 5m Chamber Sunol Bilog                                                |                        | 5m Chamber Cable   |                     | TS 8447D            |               | EIRP          |               |                |                |       |
| f<br>MHz                                                              | SA reading<br>(dBuV/m) | Ant. Pol.<br>(H/V) | SG reading<br>(dBm) | CL<br>(dB)          | Gain<br>(dBi) | Gain<br>(dBd) | EIRP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Notes |
| 70.00                                                                 | 56.6                   | H                  | -58.4               | 1.2                 | -1.8          | -3.9          | -63.5         | -13.0          | -50.5          |       |
| 216.00                                                                | 60.3                   | H                  | -50.0               | 1.9                 | 5.8           | 3.6           | -48.2         | -13.0          | -35.2          |       |
| 254.60                                                                | 63.2                   | H                  | -45.6               | 1.9                 | 6.1           | 3.9           | -43.6         | -13.0          | -30.6          |       |
| 296.00                                                                | 62.0                   | H                  | -45.1               | 2.1                 | 6.0           | 3.9           | -43.3         | -13.0          | -30.3          |       |
| 62.40                                                                 | 58.5                   | V                  | -57.1               | 1.1                 | -2.1          | -4.2          | -62.5         | -13.0          | -49.5          |       |
| 333.20                                                                | 61.5                   | V                  | -45.0               | 2.2                 | 6.0           | 3.9           | -43.4         | -13.0          | -30.4          |       |

PCS Spurious & Harmonic (EIRP):

01/31/05    **High Frequency Substitution Measurement**  
Compliance Certification Services, Morgan Hill 5m Chamber Site  
  
Test Engr: Chin Pang  
Project #:04U3076-2  
Company: Sierra Wireless  
EUT Descrip.: Dual Band with diversity 800/1900MHz CDMA Module  
EUT M/N: EM5625D  
Test Target: RSS-133  
Mode Oper: Tx, 1900MHz Band  
  
Test Equipment:

EMCO Horn 1-18GHz  
T73; S/N: 6717 @3m

Horn > 18GHz

Limit  
FCC 24

☒ High Pass Filter

Hi Frequency Cables  
☐ (2 ft)    ☒ (2 ~ 3 ft)    ☐ (4 ~ 6 ft)    ☒ (12 ft)

Pre-amplifier 1-26GHz  
T86 Miteq 924341

Pre-amplifier 26-40GHz

| f<br>GHz                                                             | SA reading<br>(dBuV/m) | Ant. Pol.<br>(H/V) | SG reading<br>(dBm) | CL<br>(dB) | Gain<br>(dBi) | Gain<br>(dBd) | EIRP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Notes |
|----------------------------------------------------------------------|------------------------|--------------------|---------------------|------------|---------------|---------------|---------------|----------------|----------------|-------|
| <b>Low Ch</b>                                                        |                        |                    |                     |            |               |               |               |                |                |       |
| 3.703                                                                | 62.1                   | V                  | -43.8               | 2.4        | 9.6           | 7.4           | -36.7         | -13.0          | -23.7          |       |
| 5.554                                                                | 62.4                   | V                  | -40.7               | 3.2        | 11.1          | 9.0           | -32.8         | -13.0          | -19.8          |       |
| 7.405                                                                | 71.0                   | V                  | -29.3               | 3.7        | 11.6          | 9.4           | -21.4         | -13.0          | -8.4           |       |
| 9.256                                                                | 45.3                   | V                  | -50.7               | 4.2        | 10.5          | 8.4           | -44.4         | -13.0          | -31.4          |       |
| 3.703                                                                | 61.0                   | H                  | -44.7               | 2.4        | 9.6           | 7.4           | -37.6         | -13.0          | -24.6          |       |
| 5.554                                                                | 62.2                   | H                  | -39.9               | 3.2        | 11.1          | 9.0           | -32.0         | -13.0          | -19.0          |       |
| 7.405                                                                | 70.0                   | H                  | -29.5               | 3.7        | 11.6          | 9.4           | -21.6         | -13.0          | -8.6           |       |
| 9.256                                                                | 56.0                   | H                  | -40.0               | 4.2        | 10.5          | 8.4           | -33.7         | -13.0          | -20.7          |       |
| <b>Mid Ch</b>                                                        |                        |                    |                     |            |               |               |               |                |                |       |
| 3.760                                                                | 62.6                   | V                  | -43.2               | 2.5        | 9.6           | 7.4           | -36.1         | -13.0          | -23.1          |       |
| 5.640                                                                | 60.1                   | V                  | -42.9               | 3.3        | 11.2          | 9.0           | -35.0         | -13.0          | -22.0          |       |
| 7.520                                                                | 71.0                   | V                  | -29.0               | 3.7        | 11.5          | 9.4           | -21.2         | -13.0          | -8.2           |       |
| 9.400                                                                | 55.0                   | V                  | -40.9               | 4.2        | 10.8          | 8.7           | -34.3         | -13.0          | -21.3          |       |
| 3.760                                                                | 62.0                   | H                  | -43.6               | 2.5        | 9.6           | 7.4           | -36.5         | -13.0          | -23.5          |       |
| 5.640                                                                | 59.1                   | H                  | -42.9               | 3.3        | 11.2          | 9.0           | -35.0         | -13.0          | -22.0          |       |
| 7.520                                                                | 69.3                   | H                  | -29.9               | 3.7        | 11.5          | 9.4           | -22.1         | -13.0          | -9.1           |       |
| 9.400                                                                | 56.0                   | H                  | -39.9               | 4.2        | 10.8          | 8.7           | -33.3         | -13.0          | -20.3          |       |
| <b>High Ch</b>                                                       |                        |                    |                     |            |               |               |               |                |                |       |
| 3.818                                                                | 59.4                   | V                  | -46.2               | 2.5        | 9.6           | 7.5           | -39.1         | -13.0          | -26.1          |       |
| 5.763                                                                | 58.0                   | V                  | -44.9               | 3.3        | 11.3          | 9.1           | -36.9         | -13.0          | -23.9          |       |
| 7.635                                                                | 69.6                   | V                  | -30.2               | 3.8        | 11.5          | 9.3           | -22.5         | -13.0          | -9.5           |       |
| 9.544                                                                | 56.3                   | V                  | -39.5               | 4.3        | 11.1          | 9.0           | -32.7         | -13.0          | -19.7          |       |
| 3.818                                                                | 60.4                   | H                  | -45.1               | 2.5        | 9.6           | 7.5           | -38.0         | -13.0          | -25.0          |       |
| 5.763                                                                | 56.5                   | H                  | -45.4               | 3.3        | 11.3          | 9.1           | -37.4         | -13.0          | -24.4          |       |
| 7.635                                                                | 68.2                   | H                  | -30.8               | 3.8        | 11.5          | 9.3           | -23.1         | -13.0          | -10.1          |       |
| 9.544                                                                | 56.0                   | H                  | -39.8               | 4.3        | 11.1          | 9.0           | -33.0         | -13.0          | -20.0          |       |
| Note: No other emissions were detected above the system noise floor. |                        |                    |                     |            |               |               |               |                |                |       |

## 7.5. MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency range (MHz)                                   | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (A) Limits for Occupational/Controlled Exposures        |                               |                               |                                     |                          |
| 0.3–3.0 .....                                           | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0–30 .....                                            | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30–300 .....                                            | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300–1500 .....                                          | .....                         | .....                         | f/300                               | 6                        |
| 1500–100,000 .....                                      | .....                         | .....                         | 5                                   | 6                        |
| (B) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
| 0.3–1.34 .....                                          | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30 .....                                           | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| 30–300 .....          | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500 .....        | .....                         | .....                         | f/1500                              | 30                       |
| 1500–100,000 .....    | .....                         | .....                         | 1.0                                 | 30                       |

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

## **CALCULATIONS**

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

Equation (1) and the measured peak power is used to calculate the MPE distance.

## **LIMITS**

From §1.1310 Table 1 (B),  $S = 1.0 \text{ mW/cm}^2$

## **RESULTS**

No non-compliance noted:

| <b>Mode</b>    | <b>Power Density<br/>Limit<br/>(mW/cm<sup>2</sup>)</b> | <b>Output<br/>Power<br/>(dBm)</b> | <b>Antenna<br/>Gain<br/>(dBi)</b> | <b>MPE<br/>Distance<br/>(cm)</b> |
|----------------|--------------------------------------------------------|-----------------------------------|-----------------------------------|----------------------------------|
| 800MHz Celllar | 0.6                                                    | 28.99                             | 5.10                              | 19.08                            |
| 1900 MHz PCS   | 1.0                                                    | 28.60                             | 3.90                              | 11.89                            |

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

## **7.6. FREQUENCY STABILITY**

### **LIMIT**

§22.355 Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

For Mobile devices operating in the 824 to 849 MHz band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

§24.235 The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### **TEST PROCEDURE**

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

### **RESULTS**

No non-compliance noted.

**800MHz CELLULAR – MID CHANNEL**

| Reference Frequency: CELLULAR Mid Channel 836.520010MHz @ 20°C |                                 |                                               |             |             |
|----------------------------------------------------------------|---------------------------------|-----------------------------------------------|-------------|-------------|
| Limit: to stay +/- 2.5 ppm = 2091.300 Hz                       |                                 |                                               |             |             |
| Power Supply<br>(Vdc)                                          | Environment<br>Temperature (*C) | Frequency Deviation Measured with Time Elapse |             |             |
|                                                                |                                 | (MHz)                                         | Delta (ppm) | Limit (ppm) |
| 4.00                                                           | 50                              | 836.520019                                    | -0.011      | 2.5         |
| 4.00                                                           | 40                              | 836.520015                                    | -0.006      | 2.5         |
| 4.00                                                           | 30                              | 836.519991                                    | 0.023       | 2.5         |
| <b>4.00</b>                                                    | <b>20</b>                       | <b>836.520010</b>                             | <b>0</b>    | 2.5         |
| 4.00                                                           | 10                              | 836.520012                                    | -0.002      | 2.5         |
| 4.00                                                           | 0                               | 836.520033                                    | -0.027      | 2.5         |
| 4.00                                                           | -10                             | 836.520007                                    | 0.004       | 2.5         |
| 4.00                                                           | -20                             | 836.520009                                    | 0.001       | 2.5         |
| 4.00                                                           | -30                             | 836.520011                                    | -0.001      | 2.5         |

| Reference Frequency: CDMA Mid Channel 836.520010MHz @ 20°C |                                 |                                               |             |             |
|------------------------------------------------------------|---------------------------------|-----------------------------------------------|-------------|-------------|
| Limit: to stay +/- 2.5 ppm = 2091.300 Hz                   |                                 |                                               |             |             |
| Power Supply<br>(Vdc)                                      | Environment<br>Temperature (*C) | Frequency Deviation Measured with Time Elapse |             |             |
|                                                            |                                 | (MHz)                                         | Delta (ppm) | Limit (ppm) |
| <b>4.00</b>                                                | <b>20</b>                       | <b>836.520010</b>                             | <b>0</b>    | <b>2.5</b>  |
| 2.9 (end point)                                            | 20                              | 836.520035                                    | -0.030      | 2.5         |
| 3.4                                                        | 20                              | 836.519989                                    | 0.025       | 2.5         |
| 4.6                                                        | 20                              | 836.520012                                    | -0.002      | 2.5         |

**1900MHz PCS – MID CHANNEL**

| Reference Frequency: PCS Mid Channel 1880.000030MHz @ 20°C      |                              |                                               |             |             |
|-----------------------------------------------------------------|------------------------------|-----------------------------------------------|-------------|-------------|
| Limit: within the authorized block or +/- 2.5 ppm = 4700.000 Hz |                              |                                               |             |             |
| Power Supply (Vdc)                                              | Environment Temperature (°C) | Frequency Deviation Measured with Time Elapse |             |             |
|                                                                 |                              | (MHz)                                         | Delta (ppm) | Limit (ppm) |
| 4.00                                                            | 50                           | 1880.000016                                   | 0.007       | 2.5         |
| 4.00                                                            | 40                           | 1879.999983                                   | 0.025       | 2.5         |
| 4.00                                                            | 30                           | 1880.000058                                   | -0.015      | 2.5         |
| <b>4.00</b>                                                     | <b>20</b>                    | <b>1880.000030</b>                            | <b>0</b>    | <b>2.5</b>  |
| 4.00                                                            | 10                           | 1879.999960                                   | 0.037       | 2.5         |
| 4.00                                                            | 0                            | 1879.999979                                   | 0.027       | 2.5         |
| 4.00                                                            | -10                          | 1880.000040                                   | -0.005      | 2.5         |
| 4.00                                                            | -20                          | 1880.000015                                   | 0.008       | 2.5         |
| 4.00                                                            | -30                          | 1880.000026                                   | 0.002       | 2.5         |

| Reference Frequency: CDMA Mid Channel 1880.000030MHz @ 20°C     |                              |                                               |             |             |
|-----------------------------------------------------------------|------------------------------|-----------------------------------------------|-------------|-------------|
| Limit: within the authorized block or +/- 2.5 ppm = 4700.000 Hz |                              |                                               |             |             |
| Power Supply (Vdc)                                              | Environment Temperature (°C) | Frequency Deviation Measured with Time Elapse |             |             |
|                                                                 |                              | (MHz)                                         | Delta (ppm) | Limit (ppm) |
| <b>4.00</b>                                                     | <b>20</b>                    | <b>1880.000030</b>                            | <b>0</b>    | <b>2.5</b>  |
| 2.95 (end point)                                                | 20                           | 1880.000022                                   | 0.004       | 2.5         |
| 3.4                                                             | 20                           | 1880.000000                                   | 0.016       | 2.5         |
| 4.6                                                             | 20                           | 1880.000016                                   | 0.007       | 2.5         |