



**Flom Test Labs**  
EMI, EMC, RF Testing Experts Since 1963

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[info@flomlabs.com](mailto:info@flomlabs.com)

## **Transmitter Certification**

of

**Mini-Card Module**  
Model: ES720

to

**Federal Communications Commission**

Rule Part(s) 22H, 24E, and Confidentiality

**Date Of Report:** June 20, 2006

**On the Behalf of the Applicant:**

Novatel Wireless Inc.

**At the Request of:**

Novatel Wireless Inc.  
9645 Scranton Rd, Suite 205  
San Diego, CA 92121

Attention of:

John Jiang, Project Manager  
888-888-9231; FAX: -2888  
Email: [jjiang@novatelwireless.com](mailto:jjiang@novatelwireless.com)

## **The Applicant has been cautioned as to the following:**

### **15.21 Information to the User.**

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **15.27(a) Special Accessories.**

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

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Required information per ISO/IEC Guide 25-1990, paragraph 13.2:

- a) **Test Report**
- b) Laboratory: M. Flom Associates, Inc.  
 (FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107  
 (Canada: IC 2044) Chandler, AZ 85225
- c) Report Number: d0660020
- d) Client: Novatel Wireless Inc.  
 9645 Scranton Rd, Suite 205  
 San Diego, CA 92121
- e) Identification: Mini-Card  
 FCC ID: PKRNVWES720  
 Description: CDMA Cell-PCS Module
- f) EUT Condition: Not required unless specified in individual tests.
- g) Report Date: June 20, 2006  
 EUT Received:
- h, j, k): As indicated in individual tests.
- i) Sampling method: No sampling procedure used.
- l) Uncertainty: In accordance with MFA internal quality manual.
- m) Supervised by: Hoosamuddin S. Bandukwala
- n) Results: The results presented in this report relate only to the item tested.
- o) Reproduction: This report must not be reproduced, except in full, without written permission from this laboratory.

Accessories used during testing:

| Type     | Quantity | Manufacturer        | Model      | Serial No. | FCC ID |
|----------|----------|---------------------|------------|------------|--------|
| Test Jig | 1        | Novatel             | EV620 Jig  | NSN        | NONE   |
| Antenna  | 1        | Antenna Specialists | ASPRDM1994 | NSN        | NONE   |

## List of General Information Required for Certification

In Accordance with FCC Rules and Regulations,  
Volume II, Part 2 and to 22H, 24E, Modular Approval and Confidentiality

### Sub-Part 2.1033

(c)(1): **Name and Address of Applicant:**

Novatel Wireless Inc.  
9645 Scranton Rd, Suite 205  
San Diego, CA 92121

**Manufacturer:**

Novatel Wireless Inc.  
9645 Scranton Rd, Suite 205  
San Diego, CA 92121

(c)(2): **FCC ID:**

PKRNVWES720

**Model Number:**

ES720 (Mini-Card Module)

**Serial Number:**

23606010053 / LI010606200031

(c)(3): **Instruction Manual(s):**

Please See Attached Exhibits

(c)(4): **Type of Emission:**

1M28F9W

(c)(5): **FREQUENCY RANGE, MHz:**

824.70 to 848.30  
1851.25 to 1908.75

(c)(6): **Power Rating, Watts:**

\_\_\_\_ Switchable

X  Variable

0.295

\_\_\_\_ N/A

(c)(7): **Maximum Power Rating, Watts:**

2.0

**Subpart 2.1033** (continued)

(c)(8): Voltages & Currents in All Elements in Final RF Stage, Including Final Transistor or Solid State Device:

|                        |   |             |
|------------------------|---|-------------|
| Collector Current, A   | = | 0.450 (max) |
| Collector Voltage, Vdc | = | 3.3         |
| Supply Voltage, Vdc    | = | 3.3         |

(c)(9): **Tune-Up Procedure:**

Please See Attached Exhibits

(c)(10): **Circuit Diagram/Circuit Description:**

Including description of circuitry & devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation and limiting power.

Please See Attached Exhibits

(c)(11): **Label Information:**

Please See Attached Exhibits

(c)(12): **Photographs:**

Please See Attached Exhibits

(c)(13): **Digital Modulation Description:**

☐ Attached Exhibits  
☒ N/A

(c)(14): **Test and Measurement Data:**

Follows



## A2LA

"A2LA has accredited M. Flom Associates, Inc. Chandler, AZ for technical competence in the field of Electrical Testing. The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 – 1999 'General Requirements for the Competence of Testing and Calibration Laboratories' and any additional program requirements in the identified field of testing."

Certificate Number: **2152-01**



UNITED STATES DEPARTMENT OF COMMERCE  
National Institute of Standards and Technology  
Gaithersburg, Maryland 20899

September 15, 1999

Mr. Morris Flom  
M. Flom Associates Inc.  
3356 N. San Marcos Place, Suite 107  
Chandler, AZ 85224

Dear Mr. Flom:

I am pleased to inform you that your laboratory has been validated by the Chinese Taipei Bureau of Standards, Metrology, and Inspection (BSMI) under the Asia Pacific Economic Cooperation Mutual Recognition Arrangement (APEC MRA). Your laboratory is now formally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA between the American Institute in Taiwan (AIT) and the Taipei Economic and Cultural Representative Office (TECRO) in the United States, covering equipment subject to Electro-Magnetic Compatibility (EMC) requirements. The names of all validated and nominated laboratories will be posted on the NIST website at <http://ts.nist.gov/mra> under the "Asia" category.

As of August 1, 1999, you may submit test data to BSMI to verify that the equipment to be imported into Chinese Taipei satisfies the applicable EMC requirements. Your assigned BSMI number is **012-0N-6-0418**; you must use this number when sending test reports to BSMI. Your designations will remain in force as long as your NVLAP and/or A2LA and/or BSMI accreditation remains valid for the CNS 13418.

Please note that BSMI requires that the entity making application for the approval of regulated equipment must make such application in person at their Taipei office. BSMI also requires the name of the authorized signatory who is authorized to sign the test reports. You can send this information via fax to C-Taipei CAB Response Manager at 301-975-5414. I am also enclosing a copy of the cover sheet that, according to BSMI requirements, must accompany every test report.

**NIST**

If you have any questions, please contact Robert Gladhill at 301-975-4273 or Joe Dhillon at 301-975-5523. We appreciate your continued interest in our international conformity assessment activities.

Sincerely,

  
Melinda L. Collins, Ph.D.  
Director, Office of Standards Services

Enclosure

## NIST

I am pleased to inform you that your laboratory has been validated by the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Your laboratory is now formally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA between the American Institute in Taiwan (AIT) and the Taipei Economic and Cultural Representative Office (TECRO) in the United States, covering equipment subject to Electro-Magnetic Compatibility (EMC) requirements. The names of all validated and nominated laboratories will be posted on the NIST website at <http://ts.nist.gov/mra> under the 'Asia' category."

Sub-part

**2.1033(c)(14):**

**Test and Measurement Data**

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1079, 2.1051, 2.1053, 2.1055, 2.1057 and the following individual Parts:

- ☐ 21 – Domestic Public Fixed Radio Services
- ☐ 22 – Public Mobile Services
- ☒ 22 Subpart H - Cellular Radiotelephone Service
- ☒ 22.901(d) - Alternative technologies and auxiliary services
- ☐ 23 – International Fixed Public Radiocommunication services
- ☒ 24 – Personal Communications Services
- ☐ 74 Subpart H - Low Power Auxiliary Stations
- ☐ 80 – Stations in the Maritime Services
- ☐ 80 Subpart E - General Technical Standards
- ☐ 80 Subpart F - Equipment Authorization for Compulsory Ships
- ☐ 80 Subpart K - Private Coast Stations and Marine Utility Stations
- ☐ 80 Subpart S - Compulsory Radiotelephone Installations for Small Passenger Boats
- ☐ 80 Subpart T - Radiotelephone Installation Required for Vessels on the Great Lakes
- ☐ 80 Subpart U - Radiotelephone Installations Required by the Bridge-to-Bridge Act
- ☐ 80 Subpart V - Emergency Position Indicating Radiobeacons (EPIRB'S)
- ☐ 80 Subpart W - Global Maritime Distress and Safety System (GMDSS)
- ☐ 80 Subpart X - Voluntary Radio Installations
- ☐ 87 – Aviation Services
- ☐ 90 – Private Land Mobile Radio Services
- ☐ 94 – Private Operational-Fixed Microwave Service
- ☐ 95 Subpart A - General Mobile Radio Service (GMRS)
- ☐ 95 Subpart C - Radio Control (R/C) Radio Service
- ☐ 95 Subpart D - Citizens Band (CB) Radio Service
- ☐ 95 Subpart E - Family Radio Service
- ☐ 95 Subpart F - Interactive Video and Data Service (IVDS)
- ☐ 97 - Amateur Radio Service
- ☐ 101 – Fixed Microwave Services

### General Information

1. Spurious radiation was measured at three (3) meters.
2. The two cellular frequency bands are available to the user automatically. Please refer to the manual contained in the documentation.
3. The normal modes of modulation are:
  - ☐ (a) Voice
  - ☐ (b) Wideband Data
  - ☐ (c) SAT
  - ☐ (d) ST
  - ☐ (e) SAT + Voice
  - ☐ (f) SAT + DTMF
  - ☒ (g) CDMA
  - ☐ (h) TDMA
  - ☐ (i) NAMPS Voice
  - ☐ (j) NAMPS DSAT
  - ☐ (k) NAMPS ST
  - ☐ (l) NAMPS Voice + DSAT

## **Standard Test Conditions and Engineering Practices**

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.4 2003, section 6.1.9, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst-case measurements.

### **Part 2.948:**

(a)(b) **Description Of Measurement Facilities**  
File: 31040/SIT

A description of the measurement facilities was filed with the Commission and was found to be in compliance with the requirements of Section 2.948, by letter dated March 5, 2003. All pertinent changes will be reported to the Commission by up-date of A2LA Accreditation.

**Name of Test:** Carrier Output Power (Conducted)

**Specification:** 47 CFR 2.1046(a)

**Test Equipment:** As per attached page

### Measurement Procedure

1. The EUT was connected to a resistive coaxial attenuator of normal load impedance, and the modulated output power was measured by means of an Spectrum Analyzer and a Power Meter.

### Measurement Results

| Nominal, MHz        | Channel | dBm  | RF Power, Watts |
|---------------------|---------|------|-----------------|
| Cellular CDMA Mode: |         |      |                 |
| 824.70              | 1013    | 24.7 | 0.295           |
| 836.52              | 384     | 24.6 | 0.288           |
| 848.31              | 777     | 24.7 | 0.295           |
| PCS CDMA Mode:      |         |      |                 |
| 1851.25             | 025     | 24.5 | 0.282           |
| 1880.00             | 600     | 24.5 | 0.282           |
| 1908.75             | 1175    | 24.5 | 0.282           |

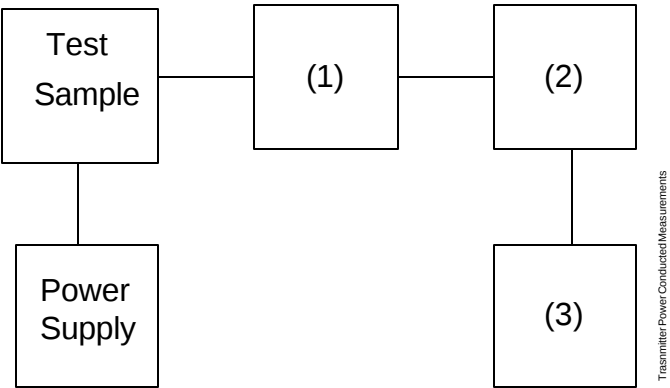
Performed By:



David McPherson, Compliance Engineer

### Transmitter Power Conducted Measurements

Test 1: RF Power Output  
Test 2: Frequency Stability



|     | Asset<br>(as applicable) | Description                                | s/n        |        | Last Cal |
|-----|--------------------------|--------------------------------------------|------------|--------|----------|
| (1) | X                        | Attenuator<br>NARDA 4772-10 (10 dB pad)    |            | NCR    |          |
| (2) | X                        | Spectrum Analyzer<br>i00274 Agilent E4443A | U540522124 | 12 mo. | Aug-05   |
| (3) |                          | Not used                                   |            |        |          |

**Name of Test:** R. F. Power Output (Radiated)

**Specification:** 47 CFR 2.1046(a)

**Test Equipment:** As per attached page

### Measurement Procedure (Radiated)

1. The EUT was placed on an open-field site and its radiated field strength at a known distance was measured by means of a spectrum analyzer. Equivalent loading was calculated from the equation  $P_t = ((E \times R)^2 / 49.2)$  watts, where  $R = 3m$ .
2. Measurement accuracy is  $\pm 1.5$  dB.

### Measurement Results

g0560269: 2006-Jun-14 Wed 10:12

State: 2:High Power

CDMA Cellular:

| Frequency Tuned, MHz | Frequency Emission, MHz | Meter, dBuV/m | CF, dB | Calc, dBm | EUT – Ant Loss, dB | ERP, dBm | ERP, Watts (Max) |
|----------------------|-------------------------|---------------|--------|-----------|--------------------|----------|------------------|
| 824.700000           | 824.700000              | 108.0         | 27.7   | 38.3      | 1.2                | 10.7     | 0.012            |
| 836.520000           | 836.520000              | 106.8         | 28.0   | 37.4      | 1.2                | 9.4      |                  |
| 848.310000           | 848.310000              | 106.6         | 28.3   | 37.5      | 1.2                | 9.2      |                  |

g0560270: 2006-Jun-14 Wed 10:12

State: 2:High Power

CDMA PCS:

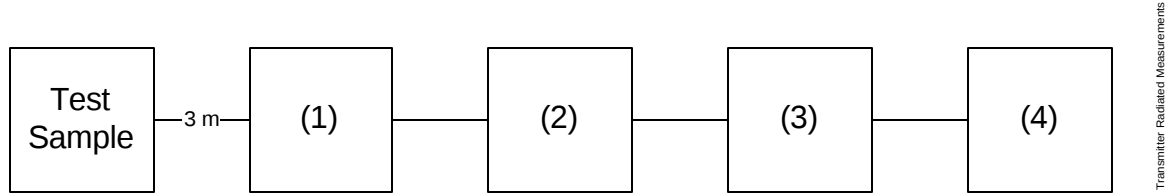
| Frequency Tuned, MHz | Frequency Emission, MHz | Meter, dBuV/m | CF, dB | Calc, dBm | EUT – Ant Loss, dB | EIRP, dBm | EIRP, Watts (Max) |
|----------------------|-------------------------|---------------|--------|-----------|--------------------|-----------|-------------------|
| 1851.250000          | 1851.250000             | 102.3         | 34.0   | 41.1      | 1.8                | 7.0       | 0.012             |
| 1880.000000          | 1880.000000             | 105.4         | 34.2   | 44.4      | 1.8                | 10.2      |                   |
| 1908.750000          | 1908.750000             | 106.1         | 34.3   | 45.2      | 1.8                | 10.9      |                   |

**Test Setup:**

**Radiated Emissions**



## Transmitter Radiated Measurements



| Asset<br>(as applicable)     | Description       | s/n        |       |        |
|------------------------------|-------------------|------------|-------|--------|
| <b>(1) Transducer</b>        |                   |            |       |        |
| X i00091                     | Emco 3115         | 001469     | 12 mo | Aug-05 |
| X i00089                     | Apel Log Periodic | 001500     | 24 mo | Oct-05 |
| <b>(2) High Pass Filter</b>  |                   |            |       |        |
| -                            | As Required       |            |       | May-05 |
| <b>(3) Preamp</b>            |                   |            |       |        |
| i00028                       | HP 8449 (+30 dB)  | 2749A00121 | 12 mo |        |
| <b>(4) Spectrum Analyzer</b> |                   |            |       |        |
| i00048                       | HP 8566B          | 2511A01467 | 12 mo |        |
| X i00029                     | HP 8563E          | 3213A00104 | 12 mo | Jan-06 |

**Name of Test:** Emission Masks (Occupied Bandwidth)

**Specification:** 47 CFR 2.1049(c)(1), 22

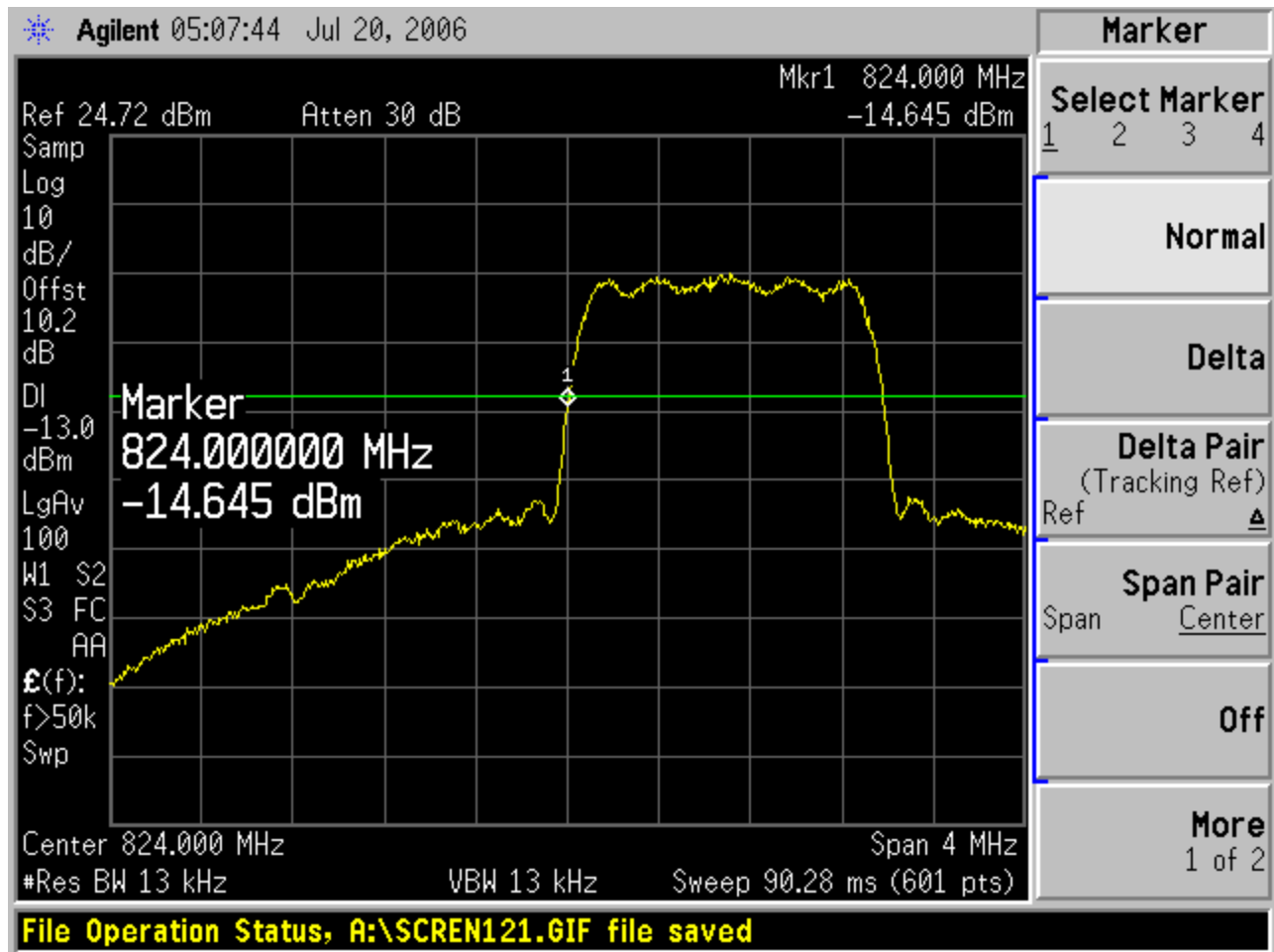
**Test Equipment:** As per previous page

### **Measurement Procedure**

1. The EUT and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.
2. For EUTs supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for  $\pm 2.5$  kHz deviation (or 50% modulation). With level constant, the signal level was increased 16 dB.
3. For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.
4. The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.
5. Measurement Results: Attached

## Data supplied by Applicant

Name of Test: Emission Masks (Band Edge)



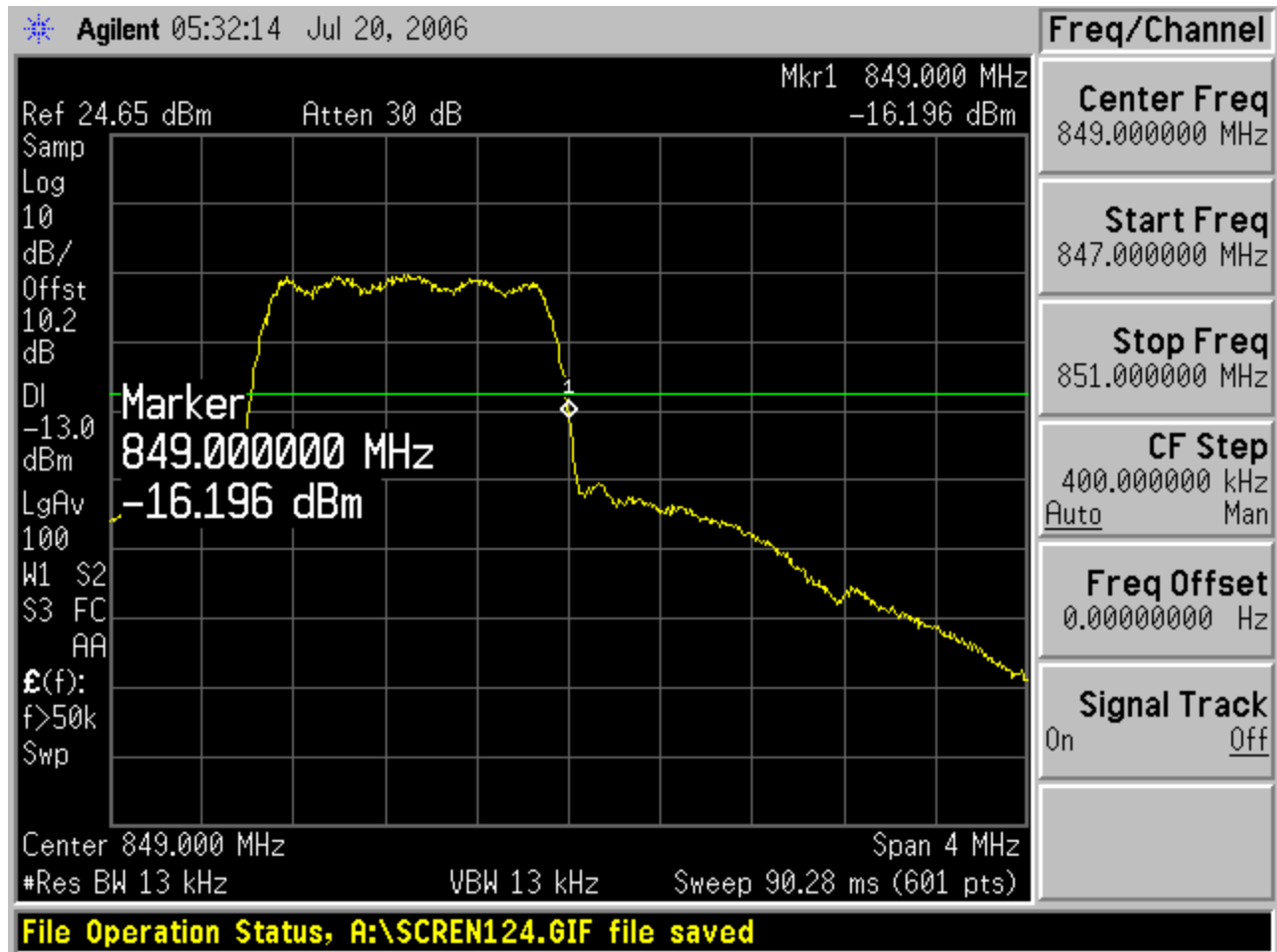
Modulation:

CELL LOWER BAND EDGE

Performed By:

  
David McPherson, Compliance Engineer

Name of Test: Emission Masks (Band Edge)



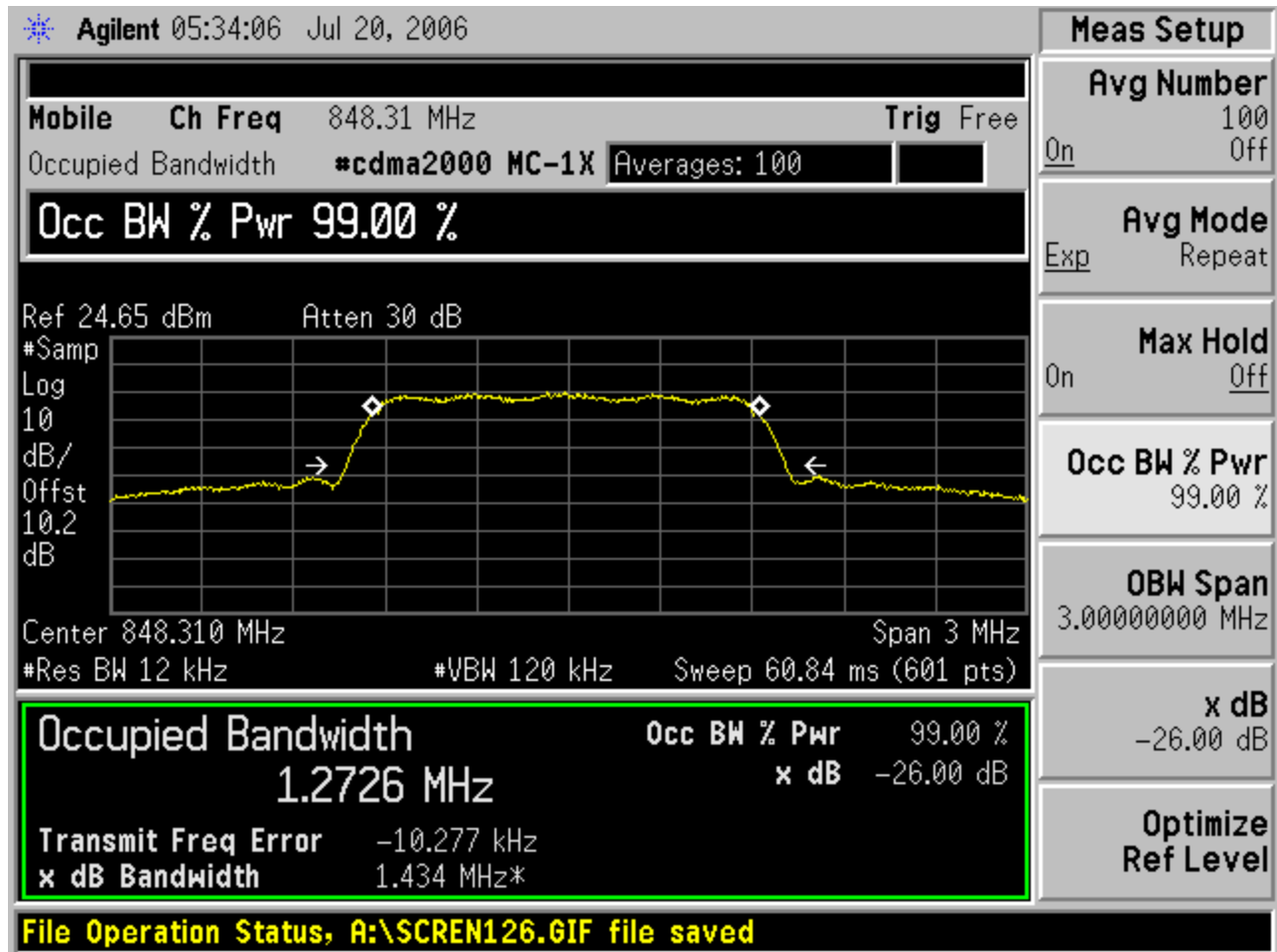
Modulation:

CELL UPPER BAND EDGE

Performed By:

*David McPherson*  
David McPherson, Compliance Engineer

Name of Test: Emission Masks (Occupied Bandwidth)



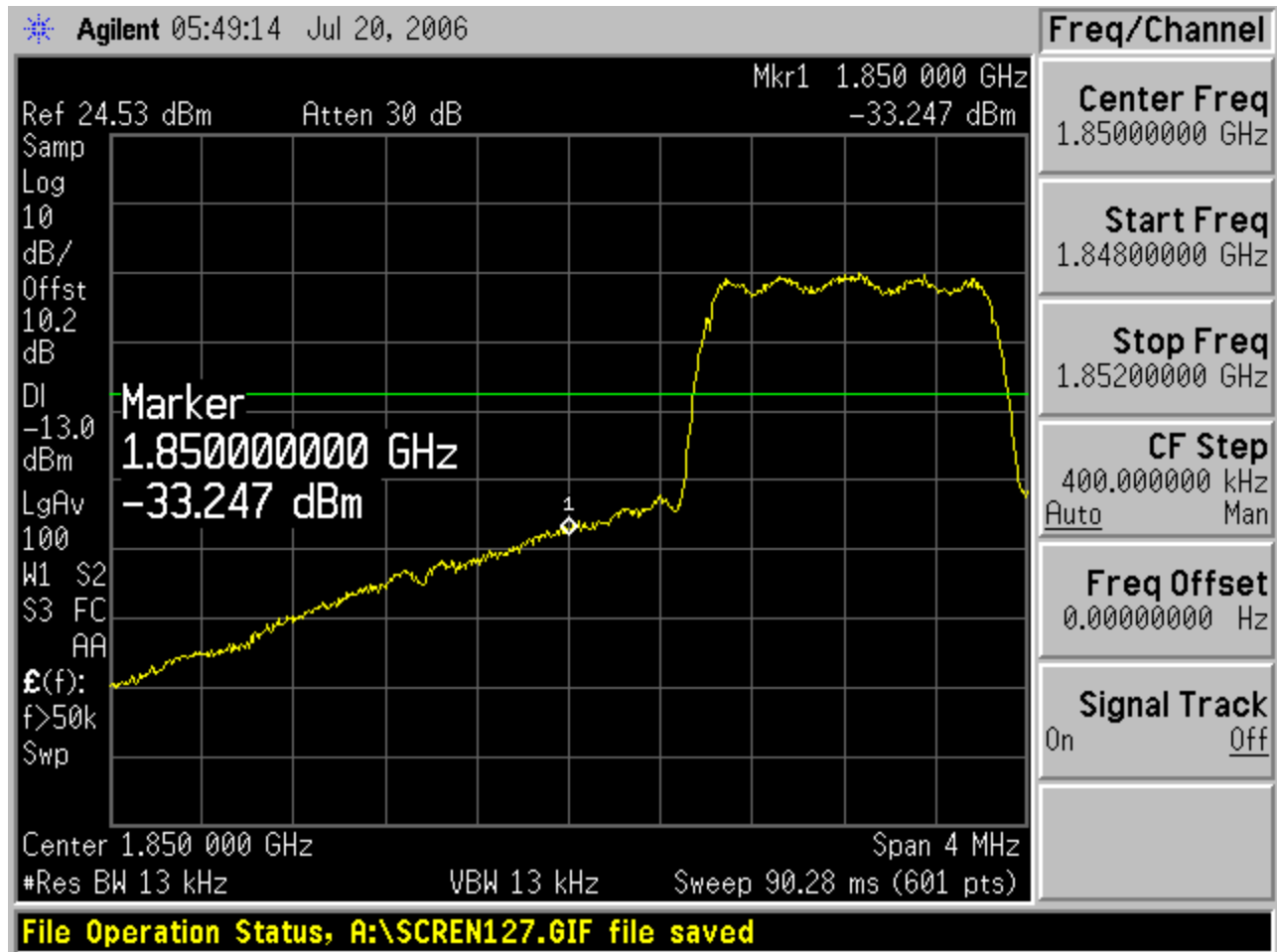
Modulation:

99% POWER BANDWIDTH (CELLULAR)

Performed By:

*David McPherson*  
David McPherson, Compliance Engineer

Name of Test: Emission Masks (Band Edge)



Modulation:

PCS LOWER BAND EDGE

Performed By:

David McPherson, Compliance Engineer

Name of Test: Emission Masks (Band Edge)



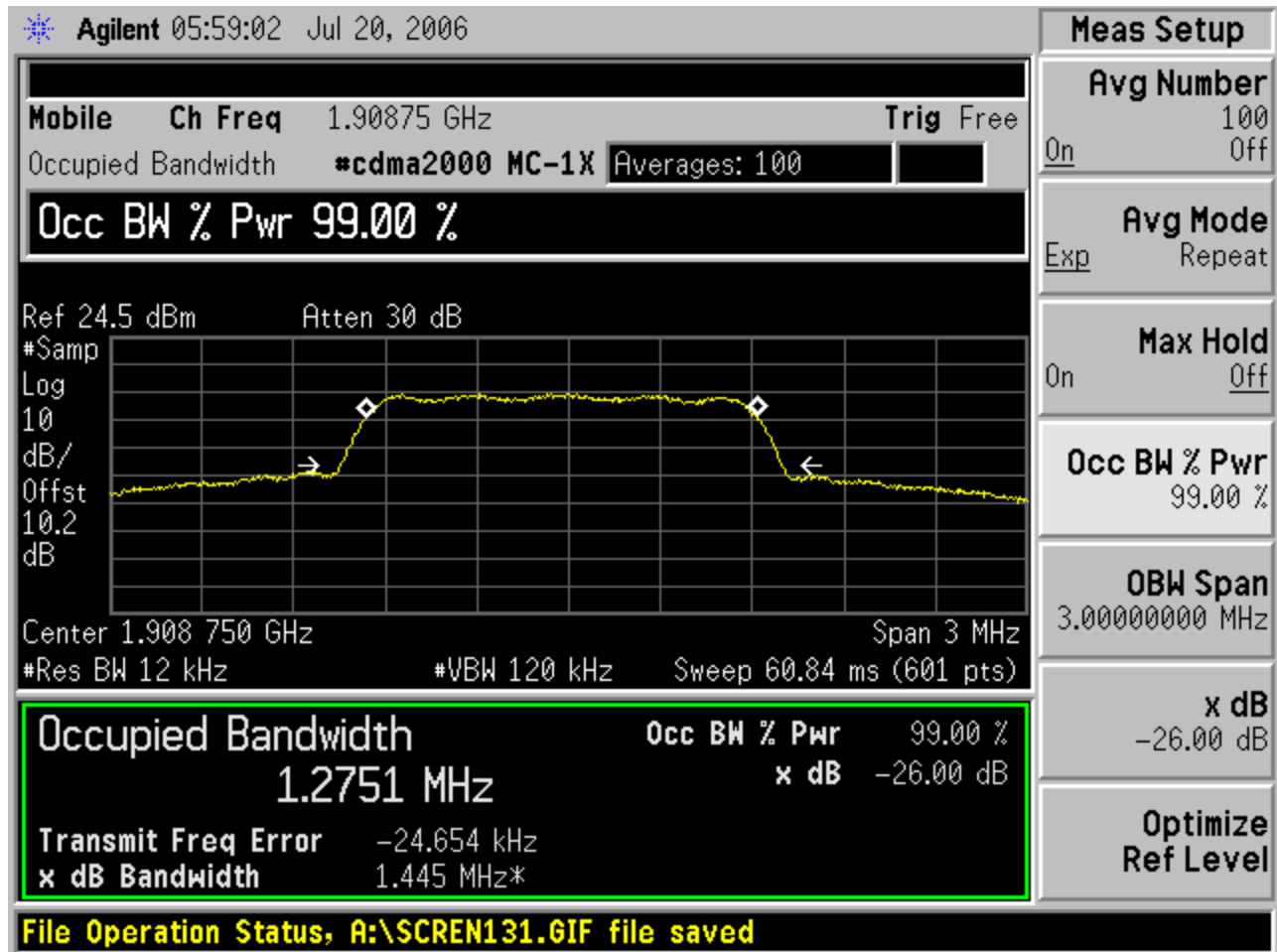
Modulation:

PCS UPPER BAND EDGE

Performed By:

  
David McPherson, Compliance Engineer

Name of Test: Emission Masks (Occupied Bandwidth)



Modulation:

99% POWER BANDWIDTH (PCS)

Performed By:

  
David McPherson, Compliance Engineer

**Name of Test:** Field Strength of Spurious Radiation

**Specification:** 47 CFR 2.1053(a)

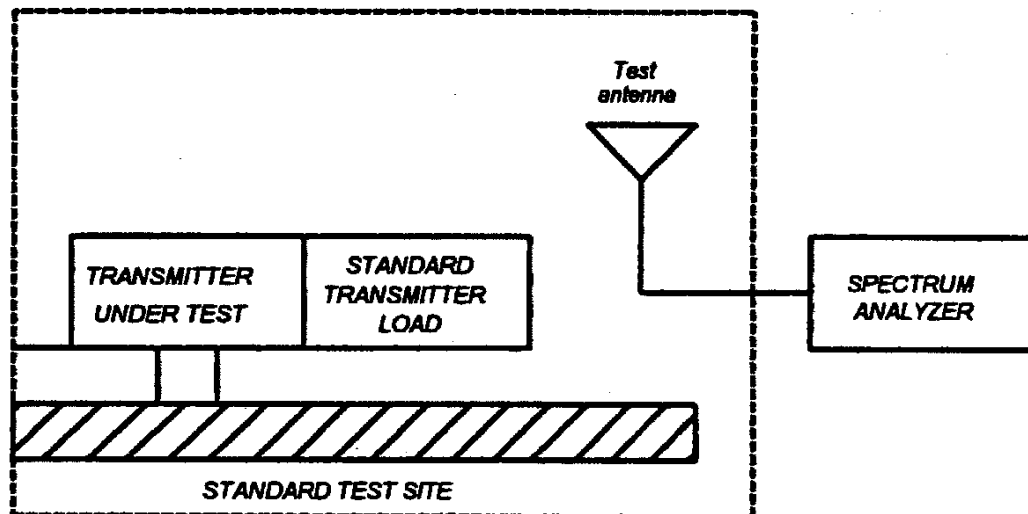
**Guide:** ANSI/TIA/EIA-603-1992/2001, Paragraph 1.2.12 and Table 16, 47 CFR 22.917

### Measurement Procedure

1.2.12.1 Definition: Radiated spurious emissions are emissions from the equipment when transmitting into a non-radiating load on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

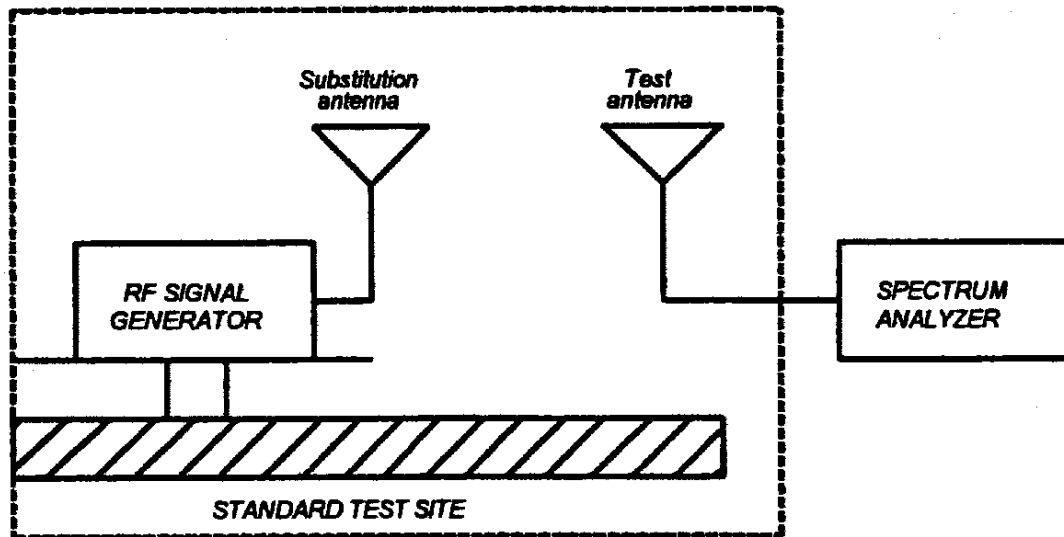
1.2.12.2 Method of Measurement

- A) Connect the equipment as illustrated
- B) Adjust the spectrum analyzer for the following settings:
  - 1) Resolution Bandwidth 100 kHz (<1 GHz), 1 MHz (> 1GHz).
  - 2) Video Bandwidth = 3 times Resolution Bandwidth, or 30 kHz (22.917)
  - 3) Sweep Speed  $\leq 2000$  Hz/second
  - 4) Detector Mode = Mean or Average Power
- C) Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non-radiating load which is placed on the turntable. The RF cable to this load should be of minimum length.



**Name of Test:** Field Strength of Spurious Radiation (Cont.)

- D) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to  $\pm$  the test bandwidth (see section 1.3.4.4).
- E) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
- F) Repeat step E) for each spurious frequency with the test antenna polarized vertically.



- G) Reconnect the equipment as illustrated.
- H) Keep the spectrum analyzer adjusted as in step B).
- I) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.

**Name of Test:** Field Strength of Spurious Radiation (Cont.)

- J) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
- K) Repeat step J) with both antennas vertically polarized for each spurious frequency.
- L) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps J) and K) by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.
- M) The levels recorded in step L) are absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

$$\text{Radiated spurious emissions dB} = 10\log_{10}(\text{TX power in watts}/0.001) - \text{the levels in step I)}$$

NOTE: It is permissible that other antennas provided can be referenced to a dipole.

**Test Equipment:**

| Asset<br>(as applicable) | Description                 | s/n        | Cycle  | Last Cal |
|--------------------------|-----------------------------|------------|--------|----------|
| <b>Transducer</b>        |                             |            |        |          |
| i00088                   | EMCO 3109-B 25MHz-300MHz    | 2336       | 24 mo. |          |
| i00065                   | EMCO 3301-B Active Monopole | 2635       | 24 mo. |          |
| X i00089                 | Apriel 2001 200MHz-1GHz     | 001500     | 24 mo. | Oct-05   |
| X i00103                 | EMCO 3115 1GHz-18GHz        | 9208-3925  | 24 mo. | Oct-05   |
| <b>Amplifier</b>         |                             |            |        |          |
| i00028                   | HP 8449A                    | 2749A00121 | 12 mo. | Mar-05   |
| <b>Spectrum Analyzer</b> |                             |            |        |          |
| X i00029                 | HP 8563E                    | 3213A00104 | 12 mo. | Jan-06   |
| i00033                   | HP 85462A                   | 3625A00357 | 12 mo. | Oct-05   |
| i00048                   | HP 8566B                    | 2511AD1467 | 12 mo. |          |

**Name of Test:** Field Strength of Spurious Radiation (Cellular)

g0560262: 2006-Jun-14 Wed 9:40

State: 2:High Power

| Frequency Tuned, MHz | Frequency Emission, MHz | Meter dBuV/m | @m | CF, dB | Calc. dBuV/m | @m | ERP, dBm |
|----------------------|-------------------------|--------------|----|--------|--------------|----|----------|
| 824.700000           | 1649.400000             | 25.8         | 3  | 32.8   | 58.6         | 3  | -38.8    |
| 836.520000           | 1673.040000             | 24.2         | 3  | 33.0   | 57.2         | 3  | -40.2    |
| 848.310000           | 1696.620000             | 26.2         | 3  | 33.1   | 59.3         | 3  | -38.0    |
| 824.700000           | 2474.100000             | 16.1         | 3  | 37.1   | 53.2         | 3  | -44.2    |
| 836.520000           | 2509.560000             | 15.2         | 3  | 37.2   | 52.4         | 3  | -44.9    |
| 848.310000           | 2544.930000             | 14.9         | 3  | 37.4   | 52.3         | 3  | -45.1    |
| 824.700000           | 3298.800000             | 11.3         | 3  | 40.4   | 51.7         | 3  | -45.7    |
| 836.520000           | 3346.080000             | 9.8          | 3  | 40.5   | 50.4         | 3  | -47.0    |
| 848.310000           | 3393.240000             | 11.9         | 3  | 40.7   | 52.6         | 3  | -44.8    |
| 824.700000           | 4123.500000             | 10.0         | 3  | 43.1   | 53.2         | 3  | -44.2    |
| 836.520000           | 4182.600000             | 12.3         | 3  | 43.2   | 55.5         | 3  | -41.9    |
| 848.310000           | 4241.550000             | 9.1          | 3  | 43.3   | 52.3         | 3  | -45.1    |
| 824.700000           | 4948.200000             | 2.9          | 3  | 45.4   | 48.3         | 3  | -49.1    |
| 836.520000           | 5019.120000             | 10.1         | 3  | 45.7   | 55.7         | 3  | -41.7    |
| 848.310000           | 5089.860000             | 9.0          | 3  | 45.9   | 54.9         | 3  | -42.5    |
| 824.700000           | 5772.900000             | 12.1         | 3  | 48.0   | 60.1         | 3  | -37.3    |
| 836.520000           | 5855.640000             | 9.5          | 3  | 48.2   | 57.7         | 3  | -39.7    |
| 848.310000           | 5938.170000             | 10.1         | 3  | 48.4   | 58.5         | 3  | -38.8    |
| 824.700000           | 6597.600000             | -6.4         | 3  | 49.5   | 43.1         | 3  | -54.3    |
| 836.520000           | 6692.160000             | -3.5         | 3  | 49.6   | 46.1         | 3  | -51.3    |
| 848.310000           | 6786.480000             | -6.5         | 3  | 49.8   | 43.3         | 3  | -54.1    |
| 824.700000           | 7422.300000             | -1.2         | 3  | 51.7   | 50.5         | 3  | -46.8    |
| 836.520000           | 7528.680000             | -8.0         | 3  | 52.1   | 44.0         | 3  | -53.3    |
| 848.310000           | 7634.790000             | -4.5         | 3  | 52.2   | 47.7         | 3  | -49.7    |
| 824.700000           | 8247.000000             | -2.9         | 3  | 53.3   | 50.4         | 3  | -47.0    |
| 836.520000           | 8365.200000             | -3.4         | 3  | 53.5   | 50.1         | 3  | -47.2    |
| 848.310000           | 8483.100000             | -1.9         | 3  | 53.7   | 51.9         | 3  | -45.5    |



Performed By:

Fred Chastain

**Name of Test:** Field Strength of Spurious Radiation (PCS)  
g0560265: 2006-Jun-14 Wed 10:29  
State: 2:High Power

| Frequency Tuned, MHz | Frequency Emission, MHz | Meter dBuV/m | @m | CF, dB | Calc. dBuV/m | @m | ERP, dBm |
|----------------------|-------------------------|--------------|----|--------|--------------|----|----------|
| 1851.250000          | 3702.500000             | 11.2         | 3  | 41.9   | 53.0         | 3  | -42.2    |
| 1880.000000          | 3760.000000             | 13.0         | 3  | 42.1   | 55.6         | 3  | -39.6    |
| 1908.750000          | 3817.500000             | 13.0         | 3  | 42.3   | 55.3         | 3  | -39.9    |
| 1851.250000          | 5553.750000             | 12.0         | 3  | 47.4   | 59.4         | 3  | -35.8    |
| 1880.000000          | 5640.000000             | 10.0         | 3  | 47.6   | 57.9         | 3  | -37.3    |
| 1908.750000          | 5726.250000             | 11.4         | 3  | 47.9   | 59.3         | 3  | -35.9    |
| 1851.250000          | 7405.000000             | 6.1          | 3  | 51.7   | 57.8         | 3  | -37.4    |
| 1880.000000          | 7520.000000             | -0.4         | 3  | 52.1   | 51.7         | 3  | -43.5    |
| 1908.750000          | 7635.000000             | -6.2         | 3  | 52.2   | 46.0         | 3  | -49.2    |
| 1851.250000          | 9256.250000             | 2.5          | 3  | 54.7   | 57.2         | 3  | -38.0    |
| 1880.000000          | 9400.000000             | -4.5         | 3  | 54.9   | 50.4         | 3  | -44.8    |
| 1908.750000          | 9543.750000             | -3.9         | 3  | 55.1   | 51.2         | 3  | -44.0    |
| 1851.250000          | 11107.500000            | 3.6          | 3  | 57.0   | 60.6         | 3  | -34.6    |
| 1880.000000          | 11280.000000            | -5.4         | 3  | 57.0   | 51.9         | 3  | -43.4    |
| 1908.750000          | 11452.500000            | -8.5         | 3  | 57.5   | 49.0         | 3  | -46.3    |
| 1851.250000          | 12958.750000            | 0.8          | 3  | 59.0   | 59.8         | 3  | -35.4    |
| 1880.000000          | 13160.000000            | -4.7         | 3  | 59.2   | 54.4         | 3  | -40.7    |
| 1908.750000          | 13361.250000            | 1.8          | 3  | 59.3   | 61.1         | 3  | -34.1    |
| 1851.250000          | 14810.000000            | 2.5          | 3  | 61.5   | 64.0         | 3  | -31.3    |
| 1880.000000          | 15040.000000            | 0.3          | 3  | 61.7   | 62.0         | 3  | -33.2    |
| 1908.750000          | 15270.000000            | -2.0         | 3  | 61.2   | 59.1         | 3  | -36.1    |
| 1851.250000          | 16661.250000            | -3.5         | 3  | 62.5   | 59.0         | 3  | -36.3    |
| 1880.000000          | 16920.000000            | 0.5          | 3  | 63.5   | 64.0         | 3  | -31.2    |
| 1908.750000          | 17178.750000            | -2.9         | 3  | 64.9   | 62.0         | 3  | -33.2    |
| 1851.250000          | 18512.500000            | -1.2         | 3  | 67.5   | 66.0         | 3  | -29.0    |
| 1880.000000          | 18800.000000            | 0.0          | 3  | 67.6   | 67.6         | 3  | -27.6    |
| 1908.750000          | 19087.500000            | 0.3          | 3  | 67.9   | 68.2         | 3  | -27.0    |



Performed By:

Fred Chastain

**Name of Test:** Frequency Stability (Temperature & Voltage Variation)

**Specification:** 47 CFR 2.1055(a)&(b)

**Test Conditions:** As Indicated

**Test Equipment:** As per previous page

#### **Measurement Temperature**

1. The EUT and test equipment were set up as shown on the following page.
2. With all power removed, the temperature was decreased to  $-30^{\circ}\text{C}$  and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute.
3. With power OFF, the temperature was raised in  $10^{\circ}\text{C}$  steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.
4. The temperature tests were performed for the worst case.

#### **Measurement Voltage**

1. The EUT was placed in a temperature chamber at  $25\pm 5^{\circ}\text{C}$  and connected as for "Frequency Stability - Temperature Variation" test.
2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.
5. Measurement Results: Attached

**Name of Test:** Frequency Stability (Temperature & Voltage Variation)

The Transmitter Oscillator in a Cellular CDMA system is locked to the received down link signal for increased accuracy. In normal operation the device will not transmit unless there is a valid received channel.

**Data supplied by Applicant**

NAME OF TEST: Frequency Stability (Temperature Variation)

|                       |                  |         |
|-----------------------|------------------|---------|
| Operating Frequency : | 836520000        | Hz      |
| Channel :             | 384              |         |
| Reference Volage :    | 3.3              | Vdc     |
| Deviation Limit :     | +/- 0.00025/ 2.5 | % / ppm |

| Voltage (%) | Voltage (Vdc) | Temp. ( C ) | Frequency (Hz) | Deviation (%) | Offset (Hz) |
|-------------|---------------|-------------|----------------|---------------|-------------|
| 100%        | 3.3           | -20         | 836520004.0    | 0.00000039    | 4.0         |
| 100%        |               | -10         | 836519993.7    | -0.00000084   | -6.3        |
| 100%        |               | 0           | 836519995.5    | -0.00000062   | -4.5        |
| 100%        |               | 10          | 836519982.0    | -0.00000224   | -18.0       |
| 100%        |               | 25 (Ref)    | 836520000.7    | 0.00000000    | 0.7         |
| 100%        |               | 30          | 836520000.7    | 0.00000000    | 0.7         |
| 100%        |               | 40          | 836519995.0    | -0.00000068   | -5.0        |
| 100%        | 3.0           | 50          | 836520005.0    | 0.00000051    | 5.0         |
| 100%        |               | 60          | 836520029.0    | 0.00000338    | 29.0        |
| 90%         |               | 25          | 836519997.0    | -0.00000044   | -3.0        |
| 110%        | 3.6           | 25          | 836520008.7    | 0.00000096    | 8.7         |

**Name of Test:** Frequency Stability (Temperature & Voltage Variation)

The Transmitter Oscillator in a PCS CDMA system is locked to the received down link signal for increased accuracy. In normal operation the device will not transmit unless there is a valid received channel.

Data supplied by Applicant

NAME OF TEST: Frequency Stability (Temperature Variation)

|                       |                  |         |
|-----------------------|------------------|---------|
| Operating Frequency : | 1880000000       | Hz      |
| Channel :             | 600              |         |
| Reference Volage :    | 3.3              | V       |
| Deviation Limit :     | +/- 0.00025/ 2.5 | % / ppm |

| Voltage (%) | Voltage (Vdc) | Temp. ( C ) | Frequency (Hz) | Deviation (%) | Offset (Hz) |
|-------------|---------------|-------------|----------------|---------------|-------------|
| 100%        | 3.3           | -20         | 1880000043.0   | 0.00000196    | 43          |
| 100%        |               | -10         | 1879999992.0   | -0.00000075   | -8          |
| 100%        |               | 0           | 1879999978.0   | -0.00000149   | -22         |
| 100%        |               | 10          | 1880000012.4   | 0.00000034    | 12.4        |
| 100%        |               | 25 (Ref)    | 1880000006.1   | 0.00000000    | 6.1         |
| 100%        |               | 30          | 1879999960.0   | -0.00000245   | -40         |
| 100%        |               | 40          | 1880000004.3   | -0.00000010   | 4.3         |
| 100%        |               | 50          | 1880000014.0   | 0.00000042    | 14          |
| 100%        |               | 60          | 1880000011.0   | 0.00000026    | 11          |
| 90%         | 3.0           | 25          | 1880000007.8   | 0.00000009    | 7.8         |
| 110%        | 3.6           | 25          | 1880000023.0   | 0.00000090    | 23          |

**Name of Test:** Necessary Bandwidth and Emission Bandwidth

**Specification:** 47 CFR 2.202(g)

Modulation = F9W

**Necessary Bandwidth:**

Necessary Bandwidth ( $B_N$ ) = 1.28MHz  
(measured at the 99% power bandwidth)

## Expository Statement for Receiver

(Cellular Receiver only – PCS Receiver above 960MHz)

1. Number of Bands = 1
2. Number of Channels = All Cellular Channels
3. Tuning Range, MHz = 869.73 to 893.31
4. Oscillator Range, MHz = 1739.540 to 1786.70
5. I.F., MHz = 0
6. Block Diagram = Attached
7. For cellular receiver only, the radio transceiver meets the requirements of FCC Bulletin OET 53 ("Cellular System Mobile Stations-Land-System Compatibility Specification."). See attached affidavit.

**Name of Test:** Receiver Spurious Emissions (Radiated)

**Specification:**

15.109: Radiated Interference Limits  
15.33: Frequency Range of Radiated Measurements

**Guide:** See measurement procedure below

**Test Conditions:** Standard Temperature & Humidity

**Test Equipment:** As per attached page

**Search Antennas:**

|                   |                                    |
|-------------------|------------------------------------|
| 25 MHz - 300 MHz: | Emco 3109 Biconical                |
| 200 MHz - 1 GHz:  | Apriel 2001 Log Periodic           |
| 1 GHz - 18 GHz:   | Emco 3115 Horn                     |
| 10 GHz - 40 GHz:  | Emco 3116 Horn with HP11970A Mixer |

**Measurement Procedure**

1. At first, bench tests were performed to locate the spurious emissions at the antenna terminals.
2. In the field, tests were conducted over the range shown, The test sample was set up on a wooden turntable above ground, and at a distance of three meters from the antenna connected to the Spectrum Analyzer.
3. In order to obtain the maximum response at each frequency, the turntable was rotated, and the search antenna was raised and lowered. The EUT was also adjusted for maximum response. Tests were conducted in Horizontal & Vertical polarization modes.
4. The field strength was calculated from:

$$E \text{ } \mu\text{V/m @ 3 m} = \text{Log}_{10}^{-1}(\text{dB}\mu\text{V} + \text{A.F.} + \text{C.L.})$$

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5. Measurement Results: Attached for "Worst Case" conditions.

**Name of Test:** Receiver Spurious Emissions (Radiated)

### Measurement Details

|                     |   |                           |
|---------------------|---|---------------------------|
| Site Reference      | = | 31040/SIT                 |
| Spectrum Searched   | = | 0 to 10 x F <sub>R</sub>  |
| Worst Case          | = | V                         |
| Limits              | = | 15.109(a) (Attached)      |
| All Other Emissions | = | 20 dB or More Below Limit |

### Tests were conducted with:

- All controls and switches operated.
- Half-wave dipole antenna or manufacturer/applicant supplied antenna.

### Sample Calculation:

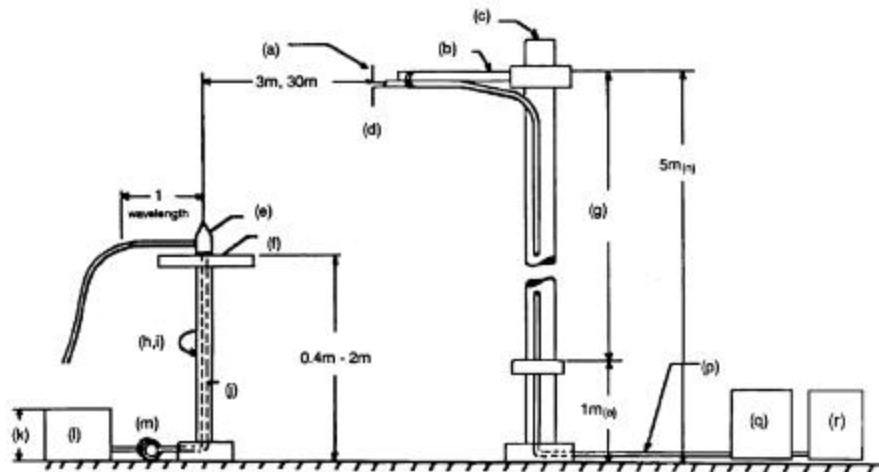
$$\begin{aligned} \text{Emission Frequency, MHz} &= 1739.460000 \\ \text{Level} &= \text{Log}_{10}^{-1} \left( \frac{-0.44 + 30.98}{20} \right) \\ \text{Level, } \mu\text{V/m @ 3m} &= 33.65 \end{aligned}$$

Measurement Results = Attached

Note: Worst Case of Scan and Non-Scan Modes Reported.

Name of Test: Receiver Spurious Emissions (Radiated)

### Radiated Test Setup



#### NOTES:

- |                                                                          |                                                   |
|--------------------------------------------------------------------------|---------------------------------------------------|
| (a) Search Antenna - Rotatable on boom                                   | (j) Cables routed through hollow turntable center |
| (b) Non-metallic boom                                                    | (k) 30 cm or less                                 |
| (c) Non-metallic mast                                                    | (l) External power source                         |
| (d) Adjustable horizontally                                              | (m) 10 cm diameter coil of excess cable           |
| (e) Equipment Under Test                                                 | (n) 25 cm (V), 1 m-7 m (V, H)                     |
| (f) Turntable                                                            | (o) 25 cm from bottom end of 'V', 1m normally     |
| (g) Boom adjustable in height.                                           | (p) Calibrated Cable at least 10m in length       |
| (h) External control cables routed horizontally at least one wavelength. | (q) Amplifier (optional)                          |
| (i) Rotatable                                                            | (r) Spectrum Analyzer                             |

| Asset<br>(as applicable) | Description              | s/n        | Cycle  | Last Cal |
|--------------------------|--------------------------|------------|--------|----------|
| <b>Transducer</b>        |                          |            |        |          |
| X i00088                 | EMCO 3109-B 25MHz-300MHz | 2336       | 24 mo. | Aug-05   |
| X i00089                 | Apriel 2001 200MHz-1GHz  | 001500     | 24 mo. | Oct-05   |
| i00103                   | EMCO 3115 1GHz-18GHz     | 9208-3925  | 24 mo. |          |
| <b>Amplifier</b>         |                          |            |        |          |
| i00028                   | HP 8449A                 | 2749A00121 | 12 mo. |          |
| <b>Spectrum Analyzer</b> |                          |            |        |          |
| i00029                   | HP 8563E                 | 3213A00104 | 12 mo. |          |
| X i00033                 | HP 85462A                | 3625A00357 | 12 mo. | Jan-06   |

**Test Setup:**

**Radiated Emissions**



**Results:**
**Receiver Spurious Emissions (Radiated)**

Rule 15.109(a) Limits:

| Tuned<br>MHz | Emission<br>MHz | dBuV/m | @m | C.F.<br>dB | Calc.<br>dBuV/m | @m | Limit<br>dBuV/m | Marginal<br>dB |
|--------------|-----------------|--------|----|------------|-----------------|----|-----------------|----------------|
| 0.000        | 110.140000      | 12.6   | 3  | 14.6       | 27.2            | 3  | 43.0            | -15.8          |
| 0.000        | 172.570000      | 8.4    | 3  | 16.5       | 24.8            | 3  | 43.0            | -18.2          |
| 0.000        | 198.980000      | 14.0   | 3  | 14.3       | 28.3            | 3  | 43.0            | -14.7          |
| 0.000        | 389.890000      | 11.8   | 3  | 21.9       | 33.7            | 3  | 46.0            | -12.3          |
| 0.000        | 411.330000      | 10.3   | 3  | 21.9       | 32.2            | 3  | 45.0            | -13.8          |
| 0.000        | 418.650000      | 11.3   | 3  | 21.7       | 33.0            | 3  | 46.0            | -13.0          |
| 0.000        | 765.190000      | 12.7   | 3  | 27.2       | 40.0            | 3  | 46.0            | -6.1           |
| 0.000        | 992.950000      | 12.9   | 3  | 31.0       | 43.9            | 3  | 54.0            | -10.1          |

END OF TEST REPORT

|                                                                                              |
|----------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Testimonial<br/>and<br/>Statement of Certification</b></p> |
|----------------------------------------------------------------------------------------------|

**This is to certify that**

1. **That** the application was prepared either by, or under the direct supervision of, the undersigned.
2. **That** the technical data supplied with the application was taken under my direction and supervision.
3. **That** the data was obtained on representative units, randomly selected.
4. **That**, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.