



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

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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

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

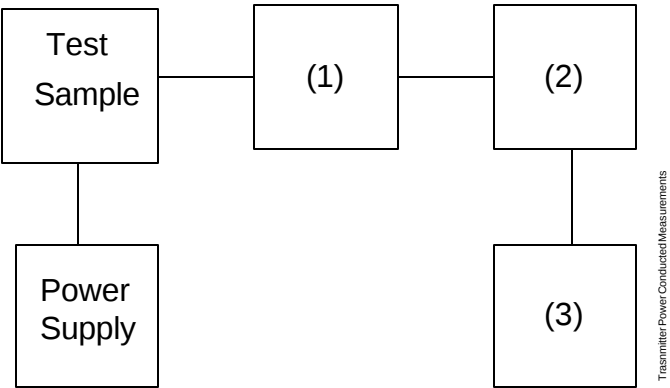
Performed By:



David McPherson, Compliance Engineer

Transmitter Power Conducted Measurements

Test 1: RF Power Output
Test 2: Frequency Stability



	Asset (as applicable)	Description	s/n		Last Cal
(1)	X	Attenuator NARDA 4772-10 (10 dB pad)		NCR	
(2)	X	Spectrum Analyzer 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 ± 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:

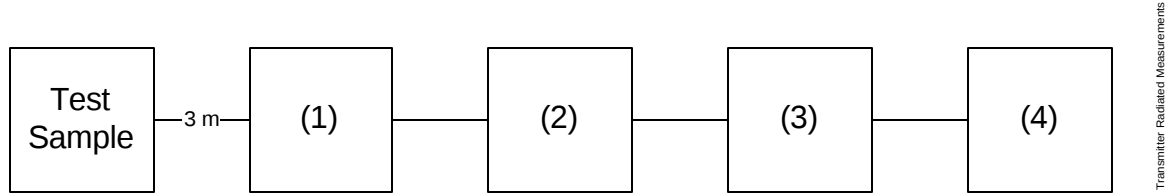
Frequency Tuned, MHz	Frequency Emission, MHz	Meter, dBuV/m	CF, dB	Calc, dBm	EUT – Ant Loss, dB	EIRP, dBm	EIRP, Watts (Max)
1851.250000	1851.250000	102.3	34.0	41.1	1.8	7.0	0.012
1880.000000	1880.000000	105.4	34.2	44.4	1.8	10.2	
1908.750000	1908.750000	106.1	34.3	45.2	1.8	10.9	

Test Setup:

Radiated Emissions



Transmitter Radiated Measurements



Asset (as applicable)	Description	s/n		
(1) Transducer				
X i00091	Emco 3115	001469	12 mo	Aug-05
X i00089	Apel Log Periodic	001500	24 mo	Oct-05
(2) High Pass Filter				
-	As Required			May-05
(3) Preamp				
i00028	HP 8449 (+30 dB)	2749A00121	12 mo	
(4) Spectrum Analyzer				
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

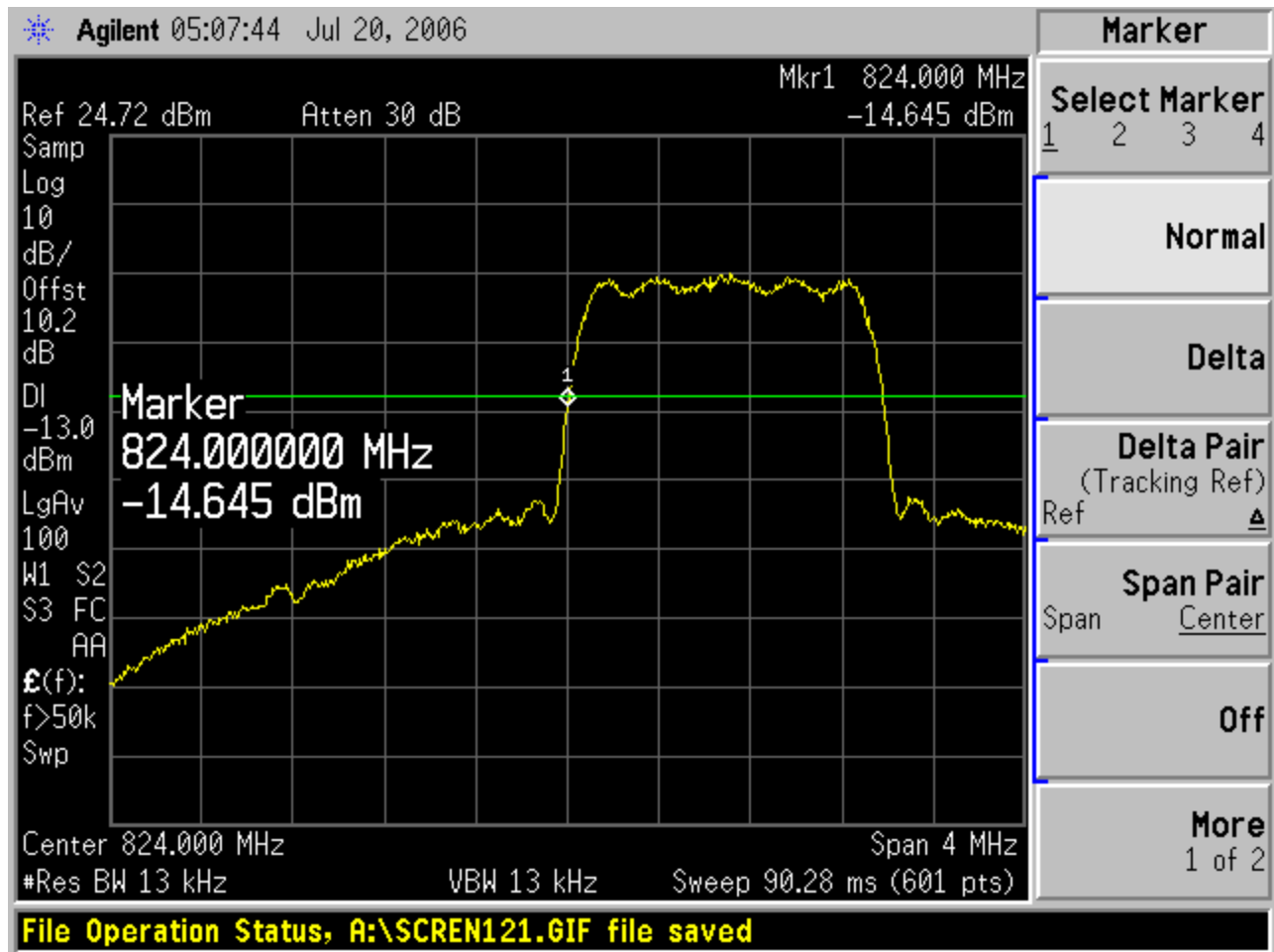
Test Equipment: As per previous page

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 ± 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)



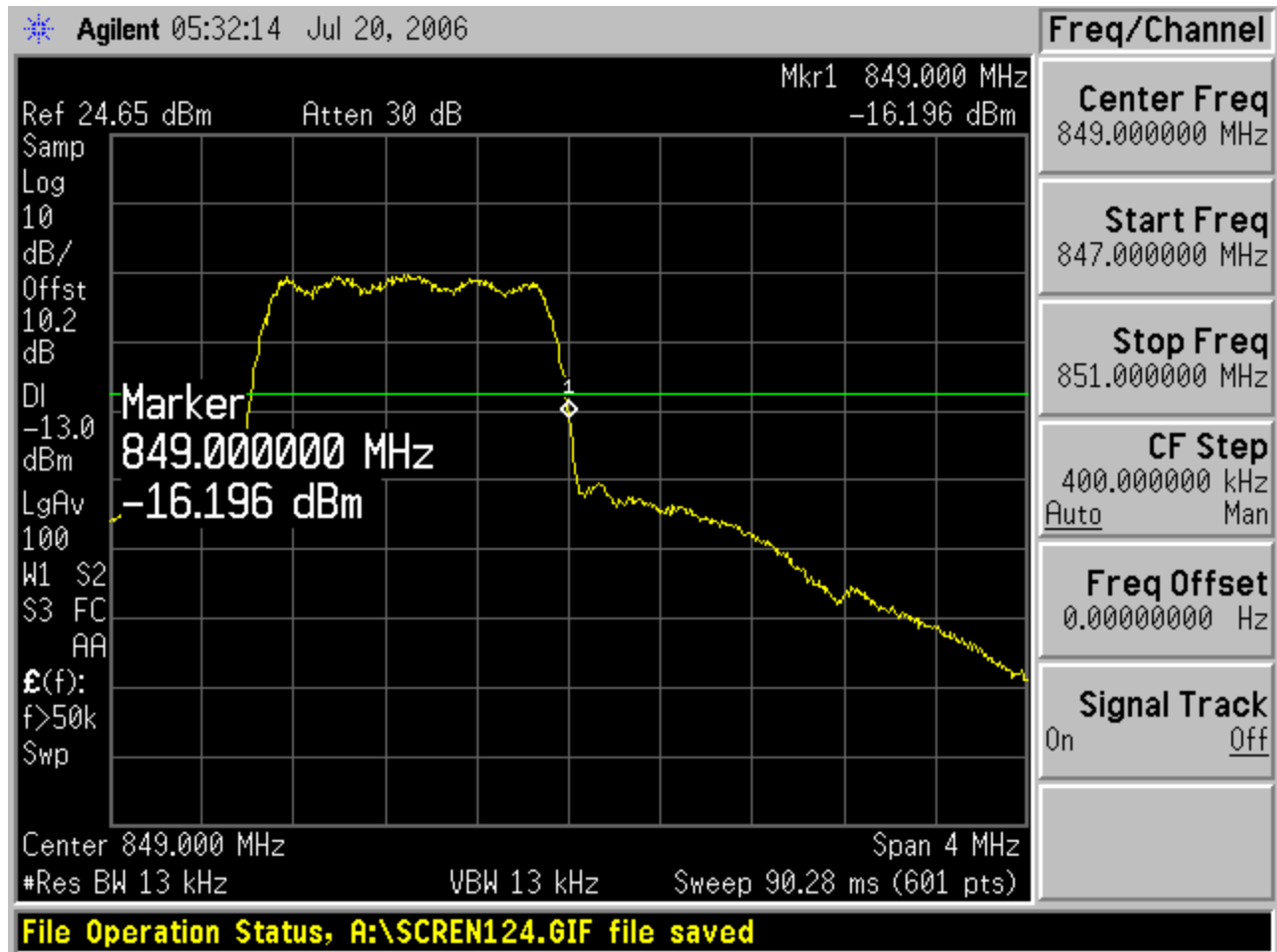
Modulation:

CELL LOWER BAND EDGE

Performed By:

David McPherson, Compliance Engineer

Name of Test: Emission Masks (Band Edge)



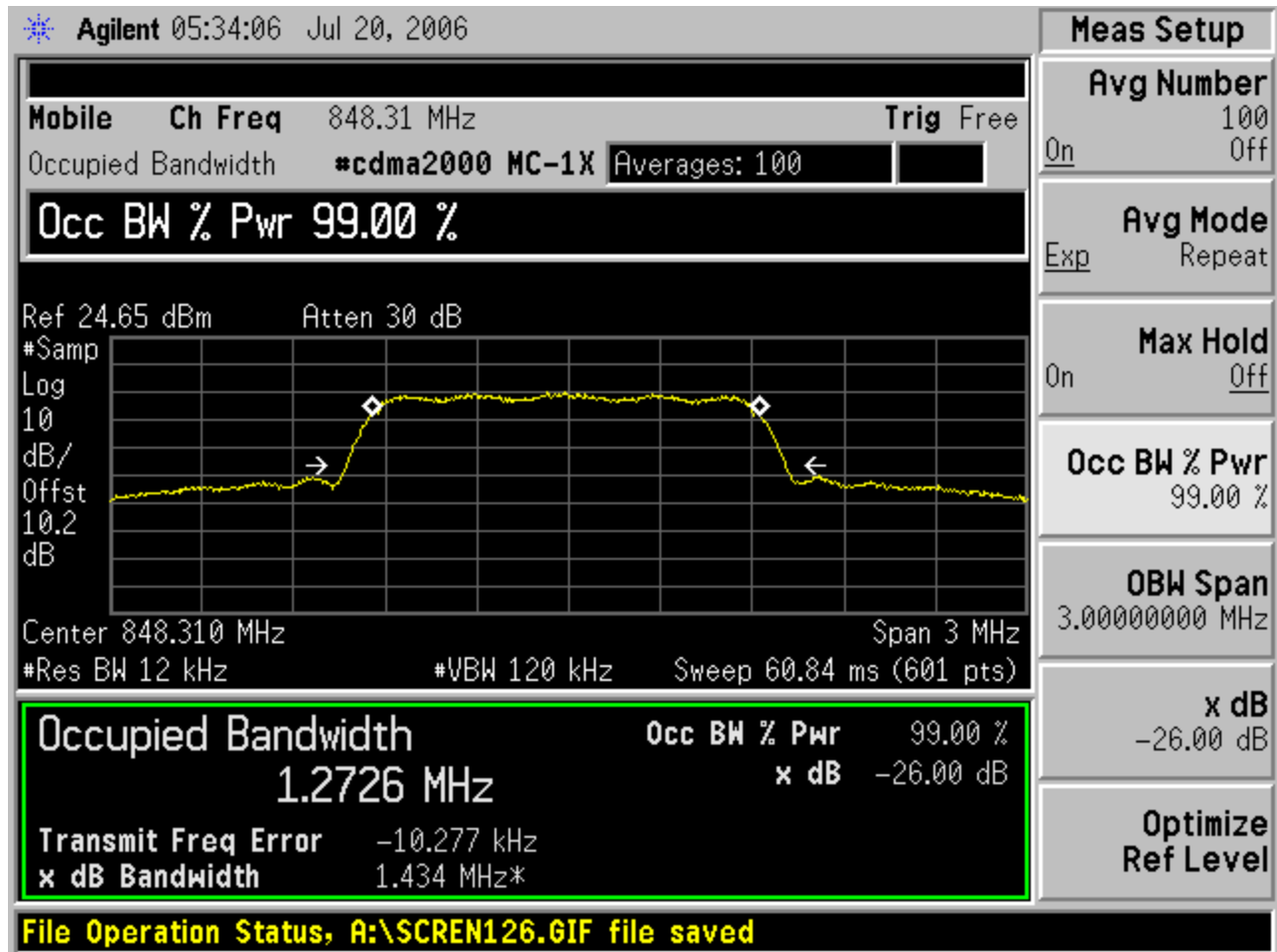
Modulation:

CELL UPPER BAND EDGE

Performed By:

David McPherson
David McPherson, Compliance Engineer

Name of Test: Emission Masks (Occupied Bandwidth)



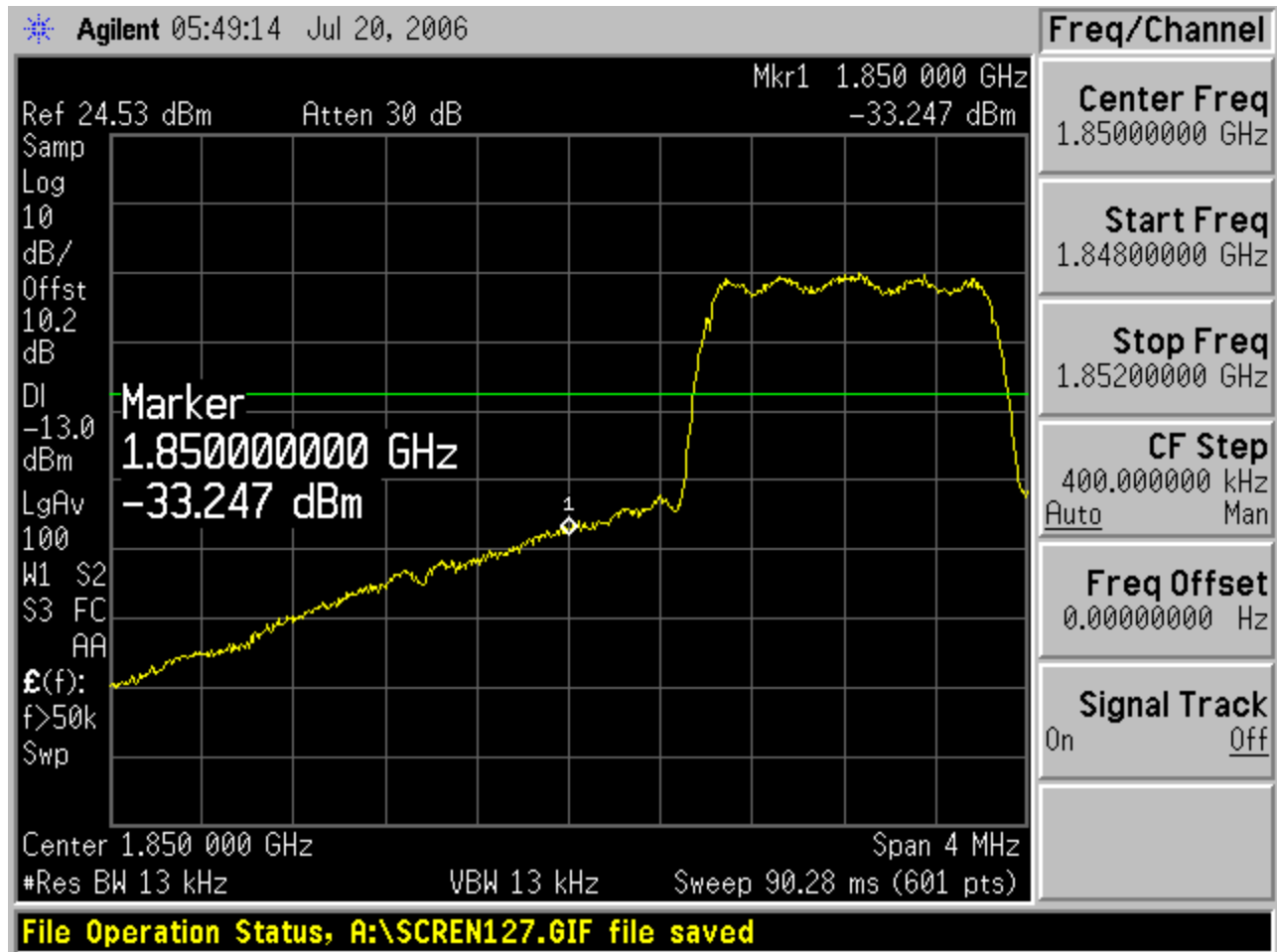
Modulation:

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)



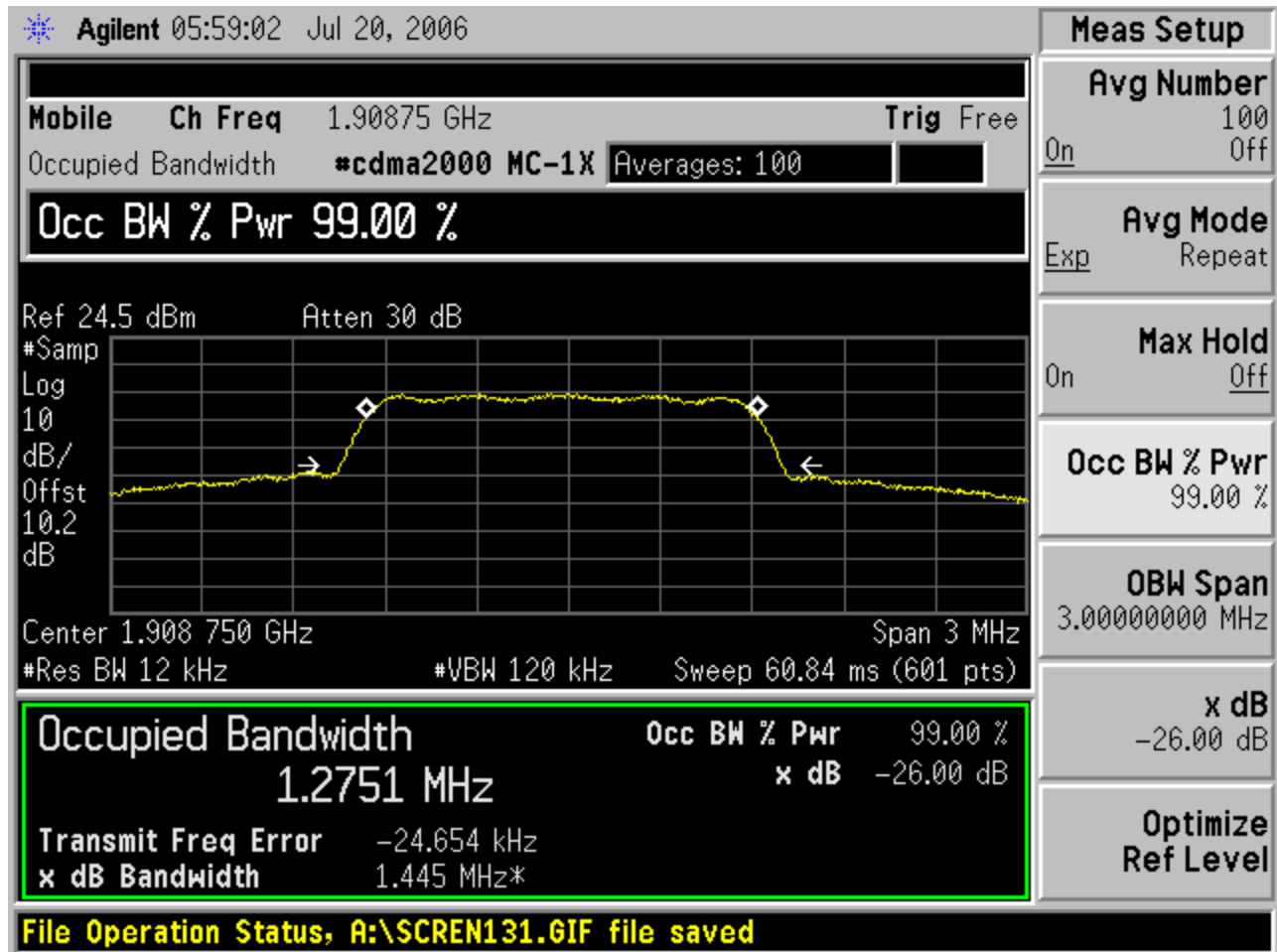
Modulation:

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)

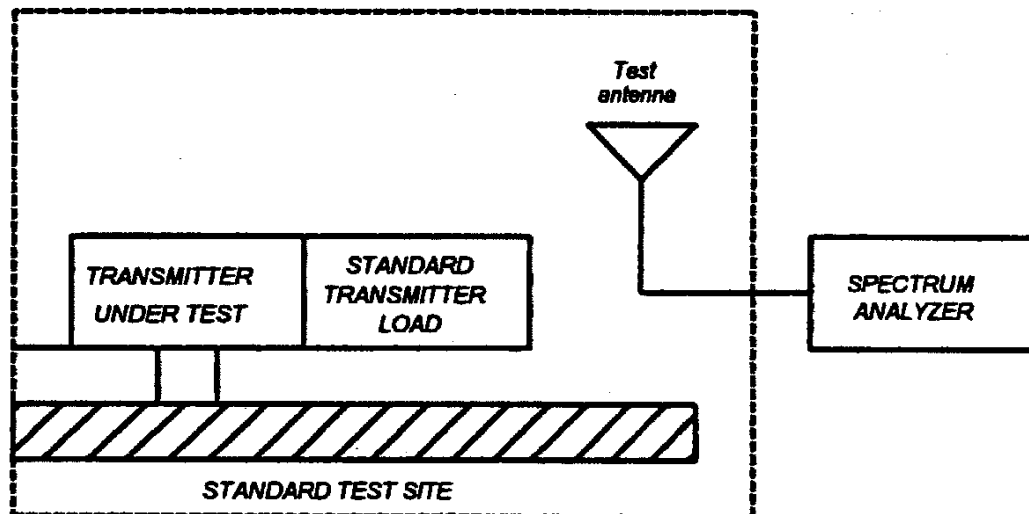
Guide: ANSI/TIA/EIA-603-1992/2001, Paragraph 1.2.12 and Table 16, 47 CFR 22.917

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.

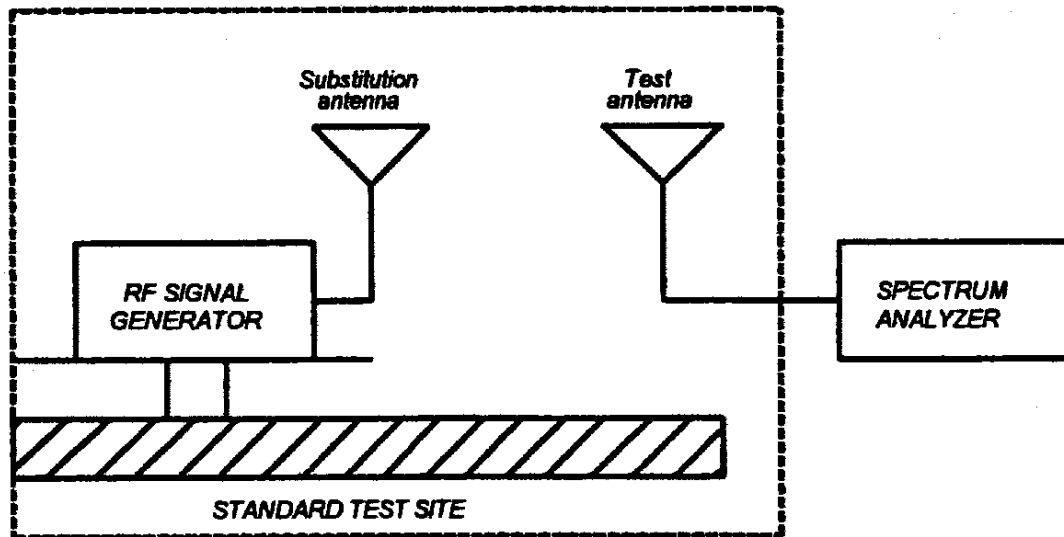
1.2.12.2 Method of Measurement

- 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 ≤ 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 (as applicable)	Description	s/n	Cycle	Last Cal
Per ANSI C63.4-1992/2000 Draft, 10.1.4					
Transducer					
	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
Amplifier					
	i00028	HP 8449A	2749A00121	12 mo.	Mar-05
Spectrum Analyzer					
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°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°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:

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

20

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 _R
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:

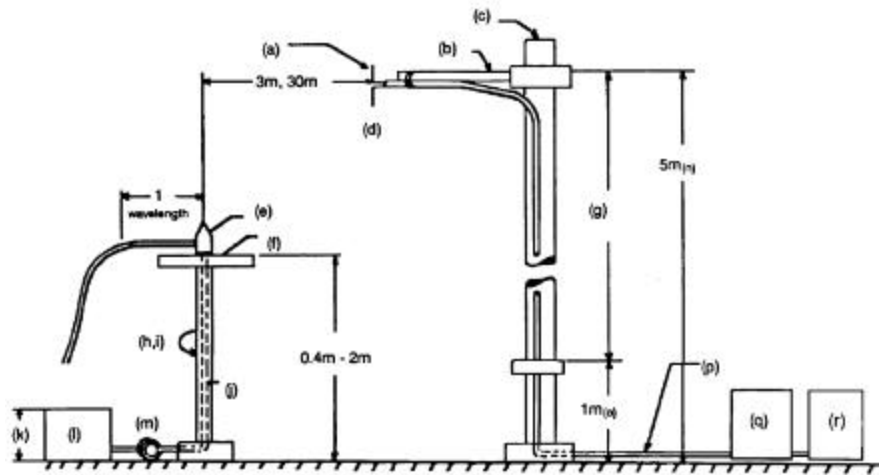
$$\begin{aligned} \text{Emission Frequency, MHz} &= 1739.460000 \\ \text{Level} &= \text{Log}_{10}^{-1} \left(\frac{-0.44 + 30.98}{20} \right) \\ \text{Level, } \mu\text{V/m @ 3m} &= 33.65 \end{aligned}$$

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 (as applicable)	Description	s/n	Cycle	Last Cal
Transducer				
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.	
Amplifier				
i00028	HP 8449A	2749A00121	12 mo.	
Spectrum Analyzer				
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 MHz	Emission MHz	dBuV/m	@m	C.F. dB	Calc. dBuV/m	@m	Limit dBuV/m	Marginal 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

Testimonial and Statement of Certification
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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.