FCC CFR47 PART 22 SUBPART H
AND PART 24 SUBPART E
CERTIFICATION TEST REPORT

FOR

EVDO Mini-PCI EXPRESS CARD CDMA MODEM MODULE

MODEL NUMBER: MC5725, MC5725V*

FCC ID: N7N-MC5725

REPORT NUMBER: 06U10171-1, REVISION C

ISSUE DATE: MAY 15, 2006

Prepared for
SIERRA WIRELESS
2290 COSMOS CT.
CARLSBAD, CA 92009 USA

Prepared by
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* Details of specific model(s) tested and model differences are identified in the body of report.

LAB CODE:200065-0

Revision History

Rev.	Date	Revisions	Revised By
--	5/03/06	Initial Issue	Thu
B	5/12/06	Updated section 5.6; updated all the RF data	Thu
C	5/15/06	Updated section 5.1, 5.3 and 5.6; added photos to section 8	Thu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SIERRA WIRELESS
2290 COSMOS CT.
CARLSBAD, CA 92009, USA

EUT DESCRIPTION: EVDO Mini-PCI EXPRESS CARD CDMA MODEM MODULE

MODEL NUMBER: MC5725; MC5725V

SERIAL NUMBER: 121103

DATE TESTED: APRIL 24-27, 2006

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:

THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

CHIN PANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA/EIA 603C (2004), 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 800 / 1900MHz Mini-PCI Express Card CDMA Modem Module.

The module is manufactured by Sierra Wireless, Inc.

The EUT description was changed after testing commenced. All data in this report is applicable to the model number documented in Section 1 above.

MC-5725 supports IS95 2G networks, CDMA 2000 1X, 1xEVDO Rev. 0 and 1xEVDO Rev.A. Device capabilities is documented in the theory of operation.

5.2. MANUFACTURER'S DESCRIPTION OF MODEL DIFFERENCES

The EUT model MC5725 is similar to MC5725V, which is the other model number listed in this report. Below is the description of model difference:

• The RF circuitry is the same for both models as well as the RF performance.
• The PCB (Printed Circuit Board) is the same for both modules.
• The MC5725V routes two audio lines via resistor selection to the IO connecter and the MC5725 does not.

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

824 to 849 MHz Authorized Band

Frequency Range (MHz)	Modulation	Conducted Average Power (dBm)	Conducted Average Power (mW)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)
Low CH - 824.7	1 x EVDO	24.77	299.92	29.01	796.16
Mid CH - 836.5		25.13	325.84	29.23	837.53
High CH - 848.3		24.73	297.17	28.74	747.31

1850 to 1910 MHz Authorized Band

Frequency Range (MHz)	Modulation	Conducted Average Power (dBm)	Conducted Average Power (mW)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)
Low CH - 1851.25	1 x EVDO	24.77	299.92	28.45	699.84
Mid CH - 1880		24.84	304.79	28.83	763.84
High CH - 1908.75		24.78	300.61	28.07	641.21

NOTE: RBW=VBW=3MHz.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a monopole 2x antennas, with a maximum allowed gain of 5.10 dBi for Cellular bands and 4.15 dBi for PCS bands.

5.5. SOFTWARE AND FIRMWARE

The EUT is linked with Agilent Communication Test Set.

5.6. WORST-CASE CONFIGURATION AND MODE

Pre-scan was performed on RF conducted port to determine the worst-case scenario:

Cellular Band	Avg. Output Power (dBm) Mid CH	99% BW (MHz) Mid CH	26 dB BW (MHz) Mid CH	Band edge (dBm) Low CH	Band edge (dBm) High CH
1xRRT RC3, SO2	24.90	1.265	1.407	-16.724	-13.551
1xRRT RC3, SO32 (+F-SCH)	24.90	**1.286**	**1.407**	-16.221	-13.283
1xRRT RC3, SO32 (+SCH)	24.90	1.261	1.384	-16.312	-13.327
1xRRT RC3, SO55	24.90	1.278	1.405	-16.998	-13.334
EVDO	**25.13**	1.267	1.399	-16.721	-13.492

PCS Band	Avg. Output Power (dBm) Mid CH	99% BW (MHz) Mid CH	26 dB BW (MHz) Mid CH	Band edge (dBm) Low CH	Band edge (dBm) High CH
1xRRT RC3, SO2	24.80	1.273	1.389	-34.678	-32.699
1xRRT RC3, SO32 (+F-SCH)	24.80	**1.276**	**1.400**	-33.685	-31.233
1xRRT RC3, SO32 (+SCH)	24.80	1.273	1.383	-34.067	-31.926
1xRRT RC3, SO55	24.80	1.263	1.397	-34.889	-31.326
EVDO	**24.84**	1.261	1.387	-33.942	-31.344

Based on the above results from the different modulations, EVDO is determined to be the worst-case scenario for fundamental ERP /EIRP measurement and radiated spurious emissions tests; and 1xRRT RC3, SO32 (+F-SCH) to be the worst-case scenario for RF conducted band-edge and bandwidth tests.

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at mid channel for both bands.

1xEVDO Rev. A can not be performed with Base Station simulator due to 1xEVDO Rev. A network is not widely supported in the U.S. at the time of tests.

3GPP2 C.S0024 refers to 3GPP2 C.S0033 for EV-DO Rev A maximum transmit power measurements. The channel configuration is the same for Rev 0 and Rev A. Sierra Wireless has provided an engineering evaluation data from the chip set manufacturer to show the differences in term of output power between Rev. 0 and Rev. A. As the result indicated, the difference is 0.08 dB thus 1xEVDO Rev. A configuration is not evaluated in this test report.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	IBM	Thinkpad T43	99-B2015	DoC
AC Adapter	IBM	08K8204	11S08K8204Z1Z9V04BY9Y5	DoC
AC Adapter	Elpac Power Systems	W1505	E150854	DoC
Test Kit	Sierra Wireless Inc	CCA-000051-0001	NA	NA

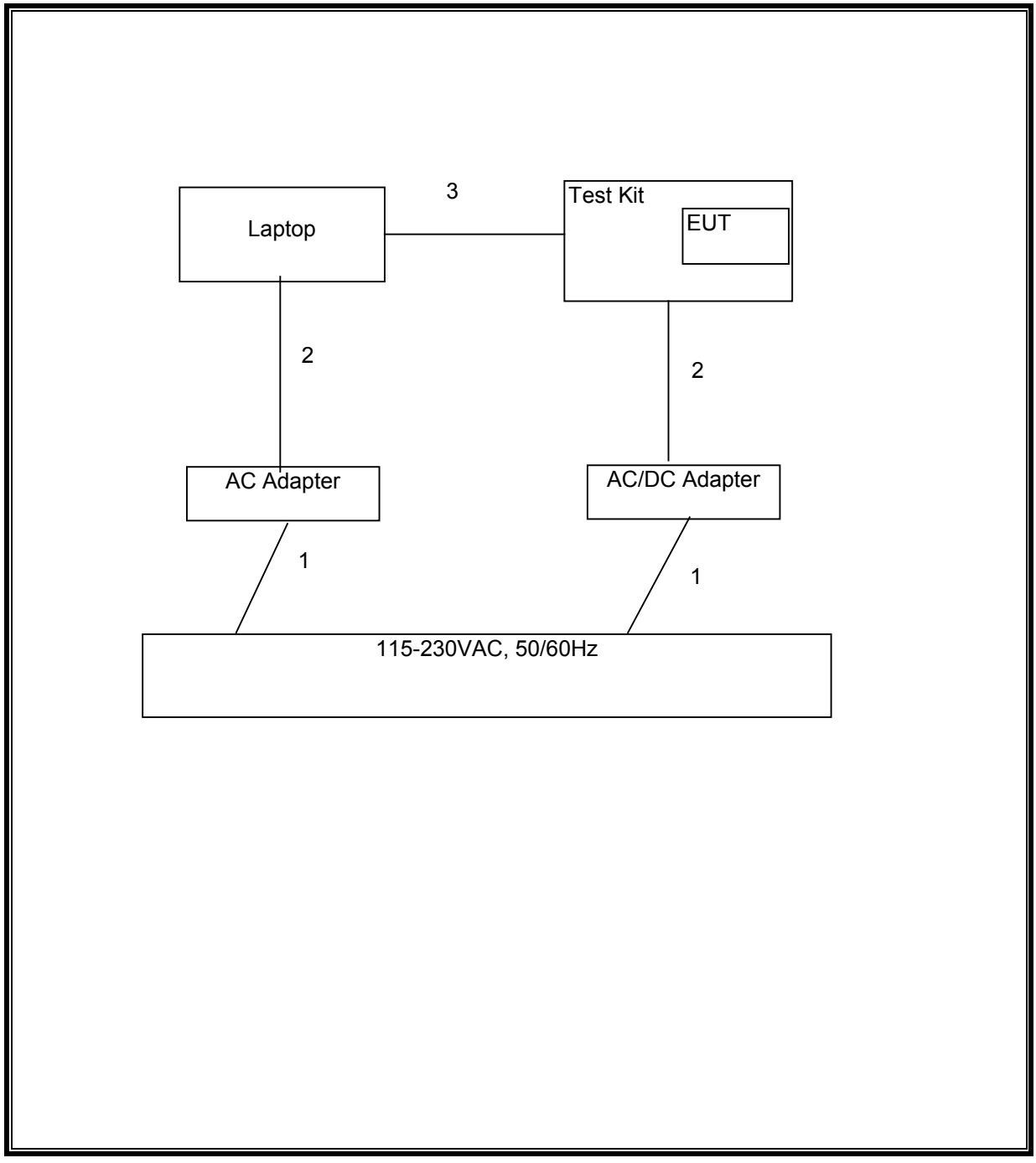
I/O CABLES

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	2m	NA
3	USB	1	USB	Un-shielded	2m	Connected to Test Kit

TEST SETUP

The EUT is installed in a Test Kit during the tests, and a Laptop is connected to the Test Kit. The EUT is linked with Agilent Communication Test Set.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	8/2/1981	6/10/2006
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	9/3/06
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	4/22/07
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	2/4/07
RF Filter Section	Agilent / HP	85420E	3705A00256	2/4/07
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/2/07
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/2/07
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	4/22/07
Signal Generator 2 -40 GHz	R & S	SMP04	DE 34210	6/2/06
Signal Generator 1024 MHz	R & S	SMY01	DE 12311	5/11/07
Dipole	EMCO	3121C-DB2	22435	5/7/06
2.7GHz HPF	MicroTronic	HPM13194	2	CNR
1.5GHz HPF	MicroTronic	HPM13195	1	CNR
Communication Test Set	Agilent	E5515C	91936	4/8/07

7. LIMITS AND RESULTS

7.1. OCCUPIED BANDWIDTH

Worst c

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

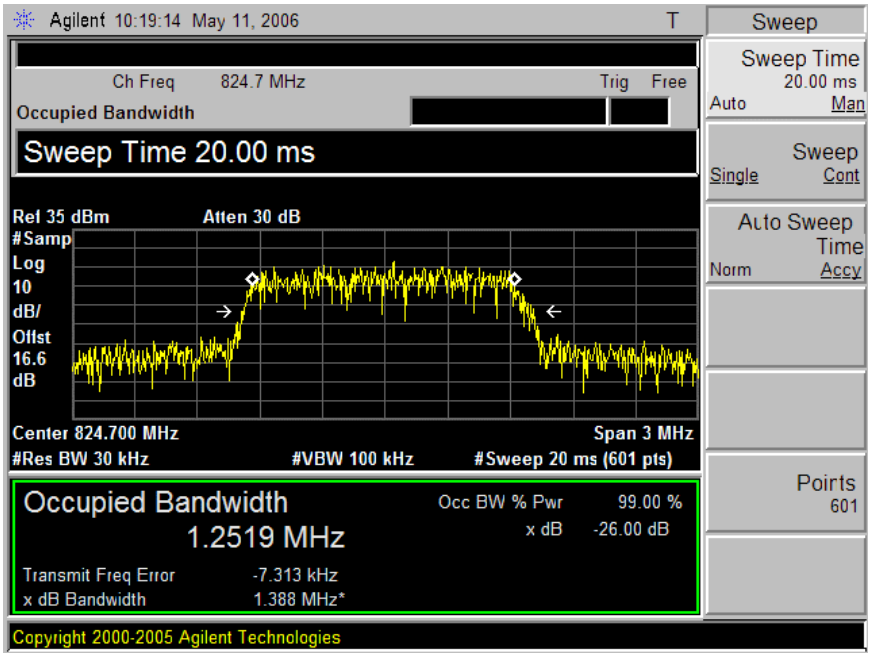
Channel	Frequency (MHz)	Bandwidth (MHz)
Low	824.70	1.388
Middle	836.52	1.404
High	848.31	1.416

1900MHz PCS Modulation

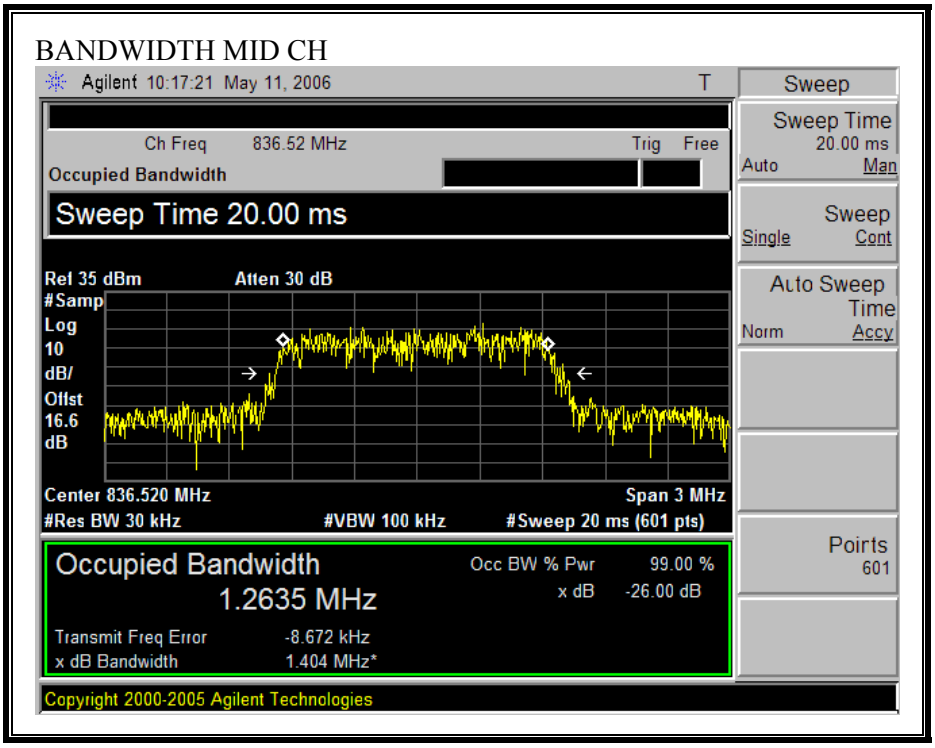
Channel	Frequency (MHz)	Bandwidth (MHz)
Low	1851.25	1.401
Middle	1880.00	1.400
High	1908.75	1.402

800MHz CELLULAR 26 dB BANDWIDTH

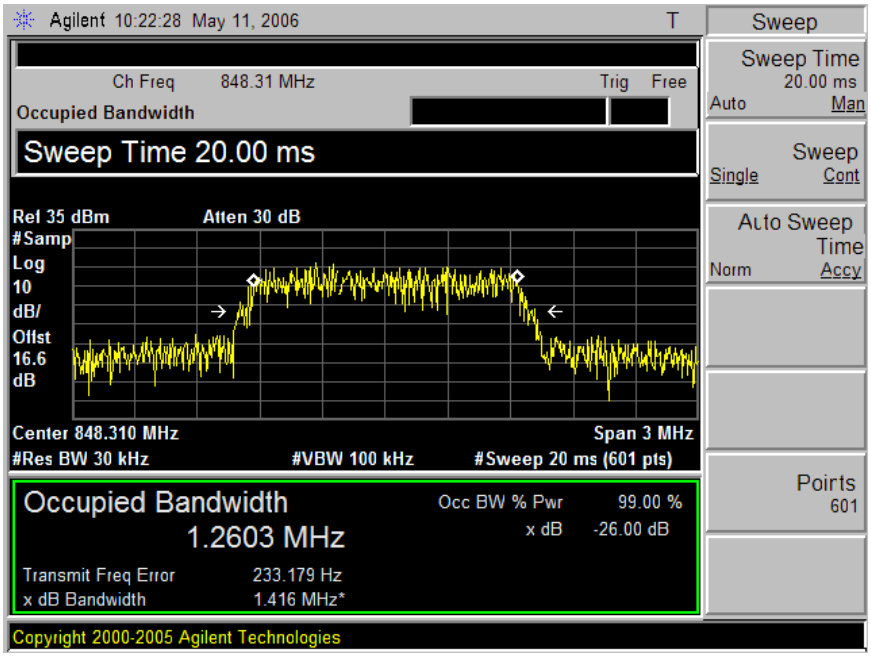
BANDWIDTH LOW CH



BANDWIDTH MID CH

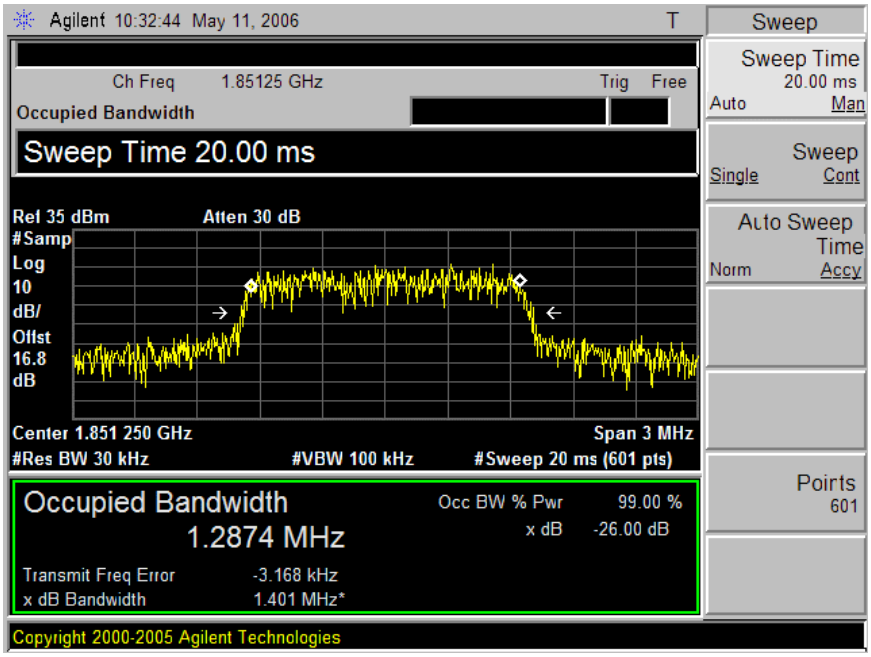


BANDWIDTH HIGH CH

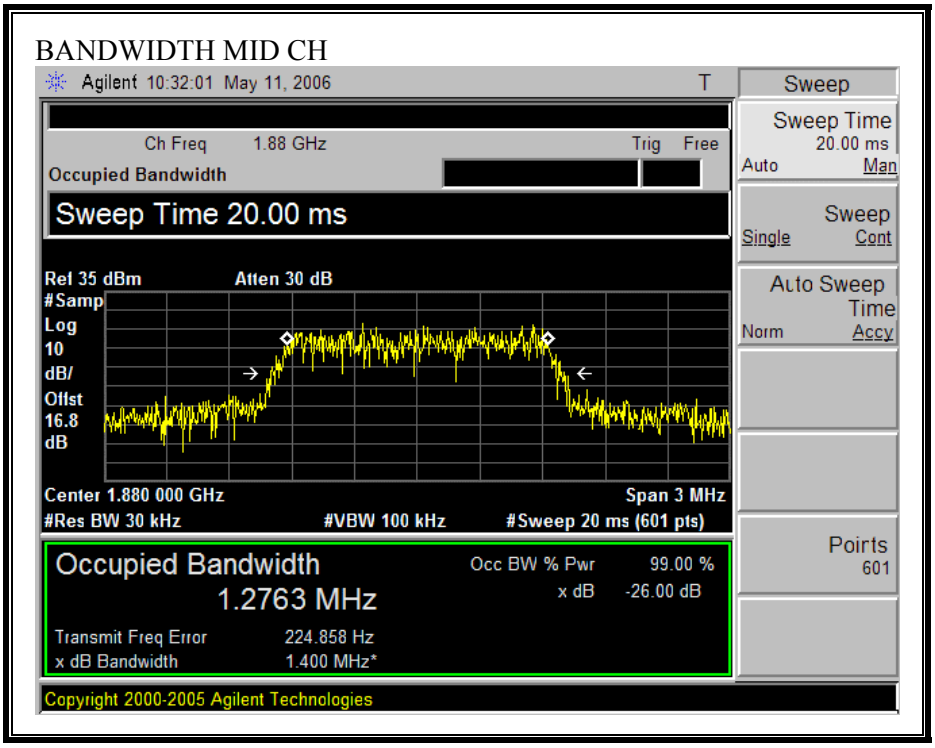


1900MHz PCS 26 dB BANDWIDTH

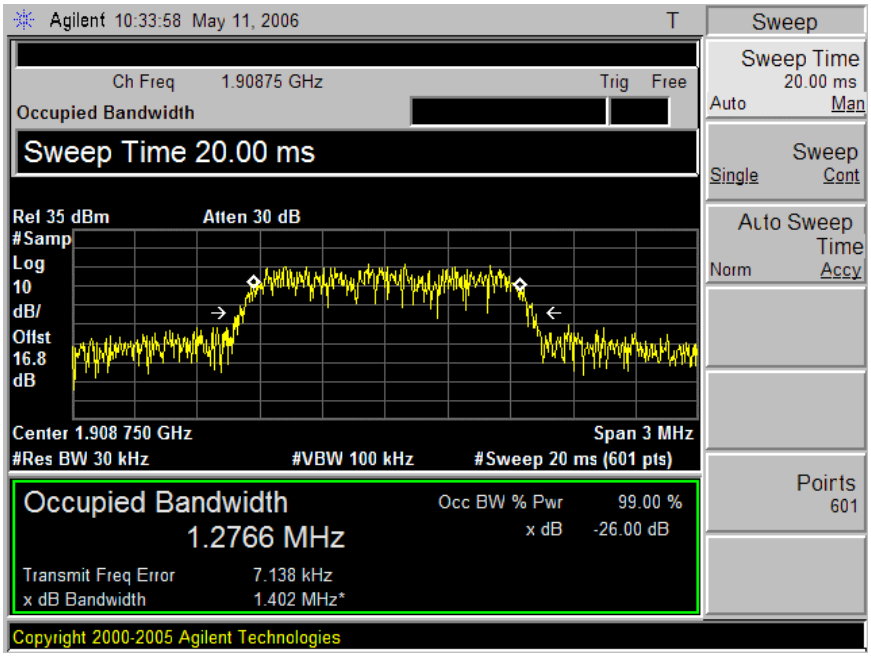
BANDWIDTH LOW CH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



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 603C Clause 2.2.17

RESULTS

No non-compliance noted.

800MHz CELL CDMA Modulation

Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)
Low	824.7	29.01	796.16
Middle	836.5	29.23	837.53
High	848.3	28.74	747.31

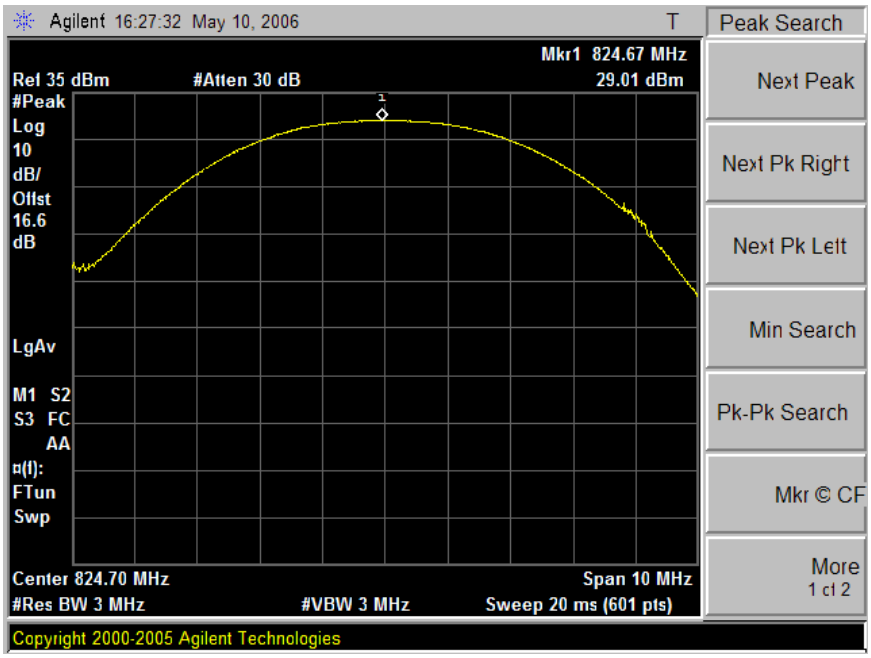
1900MHz PCS Modulation

Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Peak Power (mW)
Low	1851.25	28.45	699.84
Middle	1880.00	28.83	763.84
High	1908.75	28.07	641.21

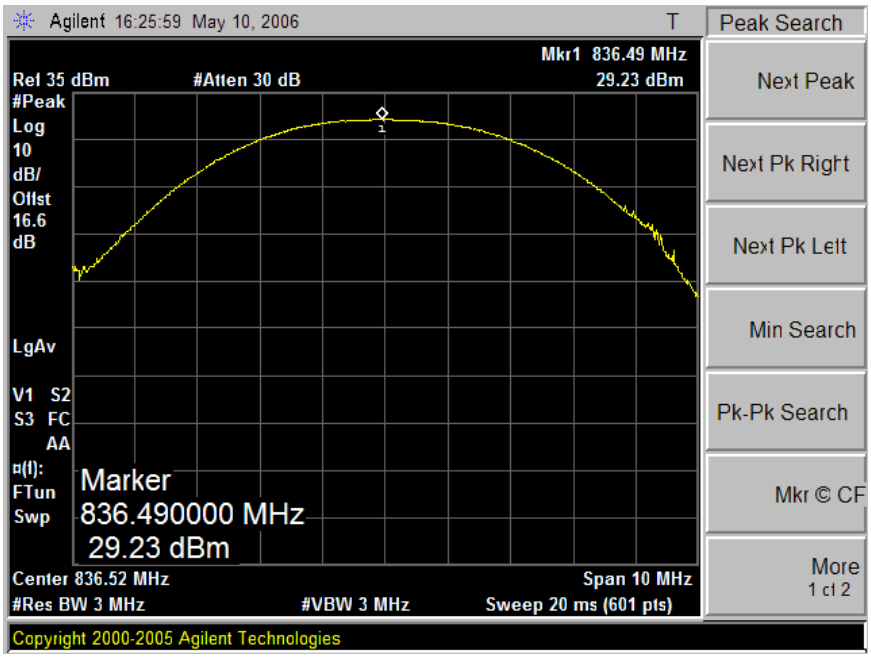
NOTE: RBW=VBW=3MHz

800MHz CELLULLAR (RF CONDUCTED OUTPUT POWER)

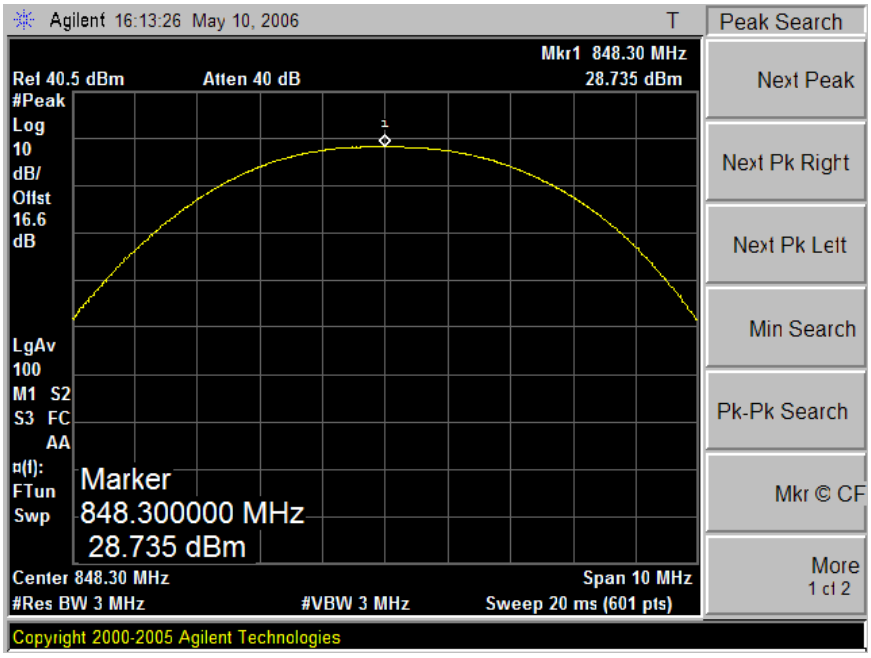
OUTPUT POWER LOW CH



OUTPUT POWER MID CH

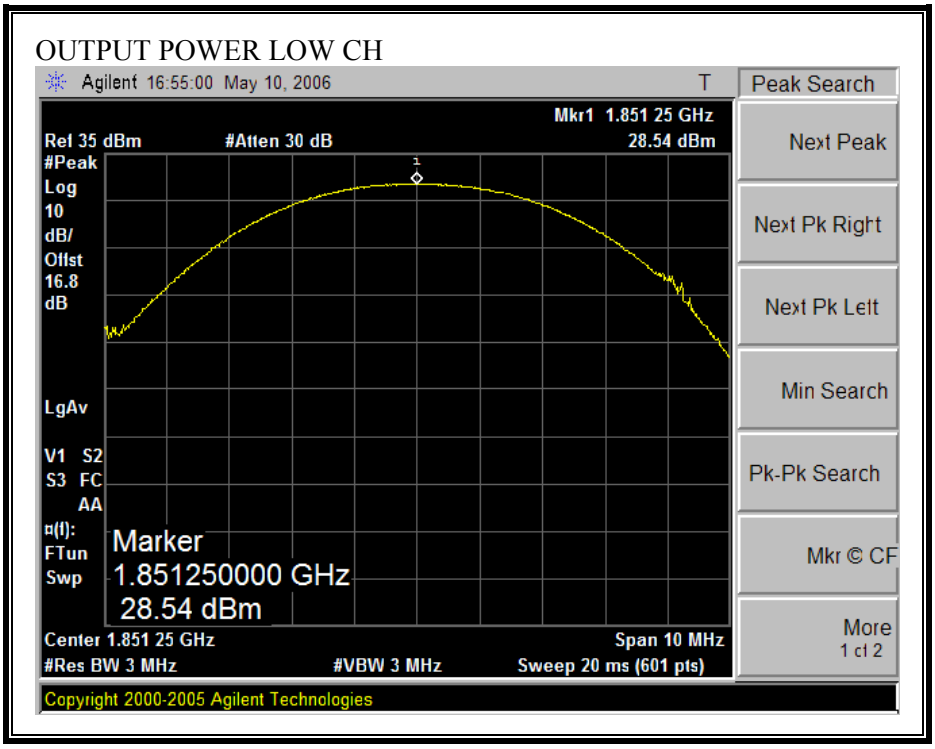


OUTPUT POWER HIGH CH

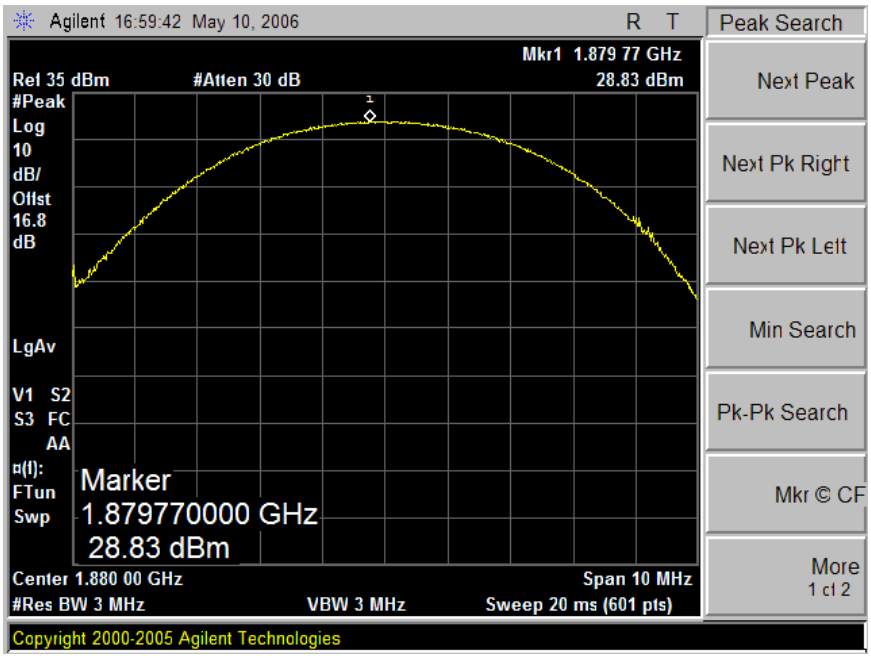


1900MHz PCS (RF CONDUCTED OUTPUT POWER)

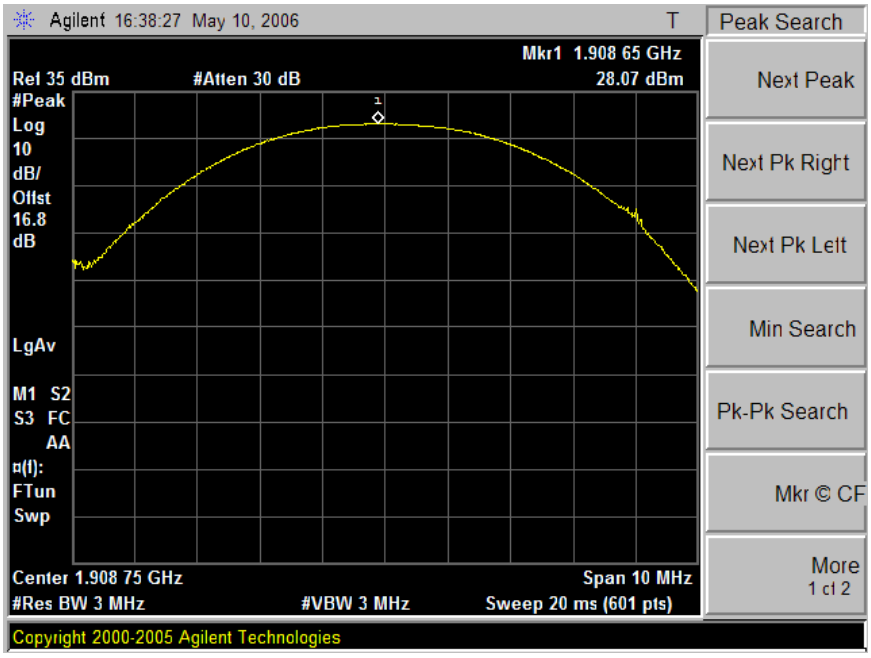
OUTPUT POWER LOW CH



OUTPUT POWER MID CH



OUTPUT POWER HIGH CH



Cellular Output Power (ERP)

f MHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Y Pos									
824.20	104.6	V	27.7	0.5	0.0	27.2	38.5	-11.3	
824.20	99.9	H	21.6	0.5	0.0	21.1	38.5	-17.4	
836.50	104.5	V	28.5	0.6	0.0	27.9	38.5	-10.5	
836.50	100.1	H	21.9	0.6	0.0	21.3	38.5	-17.1	
848.80	104.0	V	28.6	0.7	0.0	27.9	38.5	-10.5	
848.80	99.0	H	20.9	0.7	0.0	20.2	38.5	-18.2	

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

PCS Output Power (EIRP)

f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
X Pos									
1.850	91.0	H	13.8	0.9	8.3	21.2	33.0	-11.8	
1.850	95.3	V	17.9	0.9	8.3	25.3	33.0	-7.7	
1.880	92.1	H	15.2	0.9	8.3	22.7	33.0	-10.4	
1.880	95.0	V	17.3	0.9	8.3	24.8	33.0	-8.3	
1.910	91.8	H	15.2	0.9	8.4	22.7	33.0	-10.3	
1.910	94.5	V	17.5	0.9	8.4	25.0	33.0	-8.0	

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

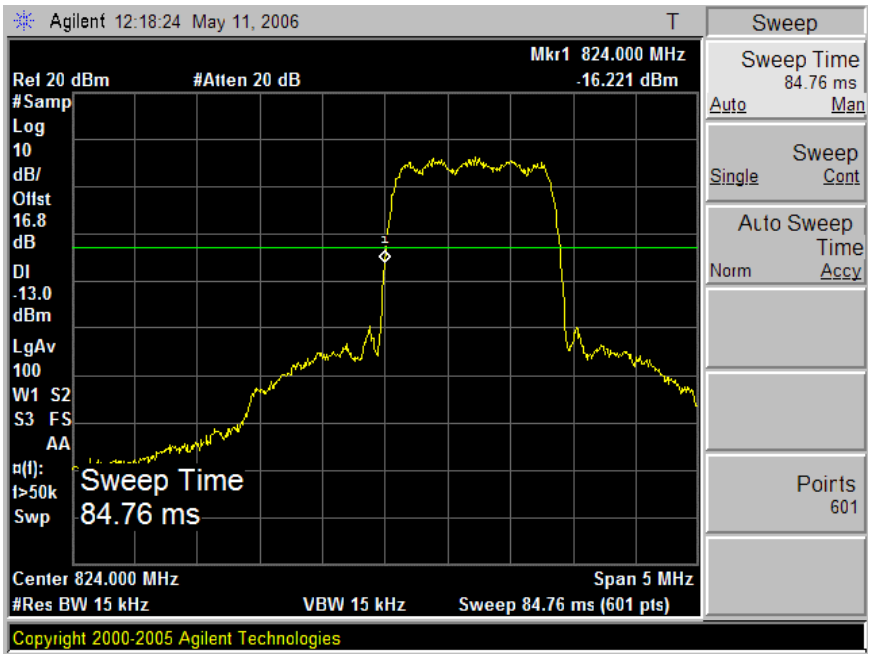
ANSI / TIA / EIA 603C Clause 2.2.12, FCC 22.917 (h), & FCC 24.238 (b)

RESULTS

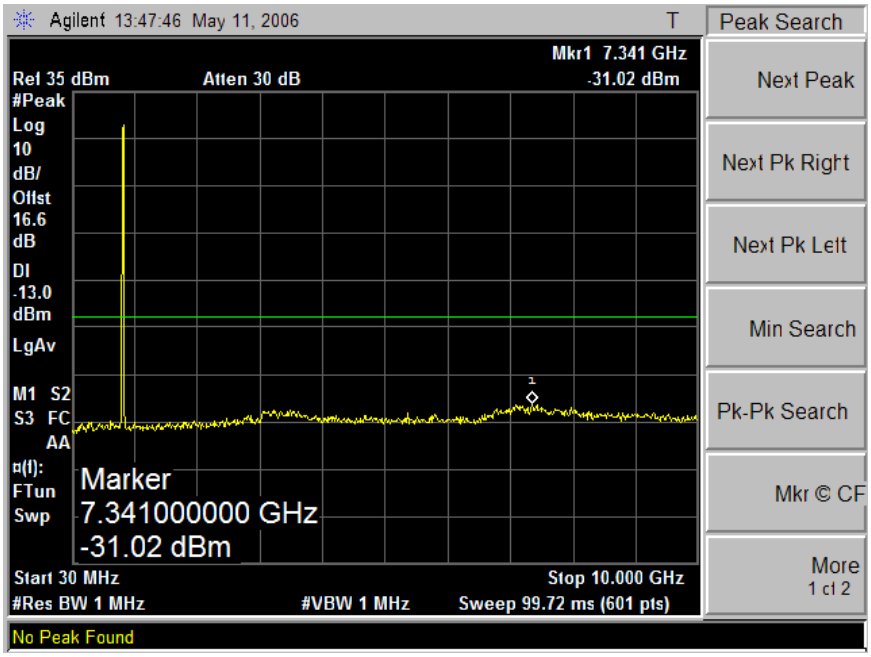
No non-compliance noted.

800MHz CELLULAR

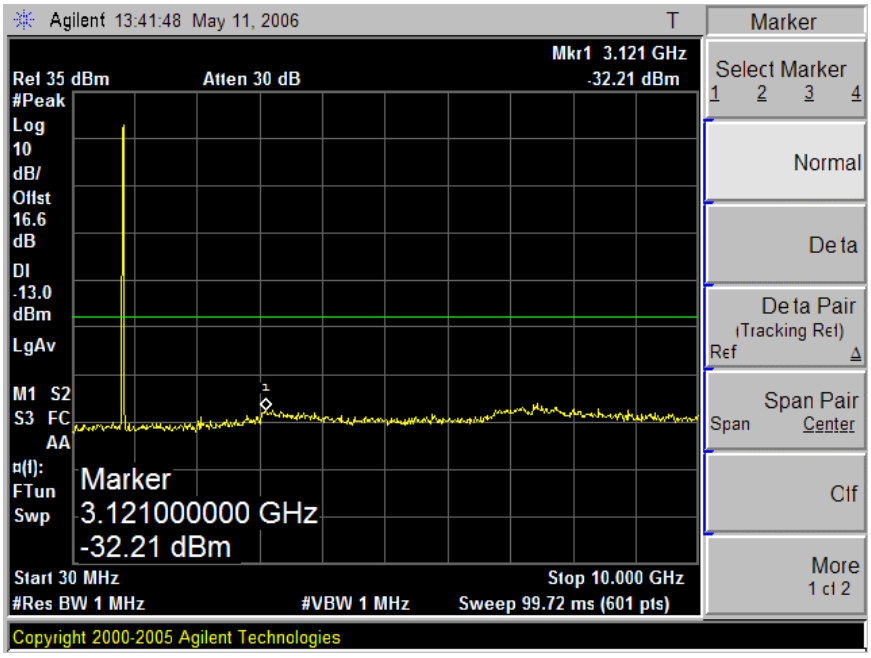
CELLULAR LOW CH BANDEDGE



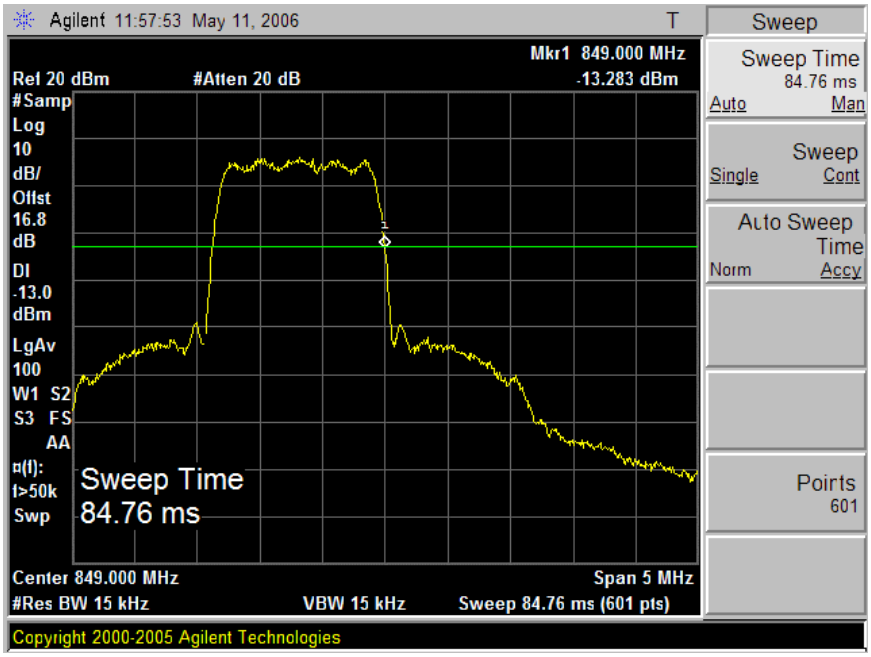
CELLULAR LOW CH SPURIOUS



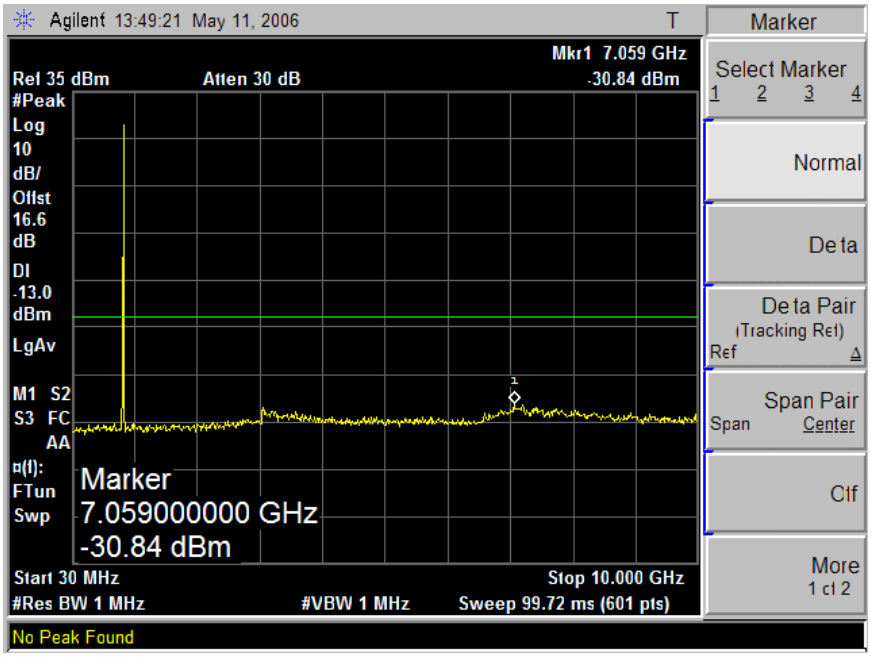
CELLULAR MID CH SPURIOUS



CELLULAR HIGH CH BANDEDGE

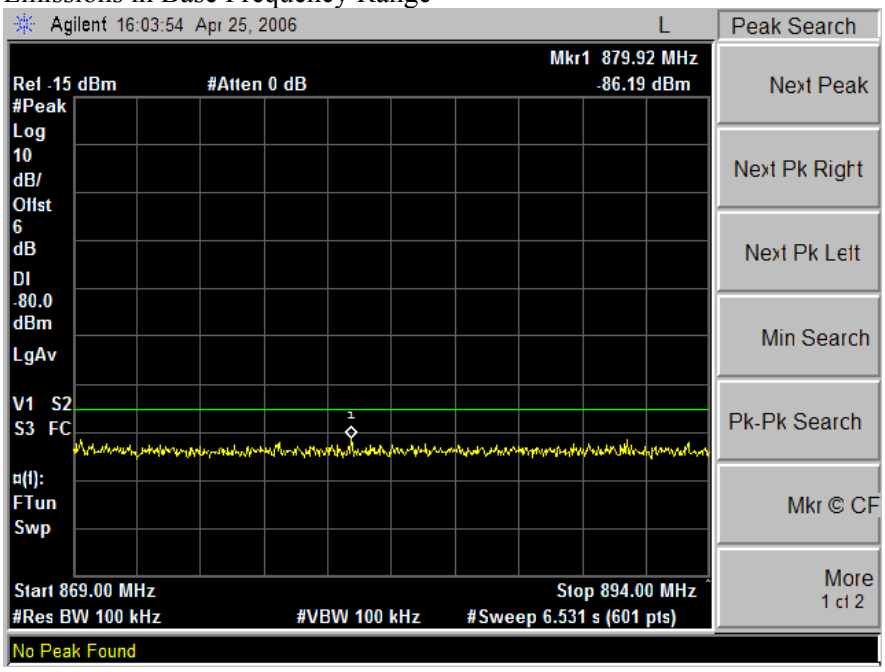


CELLULAR HIGH CH SPURIOUS



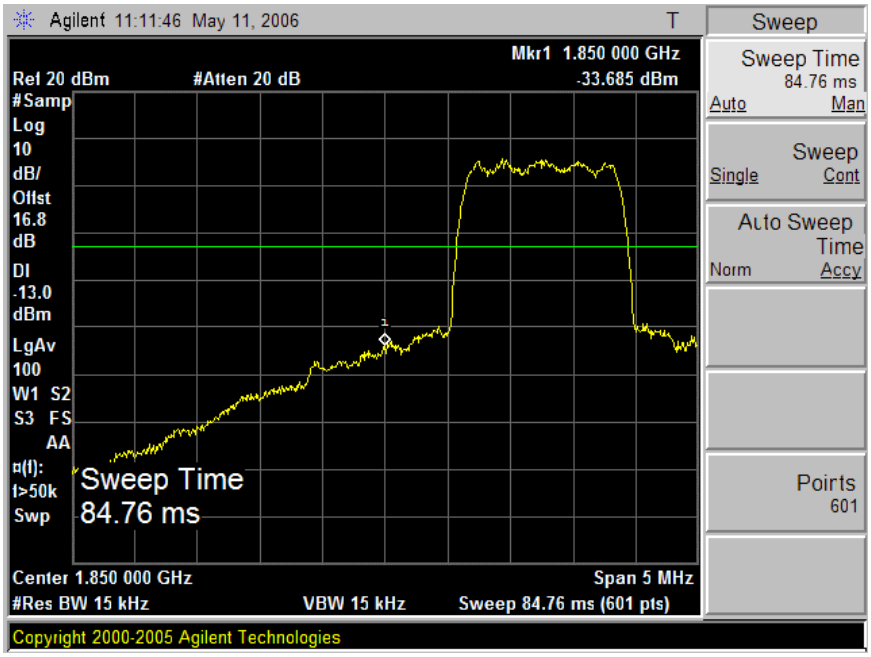
800MHz Cellular Mobile Emissions in Base Frequency Range

Emissions in Base Frequency Range

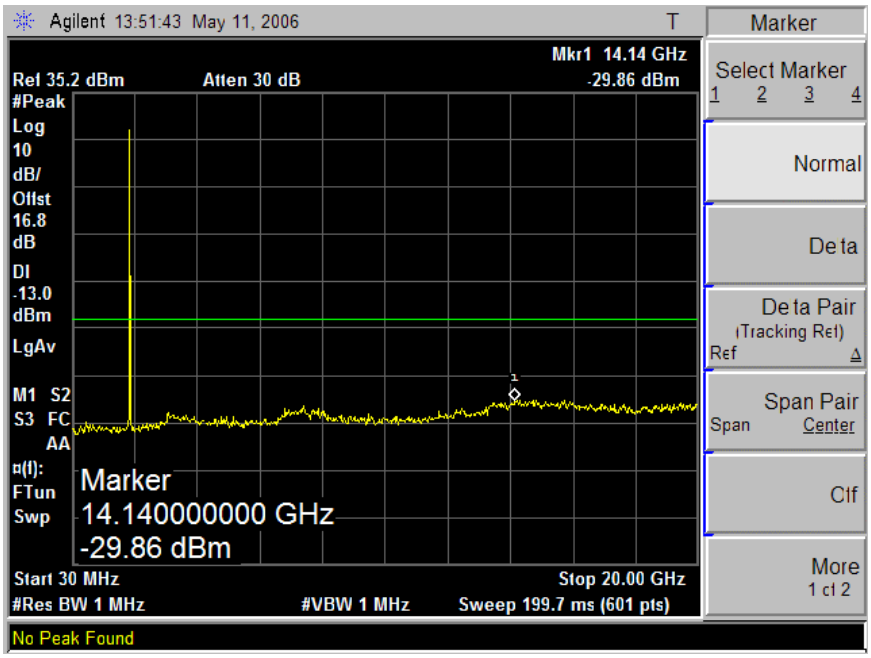


1900MHZ PCS

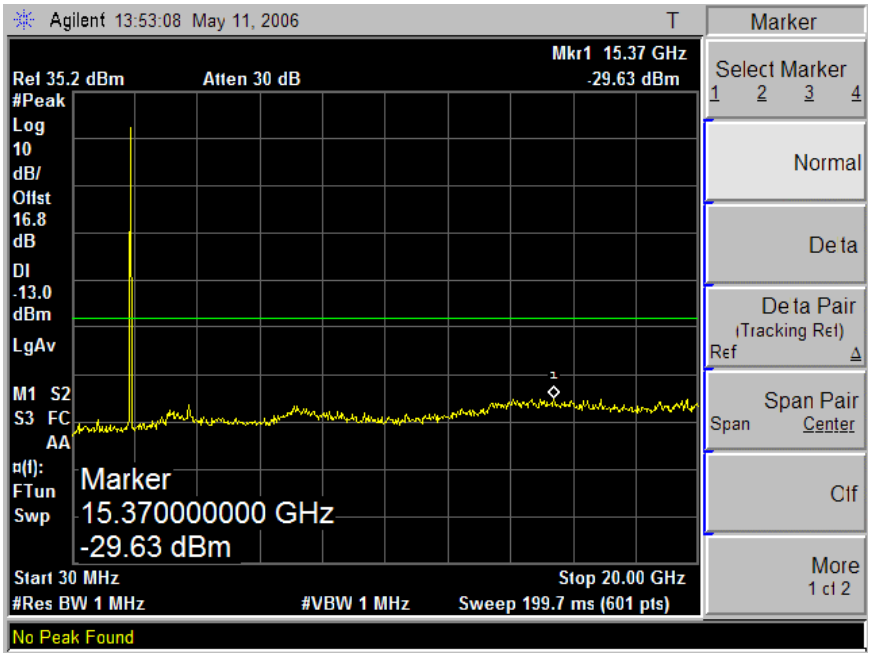
PCS LOW CH BANDEDGE



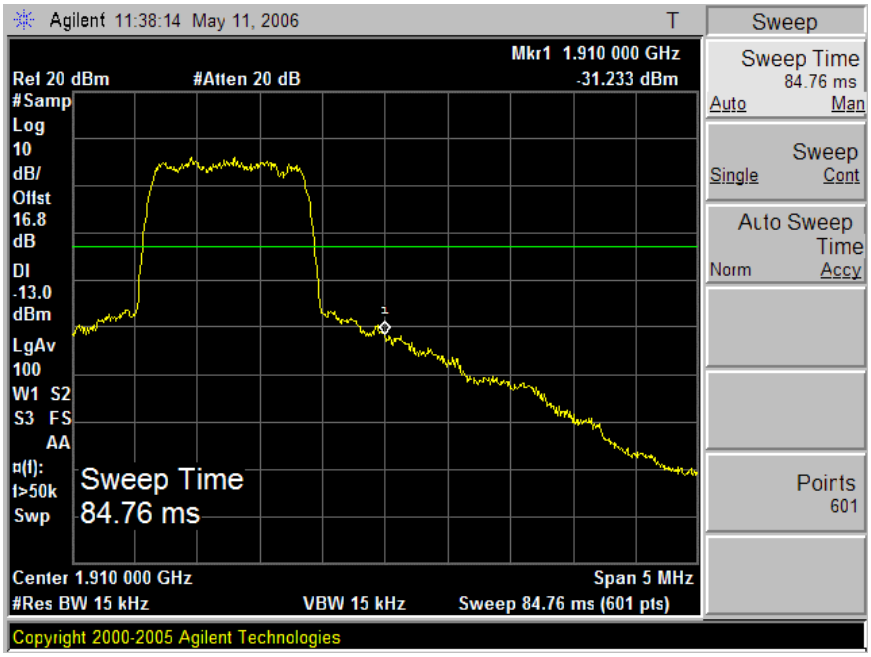
PCS LOW CH SPURIOUS



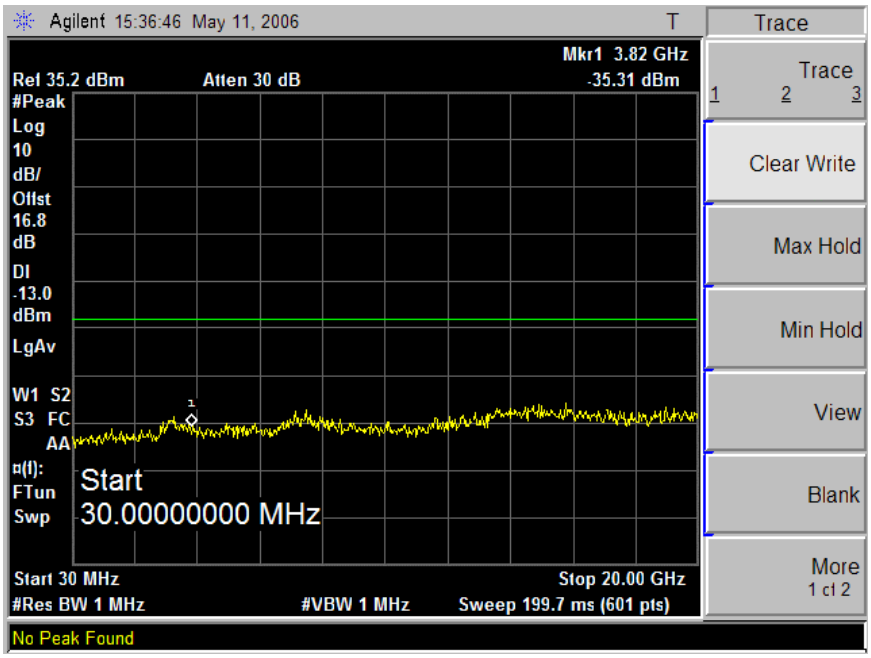
PCS MID CH SPURIOUS



PCS HIGH CH BANDEDGE



PCS HIGH CH SPURIOUS



7.4. FIELD STRENGTH OF SPURIOUS RADIATION

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 603C Clause 2.2.12, FCC 22.917 (h), & FCC 24.238 (b)

RESULTS

No non-compliance noted.

Note: No emissions were found within 30-1000MHz of 20dB below the system noise.

800MHz Band CDMA Spurious & Harmonic (ERP)

05/10/06 **High Frequency Substitution Measurement**
Compliance Certification Services, Morgan Hill 5m Chamber Site

Test Engr:Chin Pang
Project #:06U10171
Company:Sierra Wireless
EUT Descrip.:PCA,EVDO Mini-PCI Express CDMA Modem
EUT M/N:MC5725
Test Target:FCC Part 22
Mode Oper:1xEV-DO, TX, CELL

Test Equipment:

EMCO Horn 1-18GHz: T73; S/N: 6717 @3m
Horn > 18GHz:
Limit: FCC 22
☑ High Pass Filter
Hi Frequency Cables: ☐ (2 ft) ☑ (2 ~ 3 ft) ☐ (4 ~ 6 ft) ☑ (12 ft)
Pre-amplifer 1-26GHz: T145 Agilent 3008A
Pre-amplifer 26-40GHz:

f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch										
1.649	60.3	V	-50.3	1.6	8.1	5.9	-46.0	-13.0	-33.0	
3.299	54.6	V	-50.6	2.3	9.5	7.4	-45.5	-13.0	-32.5	
4.124	47.0	V	-55.2	2.6	9.6	7.4	-50.4	-13.0	-37.4	
1.649	57.5	H	-52.4	1.6	8.1	5.9	-48.1	-13.0	-35.1	
3.299	53.4	H	-51.7	2.3	9.5	7.4	-46.6	-13.0	-33.6	
4.124	46.3	H	-55.5	2.6	9.6	7.4	-50.7	-13.0	-37.7	
Mid Ch										
1.673	59.6	V	-51.0	1.6	8.1	6.0	-46.6	-13.0	-33.6	
3.346	52.7	V	-52.3	2.3	9.5	7.4	-47.2	-13.0	-34.2	
4.183	48.3	V	-53.8	2.6	9.6	7.5	-49.0	-13.0	-36.0	
1.673	56.7	H	-53.2	1.6	8.1	6.0	-48.8	-13.0	-35.8	
3.346	48.4	H	-56.5	2.3	9.5	7.4	-51.4	-13.0	-38.4	
4.183	45.6	H	-56.2	2.6	9.6	7.5	-51.3	-13.0	-38.3	
High Ch										
1.697	59.4	V	-51.1	1.6	8.2	6.0	-46.7	-13.0	-33.7	
2.545	54.6	V	-53.5	2.0	9.6	7.4	-48.0	-13.0	-35.0	
3.393	52.3	V	-52.5	2.3	9.5	7.4	-47.4	-13.0	-34.4	
1.697	57.5	H	-52.3	1.6	8.2	6.0	-47.9	-13.0	-34.9	
2.545	50.0	H	-57.9	2.0	9.6	7.4	-52.4	-13.0	-39.4	
3.393	47.2	H	-57.5	2.3	9.5	7.4	-52.4	-13.0	-39.4	
Note: No other emissions were detected above the system noise floor.										

PCS Spurious & Harmonic (EIRP):

05/10/06 **High Frequency Substitution Measurement**
Compliance Certification Services, Morgan Hill 5m Chamber Site

Test Engr:Chin Pang
Project #:06U10171
Company:Sierra Wireless
EUT Descrip.:PCA,EVDO Mini-PCI Express CDMA Modem
EUT M/N:MC5725
Test Target:FCC Part 24
Mode Oper:1xEV-DO, TX, PCS

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-amplifer 1-26GHz: T144 Miteq 3008A0(
Pre-amplifer 26-40GHz:

f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch										
3.702	58.8	V	-46.7	2.4	9.5	7.3	-39.7	-13.0	-26.7	
7.405	51.6	V	-48.2	3.7	12.0	9.8	-39.9	-13.0	-26.9	
9.257	50.0	V	-49.3	4.2	12.4	10.2	-41.1	-13.0	-28.1	
3.702	56.0	H	-49.4	2.4	9.5	7.3	-42.4	-13.0	-29.4	
7.405	49.5	H	-49.5	3.7	12.0	9.8	-41.2	-13.0	-28.2	
9.257	47.0	H	-52.3	4.2	12.4	10.2	-44.1	-13.0	-31.1	
Mid Ch										
3.760	59.0	V	-46.3	2.5	9.5	7.3	-39.3	-13.0	-26.3	
7.520	52.3	V	-47.3	3.7	11.9	9.8	-39.1	-13.0	-26.1	
9.400	46.8	V	-52.4	4.2	12.4	10.2	-44.2	-13.0	-31.2	
3.760	57.0	H	-48.2	2.5	9.5	7.3	-41.2	-13.0	-28.2	
7.520	46.5	H	-52.3	3.7	11.9	9.8	-44.1	-13.0	-31.1	
9.400	44.2	H	-55.0	4.2	12.4	10.2	-46.8	-13.0	-33.8	
High Ch										
3.818	63.4	V	-41.7	2.5	9.5	7.3	-34.7	-13.0	-21.7	
5.726	49.3	V	-52.2	3.3	11.1	8.9	-44.4	-13.0	-31.4	
7.635	51.5	V	-47.8	3.8	11.9	9.8	-39.7	-13.0	-26.7	
9.544	47.6	V	-51.5	4.3	12.4	10.3	-43.3	-13.0	-30.3	
3.818	54.6	H	-50.4	2.5	9.5	7.3	-43.4	-13.0	-30.4	
5.726	46.0	H	-54.5	3.3	11.1	8.9	-46.7	-13.0	-33.7	
7.635	49.2	H	-49.3	3.8	11.9	9.8	-41.2	-13.0	-28.2	
9.544	44.0	H	-55.1	4.3	12.4	10.3	-46.9	-13.0	-33.9	

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^2)	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	*($900/f^2$)	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	*($180/f^2$)	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^2)	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 (mW) = P (W) / 1000 and
d (cm) =100 * d (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^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

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

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

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

LIMITS

From §1.1310 Table 1 (B), S = 1.0 mW/cm^2

RESULTS

No non-compliance noted: (MPE distance equals 20 cm)

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.

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)
800MHz Celllar	20.0	29.23	5.10	0.539
1900 MHz PCS	20.0	28.83	4.15	0.395

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 603C Clause 2.3.1 and 2.3.2

RESULTS

No non-compliance noted.

800MHz CELLULAR – MID CHANNEL

Reference Frequency: Cellular Mid Channel 835.843716MHz @ 20*C Limit: to stay +- 2.5 ppm = 2089.563 Hz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (*C)**	**(MHz)**	**Delta (ppm)**	**Limit (ppm)**
3.60	50	835.825028	0.266	2.5
3.60	40	835.825215	0.042	2.5
3.60	30	835.825092	0.189	2.5
3.60	***20***	***835.825250***	***0***	2.5
3.60	10	835.825005	0.293	2.5
3.60	0	835.824988	0.313	2.5
3.60	-10	835.825202	0.057	2.5
3.60	-20	835.825239	0.013	2.5
3.60	-30	835.825322	-0.086	2.5

Reference Frequency: Cellular Mid Channel 835.839966MHz @ 20*C Limit: to stay +- 2.5 ppm = 2089.563 Hz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (*C)**	**(MHz)**	**Delta (ppm)**	**Limit (ppm)**
3.60	***20***	***835.825250***	***0***	***2.5***
3.4 (end point)	20	835.825056	*0.232*	2.5
3.5	20	835.825226	*0.029*	2.5
4.14	20	835.825330	*-0.096*	2.5

1900MHz PCS – MID CHANNEL

Reference Frequency: PCS Mid Channel 1880.000030MHz @ 20*C Limit: within the authorized block or +- 2.5 ppm = 4698.273 Hz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (*C)**	**(MHz)**	**Delta (ppm)**	**Limit (ppm)**
3.60	50	1879.309303	-0.120	2.5
3.60	40	1879.308929	0.079	2.5
3.60	30	1879.309022	0.029	2.5
3.60	***20***	***1879.309077***	***0***	***2.5***
3.60	10	1879.309913	-0.445	2.5
3.60	0	1879.309036	0.022	2.5
3.60	-10	1879.309152	-0.040	2.5
3.60	-20	1879.309199	-0.065	2.5
3.60	-30	1879.309214	-0.073	2.5

Reference Frequency: PCS Mid Channel 1880.000030MHz @ 20*C Limit: within the authorized block or +- 2.5 ppm = 4698.273 Hz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (*C)**	**(MHz)**	**Delta (ppm)**	**Limit (ppm)**
3.60	***20***	***1879.309077***	***0***	***2.5***
3.4 (end point)	20	1879.308066	*0.538*	2.5
3.5	20	1879.309123	*-0.024*	2.5
4.14	20	1879.309737	*-0.351*	2.5