FCC CFR47 PART 22 SUBPART H
AND PART 24 SUBPART E
CLASS II PERMISSIVE CHANGE
CERTIFICATION TEST REPORT

FOR

PCA, EVDO REV A, MINI-PCI EXPRESS CARD CDMA MODEM

MODEL NUMBER: MC5725

FCC ID: N7N-MC5725-L

REPORT NUMBER: 07U10918-3

ISSUE DATE: MARCH 25, 2007

Prepared for
SIERRA WIRELESS
2290 COSMOS CT.
CARLSBAD, CA 92010, USA

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
---	03/25/07	Initial Issue	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SIERRA WIRELESS
2290 COSMOS CT.
CARLSBAD, CA 92010, USA

EUT DESCRIPTION: PCA, EVDO REV. A, MINI-PCI EXPRESS CARD CDMA MODEM

MODEL: MC5725

SERIAL NUMBER: ZZF591

DATE TESTED: MARCH 14-15, 2007

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 47173 Benicia Street, Fremont, 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 PCA, EVDO REV. A, Mini-PCI Express Card CDMA Modem, and the module is manufactured by Sierra Wireless, Inc.

5.2. DESCRIPTION OF CLASS II CHANGE

Change #1 - To change from a Limited Modular Approval, Mobile Condition to Limited Modular Approval, Portable Condition.

Change #2 - To change the antenna type from monopole (MC5725-L Modular Grant) to PIFA. The PIFA antenna has lower gain compared to the monopole

Change #3 - Collocated the MC5725-L with Bluetooth radio FCC ID: MCLJ07H081

Change #4 – To add BIOS Lock function for user installable capability

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak ERP & EIRP output powers as follows:

Part 22 (824 - 849MHz) & Part 24 (1850 - 1910MHz) Authorized Band:

Frequency Range (MHz)	Modulation	ERP Peak Power (dBm)	ERP Peak Power (mW)
824.7 - 848.3	EVDO REV A	27.30	537.03

Frequency Range (MHz)	Modulation	EIRP Peak Power (dBm)	EIRP Peak Power (mW)
1851.25 - 1908.75	EVDO REV A	27.00	501.19

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a dual band planner Inverted F antenna with a maximum gain of 3.01 dBi for Cellular band and 3.32 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

ROCEDURE USED TO ESTABLISH TEST SIGNAL

3G-CDMA2000 1xEV-DO Revision A (Rev A)

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

Application	Rev, License
1xEV-DO Terminal Test	A.06.06, L

FETAP

- Call Setup > Shift & Preset
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > FETAP
- FTAP Rate > 307.2 kbps (2 Slot, QPSK)
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 0
- Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots
- Rvs Power Ctrl > All Up bits (to get the maximum power)

RETAP

- Call Setup > Shift & Preset
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > RETAP
- F-Traffic Format > 4 (1024, 2,128) Canonical (307.2k, QPSK)
- R-Data Pkt Size > 4096 (for PCS band), 12288 (for Cellular band)
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2
  > PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots
  > ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

Worst-case Measurement Result @ Low, Middle and High Channel

EV-DO REV A Worst Case Data

Based on the above results from the different modulations, EV-DO, REV A Protocol RETAP to be the worst-case scenario for all measurements.

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at mid channel for Cell band and low channel for PCS band.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	ThinkPad T61/R61 14.1-inch widescreen	ZZF5291	DoC
AC Adapter	Lenovo	92P1158	11S92P1158Z1ZAW55C9084	DoC
Wireless Communications Test Set	Agilent	E5515C	10092	DoC

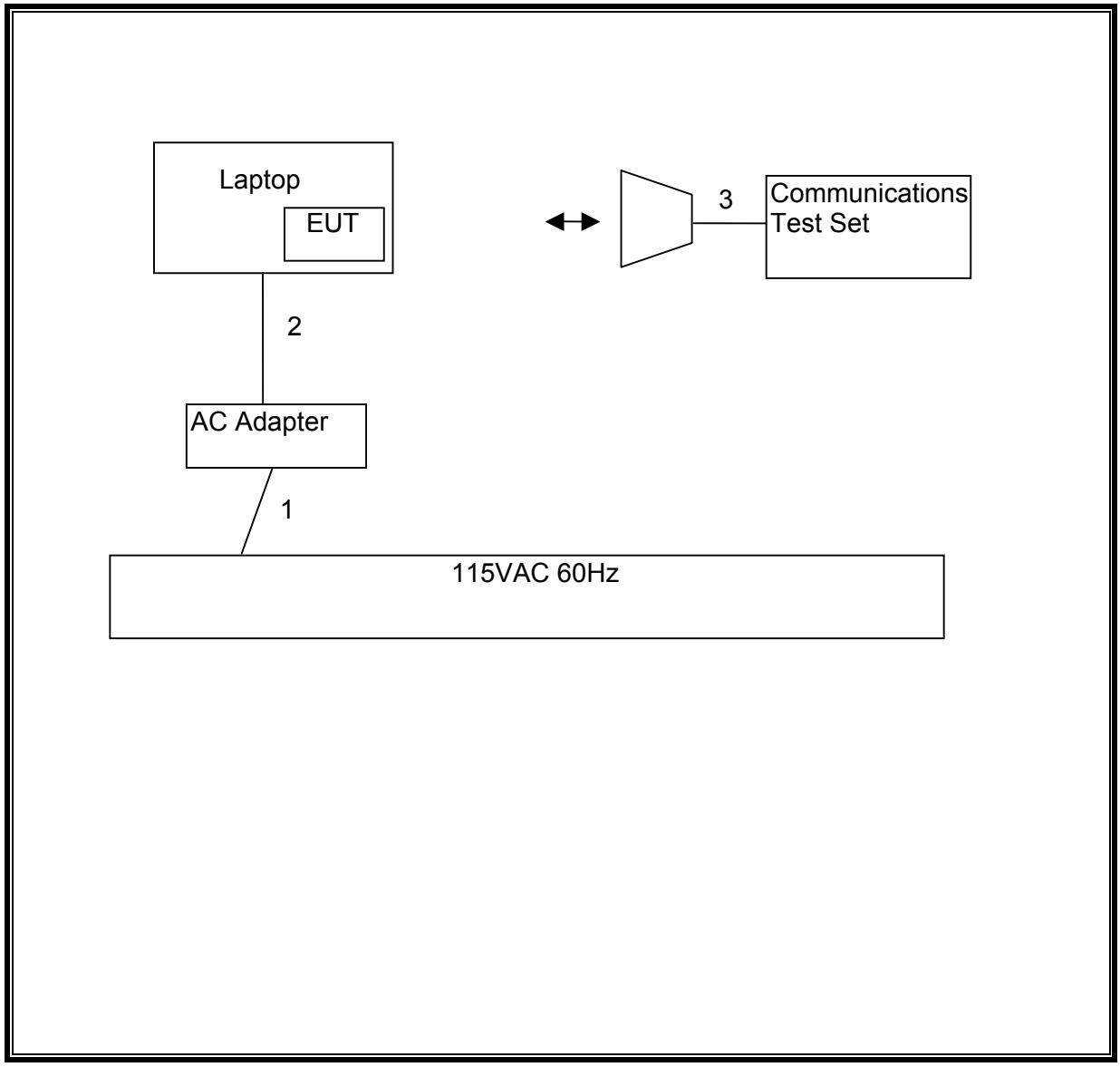
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	2 m	NA
2	DC	1	DC	Un-shielded	2m	Ferrite on DC end
3	RF In/Out	1	SMA	Un-shielded	1m	NA

TEST SETUP

The EUT is installed inside a Lenovo ThinkPad T61/R61 14.1-inch Widescreen Laptop during the tests. The Wireless Communication test set exercised the EUT.

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**
Quasi-Peak Adaptor	Agilent / HP	85650A	2521A01038	01/11/08
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08
Preamp 30-1000MHz	Sonoma Instrument	310N	185623	01/20/08
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	08/13/07
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	05/03/07
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	04/22/07
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	04/22/07
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00369	08/17/07
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	29800	06/10/07
Wireless Communications Test Set	Agilent	E5515C	10092	10/19/07
2.7GHz HPF	MicroTronic	HPM13194	2	CNR
1.5GHz HPF	MicroTronic	HPM13195	1	CNR
Signal Generator 2 -40 GHz	R & S	SMP04	DE 34210	06/02/07
Signal Generator 1024 MHz	R & S	SMY01	DE 12311	05/11/07
Dipole	EMCO	3121C-DB2	22435	03/25/07
Power Splitter	Picosecond Pulse Lab	5350-216	55564214C	N/A

7. LIMITS AND RESULTS

7.1. RF POWER OUTPUT

LIMIT

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

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.2.17

RESULTS

No non-compliance noted.

850MHZ GPRS

Channel	Frequency (MHz)	ERP Peak Power (dBm)	ERP Peak Power (mW)
Low	824.7	26.30	426.58
Middle	836.52	27.30	537.03
High	848.31	26.50	446.68

1900 MHz GPRS

Channel	Frequency (MHz)	EIRP Peak Power (dBm)	EIRP Peak Power (mW)
Low	1851.25	27.00	501.19
Middle	1880.00	26.70	467.74
High	1908.75	26.20	416.87

NOTE: RBW=VBW=3MHz

Cellular Output Power (ERP)

High Frequency Fundamental Measurement

Compliance Certification Services, Fremont Chamber A

Company: Sierra Wireless
Project #: 07U10918
Date: 3/14/2007
Test Engineer: Chin Pang
Configuration: EUT Only
Mode: TX, Cell, EVDO Rev A,

Test Equipment:
Receiving: Sunol T122, and 5m Chamber N-type Cable (Setup this one for testing EUT)
Substitution: Dipole S/N: 00022117, and 4ft SMA Cable Warehouse S/N: 177081002

f MHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
824.70	100.4	V	26.8	0.5	0.0	26.3	38.5	-12.1	
824.70	98.3	H	23.0	0.5	0.0	22.5	38.5	-15.9	
836.50	100.9	V	27.9	0.6	0.0	27.3	38.5	-11.1	
836.50	99.8	H	24.7	0.6	0.0	24.1	38.5	-14.3	
848.31	100.4	V	27.2	0.7	0.0	26.5	38.5	-11.9	
848.31	99.5	H	24.0	0.7	0.0	23.3	38.5	-15.1	

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PCS Output Power (EIRP)

High Frequency Fundamental Measurement
Compliance Certification Services, Fremont Chamber A

Company: Sierra Wireless
Project #: 07U10918
Date: 3/14/2007
Test Engineer: Chin Pang
Configuration: EUT Only
Mode: TX, PCS, EVDO Rev A,

Test Equipment:
Receiving: Horn T73, and 12ft S/N: 197209005 (Setup this one for testing EUT)
Substitution: Horn T60 Substitution, 4ft SMA Cable Warehouse S/N: 177081002

f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading (dBm)	CL (dB)	Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
1.851	93.0	V	19.6	0.9	8.3	27.0	33.0	-6.0	
1.851	90.0	H	16.1	0.9	8.3	23.5	33.0	-9.5	
1.880	93.6	V	19.3	0.9	8.3	26.7	33.0	-6.3	
1.880	90.2	H	15.4	0.9	8.3	22.8	33.0	-10.2	
1.909	92.0	V	18.7	0.9	8.4	26.2	33.0	-6.8	
1.909	90.0	H	17.2	0.9	8.4	24.7	33.0	-8.4	

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7.2. 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.

CELL Spurious & Harmonic (ERP)

High Frequency Substitution Measurement
Compliance Certification Services, Fremont Chamber A

Company: Sierra Wireless
Project #: 07U10918
Date: 3/14/2007
Test Engineer: Tom Chen
Configuration: EUT Only
Mode: Cell TX, EVDO Rev A

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: T34 HP 8449B
Pre-amplifer 26-40GHz:

f GHz	SA reading (dBuV/m)	Ant. Pol. (H/V)	SG reading 75.0	CL (dB)	Gain (dBi)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch (1013): 824.7 MHz										
1.64900	53.7	V	-54.0	3.8	8.0	5.8	-52.0	-13.0	-39.0	
2.47410	52.6	V	-51.0	4.9	9.5	7.4	-48.5	-13.0	-35.5	
1.64900	50.1	H	-56.9	3.8	8.0	5.8	-54.9	-13.0	-41.9	
2.47410	48.3	H	-55.1	4.9	9.5	7.4	-52.6	-13.0	-39.6	
Mid Ch (384): 836.52 MHz										
1.67304	54.6	V	-53.0	3.9	8.0	5.9	-51.0	-13.0	-38.0	
2.50956	51.4	V	-52.0	4.9	9.6	7.4	-49.5	-13.0	-36.5	
3.34608	43.2	V	-56.1	5.6	9.8	7.6	-54.1	-13.0	-41.1	
1.67304	50.4	H	-56.5	3.9	8.0	5.9	-54.4	-13.0	-41.4	
2.50956	48.2	H	-55.0	4.9	9.6	7.4	-52.5	-13.0	-39.5	
3.34608	42.3	H	-56.8	5.6	9.8	7.6	-54.9	-13.0	-41.9	
High Ch (777) 848.31 MHz										
1.69662	52.0	V	-55.4	3.9	8.1	5.9	-53.4	-13.0	-40.4	
2.54493	50.3	V	-53.0	4.9	9.6	7.4	-50.5	-13.0	-37.5	
3.39324	49.4	V	-49.6	5.7	9.7	7.6	-47.7	-13.0	-34.7	
1.69662	48.7	H	-58.0	3.9	8.1	5.9	-56.0	-13.0	-43.0	
2.54493	47.8	H	-55.3	4.9	9.6	7.4	-52.8	-13.0	-39.8	
3.39324	46.3	H	-52.6	5.7	9.7	7.6	-50.7	-13.0	-37.7	

Rev. 1.24.7

PCS Spurious & Harmonic (ERP)

High Frequency Substitution Measurement
Compliance Certification Services, Fremont Chamber A

Company: Sierra Wireless
Project #: 07U10918
Date: 3/14/2007
Test Engineer: Tom Chen
Configuration: EUT Only
Mode: PCS, TX EVDO Rev A

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 75.0	CL (dB)	Gain (dBi)	Gain (dBd)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch: 1.85125 GHz										
3.703	53.8	V	-44.3	6.4	9.7	7.6	-41.0	-13.0	-28.0	
5.554	47.0	V	-45.7	8.0	11.3	9.1	-42.4	-13.0	-29.4	
7.405	43.7	V	-46.7	9.0	12.6	10.4	-43.1	-13.0	-30.1	
3.703	43.2	H	-54.8	6.4	9.7	7.6	-51.5	-13.0	-38.5	
5.554	40.7	H	-51.0	8.0	11.3	9.1	-47.7	-13.0	-34.7	
7.405	42.8	H	-46.8	9.0	12.6	10.4	-43.2	-13.0	-30.2	
Mid Ch: 1.88 GHz										
3.760	54.4	V	-43.4	6.4	9.7	7.6	-40.1	-13.0	-27.1	
5.640	47.3	V	-45.5	8.1	11.5	9.3	-42.1	-13.0	-29.1	
7.520	44.7	V	-45.6	9.1	12.6	10.5	-42.0	-13.0	-29.0	
3.760	45.2	H	-52.5	6.4	9.7	7.6	-49.2	-13.0	-36.2	
5.640	43.8	H	-48.0	8.1	11.5	9.3	-44.6	-13.0	-31.6	
7.520	43.0	H	-46.5	9.1	12.6	10.5	-42.9	-13.0	-29.9	
High Ch: 1.90875 GHz										
3.818	52.6	V	-44.9	6.5	9.7	7.5	-41.7	-13.0	-28.7	
5.726	48.2	V	-44.8	8.1	11.6	9.5	-41.3	-13.0	-28.3	
7.635	44.7	V	-45.4	9.1	12.7	10.5	-41.9	-13.0	-28.9	
3.818	48.6	H	-48.8	6.5	9.7	7.5	-45.6	-13.0	-32.6	
5.726	43.7	H	-48.3	8.1	11.6	9.5	-44.8	-13.0	-31.8	
7.635	44.2	H	-45.1	9.1	12.7	10.5	-41.6	-13.0	-28.6	

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7.3. 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)

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)
800MHz Celllar	20.0	27.30	3.01	0.21
1900 MHz PCS	20.0	27.00	3.32	0.21

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.