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Electromagnetic Emissions Test Report
For a Class II Permissive change
FCC Part 24 Subpart E
on the
SOMAport Wireless Terminal
Model: CPE-100-200

GRANTEE:	SOMA Networks, Inc. 400 Industrial Street, Suite 100 Reichardson, Tx 75081
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	March 20, 2002
FINAL TEST DATE:	March 14, 2002
AUTHORIZED SIGNATORY:	Juan Martinez Sr. EMC Engineer

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FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part2, Subpart J, Section 2.1033(C).

2.1033(c)(1) Applicant:

SOMA Networks, Inc.
400 Industrial Street, Suite 100
Reichardson, Tx 75081

2.1033(c)(2) FCC ID: **POZ-CPE-0140A-000**

2.1033(c)(4) Type of emissions

W-CDMA modulation, emissions designator: 4M18FXW

2.1033(c)(5) Frequency Range

Transmit: 1852.5 – 1907.5 MHz
Receives: 1932.5 – 1987.5 MHz

2.1033(c)(6) Range of Operation Power

Maximum 32 dBm EIRP
Minimum –45 dBm EIRP

2.1033(c)(7) Maximum Power Rating

Section 24.232: Mobile/Portable stations are limited 2-Watts (33-dBm) E.I.R.P. peak power.

2.1033(c)(11) Photographs or Drawing of the Equipment Identification Plate or Label

Refer to Exhibit 4

2.1033(c)(12) Photographs of equipment

Refer to Exhibit 5

2.1033(c)(13) Equipment Employing Digital Modulation

W-CDMA is a "direct-sequence spread spectrum" technique. It is similar to IS-95, but with a wider (5 MHz) carrier. SOMA's air interface is a variant of W-CDMA (aka 3GPP), and uses the same chip rate of 3.84 Mcps. In addition to the standard QPSK modulation scheme contained in W-CDMA, SOMA's radio system utilizes higher-order modulation: 16- and 64-QAM.

2.1033(c)(14) Data taken per Section 2.1046 to 2.1057

Refer to Exhibit 2

SCOPE

FCC Part 24, Subpart E testing was performed for the equipment mentioned in this report. The equipment was tested in accordance with the procedures specified in Sections 2.1046 to 2.1057 of the FCC Rules. TIA-603 may also be used as a test procedure guideline to perform the some of the required tests.

The intentional radiator above was tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with FCC part 24 Subpart E. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to FCC. FCC issues a grant of equipment authorization and a certification number upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

PERMISSIVE CLASS II CHANGES

1) New antenna layout to allow the connection of an external amplifier.

No other changes were made to the unit other then as mention above.

EMISSION TEST RESULTS

Section 2.1046: RF Power Output

The RF Power Output was tested to Section 24.232 (b)

The following modulations were tested: W-CDMA

Procedure used: **A and B**

Result: 32.2 dBm EIRP

Result: 26.4 dBm (using Power meter)

Refer to Setup Photo# 1 & 2 in Exhibit 3 and the test data in Exhibit 2: Test Measurement Data for full details.

SECTION 2.1053: FIELD STRENGTH OF SPURIOUS RADIATION.

The Field Strength was tested to Section 24.238(a).

Procedure used: **N**

Result: -8.6 dB @ 3750 MHz (Middle Channel)

Refer to Setup Photo# 1 & 2 in Exhibit 3 and the test data in Exhibit 2: Test Measurement Data for full details.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Soma Networks model CPE-100-200 is a wireless terminal that is designed to provide wireless Internet access in homes. Normally, the EUT would be placed on a table during operation. During emissions testing the EUT was placed on a table such that it was at a height of 0.8 m above the ground plane.

The sample was received on March 14, 2002 and tested on March 14, 2002. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Soma Networks CPE-100-200 Wireless Terminal	N/A

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 12 cm wide by 22 cm deep by 28 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer	Model	Description	Serial Number	FCC ID
HP	Pavilion 7840	PC	KR10504395	DoC
Mitsubishi	Diamond Plus 91	Monitor	011A34108	DoC
HP	5181	Keyboard	BD05106245	DoC

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
USB	PC computer	USB	Shielded	2

EUT OPERATION

The EUT was set to transmit continuously at the low, middle, and high channels at maximum power.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on March 14 , 2001 at the Elliott Laboratories Open Area Test Site #2 and test facility located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to Section 2.948 of the FCC Rules, construction, calibration, and equipment data has been filed with the Commission.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with Section 2 of FCC Rules. Measurements are made with the EUT connected to a spectrum analyzer through an attenuator to prevent overloading the analyzer.

RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR 16-1 defined elliptical area.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers are capable of measuring over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the particular detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. If average measurements above 1000MHz are performed, the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz is used.

INSTRUMENT CONTROL COMPUTER

A personal computer is utilized to record the receiver measurements of the field strength at the antenna, which is then compared directly with the appropriate specification limit. The receiver is programmed with appropriate factors to convert the received voltage into filed strength at the antenna. Results are printed in a graphic and/or tabular format, as appropriate.

The test receiver also provides a visual display of the signal being measured.

POWER METER

A power meter and thermister mount may be used for output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or EUT and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transmitters and transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor drive to vary the antenna height.

The requirements of ANSI C63.4 were used for configuration of the equipment turntable. It specifies that the test height above ground for table-mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

Tet equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals up to one year with respect to tuned half-wave dipoles. An appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

General: For transmitters with a detachable antenna, direct measurements for output power, modulation characterization, occupied bandwidth, and frequency stability are performed with the antenna port of the EUT connected to either the power meter, modulation analyzer, or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the transmitter fundamental will not overload the front end of the measurement instrument.

For transmitters with non-detachable antennas, field strength measurements are performed. The substitution method is also performed for the appropriate test requirement.

Procedure A – Power Measurement (Radiated Method): The following procedure is used for transmitters that do not use detachable antennas.

1) The EUT is set for maximum power and to the lowest channel.
2) A spectrum analyzer is used to measure the power output. The receiving antenna was located 3 meters from the EUT.
3) The spectrum analyzer resolution and video bandwidth are set to 1 MHz to measure the power output. No amplifier is used since the fundamental will cause the amplifier to saturate.
4) The EUT was then rotated for a complete 360 degrees and the search antenna was raised and lowered to maximize the signal strength. The receive antenna was set for both vertical and horizontal polarization to determine the maximum signal strength. All correction factors are applied to the measurement to yield a field strength value.
5) A substitution for the EUT is then performed. The substitution is performed by replacing the EUT with an antenna with factors that are referenced to a half-wave dipole and driven with a signal generator. The signal generator power level is adjusted until the level that was measured in step 4 is achieved on the spectrum analyzer. The drive level of the signal generator is added to the antenna factor, in dBi, which is equal to the equivalent isotropic radiated power from the EUT.
6) Steps 4 to 5 are then repeated for the middle, and high channel.

Procedure B – Power Measurement (Conducted Method): The following procedure was used for transmitters that have removable antennas.

1) Set the EUT to maximum power and to the lowest channel.
2) A power meter was used to measure the power output.
3) A power meter was used. Corrected for any external attenuation used for the protection of the input of the sensor head. Also set the power sensor correction by setting up the frequency range that will be measured.
4) Repeat this for the middle and high channel and all modulations that will be used and all output ports used for transmission

Procedure N - Field Strength Measurement: The EUT was set on the turntable and the search antenna positioned 3 meters away. The output antenna terminal was terminated with a 50-ohm terminator. The EUT was set at the middle of the frequency band and set at maximum output power.

For the first scan, a preliminary measurement is performed. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. One of these is with the antenna polarized vertically and one is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

For the final measurement, the substitution method is used for spurious emissions not being 20 dB below the calculated radiated limit. The substitution is performed by replacing the EUT with an antenna with factors that are referenced to a half-wave dipole and driven with a signal generator. The signal generator power level is adjusted until the level that was measured from the EUT is achieved on the spectrum analyzer. The drive level of the signal generator is added to the antenna factor, in dBi, which is equal to the equivalent isotropic radiated power from the EUT.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

RADIATED EMISSIONS SPECIFICATION LIMITS

The limits for radiated emissions are based on the power of the transmitter at the operating frequency. Data is measured in the logarithmic form of decibels relative to one milliwatt (dBm) or one microvolt/meter (dBuV/m,). The field strength of the emissions from the EUT is measured on a test site with a receiver or spectrum analyzer.

Below is the formula used to calculate the attenuation requirement, relative to the transmitters power output when the field strength in dBuV/m is measured. For this example an operating power of 3 watts is used. The radiated emissions limit for spurious signals outside of the assigned frequency block is $43+10\text{Log}_{10}$ (mean output power in watts) dB below the measured amplitude at the operating power.

CALCULATIONS – EFFECTIVE RADIATED POWER

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

E= Field Strength in V/m
P= Power in Watts (for this example we use 3 watts)
G= Gain of antenna in numeric gain (Assume 1.64 for ERP)
d= distance in meters

$$E(V/m) = \frac{\sqrt{30 * 3 \text{ watts} * 1.64}}{3 \text{ meters}} = 4.05 \text{ V/m}$$

20 * log (4.05 V/m * 1,000,000) = 132.15 dBuV/m @ 3 meters

FCC Rules require an attenuation of 43 + 10 log (3) or 47.77 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

132.15 dBuV/m – 47.77 dB = 84.38 dBuV/m @ 3 meter.

Note: For EIRP the calculation yields a value of 82.2 dBuV/m @ 3 meters. The substitution method is used for spurious emission not being 20 dB below the calculated field strength.

EXHIBIT 1: Test Equipment Calibration Data

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the Soma Networks model CPE-100-200.

9 Pages / T46541

EXHIBIT 3: Photographs of Test Configuration

2 Pages

EXHIBIT 4: FCC ID Label and Location

2 page

EXHIBIT 5: Internal and External Photos

External Photographs	3 Pages
Internal Photographs	5 Pages