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Electromagnetic Emissions Test Report In Accordance With FCC Part 24 Subpart E on the Wireless Base Station Model: NPM-1000-100

FCC ID: POZ-NPM-1000-100

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: September 6, 2001

FINAL TEST DATE: September 9, 2001

AUTHORIZED SIGNATORY:

Juan Martinez
EMC Engineer

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FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2, Subpart J, Section 2.1033(C).

2.1033(c)(1) Applicant:

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

2.1033(c)(2) FCC ID: **POZ-NPM-1000-100**

Technical Description:

The NPM is a hardware platform designed for deployment in cell sites. It provides fixed wireless access to consumer terminals, connecting voice and data IP flows to a backhaul network. Additionally, the NPM provides computing resources to implement telecomputation services such as telephony and always on high-speed Internet access.

The NPM is typically located in the building atop which the antennas are mounted or in a cabinet at the base of the tower or pole. The NPM aggregates traffic from the air interfaces of up to six radio sectors onto 100Base-T links for connection to the backhaul network.

The IF card and PA are combined to created the radio portion of the NPM, The radio modems send the baseband data to the IF/RF card, which converts the data into an analog signal. The IF/RF card sends the analog signal to the power amplifiers in the RFSS. From there, the signal is broadcast through the main and diversity antennas.

The IF card and PA are considered a single system architecture (not stand alone devices)

2.1033(c)(3) Instructions/Installation Manual

Please refer to Exhibit 7:Statement Letter, Theory of Operation, and Tune-Up procedure

2.1033(c)(4) Type of emissions

W-CDMA modulation, emissions designator: 4M3FXW

2.1033(c)(5) Frequency Range

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

2.1033(c)(6) Range of Operation Power

Maximum: 20 Watts
Minimum: 0.0005 Watts

2.1033(c)(7) Maximum FCC Allowed Power Level

Section 24.232: Base stations are limited 100-Watts E.R.P. peak power.

2.1033(c)(8) Applied voltage and currents into the final transistor elements

5Vdc, 100mA

2.1033(c)(9) Tune-up Procedure

Please refer to Exhibit 7: Tune-Up procedure. The Tune-Up procedure is for the IF card, no tune-up for the amplifier is needed since it is fixed tuned and no adjustments are provided.

2.1033(c)(10) Schematic Diagram of the Transmitter

Please refer to Exhibit 6: Schematics, Part list, and Tune-up procedure.

2.1033(c)(10) Means for Frequency Stabilization

A 19.2 MHz TXCO is identified as Y2 provides the clock source for the amplifier, with a tolerance of +/- 2.5 ppm. A 122.88 MHz VCXO identified asY3 is used for the IF card also with a tolerance of a +/- 2.5 ppm.

2.1033(c)(10) Means for Suppression of Spurious radiation

Part identified as U32 is a filter.

2.1033(c)(10) Means for Limiting Modulation

Modulation limiting is controlled by the DSP chip, identified as U30 on the IF card and U50 on the amplifier.

2.1033(c)(10) Means for Limiting Power

Power Limiting is controlled by the DSP chip, identified as U30 on the IF card and U50 on the amplifier.

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

Please refer to Exhibit 4: FCC ID label and location

2.1033(c)(12) Photographs of equipment

Please refer to Exhibit 5: Internal and External photographs

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

Please refer to Exhibit 2: Test Measurement Data.

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 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 the FCC Rules 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.).

EMISSION TEST RESULTS

Section 2.1046: RF Power Output

The RF Power Output was tested for compliance with Section 24.232(a).

The following modulations were tested: W-CDMA

Procedure used: B

Result: 43 dBm

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

SECTION 2.1047: MODULATION CHARACTERISTICS

Section 2.1047 (d) Other types of equipment.

The modulation were tested according to Section 24.235.

Procedure used: H and D

Result: 4.3 MHz

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

SECTION 2.1049: OCCUPIED BANDWIDTH

The Occupied Bandwidth was tested to Section 24.235(a).

The following modulations were tested: W-CDMA

Procedure used: D

Result: 4.3 MHz

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

SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINAL.

The Spurious Emission at the Antenna terminal was tested to Section 24.235(a).

The following modulations were tested: W-CDMA

Procedure used: J

Result: -24.74 dBm at the low channel

Refer to Setup Photo# 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 24.235(a).

Procedure used: N

Result: -21.2dB @ 5960.388 MHz

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

SECTION 2.1055: FREQUENCY STABILITY

The Frequency Stability was tested to Section 24.235.

Procedure used: K and L

Result: Maximum of .3 Hz variation in frequency

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on August 15 and 16 at the Elliott Laboratories Open Area Test Site #2 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. Frequency Stability was performed at SOMA Networks facility on September 9, 2001.

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

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

TEST PROCEDURES

Part 24 Subpart H Test Procedures

General: For Transmitters with 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 overload the front end of the measurement instrument.

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

1) Set the EUT to maximum power and to the lowest channel.
2) Either a power meter or a spectrum analyzer was used to measure the power output.
3) If a spectrum analyzer was used a resolution and video bandwidth 10 kHz was used to measure the power output.
4) Repeat this for the high channel and all modulations that will be used and all output ports used for transmission

Procedure D - Occupied Bandwidth (Conducted Method): Either for analog, digital, or data modulations, occupied bandwidth was performed. The EUT was set to transmit the appropriate modulation at maximum power. The bandwidth was measured using following methods:

1) The built-in 99% function of the spectrum analyzer was used.
2) If the built-in 99% is not available then the following method is used:

   26-dB was subtracted to the maximum peak of the emission. Then the display line function was used to, in conjunction with the marker delta function, to measure the emissions bandwidth.

3) For the above two methods a resolution and video bandwidth of 10 kHz was used to measure the emission's bandwidth.

Procedure H – Modulation for Other Types of Equipment: Either digital or data modulated signals were simulated, by software or external sources, to performed the required tests. The EUT was set to transmit the appropriate digital modulation.

Procedure I – Bandedge: Where bandedge measurements are specified the following procedure was performed:

1) Set the transmitting signal as close as possible to the edge of the frequency band/block per Section 24.235(a). Power is set to maximum
2) Set the spectrum analyzer display line function to –13-dBm.
3) Set the spectrum analyzer bandwidth to 30 kHz. Which is 1 % of the emission bandwidth. Per FCC if a resolution less then the calculate 1% is used, for the Bandedge measurement, then the following formula is to be used to correct the measured value (10*log (1% RB / RB used).
4) Set the marker function to the FCC specified frequency band/block.
5) Set the spectrum analyzer span to show any emission within 2 MHz above or below the frequency band/block. All spurious or intermodulation emission must not exceed the –13-dBm limit.
   Steps 1 to 3 were repeated for all modulations and output ports that will be used for transmission.

Procedure J – Antenna Conducted Emissions: For spurious emission measurements at the antenna terminal the following procedure was performed:

1) Set the transmitting signal as close as possible to the edge of the frequency band/block per Section 24.235(a). Power is set to maximum
2) Set the spectrum analyzer display line function to –13-dBm.
3) Set the spectrum analyzer bandwidth to 1 MHz.
4) For the spectrum analyzer, the start frequency was set to 0 Hz and the stop frequency set to 20 GHz. All spurious or intermodulation emission must not exceed the –13-dBm limit.
5) Steps 1 to 3 were repeated for all modulations and output ports that will be used for transmission.

Procedure K - Frequency Stability: The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The spectrum analyzer is configured to give a 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature. The Temperature chamber was varied from –30 to +50° C in 10 degrees increment. The EUT was allowed to stabilize for each temperature variation.

Procedure L - Frequency Stability: For AC operated devices the nominal voltage is varied to 85% and to 115% at either room temperature or at a controlled +20°C temperature.

Procedure N - Field Strength Measurement: The EUT was set on the turntable and the search antenna position 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 pre-liminary 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 or more of these is with the antenna polarized vertically while the one or more of these are 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, Substitution method is performed on spurious emissions within 20 dB of the calculated radiated limit. Substitution method is performed by replacing the EUT with a horn antenna, for which factors can be referenced to a isotropic radiator, and a signal generator. The signal generator power level is adjusted until the same level measured from the EUT is achieved on the spectrum analyzer. The level on the signal generator is than added to the antenna factor, in dBi, and any cable loss, which will give the corrected value for 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.

Below is a formula example used to calculate the attenuation requirement, relative to the transmitters power output, in dBuV/m. For this example an operating power range 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

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

20 * log (4.049 V/m * 1,000,000) = 132.14 dBuV/m @ 3 meters

FCC Rules request an attenuation of 43 + 10 log (3) or 47.8 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

132.1 dBuV/m – 47.8 dB = 84.3 dBuV/m @ 3 meter.

Note: Substitution Method is performed for spurious emission within 20 dB of the calculated field strength limit.

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions, 30 - 1000 MHz, 07-Sep-01 03:37 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Biconical Antenna, 30-300 MHz	3110B	1320	12	5/23/2001	5/23/2002
EMCO	Log Periodic Antenna, 0.2-1 GHz	3146	1294	12	3/27/2001	3/27/2002
Rohde & Schwarz	Test Receiver, 20-1300 MHz	ESVP	1317	12	5/9/2001	5/9/2002

Part 24 Antenna Conducted and Radiated Emissions, 07-Sep-01 03:38 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Horn antenna, D. Ridge 1-18GHz (SA40 system antenna)	3115	1142	12	1/29/2001	1/29/2002
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz)	84125C	1149	12	2/5/2001	2/5/2002

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the SOMA Networks, Model No: NPM-1000-100.

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EMC Test Data

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Emissions Spec:	FCC 15.109 & 24E	Class:	A
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Soma Networks

Model

NPM-1000-100

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Emissions Spec:	FCC 15.109 & 24E	Class:	A
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a Wireless PCS telecom rack which is designed to be used by telephone network companies to provide wireless PCS service to customers. Normally, the EUT would be floor-standing during operation. The EUT was, therefore, treated as floor-standing equipment during testing to simulate the end user environment. The electrical rating of the EUT is 24Vdc, 35 Amps.

Equipment Under Test (Utility Shelf)

Manufacturer	Model	Description	Serial Number	FCC ID
Soma Networks	NPM-1000-100	Wireless PCS Base Station	N/A	N/A

Other EUT Details

Utility Shelf (Front) Cards

Slot#	Equipment	Model Name	Part Number
0-1	Power Supply	IT Enclosures 5250	000906-000
2-3	Power Supply	IT Enclosures 5250	000906-000
4-5	Power Supply	IT Enclosures 5250	000906-000
6	Ethernet Switch	Performance Technologies-CPC 4400	000904-000
7-8	Hard disk Drive	Kaprel PS 6600	001267-000
9	Application Host	Ziatec 5541	000900-001
10	Utility Bus Controller	Ziatec 5550	000900-000
11	Application Host	Ziatec 5541	000900-001
12	Alarm Card	Soma Internal (BEMA)	001045-000
13	Alarm Card	Soma Internal (BEMA)	001045-000
14	Utility Bus Controller	Ziatec 5550	000900-000
15	Application Host	Ziatec 5541	000900-001
16	Application Host	Ziatec 5541	000900-001
17-18	Hard disk Drive	Kaprel PS 6600	001267-000
19	Ethernet Switch	Performance Technologies-CPC 4400	000904-000
20	Blank	None	

Client:	Soma Networks	Job Number:	J44255
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		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Emissions Spec:	FCC 15.109 & 24E	Class:	A
Immunity Spec:	-	Environment:	-

Utility Shelf (Rear) Cards

Slot#	Equipment	Model Name	part Number
0-1	Blank	N/A	N/A
2-3	Blank	N/A	N/A
3-4	Blank	N/A	N/A
5	Blank	N/A	N/A
6-7	Ethernet switch rear I/O	Performance Technologies-CPC 4400	00127-000
8	Blank	N/A	N/A
9	App host rear I/O	Ziatec 4805	000900-003
10	UBC rear I/O card	Ziatec 4804	000900-004
11	App host rear I/O	Ziatec 4805	000900-003
12-13	Alarm wiring card	Soma Internal (BEMA)	001048-000
14	UBC rear I/O card	Ziatec 4804	000900-004
15	App host rear I/O	Ziatec 4805	000900-003
16	App host rear I/O	Ziatec 4805	000900-003
17	Blank	N/A	
18	Blank	N/A	
19-20	Ethernet switch rear I/O	Performance Technologies-CPC 4400	001127-000

Radio Shelf (Front) Cards (A total of 3 radio shelfs were tested. All had same card configuration)

Slot#	Equipment	Model Name	Part Number
0-1	Power Supply	IT Enclosures 5250	000906-000
2-3	Power Supply	IT Enclosures 5250	000906-000
4-5	Power Supply	IT Enclosures 5250	000906-000
6	Radio Modem	IT Enclosures 5250	001046-000
7	Radio Modem	Soma Internal (BEMA)	001046-000
8	Radio Modem	Soma Internal (BEMA)	001046-000
9	Radio Modem	Soma Internal (BEMA)	001046-000
10-11	IF/RF card	Soma Internal (BEMA)	001043-000
12	Radio Sector Controller	Ziatec 5550	000900-000
13	Blank	None	None
14	Radio Sector Controller	Ziatec 5550	000900-000
15-16	IF/RF card	Soma Internal (BEMA)	001043-000
17	Radio Modem	Soma Internal (BEMA)	001046-000
18	Radio Modem	Soma Internal (BEMA)	001046-000
19	Radio Modem	Soma Internal (BEMA)	001046-000
20	Radio Modem	Soma Internal (BEMA)	001046-000

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Emissions Spec:	FCC 15.109 & 24E	Class:	A
Immunity Spec:	-	Environment:	-

Radio Shelf (Rear) Cards

Slot#	Equipment	Model Name	part Number
0-9	Blank	N/A	N/A
10	Blank	N/A	N/A
11	Clock wiring card	Soma Inernal (BEMA)	001044-000
12	RSC rear I/O card	Ziatec 4804	000900-004
13	Blank	None	N/A
14	RSC rear I/O card	Ziatec 4804	000900-004
15	Blank	None	N/A
16	Clock wiring card	Soma Inernal (BEMA)	001044-000
17-20	Blank	None	N/A

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 90 cm wide by 67 cm deep by 210 cm high.

Modification History

Mod. #	Test	Date	Modification
1			
2			
3			

Client:	Soma Networks	Job Number:	J44255
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		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Emissions Spec:	FCC 15.109 & 24E	Class:	A
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Xantrex	XDC-80-75	Digital Power Supply	N/A	None

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Utitlity Shelf Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
(2x) Ethernet (Front Radio Controller)	(2x) Rear Utility Ethernet port	RJ 45	Unshielded	1.5
Ethernet (Rear Radio Controller)	-	RJ-45	-	-
3x DC input	Power distributor	PDA	Unshielded	2.5

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EMC Test Data

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Emissions Spec:	FCC 15.109 & 24E	Class:	A
Immunity Spec:	-	Environment:	-

Radio Shelf Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
(6x) Ethernet (Front Radio Controller)	(6x) Rear Utility Ethernet port	RJ 45	Unshielded	1.5
4x IF (Rear Radio Modem)	Top Diplexer	SMA	Shielded	2
4x RF (Rear Radio Modem)	Top Diplexer	SMA	Shielded	2
Ethernet (Rear Radio Controller)	-	RJ-45	-	-
IF(Front Radio Modem)	-	SMA	-	-
RF(Front Radio Modem)	-	SMA	-	-
12x DC input	Power distributor	PDA	Unshielded	2.5

Note 1: The Front and Rear for the Utility and Radio shelf "radio controller card" VGA, keyboard, USB, and Serial ports were not connected as the manufacturer stated that these are for configuration and diagnotic purpose purpose and therefore would not normally be connected.

Note 2: For the Highest emission connected more RJ45 cables to unpopulated ports. Highest Emission did not increase in amplitude

EUT Operation During Emissions

EUT was running internal exercise program that contiously checked all cards.

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Part 24E Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform engineering evaluation testing of the EUT with respect to the specification listed above.

Date of Test:	8/15/2001 & 8/16/2001	Config. Used:	1
Test Engineer:	jmartinez	Config Change:	None
Test Location:	AC #2 & OATS# 2	EUT Voltage:	28Vdc

General Test Configuration

The EUT and all local support equipment were located on a Rack for radiated emissions testing. Remote support equipment was located approximately 30 meters from the test area with all I/O connections routed underground.

For Conducted emissions testing the test reciever was connected to the EUT's antenna terminal port.

Bandedge measurements were made with a lower resolation then the calculated 1% requirement. The bandedge measurements were then corrected using the 10*log (1% RB / RB used). Were 1% RB is the 26-dB or 99 % measured emission Bandwidth and RB used is the Spectrum analyzer setting used for the Bandedge measurement.

Spurious conducted measurements were compared to - 13 dBm limit that, which is base on FCC's 43 + 10 log (P) attenuation formula. An attenuator was used to protect and prevent overload on the test receiver input port.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT. For any Spurious emission more than 20-dB of the field strenght limit, substitution was performed. If the Spurious emissions are 20-dB below the field strength limit, substituion does not have to be performed.

Ambient Conditions:

Temperature: 21°C

Rel. Humidity: 48%

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1	Power Output	24.232(a)	Pass	43 dBm
1	Low Bandedge Measurement	24.235(a)	Pass	-27.64 dBm
2	High Bandedge Measurement	24.235(a)	Pass	-24.74 dBm
3	Occupied Bandwidth (from output of power amplifier)	24.235(a)	Pass	4.3 MHz
4	Antenna Conducted Spurious Emissions (from output of power amplifier)	24.235(a)	Pass	(Low) Plot# 5, (High) Plot# 6
5	Radiated Spurious Emissions (from output of power amplifier)	24.235(a)	Pass	-21.2dB @ 5960.388 MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

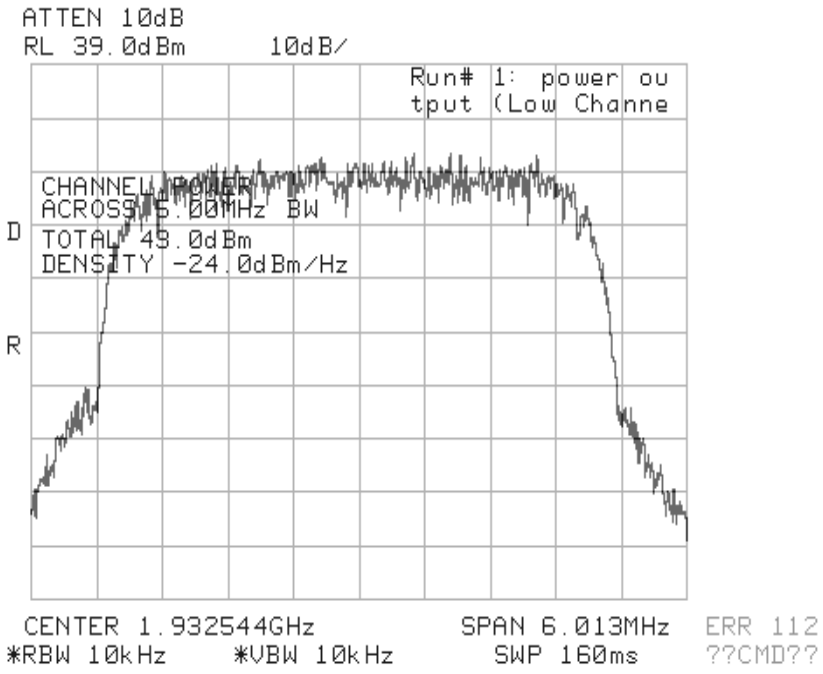
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Run #1: Power Output Measurement.

Plot# 1



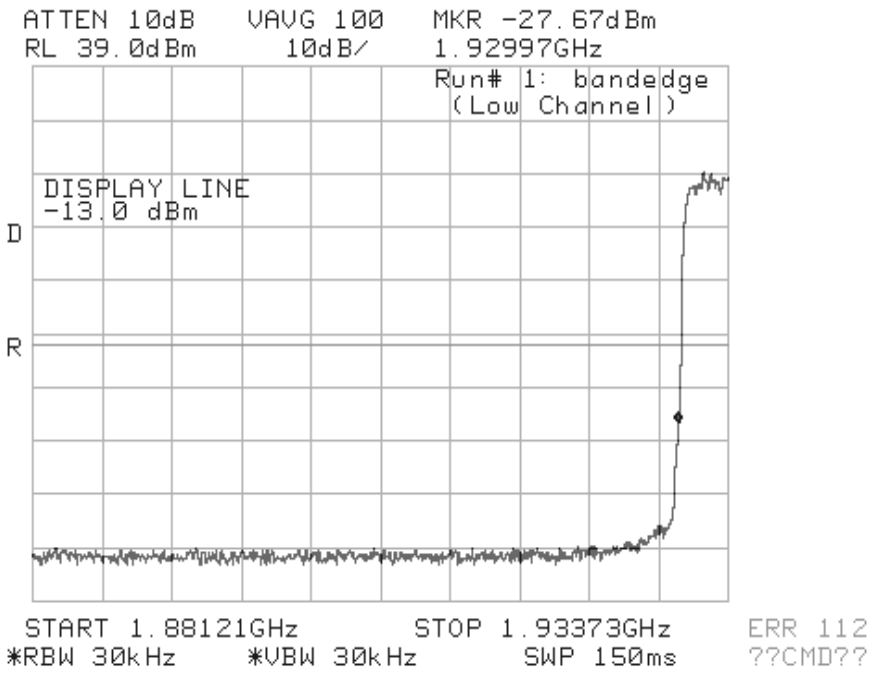
Channel	Frequency (MHz)	Res BW	Output Power	Graph reference #
Low	1932.54	10 kHz	43 dBm	1

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Run #2: Bandedge Measurement.
All emissions below the -13dBm limit

Channel	Frequency (MHz)	Resolution used (kHz)	1% Resolution BW (kHz)	Correction (dB)	Measured Bandedge (dBm)	Corrected Value (dBm)
Low	1850	30	43	1.43	-27.67	-26.24

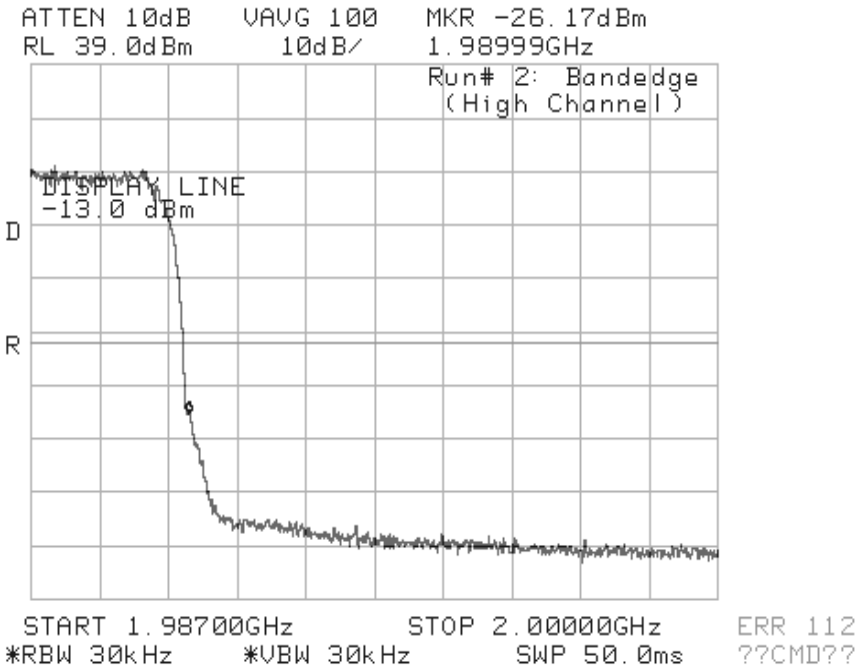
Plot# 2



Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Channel	Frequency (MHz)	Resolution used (kHz)	1% Resolution BW (kHz)	Correction (dB)	Measured Bandedge (dBm)	Corrected Value (dBm)
Low	1850	30	43	1.43	-26.17	-24.74

Plot# 3

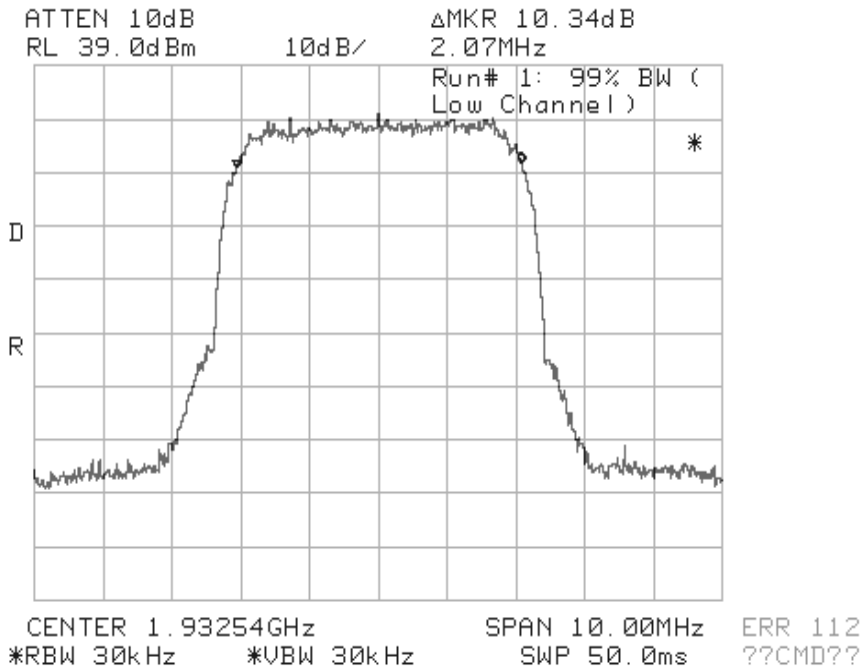


Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Run #3: Occupied Bandwidth Measurement.

Note that the plot is showing the incorrect 99% occupied bandwidth, this was due to software defaulting the marker to the highest peak, showing only half of the bandwidth. The correct bandwidth is 4.3 MHz @ 1932 MHz.

Plot# 4

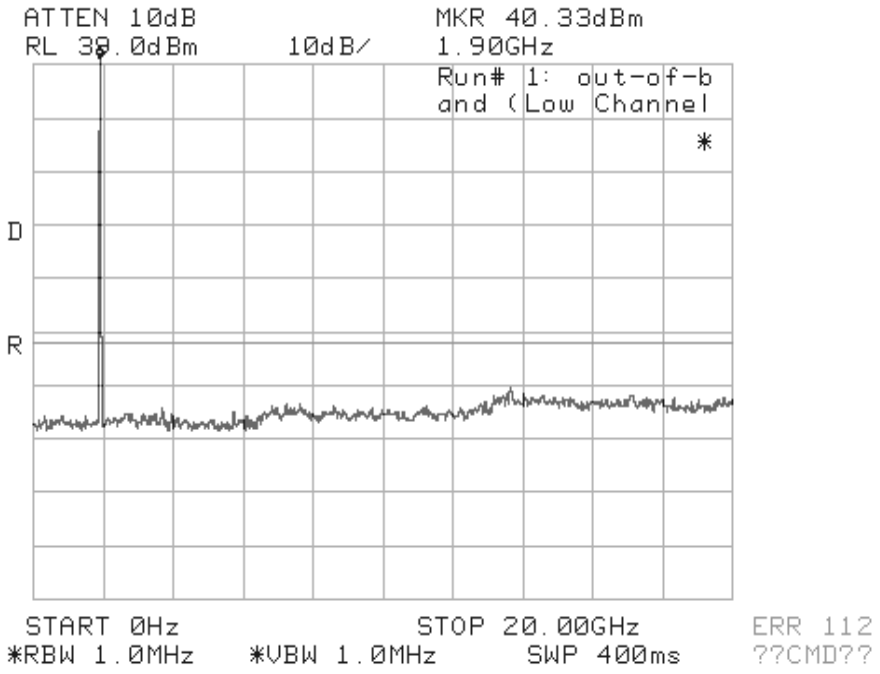


Channel	Frequency (MHz)	Resolution Bandwidth	26dB Signal Bandwidth	Graph reference #
Low	1932.54	30 kHz	4.3 MHz	4

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

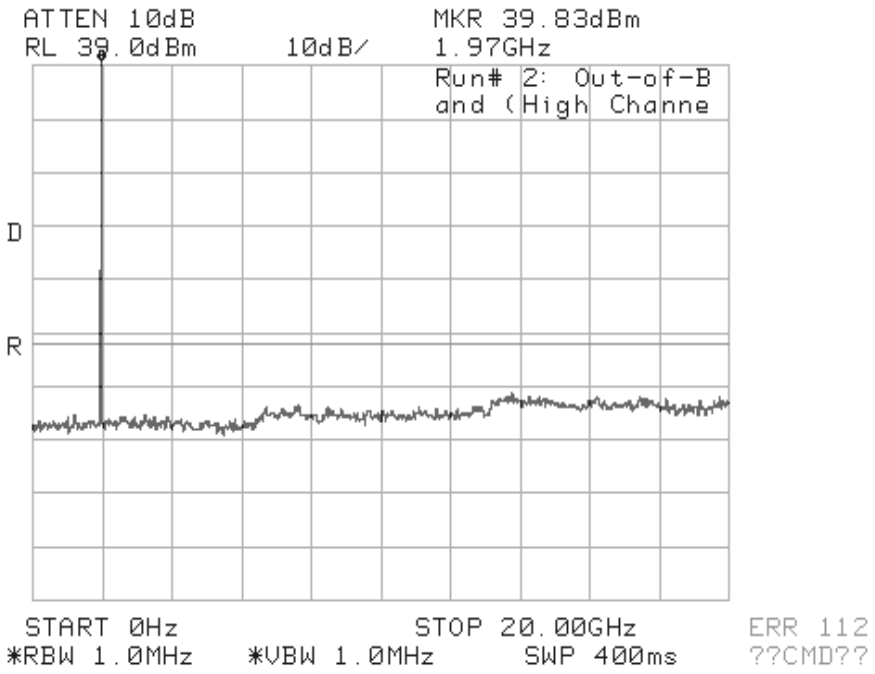
Run #4: Antenna Conducted Spurious Emissions
All emissions are below the -13dBm limit

Plot# 5



Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Plot# 6



Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Run #5: Radiated Spurious Emissions, 30 - 19,000 MHz. Low Channel @ 1900 MHz
Amplifer set to maximum power.

Frequency	Level	Pol	FCC 24.235		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
122.854	43.2	h	82.2	-39.0	QP	88	4.0	IF Card emissions
368.566	45.5	h	82.2	-36.7	QP	100	1.4	IF Card emissions
122.854	37.0	v	82.2	-45.2	QP	360	1.0	IF Card emissions
245.700	39.4	h	82.2	-42.8	QP	135	4.0	IF Card emissions
429.996	38.0	h	82.2	-44.2	QP	240	2.4	IF Card emissions
368.568	32.6	v	82.2	-49.6	QP	272	1.0	IF Card emissions
429.996	30.0	v	82.2	-52.2	QP	359	1.0	IF Card emissions
3974.055	55.6	V	82.2	-26.6	Pk	159	1.0	PA harmonic emissions
5960.388	61.0	V	82.2	-21.2	Pk	159	1.0	PA harmonic emissions
5960.875	60.9	H	82.2	-21.3	Pk	159	1.0	PA harmonic emissions
3974.383	55.8	H	82.2	-26.4	Pk	159	1.0	PA harmonic emissions

Note 1:	No other emission detected above the 3rd harmonic. A pre-scan was peformed in Chamber# 2 and no other emission were detected. Final Scan was performed on Open Area Test Site# 2.

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Section 2.1055: Frequency Stability

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 9/9/2001
Test Engineer: Soma Networks
Test Location: Enviromental Chamber
Config. Used: 1
Config Change: None
EUT Voltage: 24 Vdc

General Test Configuration

EUT was place inside the Temperature Chamber and all local support equipment were located outside on a table for testing. The Eut was connected directly to Test Receiver. An attenuator was used between the EUT and Test Receiver.

Chamber was set to -30 to 50 degrees Celsius (60 degrees Celsius for Canada). Incremented 10 degress per temperature and let unit stabilized for every temperature.

Voltage stability was done at 20 degress Celsius. For battery operated units decrease DC voltage until battery end-point was found.

Voltage stability was done at 20 degress Celsius. For AC operated units varied voltage at 85% and 115% of the nomial AC voltage.

Ambient Conditions:

Temperature: N/A
Rel. Humidity: N/A

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1a	Temperature Vs. Frequency	24.235	Pass	.3 Hz
2a	Voltage Vs. Frequency	24.235	Pass	+/- 0 Hz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Soma Networks	Job Number:	J44255
Model:	NPM-1000-100	T-Log Number:	T44256
		Proj Eng:	Mark Briggs
Contact:	Ron Raybarman		
Spec:	FCC 15.109 & 24E	Class:	A

Run# 1a: Temperature Vs. Frequency

Per Section 24.235 states that the Fundamental must stay within the blockedge.

Temperature	Deviation
(Celsius)	(Hz)
-30	0.1
-20	0.0
-10	-0.1
0	0.0
10	0.0
20	0.3
30	0.0
40	0.0
50	0.0

Run# 2a: Voltage Vs. Frequency

Per Section 24.235 states that the Fundamental must stay within the blockedge.

Nomianl Voltage is 120Vdc.

Voltage	Deviation
(Dc)	(Hz)
85%	0.0
115%	0.0

Note 2:	

EXHIBIT 3: Photographs of Test Configuration

Uploaded as a separate attachment

EXHIBIT 4: FCC ID Label and Location

Uploaded as a separate attachment

EXHIBIT 5: Internal and External Photos

Uploaded as a separate attachment

EXHIBIT 6: Schematics, Block Diagram, and Parts list

Uploaded as a separate attachment

EXHIBIT 7: Statement Letter, Theory of Operation, and Tune-Up procedure

Uploaded as a separate attachment