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Electromagnetic Emissions Test Report In Accordance With Industry Canada Radio Standards Specification 118 & FCC Part 27 on the Soma Networks Model: WCS NPM 1.1

FCC ID: POZNPMWCS003353A

GRANTEE: Soma Networks
185 Berry Street, Suite 2000
San Francisco, CA. 94107

TEST SITE: Elliott Laboratories, Inc.
684 W. Maude Ave
Sunnyvale, CA 94086

REPORT DATE: November 27, 2002

FINAL TEST DATE: November 25, 2002

AUTHORIZED SIGNATORY: _____
Juan Martinez
Senior EMC Engineer

ACCREDITED

TABLE OF CONTENTS

FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2, Subpart J, Section 2.1033(C) & to Industry Canada RSP-100.

2.1033(c)(1)

Applicant:

Soma Networks
185 Berry Street, Suite 2000
San Francisco, CA. 94107

2.1033(c)(2) & RSP-100 (4)

FCC ID: POZNPMWCS003353A

2.1033(c)(3) & RSP-100 (7.2(a)) Instructions/Installation Manual

Please refer to Exhibit 7: User Manual, Theory of Operation, Tune-up

2.1033(c)(4) & RSP-100 (7.2(b)(iii)) Type of emissions

W-CDMA: 4M17FXW

2.1033(c)(5) & RSP-100 (7.2(a)) Frequency Range

Transmitter: 2306 MHz
Receiver: 2306 MHz

2.1033(c)(6) & RSP-100 (7.2(a)) Range of Operation Power

Maximum: 70.8 Watts
Minimum: 0.0005 Watts

2.1033(c)(6) & RSP-100 (7.2(a)) Range of Operation Power

Section 27.50 (a)(1): Fixed, land, and radiolocation land stations transmitting are limited to 2000 watts EIRP.

2.1033(c)(8) & RSP-100 (7.2(a)) Applied voltage and currents into the final transistor elements

Refer to Exhibit 6. The schematic diagram

2.1033(c)(9) & RSP-100 (7.2(a)) Tune-up Procedure

Please refer to Exhibit 7: User Manual, Theory of Operation, Tune-up

2.1033(c)(10) & RSP 100 (7.2(a)) Schematic Diagram of the Transmitter

Refer to Exhibit 6. The schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Frequency Stabilization

Refer to Exhibit 6. The schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Suppression of Spurious radiation

Refer to Exhibit 6. The schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Modulation

Refer to Exhibit 6. The schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Power

Refer to Exhibit 6. The schematic diagram

2.1033(c)(11) & RSP-100 (7.2(g)) Photographs or Drawing of the Equipment Identification Plate or Label

Refer to Exhibit 4

2.1033(c)(12) & RSP-100 (7.2(c)) Photographs of equipment

Refer to Exhibit 5

2.1033(c)(13) & RSP-100 (7.2(a)) 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) & RSP-100 (7.2(b)(ii)) Data taken per Section 2.1046 to 2.1057 and RSS-133 issue 2, Rev. 1.

Refer to Exhibit 2

SCOPE

FCC Part 27 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 was also 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 27. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033 & RSP-100.

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 to Section 27.50 (a)(1)

The following modulations were tested: W-CDMA

Procedure used: **A & B**

Result: 48.5 dBm

Refer to Setup Photo#1 & 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.

N/A

SECTION 2.1049: OCCUPIED BANDWIDTH

The Occupied Bandwidth was tested to Section 27.53 (a)(4)

The following modulations were tested: W-CDMA

Procedure used: **D**

Result: 4.13 MHz

Refer to Setup Photo#1 & 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 27.53 (a)(1)(3)

The following modulations were tested: W-CDMA

Procedure used: **I & J**

Result: -44.72 dBm
Result: -58 dBm

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 FCC 27.53 (a)(3)

Procedure used: **N**

Result: -1.4 dBm @ 9408 MHz

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

SECTION 2.1055: FREQUENCY STABILITY

The Repeater contains a 16 MHz stability clock

FCC 27.54: "The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block."

The carrier is 4.17 MHz wide centered at these frequencies. The f_c centered at 2306 MHz with a bandwidth of 4.17 MHz. This provides a guard band of 40 MHz in the 2300 MHz - 2320 MHz frequency band.

Is a single channel transmitter, so based on the tolerance of the TXCO and the, bottom and top, 40 MHz guard band for the 2306 MHz, bandages, the device will maintain its emissions within the WCS bands under normal operating conditions.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on November 25, 2002 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.

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

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 not overload the front end of the measurement instrument.

For Transmitter 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 was used for transmitters that do not use external antennas.

1) Set the EUT to maximum power and to the lowest channel.
2) A spectrum analyzer was use to measure the power output. The search antenna was located 3 meter from the EUT.
3) The spectrum analyzer resolution and video bandwidth was set to 5 MHz to measure the power output. No amplifier was 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 fundamental. Both vertical and horizontal polarizations were performed. All correction factors are applied to the fundamental.
5) Substitution is then performed. Substitution method is performed by replacing the EUT with a horn antenna, which factors can be reference to a half-wave dipole, and with a signal generator. The signal generator power level is adjusted until a similar level, which was measured, in step 4, is achieved on the spectrum analyzer. The level on the signal generator is than added to the antenna factor, in dBi, which will give the corrected value.
6) Steps 1 to 5 are repeated for the middle and the highest channel.

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 power meter was used, correct 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 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 1 kHz was used to measure the emission's bandwidth.

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 27.5 (a)(3). Power is set to maximum
2) Set the spectrum analyzer display line function to –13-dBm.
3) Set the spectrum analyzer bandwidth to 100 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.
6) 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 27.5 (a)(3). Power is set to maximum
2) Set the spectrum analyzer display line function to –40-dBm.
3) Set the spectrum analyzer bandwidth to 1MHz.
4) For the spectrum analyzer, the start frequency was set to 2290 and the stop frequency set to 2321 MHz. All spurious or intermodulation emission must not exceed the –40-dBm limit.
5) Steps 1 to 3 were repeated for all modulations and output ports that will be used for transmission.

For Section 27.5 (a)(1) the start and stop was set to 2320 to 2345 MHz. Spurious emission within this band must not exceed –50 dBm.

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 not being 20-dB below the calculated radiated limit. Substitution method is performed by replacing the EUT with a horn antenna, which factors can be reference to a half-wave dipole, and with a signal generator. The signal generator power level was adjusted until a similar level, which was measured on the first scan, is achieved on the spectrum analyzer. The level on the signal generator is than added to the antenna factor, in dBi, which will give the corrected value.

For the final measurement, Substitution method is performed on spurious emissions not being 20-dB below the calculated radiated limit. Substitution method is performed by replacing the EUT with a horn antenna, which factors can be reference to a half-wave dipole, and with a signal generator. The signal generator power level was adjusted until a similar level, which was measured on the first scan, is achieved on the spectrum analyzer. The level on the signal generator is than added to the antenna factor, in dBi, which will give the corrected value.

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 not being 20-dB below the calculated field strength.

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions, 30 - 2000 MHz, 25-Nov-02
Engineer: Chris

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	12	1/4/2002	1/4/2003
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	12	3/2/2002	3/2/2003
EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	12	9/12/2002	9/12/2003
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	12	12/26/2001	12/26/2002

Radiated Emissions, 30 - 24000 MHz, 25-Nov-02
Engineer: Chris

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	12	1/4/2002	1/4/2003
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	12	3/2/2002	3/2/2003
EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	12	9/12/2002	9/12/2003
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 ¸9 KHz -26.5GHz	8593EM	1141	12	3/11/2002	3/11/2003
Hewlett Packard	High Pass filter, 3.5GHz	P/N 84300-80038	1157	12	3/1/2002	3/1/2003
Hewlett Packard	Microwave EMI test system (SA40, 9Hz - 40GHz), system 2	84125C	1410	12	4/2/2002	4/2/2003
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	12	12/26/2001	12/26/2002
EMCO	Horn antenna, D. Ridge 1-18GHz (SA40 system antenna)	3115	1142	12	4/20/2002	4/20/2003
Rohde & Schwarz	Power Meter	NRVS	1422	12	9/6/2002	9/6/2003
Rohde & Schwarz	Power Sensor 100uW - 2 Watts	NRV-Z32	1423	12	9/6/2002	9/6/2003
Hewlett Packard	Signal Generator (sweep) 0.01 - 26.5 GHz	8340A	1244	N/A		

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the Soma Networks model: NPM Phase.

13 Pages

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EMC Test Data

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Emissions Spec:	EN55022, FCC, FCC part 27	Class:	A
Immunity Spec:		Environment:	

EMC Test Data

For The

Soma Networks

Model

003353A, WCS NPM

EUT: Model P/N 003353A, Model Name: Shippable, NPM, 1-Sector, 24V, WCS-A, TT-LNA, revision: 00B MC-01138

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Emissions Spec:	EN55022, FCC, FCC part 27	Class:	A
Immunity Spec:	Enter immunity spec on cover	Environment:	

EUT INFORMATION

General Description

The EUT is a base station which is designed to transmit and receive data between CPE and base station via WCS RF band. 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 24 volts DC, 12.5 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
SOMA	003353A, WCS NPM	WCS Base Station	N/A	N/A

EUT Enclosure

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EMC Test Data

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Emissions Spec:	EN55022, FCC, FCC part 27	Class:	A
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Sorensen	DHP Series	Power Supply	-	-
Soma	003353A	Power amplifier	-	-

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
PDU				
CB01	Lower PS2	Multiwire	Shielded	2
CB02	Lower PS1	Multiwire	Shielded	2
CB03	Lower PS0	Multiwire	Shielded	2
CB04	PA DC in	Multiwire	Shielded	2
CB05	3rd unit from top DC in	Multiwire	Shielded	2
CB11	Upper PS0	Multiwire	Shielded	2
CB12	Upper PS0	Multiwire	Shielded	2
CB13	Upper PS1	Multiwire	Shielded	2
CB15	Fan Assy DC in	Multiwire	Shielded	2
CB06-CB10, CB14	Not connected			
24(1), (2), (3)	DC supply	single wire	Unshielded	
RETURN (x3)	DC supply	single wire	Unshielded	
Upper Chassis Rear				
Slot 0/1 port 10	Slot 2 ENET A	CAT 5	Unshielded	
Slot 0/1 port 12	Slot 6 ENET A	CAT 5	Unshielded	
Slot 0/1 port 14	Slot 11 ENET B	CAT 5	Unshielded	
Slot 0/1 port 16	Slot 10 ENET B	CAT 5	Unshielded	
Slot 0/1 port 18	Lower chassis slot 8 ENET B	CAT 5	Unshielded	

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EMC Test Data

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Emissions Spec:	EN55022, FCC, FCC part 27	Class:	A
Immunity Spec:	Enter immunity spec on cover	Environment:	

Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Upper Chassis Rear				
Slot 0/1 ports 1-7, 9, 11,13,15,17,18-22, 24	Not cabled			
Slot 0/1 port 23	Slot 13/14 port 24	CAT 5 (Clip on ferrite on each end)	Unshielded	
Slot 6 ENET B	Slot 13/14 port 12	CAT 5	Unshielded	
Slot 11 ENET A	Slot 13/14 port 14	CAT 5	Unshielded	
Slot 2 ENET B	Slot 13/14 port 10	CAT 5	Unshielded	
Slot 10 ENET A	Slot 13/14 port 16	CAT 5	Unshielded	
Slot 13/14 port 18	Lower chassis slot 8 ENET A	CAT 6	Unshielded	
Slots 3/4/5,9,12,18/19/20	Blanks			
Lower Chassis Rear				
Slot 9 upper SAM	terminated			
Slot 9 lower SMA	3rd unit from top Freq. Out	coax	Shielded	
Lower Chassis Front				
RX main	PA	RF receive	Shielded	1.5
TX main	PA	RF transmit	Shielded	1.5
Tx DIV	Terminated			
Rx DIV	Terminated			
PA				
SGNL	Laptop	multiwire	Shielded	

NOTE: Slots are numbered 0 to 20. The power supplies take up slots 0 through 3 on both the upper and lower. There is no set order for the ports on the swtich, cables can be plugged in any port on switch. Not all ports on the switch are used. Any ports not listed above were not cabled. Soma Networks stated that unused ports are not used for a 1 sector unit.

EUT Operation During Emissions

At the beginning of the test the Somaport was connected directly to the NPM, the download signal was acquired on the Somaport, and the uplink signal from the Somaport was acquired on the NPM. This state establishes that the NPM was configured and initialized, and that transmitting/receiving is operating normally. The cables to the Somaport were then disconnected and then connected to the PA. This is the normal connection for these cables.

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	N/A

Radiated Emissions

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: 11/25/02
Test Engineer: Chris Byleckie
Test Location: SVOATS #1

Config. Used:
Config Change:
EUT Voltage: 24VDC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

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

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature: 16°C
Rel. Humidity: 32%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Power Output (Radiated Measurement)	FCC 27	Pass	Refer to individual runs
2	Power Output (Subsitution Method)	FCC 27	Pass	Refer to individual runs
3	Power Output	FCC 27	Pass	Refer to individual runs
4	Occupied Bandwidth	FCC 27	Pass	Refer to individual runs
5	Emission Mask	FCC 27	Pass	Refer to individual runs
6	Antenna Conducted	FCC 27	Pass	Refer to individual runs

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:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	N/A

Run #1: Radiated Output Power (EIRP)
Antenna Port terminated

Channel	Frequency (MHz)	Measured Peak Value (dBuV)	Measured Average Value (dBuV)	Antenna Pol. (H/V)	Res BW
Middle	2352.0	89.6	80.8	V	3 MHz
Middle	2352.0	98.3	89.5	H	3 MHz

Run #2: Output Power (Substitution Method)
Antenna Port terminated

			Substitution Note 1				Comments
Frequency	Level	Pol	Pin	Gain	EIRP		
MHz	dBµV	v/h	(dBm)	(dBi)	(dBm)		
2352.00	80.8	v	-27.0	7.1	-19.9		
2352.00	89.5	h	-22.3	7.1	-15.2		

Run #3a: Output Power (Peak Power Meter)
Antenna Port terminated

Channel	Frequency (MHz)	Peak Power (dBm)	Antenna Gain	
Middle	2352.0	48.5		

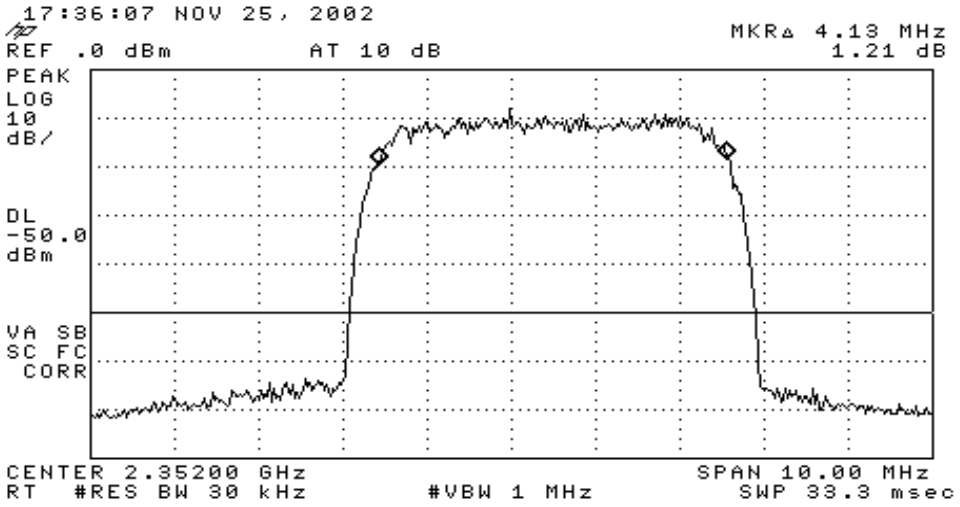
Run #3b: Output Power (Average Power Meter)
Antenna Port terminated

Channel	Frequency (MHz)	Average Power (dBm)	Antenna Gain	
Middle	2352.0	44.0		

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	N/A

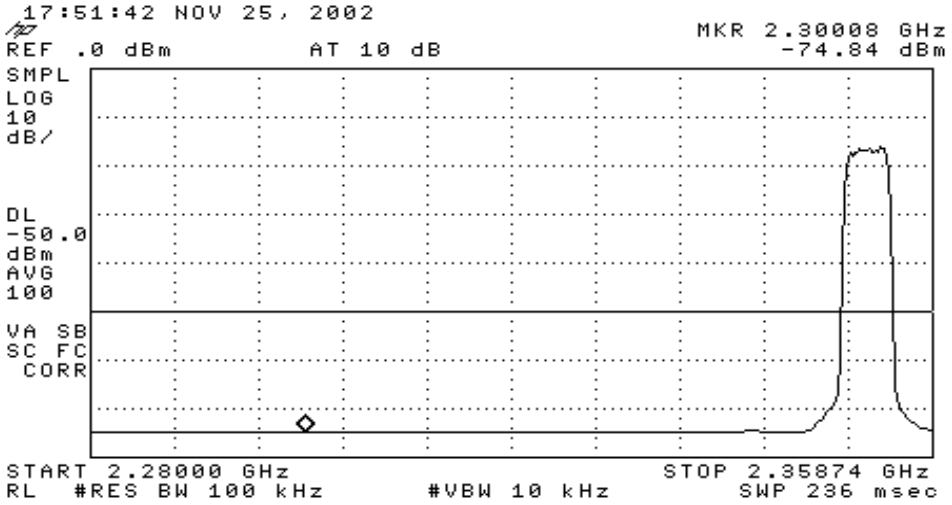
Run #4: Occupied Bandwidth

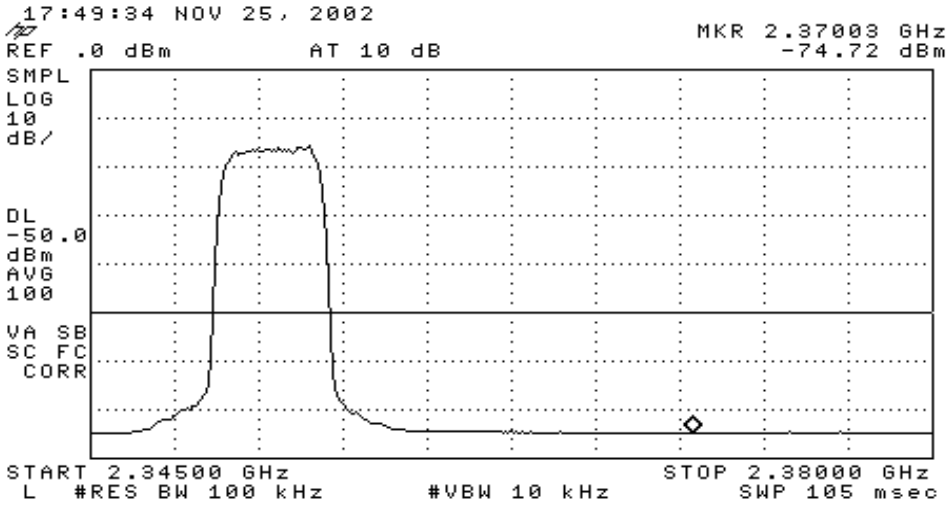
40dB attenuation between EUT and analyzer



Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	N/A

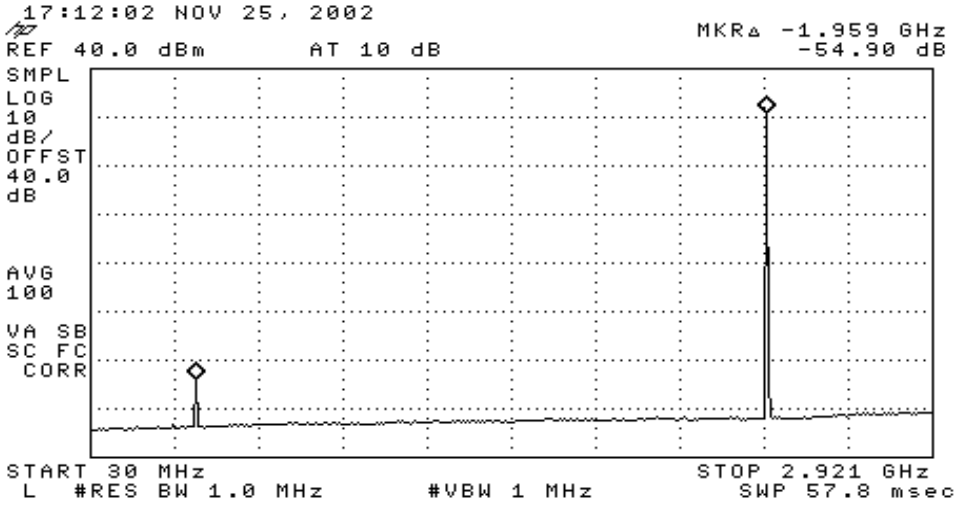
Run #5: Emission Mask (Bandedge Measurement)

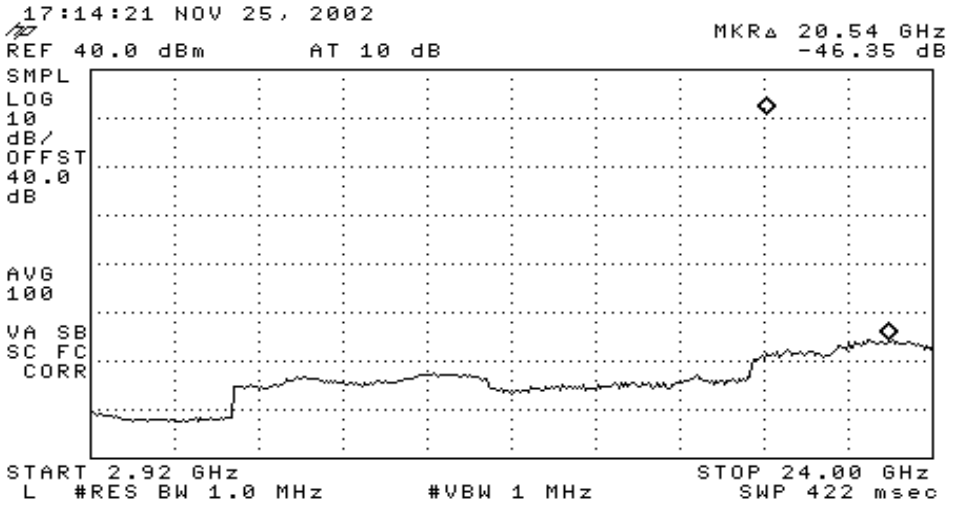




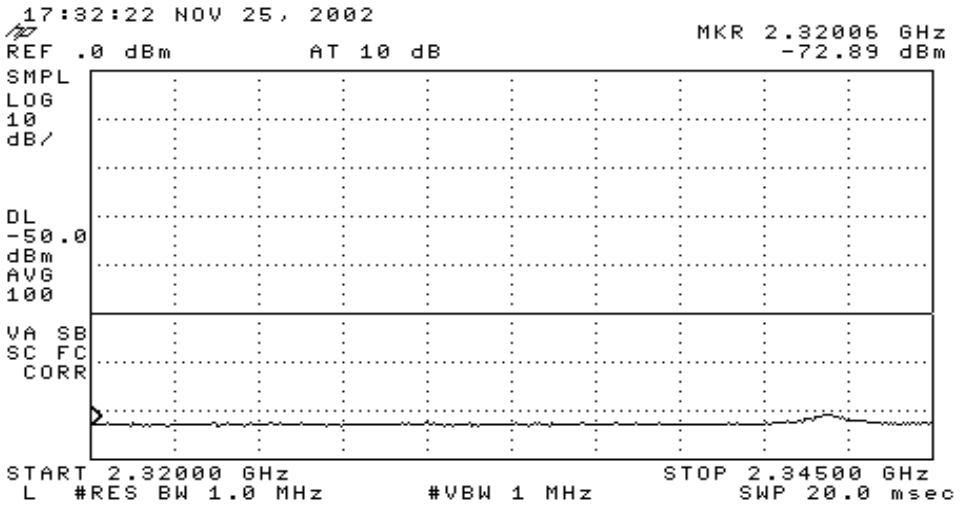
Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	N/A

Run #6: Spurious Emission at the antenan terminal (Antenna conducted Emissions)
40dB attenuation between EUT and analyzer





Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	N/A



Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	A

Radiated Emissions

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: 11/25/02
Test Engineer: Chris Byleckie
Test Location: SVOATS #1

Config. Used: 1
Config Change:
EUT Voltage: 24VDC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.

Ambient Conditions:

Temperature: 16°C
Rel. Humidity: 32%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Radiated Emissions 1000-24000 MHz (Field Strength)	FCC Part 27	Pass	Refer to individual runs
2	Radiated Emissions 1000-24000 MHz (EIRP)	FCC Part 27	Pass	Refer to individual runs

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.

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EMC Test Data

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	A

Run #1: Radiated Emissions, 1000-24000 MHz (Field Strength)

Fundamental signal at 2352 MHz

Frequency	Level	Pol	FCC Part 27		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4704.00	51.7	v	55.0	-3.3	Avg			
7056.00	43.6	v	55.0	-11.5	Avg			
9408.00	57.2	v	55.0	2.2	Avg			
11760.00	50.5	v	55.0	-4.6	Avg			
14112.00	43.7	v	55.0	-11.3	Avg			
16464.00	42.1	v	55.0	-12.9	Avg			
4704.00	48.9	h	55.0	-6.1	Avg			
7056.00	41.8	h	55.0	-13.2	Avg			
9408.00	58.7	h	55.0	3.7	Avg			
11760.00	48.9	h	55.0	-6.1	Avg			
14112.00	44.5	h	55.0	-10.5	Avg			
16464.00	42.1	h	55.0	-12.9	Avg			

Note 1:	Add note here
Note 2:	

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EMC Test Data

Client:	Soma Networks	Job Number:	J48523
Model:	003353A, WCS NPM	T-Log Number:	T49483
		Proj Eng:	Mark Briggs
Contact:	Moataz Drebika		
Spec:	EN55022, FCC, FCC part 27	Class:	A

Run #2: Radiated Emissions, 1000-22,000 MHz (EIRP)

EIRP and ERP measurements

Average measurements from Run #1

Frequency	Level	Pol	Substitution					
MHz	dBµV/m	v/h	Pin	Gain	EIRP	Limit [Note 1]	Margin	
			(dBm)	(dBi)	(dBm)	(dBm)	(dB)	
4074.00	51.7	v	-61.2	9.2	-52.0	-40	-12.0	
4074.00	48.9	h	-69.8	9.2	-60.6	-40	-20.6	
7056.00	43.6	v	-77.5	9.8	-67.7	-40	-27.7	
7056.00	41.8	h	-80.1	9.8	-70.3	-40	-30.3	
9408.00	43.6	v	-71.1	10.8	-60.3	-40	-20.3	
9408.00	58.7	h	-52.2	10.8	-41.4	-40	-1.4	
11760.00	50.5	v	-66.9	10.7	-56.2	-40	-16.2	
11760.00	48.9	h	-70.0	10.7	-59.3	-40	-19.3	

Note 1:	The limit was derived from 70+10log(P) from FCC part 27.53(a)(3). The output power used for the calculation was 25W or 44 dBm.

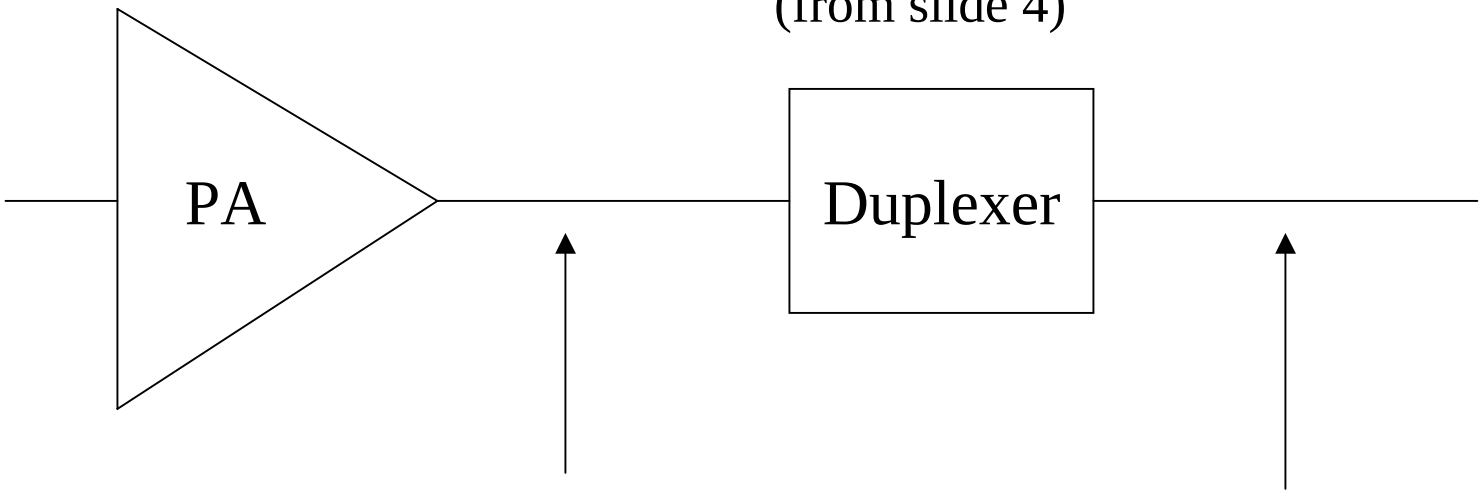
Slide 1

The following measurements were taken to demonstrate compliance with the requirement for –50 dBm (max.) per 1 MHz bandwidth spurious emission in the SDARS band (2320 to 2345 MHz).
The test equipment used was a Rhode and Schwarz FSIQ 7 spectrum analyzer and an Agilent 8753ES network analyzer. The accuracy of the test equipment was verified by substitution of a signal generator.

As can be seen on slide 2, the NPM transmitter exhibits a maximum spurious output of –58 dBm per 1 MHz bandwidth from 2320 to 2345 MHz, as calculated from the individual measurements of the transmitter chain through the power amplifier (PA), and of the duplexer.

Slide 2

Loss = 29 dB (min.)
2320 to 2345 MHz
(from slide 4)

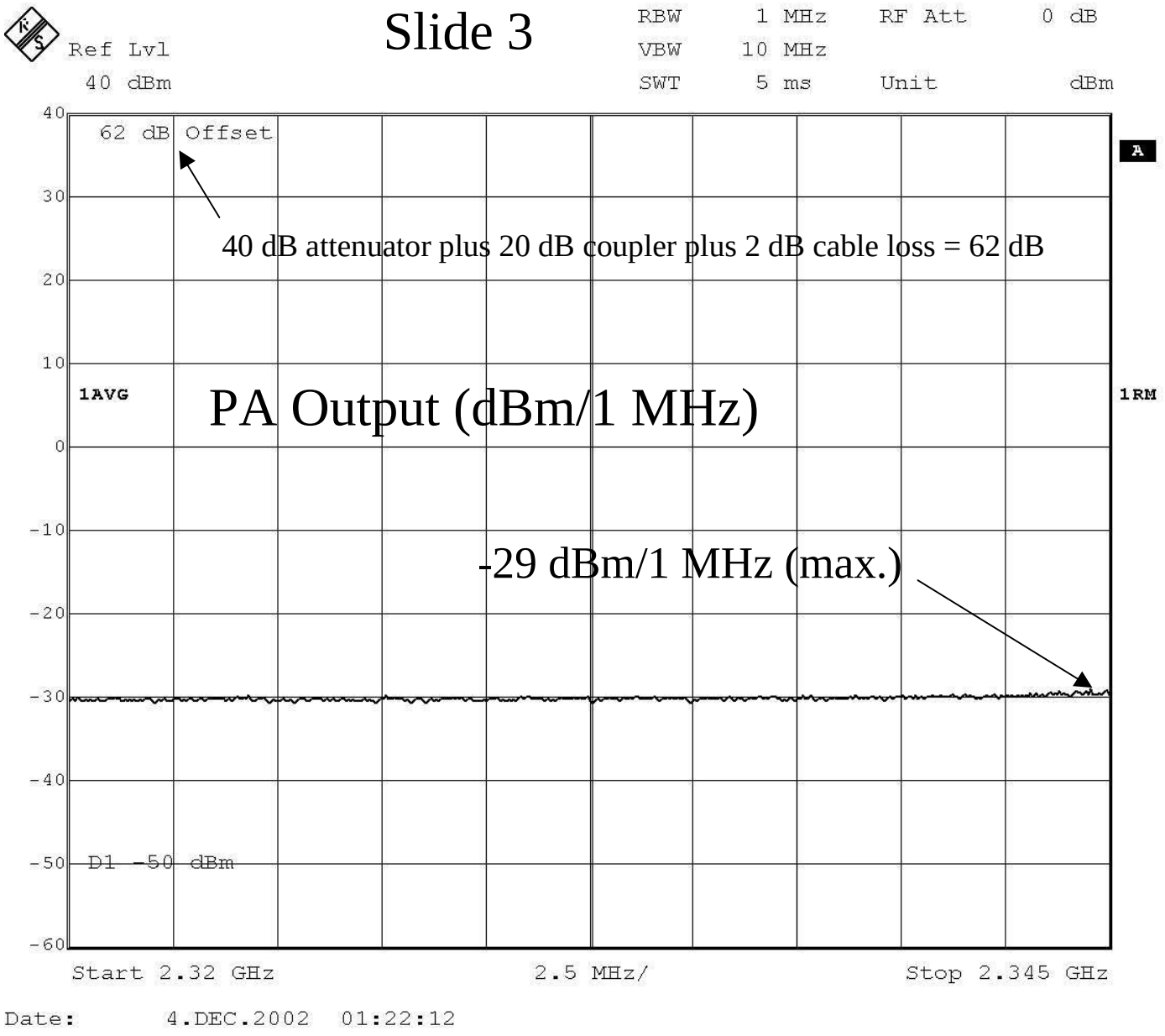


-29 dBm/1 MHz (max.)
2320 to 2345 MHz
(from slide 3)

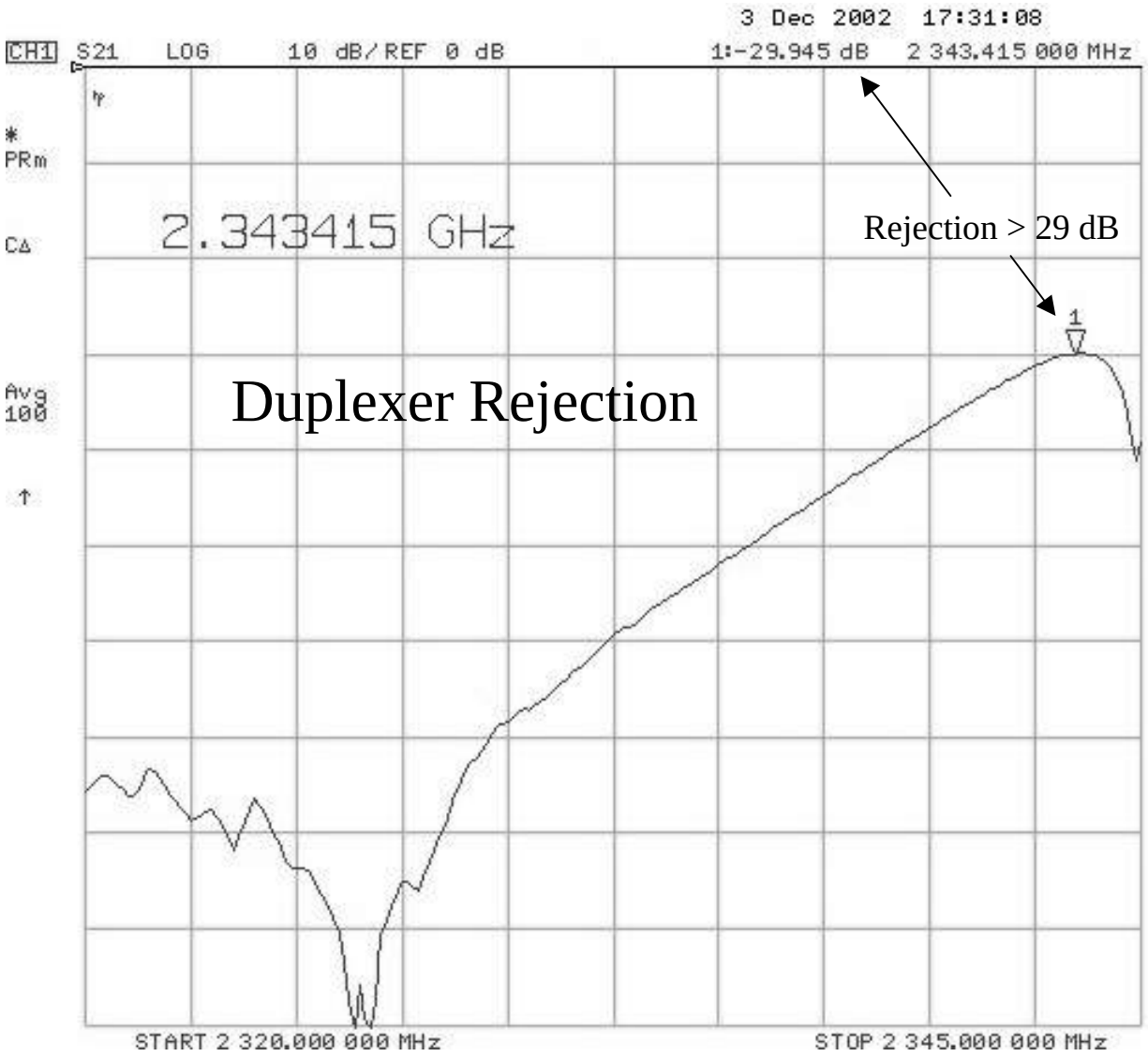
-58 dBm/1 MHz (max.)
2320 to 2345 MHz

FCC limit: -50 dBm/1 MHz

Slide 3


Ref Lvl
40 dBm
RBW 1 MHz
VBW 10 MHz
SWT 5 ms
RF Att 0 dB
Unit dBm
62 dB Offset
40 dB attenuator plus 20 dB coupler plus 2 dB cable loss = 62 dB
1AVG
PA Output (dBm/1 MHz)
1RM
A
-29 dBm/1 MHz (max.)
D1 -50 dBm
Start 2.32 GHz
2.5 MHz/
Stop 2.345 GHz
Date: 4.DEC.2002 01:22:12

Slide 4


3 Dec 2002 17:31:08
CH1 S21 LOG 10 dB/ REF 0 dB
1:-29.945 dB 2 343.415 000 MHz
PRm
2.343415 GHz
Rejection > 29 dB
1
Avg
100
Duplexer Rejection
START 2 320.000 000 MHz
STOP 2 345.000 000 MHz