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Electromagnetic Emissions Test Report In Accordance With FCC Part 21 Subpart K on the Soma Networks Model: SOMA(TM) macro base station

FCC ID:	POZNPMMDS004699
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:	July 29, 2003
FINAL TEST DATE:	July 24, 2003

AUTHORIZED SIGNATORY: _____

Juan Martinez
Sr. 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) (4) FCC ID: POZNPMMDS004699

2.1033(c)(3) Instructions/Installation Manual

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

2.1033(c)(4) Type of emissions

4M17FXW

2.1033(c)(5 Frequency Range

2620 – 2686 MHz

2.1033(c)(6) Range of Operation Power

Maximum: 21.4 Watts
Minimum: 0.0005 Watts

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

§ 21.904 EIRP limitations: (a) The maximum EIRP of a main or booster station shall not exceed 33 dBW + 10log(X/6) dBW, where X is the actual bandwidth if other than 6 MHz, except as provided in paragraph (b) of this section.

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

Refer to Exhibit 6. Schematic diagram

2.1033(c)(9) Tune-up Procedure

Refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure.

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

Refer to Exhibit 6. Schematic diagram

2.1033(c)(10) Means for Frequency Stabilization

122.88MHz VCXO (Y2)

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

Refer to Exhibit 6. The schematic diagram

2.1033(c)(10) for Limiting Modulation

Controlled by the DSP software.

2.1033(c)(10) Means for Limiting Power

Controlled by the DSP software.

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

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:
SOMA(TM) macro base station

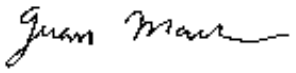
Manufacturer:
Soma Networks
185 Berry Street, Suite 2000
San Francisco, CA 94107

Tested to applicable standards:
FCC Part 21 Subpart K

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC4549_**3** Dated March 5, 2003

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of TIA/EIA-603 and the specific RSS standards applicable to this device); and that the equipment performed in accordance with the data submitted in this report.



Signature	_____
Name	Juan Martinez
Title	Sr. EMC Engineer
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	July 29, 2003

Maintenance of compliance with the above standards is the responsibility of the manufacturer. Any modification of the product, which 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.).

SCOPE

Part 21 Subpart K 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 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 Part 21 Subpart K. 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.).

SUMMARY OF TEST RESULTS

Part 21K Test Summary

Part 2 Measurements Required Section	FCC Part 21 Subpart K Section	Test Performed	Measured Value	Test Procedure Used	Result
Modulation Tested	W-CDMA	-	-	-	-
2.1047: Modulation characteristics	21.905	99% Bandwidth	4.167 MHz	D	Complies
2.1046: RF power output	21.904	Radiated Output Power Test	N/A	A	-
2.1046: RF power output	21.904	Conducted Output Power Test	43.3 dBm (21.4Watts)	B	Complies
2.1051: Spurious emissions at antenna Port	21.908(a)	Emission Limits and/or Unwanted Emission 30MHz – 25GHz (**Antenna Conducted**)	All spurious emissions: Bandedge: 25dB 250kHz: 40dB 3MHz: 60dB > 3 MHz: 60 dB	J	Complies
2.1049: Occupied Bandwidth	21.908(a)	Out of Block Emissions (**Antenna Conducted**)	All spurious emissions < 60dBm	I	Complies
2.1053 Field strength of spurious radiation	21.908(a)	Radiated Spurious Emissions 30MHz – 25GHz	-27.9 dBm @ 4605 MHz (-10.9 dB)	N	Complies
2.1055: Frequency stability	21.101(a)	Frequency Stability (Frequency Vs. Temperature)	0 Hz	K	Complies
2.1055: Frequency stability	21.101(a)	Frequency Stability (Frequency Vs. Voltage)	0 Hz	L & M	Complies
2.1093: Exposure to portable devices	1.1307	Exposure of Humans to RF Fields	N/A	N/A	-
-	N/A	Receiver Spurious Emissions (**Antenna Conducted**)	All spurious emission below 1 GHz < 2 nanowatts and above 1 GHz < 5 nanowatts	N/A	N/A

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Soma Networks model SOMA(TM) macro base station is a base station, which is designed to transmit and receive data between CPE and base station via MMDS 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 33Vdc, 69 Amps.

The sample was received on July 18, 2003 and tested on July 24, 2003.

The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
SOMA	SOMA(TM) macro base station	MMDS Base Station	N/A	N/A

ENCLOSURE

The RF EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 56 cm wide by 45 cm deep by 211 cm high. The Radio EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 61 cm wide by 45 cm deep by 211 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following support equipment was used as for emissions testing.

EUT INTERFACE PORTS

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

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	

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Untility Shelf				
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	
Radio Shelf				
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 switch, 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 TESTING

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.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on July 24, 2003 at the Elliott Laboratories Open Area Test Site #3 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 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 1MHz was used to measure the power output. Corrected for any external attenuation used for the protection of the input of analyzer. In addition, For CDMA or TDMA modulations set spectrum analyzer resolution to 1MHz and video to 30 kHz. Use video averaging with a 100-sample rate.
4) If 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.
5) 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, 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 or 30 kHz was used to measure the emission's bandwidth.

Procedure H - 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 – Occupied Bandwidth (Emission Mask): The following procedure was used:

1) Set the frequency of the device as close as possible to the FCC frequency block edge.
2) Set the center frequency to the FCC frequency block edge. The span was set to 30 MHz to encapsulate the fundamental and any other spurs 6 MHz away from the fundamental.
3) Set the RBW and VBW to 100 kHz to measure the spectral points of the fundamental.
4) The digital signal is W-CDMA a non-constant envelope, so average video was enabled.
5) Section 21.908(a) for digital modulation states the following attenuation:

   At 6 MHz channel edge: 25dB below the average 6 MHz channel power
   From edge to 250 kHz: 40-dB linearly slope
   Then 3MHz removed from the center frequency: 60-dB linearly slope
   More then 3MHz removed from the center frequency: 60-dB

6) Per section 21.908(e):

   Absolute power measurements:
   Attenuation in dB (below channel power) = A + 10log (R_{BW1}/R_{BW2})

7) Results were then plotted and mask applied. Repeated for the higher channel used by the transmitter.

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 as specified in the standard. Power is set to maximum.
2) Set the spectrum analyzer display line function to 60-dB below the average 6 MHz channel power.
3) Set the spectrum analyzer bandwidth to 100 kHz.
4) For the spectrum analyzer, the start frequency was set to 30 MHz and the stop frequency set to the 10^{th} harmonic of the fundamental. All spurious or intermodulation emission must not exceed the 60-dB attenuation.
5) Steps 1 to 4 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 (or +60° C for some IC RSS standards) in 10 degrees increment. The EUT was allowed enough time to stabilize for each temperature variation.

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

Procedure M - Frequency Stability: For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function. This is performed 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 not being 20-dB below the calculated radiated limit. Substitution method is performed by replacing the EUT with a horn antenna and signal generator. The horn antenna factors can be reference to a half-wave dipole in dBi. 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

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

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

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

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, 1000-30,000 MHz, 11-Sep-03
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	3/27/2003	3/27/2004
Hewlett Packard	Microwave EMI test system (SA40, 9kHz - 40GHz)	84125C	1149	12	3/12/2003	3/12/2004

Substitution Method, 11-Sep-03
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	12	4/24/2003	4/24/2004
Hewlett Packard	Signal Generator (sweep) 0.01 - 26.5 GHz	8340A	1244	N/A		

Power measurement, 11-Sep-03
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1534	12	3/20/2003	3/20/2004
Rohde & Schwarz	Power Sensor 100uW - 10 Watts	NRV-Z53	1236	12	8/15/2002	9/15/2003

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the Soma Networks, model: SOMA(TM) macro base station

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EMC Test Data

Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Emissions Spec:	FCC part 21	Class:	Radio
Immunity Spec:		Environment:	

EMC Test Data

For The

Soma Networks

Model

SOMA(TM) macro base station

Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Emissions Spec:	FCC part 21	Class:	Radio
		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 MMDS 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 33Vdc, 69 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
SOMA	SOMA(TM) macro base station	MMDS Base Station	N/A	N/A

EUT Enclosure

The RF EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 56 cm wide by 45 cm deep by 211 cm high. The Radio EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 61 cm wide by 45 cm deep by 211 cm high.

Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Emissions Spec:	FCC part 21	Class:	Radio
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
			-	-
			-	-

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	

Elliott

EMC Test Data

Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Emissions Spec:	FCC part 21	Class:	Radio
Immunity Spec:	Enter immunity spec on cover	Environment:	

Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Untility Shelf				
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	
Radio Shelf				
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 switch, 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:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	Radio

Power Output Measurement

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: 7/25/03
Test Engineer: jmartinez
Test Location: SVOATS #3

Config. Used: 1
Config Change: None
EUT Voltage: 33VDC

General Test Configuration

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

Ambient Conditions:

Temperature: 21°C
Rel. Humidity: 35%

Summary of Results

Run #	Test Performed	Limit	Result	Measurement
1	Conducted Power Measurement	21.904	Pass	43.3 dBm

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.

Run #1: Conducted Output Power (Average Power Meter)

Channel	Frequency (MHz)	Average Power (dBm)
Middle	2653.0	43.3

Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	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: 7/21/03
Test Engineer: Jmartinez
Test Location: SVOATS# 3

Config. Used: 1
Config Change: None
EUT Voltage: 33VDC

General Test Configuration

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.

Ambient Conditions:

Temperature: 21°C
Rel. Humidity: 35%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
Low Channel (Part 21)				
1	Emission Mask	FCC 21	Pass	Refer to plot
1	Occupied Bandwidth	FCC 21	Pass	4.12 MHz
1	Antenna Conducted	FCC 21	Pass	Refer to plot
High Channel (Part 21)				
2	Emission Mask	FCC 21	Pass	Refer to plot
2	Occupied Bandwidth	FCC 21	Pass	4.167 MHz
2	Antenna Conducted	FCC 21	Pass	Refer to plot

Modifications Made During Testing:

No modifications were made to the EUT during testing

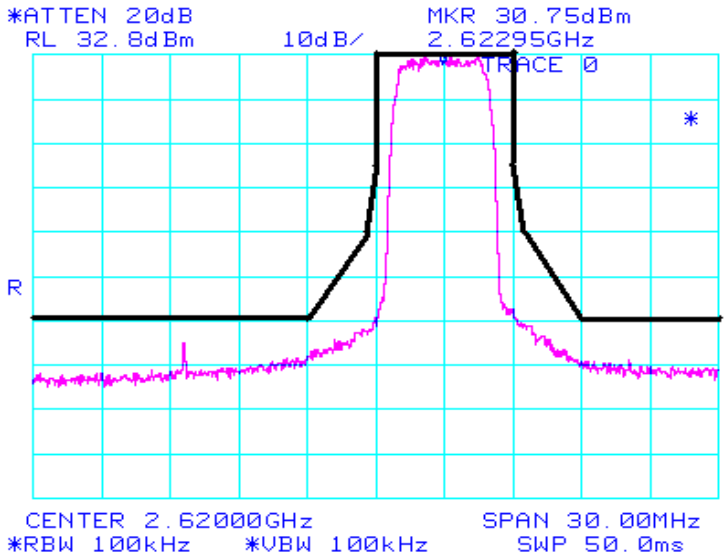
Deviations From The Standard

No deviations were made from the requirements of the standard.

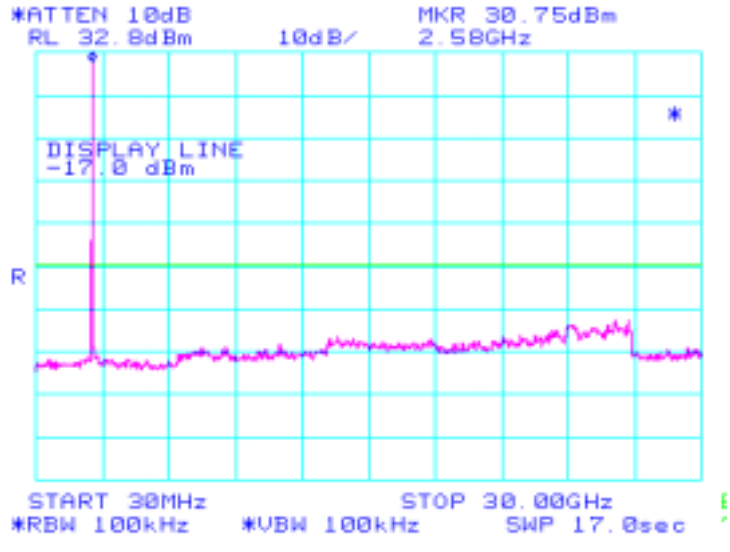
Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	N/A

Run #1: Emission Mask (Bandedge Measurement), 99% BW, Out of Band emissions, low channel

Low Channel

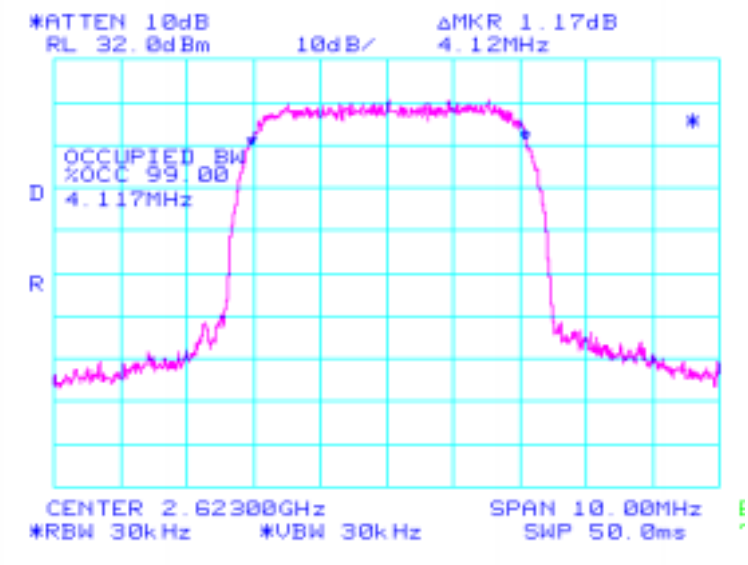


Low Channel out of band



Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	N/A

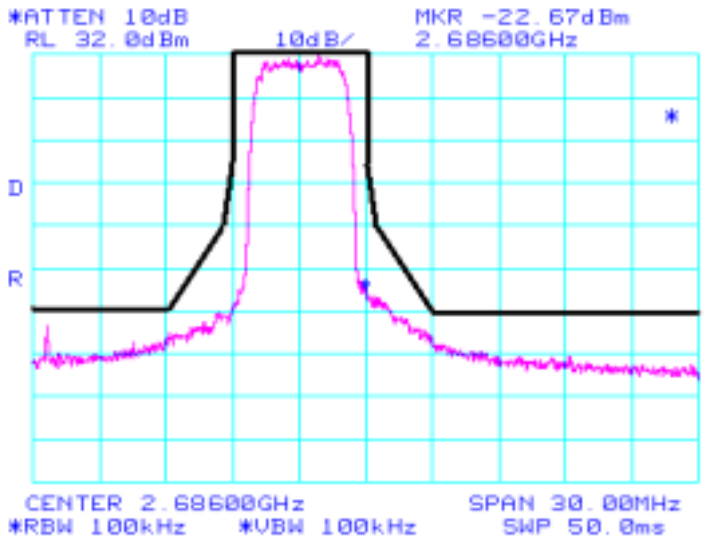
99% BW



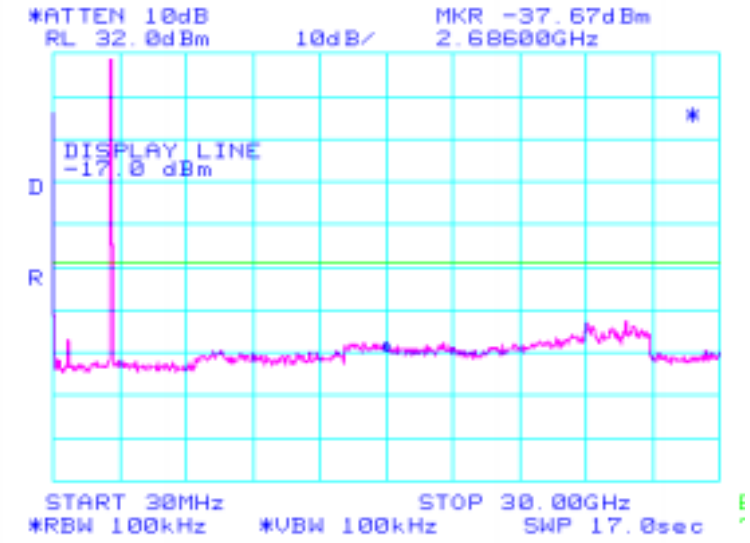
Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	N/A

Run #2: Emission Mask (Bandedge Measurement), 99% BW, Out of Band emissions, High channel

High Channel

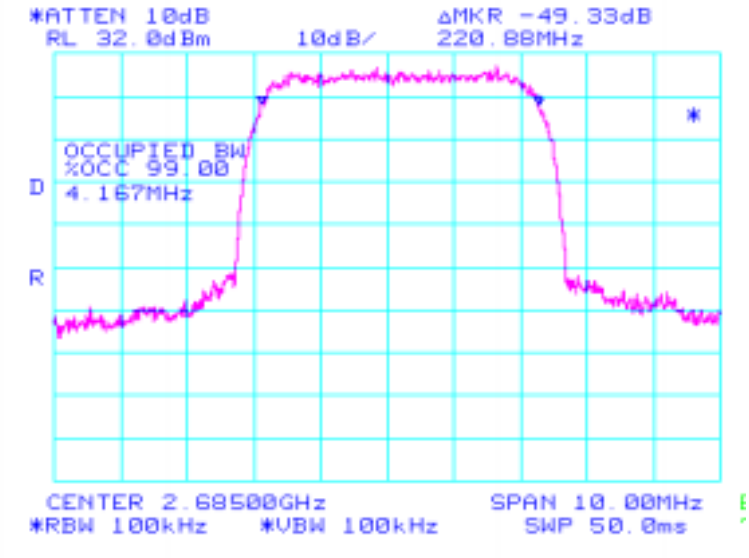


High Channel out of band



Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	N/A

99% BW



Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	Radio

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: 7/18/03
Test Engineer: Jmartinez
Test Location: SVOATS# 3

Config. Used: 1
Config Change: None
EUT Voltage: 33VDC

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 3 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 27 GHz.

Ambient Conditions:

Temperature: 20°C
Rel. Humidity: 45%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1-3	Radiated Emissions 1000-27000 MHz (EIRP)	FCC Part 21	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:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	Radio

Run #1: Radiated Emissions, 1000-27000 MHz (Substitution)

Fundamental signal at 2622 MHz

EIRP measurements

Frequency	Level	Pol	Substitution						
MHz	dBµV/m	v/h	Pin	Gain	EIRP	Limit [Note 1]	Margin		
			(dBm)	(dBi)	(dBm)	(dBm)	(dB)	Comments	
4488.00	53.4	v	-53.9	10.5	-43.4	-16.7	-26.7	Ch. 1	Note 1 & 2
4625.00	63.0	v	-43.5	10.5	-33.0	-16.7	-16.3	Ch. 1	Note 1 & 2
4485.00	53.4	h	-52.7	10.5	-42.2	-16.7	-25.5	Ch. 1	Note 1 & 2
4625.00	66.3	h	-39.8	10.5	-29.3	-16.7	-12.6	Ch. 1	Note 1 & 2
5244.00	46.8	v	-59.0	9.8	-49.2	-16.7	-32.5	Ch. 1	Note 1 & 2
5244.00	39.5	h	-66.6	9.8	-56.8	-16.7	-40.1	Ch. 1	Note 1 & 2

Note 1:	The limit is 60-dB below the transmitted output power. The output power used for the calculation was 43.3 dBm.
Note 2:	Noise floor measurement. No othe harmonic emission detected close to 20-dB ol the limit after the 2nd harmonic

Run #2: Radiated Emissions, 1000-27000 MHz (Substitution)

Fundamental signal at 2653 MHz

EIRP measurements

Frequency	Level	Pol	Substitution						
MHz	dBµV/m	v/h	Pin	Gain	EIRP	Limit [Note 1]	Margin		
			(dBm)	(dBi)	(dBm)	(dBm)	(dB)	Comments	
4546.00	59.9	v	-47.2	10.5	-36.7	-16.7	-20.0	Ch. 6	Note 1 & 2
4685.00	64.3	v	-42.7	10.5	-32.2	-16.7	-15.5	Ch. 6	Note 1 & 2
4546.00	61.6	h	-45.5	10.5	-35.0	-16.7	-18.3	Ch. 6	Note 1 & 2
4685.00	62.8	h	-44.3	10.5	-33.8	-16.7	-17.1	Ch. 6	Note 1 & 2
5305.00	46.9	v	-58.9	9.8	-49.1	-16.7	-32.4	Ch. 6	Note 1 & 2
5305.00	38.0	h	-55.0	9.8	-45.2	-16.7	-28.5	Ch. 6	Note 1 & 2

Note 1:	The limit is 60-dB below the transmitted output power. The output power used for the calculation was 43.3 dBm.
Note 2:	Noise floor measurement. No othe harmonic emission detected close to 20-dB ol the limit after the 2nd harmonic

Elliott

EMC Test Data

Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	Radio

Run #3: Radiated Emissions, 1000-27000 MHz (Substitution)

Fundamental signal at 2683 MHz

EIRP measurements

Frequency	Level	Pol	Substitution						
MHz	dBµV/m	v/h	Pin	Gain	EIRP	Limit [Note 1]	Margin		
			(dBm)	(dBi)	(dBm)	(dBm)	(dB)	Comments	
4605.00	68.5	v	-38.6	10.5	-28.1	-16.7	-11.4	Ch. 11	Note 1 & 2
4745.00	62.0	v	-45.2	10.5	-34.7	-16.7	-18.0	Ch. 11	Note 1 & 2
4605.00	67.6	h	-38.4	10.5	-27.9	-16.7	-11.2	Ch. 11	Note 1 & 2
4745.00	64.7	h	-41.5	10.5	-31.0	-16.7	-14.3	Ch. 11	Note 1 & 2
5366.00	49.4	v	-56.4	9.8	-46.6	-16.7	-29.9	Ch. 11	Note 1 & 2
5366.00	49.4	h	-56.4	9.8	-46.6	-16.7	-29.9	Ch. 11	Note 1 & 2

Note 1:	The limit is 60-dB below the transmitted output power. The output power used for the calculation was 43.3 dBm.
Note 2:	Noise floor measurement. No othe harmonic emission detected close to 20-dB ol the limit after the 2nd harmonic

Client:	Soma Networks	Job Number:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	Radio

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: 7/24/03
Test Engineer: Juan Martinez
Test Location: Environmental Chamber
Config. Used: 1
Config Change: None
EUT Voltage: 33VDC

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 Spectrum Analyzer. An attenuator was used between the EUT and Spectrum Analzyer. 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. The power was monitor with a power meter during the test session.
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.

Summary of Results

Run #	Test Performed	Limit	Result	Result
1	Temperature Vs. Frequency	Part 21	Pass	0 Hz
2	Voltage Vs. Frequency	Part 21	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:	J51885
Model:	SOMA(TM) macro base station	T-Log Number:	T51922
		Account Manager:	Christine Vu
Contact:	Dale Kluesing		
Spec:	FCC part 21	Class:	Radio

Run# 1: Temperature Vs. Frequency

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
1	2503.00	2503.0

Temperature	Reference Frequency	Frequency Drift	Drift	Limit
(Celsius)	(MHz)	(MHz)	(Hz)	(Hz)
-30	2623.240001	2623.240001	0	2503.0
-20	2623.240001	2623.240001	0	2503.0
-10	2623.240001	2623.240001	0	2503.0
0	2623.240001	2623.240001	0	2503.0
10	2623.240001	2623.240001	0	2503.0
20	2623.240001	2623.240001	0	2503.0
30	2623.240001	2623.240001	0	2503.0
40	2623.240001	2623.240001	0	2503.0
50	2623.240001	2623.240001	0	2503.0

Run# 2: Voltage Vs. Frequency

Nominal Voltage is 33Vdc.

Voltage	Voltage	Drift	Limit
(Dc)	(AC)	(Hz)	(Hz)
85%	28.05	0.0	2503.0
115%	37.95	0.0	2503.0