

RF Monitoring Products

CATS* 72000 SERIES

VSWR POWER MONITOR FOR MULTIPLE Tx AND Rx ANTENNAS

CELLULAR / SMR MODELS



*Communication Antenna Testing System

The Narda Series 72000 provide the complete cell site antenna monitoring and power measurement solution for cellular, SMR and Paging applications.

The products are precise in-line instruments which measure forward and reflected power and calculate actual VSWR. They are designed for use in analog and digital systems and employ low loss, high directivity couplers in conjunction with high sensitivity detectors and built-in microprocessors. A RS232 bus is provided for remote control and computer interface. These units provide the state of the art for in-line, continuous power and VSWR monitoring and offer the following features:

- Precision Power and VSWR measurements resulting from the use of a high directivity coupler (30dB minimum) and imbedded microprocessors.
- Prime system power meter—true RMS power measurements with over a 30dB dynamic range up to 600 watts average power with multiple frequencies. This provides the accuracy and linearity needed for precise system setup.
- Alarms for high VSWR and low power (CCH channel monitor) with form-C relays for VSWR alarms.
- Continuous Transmitter VSWR measurements with logging for tracking antenna feed performance and predicting failures.
- Unattended Receive Antenna VSWR sweeps.
- Remote and local operation over the RS232 bus with access to all functions and controls and the ability to log power, VSWR, alarm status and temperature.

- System transparent with extremely low residual insertion loss and VSWR. Intermodulation products and harmonic generation are extremely low.
- Option for the onboard storage of up to six months of Tx VSWR data and Rx antenna sweeps
- Readily compatible with AT&T, Motorola, and NorTel base station equipment.

THE SERIES 72000

The Narda Series 72000 Tx/Rx Antenna Monitor utilizes two types of monitoring instrumentation. A modified Narda **CellGuard™** Series 8455 (see page 105) is used to monitor the forward and reflected power on each transmitting antenna. A multiplexed, low power synthesized transmitter/receiver is used to monitor each receive antenna. Both types of monitor are operated on an IEEE485 multi-drop bus, which allows for up to 16 sensors to be individually controlled and monitored over a single balanced wire pair. The IEEE485 bus is converted to a RS232 output within the unit. The Series 72000 is supplied with Windows-based, menu driven software which will assist in system integration and provides a user-friendly operating Interface.

The Series 72000 is designed for a 19 or 23 inch rack. The standard configuration allows for monitoring up to six Tx and six Rx antennas. The mix of transmit and receive antenna monitors can be modified and multiple units can be combined as required.

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TRANSMITTER ANTENNA SENSORS

The transmitter measurement portion of the Series 72000 Monitor uses individual antenna sensors which are special versions of the **CellGuard™** Model 8455. These devices make use of advanced microprocessors for control, calibration and communications and gallium arsenide RF circuits to give over 30dB of dynamic range. The transmission sensors are available with full scale power measurement capability of 50, 200 or 600 Watts. The peak power handling capability is 7 Kw for a 600W full scale unit and changes proportionally with full scale rating.

RECEIVE ANTENNA SENSORS

The receive antenna sensor consists of a multiplexed, low power synthesized transmitter and a receiver. The antenna VSWR is measured with an rf signal of less than -10 dBm on the antenna feedline. This power level is sufficiently low such that the the measurement signal is not discernible on the cellular system.

The receive antenna sensors can be operated either in a single frequency measurement mode or a VSWR sweep mode. In the single frequency mode, the VSWR measurement can be made at a predetermined frequency or any desired frequency. The measurement takes less than 0.2 seconds. This low power single frequency "Ping" test allows for quick assessment of the Rx antenna condition and can be quickly and easily applied to all the Rx antennas at the site.

In the VSWR sweep mode, each Rx antenna can be quickly measured at up to 25 frequencies across the band of interest. The results are tabulated, plotted, displayed or exported to a spread sheet. Users can select preset frequency ranges or create their own measurement frequencies.

COMPUTER INTERFACE

The Series 72000 Tx/Rx Monitor system is provided with an RS232 interface which can be used for either direct connection to a local computer or to modem for remote communications. A DTE / DCE switch is provided for selecting the respective mode of operation. The individual sensors within the system are connected via an RS485 bus. As a result, each unit on the bus has a unique ID and can be individually polled. A RS 485 to RS 232 converter is included to complete the digital interface. Narda CELLPRO Plus software is provided with the system to facilitate setup and use. It provides complete monitoring and setup for up to six transmitter and six receiver antenna configurations of the Series 72000. In addition, when used either locally or remotely via modem, it converts the host computer to a *real time virtual instrument* for quickly

measuring VSWR at all antenna feeds and forward and reflected power at transmit antenna feeds. The virtual power meter feature allows for accurate local or remote system setup.

CELLPRO Plus operates in a Windows 3.1, Windows 95 or Windows NT environment.

ALARMS

Transmit Antenna Alarms

Each Tx antenna sensor has two alarms: low power and VSWR.

The low power alarm is nonlatching or latching and its level is typically set just below the control channel (CCH) power level to detect a CCH failure. The alarm is on when the power falls below the set limit.

The VSWR alarm is latching and activates whenever it is not inhibited and the VSWR exceeds the set limit. When a Tx monitors VSWR alarms, the red Tx alarm light on the Series 72000 goes on and the form C relay closes. The VSWR alarm, the red Tx alarm light and the form C relay can only be reset from the Reset screen.

The Tx antennas VSWR alarms operate continuously. Any time a radio is keyed up and the antenna does not meet the VSWR alarm criteria the alarm activates.

Receive Antenna Alarms

The Series 72000 Rx VSWR alarm is activated whenever the VSWR of any Rx antenna is measured to be at a level in excess of the VSWR Alarm limit setting. The alarm is latching and activates the red Rx alarm light and closes a form C relay. The alarm, light and relay are reset from the Reset screen only.

Rx VSWR measurements must be initiated to activate the alarm. The status of an individual Rx antenna can be quickly determined by using the "Ping" test. In this mode the VSWR of each antenna is measured at the default RF test frequency. This measurement is made with an RF signal of less than -10 dBm with a duration of less than .2 seconds. The Rx VSWR alarm also is activated if an alarm condition is detected during the RX Sweep mode of operation. An optional autonomous mode of operation is offered for automatically polling the Tx and Rx antennas and storing the measurements for up to six months. In this mode the VSWR alarms will activate when a failure is detected.

CELL SITE STATUS

The Series 72000 Tx/Rx Monitor system provides a convenient means of quickly determining the complete status

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of all cell site antennas. With a single click of the mouse the screen shown in Figure 1 appears and the instantaneous condition of each antenna is displayed. Forward power, reflected power and VSWR are provided for each Tx antenna. Ping test results are provided for each Rx antenna. Complete antenna status is displayed in less than 30 seconds.



Figure 1 - Cell Site Status

VIRTUAL POWER METER

Figure 2 shows the virtual power meter display which is provided by Cellpro Plus for setup and diagnostics. The meter is always in-line and eliminates the need to break the line when doing cell site power setup. This meter reads the instantaneous forward power entering the antenna feed line. The default units are in Watts. By simply clicking the respective button power in dBm can be displayed. The dB setting provides power readings in dB relative to the instant the dB button was clicked.

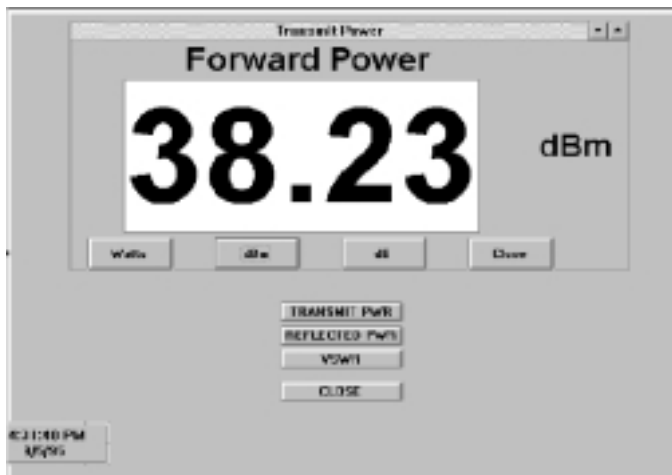


Figure 2 - Virtual Power Meter

Rx ANTENNA VSWR SWEEPS

The Series 72000 can easily and quickly perform unattended Rx antenna VSWR sweeps. Since the unit is permanently inline, these tests are performed without breaking the feedlines and with greater convenience and significantly reduced cost than the current practice. A typical sweep traverses up to 25 test points and is completed in less than 30 seconds. The data can be presented in VSWR units or return loss as desired. The sweep of a single antenna or of multiple antennas can be initiated locally or remotely via the RS 232 connection. A typical Rx antenna sweep is shown in Figure 3. These sweeps are date stamped and can easily be printed.

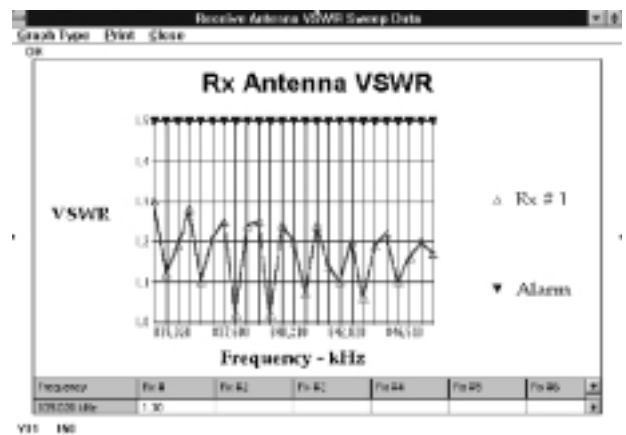


Figure 3 - Rx Antenna Sweep

AUTONOMOUS OPERATION (-01 Option) Programmable Measurements with Data Storage and Analysis

The series 72000 is offered with an option for an autonomous mode of operation which is implemented with a programmable on-board computer. The computer is programmed to schedule, control, monitor and store VSWR measurements and antenna sweeps. Typically up to six months of data can be stored.

- Tx and Rx VSWR alarms and associated Form-C relay closures occur as soon as an alarm condition is detected.
- The on-board computer can be downloaded and programmed locally or remotely via the RS232 port.
- Stored data is outputted into a comma delimited spread sheet file which can easily be imported into Excel or other popular spread sheets.

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- Data can be Directly Imported into Excel programs for presentation and trend analysis.
- All features of the standard 72000 series products are available in this mode.

Programming - The computer is programmed by entering simple ASCII text statements into a text box. Standard measurements are:

- Sweep VSWR on one to six Rx antennas
- Read VSWR on one to twelve Tx antennas
- Measure Temperature
- Reset Alarms

Any of these measurements can be scheduled to occur at any specified time and repeated at any desired interval.

Down Loading Data - Data is stored in individual files, one for each day, and the files are named with the corresponding date. Each measurement within a given day is date/time stamped. An individual day or any time period of consecutive days can be down loaded. The capacity of the onboard computer memory is about six months and when the memory is full the last data is recorded on a FIFO basis so that the last six months is always present.

Down loaded data is stored in a text file for subsequent analysis and individual data measurements can be displayed instantly in graphic format.

Making a Spread Sheet File - Commands are provided to convert the data text file into a comma delimited file for exporting to popular spread sheet programs

A spread sheet tabulating the VSWR sweep data on four Rx antennas, each of which were swept twice a day is shown in Figure 4.

	A	B	I	J	K	L	M	N	O	
1	Cell Site ID - PR45 SECTOR A									
2	Date	Rx Ant ID#	824,010	824,500	825,120	825,600	826,140	826,680	827,000	
3	2/15/98 4:00	Rx1	1.11	1.13	1.24	1.22	1.25	1.24	1	
4	2/15/98 4:00	Rx2	1.23	1.23	1.17	1.21	1.09	1.19	1	
5	2/15/98 4:00	Rx3	1.22	1.22	1.22	1.22	1.22	1.22	1	
6	2/15/98 4:00	Rx4	1.14	1.14	1.14	1.14	1.14	1.14	1	
7	2/15/98 5:00	Rx1	1.11	1.13	1.24	1.22	1.25	1.24	1	
8	2/15/98 5:00	Rx2	1.23	1.23	1.17	1.21	1.09	1.19	1	
9	2/15/98 5:00	Rx3	1.22	1.22	1.22	1.22	1.22	1.22	1	
10	2/15/98 5:00	Rx4	1.14	1.14	1.14	1.14	1.14	1.14	1	
11	2/15/98 4:00	Rx1	1.11	1.13	1.24	1.22	1.25	1.23	1	
12	2/15/98 4:00	Rx2	1.24	1.23	1.17	1.21	1.09	1.19	1	
13	2/15/98 4:00	Rx3	1.22	1.22	1.22	1.22	1.22	1.22	1	
14	2/15/98 4:00	Rx4	1.14	1.14	1.14	1.14	1.14	1.14	1	
15	2/15/98 5:00	Rx1	1.11	1.13	1.24	1.22	1.25	1.24	1	
16	2/15/98 5:00	Rx2	1.24	1.23	1.17	1.21	1.09	1.19	1	
17	2/15/98 5:00	Rx3	1.22	1.22	1.22	1.22	1.22	1.22	1	
18	2/15/98 5:00	Rx4	1.14	1.14	1.14	1.14	1.14	1.14	1	
19	2/17/98 4:00	Rx1	1.11	1.13	1.25	1.22	1.25	1.23	1	
20	2/17/98 4:00	Rx2	1.24	1.23	1.17	1.21	1.09	1.19	1	
21	2/17/98 4:00	Rx3	1.22	1.22	1.22	1.22	1.22	1.22	1	
22	2/17/98 4:00	Rx4	1.14	1.14	1.14	1.14	1.14	1.14	1	
23	2/17/98 5:00	Rx1	1.11	1.13	1.25	1.22	1.25	1.23	1	
24	2/17/98 5:00	Rx2	1.24	1.22	1.17	1.21	1.09	1.19	1	
25	2/17/98 5:00	Rx3	1.22	1.22	1.22	1.22	1.22	1.22	1	

Figure 4 - Excel™ Spread Sheet

This data is plotted for one antenna in Figure 5 and a histogram of the recorded data is provided for that antenna.

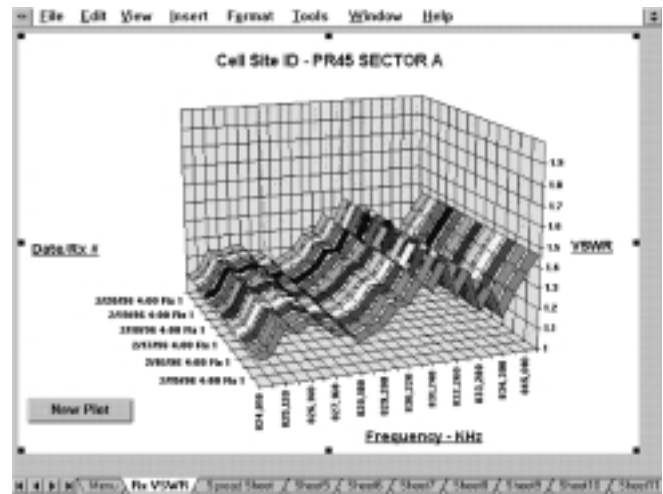


Figure 5 - Histogram of Antenna Performance

STANDARD CONFIGURATIONS AND EXPANDED CAPABILITY

The standard Series 72000 configuration monitors up to six Tx antennas and six Rx antennas. Transmit sensors are available with maximum power handling capability of 50, 200, and 600 Watts. Standard units are offered for all the common cellular, ESMR, SMR, Paging and PCS bands. The 72000 Series products are compatible with AMPS, NAMPS, TDMA, CDMA, GSM, EGSM and most other standard protocols. Standard Models are tabulated on the following chart. Custom configurations with different combinations of receive and transmit monitors are available. All models can be purchased with the -01 Option.

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SPECIFICATIONS

FEATURES	Model 72666	Model 72266	Model 72566	Model 72566G												
	AMPS*TDMA CDMA	AMPS*TDMA CDMA	AMPS*TDMA CDMA	GSM												
TRANSMIT SENSOR																
Frequency Range ¹	800-900 MHz	800-900 MHz	800-900 MHz	935-960 MHz												
Input Power Level	600 Watts Average 7kW Peak	200 Watts Average 2.3kW Peak	50 Watts Average .6kW Peak	50 Watts Average .6kW Peak												
Dynamic Power Range																
Forward Power	60mW to 600W	20mW to 200W	40mW to 50W	40mW to 50W												
Reflected Power	150mW to 150W	50mW to 50W	12.5mW to 12.5W	12.5mW to 12.5W												
Accuracy																
Forward Power	±.3dB@23°C															
Reflected Power	±.5dB 0 to 50°C															
Main Line VSWR	1.05 to 1															
Alarm Threshold Range	1.2 to 3.0:1 VSWR															
RECEIVER ANTENNA SENSOR																
Frequency Range	824 to 849 MHz			890 to 915 MHz												
Insertion Loss	0.2dB Max 0.15dB Typical															
Main Line VSWR	1.10 to 1															
Test Signal Power Level	-20 dBm Maximum															
VSWR Measurement Range	1.07 to 10:1															
VSWR Accuracy	<table border="0"> <tr> <td>Actual VSWR</td> <td>Uncertainty Limits*</td> </tr> <tr> <td>1.20:1</td> <td>+0.10, -0.08</td> </tr> <tr> <td>1.50:1</td> <td>+0.15, -0.10</td> </tr> <tr> <td>2.00:1</td> <td>+0.30, -0.20</td> </tr> <tr> <td>2.50:1</td> <td>+0.40, -0.50</td> </tr> <tr> <td>3.00:1</td> <td>+0.50, -0.50</td> </tr> </table>				Actual VSWR	Uncertainty Limits*	1.20:1	+0.10, -0.08	1.50:1	+0.15, -0.10	2.00:1	+0.30, -0.20	2.50:1	+0.40, -0.50	3.00:1	+0.50, -0.50
Actual VSWR	Uncertainty Limits*															
1.20:1	+0.10, -0.08															
1.50:1	+0.15, -0.10															
2.00:1	+0.30, -0.20															
2.50:1	+0.40, -0.50															
3.00:1	+0.50, -0.50															
	*Assuming well-matched receiver input															
Computer Interface	RS232															
Rate	500 to 9600 baud, -01 Option 9600 baud															
Error Detection	Check Sum															
Alarms	Tx and Rx LED and Form C Relays															
Input Power	+20 to +28 VDC @ 1.5 Amps Typical															
Environment																
Temperature	0 to 50° Operating															
Humidity	0 to 95% RH															
Mechanical	See Outline															

¹ Unit is calibrated for a specified 25 MHz band within this frequency range

