

**Return Loss (dB)** is a comparison of the reflected signal to the forward signal in decibels. If the antenna system is perfectly matched, the Return Loss would be negative infinity dB.

Cellular systems and antenna manufacturers often use VSWR for specifications. Match Efficiency is popular for testing because it is easy to determine a good match versus a bad match. For example a system with a VSWR of 1.50 would show -13.98 dB Return Loss and 96% Match Efficiency.

**Auto Scale vs. Manual Scale**

In swept mode Auto Scaling sets the measurement unit scale so the trace is maximized in the graph. This makes it easier to read.

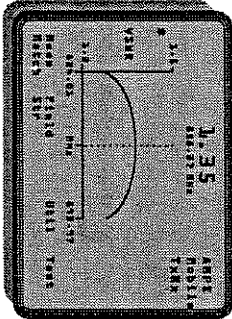


Figure 3 Auto Scaling Swept Frequency Mode

However, if you plan to look at the size or shape of traces for quick comparisons, it might be more meaningful to set a standard scale. Be aware that it is possible to set the scale manually so the information is not on the display at all.

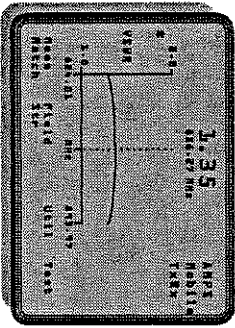


Figure 4 Manual Scaling Swept Frequency Mode

In the single sweep mode Auto Scaling sets the measurement unit scale so the pointer is mid range of the previous reading. The maximum and minimum scale values are approximately 10% higher or lower than the measured value.

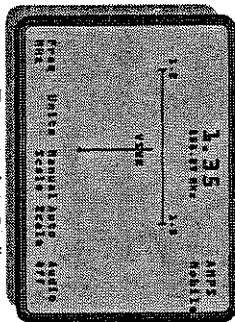


Figure 5 Auto Scaling Single Frequency Mode

This setting is an operator preference based on the mode that best presents the desired information.

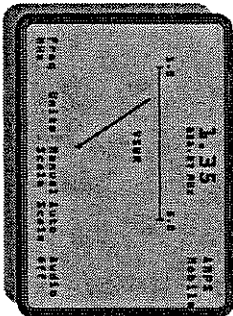


Figure 6 Manual Scaling Single Frequency Mode

**Sweep Type- Single Hold vs. Continuous**

Continuous sweep continually sweeps the selected frequency band updating the measured value with each sweep. An asterisk (\*) is blinking on the left side of the display to indicate sweep rate. The single hold mode will freeze a trace on the display and hold is displayed on the right. Holding a trace is also helpful before saving the trace, (more about saving traces under that heading later in this section).



## Understanding Various Operating Modes

The Antenna Tester is connected and the cellular system is selected (see basic operation). User selections are customized, the power is on, and the top level menu is displayed (also in basic operation). Now what?

Before we explain how to measure the antenna match, a brief discussion of your options is in order.

Since the AT-800 will change the way you test antennas we suggest taking some time to explore the different operating modes and find what is best for your application.

### Swept Frequency vs. Single Frequency

Swept frequency graphically displays the unit of measure over a band of frequencies. The cursor, a vertical dotted line, can be moved with the arrow keys to pinpoint a particular frequency. The measured match value and the frequency at the cursor position are shown at the top of the display.

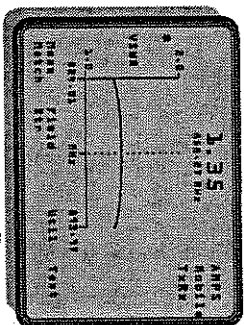


Figure 1 Swept Frequency

### Measure Match

### Swept Frequency

- Enter the frequency using the **numeric keypad** or change the frequency using the **UP/DOWN** arrow keys.
  - Press the **ENTER** key. The cursor will blink on the stop frequency.
  - Enter the frequency using the **numeric keypad** or change the frequency using the **UP/DOWN** arrow keys.
  - Press the **ENTER** key. The tester will begin sweeping.
  - **CENTER MHz** - The cursor will blink on the Center frequency and Center MHz will be highlighted.
  - Enter the frequency using the **numeric keypad** or change the frequency using the **UP/DOWN** arrow keys.
  - Press the **ENTER** key. The tester will begin sweeping.
  - Press the **ENTER** key. The tester will begin sweeping.
  - Press the **SPAN** key. Enter the frequency using the **numeric keypad** or change the frequency using the **UP/DOWN** arrow keys.
  - Press the **ENTER** key. The tester will begin sweeping.
- Select Measurement Units**
- Antenna match information can be presented using four different measurement units. Depending on your application, follow the steps below to select Rho, VSWR, %Match or Return Loss.
- Press the **MENU** key.
  - Press the **MEAS MATCH** key.
  - Press the **SWEPT FREQ** key.
  - Press the **MEAS UNITS** key.
  - Press the **UNITS** key.

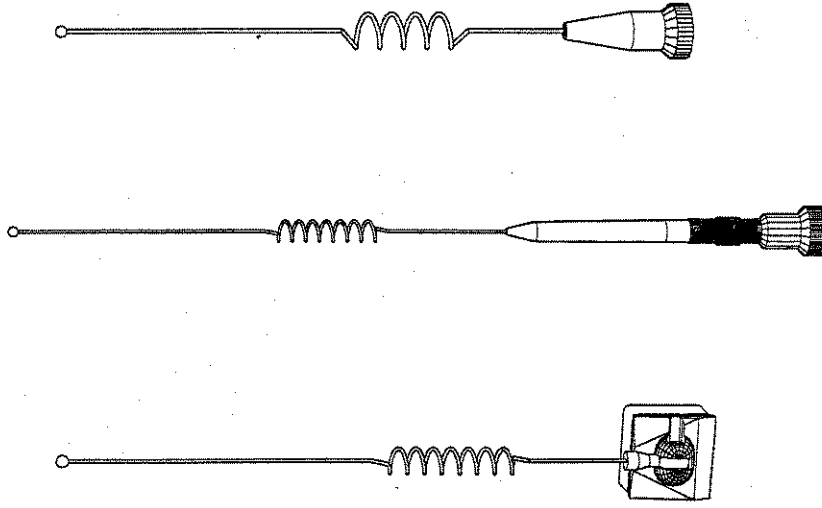
- Press either the **RHO**, **VSWR**, **%MATCH** or **RETURN LOSS** key. The selected unit will be shown on the left side of the display.
- Press **RETURN** to go back one menu level or **MENU** to return to the top menu level.

#### Select Auto or Manual Scale

Selecting the scale simply sets up how the information will look on the display.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **MEAS UNITS** key.
- Depending on desired mode press either **AUTO** or **MANUAL SCALE**:
  - **AUTO SCALE** - the units scale changes and the Antenna Tester begins sweeping.
  - **MANUAL SCALE** - the cursor will blink on the minimum scale value and Manual Scale will be highlighted.
    - Enter the desired value using the **numeric keypad** or change the value using the **UP/DOWN** arrow keys.
    - Press the **ENTER** key. The cursor will blink on the maximum scale value.
    - Enter the desired value using the **numeric keypad** or change the value using the **UP/DOWN** arrow keys.
    - Press the **ENTER** key. The tester will begin sweeping.

# Measure Match



**NOTE:** If an out of range value is entered, the minimum (if under-range) or maximum (if over-range) value will be substituted. If a maximum value that is lower than the minimum value is entered, the cursor will blink again on the minimum value waiting for a correct entry. The actual range depends on the units selected.

**HINT:** Using the arrow keys will keep you in the acceptable range. If you are not sure if the larger value should be at the top or bottom of the scale, press the auto scale key to see where the software puts it.

#### Selecting the Sweep Type

Sweep types are continuous or single hold. Continuous will sweep and update the trace automatically. Single hold will sweep once and the trace will remain in the display. Each time single hold is pressed, the trace is updated.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **SWEEP TYPE** key.
- Depending on desired mode press either **SINGLE HOLD** or **CONT** key. **HOLD** will be displayed if single hold is selected. The tester begins sweeping if continuous is selected.

#### Saving a Trace

The AT-800 can store up to 12 traces. A saved trace can be used to evaluate long term antenna performance, compare performance under different conditions or for comparison to another antenna. A saved trace is also a powerful tool in limit testing (more about limit testing later in this section). The information can later be uploaded to a PC using optional interface software and the serial port. Traces are stored in nonvolatile memory so they are not lost when the Antenna Tester is turned off.

Since the reflection coefficient is the information actually saved when saving a trace, and everything else is calculated from that, you have some flexibility

when using the trace for comparison. For example, if you save a trace displayed in VSWR, you can compare it to a trace displayed in %Match. You can also change the frequency band of the new trace to effectively zoom in on a particular section of the saved trace. This may be helpful in pinpointing a problem area in a failed limit test.

The desired units, band, and scale should be selected. You should be in the single hold mode and the trace you want stored should be displayed. If continuous sweep type is selected, the trace displayed when you save will be stored.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **TRACE** key.
- Press the **SAVE TRACE** key.
- Press a **REG-n** key that has "empty" displayed. If you select a "full" register the new trace will overwrite the old trace. If registers 1-4 are full press the **MORE SAVE** key to access 5-8 and again to access 9-12. If needed, use the **ESC** key to back up.

*HINT: It is a good idea to keep a record of which traces are in which register as they are identified by register number only.*

#### Recalling a Trace

Follow the steps below to recall a saved trace.

#### Basic Operation

#### Connecting the Antenna Tester

- **AC Mains Adapter**—Insert the barrel connector from the AC mains adaptor into the external DC connector. Insert the adaptor plug into the wall receptacle.
- **Optional Automobile Cigarette Lighter Adaptor**—Insert the barrel connector from the optional automobile cigarette lighter adaptor into the external DC connector. Insert the lighter plug into the automobile lighter jack.

#### Connecting the Antenna

Antenna leads and the Field Strength Antenna are connected to the test port. A known good RF cable can be used to connect the antenna tester directly to a coupler box, bypassing the antenna system lead. A female TNC connector is provided. Other connectors are available, see Parts List in the maintenance section for more information.



#### CAUTION

250mW max input

Exceeding the maximum input will cause damage to internal components. Do not connect transmitter output to the AT-800. Damage can also be caused by testing antennas near other transmitting antennas. If testing base station antennas, first measure the power at the coax end to be sure it does not exceed 250mW.

Special consideration must be given to the RF energy present at the feed line of site antennas. With an active site, RF energy from transmit antennas can be coupled to the antenna under test. If large enough, these signals will cause inaccurate measurements. For best results, the antenna tester should be used with all transmit antennas powered down.

- Press the **MENU** key.
- Press the **UTIL** key.
- Press the **PRESET** key.

**Set Serial Baud Rate**

Measurement data can be transferred between the AT-800 and a personal computer using the serial port and optional interface software. The data can then be used for analysis, printed, or stored.

The data transfer rate (baud rate) between the Antenna Tester and computer must be identical and set to 9600. To change the baud rate for the serial port on the Antenna Tester, follow the steps below. Complete interface software instructions are included with the software.

- Press the **MENU** key.
- Press the **UTIL** key.
- Press the **SERIAL** key.
- Repeatedly press the **SERIAL** key until the 9600 is displayed.

**Connecting the Antenna Tester**

The following paragraphs will explain how to connect the Antenna Tester for various operations. Refer to the component description diagram on page 4 of the introduction section if needed.

**Connecting External DC**

**CAUTION**

Required input is 11 to 16 VDC 250mA  
Connector is wired outside positive, inside negative.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **TRACE** key.
- Press the **RECALL TRACE** key.

- Press the **REG-n** key for the desired trace, press the **MORE RECALL** key to access 5-8 and again to access 9-12. If needed, use the **ESC** key to back up. The saved trace will be displayed and the corresponding register number will be shown at the bottom of the display.

**NOTE:** The arrow keys can be used to move the cursor, and the corresponding measurement and frequency at the cursor will be displayed. Remember the up arrow key will move the cursor to the highest value on the trace and the down arrow key will move it to the lowest.

- Press the **RETURN** key to return to register selection.
- Press the **ESC** key to return to trace menu.

**Clearing a Trace**

When a trace is no longer needed or you need to clear registers for space, follow the steps below.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **TRACE** key.
- Press the **CLEAR TRACE** key.
- Press the **REG-n** key for the desired trace, press the **MORE CLEAR** key to access 5-8 and again to access 9-12. If

needed, use the **ESC** key to back up. The word *full* will be replaced by *empty* at the selected register.

- Press the **ESC** key to return to the trace menu.

## Limit Testing

Limit testing is a quick pass-fail test using operator defined limits or a stored trace as a minimum for acceptability. Pass or fail will be displayed at the top of the display and an audible tone can be enabled to indicate a fail situation.

Limit testing is probably the most labor-efficient mode for operating the AT-800. Since all the software settings are retained when the tester is turned off, once the limit test is set up it's simply a matter of connecting the next antenna system, turning on the power and reading pass or fail.

### Turn Audio On/Off

Audio tone for fail indication.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **LIMIT** key.
- Pressing the **AUDIO** key will toggle between on and off.

### Selecting Limit Values

Valid limit values depend on measurement units selected. Valid entries are:

VSWR - between 1.0 and 100.0  
 %Match- between 0 and 100%  
 Return Loss- between -32 and 0 dB  
 RHO- between 0.000 and 1.000

- Press the **MENU** key.
- Press the **MEAS MATCH** key.

## Basic Operation

## General Information

- Press the **MENU** key.
- Press the **UTIL** key.
- Press the **CELL SYS** key.
- Press the appropriate key for the cellular system in use.
- Press either **BASE** or **MOBILE** depending on the band to be tested.

### Setting the Auto Shut-Off Timer

In order to preserve battery life, the Antenna Tester will automatically shut off after 5, 15, 30 or 60 minutes without any keystrokes. Follow the steps below to select the length of time, before auto shut-off occurs.

- Press the **MENU** key.
- Press the **UTIL** key.
- Press the **TIMER** key until the desired interval is displayed.

### Return to Factory Presets

When the Antenna Tester is turned on, the various software parameters will be set to the condition they were at when the tester was turned off.

To return the parameters to the factory setting follow the steps below. The parameters will be set to the conditions listed below.

| Software Parameter  | Factory Setting       |
|---------------------|-----------------------|
| Cellular System     | AMPS, Mobile          |
| Frequency Band      | User; 806MHz - 960MHz |
| Measurement Units   | VSWR                  |
| Scale               | min., 1.0; max., 5.0  |
| Mode                | Swept Frequency       |
| Sweep Type          | Continuous            |
| Baud Rate           | 9600                  |
| Auto Shut-off Timer | 5                     |
| Audio               | Off                   |





### Select Key

The operator instructions written for this manual were based on stepping through the software menu using the keys below the display. Once you are comfortable operating the AT-800, you might find it faster to use the select key to access some functions. These include: Units, Scale, Start and Stop Frequencies in swept frequency mode and Units, Scale, Frequency and Channel in single frequency mode.

Press the select key until the cursor is blinking at the desired function. The first function enabled depends on the last function selected through the menu.

### Utility Messages

There are five utility messages that can be displayed to inform you of equipment, or procedural, conditions.

"Lo Batt" is displayed when battery voltage is less than 6.6V, refer to maintenance section for charging batteries.

"Busy" is displayed during mode changes indicating the measurement information is being updated.

"Hold" is displayed when in the Swept Frequency mode, and Single Hold is the selected sweep type.

"Pass" or "Fail" will be displayed indicating the appropriate results of a limit test.

"Noise" will be displayed if there is excessive background noise measured. The measurement may not be accurate. See "Troubleshooting" if this condition is persistent.

### Out of Range Values

When entering numeric data, it is possible to enter a value out of range. Depending on the function, the Antenna Tester will either enter the minimum or maximum value, or the cursor will continue to blink on the function out of range waiting for the correct entry.

### Selecting the Cellular System

Select the appropriate cellular system.

### Measure Match

- Press the **SWEPT FREQ** key.
- Press the **LIMIT** key.
- Press the **VALUE** key. The cursor will blink next to it.
- Enter the desired value using the numeric keypad or change the value using the UP/DOWN arrow keys.
- Press the **ENTER** key. Pass or Fail will be displayed, a tone will be heard for fail if audio is enabled.

### Limit Testing

#### Using a Trace as the Limit

The trace you want to use for the limit must be saved. You can have the current antenna test running or start it after you set up the limit test.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **LIMIT** key.
- Press the **TRACE ->** **LIMIT** key.
- Press the **REG-n** key where the trace is stored. A dotted outline of the limit trace will be displayed over it. Pass or Fail will be displayed.

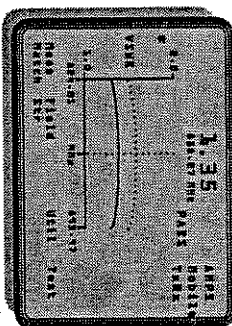


Figure 8 Dotted Outline of Limit Trace

**NOTE:** You can still move the cursor, change measurement units, frequency band and scale. The dotted outline of the limit trace will be automatically adjusted to provide a direct comparison with the antenna system under test.

**Clearing a Limit**

Follow the steps below to clear either an operator defined limit value or a trace limit. The trace will still be stored in memory, the limit value will be erased.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SWEPT FREQ** key.
- Press the **LIMIT** key.
- Press the **CLEAR LIMIT** key. The value field will change to off if an operator value was being used, the dotted outline of the limit trace will be removed if a trace was being used.

**Single Frequency**

This mode is useful for tuning antennas, particularly with the audio on. The frequency can be selected following user-defined instructions or automatically, by selecting the channel.

The correct cellular system and base or mobile should be selected and shown in the top right corner of the display, if not, follow steps in Basic Operation for Selecting Cellular System.

**Selecting the Frequency - User Defined**

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SINGLE FREQ** key.
- Press the **FREQ MHZ** key. The cursor will be blinking at the frequency and Freq MHz will be highlighted.
- Enter the desired frequency using the numeric keypad or change the value using the **UP/DOWN** arrow keys.
- Press the **ENTER** key. The measured value and the frequency will be shown at the top of the display.

**Basic Operation****General Information**

- To increase or decrease display contrast, press and hold the **BACKLIGHT** key while pressing either the **UP** or **DOWN** arrow key.
- To turn the backlight off, press the **BACKLIGHT** key.

**Display Software Menu**

- Press the **MENU** key to display the software menu.

**General Information****Blinking Cursor (black square)**

The cursor will be blinking in the selected area, indicating that the parameter for that area can be changed.

**Enter Key**

All data entry, and mode changes accessed using select key, require the enter key to be pressed before they are initiated.

**Up/Down Arrow Keys**

When a function is enabled for change, the up/down arrow keys can be used to either scroll through your choices or increase/decrease the numerical value. The actual increments depend on the function.

**Left Arrow Key**

The left arrow key can be used to backspace erasing one character at a time during data entry.

**Escape (ESC)**

Returns to previous menu without initiating a change.

## Getting Started

This section describes initial quick steps to get started. For detailed information regarding connecting the Antenna Tester refer to that section at the end of this chapter.



### Power On/Off

- To turn the Antenna Tester on, momentarily press the **ON** key. The results of a self test will be displayed if a failure is present. For more information about the self test or a failure, refer to the maintenance section.
- To turn the Antenna Tester off, press and hold the **ON** key for 1 second.

### AC Mains Adapter

Operating the Antenna Tester using the AC Mains Adapter charges the batteries. Charging time is typically 8 hours. Charge life is minimum 2 hours of continuous operation with the Backlight on. "Lo Batt" is displayed when the batteries require charging. Use supplied adapter only and do not use adapter with the batteries removed.

**NOTE: For optimum battery life, charge the batteries only after the low battery indication is displayed.**

### Automobile Cigarette Lighter Adapter

The Antenna Tester can be operated using the 12V automobile battery via the optional cigarette lighter adapter. This method also charges the batteries, however charge time will depend on actual battery voltage



### Backlight

- To turn the backlight on, press the **BACKLIGHT** key.

## Selecting the Frequency - Automatically

- Repeatedly press the **SELECT** key until the cursor is blinking on CH (channel).
- Use the numeric keypad or **UP/DOWN** arrow keys to change the value.
- Press the **ENTER** key. The frequency will change to correspond to the selected channel.

## Select Measurement Units

Antenna match information can be presented using three different measurement units. Depending on your application, follow the steps below to select Rho, VSWR, %Match or Return Loss.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SINGLE FREQ** key.
- Press the **UNITS** key.
- Press either the **RHO**, **VSWR**, **%MATCH** or **RETURN LOSS** key. The selected unit will be shown in the center of the display.
- Press the **RETURN** key to go back one menu level.

## Select Auto or Manual Scale

Selecting the scale simply sets up how the information will look on the display.

- Press the **MENU** key.
- Press the **MEAS MATCH** key from the top level menu.
- Press the **SINGLE FREQ** key.
- Depending on desired method press either **AUTO** or **MANUAL SCALE**.
- **AUTO SCALE** - the units scale changes.

- **MANUAL SCALE** - the cursor will blink on the maximum scale value and Manual Scale will be highlighted.
  - Enter the desired value using the **numeric keypad** or change the value using the **UP/DOWN** arrow keys.
  - Press the **ENTER** key. The cursor will blink on the minimum scale value.
  - Enter the desired value using the **numeric keypad** or change the value using the **UP/DOWN** arrow keys.
  - Press the **ENTER** key.

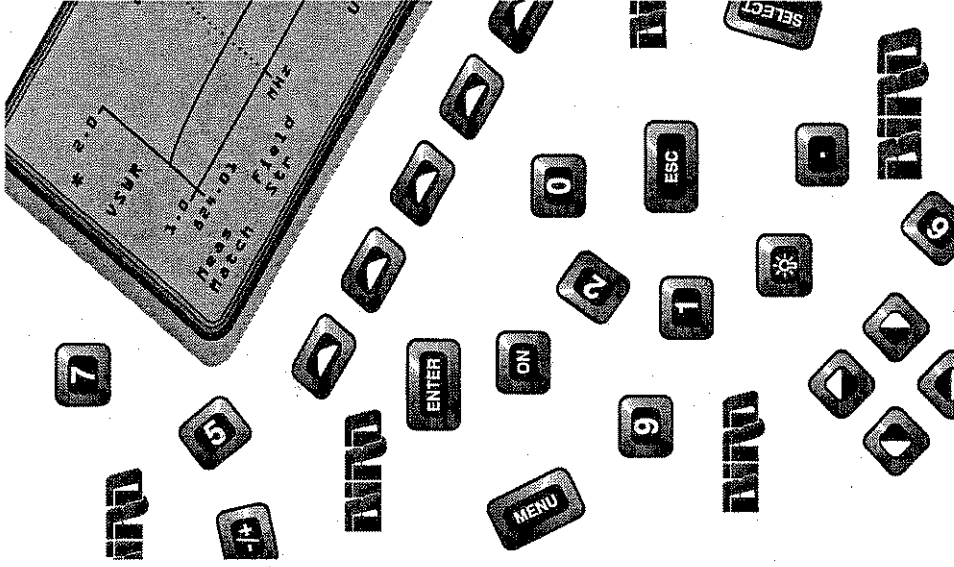
**NOTE:** If an out of range value is entered, the minimum (if under-range) or maximum (if over-range) value will be substituted. If a maximum value that is lower than the minimum value is entered the cursor will blink again on the minimum value, waiting for a correct entry. The actual range depends on the units selected.

**HINT:** Using the arrow keys will keep you in the acceptable range. If you are not sure if the larger value should be at the right or left side of the scale, press the auto scale key to see where the software puts it.

#### Turn Audio On/Off

The pitch varies with the match condition allowing you to tune an antenna without having to look at the display.

- Press the **MENU** key.
- Press the **MEAS MATCH** key.
- Press the **SINGLE FREQ** key.
- Pressing the **AUDIO** key toggles between on and off.



# BASIC OPERATION

## Features

**Swept Frequency Mode**—Fast scan shows VSWR, RHO, match efficiency or return loss across an entire band. A movable cursor can be used to pinpoint a scan frequency and the corresponding measurement value is displayed.

**Single Frequency Mode**—Provides measurement information in units of Reflection Coefficient (RHO), Voltage Standing Wave Ratio (VSWR), % Match, or Return Loss (dB) at one frequency on a simulated meter movement. An audio generator can be enabled to produce a tone that is proportional to the match condition.

**Auto Scalling**—Used in either swept or single frequency modes, sets the Y axis for best measurement display.

**Relative Field Strength**—Verifies output of portable cellular phones having fixed antennas.

**Cellular System Presets**—Pre-programmed band segments for AMPS, GSM, PDC, CT-2, and CT-2 Korea cellular testing.

**Limit Testing**—Quick pass-fail indication; compares measurements to user selected limits.

**Data Storage**—Saves and recalls up to 12 traces to be used to set limit or long term monitoring of antenna performance.

**Serial Communication Link**—Built in serial port and optional software uploads data to a personal computer for analysis or storage.

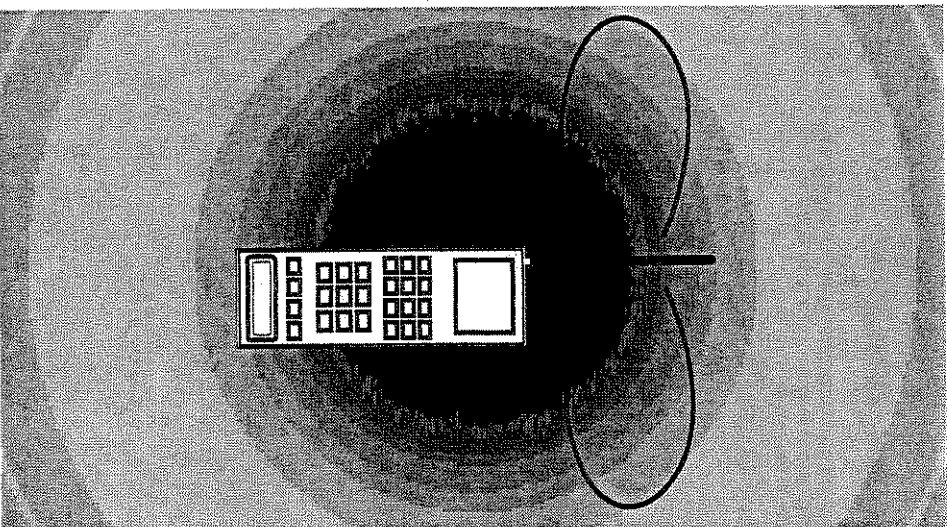
## Optional Equipment Available

**Automobile Cigarette Lighter Adapter**—(P/N 5A2238-1) Connects tester to standard 12V automobile cigarette lighter jack.

**Carrying Case**—(P/N 7000A850) Convenient and protective, large enough to carry the tester, AC adapter, connectors, field strength antenna and instruction book.

**Verification Kit**—(P/N 7000A845) Used to verify tester performance. Includes standard mismatch and connector adapter.

**Interface Software**—(P/N 7000A840) PC compatible software used to upload trace data for analysis, printing or storage. System requirements: IBM PC/XT/AT or equivalent; DOS 3.0 or later; Windows 3.1, 2Mb free hard disk space; color or grey scale VGA or SVGA monitor. Includes interface cable.



# FIELD STRENGTH

**Field Strength Measurement**

With the field strength antenna installed, the Antenna Tester can be used to verify the output of portable cellular phones with fixed antennas. This is a relative measurement. The measurement sensitivity is such that a full scale deflection will occur at about three meters from a source that is radiating 12.6 watt effective radiate power (ERP). The gain factor can be adjusted to increase the measurement sensitivity.

**Turn Audio On/Off**

The pitch varies with the field strength.

- Press the **MENU** key.
- Press the **FIELD STR** key.
- Pressing the **AUDIO** key toggles between on and off.

**Enter Gain Factor / Select Auto Gain**

Increasing the gain factor increases the measurement sensitivity. Setting the gain to auto will set a gain factor so that the pointer is in the middle of the scale.

- Press the **MENU** key.
- Press the **FIELD STR** key.
- Press either:
  - **AUTO GAIN**- the pointer moves to the approximate middle of the scale.
  - **GAIN**- The cursor will blink on the gain value. Enter the desired value using the numeric keypad or change the value using the up/down arrow keys.
    - Press the **ENTER** key.

**Display Description**

- |                                    |  |
|------------------------------------|--|
| <b>1. Sweep Rate Indicator</b>     | Blinks when sweeping.  |
| <b>2. Measurement Units</b>        | Indicates selected measurement units.  |
| <b>3. Trace</b>                    | Graphic display of measured results across selected frequency band.                          |
| <b>4. Menu Select Key Labels</b>   | Defines function of menu select keys located below the display.                              |
| <b>5. Frequency Band Scale</b>     | Displays frequency band selected.  |
| <b>6. Cursor</b>                   | Used to select measurement position on the trace.  |
| <b>7. Utility Label</b>            | Area for displaying general data (Lo Batt, Busy, Hold, Noise, and test results).             |
| <b>8. Band</b>                     | Indicates selected band for cellular system defined, (Tx, Rx, TxRx, or User).                |
| <b>9. Base / Mobile Indicator</b>  | Indicates Base or Mobile selection.  |
| <b>10. Cellular System</b>         | Indicates cellular system selected (AMPS, GSM, PDC, CT-2, CT-2 Korea).                       |
| <b>11. Frequency</b>               | Selected Frequency (for swept mode this is frequency at the cursor position).                |
| <b>12. Measured Value</b>          | Numeric display of measured value (for swept mode this is the value at the cursor position). |
| <b>13. Measurement Units Scale</b> | Displays user defined measurement scale.   |
| <b>14. Pointer</b>                 | Moves across scale to show analog type indication of measured value.                         |
| <b>15. Channel</b>                 | Channel number corresponding to selected frequency.  |

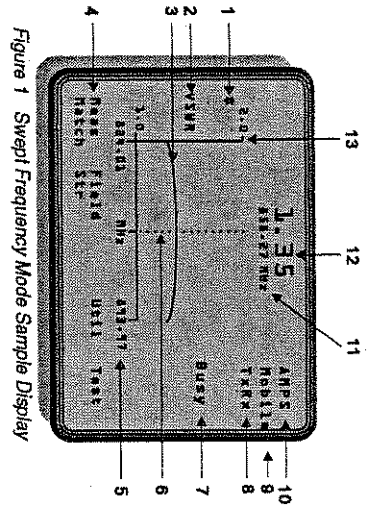


Figure 1 Swept Frequency Mode Sample Display

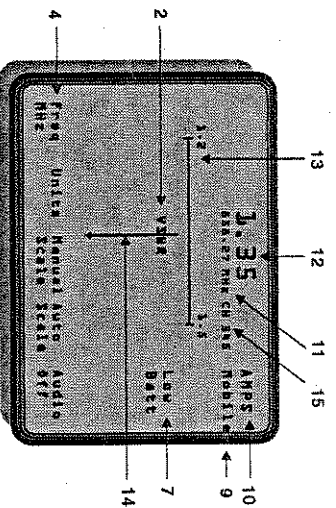
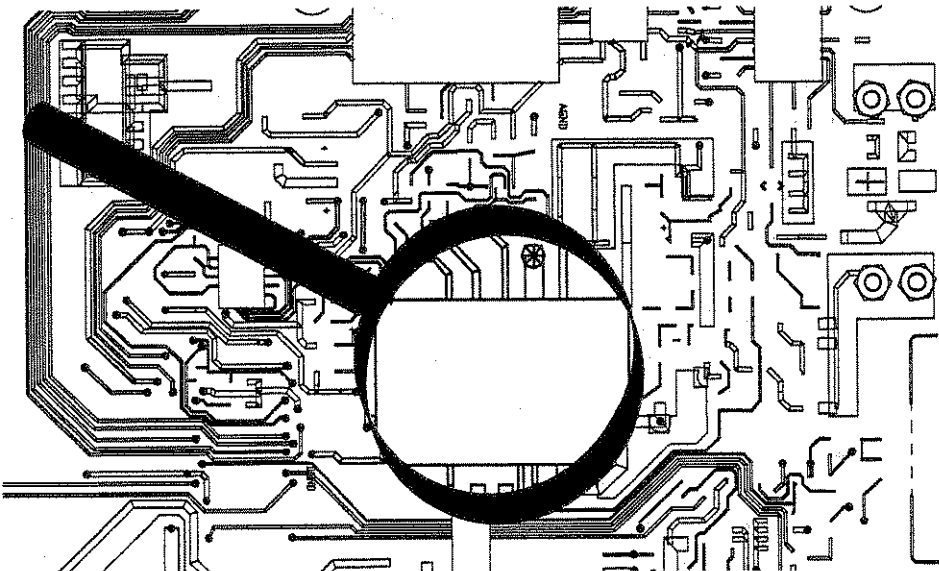


Figure 2 Single Frequency Mode Sample Display



# MAINTENANCE





**NOTE:** The AT-900 will shut off if the battery is too low and full accuracy is maintained at any battery voltage.

- Be sure the AC mains adapter is not connected.
- Press the **MENU** key.
- Press the **TEST** key.
- Press the **BATT TEST** key.
- Press the **RETURN** key to end the test.

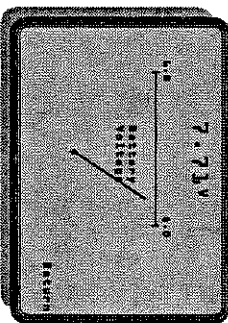


Figure 2 Battery Test

**Display Test**

The display test is used to be sure that each area of the display is functional. When the test is started the display is filled with various characters. Each pixel then changes state, either from black to white or white to black. If there is any area that is not functional return the tester to Bird Electronic for repair.

- Press the **MENU** key.
- Press the **TEST** key.
- Press the **DISP TEST** key. The test is started.
- Press the **ESC** key to stop the test.

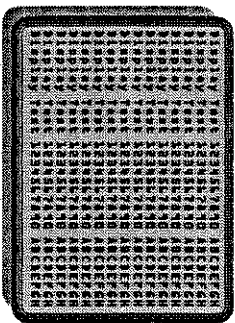
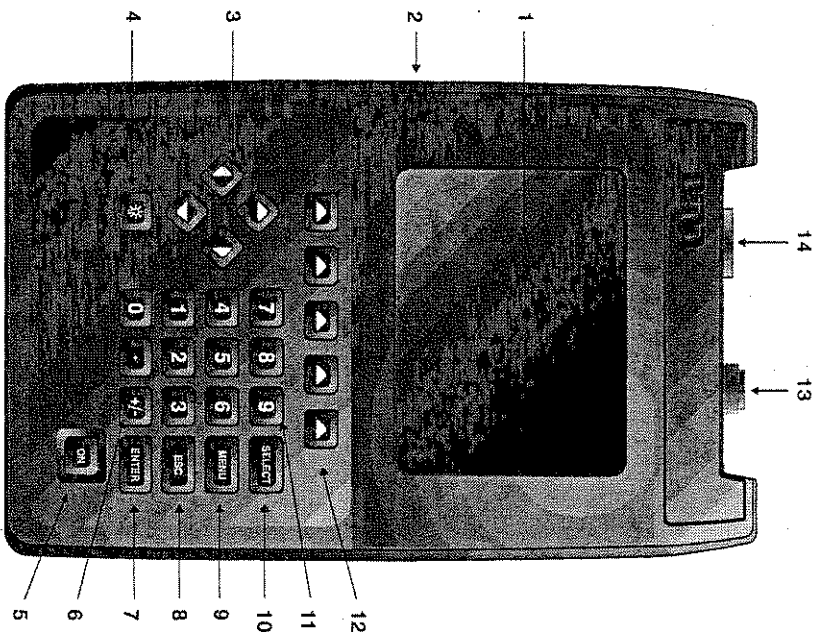


Figure 3 Display Test



**Self Test**

The self test is similar to the operational tests run at power up described on page 2 of this section. The one difference is the keypad test.

- Press the **MENU** key.
- Press the **TEST** key.
- Press the **SELF TEST** key.
- To test the keypad, Press each key (except esc and on). The value next to Keypad is hexadecimal and corresponds to the key pressed. If the value does not change for each key, refer to "Troubleshooting" in this section.
- Press the **ESC** key to stop the test.

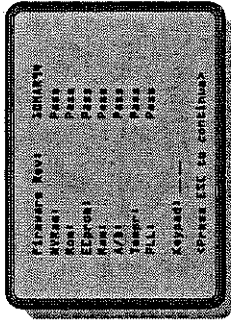
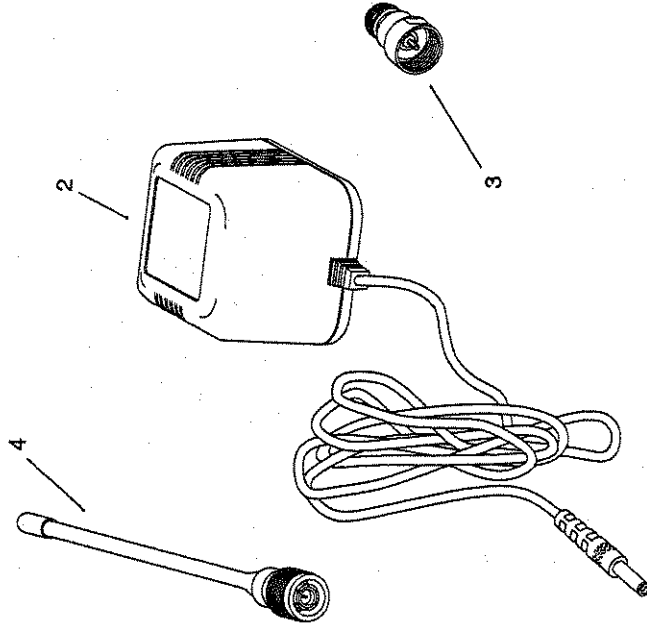


Figure 4 Self Test

**Cleaning**

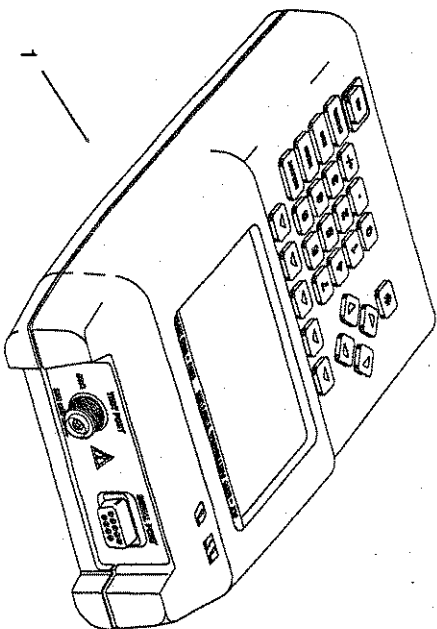
Clean the antenna tester and the display with a soft cloth dampened with mild detergent and water only.

**CAUTION**  
 Harsh or abrasive detergents and some solvents can damage the display unit and information on labels.



1. AT-800
2. AC Mains Adapter
3. Female TNC Connector
4. Field Strength Antenna
5. Instruction Book (Not Shown)

## Items Supplied



## Calibration

For maximum performance and accuracy, the Antenna Tester should be calibrated once every 12 months. Return the unit to Bird Electronic authorized service center listed below.

### Service Center

#### U.S.A. Sales and Manufacturing

Service Group  
Bird Electronic Corporation  
30303 Aurora Road  
Cleveland (Solon), Ohio 44139-2794  
Phone: (216)248-1200  
Fax: (216)248-5426  
Cable: BIRDELEC  
Telex: 706898 Bird Elec UD

### Sales Offices

#### European Sales Office

Bird Electronic Ltd.  
Unit 1 Shannon Business Centre  
Town Centre Shannon  
County Clare, Ireland  
Phone: 353 61 360583 or 353 61 360577  
Fax: 353 61 360585

#### Pan Asian Sales Office

Bird Electronic Ltd.  
3A Unit 6 Tyrwhitt Road  
Singapore 0820  
Phone: 65 299 2537  
Fax: 65 299 8509

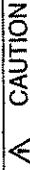
## Charging Batteries

Fully charged batteries will provide a minimum of 2 hours continuous operation with the backlight on. Charging time is typically 8 hours. The batteries are being charged when the Antenna Tester is connected to AC, with the AC mains adapter, or DC, with the automobile cigarette lighter adapter. The unit does not have to be on to charge the batteries.

**NOTE:** For optimum battery life, charge the batteries only after the low battery indication is displayed.

## Battery Replacement

The NiCad batteries need to be replaced when fully charged batteries provide less than 2 hours operation. Carefully follow the instructions below to replace the batteries.



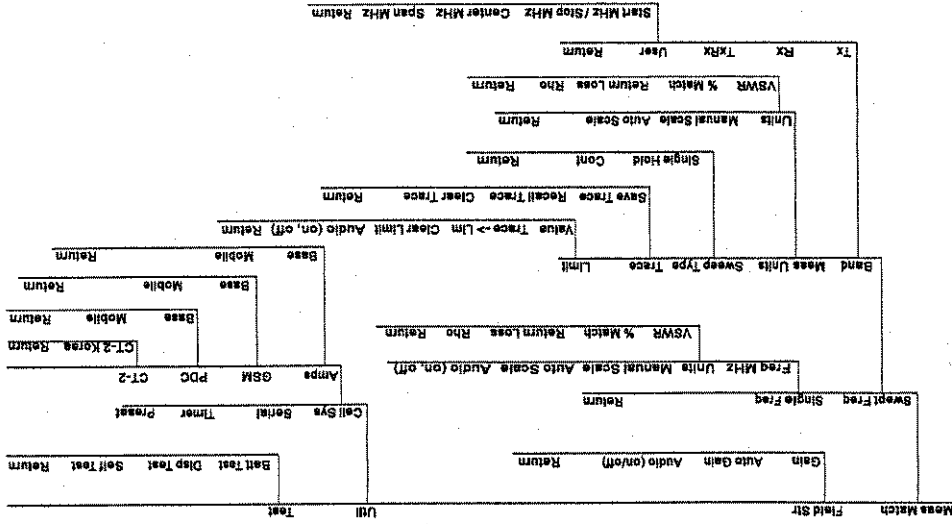
### CAUTION

Replace with only NiCad rechargeable AA batteries, IEC code KR-15/51. Nominal Voltage 1.2V; Capacity 650mAh. Do not install alkaline batteries.

**NOTE:** To retain trace data stored in nonvolatile RAM, leave the AC mains adapter connected during battery replacement.

- Lay the Antenna Tester, display side down, on a clean surface.
- Using a small standard screwdriver, remove six screws from the back cover.
- Lift the back cover approximately two inches above the front cover.

## Menu Structure

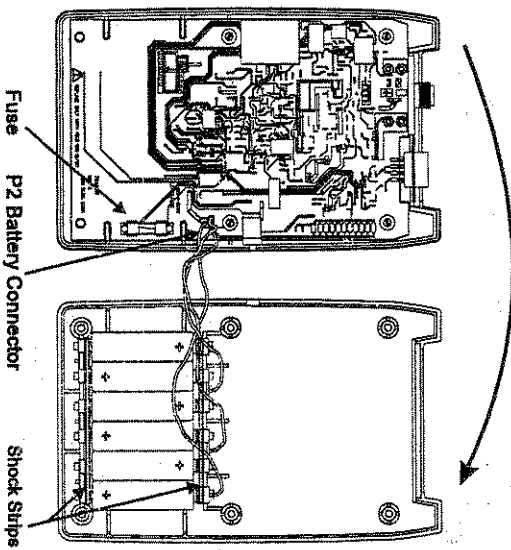


# INTRODUCTION

*Maintenance*

*Battery Replacement*

- Flip the back cover in the direction of the arrow shown below. To avoid disconnecting P2, (battery connector), lay the back cover next to the front.
- Remove the old batteries.



*Figure 5 Battery/ Fuse Replacement*

- Install the new batteries checking the orientation of the positive and negative terminals. Polarity is indicated on the case, and in figure 5.
- Be sure P2 is connected and the shock strips are still in place.
- Place the back cover over the front cover making sure it is properly seated.
- Replace the six screws.
- Run the battery test on page 2 of this section.

## Fuse Replacement

**CAUTION**

Replace with only the same type and rating fuse.  
315mA 250V

- Follow the steps outlined in "Battery Replacement" replacing the fuse where replacing the batteries is indicated.

## Troubleshooting

Operator maintenance or service is limited to battery and fuse replacement. Any other required service must be performed at the factory.

Refer to the following paragraphs for help in isolating error conditions.

### The Antenna Tester will not power up.

Power for the Antenna Tester can be provided in three ways—the internal batteries, an AC mains adapter or an optional automobile cigarette lighter adapter. Try to power the tester using each available means. The internal batteries may need charged, or if recently replaced, are installed incorrectly. The AC mains adapter may not be securely connected, may be damaged, or there is no power supplied at the wall receptacle. The internal fuse may have opened and requires replacement. If the unit was recently opened, recheck P2, the battery connector, be sure it is securely connected. Follow the instructions for battery and fuse replacement when opening the unit.

### NVRAM Test Fails

An NVRAM error indicates the information in nonvolatile RAM, a type of memory, is not valid. The probable cause is power was lost. When the unit is off, the batteries, if charged and present, or power from the AC mains adapter, if connected, supply power to retain stored trace data and software settings. This information is lost if all power is removed. Clear the error by pressing the ESC key.

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**Maintenance**

**Troubleshooting**

Be sure to read battery charging and replacement sections if the problem persists.

**ROM, EEPROM, RAM, A/D, TEMPR, PLL Test Fails**

Ensure the results are valid by repeating the self test or turning the unit off then back on. If the problem persists return the unit for service.

**Stuck Keys Test Fails**

If any characters other than 0 are displayed next to "stuck keys" during power up test, perform the keypad test on page 4 of this section. Remember, if a key is depressed during power up to display the power up test results it is normal for other characters to be displayed. If the key remains stuck return the unit for service.

**"Noise" Is Displayed During Testing**

The Antenna Tester measures background noise to determine if nearby signals could cause an erroneous match measurement. Power down all nearby transmitting antennas. All interfering signals must be removed before resuming measurement.

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## Parts List

| Part Name  | Part Number |
|--|-------------|
| AT-800 Complete  | 7000A801    |
| <b>Parts Supplied with AT-800 Complete, or Installed when shipped.</b> |             |
| Battery (6 required)   | 5A2230      |
| Fuse   | 5-1976-11   |
| AC Mains Adapter, 115v   | 5A2229      |
| AC Mains Adapter, 230v   | 5A2236      |
| Female TNC Connector   | 4240-407    |
| Field Strength Antenna   | 5A2228-1    |
| Instruction Book   | 920-AT800-1 |
| Erasm Shock Strips (2)   | 5A2243      |

### Optional Adapters:

|       |          |
|-------|----------|
| BNC/m | 4240-402 |
| N/T   | 4240-403 |
| BNC/m | 4240-404 |
| BNC/f | 4240-405 |
| TNC/m | 4241-406 |
| UHF/m | 4243-408 |
| UHF/f | 4240-409 |
| SMA/m | 4240-410 |
| SMA/f | 4240-411 |

### Optional Parts or Accessories

|                                      |               |
|--------------------------------------|---------------|
| Automobile Cigarette Lighter Adapter | 5A2238-1      |
| Interface Software                   | 7000A840      |
| Includes Cable                       | 5A2264-9MF-10 |
| Verification Kit                     | 7000A845      |
| Carrying Case                        | 7000A850      |



## About this Manual (cont.)

### Typography

There are two types of keys on the Antenna Tester. A **Hard Key** is a key that has a particular function and it is indicated on the key. These key names are set in a bold typeface, e.g. Press the **MENU** key.

A **Menu Select Key**, (there are five under the display), will have a different label, or name, depending on the selected function. The name will be at the bottom of the display located directly above the corresponding key. These key names are set in a bold italic typeface, e.g. Press the **MEAS MATCH** key.

### Chapter Layout

**Introduction**—Will help you become familiar with the parts of the Antenna Tester, Features Available, and Optional Equipment.

**Basic Operation**—Everyone should read this section! Getting Started will provide the information required to get the Antenna Tester powered up. General Information provides helpful information about how to operate the Antenna Tester, and some time saving hints for alternate operating methods.

**Measure Match**—Since the AT-800 Antenna Tester offers a unique method of measuring Antenna Systems we have included the section, "Understanding Various Operating Modes". Even if you already know the basics of antenna match testing you might find this section useful. The remainder of the chapter provides step by step instructions for measuring match.

**Field Strength**—Provides step by step instructions for measuring relative field strength of fixed cellular antennas.

**Maintenance**—This chapter contains the information required to keep the AT-800 working for you. There are instructions for several operational tests on the Antenna Tester, battery and fuse information, calibration requirements, parts information and troubleshooting information.

A decorative graphic featuring various mathematical symbols and technical icons. At the top right is a stylized antenna icon. Below it are the Greek letter  $\lambda$ , the Greek letter  $\psi$ , and the Greek letter  $\gamma$ . In the center is a large integral symbol  $\int_0^1 x dx$ . To the right of the integral is a summation symbol  $\sum_0^{\infty} i$ . Below the summation is a square root symbol  $\sqrt{\frac{R + j\omega L}{G + j\omega C}}$  with a circled (Q) below it. At the bottom left is a plus sign  $+$  and a circular antenna icon. At the bottom right is a vertical line with three horizontal bars, and the equation  $V \cdot D = p$ .

# SPECIFICATIONS

Frequency Range 806 to 960 MHz  
 Frequency Resolution 30 kHz  
 Measurement Range 1.00 to 100.00  
 VSWR 0 to 100%  
 Match Efficiency -32 to 0 dB  
 Return Loss 0.000 to 1.000  
 Rho (Typical)  
 Measurement Speed 5 Readings/second  
 Single Frequency 1 Sweep/second  
 Swept Frequency  
 Test Port 50Ω nominal (Field Interchangeable) Female TNC  
 Impedance Connector  
 Field Strength 0 to 100% Relative  
 Sensitivity Full scale deflection at 3m @ 12.6 Watts ERP  
 Power Requirements Six Rechargeable AA (KR-15/51)  
 Batteries 11 to 16 VDC 250mA  
 External DC 108 to 132, or 207 to 253 VAC @ 48 to 63 Hz  
 External AC Adapter  
 Interface Serial (female DB-9 connector)  
 Operating Temperature -40° to 71°C (-40° to 160°F)  
 Storage Temperature 6° x 4½° x 1¼" (204mm x 118mm x 42mm)  
 Size (including connector) 1½ lb (0.8 kg)  
 Weight  
 Specifications are subject to change without notice.

## About this Manual

Many people read the operators manual only as a last resort. If you are one of those people, you should at least read the next two pages so that you can find the information when you do need it. You will also learn where to find valuable time saving information.

### Safety Symbols

#### WARNING

Warning notes call attention to a procedure, which if not performed correctly, could result in personal injury.

#### CAUTION

Caution notes call attention to a procedure, which if not performed correctly, could result in damage to the equipment.



This symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area. See pages 2-7 and 5-6 for specific cautions.

**NOTE:** Calls attention to supplemental information

**HINT:** Provides time saving information concerning a particular procedure.

## Notice

### Changes to this Manual

We have made every effort to ensure this manual is accurate at the time of publication. If you should discover any errors or if you have suggestions for improving this manual, please send your comments to our factory. This manual may be periodically updated, when inquiring about updates to this manual refer to the part number and revision level on the title page.

### Limited Warranty

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one (1) year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted, no allowances shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten (10) days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. In addition, Seller's warranties do not extend to the failure of fuses, transistors, tubes and ballasts, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

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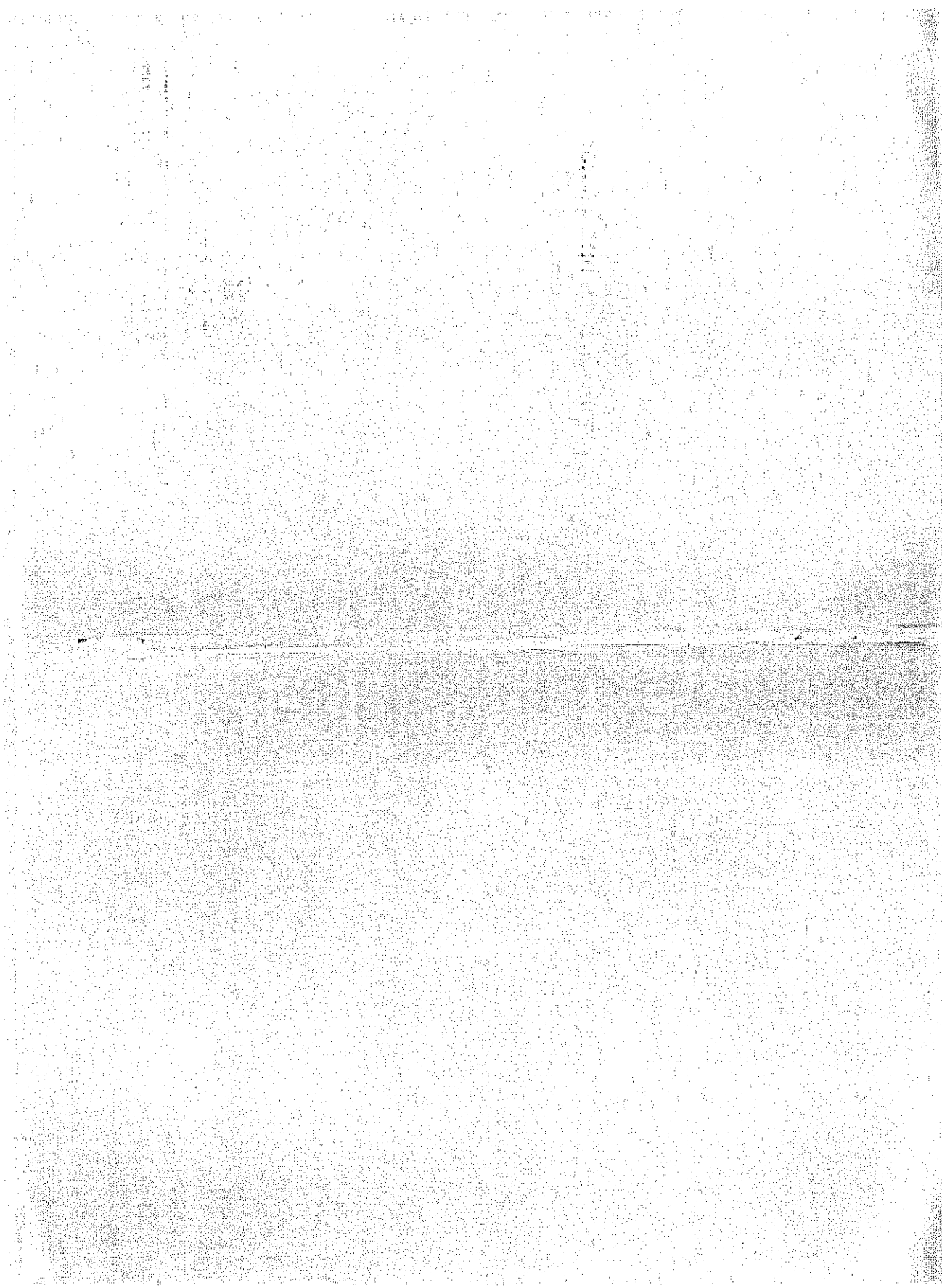
**Operator Manual**  
**AT-800 Antenna Tester**



**Electronic Corporation**  
Cleveland (Solent) Ohio USA

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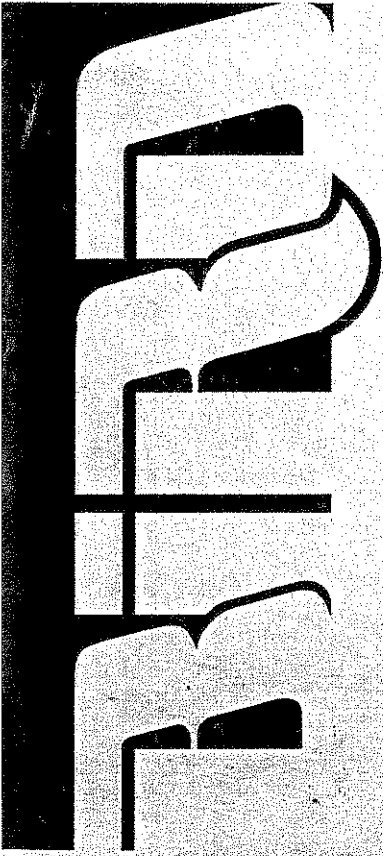
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**OPERATING INSTRUCTIONS**

**AT-800  
ANTENNA TESTER**

