AlphaWave Users Manual

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EMISSIONS

FCC	FCC Part 90
ETSI	300-113
Industry Canada	RSS-119

NOTICE

Changes or modifications not expressly approved by ArWest Communications Corporation could void the user's authority to operate this equipment.

Shielded cable must be used with this equipment in order to ensure that it meets the emissions limits for which it was designed. It is the responsibility of the user to obtain and use good quality shielded cables with this device. Shielded cables are available from most retail and commercial suppliers of cables designed to work with radio equipment and personal computer peripherals.

406.0 TO 406.1 MHZ OPERATION

The frequency band from 406.0 to 406.1 MHz is reserved for use by distress beacons. As such AW400 should not be programmed to transmit on any frequency within this band. Caution should be used when programming frequencies into the AW400 to eliminate the possibility of AW400 users interfering with rescue operations in this band (US only).

SAFETY WARNING

In order to ensure the safe operation of this radio equipment, the following practices should be observed.

DO NOT operate radio equipment near electrical blasting caps or in an explosive atmosphere

DO NOT operate any radio transmitter unless all RF connectors are secure and any open connectors are properly terminated.

DO NOT allow the antenna to come close to, or touch, the eyes, face, or any exposed body parts while the radio is transmitting.

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1. INTRODUCTION

1.1 WHAT IS THE ALPHAWAVE (AW) SYSTEM

AlphaWave (**AW**) is a wireless system operating in the frequency band (50 to 800 MHz) that provides advanced features without complicated system set up, it includes:

- AW Radio Modem;
- "AWare" - Windows based Unit Configuration and Maintenance Software Application running on a IBM PC compatible computer (Distributor and User version) "Pocket AWare"- Unit Configuration and Maintenance Software Application running on a PDA (Personal Digital Assistant).

Figure 1-1: AW Transceiver

The AW programmable, transparent radio modems provide real-time data transmission using spectrum efficient PSK/QAM modulation. It delivers error-free data at up to 38.4 kbps over the air for the 25 kHz channel spacing, 19.2 kbps for 12.5 kHz, and 9.6 kbps for 6.25 kHz.

The two ports on the AW provide access to set up and test without unplugging the application terminal device. The setting can be done through the built-in Command Line interface (CLI), or through the configuration and maintenance application software running either on a PC – "AWare" or on PDA – "Pocket AWare".
The diagnostic feature of the AW system provides information to

monitor and maintain the user's communications link. The output transmit power, receive signal strength (RSSI), antenna/feedline condition, and data decode performance will be transmitted online without application interruption.

The product is designed for maximum performance and reliability even in the harshest environments. Plug and play at its best, robust, withstanding the most adverse of conditions. With up to 2 watts RF output the AW system offers the most popular features required for telemetry and SCADA systems.

Parameter	Specification
Operating Voltage	+9….+24 VDC nominal
Pwr Consumption (avg)	6W / 2W / 0.05W – Transmit / Receive / Sleep
Operating Temp Range	-30°C…..+60°C
Dimensions (H x W x D)	5.87 in x 2.93 in x 1.51 in / 137 mm x 67 mm x 29 mm
Weight	12 oz / 340 g
Color/Housing	Two-tone Silver/Graphite, Aluminum Housing
Antenna Connector	TNC, 50Ω, female
RS232 Connector	D15 waterproof female connector

Table 1-1: AlphaWave Physical Specifications

Parameter	Specification		
Operating Frequency Range	150-170, 220-235, 403–470 MHz		
Modulation Techniques	DBPSK, DQPSK, D8PSK, and D16QAM		
Radio Protocol	Time Division Duplex (TDD) Time Division Multiple Access (TDMA)		
Max. Distance Range	50 miles / 80 km		
Occupied Bandwidth (Channel Spacing, CS)	25 kHz, 12.5 kHz or 6.25 kHz		
Data Rate (BPS)	25 kHz CS	12.5 kHz CS	6.25 kHz CS
GMSK/DBPSK	9600	4800	2400
DQPSK	19200	9600	4800
D8PSK	28800	19200	7200
D16QAM	38400	28800	9600
System Gain (Ant gain not included)	146 dB	149 dB	152 dB
Roaming Speed	60 mph / 96 km/h		
End to End delay	50 ms		

Table 1-2: AlphaWave General Radio Specifications

1.1.1 MODEL NUMBERS

The AlphaWave naming protocol utilizes a two (2) letter prefix **AW** and a three (3) character suffix to identify which part of the frequency range the particular transceiver operates on

AW100	150 to 170 MHz
AW200	220 to 235 MHz
AW400	403 to 470 MHz

1.1.2 NETWORK TOPOLOGIES

The AW Radio Modem supports Point-to-Point link (PTP) using Time Division Duplex (TDD) protocol and Point-to-Multipoint (PMP) network topology using Time Division Multiple Access (TDMA) protocol. The wireless media access contention for the PMP network can be resolved by an external controller through the data interface control lines (RTS, CTS, DTR, DSR, and DCD). In addition, the following versions of the AW software/firmware offer built-in Media Access Control (MAC) protocols to service PMP network.

1.1.3 OPERATING MODES

AW operating modes can be set through the CLI or through the external management application software. The following operating modes are available for the AW radio modem:

- Half duplex operating provides up to 9.6/19.2/38.4 kbps user data throughput. The “Transceiver” and “Repeater” are the alternative protocols for the half duplex operation.
- Full duplex mode, with up to 4.8/9.6/19.2 kbps user data throughput, is an alternative to the default half duplex.
- Sleep mode has automatic transmitter activation by an internal real-time clock, or by an external controller through the data interface control lines (RTS and DTR), or by the triggering of the external Sense Inputs.
- Programmable automatic channel scanning of the Preferred Channels is an alternative mode to the operation on the fixed Frequency Channel.
- “Test” mode supports the radio installation using Built-in test tools.

1.1.4 MANAGEMENT TOOLS

The built-in management tools along with "AWare" and "Pocket AWare" configuration and monitoring software applications provide the following benefits:

- Easy user's interface for system configuration and monitoring using well developed CLI or intuitive GUI.
- An ability to test the link using built-in test utilities without expensive external test equipment such as spectrum analyzer and BER test analyzer.
- An ability to monitor status, alarms and radio performance through the intuitive GUI.
- Software upgrades and improvements can be downloaded from "AWare" or "Pocket AWare" to the units connected with PC/PDA locally or remotely, through the wireless link.

1.2 ITEMS SUPPLIED WITH AW

Provided with each system is a transceiver (AW100, AW200, AW300), serial interface cable and a CD. The CD includes Windows PC Interface Software – **AWare**, Windows CE Interface Software **Pocket AWare** a slide show for familiarization with AWare and a set of sample configurations.

1.2.1 AW TRANSCEIVER

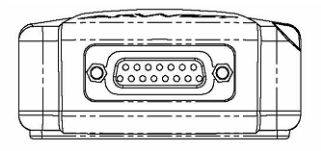

Figure 1-2: AW Transceiver – Interface Connector

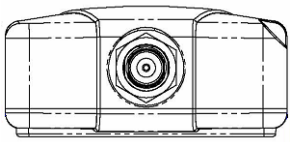

Figure 1-3: AW Transceiver – Antenna Connector

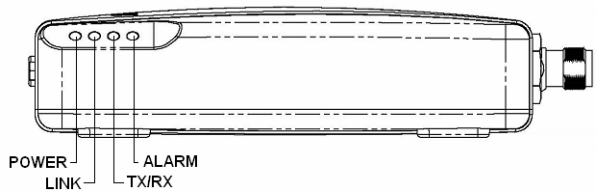

Figure 1-4: AW Transceiver – Side View LEDs

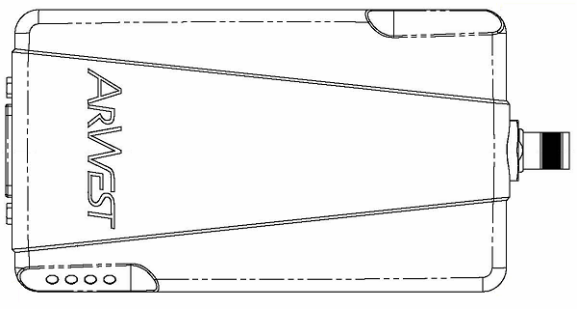

Figure 1-5: AW Transceiver – Top View

1.2.2 AW INTERFACE CABLE

Included with each system is a 2 meter interface cable for programming purposes only—THIS IS NOT A FIELD CABLE.

DB15 pin for the AlphaWave with a DB9 for connection to a PC/CE Device for configuration, field use, etc. and two tinned cables for connection to an external power supply.

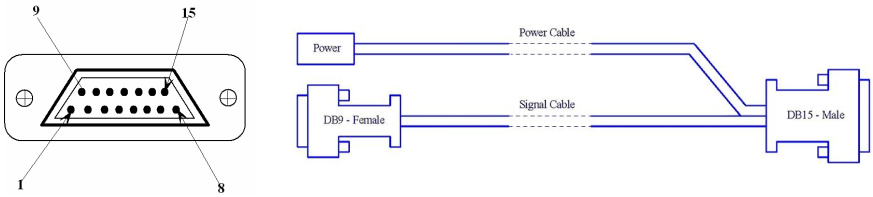

Figure 1-6: DB15 Connector

Connector Pin #	Signal Name	Signal Description	Signal Type
1	DCD	Data Carrier Detect	O
2	DSR	Data Set Ready	O
3	RTS	Request To Send	I
4	TX	Data from PC Serial Port to Modem	I
5	MP TX	Maintenance Port Serial Data In	I
6	TTLIN2	TTL In 2	I
7	TTLIN1	TTL In 1	I
8	PWRIN	DC Power between 9 and 24 VDC	DC
9	DTR	Data Terminal Ready	I
10	CTS	Clear To Send	O
11	RX	Data from Modem to PC Serial Port	O
12	MP_RX	Maintenance Port Serial Data Out	O
13	TTLOUT2	TTL Out 2	O
14	TTLOUT1	TTL Out 1	O
15	GND	DC Power and Signal to Ground	I

Table 1-3: Standard External Connector Pin Layout

The serial Data Interface can be configured through the software to operate in half and full duplex operating modes. The serial line Data Rate should also be under the software control, which provides the automatic data rate detection.

RTS, CTS, DSR, DTR and CD signals should be reserved on-board for future support of full RS-232 hardware handshake operation. This will provide the support of the wide range of different standard and none-standard, user specific, Data Link interfaces.

The serial interface is protected against static discharge (15 kV) and shorts with power and signal circuits.

1.2.3 ALARM/SENSE INTERFACE

The Alarm/Sense Interface provides two external sense CMOS/TTL input lines and two TTL output lines for connection to external Alarm and Security systems.

The TTL output lines can be configured to indicate the following alarms:

TTL_OUT1:	TTL_IN1 (received from remote unit) TTL_IN1 and TTL_IN2 (received from remote unit) TTL_IN1 or TTL_IN2 (received from remote unit)
TTL_OUT2:	TTL_IN2 (received from remote unit) BER >10^{-3} or SYNC Loss BER >10^{-4} or SYNC Loss SYNC Loss

Table 1-4: TTL Output Lines

1.2.4 SERIAL MAINTENANCE INTERFACE

The serial asynchronous interface allows connection to external serial devices. All commonly supported baud rates, parity and bit configurations are available up to 115.2 kbps. This interface is a simple 3-wire with RS-232C signal levels. The serial interface is protected against static discharge (15 kV) and shorts with power and signal circuits.

1.2.5 LINK ALARM/STATUS INDICATORS

External LED's are used for Link and Line status indication:

Pos'n	Led Name	Color	Description
1	Power	Green	Active if Power connected to modem
2	Link	Red	Active whenever a signal with a level exceeding the level required for reception exists on the radio channel (min. light on 200ms).
3	Rx/Tx	Green	Active if modem receives or transmits Data over serial interface (min. light on 200ms)
4	Alarm	Red	Alarm indicator

Table 1-5: External LEDs

1.2.6 POWER INTERFACE

The power interface allows connection to an unregulated DC power source. The DC power source (third-party or user supplied) must provide a minimum of 11.0 Watts of DC power between 9 and 24VDC. The power interface is protected against reverse polarity connection, as well as protected against high-voltage transients.

1.2.7 RF INTERFACE

The stand-lone unit's RF interface is a 50-ohm impedance matched standard BNC/TNC connector as required by regulations. The RF interface can operate without damage to the unit under DC short and open conditions.

1.2.8 ANTENNAS

Antenna type depends on the site requirements, and may be directional or omni-directional. The AW Base antenna is typically mounted on a mast that elevates the antenna a minimum of 40 feet above the average level of the terrain to support 50 miles distance range.

The total system gain allowable includes both the Radio-Modem and the antenna. The table listed below is for ArWest antennas, however the Gain values can be used with other antennas to determine AlphaWave Power Setting.

Antenna Part#	Gain (dBi)	AlphaWave Power Setting
AT-30000 to AT30005	0	33 dBm (2W)
AT-30006 to AT-30007	3	30 dBm (1W)
AT-30008 to AT-30010	5	28 dBm (0.63W)
AT-30011 to AT 30015	9	24 dBm (0.25W)
AT-30016	8.8	24 dBm
AT-30017 to AT-30018	9	24 dBm

Table 1-6: AlphaWave Power Settings v Antenna

Warning:

1. The values defined in the table must not be exceeded in order to ensure compliance with RF exposure regulations.
2. The antenna must be installed so as to ensure a separation distance of at least 25 cm from all persons.
3. The antenna of the device may not be co-located or operating In conjunction with any other antenna or transmitter.

2. CONFIGURE YOUR ALPHA-WAVE

All AW products are shipped as **Remote** units with SmartScan© and Plug-and-Play enabled.

2.1 PLUG AND PLAY (DEFAULT SETTING)

Simply connect the antenna and apply power to an AW unit that has the same Channel Mapping as the Base unit and SmartScan© technology will immediately detect the Base Station frequency and protocol and start receiving data.

2.2 BASE SETUP

Use AWare "Link Protocol Properties Tab" (Figure 5-4) to convert the default "Remote" settings to the Base settings. On completion of setting Base in the Protocol Properties ensure that the correct Protocol Option is then selected (Simplex Transmitter/Primary Transceiver/Full Duplex).

2.3 REMOTE SETUP

All AW Products are shipped as Remote units, to return a unit reconfigured as a Base or Repeater to the Remote Mode, use AWare "Link Protocol Properties Tab" (Figure 5-4) to convert the default "Remote" settings to the Base settings. On completion of setting Base in the Protocol Properties ensure that the correct Protocol Option is then selected (Simplex Receiver/Secondary Transceiver/Full Duplex).

2.4 REPEATER SETUP

Use AWare "Link Protocol Properties Tab" (Figure 5-4) to convert the default "Remote" settings to the Repeater settings.

2.5 INSTALL NEW FIRMWARE

To install new firmware in an AW unit section 6.4 covers the downloading of the "embedded software images" using AWare.

3. AWARE - GENERAL DESCRIPTION

AWare is a MS Windows® based software program designed for configuring and maintaining ArWest UHF radio systems. AWare is a user-friendly software application that provides complete and powerful tools for radio monitoring and diagnostics. It also provides software image and configuration downloading. The statistics from the monitoring can be viewed in text or graphical format. With the support of ArWest radios' real-time software, AWare architecture makes it possible to maintain all wireless network radio configuration by connecting to only one unit.

The program consists of three panes. The left pane shows the list of units in the wireless link/cluster. In the root node of the tree there is a local unit that is directly connected, through a serial cable, to the management computer running AWare. The right pane is the main window, which displays the selected unit's main configuration parameters and operating status. The bottom pane is a terminal window. It gives the ability to work directly with a Command Line Interface (CLI), without a GUI, by entering CLI commands. The bottom pane also contains a log window that shows the log records coming from selected unit.

To work with the program, the operator needs only to connect PC's COM port to local unit's maintenance port. AWare automatically generates the network tree displaying the locally connected unit in the root of the tree. AWare uses CLI commands for interaction with the radio modem.

The "Dealer" version of AWare provides the tools to preprogram the maximum output power level, channel spacing, and channel planning for specific countries and users. The "End-User" version allows an operator to select the settings preprogrammed by the dealer. The "Workshop" version of AWare provides the calibration tools used by repair centers to recalibrate the units.

3.1 PRODUCT FEATURES

3.1.1 MANAGEMENT

AWare is intended to manage the ArWest radio modems, it provides dialog boxes to change and configure all radio options. The following unit's settings are configurable through AWare:

1. Data port parameters (Line parameters);
2. Wireless transfer parameters;
3. Radio parameters (TX/RX etc.)

In addition to the individual option-tuning feature, AWare provides compound options for downloading feature. The downloading process uses X-Modem protocol that both the unit and the PC program are supporting. The manufacturing will provide configuration in shipping packages so every user can configure each unit with default parameters provided by vendor.

3.1.2. ALARMS

There is a callback feature for reading the radio alarms. It is possible to activate and deactivate this feature in any device after each device sends its alarm status to the PC where AWare is running. The well-designed graphical user interface on AWare shows each particular alarm on the corresponding unit and with an operator's request shows detailed description of that alarm.

3.1.3 STATISTICS

With a right-click of the mouse on a specific option on the menu bar, it is possible to view the statistics information on each unit. In the Statistic window an operator can see link status: number of error packets or bits arrived during unity of time (Bit Error Rate - BER), number of packets sent/received etc.). Such information can be shown in textual or graphical form. It is also possible to change the unit of time (scaling).

3.2 PRODUCT OVERVIEW

3.2.1 USER INTERFACE CONVENTIONS

AWare uses the following user interface conventions:

- Menu options and buttons that end with three dots (...) display a dialog window when selected. .
- Menu options that are followed by a shaded arrow display a submenu when selected.
- Buttons not followed by three dots or shaded arrow performs a function (command) when selected.
- Underlined letters in menu options identify keyboard shortcuts.
- If you are using a PC keyboard, hold down the [Alt] key and press the key underlined in the menu option to select that option.
- The arrow keys on the keyboard allow an operator to scroll up, down, right, or left within a menu.
- Menu options are dimmed when they are not active for a particular window.
- All windows and dialog boxes in AWare indicate object or property name in the title bar for which they are activated.

3.2.2 MAINFRAME

The AWare Mainframe has three child windows: Site View (left pane), Main (right pane), and Display (bottom of the Mainframe). The double-clicking magnifies the child windows. The magnified child window can be docked back to the original position by the double-clicking on its title bar.

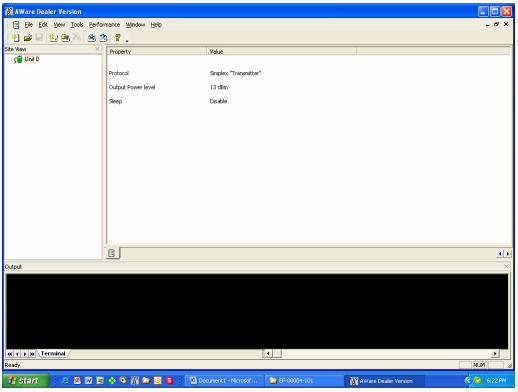

Figure 3-1: Mainframe Default View

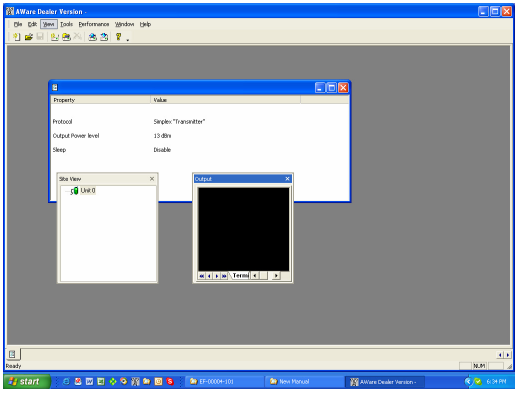

Figure 3-2: Mainframe with Undocked Child Windows

3.2.3 SITE VIEW PANE

This window shows the list of all units in the wireless network. The wireless cluster is pictured as a tree with the Base/Primary unit as the root.

Operators are able to refresh the content of window through the main menu or popup menu by clicking mouse's right button. The refresh command can be activated manually or by setting polling option in the Preference dialog box. The system reacts on this command inactively because of slow wireless connection of the service

channel.

In the "Dealer" version of AWare, the Site View Pane is also used to display the tree of available unit profiles. The "Unit Profile" tree provides an operator with the tools to select, add, or delete a unit profile, or a folder of units' profiles.

The default position for Site View Pane is in the left side of main window.

3.2.4 MAIN PANE

AWare Main pane contains the Quick View tab that displays the selected unit's main configuration parameters and operating status. The Main tab is used also for the Statistics tabs, which can be activated through the Performance menu items (see section 3.2.11)

Any of Statistics tabs can be opened and hidden by the operator. Meanwhile the Quick View tab is always in the Main pane and can be hidden only if the pane itself is hidden.

3.2.5 DISPLAY PANE

This window shows the log records coming from selected unit. The log records include all "Informative Events" with the time stamps along with the "System Errors/Major Alarms" and "Warnings/Minor Alarms". The log information can be accumulated, even if the unit is not selected (in the background). This window gives the operator the ability to sort and filter log information by user-preferred criteria (by date, by type and so on). In this window, it is also possible to accumulate all logs coming from AWare itself.

The Terminal tab of the Display pane is designed for advanced operators to give them an ability to work with unit directly without GUI using the CLI commands.

3.2.6 MENU BAR

The menu is a major entry point for all program features. The operator through this interface can access and change the properties of the AlphaWave radio. The Menu Bar consists of following items:

Figure 3-3: Menu Bar

3.2.7 FILE MENU

The configuration information is stored in the Configuration Profiles. The Configuration Profiles can be saved or loaded under the File option of the menu bar. If necessary, this option allows the operator to set the same configuration of one unit on a different unit simply by loading it. The operator may save as many Configuration Profiles as he needs.

The File Menu contains the following commands (Figure 3-4):

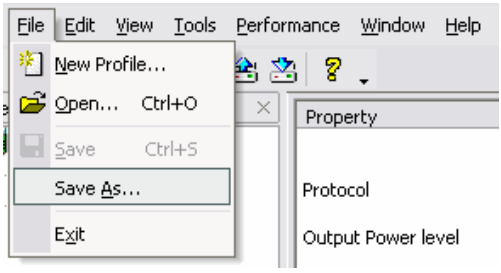

Figure 3-4: File Menu

Where:

New Profile – to create a New Profile;
Open – to open a Profile from the hard or floppy disk;
Save – to save the modified Profile to the same device from where it was loaded;
Save **A**s – to save a newly created or modified Profile on the specified devices with the specified name and "*.awn" extension;
E**x**it – to exit AWare.

3.2.8 EDIT MENU

This menu item (Figure 3-5) helps to configure the radio's external

and internal parameters. Those parameters are, input/output line properties, link configuration, radio modems configuration and so on (see section 5).

The AWare Preferences item in the Edit Menu helps to setup the user's Preferences for AWare.

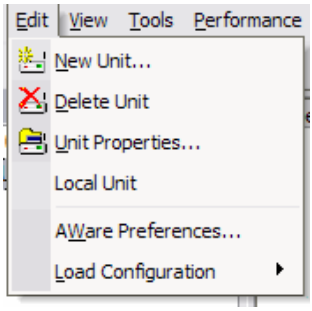

Figure 3-5: Edit Menu

Where:

New Unit – to add a new unit into the wireless network/link;
Delete Unit – to delete the selected unit from the wireless network/link;
Unit Properties – to open a configuration dialog box for the selected unit;
A**W**are Preferences – to open AWare preferences dialog box;
Load Configuration – to load a configuration to/from the selected unit from/to the open Configuration Profile.

3.2.9 VIEW MENU

The View menu intended to show/hide all toolbars, menus and windows to construct working layout.

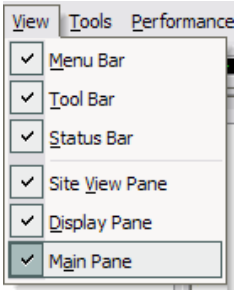

Figure 3-6: View Menu

Where:

Menu Bar – Show/Hide menu bar;
Tool Bar – for hide/show the tool bar;
Status Bar – for hide/show the status bar;
Site **V**iew Pane – for hide/show the site view pane;
Display Pane – for hide/show the terminal and log tabs in the display pane;
Main Pane – for hide/show the main pane

3.2.10 TOOLS MENU

The Tools menu consists of following items:

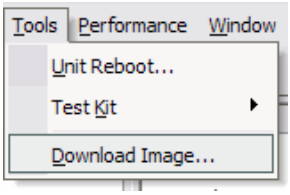

Figure 3-7: Tools Menu

Where:

Unit Reboot – used to access "Reboot" dialog box;
Test Kit – provides a set of installation support and diagnostic utilities (see section 6.1);
Download Image – used to access the Firmware Image Downloading Manager;

Dealer **C**onfiguration – provides a set of tools to edit and load Dealer Configuration Parameters (available for Dealer and Workshop Version);

Factory Configuration – provides a set of tools to calibrate the unit and download Calibration Parameters to the unit (available only for Workshop Version);

The "Dealers Configuration" sub-menu of "Tools" menu is intended to manipulate the dealer's configuration File. "Dealer Configuration" sub-menu contains the following items (Figure 3-8):

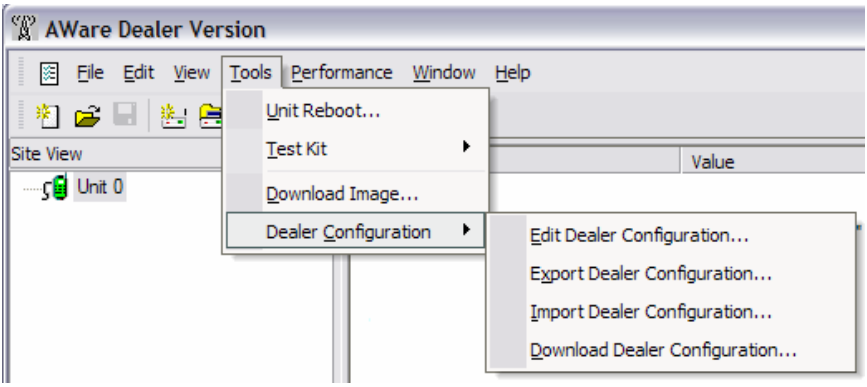

Figure 3-8: Dealer Configuration Sub-menu

- **Edit Dealer Configuration** – opens dealer configuration dialog box to edit dealer configuration parameters

- **Export Dealer Configuration** – save dealer configuration into the file on the disk. The New Profile dialog box uses this file to choose the dealer configuration as basis for network profile.

- **Import Dealer Configuration** – load Dealer Configuration file into the system for editing it. The "Import Dealer Configuration" menu item also substitute dealer configuration file in the profile that currently active in AWare.

- **Download Dealer Configuration –** download Dealer Configura-

tion parameters into the unit through the serial interface.

The "Factory Configuration" sub-menu of "Tools" menu provides an access to the tools intended for the unit calibration. "Factory Configuration" sub-menu contains the following items (Figure 3-9):

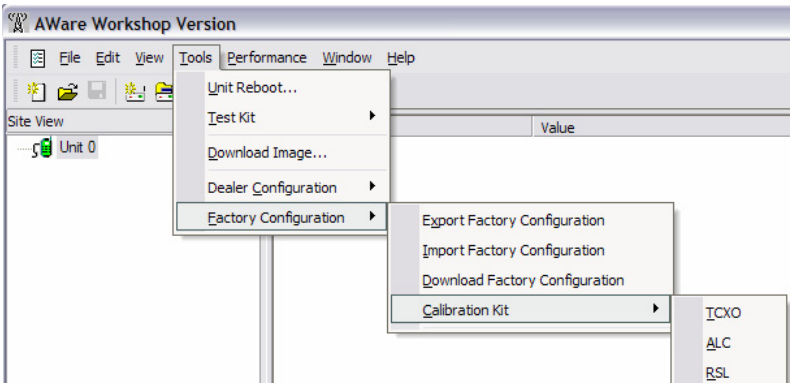

Figure 3-9: Factory Configuration Sub-menu

- **Export Factory Configuration** – save dealer configuration into the file on the disk. The New Profile dialog box uses this file to choose the dealer configuration as basis for network profile.
- **Import Factory Configuration** – load Factory Configuration file into the system for editing it. The "Import Dealer Configuration" menu item also substitute dealer configuration file in the profile that currently active in AWare.
- **Download Factory Configuration –** download Factory Configuration parameters into the unit through the serial interface.
- **Calibration Kit –** provides access to the unit calibration tools (see section 6.3**).**

3.2.11 PERFORMANCE MENU

The Performance Menu is intended to retrieve the statistics from the unit and present the retrieved information in graphical formats:

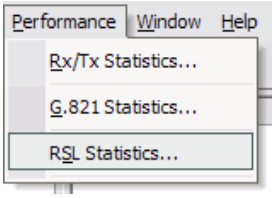

Figure 3-10: Performance Menu

Where:

Rx/Tx Statistics – opens the tables and graphs of performance information unique for ArWest radio modems not covered by G.821 standard of ITU.
G.821 Statistics – opens the graphs of the Error Performance Parameters and Objectives defined by G.821 standard of ITU.
R**S**L - opens the graphs of received signal level for ArWest radio

3.2.12 WINDOW MENU

The "Window" menu (Figure 3-11) contains the following commands:

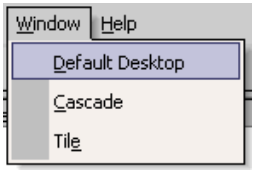

Figure 3-11: Window Menu

Where:

Default Desktop – to open and arrange the windows as it was designed for Default Desktop;
Cascade – to arrange windows so they are all partially visible;
Til**e** – to arrange windows horizontally or vertically so they are all very visible.

3.2.13 HELP

This menu item helps with the questions that arise about the available commands, information about commands usage and general information about AWare.

Help contains the following items:

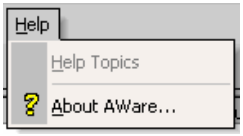

Figure 3-12: Help Menu

Where:

Help Topics – opens application help topics in the separate dialog with contents, index and find tabs;
About AWare – opens about dialog box.

3.2.14 TOOL BAR ICONS

The AWare Tool Bar contains the buttons with images so the operator can quickly associate the command with the image (see Figure 3-13).

Figure 3-13: AWare Tool Bar

Where:

- Create a New Profile;
- Save Profile;
- Open Profile;
- Add a Unit into Profile;
- Delete the selected unit from the Profile;
- Activate the selected unit's Configuration Properties;
- Download unit's configuration from the Profile into the unit;

4. CONFIGURATION FILES

The configuration information used by AWare is stored in four types of files:

- AWare Preferences
- Factory Configuration files
- Dealer Configuration files
- User Setting Profile

Factory Configuration files can be modified only by "Workshop" version of AWare. While Dealer Configuration file can be modified and loaded into the unit by "Dealer" version of AWare.

4.1 AWARE PREFERENCES

The "AWare Preferences" file is where AWare settings are stored. It includes two groups of setting parameters:

- Startup Preferences
- Communication Preferences

To open the "AWare Preferences" dialog box, the operator must click "AWare Preferences" menu item on "Edit" menu.

4.1.1 STARTUP PREFERENCES

AWare allows three different startup procedures, which could be selected from the Startup preferences of the preferences dialog box:

- New Profile
- Upload the Unit Profile
- Open last Saved Profile

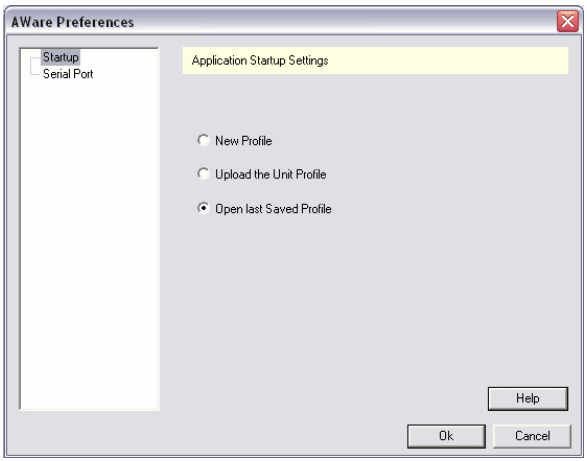

Figure 4-1: AWare Preferences

4.1.2 COMMUNICATION PREFERENCES

The Communication preferences tab allows a variety of options for PC's COM port selection. For Dedicated Maintenance Port, the COM ports for both Maintenance and Data must be defined. For Non-dedicated Maintenance Port, the shared COM port and the control line must be selected (DTR or RTS).

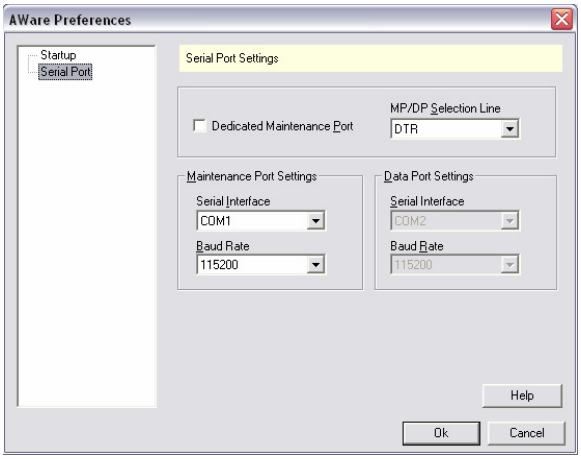

Figure 4-2: Communication Preferences

By default, the Dedicated Maintenance Port is unchecked and Set-

tings for Maintenance serial port are grayed out.

If the Dedicated Maintenance Port is checked then the MP/DP Selection Line option must be grayed out and controls for Maintenance serial port settings become active.

4.2 CONFIGURATION FILES

The configuration files' structure has a binary format to protect configuration file from any type of external intervention from the user. The file has a tree type structure to keep information of the whole cluster in the root of the tree and each unit's configuration in the nodes. Further changes of any parameter will be saved in the configuration file in its corresponding place.

"Dealer" and "Workshop" versions of AWare are used to create, modify, save on disk, and load into the units the "Dealer Configuration" and "Factory Configuration" files. The "Dealer Configuration" and "Factory Configuration" tools are developed for this purpose (see sections 6-2, and 6-3).

4.3 USER SETTINGS PROFILE

User Setting Profile defines the settings of the wireless cluster/link and the units in that cluster/link. At the same time, an operator is able to open only one profile in AWare and work with units in that cluster. The User Setting profile contains two groups of information:

- Cluster/Link Properties – common for all units in the same wireless cluster
- Unit Specific Properties – setting unique for each unit in the wireless cluster

The group of Cluster/Link Properties includes:

- Frequency
- Link Data Rate
- Topology
- Scrambling Seed

The group of unit specific properties includes:

- Data Port Rate

- Output Power Level
- Protocol
- Sleep mode
- Alarm Settings

4.3.1 CREATE A USER SETTING PROFILE

The menu item F**ile > New Profile** creates a new User Setting Profile (see Figure 4-3). By default, it creates one Base Station unit in the profile with factory default User Settings for that unit and opens unit properties dialog box to modify user settings for newly created unit.

The tree on the left shows all available configurations provided by dealer or automatically generated from existing units. By clicking on each configuration, the corresponding fields on the right will show all settings filled up by dealer for selected item.

The beige title on the dialog box shows the Product Name for current configuration.

- **Maximum Power** – determines maximum output power settable by the operator through the Unit Settings tools.
- **Call Sign** – indicates the unique ID assigned by FCC (filled by dealer).
- **Channel Spacing** – defines channel spacing 25 kHz, 12.5 kHz, or 6.25 kHz.
- **Channel Mapping** – defines the list of central frequencies mapped to channel numbers.

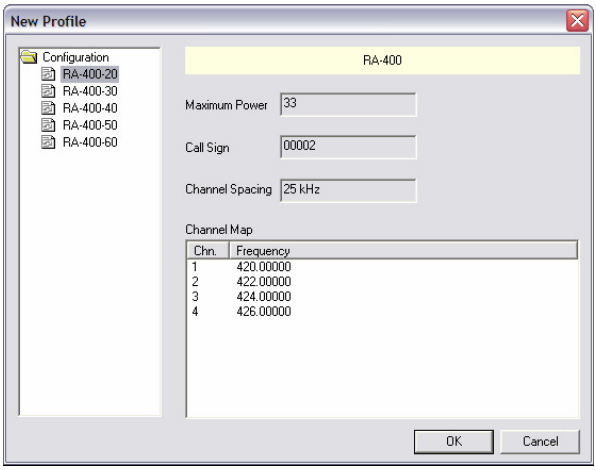

Figure 4-3: New Profile Dialog Box

The New Profile dialog box indicates the list of available units' configurations. The indicated unit configurations include Factory and Dealer configurations (refer to section 6.2 for Dealer Configuration). The full list of products currently supported by AWare includes:

AW400	AlphaWave UHF transceiver
AW200	AlphaWave Chinese version VHF transceiver
AW100	AlphaWave VHF transceiver
AW400R	Receive-Only UHF radio
AW200R	Receive-Only Chinese version VHF radio
AW100R	Receive-Only VHF radio
AW400*Plus*	High Power UHF transceiver
AW200*Plus*	High Power Chinese version VHF transceiver
AW100*Plus*	High Power VHF transceiver

Table 4-1: Products supported by AWare

First two characters of name indicate the model family (AW). The following three digits after the dash is an operating frequency band:

400	403 to 470 MHz UHF band radio
200	220 to 232 MHz Chinese version VHF radio
100	150 to 170 MHz VHF radio

4.3.2 Open a User Setting Profile

The full path of the User Setting Profile last used is stored in the system registry. The program automatically opens that profile after starting up when corresponding option is selected in the AWare preferences dialog box.

Choosing the “Open” menu item in “File” menu opens the File Open dialog box. This is where the chosen profile is loaded. Then the program automatically loads the newly chosen profile.

4.3.3 Save a User Setting Profile

To store the current user settings, the “Save” and “Save As” are being used. “Save As” menu item opens “Save File” dialog box, which allows an operator to store the current user settings into the different file.

4.3.4 Add a Unit into Profile

By selecting this menu item, the program adds Remote/Secondary units into the Profile. A unique name and serial number of all zeros specified for newly added unit. From this point the operator is able to set the unit specific parameters or change the cluster parameters for all units. The newly added into profile unit has the factory default user settings.

4.3.5 Delete a Unit from Profile

The Delete Unit Menu item deletes the unit from the User Setting Profile. The delete operation can not be performed on the root item in the Site View configuration tree, as long as the configuration of the rest of all units is based on the root item’s unit.

4.3.6 Select a Local Unit

The “Local Unit” menu item specifies the unit that locally connected to the PC through the Serial Interface. This option used by AWare to substitute the Serial Number automatically (if last one is all zeros) with the serial number of locally connected unit during download process. The green icon will indicate local unit in the Profile Tree.

There should always be one unit in the profile and this one unit will be local.

5. PLANNING OF WIRELESS CLUSTER

To open "Unit Properties" dialog box for the unit selected in the Site View pane, the operator can select the "Unit Properties" item from "Edit" menu ("Edit > Unit Properties… ".) Double-clicking on the unit icon in the Site View pane also opens the "Unit Properties" dialog.

The left pane of the "Unit Properties" dialog is a unit's User Setting Tree intended to facilitate and visualize the setup process. Each node in the tree pane corresponds to a specific tab on the dialog's right side. The tab can be selected by clicking on the node in the tree.

The AlphaWave radio modems have four main groups of settings: Identification, Link, Modem and Serial Port Properties. Some of the units' parameters are common for all units in the wireless link/ cluster. A warning message appears if the operator attempts to set a parameter mismatched with the rest of the units in the wireless link/ cluster. The warning message should have an option control to automatically set the common parameter for all units in the wireless link/ cluster or cancel the new setting.

To configure the units, AWare uses CLI commands described in Appendix B

5.1 IDENTIFICATION PROPERTIES

On the Identification Properties tab (see Figure 5-1), there is unit's identification information such as:

- Product Name –With this option, the operator can select one of the ArWest radio models (see Section 4.3.1).
- Call Sign – Indicates the unique ID assigned by the FCC (filled by dealer).
- Current Software – Shows/Actives embedded software version that is running on the unit.
- Unit Name – Indicates the logical name of the unit given by the operator.
- Owner – Indicates the network ownership (filled by the operator).

The last three identification parameters (Unit Name, Owner and Call Sign) are user assigned settings. The Embedded Software version should be retrieved from the unit through its maintenance serial port. For AlphaWave operating in Half or Full Duplex modes it can be read also over the air.

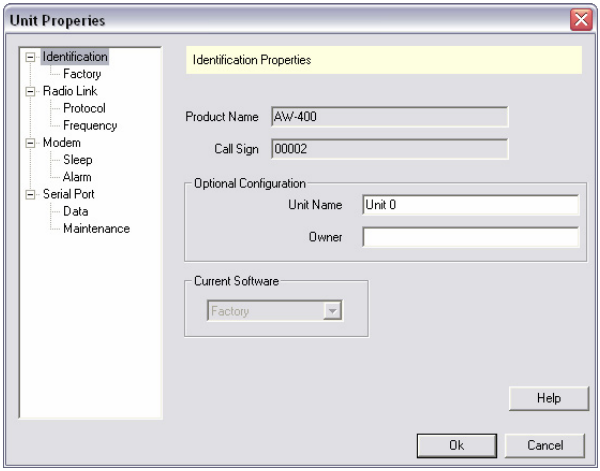

Figure 5-1: Identification Properties

5.1.1 FACTORY PROPERTIES

The Factory Properties is a sub-tab of the Identification Properties tab (see Figure 5-2). It contains the information that the vendor sets during manufacturing process.

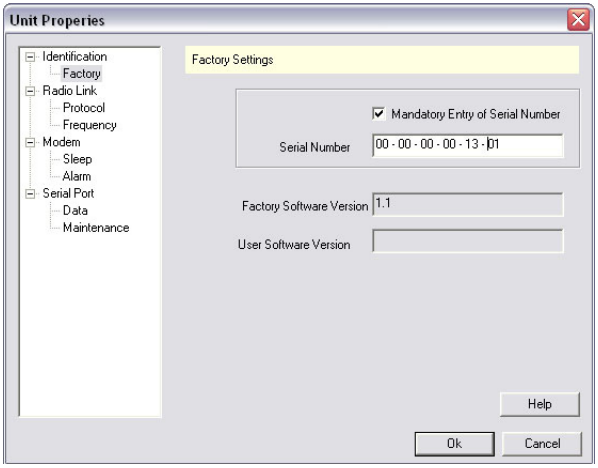

Figure 5-2: Factory Properties

The unit's factory identification includes:

- **Mandatory Entry of Serial Number** – Specifies whether AWare will automatically fill the Serial Number during downloading configuration into the unit or the operator should mandatory enter serial number in the "Serial Number" field.
- **Serial Number** – Indicates the serial number (six/6 bytes) of the unit given by the manufacture;
- **Factory Software Version** – The version of software image loaded in factory. The factory software becomes active if operator updated image is corrupted or failed. The factory software cannot be upgraded on the field.
- **User Software Version** - The version of software image loaded or upgraded by operator.

5.2 LINK PROPERTIES

The Link settings are split between three tabs: Link General Properties, Link Protocol Properties, and Link Frequency Properties.

Changing Link Properties of unit's configuration may cause link interruption. That is why after choosing Base/Primary unit's configuration the operator has limited choices for secondary unit.

5.2.1 LINK GENERAL PROPERTIES

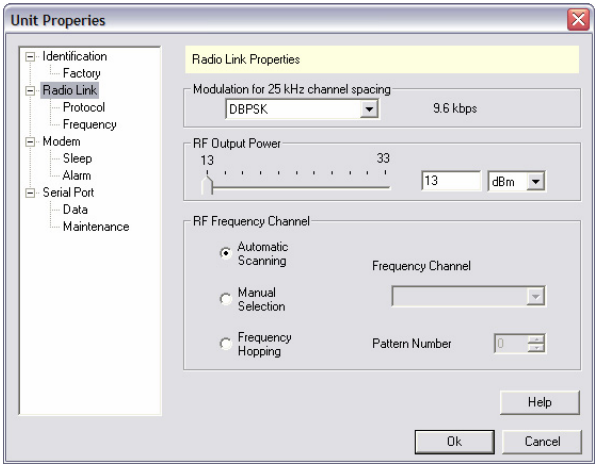

Figure 5-3: Link General Properties Tab

The following controls reside in the Link General Properties tag:

- Modulation:

	CS = 6.25 kHz	CS = 12.5 kHz	CS = 25 kHz
DBPSK	2.4 kbps	4.8 kbps	9.6 kbps
DQPSK (default)	4.8 kbps	9.6 kbps	19.2 kbps
D8PSK	7.2 kbps	14.4 kbps	28.8 kbps
D16QAM	9.6 kbps	19.2 kbps	38.4 kbps

This control should show the modulation type along with the wireless link data rate that is provided by a specific radio modem. This option is available only for Base/Primary unit.

- RF Output Power Level (selectable from 13dBm/20mW to Maximum Value defined by Dealer in the "Dealer Configuration").
- RF Frequency Channel:

- Automatic Scanning – it is a default option that grays out the Frequency Channel edit box. The List of frequencies scanned by the unit can be assigned through the Link Frequency Properties tab.
- Manual Selection – with this option, the operator can select one of the fixed channels (the actual range is based on the facture configuration). The Frequency Channel can be selected using the Frequency Channel combo box
- Frequency Hopping – the selected Frequency Hopping grays out the Frequency Channel edit box. The List of hopping frequencies can be assigned through the Link Frequency Properties tab.
- Hopping Pattern:
  This control is applicable only if the Frequency Hopping mode is selected. The network operator selects one of the 32 avail able Hopping Patterns.

Note:
- RF Frequency Channel option is available only for Base/ Primary unit. It is same for all units in the network.
- For Receive-Only radio, this option is disabled.

5.2.2 LINK PROTOCOL PROPERTIES

The following controls reside in the Link Protocol Properties tab:

The Protocol sub-group contains radio-button to choose between two types of units: Base and Remote each type has specific list of protocols that listed in the List of Protocols combo-box.

- **Base**
  - Simplex Transmitter
  - Primary Transceiver
  - Full Duplex
- **Remote**
  - Simplex Receiver
  - Secondary Transceiver
  - Full Duplex
- **Delay** (this variable is valid only for “Transmitter” mode):

  - Range (0-7)
  - Scrambling: On/Off
- **Link ID** (this variable is valid only if Scrambling is "On"):
  - Seed for Pseudo-Random Sequence Generator (1-255)
  - ARQ:
    The ARQ check box enables/disables the Automatic Repeat Request option. This option is not available for "Repeater" and Simplex modes (default is unchecked).
- **Number of Requests** (this variable is valid only if ARQ is "On")
  - Range (1 – 8)
- **FEC**:
  - The FEC check box enables/disables the Reed-Solomon FEC coding (default is checked).

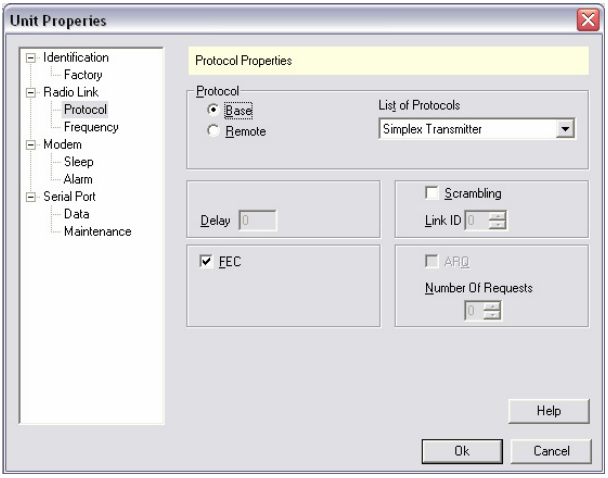

Figure 5-4: Link Protocol Properties Tab

Note:
- The link with Receive-Only radios does not support ARQ option.

5.2.3 LINK FREQUENCY PROPERTIES

This tab displays the list of up to 32 available frequencies mapped to

corresponding channels. AWare displays the list of available carrier frequencies based on information from the specific unit profile file.

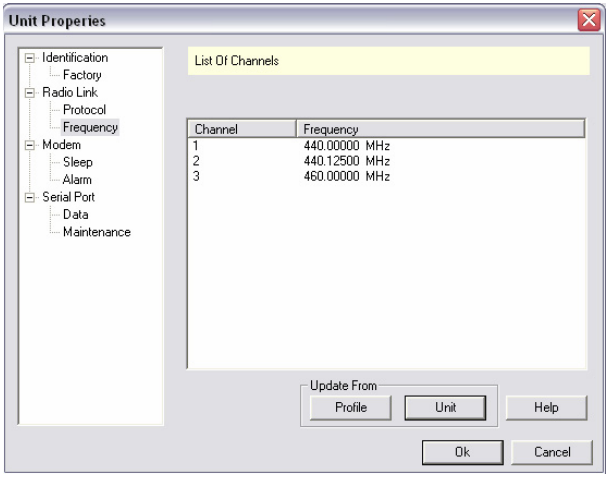

Figure 5-5: Link Frequency Properties Tab

Two buttons under Update Form group helps to update the list of frequencies from saved dealer configuration or directly upload from the unit.

5.3 MODEM FEATURES PROPERTIES

This menu item helps to configure radios' service features such as the alarm indication mode and alarm control lines' behavior, and the sleep mode.

5.3.1 MODEM SLEEP PROPERTIES

The Sleep check box enables the sleep mode. The unit with the enabled sleep mode goes to sleep if there is no activity on the wireless link during waiting time defined by Wait edit box (range 10 – 2550 ms).

The sleeping AlphaWave unit can be activated again by the real-time CLK, DTR/RTS lines, and command received through TTL inputs. The operator can select one, two, or all three conditions:

- Activate by Real-time clock:
- After 100 to 2550 ms of sleeping time
- Activate by Control Lines:
- DTR
- RTS (default)
- DTR & RTS
- Activate by Sense input lines:
- Sensor 1
- Sensor 2
- Sensor 1 and Sensor 2

To activate the sleeping unit, the operator can select either Sense TTL inputs or/and RTS and DTR inputs.

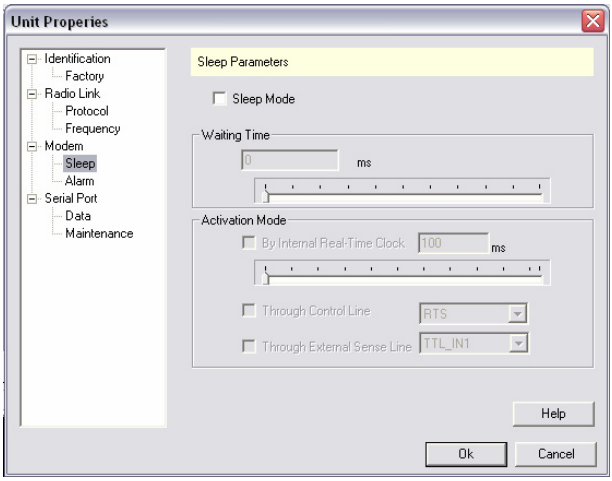

Figure 5-6: Sleep Properties Tab

5.3.2 MODEM ALARM PROPERTIES

The AlphaWave radio modem has the ability to indicate alarms using Alarm LED indicator and two TTL outputs.

The First Event Output (TTL1) control allows the operator to route the alarms and the inputs from remote sensors to the first event (TTL) output:

- Sensor 1 (the sensor's input on remote unit, default value)
- Sensor 1 and Sensor 2 (logic "and" of the sensors' inputs on remote unit)
- Sensor 1 or Sensor 2 (logic "or" of the sensors' inputs on remote unit)

The Second Event Output (TTL2) control allows the operator to rout the alarms and the inputs from remote sensors to the second event (TTL) output:

- Sensor 2 (the sensor's input on remote unit, default value)
- SYNC Loss
- BER > Threshold or SYNC Loss

The BER control allows the operator to select the BER threshold level for second event output in case of selected "BER > Threshold or SYNC Loss":

- BER $>10^{-3}$ (default value)
- BER $>10^{-2}$

Note: The Alarm Properties are not available for Simplex Transmitter configuration.

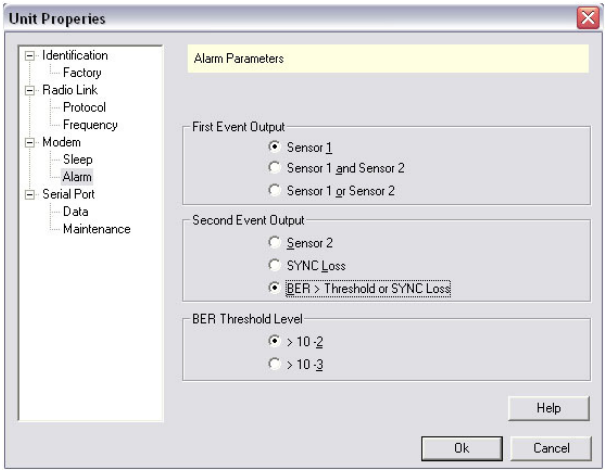

Figure 5-7: Alarm Properties Tab

5.4 SERIAL PORT FEATURES PROPERTIES

This menu item helps to configure radios' service features such as the user data port and maintenance port settings.

5.4.1 DATA PORT PROPERTIES

From the Port tab of Unit Configuration dialog box the operator can configure the following data port parameters:

- **Baud Rate** – indicates the operating rate for the data port (300 bps to 115 kbps). The "MP Baud Rate" operating option does not define the data rate specifically. In this mode on, the same data rate is used for both maintenance commands and user data. The baud rate is defined by Maintenance Port settings or automatically detected when the serial port operates as a Maintenance Port.
- **Parity Scheme** – for enable/disable parity checking, can be one of the following settings: none, odd, even.
- **Byte Size** – number of bits in the bytes transmitted and received
- **Flow Control** – This field indicates the Data Port flow control option:

Hardware - (RTS/CTS) flow control;
Xon/Xoff – flow control is performed by software;
None – flow control is not used.

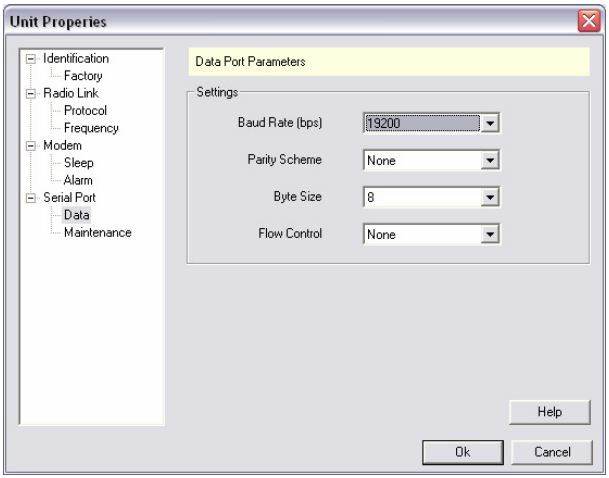

Figure 5-8: Data Port Properties Tab

5.4.2 MAINTENANCE PORT PROPERTIES

From the Port tab of Unit Configuration dialog box the operator can configure the maintenance port parameters:

- **Baud Rate** – indicates the operating rate for the maintenance port (300 bps to 115 kbps). The "Auto" operating option does not define the data rate specifically. In this mode on, the baud rate is automatically detected using the maintenance commands as the key words.
- **Byte Size** – number of bits in the bytes transmitted and received.

6. TOOLS

AWare built-in installation and system monitoring tools are using special CLI commands, which are typically not used by the operator working with the unit through the Hyper Terminal. This list includes the following commands:

6.1 TEST KIT

The Test Kit is a set of four utilities that facilitate unit installation and maintenance. AWare tools allow the operator to investigate the frequency spectrum, to align the antennas precisely, to set a reasonable output power level, and eventually check the link using the BER test.

6.1.1 SPECTRUM ANALYZER

The Spectrum Analyzer test run on an AlphaWave unit is activated by the SPECTRUM command sent from AWare. By this command the unit scans the full frequency spectrum defined by the Factory Defined Configuration file and stores the measured values of the receive signal levels (RSL) in the RAM memory. To upload the measured RSL values from the unit the X-Modem protocol is used.

The Spectrum Analyzer test provides a graphical representation of the measured RSL values using two-dimensional graphs with the frequencies scaled on the abscissa (y axis) and RSL scaled in dBm on the ordinate (x axis). The Start and Stop Frequency controls define the Frequency Span, which determines the scale on the abscissa. Meanwhile the range of the RSL on the ordinate is fixed and equal to 10 dB, in range of –120 dBm to –20 dBm (Reference Level).

The following controls are available:

- Start Frequency – defines the sweep starting frequency in MHz;
- Stop Frequency – defines the sweep stopping frequency in MHz;

- Refresh – starts the Spectrum Analyzer test procedure on the unit.

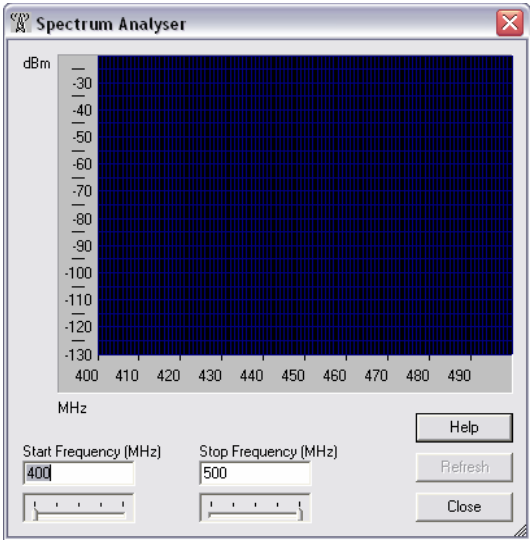

Figure 6-1: Spectrum Analyzer Dialog Box

To activate Spectrum Analyzer dialog box:

1. Select a unit name (icon) from the Site View pane.
2. Select the **Tools > Test Kit** > **Spectrum Analyzer** item of AWare main menu bar.

6.1.2. BERT

The BERT test is developed to test the wireless link quality in the network. It provides the BER statistics measured by a built-in test sequence generator.

The transmit output power level of the AlphaWave units is user selectable. The power level must provide the intact data transmission with minimal influence on other radio systems. The BERT test is also intended to estimate the quality of received radio signal depending on Transmit Power.

There are two states for this test: Transmit or Receive. By selecting

the Transmit option, the network operator will be able to select these values for BERT test:

- The Output Power Level for transmitter: defined through the dedicated control in the range from 13 to 33 dBm (to set the required values, the LINK PWRB command must be used)
- Interval – defines in ms the interval in which the frames will be transmitted. The Interval range is 125 to 1000 ms.
- The modulation type of transmitter – DBPSK, DQPSK, D8PSK, D16QAM

In Transmit state, AWare first sets the outputted power level and then periodically sends the test sequences in predefined intervals. By receiving that sequence, the unit starts transmitting the received frames to the receiver.

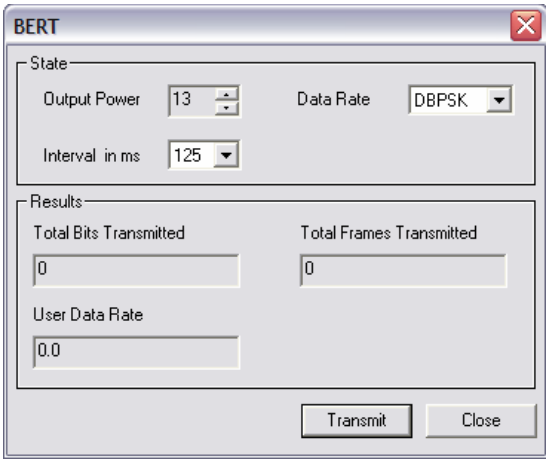

Figure 6-2: BERT Transmit Dialog Box

In Receive state, AWare BERT dialog box shows the received and lost frames counters, total received bits, user data, rate of BER and FLR (Frame Loss Rate). The BERT dialog also indicates the power level of transmitter (TSTUFR REMOTEPWR command will be used), the RSSI/RSL on receiver (it will be obtained through Statistics Interface), and Recommended Output Power Level for transmitter which is calculated based on the transmitter's power level, receiver's RSSI/RSL level, BER and frame loss rate tolerance on receive site.

The allowed values for BER tolerance is $<10^{-3}$, $<10^{-4}$, and $<10^{-5}$. The range of tolerance for frame loss rate is in the range from 10%, 1%, and 0.1%.

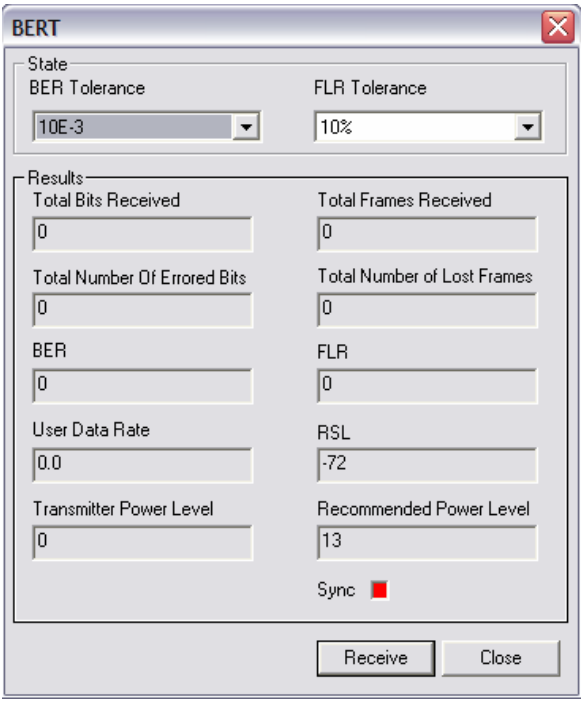

Figure 6-3: BERT Receive Dialog Box

To calculate the Recommended Output Power Level, the following formula must be used:

1. **RPWR = Fade + PWR – RSL + RXS** (recommended value range is from 13 to 33dBm)
2. **Fade** is the Fade Margin in dB as a function of the error tolerance:

	BER	FLR
45 dB	$<10^{-5}$	0.1%
40 dB	$<10^{-4}$	1%
35 dB	$<10^{-2}$	10%

RXS is the receiver sensitivity as a function of the selected modulation type and channel spacing:

	CS	Modulation
-113 dBm	25 kHz	DBPSK
-116 dBm	12.5 kHz	DBPSK
-119 dBm	6.25 kHz	DBPSK
-110 dBm	25 kHz	DQPSK
-113 dBm	12.5 kHz	DQPSK
-116 dBm	6.25 kHz	DQPSK
-97 dBm	25 kHz	D8PSK
-110 dBm	12.5 kHz	D8PSK
-113 dBm	6.25 kHz	D8PSK
-94 dBm	25 kHz	D16QAM
-97 dBm	12.5 kHz	D16QAM
-110 dBm	6.25 kHz	D16QAM

PWR is the transmitter's output power level and **RSL** is the measured receive signal strength.

To activate BERT Test dialog box:

1. Select a unit name (icon) from the Site View pane.
2. Select the **Tools > Test Kit** > **BERT Test** >**Transmit or Receive** option of AWare main menu bar.

Note: The Transmit mode of BER test is not applicable for the receive-only systems.
The BERT test cannot be run for Simplex Transmitter since the remote Simplex Receiver operating in receive-only mode does not provide information needed for link quality estimation.
The BER does not include the bits in the lost frames.

6.2 DEALER CONFIGURATION TOOLS

Dealer Configuration Tools is the group of software utilities intended to load Dealer Configuration Parameters. Dealer Configuration parameters can be stored in the file on the disk and used from the New Profile dialog box.

To activate "Dealer Configuration" dialog box the dealer has to select Tools > Dealer Configuration > Edit Dealer Configuration Menu item. "Dealer Configuration" dialog box consists of two sections in the tab tree:

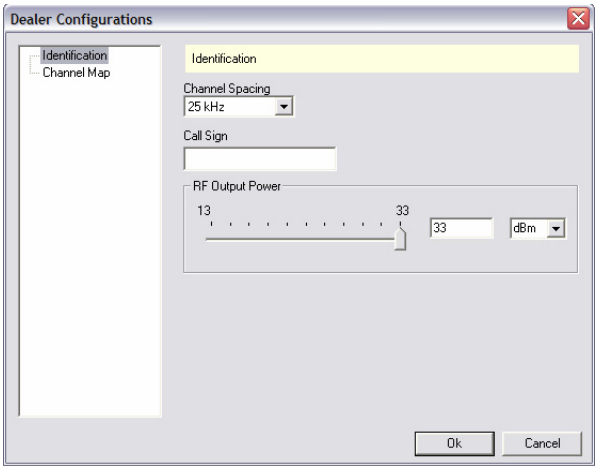

Figure 6-4: Identification for Dealer Configuration

The Identification tab intended to configure main features of the Dealer Configuration. The Identification tab contains following fields:

- **Channel Spacing** – specifies the channel spacing for current configuration. The channel spacing can be one of three different values (6.25 kHz, 12.5 kHz, and 25 kHz) all these values may be specified by the dealer for different users
- **Call Sign** – Indicates the unique ID assigned by FCC
- **Maximum Output Power Level** – specifies maximum allowable output

6.2.1 CONFIGURING CHANNEL MAPPING

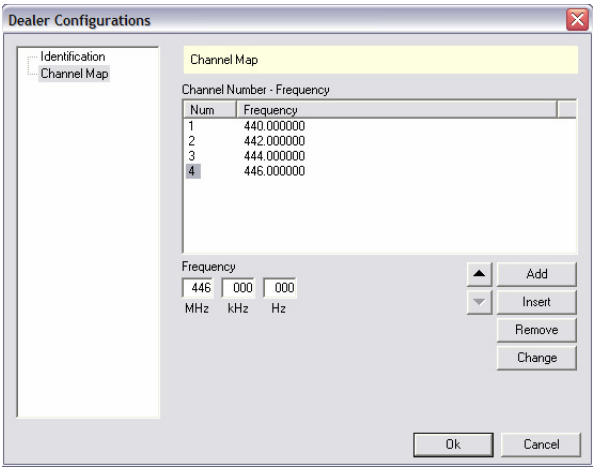

Figure 6-5: Channel Map for Dealer Configuration

The Dealer uses Channel Map tab to program frequencies and map them to corresponding channels. The maximum number of available channel for all ArWest radios is 32. The Channels List field shows all programmed frequencies in the current dealer configuration. The central frequencies are in MHz format and they have to be divisible to minimum channel spacing – 6.25 kHz. The dealer can add and remove channels from dealer configuration, also he can change central frequency and channel mapping.

6.3 FACTORY CONFIGURATION TOOLS

The Factory Configuration tools is a set of software utilities intended to create, export/import to/from external storage, and download to unit factory configuration parameters (including calibration parameters). The calibration parameters include TCXO tuning value (from 1 to 32), and ALC and RSSI/RSL calibration tables.

> Note: The Calibration option is available only in the “Workshop” version of AWare.

6.3.1 TCXO CALIBRATION TOOL

This option allows operator/technician to adjust the output frequency value if it varies during the operation from the predefined value. By opening the TCXO Calibration Tool dialog box the operator/ technician first orders the AlphaWave unit to generate continuous bit stream of all 0-s. The following frequencies are used to measure the TCXO accuracy:

	AW400	AW200	AW100
Testing Frequency	470 MHz	230 MHz	170 MHz
Required Accuracy	400 Hz	200 Hz	150 Hz

The Up/Down controls allow operator/technician to tune the TCXO generated frequency. If the difference between the nominal and measured value is less than Required Accuracy then the test can be completed. To save the TCXO Control value in the Configuration Image, the operator/technician must click the "Apply" button.

AWare automatically switches off the testing mode of unit, if the TCXO Calibration dialog box is closed.

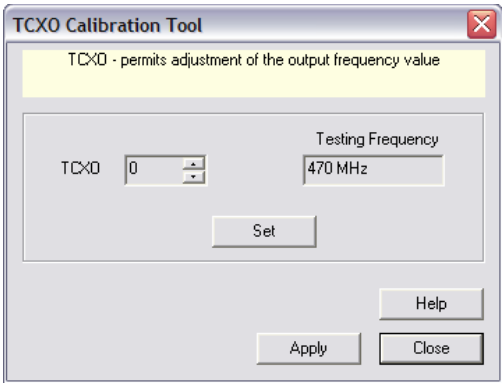

Figure 6-6: TCXO Calibration Box

To activate the TCXO Calibration Tool dialog box:

1. Select a unit name (icon) from the Site View pane.

2 Select the **Tools > Factory Configuration > Calibration Kit** > **TCXO** of AWare main menu bar.

6.3.2 ALC CALIBRATION TOOL

This option allows operator/technician to build the *ALC Table* used by unit's Automatic Level Control (ALC) module to set the precise value of required output power level. The *ALC Table* lists the measurements provided by unit's built-in Power Detector for the output power levels from 13 dBm to 33 dBm. The *ALC Table* also contains the DAC gain and attenuation level for each output power level in the list.

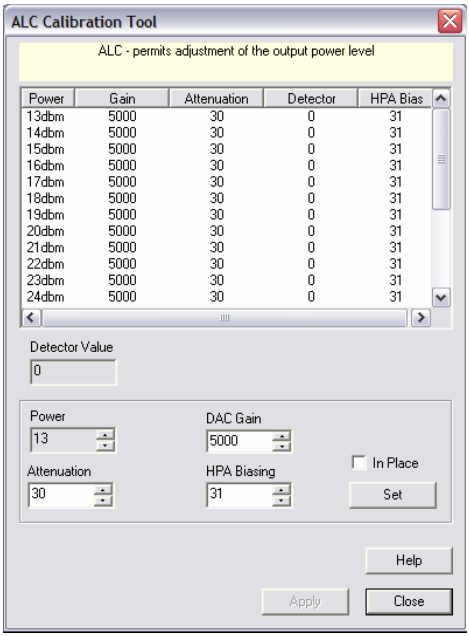

Figure 6-7: ALC Calibration Box

By opening the ALC Calibration Tool dialog box the operator/technician first orders the AlphaWave unit to generate 511-bit length pseudo-random sequence.

The measurement procedure shall be as follows:

1. Set the Desired Output power level to 13 dBm (Power);

Note:	The HPA biasing level is explicitly defined by Desired Output Power level.

2. Change the Attenuation value from 31 to 0 (by step 1); the DAC gain is automatically set to 5000 central value (to set Attenuation, DAC, and HPA biasing, the ALC command must be used, see IS-00003-104);
3. Measure the output power level and go to step 4 if the difference between nominal desired and measured values is less than Required Rough Accuracy (± 2 dBm), if not repeat step 2;
4. Change the DAC Gain value from 2000 – 9000;
5. Measure the output power level, if the difference between the nominal desired and measured values is less than Required Accuracy (± 0.3 dBm) then store the Measured Detector value in the ALC Table using "Apply" button and go to step 6, if not repeat step 4.
6. Increase the output power level by 1 dB and go back to step 2.

The test is completed if the *ALC Table* is filled for all output power levels from 13 to 33 dBm. The Measured Power Detector values are stored in the unit's configuration files image to be loaded into the unit (see section 6.4.2).

To activate the ALC Calibration Tool dialog box:

1. Select a unit name (icon) from the Site View pane.
2. Select the **Tools > Factory Configuration > Calibration Kit** > **ALC** of AWare main menu bar.

6.3.3 RSL CALIBRATION TOOL

The RSL Calibration Tool is intended to map the receive signal level (RSL) to the receive signal strength (RSSI) measured by real time software and to show the AGC value in dB. The range of RSL is -120 to -60 dBm. The Signal Generator used in calibration must cover the frequency range covered by the receiver being tested (100 to 470 MHz to cover the frequency range from VHF to UHF).

By opening RSL Calibration Tool dialog, the operator/technician first

orders the AlphaWave unit to switch on the testing receive mode (TSTRX ON command).

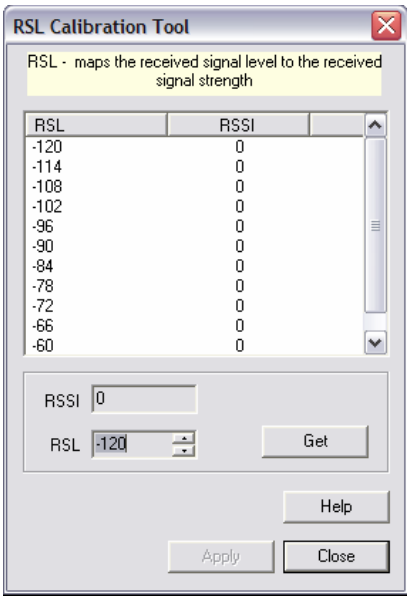

Figure 6-8: RSL Calibration Box

The measurement procedure shall be as follows:

1. Set unit's receiver for 440.000 MHz central frequency
2. Set signal generator to generate 440.00 MHz frequency with -120 dBm output power level
3. Set Receive Test mode using TSTRX ON command (see also IS-00003-14)
4. Save the RSSI value in the RSL/RSSI table using "Apply" button (the TSTRX command is used to read the RSSI value from the unit)
5. Increase the input signal by 6 dBm (for output generator)
6. Repeat steps 4 to 5 for up to -60 dBm

Closing this dialog box stops the testing mode of unit. To load the RSSI/RSL Table into the unit, the Download FCFG dialog box must be used (see section 6.4.2).

To activate the RSL Calibration Tool dialog box:

1. Select a unit name (icon) from the Site View pane.
2. Select the **Tools > Factory Configuration > Calibration Kit** > **RSL** of AWare main menu bar.

6.4 DOWNLOADING TOOLS

6.4.1 DOWNLOADING A NEW IMAGE

The Downloading procedure includes three steps to install upgraded versions of the embedded software images from the PC, on which AWare runs. AWare setup program provides the means to upgrade the embedded software images.

- Select the **Tools > Download Image** command from main menu bar. The Download dialog box for the selected unit is activated (see Figure).
- Select the downloadable image file in the computer by clicking Browse button – the **File Info** box shows complete information about image file if selected file is the right image.
- Select the downloadable image file in the computer by clicking Browse button – the **File Info** box shows complete information about image file if selected file is the right image.
- After selecting the image file, click the Download button to start downloading. The downloading progress is indicated in a separate dialog box.

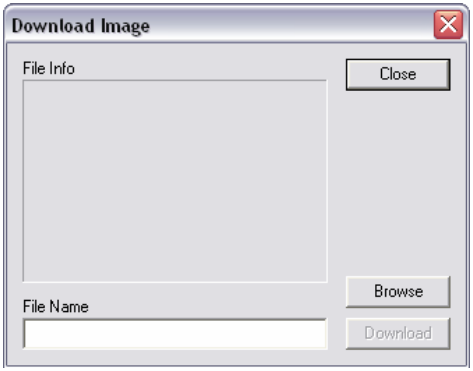

Figure 6-9: Download Dialog Box

> Note: Downloading over the air is not possible for a receive-only system.

6.4.2 DOWNLOADING A DEALER CONFIGURATION FILE

To activate Downloading Dealer Configuration dialog box:

1 Select a unit name (icon) from the Site View pane.
2 Select the **Tools > Dealer Configuration > Download Dealer Configuration ….**

To create the dealer configuration file, the "Dealer Configuration" dialog box is used (see section 6.2).

For the end users the dealer configuration file is a read-only structure. It is prepared and loaded into the unit in production through the serial port using X-Modem protocol.

> Note: Downloading of the dealer configuration file is available only in the "Dealer" version of AWare.

6.4.3 DOWNLOADING A FACTORY CONFIGURATION FILE

To activate Downloading Factory Configuration dialog box:

1 Select a unit name (icon) from the Site View pane.
2 Select the **Tools > Factory Configuration > Download Factory Configuration ...**.

To create the dealer configuration file, the "Dealer Configuration" dialog box is used (see section 6.2)

For the end users the factory configuration file is a read-only structure. It is prepared and loaded into the unit in production through the serial port using X-Modem protocol.

Note:	Downloading of the Factory configuration file is available only in the "Workshop" version of AWare.

7. STATUS AND STATISTICS

7.1 STATUS

7.1.1 TERMINAL TAB

This window is designed for the advanced operator, who is familiar with the system and CLI commands. It allows the operator to work with unit directly without GUI. The Terminal shows all information coming from the unit or transmitting towards it. It can be activated by selecting the appropriate item from menu bar or by right clicking on the unit in the Site View pane.

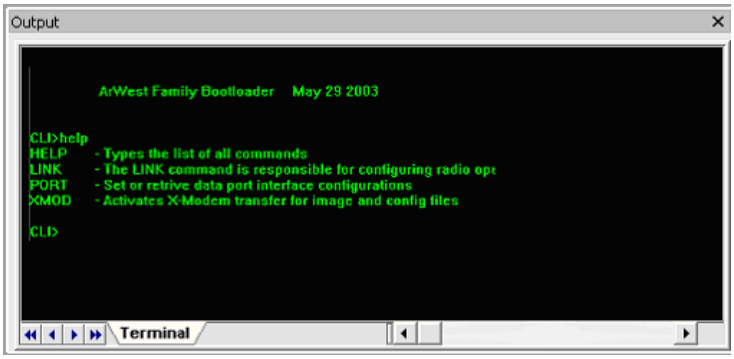

Figure 7-1: Terminal Tab

The Terminal window is located in the Display Pane as its tab.

7.2 PERFORMANCE

7.2.1 VIEWING G.821 STATISTICS

AWare displays the Error Performance reports defined by the G.821 Standard. Each statistical measurement graph displays up to 96 data points along the horizontal axis, and up to 900 seconds on the vertical axis. Each data point along the horizontal axis represents 15 minutes of performance data collection. The G.821 Statistics tabs

include ES, SES, ESR, SESR, Unavailable Time, and Available Time (see Figure 7-3):

- **Errored Second (ES)** - is a one-second period in which one or more bits are in error.
- **Severely Errored Second (SES)** - is a one-second period which has a bit error ratio more than 0.001
- **Errored Second Ratio (ESR)** - shows the ratio of ES to total seconds in available time during a fixed measurement interval.
- **Severely Errored Second Ratio (SESR)** - shows the ratio of SES to total seconds in available time during a fixed measurement interval.
- **Unavailable Time** - begins when the Bit Error Rate (BER) in each second is worse than 0.001 for a period of ten consecutive second (shows period of ten consecutive seconds when the BER in each second is worse than 0.001.)
- **Available Time** - begins when the first second of a period of ten consecutive seconds each of which has a BER better than 0.001.

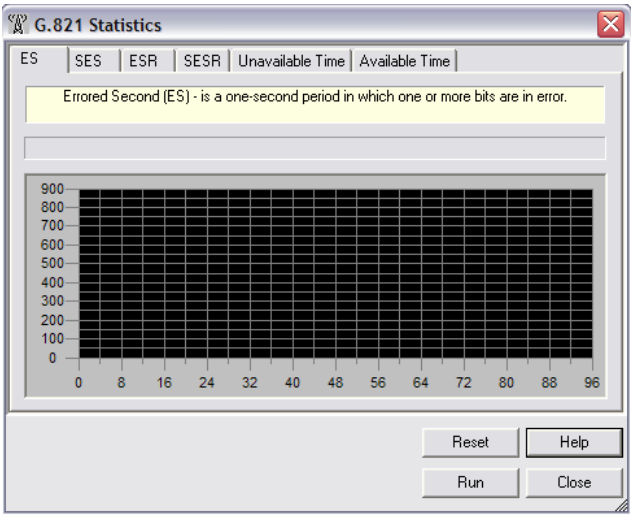

Figure 7-2: G.821 Statistics

The G.821 Statistics tab contains the following controls:

- Reset – Resets the statistic information;
- Run – gets the statistic information;
- Close - Close statistic window;
- Help - Help options for statistic window.

7.2.2 VIEWING RX/TX STATISTICS

The Rx/Tx Statistics dialog window provides the AlphaWave specific statistic information not covered by G.821 standard. This dialog contains nine tabs where the first tab exposes the numerical values for the monitoring parameters:

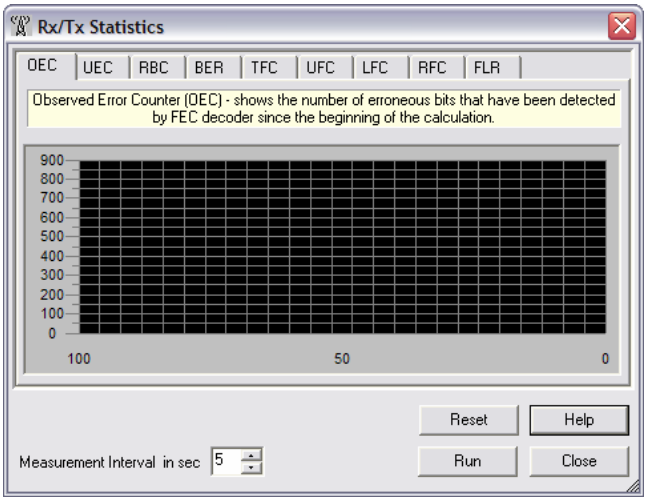

Figure 7-3: RX/TX Statistics

- **Observed Error Counter (OEC) –** shows the number of erroneous bits that have been detected by FEC decoder since the beginning of the calculation.
- **Uncorrected Error Counter (UEC) –** shows the number of erroneous bits that have not been corrected by FEC decoder since the beginning of the calculation.
- **Received Bit Counter (RBC) –** indicates the actual number of bits received since the beginning of the calculation.
- **Bit Error Rate (BER) –** shows the ratio of the number of corrected errors to the number of bits received since the beginning of the calculation.

- **Transmitted Frame Counter (TFC)** – displays the number of transmitted frames since the beginning of the calculation.
- **Unrecoverable Frame Counter (UFC)** – displays the number of received frames that have not been recovered by FEC decoder since the beginning of the calculation.
- **Lost Frame Counter (LFC)** – displays the number of lost frames since the beginning of the calculation.
- **Received Frame (RFC)** – displays the number of received frames since the beginning of the calculation.
- **Frame Loss Rate (FLR)** – shows the ratio of the lost frame number to the total number of frames, which should be received since the beginning of the calculation.

The tabs (OEC, UEC, RBC, TFC, UFC, LFC, RFC, and FLR) are the graphical representation of the monitoring parameters presented in time domain.

7.2.3 VIEWING RSL STATISTICS

The **Receive Signal Level (RSL)** Statistics dialog shows the current level of received signal in dBm. The statistical measurement graph displays up to 96 data points along the horizontal axis. The vertical axis shows the signal level in dBm. This tab contains a control to specify the measurement interval in seconds (the minimum interval equals to 5 seconds). During the measurement process AWare alters the diagram whenever the received signal's diapason changes.

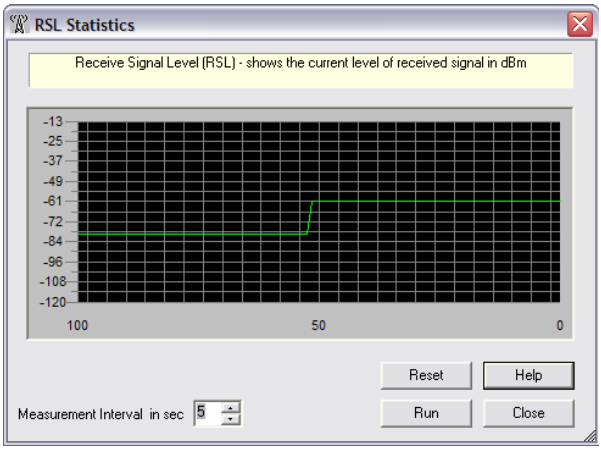

Figure 7-4: RSL Statistics

8. FIRMWARE COMPONENTS

8.1 EMBEDDED SOFTWARE / FIRMWARE

The Embedded Software/Firmware runs on the AlphaWave unit. The firmware consists of the following components:

- Link Control Level (LCL) module, which includes MAC controller and Framer;
- Kernel is a multitask operating system specifically developed for AlphaWave,
- Signal Processing module, responsible for modulation/ demodulation and FEC coding/decoding;
- Configuration and Timing Control module;
- Serial Line Control module.

8.2 COMMAND LINE INTERFACE

The built-in user-friendly Command Line Interface (CLI) allows a user to perform a full configuration of the unit and read the statistics and alarm status. It is the most powerful tool to configure the unit. It makes changes to all possible settings that system will not be able to determine automatically.

The CLI commands allow user to configure and reconfigure the unit's settings. The user configuration parameters that could be changed through the CLI are:

- Data Port Settings
  - Baud Rate
  - Data Bits (8, 7)
  - Parity (Odd, Even, None)
  - Flow control (None, RTS/CTS, XON/XOFF)
- Alarm Settings
  - See Section 1. 2.3 for details.
- Radio Operation Modes
  - See Section 1.1.3 for details
- Sleep modes
  - On/Off

- Activate by internal real-time clock
- Activate through RTS/CTS lines
- Activate by external sense lines
- Activate by any combination of the parameters mentioned before

Note: The unit's configuration that is set or modified through the CLI will be lost after unit's reboot, unless the saving operation is used to store a new setting in the unit's configura-

The CLI commands also provide filing operations, which include:

- Downloading
  - Unit's Configuration files
  - Software Images
- Uploading Unit's Configuration files
- Saving into the configuration files the configuration parameters modified through the CLI.

There are a few commands hidden from the end-user to support the test utilities offered by AWare and Pocket AWare software applications. Another set of hidden CLI commands is intended to facilitate the unit's troubleshooting in production and repair centers.

8.2.1 Command Line Interface Convention

The following convention is implemented in AlphaWave Command Line Interface (CLI):

- An error in the command will be replied by a list of available commands (see also section 4.2.2).
- An error in the in the command's parameters will be replied by a command usage.
- A command followed by "/?" will display a command usage.
- A command with the certain [*Parameter Name*] and blank [*Parameter List*] will display the current settings for a given parameter.

A command with the blank [*Parameter Name*] and [*Parameter List*] will display the current settings for all parameters.

8.3 "AWARE" CONFIGURATION SOFTWARE

"AWare" is a software application running on an external PC in Windows 98/ME/2000/NT/XP environment that provides sophisticated and complete solution for remote and local configuration, performance monitoring and diagnostics. It allows the Network Administrator to organize, manage, and control wireless connections built on AW.

Refer to Chapter 3 for a detailed description of the "AWare" GUI.

8.4 "POCKET AWARE" CONFIGURATION SOFTWARE

"Pocket AWare" Windows-CE based software application, run on PDA (Personal Digital Assistant), will allow operators to configure and maintain the AW radio units.

Refer to Chapter 3 for a detailed description of the "AWare" GUI

APPENDIX A
RADIO MODEM SPECIFICATIONS

Parameter	Specification
Temperature	Operating –30°c to +60°c (ETSI 300-019-1-3 Class 3.1 (E)) Storage –40°c to +80°c
Solar radiation	1000 w/m2 at +40°c
Vibration without Transportation Case	10 to 500 Hz; ± 0.35 mm, 5 cycles, 1 octave/ min within operating temperature range (ISO 9022-36-08)
Bump	25g, 6 ms, 4000 shocks in each direction and axis within operating temperature range ISO9022-31-06 @ operating temperature min./max.
Drop without Transportation Case	1.5 m once to all surfaces on to hardwood (50 mm) over concrete floor within operating temperature range
Water, Sand, and Dust Meets or exceeds the standard outlined in IEC 529 I.P. 67 (water-tight and dust-tight).	Rain: MIL506.4-I Submersion: MIL512.4-I Dust: MIL510.4-I
Humidity (MIL-STD-810F Method 507.4-1)	Min 5 cycles/1 cycle = 48h Max 60°C, max. RH 95% operating Max 65°C, RH 95%, 65h (none operating)
Altitude	-1,000m under sea level to 8,500 m above sea level
Compliance to IEC61000-4:	
Radiated, radio frequency, electromagnetic field immunity	IEC61000-4-3 Level 3
Immunity to the conducted disturbances induced by RF field	IEC61000-4-6 Level 3
Power frequency magnetic field immunity	IEC61000-4-8 Level 4
Electrostatic discharge (contact and air discharge)	IEC61000-4-2 Level 4
Electronic Compliance	
ETSI	ETSI 300-113
FCC	FCC Part 15
Industry Canada	RSS-210
UL	UL 1419
UL Hazardous Location	Class 1, Div 2; Groups A, B, C, and D; hazardous locations
FM	Approved

A-1 Alpha-Wave Environmental Specifications

Parameter	Specification		
Output Power	13 dBm to 33 dBm in 1 dB steps		
Output Power Control Accuracy	±1.5 dB (at normal test conditions) +2.0 dB and -3.0 dB (under extreme test conditions)		
Nominal Output Impedance	50 Ohms		
Carrier Frequency Stability	±1.5 ppm initial stability over temp with ±3 ppm aging/year		
Max. Frequency Error	±1.0 kHz (at normal test conditions) ±1.5 kHz (under extreme test conditions)		
Adjacent Channel Power (Conducted)	25 kHz CS	12.5 kHz CS	6.25 kHz CS
	70 dBc	60 dBc	50 dBc
Spurious Emission (Conducted)	-36 dBm @(9 kHz – 1 GHz) -30 dBm @(1 GHz – 4 GHz)		
Spurious Emission (Radiated)	-36 dBm @(9 kHz – 1 GHz) -30 dBm @(1 GHz – 4 GHz)		
Compliance	FCC Part 15 ETSI EN 300-113		

A-2 Transmitter Specifications

Parameter	Specification		
Noise Figure	10 dB		
Nominal Input Impedance	50 Ohms		
Dynamic Range	-119 to -52 dBm		
Max. Input Signal Level	-10 dBm		
	25 kHz CS	12.5 kHz CS	6.25 kHz CS
Receiver Sensitivity for DBPSK (@ BER 1x 10^{-4}, over temperature –30°C to +60°C)	-113 dBm	-116 dBm	-119 dBm
Co-channel Rejection	-8 dB	-12 dB	-16 dB
Adjacent Channel Selectivity	70 dBc	60 dBc	50 dBc

A-3 Receiver Specifications

APPENDIX B
COMMAND LINE INTERFACE COMMANDS

The built-in user-friendly Command Line Interface (CLI) allows the user to perform a full configuration of the unit and read the statistics and alarm status. It is the most powerful tool to configure the unit. It makes changes to all possible settings that system will not be able to determine automatically.

The CLI commands allow a user to configure and reconfigure the unit's settings. The user configuration parameters that can be changed through the CLI are:

- Data Port Settings
  - Baud Rate
  - Data Bits (8, 7)
  - Parity (Odd, Even, None)
  - Flow control (None, RTS/CTS, XON/XOFF)
- Alarm Settings
- Radio Operation Modes
- Sleep modes
  - On/Off
  - Activate by internal real-time clock
  - Activate through RTS/CTS lines
  - Activate by external sense lines
  - Activate by any combination of the parameters mentioned before

Note*:* The unit's configuration that is set or modified through the CLI will be lost after unit's reboot, unless the saving operation is used to store a new setting in the unit's configura-

The CLI commands also provide filing operations, which include:

- Downloading
  - Unit's Configuration files
  - Software Images
- Uploading Unit's Configuration files
- Saving into the configuration files the configuration parameters modified through the CLI.

There are a few commands hidden from the end-user to support the test utilities offered by AWare and Pocket AWare software applications. Another set of hidden CLI commands is intended to facilitate the unit's troubleshooting in production and repair centers.

B.1 CONVENTION

The following convention is implemented in the Alpha-Wave Command Line Interface (CLI):

- The Carriage Return/Line Feed (CR/LF, 0x0D/0x0A) is a command delimiter.
- The Carriage Return/Line Feed (CR/LF, 0x0D/0x0A) followed by the "CLI> " prompt is a reply delimiter.
- An error in the command is replied by a list of available commands (see also section 0).
- An error in the in the command's parameters is replied by a command usage.
- A command followed by "/?" displays a command usage.
- A command with the certain [*Parameter Name*] and blank [*Parameter List*] displays the current settings for a given parameter.
- A command with the blank [*Parameter Name*] and [*Parameter List*] displays the current settings for all parameters.

B.2 HELP

The HELP command types the list of all available commands:

AW Radio
Command Line Interface

LINK	RF Link Operation Mode
FREQ	Frequency Assignment
DPORT	Data Port Configuration
MPORT	Maintenance Port Configuration
ALARM	Alarm Indication and Alarm Control Configuration
SLEEP	Sleep Mode Configuration
CONNECT	Managed Unit Connection
XMOD	X-Modem mode
STATE	Display Status and Statistics
EVENT	Display List of Events
BOOT	Reboot the unit
SAVE	Save Current Configuration into Configuration File
[COMMAND] /?	Display Command Usage
HELP	Display this usage

Figure B-1: Command Line Interface Usages

B.3 LINK

The LINK command is responsible for configuring radio's operation mode. It has six parameters listed below.

LINK [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter Name	***Parameter List***
PROT	1 – Simplex "Receiver" 2 – Simplex "Transmitter" 3 – "Repeater" 4 – Secondary "Transceiver" (default) 5 – Primary "Transceiver" 6 – Full duplex
DELAY	0 – No Delay (default) The delay (1 – 7) is required delivering the data to the destination receiver. The number of repeaters in the chain defines this value.
MOD	1 – DBPSK 2 – DQPSK (default for AW) 3 – D8PSK 4 – 16QAM
PWRB / PWRW	(13 – 33) / (20 – 2000) – RF output Power in dBm / mW
CHAN	Selects the frequency channel, CN = (1 – 32). The maximal value is defined by number of frequencies in the channel list. The CN = 0 is reserved to set the Frequency Automatic scanning mode.
FHOP	(1 – 128) – Frequency Hoping Pattern number
SCRAM	0 – No Scrambling (default) (1 – 255) – Seed for Pseudo-Random Sequence Generator
ENROL	Enrolls the secondary units into the wireless cluster. The enrolled unit's 6-digit serial numbers are delimited by commas SN_1, SN_2, SN_3 ... SN_{31}, SN_{32}. The number of units in the cluster does not exceed 32.
FEC	0 – Disable Forward Error Correction (FEC) 1 – Enable Reed-Solomon encoding
ARQ	0 – Disable ARQ (1 – 8) – Number of Requests

Note: The frequency defined by CHAN parameter is not valid if Frequency Hopping mode is selected.
In the Frequency Hoping mode, the Frequency Pattern generator must generate random numbers smaller than the number of frequencies listed in the unit's frequency list.
The ENROL parameter is not valid if the "Receiver" protocol is selected

B.4 DPORT

The PORT is an object that responsible for data port interface configurations like Bit Rate, Flow Control, etc.

PORT [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter	***Parameter List***
RATE	0 – Maintenance Port baud rate Others – Set or retrieve data port's baud rate
BITS	Set number of bits in one byte (8 or 7)
PARITY	0 – None 1 – Odd 2 – Even
FLOW	0 – None 1 – SW (XON/XOFF) 2 – HW (RTS/CTS)

B.5 MPORT

The PORT is an object that responsible for data port interface configurations like Bit Rate, Flow Control, etc.

PORT [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter Name	***Parameter List***
RATE	0 – Auto. Others – Set or retrieve maintenance port's baud rate
BITS	Set number of bits in one byte (8 or 7)

B.6 ALARM

The ALARM command is intended to set up the alarm indication mode and alarm control lines' behavior.

ALARM [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter Name	*Parameter List*
TTL1	0 – TTL_OUT1 = logic "1" 1 – TTL_OUT1 = TTL_IN1 (received from remote unit) 2 – TTL_OUT1 = TTL_IN1 and TTL_IN2 (received from remote unit) 3 – TTL_OUT1 = TTL_IN1 or TTL_IN2 (received from remote unit)
TTL2	0 – TTL_OUT2 = logic "1" 1 – TTL_OUT2 = TTL_IN2 (received from remote unit) 2 – TTL_OUT2 = SYNC Loss 3 – TTL_OUT2 = BER > BERTH or SYNC Loss
BERTH	1 – BER Threshold $>10^{-3}$ (default threshold level for BER) 2 – BER Threshold BER $>10^{-4}$

The Alarm LED must indicate the SYNC Loss and BER exceeding the defined threshold.

B.7 SLEEP

The SLEEP command determines the sleep mode parameters. The sleeping AW can be activated by real-time CLK, DTR/RTS lines, and command received through TTL inputs. The user can select one, two, or all three conditions.

SLEEP [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter Name	*Parameters List*
CLK	0 – Do not activate by internal real-time clock (1 – 255) – Activate by internal real-time clock after 100 to 25500 msec of sleeping
HW	0 – Do not activate through DTR/RTS lines 1 – Activate through DTR/RTS lines
TTL	0 – Do not activate by external sense lines 1 – Activate by external sense lines
GTS	0 – Disable Sleep mode (default) (1 – 255) – Go to sleep mode if there is no activity in 10 to 2550 msec

B.8 CONNECT

To connect the radio unit (local or remote) through the local maintenance serial port, the CONNECT command must be used.

CONNECT [*Unit_Numb*] [*/?*]

Where the *Unit_Numb* is an assigned decimal number for the unit to

be connected. To get the complete unit list, the CONNECT command must be used with no parameter. The list of units in the Point-to-Point link with established connection with a remote unit is shown in Figure B-2:

Unit	Product	Serial Number	Connect
1	UK00425	003578659922	
2	UK00425	003574459923	C

Figure B-2: Connection List

Where the Product column show the factory configuration number loaded into the unit and Serial Number column shows its unique serial umber.
To connect to the local unit, the parameter (*Unit_Numb*) must be equal to 1.

B.9 XMOD

The XMOD command activates the X-Modem mode that is used by system operator to load a factory configuration or update a firmware image.

XMOD [*Loading*] [*/?*]

The *Loading* specifies a file being loaded:

- IMAGE – intended to load an updated firmware image (can be used in the field by end-user);
- FACTIMG – intended to load a factory firmware image (hidden command used only in production);
- DFCFG – intended to load a factory configuration (hidden command used only in production);
- CFGUP – intended to upload the radio configuration, which includes the factory and user-defined configuration (hidden command used by AWare application only);
- CFGDN – intended to download the radio user configuration (hidden command used by AWare application only).

Note: To activate a newly loaded firmware image and conf iguration, the unit must be rebooted (see also Section 6.4.3).

B.10 STATE

The STATE command is used to check the state of the wireless link, the unit in the link, and the alarm control lines. To specify a radio unit (local or remote), the CONNECT command must be used in prior of STATE command using.

STATE [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter Name	***Parameters List***
TTL1	0/1 – State of TTL_IN1 line
TTL2	0/1 – State of TTL_IN2 line
RSSI	-52 to -116 dBm – Indicates the Receive Signal Strength in dBm
BER	10^{-8} to 10^{-3} – Indicates the BER level

The STATE command without *Parameter Name* indicates all values as shown in Figure B-3:

TTL_IN1 = 0
TTL_IN2 = 1
RSSI = -110 dBm
BER < E-5

Figure B-3: STATE Command Display

B.11 EVENT

The AW unit records the events in the event log, which is 100 events deep. The events in the log are identified by a unique event code.

The EVENT command is intended to read the log of events from the unit. The unit responses to the EVENT command by sending the event codes consecutively in order of occurrence.

B.12 BOOT

The BOOT command is intended to reboot the unit using the factory and user selectable configurations for system initialization. A new unit will have the default values for user selectable parameters that should be loaded in production.

The BOOT command also selects the real-time software/ firmware image. The software loader after reboot runs the image selected by BOOT command. The factory firmware image will be used if the updated firmware is not loaded or if it is corrupted or has any other problem.

BOOT [*Image*] [*/?*]

The *Image* specifies a selected real-time software image:

* FACT – selects the real-time software/firmware image;
* UPDT – selects the user updated real-time software/firmware image.

B.13 SAVE

The SAVE command is intended to store the unit's currently used configuration into the User Configuration file. The configuration stored in the User Configuration file will be activated by automatically after unit's reboot.