



NetLink e340/h340/i640 Wireless Telephone
NetLink Telephony Gateway and SpectraLink Radio Protocol (SRP)
Configuration and Administration

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Issue J

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Note concerning the NetLink Wireless Telephones:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.



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WARNING: SpectraLink products contain no user-serviceable parts inside. Refer servicing to qualified service personnel.

**IMPORTANT SAFETY INFORMATION**

Follow these general precautions while installing telephone equipment:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines



Please visit spectralink.com to view regulatory declarations.

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1. About This Document

This document explains how to configure and maintain the NetLink e340, h340 and i640 Wireless Telephones (handsets) when used with the NetLink Telephony Gateway.

1.1 SpectraLink Corporation Model Numbers

This document covers the following registered model numbers:

SNP2400, RNP2400

1.2 Related Documents

SpectraLink 8000 Telephony Gateway: Administration Guide for SRP
(1725-36028-001)

SpectraLink 8000 SVP Server: Administration Guide for SRP (1725-36032-001)
Available at http://www.spectralink.com/resources/manual_netlink.jsp.

LinkPlus Interface Guide (1725-361xx-001 where xx indicates a number corresponding to the type of PBX)
Available at http://www.spectralink.com/resources/interface_guides.jsp.

Polycom WLAN Compatibility Table (1725-36040-001)

Access Point Configuration Guide (1725-36xxx-001 where xxx indicates a number corresponding to the type of access point).
Available at http://www.spectralink.com/resources/wifi_compatibility.jsp.

Best Practices for Deploying Enterprise-Grade Wi-Fi Telephony white paper.
Available at http://www.spectralink.com/resources/white_papers.jsp.

1.3 Customer Support Hotline

SpectraLink wants you to have a successful installation. If you have questions please contact the Customer Support Hotline at (800) 775-5330. The hotline is open Monday through Friday, 6 a.m. to 6 p.m. Mountain time.

1.4 Icons and Conventions

This manual uses the following icons and conventions.



Caution! Follow these instructions carefully to avoid danger.



Note these instructions carefully.

NORM

This typeface indicates a key, label, or button on the NetLink Wireless Telephone (handset)..

2. NetLink Wireless Telephone Overview

The NetLink e340, h340 and i640 Wireless Telephones are mobile handsets for workplace telephone systems. The handset operates over an 802.11b wireless Ethernet LAN providing users a wireless voice over IP (VoIP) extension. By seamlessly integrating with the NetLink Telephony Gateway and the site PBX, handset users are provided with high-quality mobile voice communications throughout the workplace. The handset gives users the freedom to roam throughout the workplace while providing all the features and functionality of a desk phone.

The handsets reside on the wireless LAN with other wireless devices using direct sequence (DS) spread spectrum radio technology. The handset radio transmits and receives packets at up to 11 Mb/s.

All SpectraLink products use our LinkPlus digital integration technology to integrate with various digital switch platforms. Using LinkPlus technology, handsets emulate digital telephone sets to deliver advanced capabilities such as multiple line appearances and LCD display features. See the *LinkPlus Interface Guide* for your PBX for information about mapping the PBX features to the handset.

2.1 SpectraLink Voice Priority (SVP)

SVP is the SpectraLink quality of service (QoS) mechanism that is implemented in the handset and AP to enhance voice quality over the wireless network. SVP gives preference to voice packets over data packets on the wireless medium, increasing the probability that all voice packets are transmitted efficiently and with minimum or no delay. SVP is fully compatible with the IEEE 802.11b standards.

2.2 QoS and Security

The NetLink SVP Server is an Ethernet LAN device that works with the AP to provide QoS on the wireless LAN. Voice packets to and from the handsets are intercepted by the NetLink SVP Server and encapsulated for prioritization as they are routed to and from an IP telephony server or gateway. See *SpectraLink 8000 SVP Server: Administration Guide for SRP* for detailed information about this device.

NetLink Wireless Telephones support basic Wi-Fi Multimedia (WMM) as part of the 802.11e protocol. If the AP supports WMM, the handset automatically discovers and uses it. WMM does not replace the NetLink SVP Server as described in the following paragraph. WMM settings must be configured on the NetLink Telephony Gateway and on the NetLink SVP Server.

When the system employs four or fewer NetLink Telephony Gateways and no NetLink SVP Server, the NetLink Telephony Gateways provide SpectraLink Voice Priority (SVP). SVP is required for handling voice packets on an 802.11 WLAN. In this configuration the handsets are limited to a maximum of 2 Mb/s. If the 11 Mb/s transmission rate is desired, a NetLink SVP Server must be added to the system. Note that if any 2 Mb/s NetLink handsets are in use (PTB500's) the NetLink e340/h340/i640 Wireless Telephones will automatically limit speed to 2 Mb/s to maintain compatibility.

The NetLink e340/h340/i640 Wireless Telephones support Wired Equivalent Privacy (WEP) as defined by the 802.11 specification. SpectraLink offers the product with both 40-bit and 128-bit encryption.

NetLink Wireless Telephones also support the 802.11i protocol including Wi-Fi Protected Access (WPA and WPA2) pre-shared key (PSK). As vendors introduce access points (APs) that are eligible to become Wi-Fi Certified for WPA-PSK and/or WPA2-PSK, SpectraLink will determine their compatibility with the handsets and include them on the *Polycom WLAN Compatibility Table*.



The latest software versions are required to support the features described in this document.

2.3 Quick Start Guide

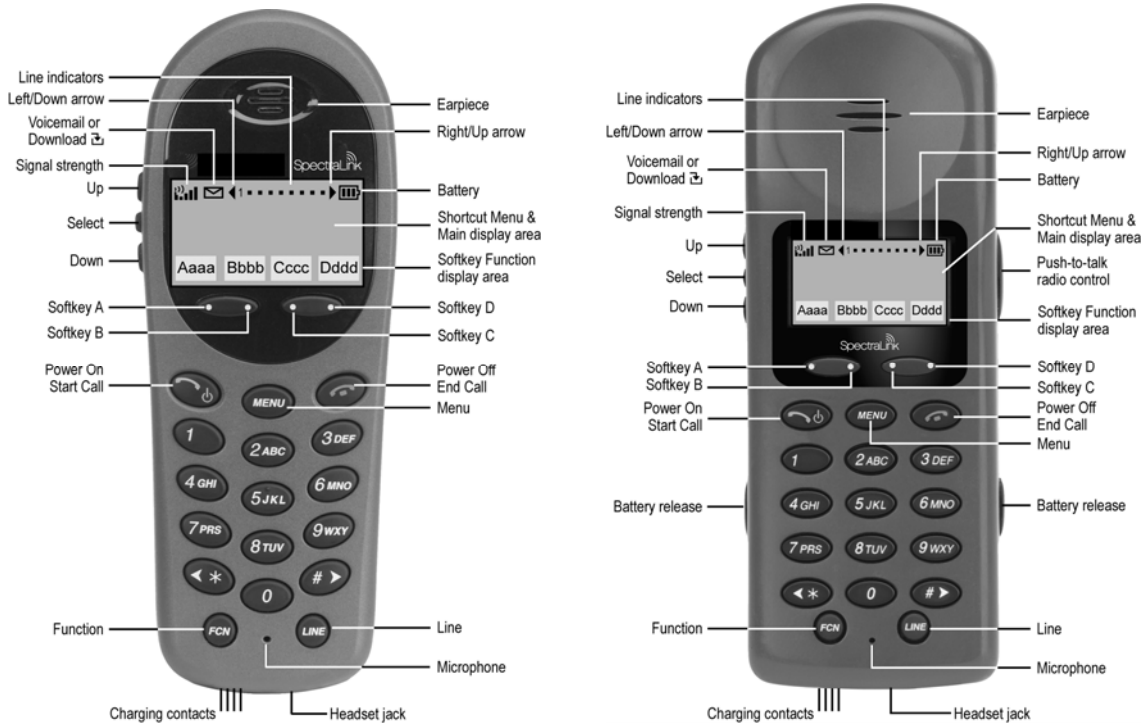
1. A wireless LAN must be properly configured and operational through the use of 802.11b wireless access points.
2. A NetLink Telephony Gateway must be available on the network and the handset must be registered to it in order to load the appropriate software into the handsets. Most installations choose to take advantage of the TFTP server that accompanies the NetLink Telephony Gateway, making a separate TFTP server unnecessary.
3. The NetLink Telephony Gateway or NetLink SVP Server, which controls the QoS on the wireless LAN for the handsets, must be on the same subnet as the handsets and have the proper versions of software.
4. Download the correct NetLink Wireless Telephone software per section 4.2 *Configuration Process*. Ensure the software is properly loaded on the NetLink Telephony Gateway, or a separate TFTP server.
5. Download updates to the NetLink SVP Server software (if the NetLink SVP Server is installed) per *SpectraLink 8000 SVP Server: Administration Guide for SRP* Chapter 5, section on *Software Updates*.
6. Download updates to the NetLink Telephony Gateway software per *SpectraLink 8000 Telephony Gateway: Administration Guide for SRP* chapter 18, *Software Maintenance*.
7. Configure your handset to ensure that it associates with the wireless LAN, has the appropriate software and is registered to the appropriate NetLink Telephony Gateway.



IP multicast addresses are used by the NetLink i640 Wireless Telephone. This requires that multicasting be enabled on the subnet used for the NetLink Wireless Telephones, SVP Server, and Telephony Gateways.

Routers are typically configured with filters to prevent multicast traffic from flowing outside of specific domains. The wireless LAN can be placed on a separate VLAN or subnet to reduce the effects of broadcast and multicast traffic from devices in other network segments.

2.4 NetLink Wireless Telephone Specifications



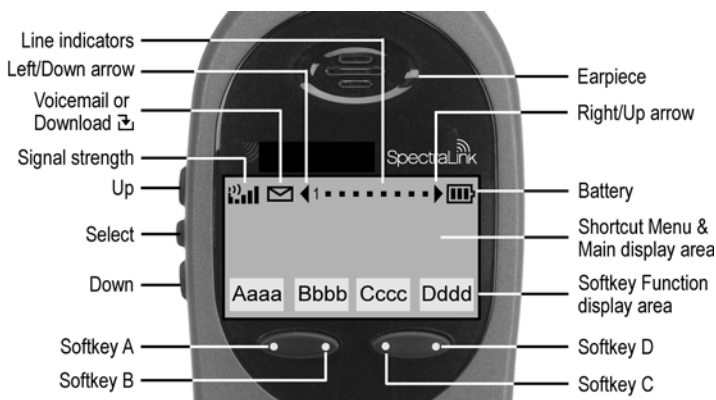
NetLink e340/h340 Wireless Telephone¹

NetLink i640 Wireless Telephone

Radio frequency	2.4000 - 2.4835 GHz
Transmission type	Direct sequence spread spectrum (DSSS)
Transmit data rate	Up to 11 Mb/s
Radio QoS	SpectraLink Voice Priority (SVP), WMM
Wireless security	Wired Equivalent Privacy (WEP), 40-bit and 128-bit; Cisco FSR; WPA-PSK, WPA2-PSK
FCC certification	Part 15.247
Management	DHCP, TFTP
Voice encoding	ADPCM (Proprietary)
Transmit power	up to 100 mW peak, < 10 mW average (U.S./N.A.)
Display	Pixel-based (up to 4-line x 18-character alphanumeric, plus line and status indicators)
e340/h340 dimensions	5.5" x 2.0" x 0.9" (14.0 x 5.1 x 2.3 cm)
i640 dimensions	5.9" x 2.2" x 1.0" (15.0 x 5.6 x 2.5 cm)
e340/h340 weight	4.2 ounces (119.0 g)
i640 weight	6.0 ounces (170.1 g)
Battery capacity	4 hours talk time, 80 hours standby (30 hours standby if PTT is enabled)

¹ The NetLink e340 Wireless Telephone is shown. The NetLink h340 Wireless Telephone's specifications are identical to the NetLink e340 Wireless Telephone's specifications.

2.5 Handset Display



See the *LinkPlus Interface Guide* for your PBX for information about how the handset emulates the features of the PBX utilized at your site. The following general explanations may not apply due to differences in PBX configurations.

Alphanumeric

Display information provided by the PBX when the handset is off-hook will be passed directly to the handset main display. Certain characters may be used by the PBX that are not implemented in the handset, such as definable and special characters.

Signal strength

The Signal Strength icon indicates the strength of the signal from the access point and can assist the user in determining if the handset is moving out of range. It is always present on the display in the upper left corner.

Battery charge

The Battery icon indicates the amount of charge remaining in the Battery Pack. It is always present on the display in the upper right corner. There are three levels and when only one level remains there is limited talk time remaining and the Battery Pack needs to be charged.

Voicemail

The Voicemail icon is activated when a new voice mail message is received if the feature is supported by the phone emulation. It appears to the right of the Signal Strength icon.

Download

Indicates that the handset is checking for or downloading code. This icon only appears while the handset is running the over-the-air downloader. It appears to the right of the Signal Strength icon in the same location as the Voicemail icon.

Ringling and tones

The ringing types (normal or vibrate) are selected by the handset user and are not accessible or changeable by the PBX. The audible and vibrating ringer on the

handset will follow the protocol command provided by the PBX if the user selects **PBX** cadence described in section 3.2 *User-defined Preferences*.

Audio features

Speaker-phone features are not available on the handset unless using the NetLink Docking Station.

Line indicators

The Line Indicator bullets on the handset will convert to a solid or flashing number to mimic the Line LEDs on the deskset, based on the assignment made at the PBX.

2.6 Startup Sequence

The handset goes through an initialization sequence at startup. The line icons **1** through **9** display and count down as the handset steps through this sequence. This is usually very rapid. If there is any difficulty at any step that prevents initialization from continuing, an error message will display and the related icon(s) will stay on. Please see the *Handset Status Messages* table at the back of this document for instructions on how to handle error messages that occur during initialization.

Icon	The icon(s) shown in bold turns off when:
123456789	The handset has located and authenticated and associated with at least one AP, and is proceeding to bring up higher-layer networking functions.
12345678	The handset is either configured for Static IP, or if configured for DHCP the DHCP discovery process has started.
1234567	If DHCP is configured, a DHCP response was received which contains a good DNS server configuration.
123456	Note: Only valid on non-SRP protocol. Indicates one of the following: Static IP configuration, or SVP Server address found in DHCP response, or SVP Server address found via DNS lookup.
12345	All networking functions are complete (notably, DHCP) and the handset is proceeding with establishing the SRP link to the NetLink Telephony Gateway.
1234	The SRP link is established, all network stack initialization is complete, proceeding with application-specific initialization.
123	The link between the handset and the NetLink Telephony Gateway is established.
(no icons) EXT. XXX	Initialization is complete. The handset is in standby mode ready to receive and place calls.

2.7 Handset Modes

Standby (on-hook)

In the standby mode the handset is waiting for an incoming call or for the user to place an outgoing call. The extension number is shown on the display and there is no dial tone. In this mode, the handset is conserving battery power and wireless LAN bandwidth.

When an incoming call occurs the handset enters a transitional state and will ring until the call is answered by pressing the **Start Call** key or the **End Call** key is pressed to silence the ringing.

Active (off-hook)

To place a call, press the **Start Call** key. This transitions the handset to active off-hook mode. There is a dial tone, the handset is in communication with the PBX, and the display shows information as it is received from the PBX. The user may place a call or press the **FCN**, **MENU** or **LINE** key to access operations.

The handset is also in the active mode when an incoming call is answered.

When an incoming call occurs during an active call the handset will play the second line ringing sound until the call is answered, the caller hangs up, or the call transfers to voice mail. If **End Call** is pressed, the first call is terminated and the handset reverts to a full ring.

The active modes utilize the most bandwidth and battery power. To conserve these resources, return the handset to the standby mode when a call is completed by pressing the **End Call** key.

2.8 Handset Displays

Status display

Displays information from the PBX in two lines of text and displays available softkeys in the softkey display area. The PBX text may be truncated as some PBXs send 24 characters and the handset display area is 16 characters.

LINE display

Most, but not all, PBXs allow for more than one line appearance. The line appearances are mapped to corresponding line icons across the top of the handset display.

MENU display

Most, but not all, PBXs have expanded features that are programmed to the softkeys on the handset. Pressing the **MENU** key from the active state displays the full list of features that have been programmed to the softkeys and their shortcut. OAI features, if assigned, will also be displayed with their shortcuts. If configured, pressing **MENU** in an active state will display the diagnostic menus.

FCN display

The **FCN** key is used to scroll through the softkey display area. Pressing the **FCN** key will display the next level of programmed softkeys. Pressing it repeatedly will scroll through all four levels, or as many levels as have been programmed.

3. NetLink Wireless Telephone Configuration

Prior to configuring a NetLink e340, h340, or i640 Wireless Telephone, it must be associated with one and only one line on one of the NetLink Telephony Gateways. Then it must be configured per the instructions in this section. The following instructions assume that the handset has been properly associated with a line on a NetLink Telephony Gateway. See *SpectraLink 8000 Telephony Gateway: Administration Guide for SRP* for additional information. While handsets are being associated, the system will continue normal operation.

Use the *Wireless Device Planning Worksheets* filled out by the network or system administrator to be sure you are correctly assigning telephone parameters.

The NetLink Configuration Cradle is an accessory device designed to automate configuration of e340, h340, and i640 models of the NetLink Wireless Telephone. The Configuration Cradle is connected to a PC via a serial cable. A downloadable Configuration Cradle program runs on the PC and enables the system administrator to establish and store configuration options for system, group and user levels. A configuration plan may be set up in the program and downloaded into a handset or a configured handset may be placed in the cradle and its configuration may be uploaded and edited or saved.

Please see your service representative or contact SpectraLink Customer Service for more information about this time-saving device.

3.1 The Admin Menu

The Admin menu contains configuration options that are stored locally (on each handset). Every handset is independent; if the default settings are not desired, the admin options must be set in each handset requiring different settings.

Opening the Admin menu

1. With the handset powered OFF, simultaneously press and hold the **Power On** and **Power Off** keys.
2. Release the **Power On** key, wait for a single beep, then release the **Power Off** key. The first option on the Admin menu displays.



If an admin password has been set, the display will require its entry before opening the Admin menu. If no password is set, the display will proceed directly into the Admin menu.

Entering and editing Admin menu options

An asterisk (*) next to an option on the display indicates that the option is selected. Use the **Up**, **Down**, and **Select** side buttons and the softkeys to navigate and select:

- Up/Down buttons:** Display previous/next menu item.
- Select button:** Selects the menu item or option.
- OK softkey:** Selects the menu item or option.
- Save softkey:** Saves the entry.
- Bksp softkey:** Backspaces to allow editing of entry.
- Cncl softkey:** Cancels edit and returns to previous menu level.
- Up softkey:** Returns to previous menu level.
- Exit softkey:** Exits the menu (at the top level).
- End Call key:** Exits to standby mode (from any level)

Alphanumeric string entry

1. Press the first digit/letter. The digit displays. Press the key again to scroll through the letters associated with that key.

Example: If you press **2** repeatedly, you will see **2, A, B,** and **C, a, b,** and **c.**

The following table shows which key will allow you to enter non-numeric characters or other characters not represented on the keypad.

To Enter	Press
. - _ ! # \$ % & ' () * + , ; / \ = @ ~	1
Space	0
Q,q	7
Z,z	9

2. When the correct entry displays, press the right-arrow key to move on to the next character. Repeat for each digit/letter of the entry. To erase, press the left-arrow key or **Bksp** softkey to erase the previous character.
3. Press the **Save** softkey to save the entry.
Press the **Cncl** softkey to abort and return to the menu without saving any changes.

The following table lists the Admin menu items. The default settings have an * prior to the option. Detailed descriptions of each item appear below the table.

Admin menu

Admin Menu Items	2 nd Level	3 rd Level	4 th Level	5 th Level
Phone Config	License Option	Set Current	[List per download]	
	Push-to-talk	Enable Channels	*Channel 1 *Channel 2 *Channel 3 *Channel 4 *Channel 5 *Channel 6 *Channel 7 *Channel 8	
		Allow/Disallow	*Allow PTT Disallow PTT	
Admin Password	Enter PW	Re-enter Password		
Network Config	IP Addresses	*Use DHCP		
		Static IP	Phone IP Default Gateway Subnet Mask Syslog Server IP	
	ESS ID	*Learn Once		
		Learn Always		
		Static Entry		
	Security	*None		
		WEP	Authentication	Open System Shared Key
			WEP On/Off	
		Key Information	Default Key Key Length Key 1-4	
		Rotation Secret		
Cisco FSR	Username Password			
WPA-PSK	Passphrase Direct Entry			
WPA2-PSK	Passphrase Direct Entry			
Reg. Domain: xx				
Transmit Power	*Maximum 50 mW 30 mW 20 mW 15 mW 10 mW 5 mW			
Diagnostics	Run Site Survey			
	Diagnostics Mode	Diagnostics On		
		*Diagnostics Off		
Syslog Mode	*Disabled Errors Events Full			
Restore Defaults				

* default setting

Phone Config

License Option

License Option lets you select the VoIP protocol that your site is licensed to download and run. The SpectraLink Radio Protocol (SRP) used for the NetLink e340/h340/i640 Wireless Telephones in a NetLink Telephony Gateway system requires License Option Selection **007**. Any other protocol will cause the handset to malfunction.

Push-to-talk

All eight push-to-talk channels are allowed by default. To toggle the allowed status of any channel, select **Allowed Channels**, scroll to the channel to be disallowed and press the **Select** side button. Allowed channels are displayed with an ***** in the left column. Only those channels allowed in the Admin menu will appear on the Standby menu where they can be enabled or disabled by the end user. To disallow push-to-talk entirely, select **Allow/Disallow**, scroll to and select **Disallow PTT**.

Admin Password

The Admin Password controls access to the administration functions in the Admin menu. The password must be set in each handset for which controlled access is desired. Handsets are shipped without any Admin menu password. Data entry for the password uses the alphanumeric string entry technique. Type the password and press the **Save** softkey. A confirmation prompt will appear. Type the password again and press the **Save** softkey. If the passwords match, the Admin password has been set.



If you **Save** with no entry, the password is erased and the display will not require it before displaying the Admin menu.

Network Config

IP Address

There are two modes in which the handset can operate: DHCP enabled or Static IP. Select the mode for operation from the IP Address menu:

*** Use DHCP** Will use Dynamic Host Configuration Protocol to assign an IP Address each time the handset is turned on. If DHCP is enabled, the handset also receives all other IP Address configurations from the DHCP server.

Static IP Allows you to manually set a fixed IP Address. If selected, the handset will prompt for the IP Addresses of each configurable network component. When entering addresses, enter the digits only, including leading zeroes. No periods are required.

Regardless of the mode in which the handset is operating, the following components must be configured:

Phone IP The IP Address of the handset. This is automatically assigned if DHCP is used. If using Static IP configuration, you must obtain a unique IP Address for each handset from your network administrator.

Default Gateway and Subnet Mask Used to identify subnets, when using a complex network which includes routers. Both of these must be configured either with an IP address under Static IP (not set to 000.000.000.000 or 255.255.255.255) or with DHCP for the handset to contact any network

components on a different subnet. If configured on the DHCP server, use option 3 for the Default Gateway and option 1 for the Subnet Mask. Contact your network administrator for the proper settings for your network.



NetLink Wireless Telephones cannot roam with uninterrupted service between subnets unless specific LAN components are present. Certain AP/Ethernet switch combinations establish a layer-2 tunnel across subnets that enables the handsets to roam. Without this capability, any call in progress will be dropped when the user moves out of range and the handset must be power cycled in order to resume functionality in the new subnet area.

Ensure that all your access points are attached to the same subnet for proper operation. The handset can change subnets if DHCP is enabled and the handset is powered off then back on when within range of access points on the new subnet.

Please see *Best Practices for Deploying Enterprise-Grade Wi-Fi Telephony* for detailed configuration information.

Subnets are not recommended in NetLink Telephony Gateway environments.

Syslog Server IP The IP address of the syslog server. See section 6 *Diagnostic Tools* for more information.

ESSID

Select the option that will enable the handset to acquire APs with the correct ESSID (Extended Service Set ID, aka SSID) each time it is turned on.

Note about Automatic Learn options: Broadcast ESSID must be enabled in the access points for ESSID learning to function. Refer to the *Configuration Guide* for your access point or call your access point vendor for specifics. Overlapping wireless systems complicate the use of ESSID learning as the handset in an overlapping area could receive conflicting signals. If this is the situation at your site, use **Static Entry** or **Learn Once** in an area without overlapping ESSIDs.

Static Entry If your access points do not accept broadcast ESSID or if there are overlapping wireless systems in use at the site, enter the correct ESSID manually.

*** Learn Once** Allows the handset to scan all ESSIDs for a DHCP server and/or the NetLink Telephony Gateway. Once either is found, the handset retains the ESSID from whichever access point it associates with at that point. When overlapping wireless systems exist, the Learn Once feature allows the handset to use only the ESSID established at first learn at all subsequent power ons. This ESSID is retained by the handset until the ESSID option is reselected.

Learn Always Allows the handset to automatically learn the ESSID at each power on or loss of contact with the wireless LAN (out of range). This may be useful if the handset will be used at more than one site.

Security

***NONE** Disables any 802.11 encryption or security authentication mechanisms.



For WEP, WPA-PSK and WPA2 PSK set each of the following options to match exactly the settings in your APs.



Encryption codes display as they are entered. For security reasons codes will not display when a user returns to encryption options in the Admin menu.

WEP (Wired Equivalent Privacy) A wireless encryption protocol that encrypts data frames on the wireless medium allowing for greater security in the wireless network. If WEP is required at this site, you must configure each handset to correspond with the encryption protocol set up in the access points. Select the entries from the options below to enable the handset to acquire the system.

Authentication

Select either **Open System** or **Shared Key**.

WEP On/Off

Select either **WEP Off** or **WEP On**.

Key Information

Default Key Enter the key # specified for use by the handsets. This will be **1** through **4**.

Key Length Select either **40-bit** or **128-bit**, depending on the key length specified for use at this location.

Key 1-4 Scroll to the key option that corresponds to the **Default Key** that was entered above. Enter the encryption key as a sequence of hexadecimal characters. (Use the **2** and **3** keys to access hexadecimal digits A through F, use the right arrow key to advance to the next digit, and the left arrow key to backspace.) For 40-bit keys you will need to enter 10 digits, for 128-bit keys you will need to enter 26 digits. The display will scroll as needed.

Rotation Secret This is used for proprietary WEP key rotation. Refer to your custom document if this feature is supported in your system.

Cisco FSR (Fast Secure Roaming) In order to provide the highest level of security without compromising voice quality on Cisco Aironet wireless LAN access points, SpectraLink and Cisco Systems have cooperated to implement the Fast Secure Roaming mechanism. FSR is designed to minimize call interruptions for NetLink handset users as they roam throughout a facility. Existing Aironet 350, 1100, and 1200 APs may require a firmware upgrade to support FSR. Cisco FSR requires advanced configuration of the Cisco access points in your site. See your Cisco representative for detailed documentation on configuring your access points and other required security services on your wired network. To configure Cisco FSR in your NetLink Wireless Telephone, you must enter a Radius Server username and password into each handset.

Username Enter a username that matches an entry on your Radius server. Usernames are alphanumeric strings, and can be entered using the alphanumeric string entry technique.

Password Enter the password that corresponds to this username.

WPA-PSK The security features of WPA (Wi-Fi Protected Access) using PSK (pre-shared key) are available and may be used if supported by the access points in the facility. Select either **Passphrase** and enter a passphrase between 8 and 63 characters in length or **Direct Entry** and enter the 256-bit key code.

WPA2-PSK The security features of WPA2 using PSK are available and may be used if supported by the access points in the facility. Select either **Passphrase** and enter a passphrase between 8 and 63 characters in length or **Direct Entry** and enter the 256-bit key code.



Consult the *Configuration Guide* for the access points installed in your facility for information on which of the WPA versions are recommended by SpectraLink engineering. Configure the recommended version on the AP and select the corresponding option on the Admin menu.

Regulatory Domain

The Regulatory Domain will default to North America on the handset display. FCC requirements dictate that the menu for changing the domain be available by password, which in our case is the **LINE** key. To change the domain, press **LINE** and then enter the digits that represent the site's domain. Note that both digits must be entered.

01 - North America

02 - Europe (except Spain and France); Japan (channels 1-13)

04 - Spain

05 - France



As of this writing, Spain and France are adopting the general European Regulatory rules. Check with your wireless LAN administrator or supplier for which domain to enter in these countries.

Transmit Power

Default transmit power is Maximum. It may be set to a lower number if necessary. If changed from the default, ensure the Transmit Power setting is the same on all handsets and all APs.



Power is limited to 30mW in regulatory domains other than North America.

Diagnostics

Run Site Survey

The Site Survey mode is activated by selecting this option. Site survey starts running immediately upon selecting this option. See the *Diagnostic Tools* section for more information about Site Survey.

Diagnostics Mode

See section 6.2 *Diagnostics Mode* for a detailed explanation of the Diagnostics Mode options.

Syslog Mode

See section 6.3 *Syslog Mode* for a detailed explanation of the Syslog Mode options.

Restore Defaults

The Restore Defaults option will set all user and administrative parameters except License Option to their factory defaults.

3.2 User-defined Preferences

The following user-defined preferences are also covered in the NetLink e340/h340/i640 Wireless Telephone user guides. The system administrator can refer to this list for more information about customizing handset settings.

To configure the following options, the handset must acquire the system (no error message may display) and be in standby mode at the extension display. This is the standby mode. While in the standby mode, press and hold **FCN** briefly to open the user options menu. Use the following keys to display and select options:

- Up/Down buttons:** Display previous/next menu item.
- Select button:** Selects the menu item or option.
 - OK softkey** Selects the menu item or option.
- Save softkey:** Saves the entry.
- Bksp softkey:** Backspaces to allow editing of entry.
- Cncl softkey:** Cancels edit and returns to previous menu level.
 - Up softkey:** Returns to previous menu level.
- Exit softkey:** Exits the menu (at the top level).
- End Call key:** exits to standby mode (from any level).

Standby menu

Standby menu item	2 nd Level	3 rd Level	4 th Level
Lock Keys			
Language	[List per download]		
Ring Options	Telephone Ring	Ring Cadence	Off *PBX Continuous Short Pulse Long Pulse
		Ring Tone	*Tone 1 Tone 2 Tone 3 Tone 4 Tone 5
		Ring Volume ²	Bars
		Vibrate Cadence	*Off PBX Continuous Short Pulse Long Pulse
		Ring Delay	*No Delay 5 Second Delay 10 Second Delay
	Auxiliary Ring 1 Auxiliary Ring 2		
Phone Options	Noise Mode	*Normal High Severe	
	Key Tones	*Enable Tones Disable Tones	
	Warning Tones	*Enable warnings Disable warnings	
	Display Contrast	Contrast %	
	Keypad Autolock	*Disable 5 seconds 10 seconds 20 seconds	
System Info	Phone IP Addr		
	Gateway IP Addr		
	Firmware Version		
Extension			
Push-to-talk ³	Channel	Current Channel: X 1 2 3 4 5 6 7 8 New Channel = ?	
	Enable/Disable	PTT Enabled *PTT Disabled	
	Audio Volume	Bars	
	Tone Volume	Bars	

* default setting

² Ring volume setting is available only on the NL i640 Wireless Telephone.³ Push-to-talk is available only on the NetLink i640 Wireless Telephone.

Main Menu Scroll through the list of options by pressing the **Up** and **Down** side buttons. Select an option by pressing the **Select** side button.

Lock Keys			
Language			
Ring Options			
Phone Options			
System Info			
Extension			
Push-to-talk [i640]			
OK			Exit

Lock Keys When enabled, the Keypad Lock option will lock the keypad immediately. If the keypad is locked, it may be unlocked by the end user pressing the **Unlk** softkey and then the **#** key.

Language If the system supports multiple languages, the language option will list what languages are available. Select the language from the list.

Ring Options The Ring option allows the user to set the ring for three separate functions. Telephone ring is used for usual telephony functions. The Auxiliary Rings may be used to set different ringing patterns for OAI applications.

Telephone Ring			
Auxiliary Ring 1			
Auxiliary Ring 2			
OK			Up

Telephone Ring Telephone Ring allows the user to set a distinctive ring style, volume and sequence. Select from an audible ring or a vibrate-only ring or a vibrate ring along with or followed by an audible ring.

Ring Cadence			
Ring Tone			
Ring Volume [i640]			
Vibrate Cadence			
Ring Delay			
OK			Up

Ring Cadence The cadence is the rhythm of the ring. It may be set to a pre-programmed ring cadence or it may be set to obtain its cadence from the PBX. The PBX option is designed to utilize any distinctive rings sent by the PBX while allowing the user to set unique rings for auxiliary applications.

Off			
PBX			
Continuous			
Short Pulse			
Long Pulse			
OK			Up

Off: silent

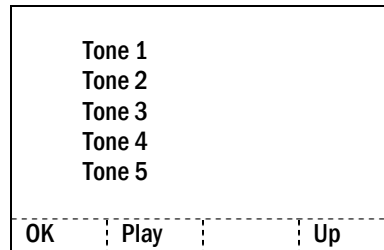
PBX: PBX determines ring cadence (e.g. the PBX may send rings that differentiate between internal and external calls.)

Continuous: rings continually until answered

Short Pulse: rings in short bursts

Long Pulse: rings in long bursts

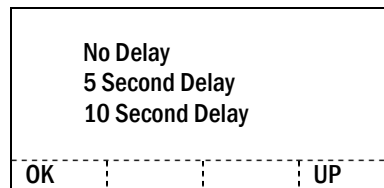
Ring Tone Select from five available tones (scroll to Tone 5 option). The **Play** softkey allows the user to preview the tone before selecting. If Ring Cadence is turned off, the Ring Tone option will not appear on the menu.



Ring Volume (NetLink i640 Wireless Telephone only) The user may select a volume level by pressing the **Up** and **Down** side buttons and then pressing the **OK** softkey. The graduated volume bar indicates the levels. This setting may be overridden by adjusting volume while the handset is ringing. Ring Volume does not display if Ring Cadence is turned off.

Vibrate Cadence Vibrate Cadence options are the same as for Ring Cadence

Ring Delay Ring Delay determines how long the vibrate cadence will play before the audible ring starts. If the Ring Cadence or Vibrate Cadence is turned off, the Ring Delay option will not appear on the menu.



Auxiliary Ring 1 and 2 Ring Auxiliary rings are designed to be utilized by OAI applications, enabling the user to set a distinctive ring for these applications.

Phone Options

Noise Mode Provides options that describe the noise level in your environment. Changing this mode to **High** or **Severe** adjusts the handset's microphone and in-ear speaker volume to account for background noise. Select **Normal** for most office environments; **High** for moderate background noise; or **Severe** for extremely noisy conditions. If you use **High** or **Severe** modes in a quiet environment, the person on the other end of the line may find it difficult to hear your voice.

Key Tones Key tones may be turned on or off and determine if tones play when keys are pressed. Key tones are enabled by default.

Warning Tones The handset plays various warning tones such as system up or down, out of range, etc. These tones may be turned on or off and are enabled by default.

Display Contrast The display may need to be adjusted for different lighting situations. Contrast may be set by pressing the **Up** and **Down** side buttons until the desired contrast is displayed and then pressing the **OK** softkey.

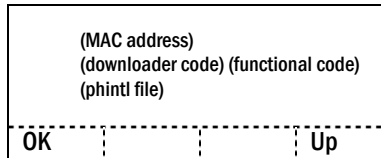
Keypad Autolock The handset may be set to lock the keypad automatically when in standby mode. The automatic locking function of the keypad may be disabled (the default) or adjusted for a 5, 10 or 20 second delay before locking.

System Info

Phone IP Addr Displays the IP address currently assigned to the handset.

Gateway IP Addr Displays the IP address currently assigned to the NetLink Telephony Gateway.

Firmware Version Displays the software version running the handset. The MAC address is the hardware identification number and is set at the factory. Three code numbers correspond to the three files that each version uses.



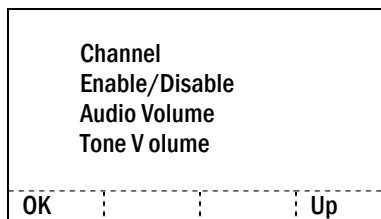
Downloader: pd11gl3.bin

Functional: pd11spc3.bin

Phintl: phintl24.bin

Extension Displays the extension currently assigned to the handset. This number is for display purposes only; entering it does not assign the extension in the host telephone system.

Push-to-talk The NetLink i640 Wireless Telephone incorporates push-to-talk functionality. PTT may be allowed or disallowed in the Admin menu. If allowed, the user may enable or disable locally, and may set the channel, tone volume and audio volume. The menu for push-to-talk does not appear if PTT is disallowed on the Admin menu or if no channel is enabled on the Admin menu.



Channel The user may enable any PTT channel that has been allowed in the Admin menu by entering the corresponding number from the keypad. If PTT has been enabled in this handset, the default channel is the lowest allowed channel as set in the Admin menu.

Current Channel: X			
1	2	3	4
5	6	7	8
New Channel = ?			
-----			Up

Enable/Disable The user may enable or disable PTT on this handset. PTT is disabled by default.

PTT Enabled			
PTT Disabled			
-----			Up
OK			Up



If PTT is allowed in the Admin menu and enabled by the user, Battery Pack life when the handset is in standby mode is decreased to about 30 hours.

Audio Volume, Tone Volume The user may select volume levels by pressing the **Up** and **Down** side buttons and then pressing the **OK** softkey. The graduated volume bar indicates the levels. The Audio Volume setting may be overridden by adjusting volume while the handset is in a push-to-talk call.

(Additional options may be present. Contact your system administrator for information.)

4. License Management

The NetLink Wireless Telephone system supports a number of different IP protocol integrations. All NetLink e340, h340, and i640 Wireless Telephones are shipped from SpectraLink with a generic software load that allows them to associate to a wireless LAN and download their functional software from a TFTP server. **The handsets may not function properly without downloading appropriate software.**

The following details the process to properly configure handsets and download software via over-the-air file transfer.

4.1 Requirements

- A wireless LAN must be properly configured and operational through the use of 802.11b wireless access points.
- NetLink Telephony Gateway must also be connected to your network and completely operational, and the handset must be registered to it.
- The NetLink Telephony Gateways have a TFTP server and must be available on the network in order to load the appropriate software into the handsets. Most installations choose to take advantage of the TFTP server that accompanies the NetLink Telephony Gateway, making a separate TFTP server unnecessary.
- Finally, ensure that the Battery Pack on the handset is fully charged.

4.2 Configuration Process

1. Download the latest NetLink Wireless Telephone software from <http://www.spectralink.com/softwareUpdates>,
2. Place the latest version of the NetLink e340, h340 or i640 Wireless Telephone SRP code on the TFTP server and ensure the TFTP server is started. The four files that are needed must be named:

```
pd11spc.bin  
pd11gl3.bin  
pd11spc3.bin  
phintl24.bin.
```

See *SpectraLink 8000 Telephony Gateway: Administration Guide for SRP* to set the TFTP server information and/or use the NetLink Telephony Gateway's built-in TFTP server.

3. If statically assigning IP addresses, ensure that the **Phone IP**, **Subnet Mask**, and **Default Gateway** information are accurate in the Admin menu. If using a DHCP server, ensure that the DHCP option is set. See section 3 *NetLink Wireless Telephone Configuration* for detailed configuration instructions.
4. Ensure the handset has properly configured **ESSID** and **Reg Domain** Information within the Admin menu. If you are accepting broadcast **ESSIDs** at your access points, the handset will automatically learn the ESSID information when powering on. See section 3 *NetLink Wireless Telephone Configuration* for detailed configuration instructions.
5. Using the Admin menu on the handset, ensure the **License Option** menu option is set to **007**. This ensures the handset will check for the proper SRP files each time it powers on.
6. Ensure security settings are properly programmed. See section 3 *NetLink Wireless Telephone Configuration* for detailed configuration instructions.
7. Exit the Admin menu.
8. The SRP code will now download to the handset. The status bar will increment fully across the display for each function that is being performed in the download process. Upon completion of the update process, the handset will re-boot with the new firmware.



For future software upgrades, simply update the files that are stored on the TFTP server. Each time the handset is powered up, it will check with the TFTP server to ensure it has the proper software version.

5. Testing a Handset

Verify proper registration and operation of each handset by performing the following tests on the handset in an active wireless area.

1. Power on the handset by pressing **Power On**. You will see a series of messages displayed as the handset acquires the system. The handset should display the user extension or dashes if no extension is programmed. Any error messages should clear.
2. Press the **Start Call** key. The extension number should clear and you should hear dial tone. On some digital systems, depending on how the telephone system is programmed, you may have to select a line to get dial tone. Place a call and listen to the audio quality. End the call by pressing the **End Call** key.
3. Place a call to the handset and verify ring, answer, clear transmit, and clear receive audio.
4. Use the **FCN** key to verify all softkey programmed features on the handset. Use the **MENU** key and scroll through the Shortcut menu. Ensure the features displayed on the Shortcut menu match those displayed in the softkey function display area.
5. Press the **End Call** key. Any line indicators should turn off and the extension number display will return.

If any of these steps fails to operate as described, refer to section 9 *Troubleshooting* for corrective action.

6. Diagnostic Tools

Run Site Survey, **Diagnostic Mode** and **Syslog Mode** are three diagnostic tools provided to assist the WLAN administrator in evaluating the functioning of the handset and the system surrounding it. Diagnostic Tools are enabled in the Admin menu.

6.1 Run Site Survey

Site Survey is used to evaluate the facility coverage before certifying that an installation is complete. It can also be used at any time to evaluate coverage by testing signal strength, to gain information about an AP, and to scan an area to look for all APs regardless of ESSID. The information available through Site Survey includes:

- ESSID
- Beacon Interval
- Information regarding support of 802.11d, 802.11g, 802.11h, and other 802.11 amendment standards as required.
- Current security configuration
- Start the site survey by selecting **Run Site Survey** from the Admin menu. The mode starts immediately.

When the test is started, it is by default in “single ESSID” mode. When the **Any** soft key is pressed (softkey **A**), all APs, regardless of ESSID are displayed, and the softkey changes to say **MyID**. Pressing the **MyID** soft key will revert to the “single ESSID” mode and change the softkey back to **Any**.

The display would look like the following for the multiple AP mode.

1	1	1	1	1	1	-	2	2	3	3	4	4	4	
1	1	1	1	1	1	-	2	2	3	3	4	4	4	
1	1	1	1	1	1	-	2	2	3	3	4	4	4	
1	1	1	1	1	1	-	2	2	3	3	4	4	4	
A	n	y									D	e	t	l

Where:

- 111111 = The last three octets of the on-air MAC address for a discovered AP.
- 22 = The signal strength for the specified AP.
- 33 = The channel number of the specified AP.
- 444 = The beacon interval configured on the specified AP.
- Any/MyID = Softkey to toggle between “single ESSID” and “any ESSID” mode.
- Detl/Smry = Softkey to toggle between the multiple AP (summary) display, and the single (detail) displays for each AP.

The following screen shows how the display would look when there are three APs configured with an ESSID that matches that of the handset. The first has a signal strength of -28dbm, is configured on channel 2, with a beacon interval of 100ms. The second has a signal strength of -48dbm, is configured on channel 6, with a

beacon interval of 200ms. The third has a signal strength of -56dbm, is configured on channel 11 with a beacon interval of 100ms.

```

a b 7 b c 8 - 2 8 0 2 1 0 0
2 a e 5 7 8 - 4 8 0 6 2 0 0
2 a e 5 9 6 - 5 6 1 1 1 0 0

A n y                               D e t l

```

When the any ESSID mode is selected, the summary display contains the first six characters of the APs ESSID instead of the beacon interval as in the example below.

```

a b 7 b - 2 8 0 2 A L P H A
2 a e 5 - 4 8 0 6 W S M T E S
2 a e 5 - 5 6 1 1 v o i c e

M y I D                               D e t l

```

In detail mode the display would appear as follows. The left/right arrow keys will move between AP indices.

```

i : b b b b b b s n c h b c n
e e e e e e e e e e D G H I
r r r r r r r r r r r r + x x x x
m m m G : g g g g P : p p p p
A n y                               S m r y

```

Where:

- i = Index of selected AP (value will be from 0 to 3 inclusive)
- bbbbbb = The last three octets of the BSSID for a discovered AP.
- sn = Signal strength in -dbm
- ch = Channel
- bcn = Beacon interval
- eeeeeeeee = ESSID (Up to first 11 characters)
- DGHI = Standards supported
- rrrrrrr = Rates supported. Basic rates will have a “b” following the rate.
- + = more rates are supported than those displayed
- xxxx = WMM or UPSD if those QoS methods are supported
- mmm = Security mode
- G:gggg = Group key security
- P:pppp = Pairwise key security
- Any/MyID = Softkey to toggle between “single ESSID” and “any ESSID” modes.
- Detl/Smry = Softkey to toggle between the multiple AP display (summary), and the single AP display (detail).

Numbers racing across the handset display indicate AP information is being obtained. A **Waiting** message indicates the system is not configured properly and the handset cannot find any APs.

Solving coverage issues

Coverage issues are best resolved by adding and/or relocating access points.

Overlap issues may be resolved by reassigning channels to the access points or by relocating the access points. See section 9.1 *Access Point Problems* for more information.

6.2 Diagnostics Mode

The Diagnostics Mode is used to evaluate the overall quality of the link between the handset, AP, and infrastructure side equipment, such as PBX, SVP Server, and gateways. Unlike Site Survey, the Diagnostics Mode is used while the functional code is running, and during a call.

When Diagnostics Mode is turned on in the Admin menu, the handset can display diagnostic screens any time it is active (in a call).

The display of information is instigated by pressing the **MENU** key. Only four of the diagnostic counters listed below can be shown at a time. Pressing the **MENU** key multiple times will cycle through the various counters and the normal off hook (PBX) display. The numeric icon at the top of the display indicates what screen number is being displayed. For example the first time the **MENU** key is pressed, the **1** icon is shown, and the first four counters are displayed, the next time it is pressed, the **2** icon is shown, and the next four counters are displayed, the counters will be cycled through in this fashion until there are no more counters to be displayed. After all the counters have been displayed, the screen returns to the normal off hook PBX screen.

Note that the normal use of the **MENU** key is not available if Diagnostics Mode is enabled.

The information provided by the Diagnostics Mode includes:

Screen 1

- Missed receive packet count since power up (MissedRcvCnt)
- Missed transmit packet count since power up (MissedXmtCnt)
- Receive retry count since power up (RxRetryCount)
- Transmit retry count since power up (TxRetryCount)

M	i	s	s	e	d	R	c	v	C	n	t	n	n	n	n	n
M	i	s	s	e	d	X	m	t	C	n	t	n	n	n	n	n
R	x	R	e	t	r	y	C	o	u	n	t	n	n	n	n	n
T	x	R	e	t	r	y	C	o	u	n	t	n	n	n	n	n

Screen 2

- Jitter = average error or “wobble” in received packet timing, in microseconds
- LastRate = Last successful transmit data rate
- GatewayType = Gateway type

J i t t e r	n n n n n
L a s t R a t e	n n n n n
G a t e w y T y p e	m n e m o

Where:

- mnemo – A mnemonic that indicates what type of gateway is being used
- SawA2 – All handsets are rate limited to 2Mb because a 500 series NetLink Wireless Telephone is on the network.
- 11Mb – Gateway with SVP Server and no 500 series NetLink Wireless Telephones. This system can run at the full 11Mb speed.

Screen 3

Screen 3 contains a list of the APs that are heard and the following parameters from each AP:

- Indicator as to whether this is the current AP or an index into the list of other APs heard
- Last 2 octets of the MAC address of the AP
- Channel number
- Signal strength
- Either the 802.11 Association ID from the current AP or a mnemonic for the reason code indicating why the handset didn’t hand off to this other AP.

C	:	m	m	m	m	c	h	-	s	s	a	i	d	
1	:	m	m	m	m	c	h	-	s	s	m	n	e	m
2	:	m	m	m	m	c	h	-	s	s	m	n	e	m
3	:	m	m	m	m	c	h	-	s	s	m	n	e	m

Where:

- C – Indicates the AP that the handset is currently using
- n – Indicates an index into the list of other APs, where n is equal to 1, 2, or 3
- mmmm – This hexadecimal number is the last 2 octets of this AP’s MAC address
- ch – Channel number the AP is configured on
- -ss – Signal strength for the AP in dBm
- aid – The Association ID for the currently associated AP
- mnem – A mnemonic that indicates why the handset didn’t hand off to this other AP:
 - Unkn – Reason unknown
 - Weak – Signal Strength too weak
 - Rate – One or more basic rates not supported

Full – AP can not handle bandwidth requirements
 AthT – Authentication Timeout
 AscT – Association Timeout
 AthF – Authentication Failure
 AscF – Association Failure
 SecT – Security Handshake Timeout
 SecF – Security Handshake Failure
 Cnfg – AP not configured correctly for security, QoS mode or infrastructure network.

Screen 4

- Association count since power up (AssocCount)
- Re-association count since power up (ReAssocCount)
- Association failures since power up (AssocFailure)
- Re-association failures since power up (ReAssocFail)

A s s o c C o u n t	n n n n n
R e A s s o c C o u n t	n n n n n
A s s o c F a i l u r e	n n n n n
R e A s s o c F a i l	n n n n n

Screen 5

- Security error count since power up (Sec-ErrCount)
- MAC sequence number of frame with last security error (LstSecErrSeq)

S e c - E r r C o u n t	n n n n n
L s t S e c E r r S e q	n n n n n

6.3 Syslog Mode

A syslog server must be present on the network in order for the handset to send the log messages and have them saved. The syslog server will be found with DHCP option 7 if the handset is using DHCP. If static addresses are configured, the syslog server's IP address can be configured statically in the Admin menu.



If the syslog server address is blank (000.000.000.000 or 255.255.255.255) or the handset is using DHCP and no option 7 is received from the DHCP server, the handset will not send any syslog messages.

Admin menu options:

- ***Disabled** turns syslog off.
- **Errors** causes the handset to log only events that we consider to be an error (see below).
- **Events** logs all errors plus also some other interesting events (see below).
- **Full** logs all the above plus a running stream of other quality information (see below).

The table below lists the syslog messages and which level of logging will produce them:

Message type	Errors	Events	Full
Failed Handoff	Yes	Yes	Yes
Successful Handoff	No	Yes	Yes
Security Error	Yes	Yes	Yes
Call Start/End	No	Yes	Yes
Audio stats	No	No	Yes (every 5 secs)
Audio error threshold exceeded	Yes	Yes	Yes
Radio stats	No	No	Yes (every 5 secs)
Radio error threshold exceeded	Yes	Yes	Yes

All syslog messages will include:

- Date and time (to 1/100th of second) since handset power on (currently set to Jan-1 00:00.00)
- Handset's MAC address
- Handset's IP address
- Sequence number

The table below lists the additional items in each Message type:

Failed Handoff (Sent whenever the handset attempted to handoff, but failed trying.)	Failed AP MAC Failed AP signal strength Current AP MAC Current AP signal strength Failure reason
---	---

Successful Handoff	New AP MAC New AP signal strength Old AP MAC Old AP signal strength Reason for handoff Other candidate APs: MAC Signal strength Reason not used
Security Error	AP MAC AP signal strength Security mode Error details (mode dependent)
Call Start	Call type (telephony, OAI, PTT) AP MAC AP signal strength
Call End	AP MAC AP signal strength
Audio stats	AP MAC AP signal strength Payload size (in msec) Payloads sent Payloads received Payloads missed (not received) Payloads missed rate (over last 5 seconds) Payloads late Payloads late rate (over last 5 seconds) Average jitter
Audio error threshold exceeded (Sent if payloads missed rate or payloads late rate exceeds 2%, or if the average jitter is over 2 msec)	Same as audio stats
Radio stats	AP MAC AP signal strength Directed packets sent Directed packets received Multicast packets sent Multicast packets received Broadcast packets sent Broadcast packets received TX dropped count TX drop rate (over last 5 seconds) TX retry count TX retry rate (over last 5 seconds) RX retry count RX retry rate (over last 5 seconds)
Radio error threshold exceeded (Sent if TX drop rate exceeds 2% or TX or RX retry rate exceeds 5%)	Same as radio stats

Messages are formatted like the following example:

```
Jan 1 00:01:26.72 0090.7a02.2a1b (172.16.0.46) [001a] RStat: AP 00:40:96:48:1D:0C (-56 dBm),
Sent 783523, Recvd 791342, MSnt 245, MRcd 5674, BSnt 43, BRcd 10783, TX drop 43 (0.0%), TX retry
578 (1.2%), RX retry 1217 (1.6%)
```

7. Certifying the Handsets

Prior to determining that an installation is complete, test the handsets following the sequence given in section 5 *Testing a Handset* and conduct a site survey mode test according to the directions given in section 6 *Diagnostic Tools*. Note any areas where coverage is conflicting or inadequate. Note any system difficulties and work with your wireless LAN and/or LAN system administrator to determine the cause and possible remedy. See section 9 *Troubleshooting* for clues to possible sources of difficulties. If any adjustments are made to the system, re-test the device in the same vicinity to determine if the difficulty is resolved.

The SpectraLink field service engineer should not leave the site before performing installation verification.

These tests must be performed in typical operating conditions, especially if heavy loads occur. Testing sequence and procedure is different for every installation. Generally, you should organize the test according to area and volume, placing numerous calls to others who can listen while you perform coverage tests. Note any areas with excessive static or clarity problems and report it to a SpectraLink service engineer.

The coverage test will also require you to put the handset in **Site Survey** mode and walk the entire coverage area to verify all access points.

7.1 Conducting a Site Survey

Conduct a Site Survey of the installation, by walking the site looking for interfering 802.11 systems, adequate coverage and channel assignment, and correct AP configuration.

1. Referring to section 6.1 *Run Site Survey*, put a handset into Site Survey in the **Any** ESSID mode, **Smry** display. Walk throughout the site checking for any expected APs or other ESSIDs.
2. Then, walk the site again, in **MyID** ESSID mode, **Smry** display. This time check that every location has adequate coverage (there should be at one AP stronger than -70dBm in all areas) and has good channel allocation (at any point, the strongest AP shown should be on a different channel than the next best choice).
3. Finally, use the single AP (**MyID**) and **Detl** display to check each AP, to ensure it is configured for the proper data rates, beacon interval, 802.11 options enabled, QoS method, and security method.
4. Make any necessary adjustments to AP locations and configurations and repeat steps 1 through 3 until the Site Survey shows adequate coverage and correct configuration at every location.

The installation is not complete until these certification steps have been performed. Do not hand out Wireless Telephones at a site that has not been certified.

8. Software Maintenance

The NetLink e340, h340, and i640 Wireless Telephones use proprietary software programs written and maintained by SpectraLink Corporation. The software versions that are running on the handsets can be displayed during power on by holding down the **Power On** button.

SpectraLink or its authorized dealer will provide information about software updates and how to obtain the software (for example, downloading updates from a Web site).

Upgrading handsets

After software updates are obtained from SpectraLink, they must be transferred to the NetLink Telephony Gateway or other TFTP server. See *SpectraLink 8000 Telephony Gateway: Administration Guide for SRP* for an explanation of how to update the NetLink Wireless Telephone software in the NetLink Telephony Gateway so that it can then be downloaded into the handsets.

NetLink Wireless Telephones allow over-the-air transfer of software updates from the NetLink Telephony Gateway to the handsets. The downloader function in the handset checks its software version every time the handset is turned on. If there is any discrepancy the handset immediately begins to download the update.

Normal download messages

When the handset is powered on, it displays a series of messages indicating that it is searching for new software, checking the versions, and downloading. The normal message progression is:

Message	Description
Checking Code	Handset is contacting the TFTP server to determine if it has a newer version of software that should be downloaded.
Erasing Memory	Handset has determined that a download should occur and is erasing the current software from memory. This message also displays a progress bar. When the progress bar fills the display line the erase operation is complete.
Updating Code	Handset is downloading new software into memory. The number icons at the bottom of the display indicate which file number is currently being downloaded. This message also displays a progress bar. When the progress bar fills the display line the update operation is complete on that file.

When the update is complete, the handset displays the extension number, and is ready for use.

Download failure or recovery messages

The following display messages indicate a failure or recovery situation during the download process. See section 9 *Troubleshooting* for more information about each message.

- Server Busy
- TFTP ERROR(x):yy
- Erase Failed
- Waiting
- Internal Errors

9. Troubleshooting

NetLink e340, h340, and i640 Wireless Telephones can exhibit transmission problems in several ways. They can cease functioning properly, display error messages, or display incorrect data. When using and troubleshooting handsets, consider the following problem sources to determine the best method of approaching any specific situation.

9.1 Access Point Problems

Most, but not all, handset audio problems have to do with access point range, positioning and capacity. Performing a Site Survey as described above can isolate the access point causing these types of problems. If the handset itself is suspected, conduct a parallel Site Survey with a handset that is known to be properly functioning.

In range/out of range

Service will be disrupted if a user moves outside the area covered by the wireless LAN access points. Service is restored if the user moves back within range. If a call drops because a user moves out of range, the handset will recover the call if the user moves back into range within a few seconds.

Capacity

In areas of heavy use, the call capacity of a particular access point may be filled. If this happens, the user will hear three chirps from the handset. The user can wait until another user terminates a call, or move within range of another access point and try the call again. If a user is on a call and moves into an area where capacity is full, the system attempts to find another access point. Due to range limitations, this may be the same as moving out of range.

Transmission obstructions

Prior to system installation, the best location for access points for optimum transmission coverage was determined. However, small pockets of obstruction may still be present, or obstructions may be introduced into the facility after system installation. This loss of service can be restored by moving out of the obstructed area, or by adding access points.

9.2 Configuration Problems

Certain problems are associated with improper configuration of either the NetLink Telephony Gateway, NetLink Wireless Telephone, or NetLink SVP Server.

For instance, no extension displayed or wrong extension displayed on the handset has no effect on its operation but serves to easily identify it. Other configuration problems, like having incorrect menu items, or inability to connect or access telephone system features, affect the handset's functioning.

Configuration problems are generally corrected by changing the configuration at the NetLink Telephony Gateway, the NetLink SVP Server, or on the handset. See the *SpectraLink 8000 Telephony Gateway: Administration Guide for SRP* document for specific configuration steps. There may also be incorrect programming of the PBX

or access point. See the appropriate *LinkPlus Interface Guide* or the *Configuration Guide* for the access point in use at the site.

9.3 Infrastructure Problems

Calls ringing on the wrong handset, or multiple handsets not working, are likely to be caused by faulty installation. The wires that connect the demarcation (demarc) block to the NetLink Telephony Gateway could be installed incorrectly.

Contact your wireless LAN and/or PBX vendor for more information about troubleshooting infrastructure problems.

9.4 Dialtone Problems

A dialtone problem exists if the handset has no dialtone, or if the user is unable to hear the other party's voice, hears echo or hears dead air. Dialtone problems can be caused by a number of different situations and should be investigated by following these steps:

1. Power on the handset in an active service area. If the handset does not get a dialtone in an active area, continue with the steps below. If the no dialtone problem is limited to a certain area, see section 9.1 *Access Point Problems*.
Any initialization or error messages should turn off a few seconds after the handset is powered on.
2. Swap the Battery Pack with a Battery Pack from a functional handset, power the handset back on and check for dialtone. If this corrects the problem, charge the Battery Pack that was removed.
3. Turn the handset off, then on again, and then test again for dialtone. If OK, place a call and determine voice quality.
4. While maintaining an active call, walk through several access point areas. If fluctuation occurs see section 9.1 *Access Point Problems*.
5. Check for alarms on the NetLink Telephony Gateway or the NetLink SVP Server (via System Status). If there are alarms, see *SpectraLink 8000 Telephony Gateway: Administration Guide for SRP* or *SpectraLink 8000 SVP Server: Administration Guide for SRP* for information.
6. Make sure the handset's gateway port is connected to a working phone line. Check the line at the demarc block. You may need to contact your vendor to perform this check.
7. Check the cabling between the gateway and the demarc block, and between the demarc block and the telephone system ports.
8. Move the handset to a different port location and test again.

9.5 Handset Status Messages

Handset status messages provide information about the NetLink e340, h340, and i640 Wireless Telephone's communication with the access point and host telephone system. The following table summarizes the status messages, in alphabetical order.

Message	Description	Action
3 chirps (audio)	Handset is not able to communicate with the best AP, probably because that AP has no bandwidth available.	None. This is only a warning, the call will handoff to the best AP once it becomes available.
Address Mismatch	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .
ASSERT xxx.c Line yyy	Handset has detected a fault from which it cannot recover.	Record the error code so it can be reported. Turn the handset off then on again. If error persists, try registering a different handset to this telephone port. If error still persists, contact SpectraLink Technical Support and report the error.
Assoc Failed xxxxxxxxxxx	x...x = AP MAC address. Handset association was refused by AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per <i>Configuration Guide</i> . Try another AP.
Assoc Timeout xxxxxxxxxxx	x...x = AP MAC address. Handset did not receive association response from AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per <i>Configuration Guide</i> . Try another AP.
Auth Failed xxxxxxxxxxx	x...x = AP MAC address. Handset authentication was refused by AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per <i>Configuration Guide</i> . Try another AP.
Auth Timeout xxxxxxxxxxx	x...x = AP MAC address. Handset did not receive authentication response from AP; displays MAC of failing AP.	Check handset and AP security settings. Ensure AP is configured per <i>Configuration Guide</i> . Try another AP.
Bad Code Type xx Expected Code Type yy	xx, yy = software license types Handset software does not match current handset license selection.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .
Bad Config	Some needed configuration type has not been set.	Check all required handset configuration parameters for valid settings.
Bad ESSID	The handset is configured for "static ESSID" (as opposed to "Learn once" or "Learn always") and no ESSID has been entered.	Enter an ESSID in the configuration settings or change to one of the "Learn" modes.
Bad Phintl File	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .
Bad Program File	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .

Message	Description	Action
(battery icon), Battery Low, beep (audio)	Low battery.	<p>In call: the battery icon displays and a soft beep will be heard when the user is on the handset and the battery charge is low. User has 15–30 minutes of battery life left.</p> <p>The Battery Pack can be changed while the call is still in progress. Do not press Power Off/End Call. Quickly remove the discharged battery and replace with a charged battery, power on the handset and press Power On/Start Call to resume the call in progress.</p> <p>Not in call: The battery icon displays whenever the Battery Pack charge is low The message Low Battery and a loud beep indicate a critically low battery charge when user is not on the handset. The handset will not work until the Battery Pack is charged.</p>
Battery Failure	The Battery Pack is not functioning.	Replace the Battery Pack with a new or confirmed SpectraLink Battery pack. Any non-SpectraLink Battery Packs will not work.
Battery Failed	Battery Pack is damaged or incompatible with handset.	Replace the Battery Pack with a new or confirmed SpectraLink Battery pack. Any non-SpectraLink Battery Packs will not work.
Cant Renew DHCP yyy.yyy.yyy.yyy	y...y = DHCP server IP address DHCP server is not responding to initial renewal attempt.	Configuration problem. Check the IP address configuration in the DHCP server.
Charging ...	The handset is charging in the Desktop Charger.	No action needed.
Charge Complete	The handset is now fully charged	No action needed.
Checking Code	Handset is contacting the Download Master to determine if it has a newer version of software that should be downloaded.	None, this message should only last for approximately one second. If message remains displayed, power off and contact customer support for a replacement handset.
Checking DHCP IP	The handset is retrieving DHCP information from the DHCP server.	None. This is informational only.
CRC Code Error	The software which has been TFTP downloaded has a bad redundancy code check.	Try the download again, it is possible the software was corrupted during download. If the error repeats, check that the download image on the TFTP server is not corrupted.
Code Mismatch!	The software loaded into the handset is incorrect for this model handset.	Verify the License Management value is correct. Replace the software image on the TFTP server with software that is correct for the handset model.
DCA Timeout	The handset has detected a fault from which it cannot recover, possibly due to a failure to acquire any network.	Turn the handset off then on again. If error persists, contact SpectraLink Technical Support and report the error.

Message	Description	Action
DHCP Error (1-5)	<p>DHCP Error 1</p> <p>DHCP Error 2</p> <p>DHCP Error 3</p> <p>DHCP Error 4</p> <p>DHCP Error 5</p>	<p>The handset cannot locate a DHCP server. It will try every 4 seconds until a server is located.</p> <p>The handset has not received a response from the server for a request for an IP address. It will retry until a server is found.</p> <p>The server refuses to lease the handset an IP address. It will keep trying.</p> <p>The server offered the handset a lease that is too short. The minimum lease time is 10 minutes but SpectraLink engineers recommend at least one hour minimum lease time. The handset will stop trying. Reconfigure the server and power cycle the handset.</p> <p>Failure during WEP Key rotation process (proprietary feature).</p>
DHCP Lease Exp. yyy.yyy.yyy.yyy	y...y = DHCP server IP address DHCP is not responding to renewal attempts (at least one renewal succeeded).	The handset failed to renew its DHCP lease, either because the DHCP server is not running, or because the configuration has been changed by the administrator. The handset will attempt to negotiate a new lease, which will either work, or change to one of the above DHCP errors (1-4).
DHCP NACK Error yyy.yyy.yyy.yyy	y...y = DHCP server IP address DHCP server explicitly refused renewal.	The DHCP lease currently in use by the handset is no longer valid, which forces the handset to restart. This problem should resolve itself on the restart. If it does not, the problem is in the DHCP server.
DL not on sector	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .
DO NOT POWER OFF	The handset is in a critical section of the software update.	None. Do not remove the Battery Pack or attempt to power off the handset while this is displayed. Doing so may require the handset to be returned to SpectraLink to be recovered.
Duplicate IP	The handset has detected another device with its same IP address.	<p>If using DHCP, check that the DHCP server is properly configured to avoid duplicate addresses.</p> <p>If using Static IP, check that the handset was assigned a unique address.</p>
Erase Failed	Download process failed to erase the memory in the handset. This operation will retry.	Operation will retry but may eventually report the error "int. error: 0F". Power cycle the handset.
Erasing Memory	Handset has determined that a download should occur and is erasing the current software from memory. This message also displays a progress bar. When the progress bar fills the display line the erase operation is complete.	<p>None. When the progress bar fills the display line the erase operation is complete.</p> <p>Do not turn the handset off during this operation.</p>

Message	Description	Action
Files too big	Handset software download files are incorrect or corrupted.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .
Flash config error	Handset internal configuration is corrupt.	Perform "Restore Defaults" operation via administrator menus [or reprogram with Configuration Cradle].
Initializing ...	The handset is performing power on initialization.	None. This is informational only.
Internal Err. ##	The handset has detected a fault from which it cannot recover. OE = Error while writing the Flash (return handset to factory). OF = No functional code (contact SpectraLink Technical Support).	Record the error code so it can be reported. Turn the handset off then on again. If error persists, try registering a different handset to this telephone port. If error still persists, contact SpectraLink Technical Support and report the error.
Multiple GW Reg yyy.yyy.yyy.yyy	y...y = Gateway IP address Handset received responses from multiple gateways; displays IP address of one responding gateway.	Check each NetLink Telephony Gateway for the handset's MAC address on the Telephone Line Configuration screen. Delete any duplicate entries leaving only one entry on the correct Telephone Gateway and port for this handset.
Must Upgrade SW!	Handset software is incompatible with hardware.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .
Net Busy xxxxxxxxxxxx	x...x = AP MAC address Handset cannot obtain sufficient bandwidth to support a call; displays MAC of failing AP.	Try the call again later.
No DHCP Server	Handset is unable to contact the DHCP server.	Check that DNCP is operational and connected to WLAN or use Static IP configuration in the handset.
No ESSID	Attempted to run site survey application without an ESSID set.	Let handset come completely up. Statically configure an ESSID in the Admin menu.
No Func Code	Handset software download files are incorrect or corrupted.	Reconfigure the handset to gain access to the WLAN and download new code.
No GW Response yyy.yyy.yyy.yyy	y...y = Gateway IP address Handset has lost contact with the NetLink Telephony Gateway. Handset cannot find an NetLink Telephony Gateway. Handset not registered on NetLink Telephony Gateway.	Verify that the NetLink Telephony Gateway is properly configured.
	NetLink Telephony Gateway is not working No LAN connection at the AP or NetLink Telephony Gateway.	Verify that the NetLink Telephony Gateway is powered on. If so, follow standard NetLink Telephony Gateway troubleshooting procedures. Verify NetLink Telephony Gateway connection to LAN and all APs.

Message	Description	Action
No IP Address	Invalid IP.	Check the IP address of the handset and re-configure if required.
No Net Found	This indicates the handset cannot find any access points due to: No radio link. No ESSID – Auto-learn not supported (or) Incorrect ESSID. AP does not support appropriate data rates. Out of range. Incorrect Security settings.	Verify that the AP is turned on. Verify the ESSID of the wireless LAN and enter or Auto-learn it again if required. See <i>NetLink Wireless Telephone Configuration</i> section. Check the AP configuration against <i>Configuration Guide</i> for AP. Try getting closer to an AP. Check to see if other handsets are working within the same range of an AP. If so, check the ESSID of this handset. Verify that all the security settings in the WT match those in the APs.
No Net Found xxxxxxxxxx yy	x...x = AP MAC address yy = AP signal strength Handset cannot find a suitable access point; displays MAC and signal strength of “best” non-suitable AP found.	Check AP and handset network settings such as ESSID, Security, Reg domain and Tx power. Ensure APs are configured per <i>Configuration Guide</i> . Try Site Survey mode to determine more specific cause.
No Reg Domain	Regulatory Domain not set.	Configure the Regulatory Domain of the handset.
No PBX	No communication with host telephone system.	Displays before the system has synchronized ports with the host telephone system. Should disappear when the ports are correctly wired and programmed. Make sure the proper PBX switch has been selected within the NetLink Telephony Gateway.
No SW found	A required software component has not been identified.	Check that the correct software has been downloaded and is available.
Server Busy	Handset is attempting to download from a Download Master that is busy downloading other handsets and refusing additional downloads.	None. The handset will automatically retry the download every few seconds.
SKT Open Failed	Socket open fail. Occurs when the handset tries to connect to the PBX but there is no response. If resiliency is active, the handset will keep trying.	If the PBX is inoperative and resiliency is not active or the handset cannot locate a backup PBX, turn off the handset and repair the primary PBX. Note that it may be advisable to reconfigure the backup PBX to be the primary PBX if the repair is more time-consuming than the reconfiguration.
Storing Config	Handset is storing changes to handset configuration.	None. Informational only. The handset may display this briefly following a configuration change or software download.

Message	Description	Action
System Busy yyy.yyy.yyy.yyy	y...y = SVP Server/Telephony Gateway IP Address Gateway or SVP server has reached call capacity; displays IP address of Gateway/SVP Server.	All call paths are in use, try the call again in a few minutes.
System Locked (with Busy Tone)	Gateway is locked.	Try the call again, system has been locked for maintenance.
TFTP ERROR(x):yy	A failure has occurred during a TFTP software download. (x) = The file number which was being downloaded; yy is an error code describing the particular failure. Possible error codes are: 01 = TFTP server did not find the requested file. 02 = Access violation (reported from TFTP server). 07 = TFTP server reported "No such user" error. 16 = No TFTP server address 81 = File put into memory did not CRC. FF = Timeout error. TFTP server did not respond within a specified period of time.	Error code 01, 02, 07 or 16 - check the TFTP server configuration. Error code 81, the handset will attempt to download the file again. For other messages, power off the handset, then turn it on again to retry the download. If the error repeats, note it and contact SpectraLink Technical Support.
Too many errors	The handset continues to reset and cannot be recovered.	Fatal error. Return handset to SpectraLink.
Unknown xx:yy:zz	A phrase is missing from your phintl file.	Download new software from the SpectraLink site per section 8 <i>Software Maintenance</i> .
Updating ...	The handset is internally updating its software images	None. The handset may do this briefly after a download. This is informational only.
Updating Code	Handset is downloading new software into memory. The number icons at the bottom of the display indicate which file number is currently being downloaded. This message also displays a progress bar. When the progress bar fills the display line the update operation is complete on that file.	None. When the progress bar fills the display line the update operation is complete on that file. Do not turn the handset off during this operation.
Use Deskset	Handset is inserted in Docking Station cradle.	Not an error. Use the Docking Station or remove handset from cradle.
Wrong Code Type	The software loaded into the handset is the wrong type for this model handset.	Verify the license type is set correctly. If the license type is correct, replace the software image on the TFTP server with the software that is correct for the handset model.
Waiting	Handset has attempted some operation several times and failed, and is now waiting for a period of time before attempting that operation again.	None. The handset is waiting for a specified period of time before attempting that operation again.

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