INSTRUCTION MANUAL

R.C. SYSTEMS CO. INC.

WaveNet Site Survey Tool



Warning: Read & understand contents of this manual prior to operation. Failure to do so could result in serious injury or death.

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WaveNet Site Survey Toolkit (SST) General Description



Field Kit

Kit contains:

- WaveNet Site Survey Tool (SST) with RP TNC connector.
- Rubber antenna for 900MHz (2dBi dipole)or 2.4GHz (7 dBi collinear).
- AC/DC converter.
- Spare 9V Lithium non-rechargeable battery.
- Carry case.

The hand-held WaveNet Site Survey Tool (SST) is designed with modes of operation for simulating R. C. Systems *WaveNet* products including WaveCast Monitors (WCM's), WaveLink Receivers (WLR's) and WaveNet Relayers (WNR's). SST's are supplied with either a 900MHz or 2.4GHz integrated radio module depending upon which WaveNet frequency it is ordered for.

A single SST is very useful for commissioning and troubleshooting WaveNet systems that are already installed at a site. However, it is highly recommended that two SST's be used to survey sites and approve WaveNet device locations prior to installation. One SST may be set as a SERVER in Rx (receive) mode while another may be set as a CLIENT in Tx (transmit) mode. The SERVER SST simulates either a WLR or WNR location while the CLIENT simulates WCM locations. SST diagnostic features include Rx / Tx counters along with both tabulated and trended RSSI (Received Signal Strength Indication) values to determine signal strength and link integrity for the proposed wireless network. A 24 hour test is recommended to assure against high levels of interference at random times.

SST's are powered either by an integrated **non-chargeable** 9V Lithium battery or externally by a 1 amp 12VDC wall wart or automotive power point (cigarette lighter). The RP-TNC antenna connector supports the local rubber antenna or coax cabling to a remotely mounted stationary antenna. It is very important to evaluate sites using the same antennas intended for the installation. If longer distances may require yagi directional antennas then these should also be used during a site survey.

Features:

- Backlit graphic LCD readout
- Scans airwaves for "In-Range" WaveNet networks at power-up
- RSSI values are trended over time and indicated in dBm for each transmission
- Rx / Tx counters allow counting missed data packets over time
- Rx mode timer indicates elapsed time between received messages
- Tx mode offers special channel 33 which is unused by WLR's for processing alarms. This feature allows testing wireless link without tripping alarms.

Operator Interface and Menus

Function Keys:

There are four Function keys (F1-F4) with purposes that vary based upon the SST menu selected. Each menu identifies the F key purpose with a tag name on the LCD just above the button. The F3 key also serves as a power control key which cycles power when held for over 2 seconds.

Power Up and Network Discovery Scan:

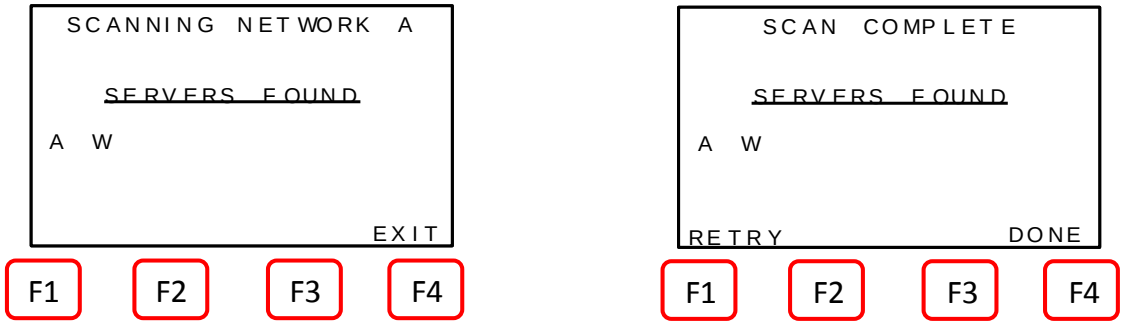

Figure 1 – Sign on / Network Discovery Screens

Power is applied by holding the F3 key for over 2 seconds. The sign-on screen will indicate operating frequency of the radio installed, the current network's letter designator (A through Z), and firmware version. The SST then scans each of the possible 26 WaveNet networks to discover if any Servers already exist and within range. Only one Server is allowed per network and the SST has built in protection to avoid itself operating as a Server that might interfere with an existing network. It is important for SST users to understand the source of any other discovered networks when performing a site survey. This scan may be aborted pressing the F4 key.

Main Menu:

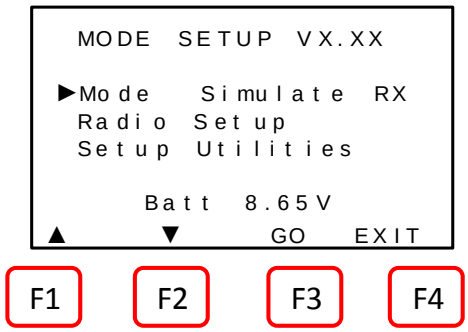

Figure 2 – Main Menu

Use the UP/DOWN keys to select an item and follow the Function key prompts for that item. The Main Menu controls these functions:

- **Mode** - Configures the SST for either Simulate Rx or Simulate Tx modes.
- **Radio Setup** – Pathway to the page of menus where the SST's radio settings for Network (A-Z), Client or Server (Client only in Tx mode) and Tx power (900MHz only) are configured. Load Radio Defaults loads factory default values into the radio.

- **Setup Utilities** – Pathway to page of menus for adjusting Contrast, Backlight Timer and Auto Off timer.
- "**No Server Found**" is indicated on the Main Menu when in Tx mode and no server is detected for the designated network.
- **Battery voltage** is indicated on the Main Menu unless the SST is powered by an external power source.

Simulate Rx Mode:

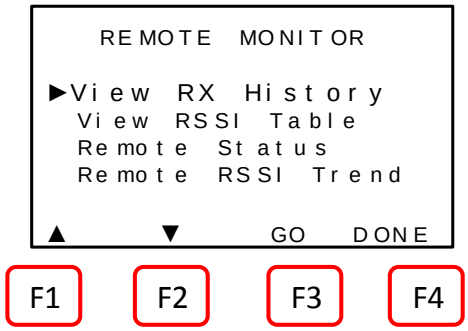

Figure 3 – Rx Mode

Simulate Rx Mode allows the SST to simulate WaveLink Receivers (WLR's) and WaveNet Relayers (WNR's). Just like WLR's and WNR's, this mode allows the SST to be configured as either Server or a Client based upon the Radio Setup menu's setting. However, prior to allowing its radio to become the Server it scans to see if a Server beacon is already within range for the selected A-Z network. If a Server is discovered for this network the SST returns its radio setting to Client before entering the Simulate Rx Mode. Only one Server is allowed per network so if the SST discovers another Server it will not function as Server for this network and another network may need to be selected.

The Simulate Rx mode is also recommended and very useful for simulating WaveNet Relayer locations during a site survey since Relayers have identical radio settings as WaveLink Receivers.

In the Rx Mode, three screens are available as:

- **View Rx History** – Pathway to a table where received packet counters for all 32 channels are displayed. From the table screen, the F1 key resets all counters to zero and F4 exits the screen.
- **View RSSI Table** – Pathway to a table where most recent RSSI value in dBm for all 32 channels are displayed. From the table screen, the F1 key resets all counters to zero and F4 exits the screen.

- **Remote Status** – Pathway to screen displaying the following for a given channel:
  - **Remote Id** = The Channel # the other data displayed on this screen is for. Select the desired channel from 1-33 using the + / - keys (33 being the channel reserved for diagnostics by the Wavelink).
  - **RX Counter** = Number of messages received for the selected channel since the SST began receiving data on this network. This is useful for comparing the Tx counter of the WaveCast to see if most of the messages were received.
  - **Last RSSI with ↑, ↓ or =**; = the value of the RSSI for the most recent message; plus arrows to indicate if it was stronger, weaker or equal to the previously recorded message.
  - **Last Interval** = a value in seconds indicating elapsed time between messages prior to most recently received message.
  - **Elapsed** = a timer running seconds indicating how long it has been since the last message received.
  - **Alarm Status** is displayed across the bottom of this screen and indicates if the WaveCast Monitor sending data to this channel has any alarms.

- **Remote Trend** = Pathway to the RSSI trend screen where the +/- keys allow scrolling through the accumulated RSSI trends for all 33 channels (33 = the WaveLink diagnostics channel). In addition to the trends, this screen displays the channel number, Rx counter and most recent RSSI value for this channel. The trend line consists of the most recent 128 receptions for the selected channel and is not time based in any way. If receptions came twice per minute, a full screen width trend consisting of 128 values took 256 minutes to accumulate. If receptions were once per minute the screen would take 128 minutes to fill. This screen can be very useful for moving equipment to different locations to determine best mounting position.

Simulate Tx Mode:

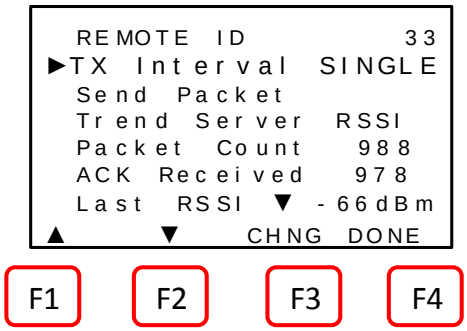

Figure 4 – Tx Mode

The Simulate Tx Mode allows the SST to simulate a WaveCast Monitor (WCM) and transmit data to WaveLink Receivers and WaveNet Relayers. The Radio Setup menu will only allow operation as a Client in this mode. To avoid accidental transmission to an active channel, the default channel for this mode is diagnostic channel 33. Channel 33 does not affect alarms at WLR's or WNR's but is received and acknowledged (ACK) by their radios. This ACK is used to capture RSSI from a server's returned packet. Items available in this mode are:

- **REMOTE ID** = Channel number setting of 1-33. Channel 33 is the default channel since it does not affect any alarms as described above.

  Warning: SST's simulating WaveCast monitors in this Tx mode transmit packets with all alarms cleared and Value Register set to 800 counts (ZERO READING). If sent to a channel on the WLR or WNR that is in alarm ALL ALARMS WILL CLEAR AND READING RETURN TO ZERO.

- **TX Interval** = Value controlling if packets are transmitted manually (SINGLE) or automatically every 6Sec, 1Min or 5Min. When set to SINGLE, packets are only sent when the **Send Packet** menu is selected and the SEND key is pressed. Other settings will automatically send packets on the interval displayed.
- **Send Packet** = Sends each packet on demand by pressing the SEND key if the TX Interval is SINGLE. If TX Interval is 6Sec, 1Min or 5Min the Send Packet field is a count-down timer displayed in seconds and the packet is sent when the timer reaches zero and the timer resets to the TX Interval. Once sent, the Packet Count advances and upon a return of the acknowledgement, the ACK Received will advance and the RSSI will be displayed for that reception. This can be useful to determine the missed packet ratio. Also, upon the ACK, the dBm is captured for that packet and displayed as Last RSSI.
- **Trend Server RSSI** = A unique test mode where the SST transmits a packet to the network Server's channel 33 approximately twice per second, and only the Server returns an ACK. When the ACK is received, the SST increments the ACKS RECEIVED counter, reads and averages the RSSI and draws an RSSI trendas a trend. A percentage value for ACKs RECEIVED is displayed across the top and should be > 95%. The most recent RSSI value appears at the bottom of the screen along with the RESET and DONE keys. Press RESET to start over on the fly and DONE to end the test. Pressing DONE brings up the results of the test including % of ACK's received, packets sent and received counters and HIGH, LOW and AVERAGE RSSI values.
- **Packet Count** = Running count of the number of packets sent by the Tx Interval settings. This may be reset to zero by selecting this item and pressing the RESET (F3) key.

Radio Setup:

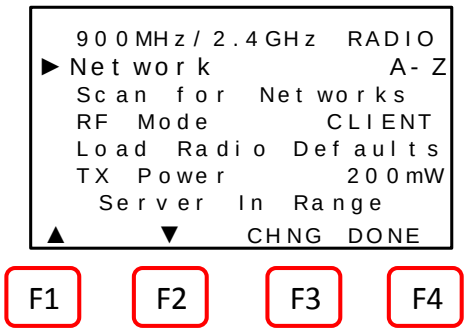

Figure 5 – Radio Setup

This menu is for configuring the SST's 900MHz or 2.4GHz radio.

Network – WaveNet devices utilize the **Network** setting to assign up to 26 unique hopping patterns. To simplify system setup, **Network** is entered using letter designators A through Z where A = [Hop Channel 1, System ID 1] and Z = [Hop Channel 26, System ID 26]. An SST will not indicate Server In-Range status or communicate with any device operating on a different **Network ID**. This feature allows multiple WaveNet wireless systems to be located within range of each other without interference.

Networks M through Z are encrypted networks. When one of these networks is selected, the data will be encrypted via proprietary methods to ensure that only devices on that network which hold the encryption key will be able to decipher the data being transmitted.

- **Scan for Networks** repeats the network discovery scan performed at power up to detect other Servers within range.
- **RF Mode** is fixed at CLIENT when the SST is in the Simulate Tx mode. It may be set as Server or Client in Simulate Rx mode. However, prior to becoming a Server the SST scans to make certain another Server does not already exist for the selected Network (A-Z). Each network requires one, and only one Server so for Site Surveys when no other WaveNet equipment exists, the SST designated as Simulate Rx should be a Server. But, if the SST is being used to "snoop" an existing network it must be set as Client.
- **Load Radio Defaults** is a "cold boot" function for the radio module provided in case its non-volatile internal memory in is corrupted.
- **TX Power is** fixed at 125mW for all 2.4GHz versions. It has 4 settings available for 900MHz versions – 10mW, 200mW, 400mW and 1W. 200mW is appropriate for most installations if maximum distance is less than 1000 feet. Care should be taken using the 1W setting indoors and when units are close to each other since it can swamp nearby WaveNet antennas.

Setup Utilities:

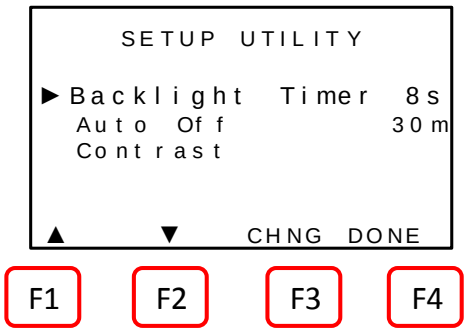

Figure 6 – Setup Utilities

This menu is for configuring miscellaneous SST parameters including:

- **Backlight Time** - which is the time the backlight remains on after a key is pressed. Selectable times consist of 10s, 20s, 30s and OFF. If a minimum 11VDC External Power source is connected, any of the settings will be overridden and the backlight will remain on constant.
- **Auto Off** may be set to 30M or DISABLED. If enabled, the timer gets reset with each keystroke. If a minimum 11VDC External Power source is connected, Auto Off is disabled and "EXT PWR" is displayed in this field.
- **Contrast** allows the LCD contrast to be adjusted.

Low Battery:

When the battery falls below 7V, a LO BATT icon appears at the top left corner of the display. In the TX Mode, the SST will still operate but if a high power setting is selected, the transmitted packet may not go out. In the RX mode the SST continues to operate below this 7V limit.