# WinA4P
Configuration Software

Programming Manual
for
ART, SRT, URT, XRT, ZRT
Radio Modems

CONTENTS

1   INTRODUCTION

1.1   PRODUCTS COVERED

This manual covers the installation and operation of the WinA4P configuration software, which is a Windows based program allowing local configuration of RF DataTech radio modems.

The software is suitable for configuration of ART, SRT, URT, XRT & ZRT series radios.

At the date of issue of this manual, Version 2.0 was the latest version of the WinA4P software available and the manual is based on that release. Subsequent releases of the software may differ from the version described.

1.2   IMPORTANT NOTICES

1.2.1   Copyright
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1.2.4   Safety Critical Applications
The software and the radios with which it can be used have not been designed for, nor are they intended for, use in safety critical or life support applications. No functional warranty is given if the products are used in such applications.

1.2.5   Use
The software is intended for use in conjunction with radio modems which have been designed to work on various licensed and license-free frequency bands in use around the world. In the license-free bands, the user must ensure that the radio modem is used under the terms & conditions applicable to the use of the bands concerned.
In licensed bands, the radio user must obtain permission and the necessary licenses from the local authorities.

2   PRODUCT OVERVIEW

2.1   GENERAL

The WinA4P software has been produced as a universal programming tool suitable for programming and configuring a broad range of radios manufactured by RF DataTech. Models currently covered include the ART, SRT, URT, XRT & ZRT ranges of radio modems.

Different radio models have different functionality, and some of the programming options shown in this manual may not be applicable to every model. Where particular radio types do not support an option, it will either be greyed out or completely removed from the screen when the program is used with those models.

## 2.2   OPERATING SYSTEM REQUIREMENTS

WinA4P is designed to operate correctly with the following operating systems:-
- Windows 98
- Windows ME
- Windows 2000
- Windows XP

2.3   PC HARDWARE REQUIREMENTS

The WinA4P software is designed to operate on a broad range of hardware platforms provided that they are fitted with an external serial port to allow communication with the radios. Many modern machines do not have RS232 serial ports, but are only fitted with USB ports. With those machines it would be necessary to use some form of USB to RS232 adaptor to connect to the radios.

2.4   MENU STRUCTURE
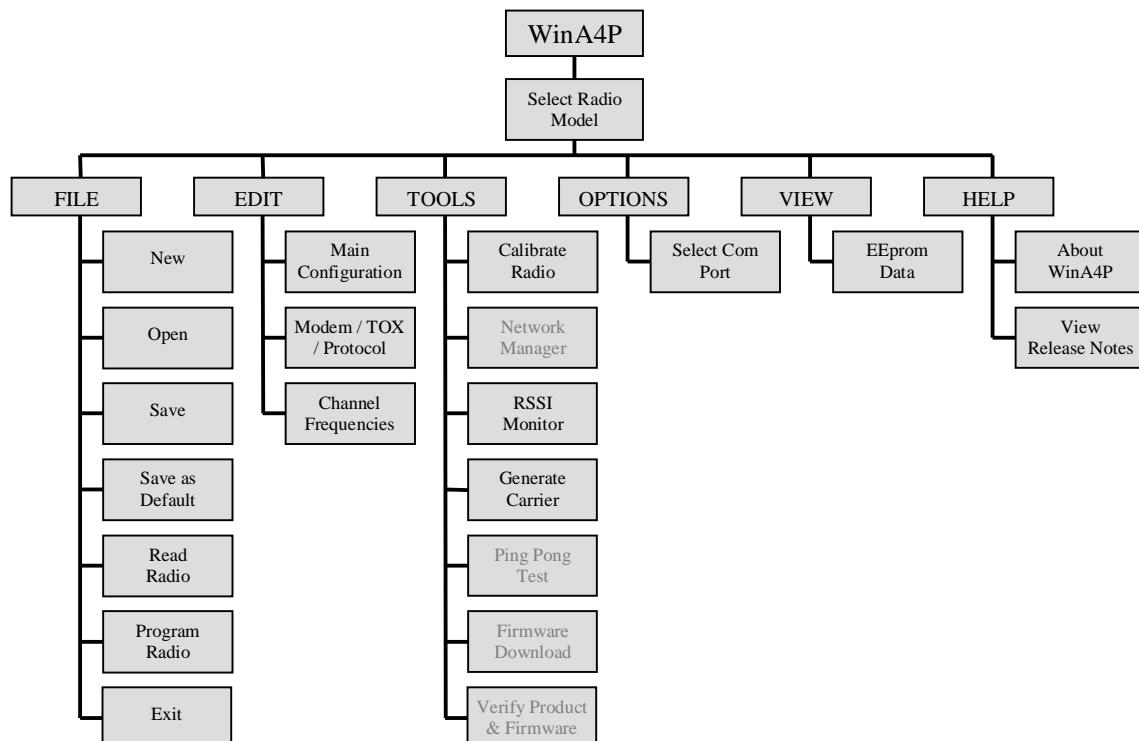
3   SOFTWARE INSTALLATION

Before starting to install the program, it is important to note that if you are re-installing the software on a machine on which it has already been installed, or if you are updating to a newer version of the software on a machine already running an old version, you should un-install the original version before installing the new version. Failure to do this may result in some files failing to update correctly. The old program should be de-installed using the Add/Remove Programs feature in the Windows "Control Panel" which can be accessed via the Windows "Start" button.

The WinA4P software is generally supplied as a .zip file on a CD ROM or as a file downloaded via the internet. In either case, extract the contents of the .zip file to a suitable directory on the hard drive of the PC. This can be a temporary directory if preferred, since once the software is fully installed, the extracted setup files are no longer required for day-to-day operation.

Amongst the extracted files, there will be a file called "setup.exe". Running this executable file will install the WinA4P software.

Before running setup.exe, it is strongly recommended that you shut down all other Windows programs which may be running on the machine, as the installation program cannot update any shared files which may be in use by another program.

When you run setup.exe, the following screen will appear:-

By default the setup program will create the directory C:\Program Files\WinA4P then install WinA4P into that directory. The user may change the directory if preferred, but this is not recommended, since any future re-installations or upgrades will expect the program to be in the directory shown. Pressing the large button with the picture on it will start the install.

During the installation, the setup program will attempt to write a number of files to the Windows System directory. These are shared files which may be used by a number of programs and may already exist on your machine. If the setup program finds that your machine has a more up-to-date version of a shared file it is trying to write, it may warn you of this and suggest that you keep your newer file. In this situation, it is recommended that you keep the newer version already on your machine by clicking "Yes" in the box which appears.

By default, the setup program will create a "WinA4P" entry in the list of programs in the start menu accessed by clicking on the "Start" button on the windows toolbar.

Once the installation is complete, a desktop shortcut can be added by the user if required. To do this, click on the "Start" button and open the program menu. Locate the WinA4P folder in the list, and within it, the WinA4P program entry. Press and hold the right mouse button to drag the entry onto a free area of the desktop, then release the mouse button and select "copy here".

4 GETTING STARTED

4.1 CONNECTING TO THE RADIO

Connect the radio to be configured (or investigated) to the PC serial port via the appropriate cable.

For the ART, SRT, XRT & ZRT Series radio modems this is a standard 9-Way Male to 9-Way Female straight-through cable (pin 1 to pin 1, pin 2 to pin 2, etc) obtainable from many sources.

On the version of the ZRT with the combined RS232/RS485/RS422 interface, the interface automatically switches back to RS232 when programming mode is selected by setting "00" on the channel switches. This allows programming from the PC with a standard RS232 cable, even if the radios are configured for RS485 or RS422 operation.

For the 5V TTL version of the ZRT, an external RS232 to TTL adaptor is needed between the computer and the radio.

For the URT, a product specific 9-Way to 25-Way programming cable is required. With this particular model, there is a possibility of damage to the PC and/or radio if cables not designed specifically for the purpose are used.

Details of pin-outs, etc. are given in the separate radio operating manuals. For programming, the only connections to the PC which are required are Tx Data, Rx Data and Ground.

To put the radio into local programming mode, select "00" on the two front panel switches. This programming mode ensures that the radio recognises any data on the serial port as programming instructions and not as data for transmission. The SYS LED on the front panel will stay on continuously while the radio is in this mode. After programming is complete, ensure the switches are reset to the required RF channel and that the SYS LED goes out.


On the XRT Series radios, there is a front panel programming port in addition to the traffic serial port on the rear. Either port can be used for programming, but the above instructions only apply when using the rear traffic port for programming.   When using the dedicated front panel programming port, it is not necessary to set the switches to 00 since this connection is only ever used for programming and the radio automatically recognises data on this port as programming data.

4.2 SELECTING REQUIRED COMMS PORT ON PC

To select which communications port on the PC the software will use for communicating with the radio, click on "Options" in the Menu-bar at the top of the WinA4P main window and then click on "Select Comms Port"

A small sub-window will appear with a pull-down menu allowing selection of port Com 1 to Com 16. Once the required port is selected, press OK to proceed. On most PCs with a single serial port, this port will be Com1.


4.3 SELECTING RADIO MODEL

On the main screen, there is a graphic showing the type of radio that the program is set up for. Below the graphic, there is a pull-down list of available radio types that are supported by the program. Click on the arrow to expand the list, then click on the model required. The program will load a suitable set of default data for the selected model.
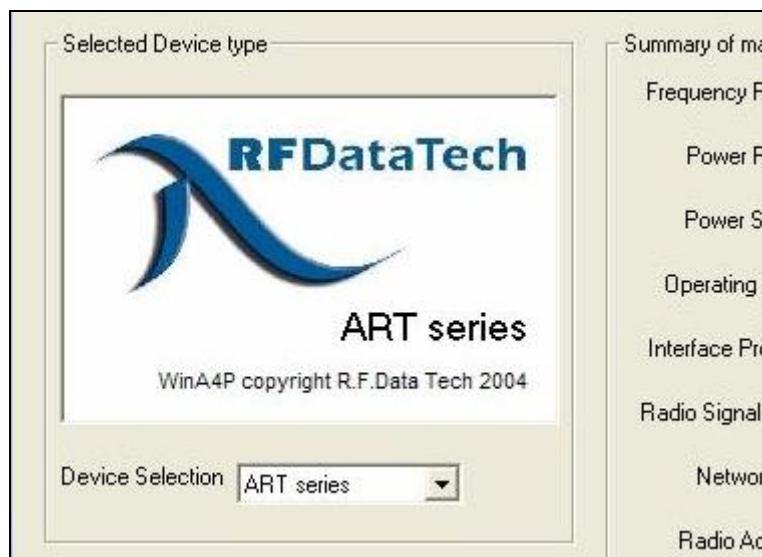
At this stage it is possible to select a radio type which differs from the radio you are connected to, so that you can create or edit configuration files for different models, but as soon as you try to read a radio or program data into it, an alert box will appear if the settings are inappropriate for the attached model.
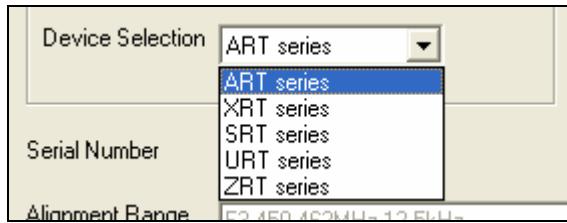

The ZRT modems are available with a number of different serial interfaces. For the RS232 Only (Full Handshaking) version or the 5V TTL version, the Device Selection should be just "ZRT Series". For the combined RS232/RS485/RS422 version, the Device Selection should be "ZRT 485".

4.4   READING THE RADIO

It is strongly recommended that the first action you take once you are successfully connected to a radio is to read it. This ensures that the information displayed on the screen reflects the factory set parameters such as the frequency range for which the unit has been aligned and the power output range of the particular radio concerned.

To read the radio, go to the "File" menu and click on "Read Radio". A small screen will briefly appear showing the progress of the data transfer, the connected Device Type, the Firmware Version of the radio, the Compatibility Code of the radio and a scrolling display of the actual data blocks being transferred.
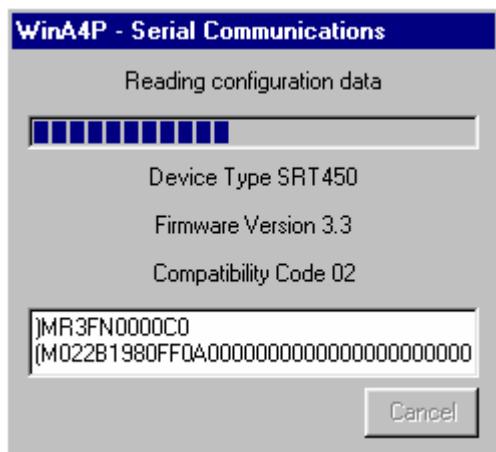
4.5   EDITING PARAMETERS

Immediately after the radio has been read, the configuration details shown in the various screens reflect the current configuration of the radio.

These values can now be changed from within the program, but it is important to note that changing parameters on the screen only changes the configuration data held within the computer and does not affect the radio unless you specifically upload the changed configuration into the radio. If you exit the program without saving the configuration file or

without actively programming the new data into the radio, the changes will be lost and the radio will remain as it originally was.

Once all the desired changes have been made, the radio needs to be reprogrammed with the amended configuration.

4.6   REPROGRAMMING THE RADIO

To upload the amended configuration data into the radio, go to the "File" menu and click on "Program Radio". As in the case when reading the radio, a small screen will briefly appear showing the progress of the data transfer, the connected Device Type, the Firmware Version of the radio, the Compatibility Code of the radio and a scrolling display of the actual data blocks being transferred.

After programming is complete and the radio is disconnected from the computer, ensure the switches are reset to the required RF channel and that the SYS LED goes out.

5   USING THE PROGRAM

5.1   MAIN SCREEN
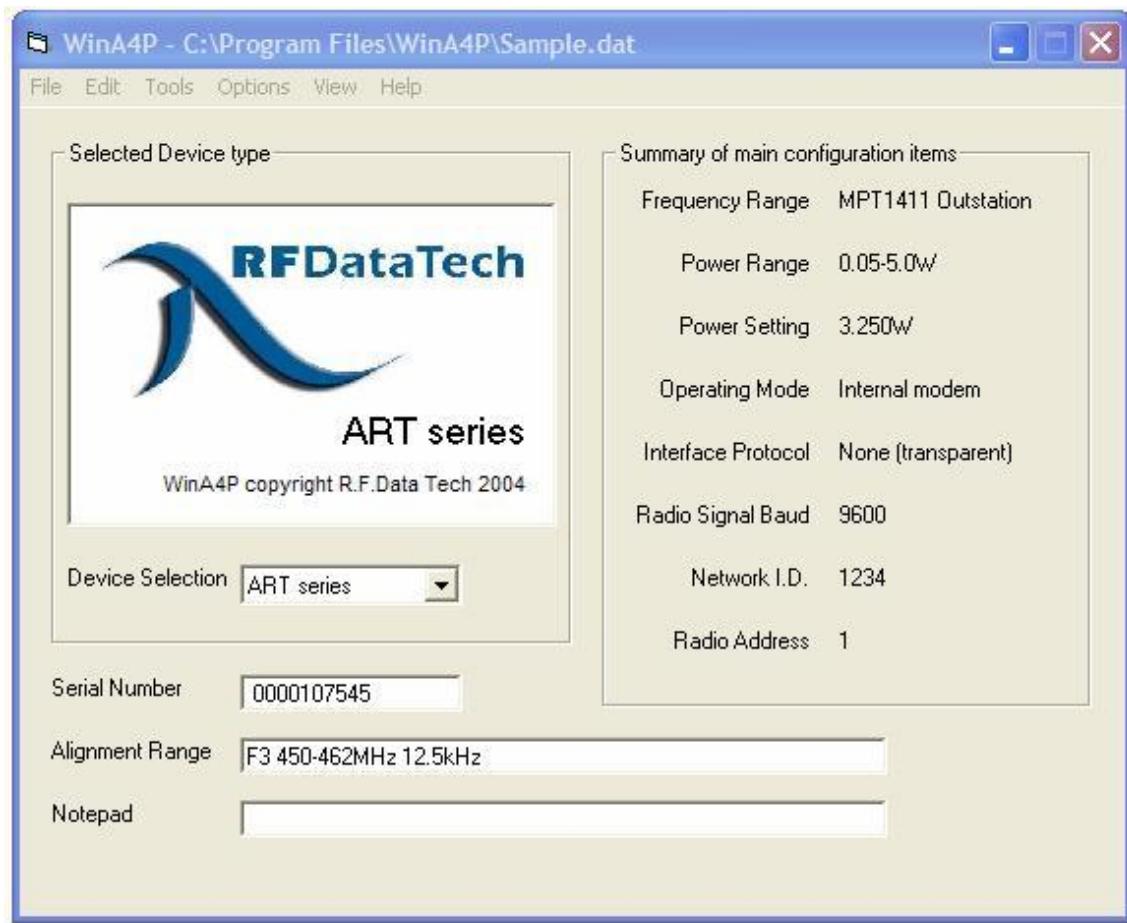
The main screen is split into a number of discrete areas:-

5.1.1   The Menu Bar

The menu bar at the top of the window provides access to all the programming and configuration options within the program. Clicking on any menu item will open up the related list of options.

5.1.2   The Device Selection Area

This area includes a graphic box showing the radio model which the program is currently configured for. Below the graphic, there is a pull-down list of available radio types that are supported by the program. Click on the arrow to expand the list, then click on the model required. The program will load a suitable set of default data for the selected model.

Should you set the program for a radio which is different from that which you are physically connected to, the program will not allow you to read from, or write to, the radio and an alert box will appear to explain the problem.

5.1.3   The Data Summary Area

This gives an at-a-glance summary of the key parameters of the configuration file loaded. Parameters cannot be edited directly in this area. To change settings it is necessary to use the screens accessed through the "Edit" menu.

5.1.4   Miscellaneous Text Fields

At the foot of the window, there are three fields which can display additional data.
The Serial Number and Alignment Range entries are factory set in the radio and cannot be changed by the user. The Alignment range shows the range of frequencies that the unit has been physically tuned to operate over and the channel spacing. Within that range, the operating frequencies can be selected by the user with this program. To operate on a frequency outside this range, it would be necessary to return the radio to the factory for re-alignment and re-calibration.
The Notepad field is user accessible and allows the user to store a text string of up to 48 characters in the configuration file. This will in turn be stored in the radio once it has been programmed. Possible uses include saving the date of installation, site names, application notes, etc.

5.2   FILE MENU

5.2.1   New

Simply erases the parameters selected by the user or imported from a file or a radio and returns to the default program parameters for the particular radio model selected on the front screen

5.2.2   Open

Allows the user to load a previously saved configuration file. On selecting "Open" from the menu, a window opens allowing you to browse your computer for suitable configuration files. These will generally have a .dat suffix. If you attempt to open a configuration file which is for a different radio model from the one selected on the main screen, the file will not load and an alert box will appear to explain the problem.

5.2.3   Save

Allows the user to save the currently displayed configuration file. On selecting "Save" from the menu, a window opens allowing you to browse your computer for a suitable location to save the file. By default, configuration files will be saved with a .dat suffix.

5.2.4   Save as Default

Allows the user to save the current configuration file as the default configuration which will be loaded whenever the program is started with the current radio model selected. On selecting "Save" from the menu, a warning window will appear to advise you that this operation cannot be undone and to ask you to confirm that you wish to permanently overwrite the saved default settings. The default configuration files are always stored in the same directory as the main program and have .def suffixes.

5.2.5   Read Radio

This allows you to read the configuration parameters from a connected radio into the program. A small screen will briefly appear showing the progress of the data transfer, the connected Device Type, the Firmware Version of the radio, the Compatibility Code of the radio and a scrolling display of the actual data blocks being transferred.
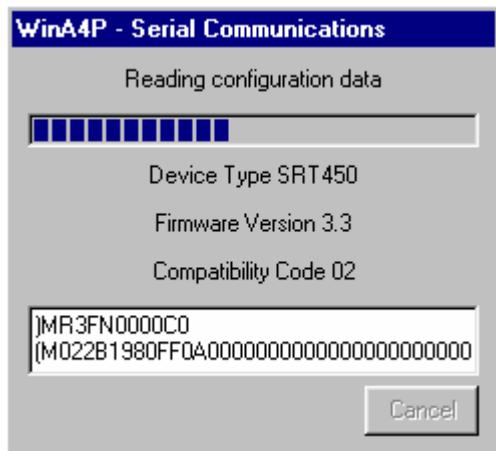

If new fields are added or changes are made to the PC configuration program, the version number changes, but in most cases a new program will program older radios. To complicate matters more, over time there will be changes and upgrades to the firmware in the radio which may not be compatible with older PC programming software. To overcome this, each modem has a compatibility code which is changed at the factory if and when the firmware changes. If the radio and PC software are not compatible, as a safety precaution the PC will not read or write to the modem but will display a compatibility error message. If this happens a different edition of PC programming software with the same compatibility number as the radio may be required.

5.2.6   Program Radio

This allows you to upload the displayed configuration data into a connected radio. As in the case of reading a radio, a small screen will briefly appear showing the progress of the data transfer, the connected Device Type, the Firmware Version of the radio, the Compatibility Code of the radio and a scrolling display of the actual data blocks being transferred.

5.2.7   Exit

This closes the program. If the displayed configuration has been changed since you last saved the file or programmed a radio, you will be warned that you are about to lose the displayed data and given the option to return to the program.
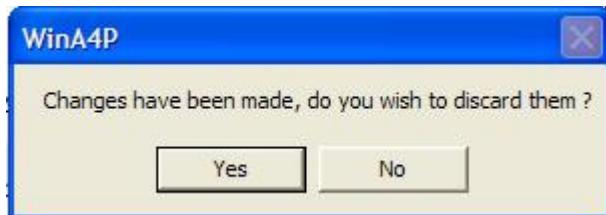
Clicking on "Yes" will close the program, discarding any changed data. Clicking on "No" will return you to the running program.

5.3 EDIT MENU

5.3.1 Main Configuration
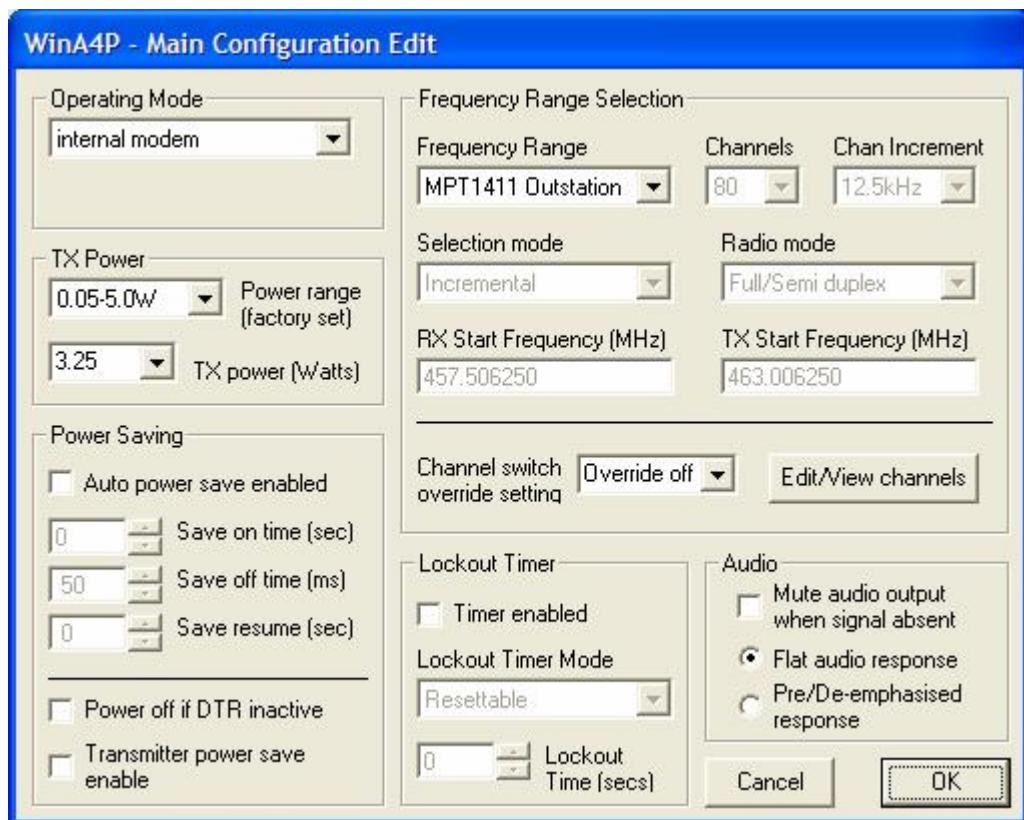
#### 5.3.1.1 Operating Mode Area

The Operating Mode area selects the interface and type of signals handled by the radio and can be set for the following:-

"Internal Modem", which sets the radio to use the RS232 serial port as a direct interface to the internal 150-9600bps modem.

"External Modem" which disables the RS232 serial data interface and instead selects the audio line interface (Only available on ART, URT & XRT models) and routes the audio via internal level amplifiers to & from the transmitter & receiver modules respectively. The radio will now transmit audio tones produced by an external modem. The interface level is normally factory set for –13dBm, but can be adjusted between –20 to +3dB from the CALIBRATE MENU.

"Switched Internal/External Modem" allows either the audio line interface or the RS232 serial data interface to be selected under the control of a digital input. Change of mode is set by digital input DI1. When inactive (open circuit) the internal modem operates, when active (pulled low) the radio switches to external audio mode. This applies only to ART, XRT and URT models. On the ART & XRT radios, DI1 is one of the auxiliary connections, while on the URT the input is available at pin 15 of the 25 way D connector.

When "External Modem" or "Switched Internal/External Modem" is selected, a second field appears in this area allowing the user to select how the radio keys up into transmit mode when using the audio interface.
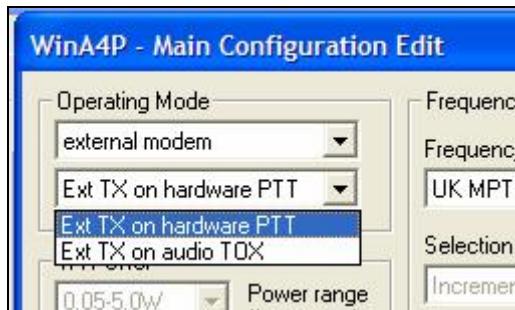
"Ext TX on Hardware PTT" sets the radio to key up when a "Push to Talk" signal is applied to the appropriate input pin. The PTT input connection arrangement differs between the various radio models which can accept external audio, but full details are given in the individual radio manuals. In particular, the URT Series has a two different options available with regard to which pins on the 25-way connector are used for PTT. These can be selected from the "Edit | Modem/TOX/Protocol" menu.
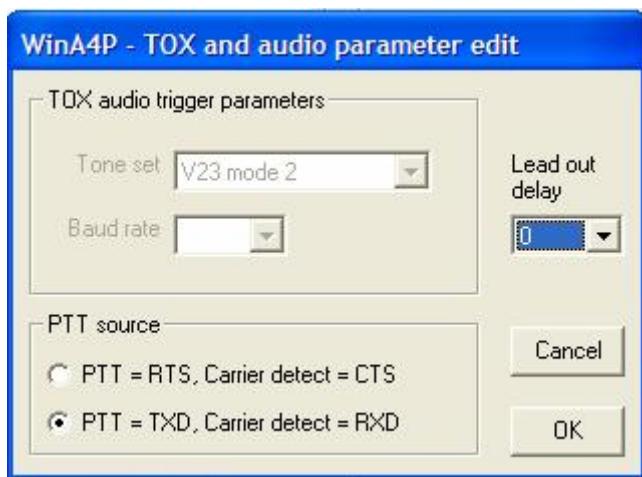
"Ext TX on audio TOX" routes the audio input via a Tone Operated Switch (TOX) which can be set to detect V23 or BELL202 formats in the "Edit | Modem/TOX/Protocol" menu. Detection of the selected format will key up the transmitter and forward the incoming data. To ensure that the radio does not key-up on noise, the TOX circuit checks for valid modem tones, not just the presence of some audio, before keying the radio.

5.3.1.2 TX Power Area

This area of the screen has 2 entry fields. The upper field is factory set and shows the range of acceptable power values which the radio can be set to. The lower field allows the user to set a value within that range. Any desired power within the allowed range can be typed directly into the box in Watts (e.g. 725mW would be entered as 0.725), or one of the preset power levels can be selected from the pull-down menu.
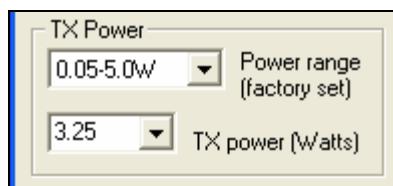
⚠ *Note:* *Programming a radio to an RF power level exceeding local regulations is strictly forbidden and may lead to prosecution. R.F. Technologies is not responsible for any illegal use of it's products and is in no way responsible for any claims or penalties arising from its operation in ways that contravene local regulations.*

5.3.1.3   Power Saving Area

If **"Auto Power Save"** is enabled by clicking to get a tick in the check-box, then the radio will power up and down automatically under the control of it's own internal timers. If disabled by clearing the check-box, the timer values will be greyed out and the timers will not operate. The save on, save off and resume time are all programmable parameters to allow the power consumption of the units to be reduced by using internal timers to put the radio into "sleep mode" for predetermined times.
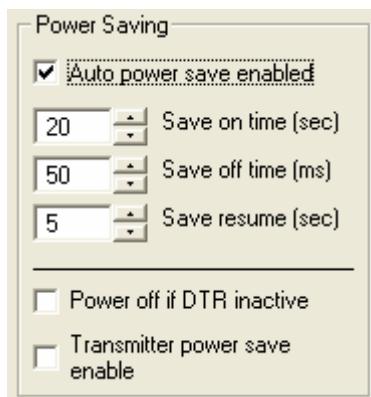
"Save On Time" sets the time that the transceiver is switched off for during the power save cycle (Power Save On). The Save On Time is programmable from 0 – 63.75 Seconds in 250ms (1/4 second) steps.

"Save Off Time" sets the time the transceiver is switched on for during the power save cycle (Power Save Off). The Save Off Time is programmable from 50 - 2550ms in 10ms steps. The default setting is 50ms.

"Save Resume Time" is the time the receiver stays active after a received carrier has dropped out, i.e. the time for which re-entry to power save mode is deferred. This is programmable between 0 - 255 seconds in 1 second steps. When a carrier is received during one of the "Save Off Time" periods, the unit will remain fully operational while the carrier is present and will continue to remain operational for the "Save Resume Time" after the carrier drops out. If a further carrier is detected during the "Save Resume Time", the "Save Resume Time" timer will be reset and will start again from the time that the last carrier dropped out.

"Power off if DTR inactive" allows the user to control the power save mode of the radio externally rather than using the internal timers. When this option is activated by clicking to place a tick in the checkbox, the DTR line is used for external power save, with the on/off ratio of the radio controlled externally via the DTR line. In this mode more of the modem's circuits are shutdown (including the microprocessor), this saves more power but care must be taken to ensure that the modem is enabled when a transmission is to take place. Note that there is a hardware link option to allow the serial port to shut off when DTR is not active, this allows the radio current to be reduced to its bare minimum. In applications where DTR is not connected this link option must of course be disabled.

"Transmitter Power Save Enable" (additional option on ART & XRT Series radios only, as they have separate TX and RX synthesizers) completely shuts down the transmitter's synthesizer section when it is not required. This saves current, but does slow down the transmitter key-up time slightly.

5.3.1.4 Frequency Range Selection Area

"Frequency Range" allows the operator to select from a number of pre-programmed standard band-plans or a more general section of the spectrum within which discrete channels can be programmed. The menus show the compete range of frequencies for which the radios can be supplied, but you should check the "Alignment Range" shown on the Main Screen for the particular tuning range of the radio with which you are working. If you require to operate on frequencies out-with the alignment range, it would be necessary to return the radio to the factory for re-alignment.

Where a pre-programmed band-plan is selected, all other fields associated with defining the allowed channels will be greyed-out and cannot be edited.
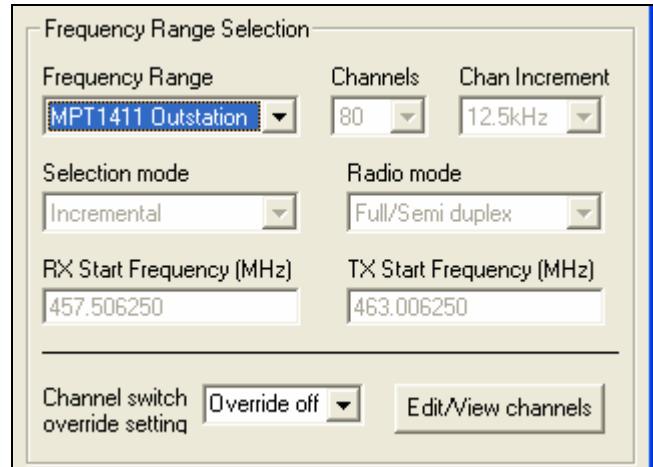
If you have selected a more generic allocation such as UHF 406-512MHz, the channel defining options become available again.
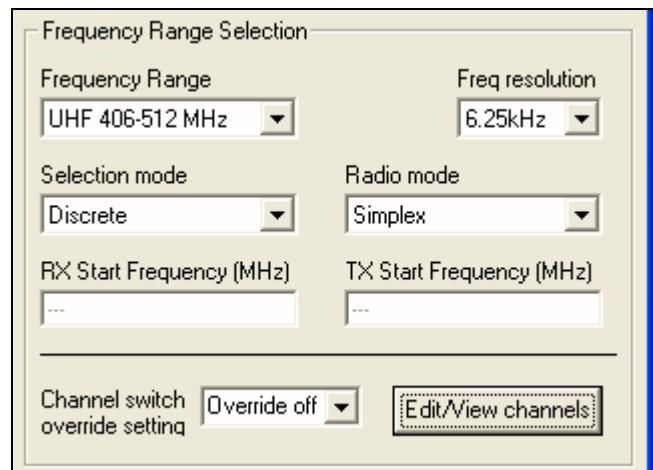
"Selection Mode" allows the choice of either "Discrete" or "Incremental. In "Incremental" mode, a start frequency for both RX and TX is set up along with a channel increment and the desired number of channels. For example, entering 450MHz as the RX and TX start frequency, 5 as the number of channels, and 12.5KHz as the channel increment, will result in frequencies of 450.0000, 450.0125, 450.0250, 450.0375, and 450.0500 being allocated to channels 1 to 5 of the modem, the TX and RX frequencies can be offset from each other by entering different start frequencies in the Rx and Tx start frequency fields.   Up to 80 incremental channels can be programmed in this way.

In "discrete" mode, up to 32 channel frequency pairs may be individually entered in the channel data table and do not have to conform to any regular spacing. Pressing the "Edit/View Channels" button will open up the channel data table (See Section 5.3.4).

"Radio Mode" allows selection of "Full/Half Duplex" or " Simplex" operation. Only the ART & XRT Series radios can support full duplex operation, and this option is greyed out for all other versions.

**"Channel Switch Override Setting"** allows the operator to force the radio always to operate on the override channel selected and to ignore the channel selection on the front panel channel selection switches. If "Override Off" is selected, the front panel switches control the selected channel. This facility is particularly useful in conjunction with the Network Management option in that it allows remote channel selection under software control.
Even if a channel override is applied, setting the front panel switches to 00 will still select local programming mode.
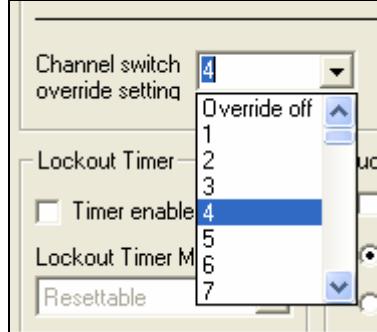
5.3.1.5 Lockout Timer Area
The transmitters have a time-out timer which can be enabled by clicking to place a tick in the check-box. This allows a maximum transmission time to be set, in order to prevent possible channel blocking due to a fault occurring in connected equipment which causes continuous data to be applied to the radio. The timer works for both internal and external modem configurations.
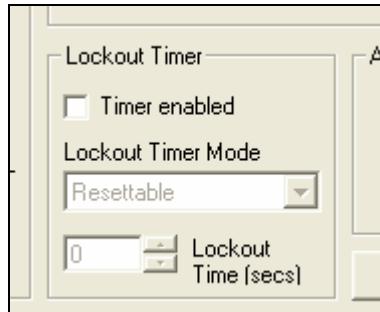
"Lockout Timer Mode" allows either resettable or cumulative mode to be selected. In resettable mode, transmission will cease after the programmed time and will not restart until the action that normally causes transmission is removed then re-applied. The timer resets and starts counting up again each time a transmission starts.
In cumulative mode, the timer counts up during transmission and counts down during receive. If the timer manages to count up to the "Lockout Time", an indefinite lockout is applied. This can only be reset by removing power from the radio and re-applying it.

The **"Lockout Time"** can be set between 0 and 255 seconds in 1 second steps.

The SYS LED on the radio front panel will flash continuously while a lockout is being applied.

5.3.1.6 Audio Area

This area of the screen is only available for ART, URT & XRT Series radios which have an audio interface available.
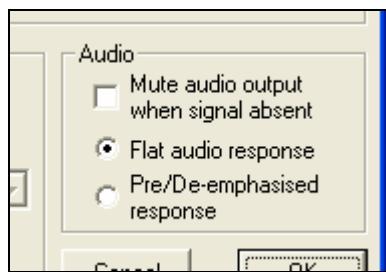
By placing a tick in the **"Mute Audio"** check-box, the receive audio path can be set to mute when no incoming carrier is detected. If this option is not selected, background noise could cause connected modems to generate spurious characters at extremely low RF signal levels.

There is also the option to set the response of the transmitter and receiver audio paths to either flat or de-/pre-emphasised.

⚠️ *Note: For "Internal Modem" operation, the audio response should be set to FLAT.*

5.3.2   Internal Modem/TOX/Protocol (External Modem)

Different screens appear when this menu item is selected depending on whether Internal Modem or External Modem has been selected on the Main Configuration Screen. The "External Modem" options only apply to the ART, URT & XRT Series radios.

When the Operating Mode is set for External Modem on these radios, the following screen appears when you select Internal Modem/TOX/Protocol in the Edit menu.
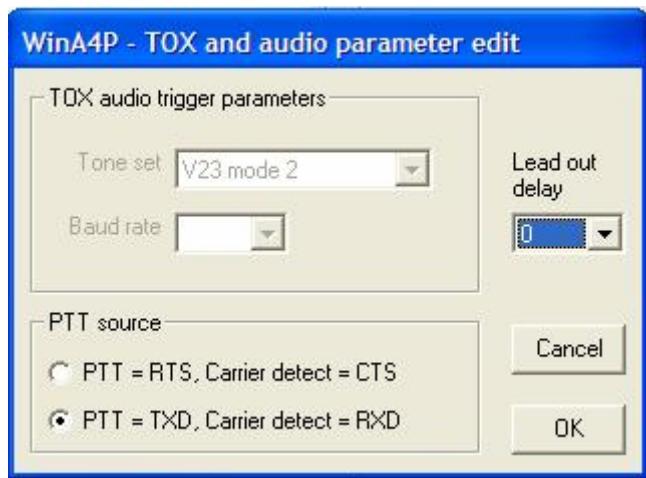
The **"TOX audio trigger parameters"** is greyed out unless TOX (Tone Operated Switch) operation has been selected on the Main configuration screen. When active, it allows the user to programme which modem tone set will operate the TOX circuit. Detection of the selected format will key up the transmitter and forward the incoming data. To ensure that the radio does not key-up on noise, the TOX circuit checks for valid modem tones, not just the presence of some audio, before keying the radio. The radios can be set to detect either V23 or Bell 202 modem tones.

The **"PTT Source"** area is only visible on URT Series radios which have a choice of which input pins will trigger transmission when using an external modem.

The **"Lead out delay"** is the time the transmitter stays up after the audio data finishes, this is to avoid mute noises that could corrupt data that is not framed, not packetised and does not have an end of message character. This is programmable between 0 & 256 milliseconds

5.3.3   Internal Modem/TOX/Protocol (Internal Modem)

As mentioned above, different screens appear when this menu item is selected depending on whether Internal Modem or External Modem has been selected on the Main Configuration Screen.

When the Operating Mode is set for Internal Modem, the following screen appears when you select Internal Modem/TOX/Protocol in the Edit menu.
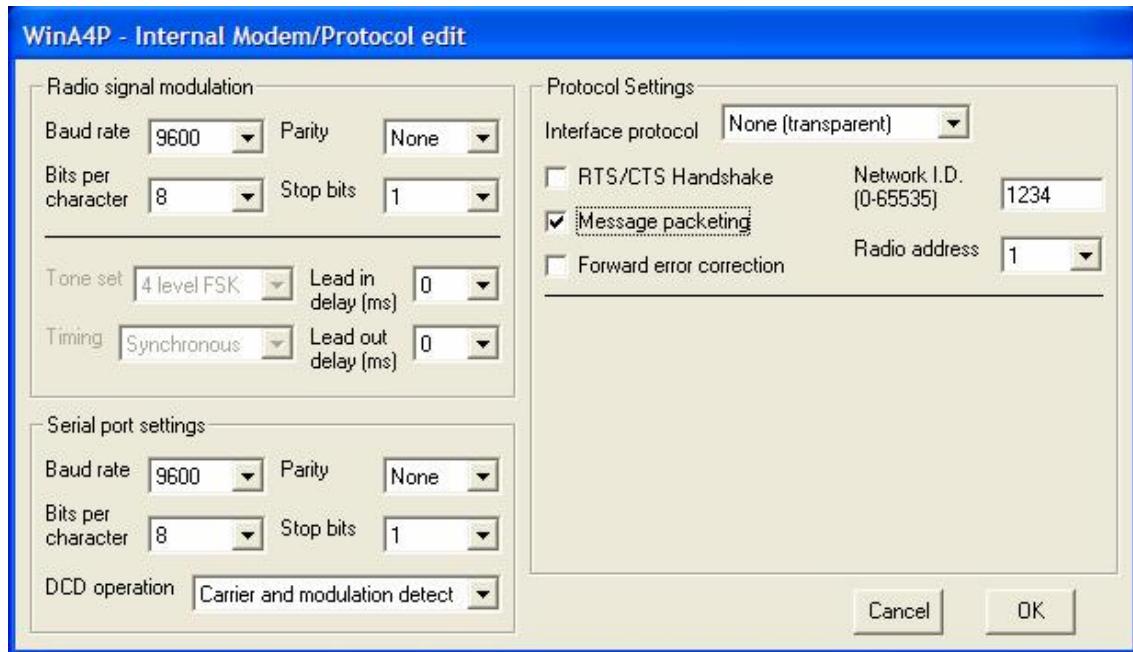
5.3.3.1   Radio Signal Modulation

This area allows the user to configure the signal format which is transmitted over air. This format does not need to be the same as that set for the interface connector, but it is recommended that the radio baud rate be set the same as, or slower than, the serial port rate. The radio baud rate should be set at the minimum possible to maintain the required throughput, lower speeds will give better results in poor signal conditions.

The "**Baud Rate**" of the internal radio modem can be set for a variety of rates between 150 baud and 9600 baud within a 12.5kHz channel.

"Bits per Character" can be set to 7 or 8

⚠ *Note: If packetisation is activated (see Section 5.3.3.3) then the **radio** "bits per character" should always be set for 8, even if the serial interface bits per character is set to 7.*

"Parity" can be set to None, Even or Odd

"Stop Bits" can be set to 1 or 2

The "**Tone Set**" used in the internal modem can be selected to be either Bell 202 or V23 to allow compatibility with other modems at baud rates up to and including 1200 baud,. At higher rates, no options are available and the window will grey out and display the default modulation scheme being used.

"Timing" allows either synchronous or asynchronous operation of the modem to be selected for speeds up to and including 1200baud. Above 1200 baud the format is fixed as Synchronous. For best performance synchronous mode is suggested. This is a parameter affecting the mode of operation of the modem and does not relate to the nature of the serial data presented on the traffic interface. The external traffic interface is always asynchronous.

"Lead In Delay" selects the time the RF carrier is raised before the transmission of data via the internal modem takes place, for more detail see the section of radio manual describing transmit/receive timing. The delay is programmable from 0 to 2500ms in 10ms steps.

"Lead Out Delay " selects the time the transmitter remains up after the data has been sent. Used sometimes to give a finite quiet pause after the data has been sent, for more detail see the section of the radio manual describing transmit/receive timing. The delay is programmable from 0 to 2500ms in 10ms steps.

5.3.3.2 Serial Port Settings

The "**Baud Rate**" of the external serial port can be set independently of the radio baud rate but for reliable operation should always be the same speed or higher than the radio baud rate. It can be set for a variety of rates between 150 baud and 38,400 baud.

"Bits per Character" can be set to 7 or 8

"Parity" can be set to None, Even or Odd

"Stop Bits" can be set to 1 or 2

"DCD Operation" allows the behaviour of the "Data Carrier Detect" line on the receiver to be customised. It can be set to activate on receipt of just a carrier, which can be useful if a busy lockout function is required. As a second option it can additionally check for the presence of both carrier and a valid data signal before activating, thereby reducing the likelihood that it will respond to an interfering carrier. Finally, as a third option, it can be set to activate at any time that there is data in the receive buffer, even if the carrier has already disappeared. This option ensures that all data has been output before DCD is released and therefore allows the DCD line to be used as a wake-up signal to externally connected equipment if required.
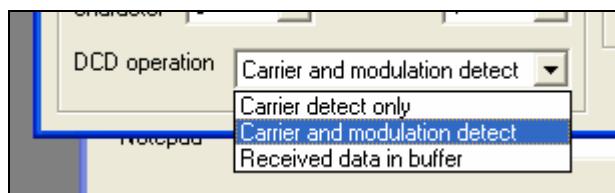
5.3.3.3 Protocol Settings

While all the radios can be programmed to operate transparently, just transmitting whatever data is applied to the input, the ART, SRT, URT & XRT Series radios can also be programmed to operate using specific protocols.

Depending on the type of radio involved, the program allows selection from a list including some, or all of:- NONE, HAYES AT, MODBUS RTU, MODBUS ASCII, RF Technologies Own Protocol, DNP3 & IEC870. At the time of writing this version of the manual DNP3 & IEC870 are still under development and they have not been fully implemented in the software.
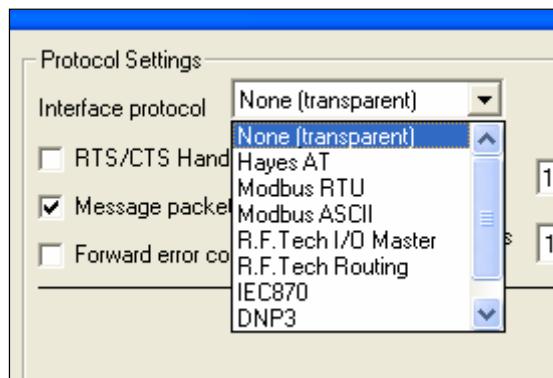
In these protocol specific modes, the radio recognises a complete message frame and only transmits data which conforms to the specified format. These modes also allow routing modes to be enabled in which messages can be passed down a chain of radios using "Store & Forward" techniques.

"RTS/CTS Handshaking" option allows the user to set the desired key-up behaviour of the transmitter. If this option is selected, transmissions will be initiated by the RTS line on the interface connector. If the option is not selected, transmission will be initiated by valid data appearing on the TX Data pin on the interface connector. The CTS line on the radio remains active in both cases.

"Message Packeting" switches on an option to add framing characters at the start and end of the user's message prior to transmission. The additional information is stripped off the messages at the receiver prior to passing the data to the interface connector. Packetisation can be useful in getting rid of any spurious characters which may otherwise be generated at the end of messages by squelch noise as the receiver mutes and which can affect old or non-tolerant protocols. This field is enabled automatically when certain protocols are selected which require the packetisation mode.

It is important to note that packetisation must be set the same on all radios operating together. All radios must have it selected or all radios must have it de-selected.

⚠ *Note:* *If packetisation is activated, then the **radio** "bits per character" should always be set for 8, even if the serial interface "bits per character" is set to 7.*

"Forward Error Correction" is a programmable option at 9600bps and will improve the BER in areas of poor performance, however there is an associated data throughput overhead of approximately 30%. It is not available at lower over-air data rates since it offers no significant performance advantage at these rates.

It is important to note that forward error correction must be set the same on all radios operating together. All radios must have it selected or all radios must have it de-selected.

"Network ID" is a number between 0 and 65535, and differentiates one network or a sub network from another. This field is only visible if the packetisation option is switched on.

"Radio Address" is a number in the range 0 to 255 and is the actual address of the radio modem as used in MODBUS and the other supported routing protocols, as well as for remote programming when using a network manager. This field is only visible if the packetisation option is switched on.

If no protocol is selected (transparent operation), a normal packeted data message contains no address information. Only the network management messages themselves incorporate the addresses.   Therefore, if network management is not being used and no protocol is selected, it is acceptable to set all radios to the same address even if packetisation is on.

When a specific protocol mode is selected, or if a network management system is being used, the "Network ID" and "Radio Address" fields must be filled out such that every radio in a given system has the same network ID, but a different radio address.

Depending on the protocol selected, a number of additional data entry fields may appear:-

 "Min Power Save Address" & **"Max Power Save Address"** define the limits of the range of radio addresses for which power save mode will be active when Modbus or RFT Routing Protocols are selected. Radios with addresses outside this range will not use power-save.

If power save operation is not required set both these fields to zero.

If power save operation is required it is enabled by setting the radio address to a value greater or equal to "Min Power Save Address" and less than or equal to "Max Power Save Address". The radio will then enter low power standby mode for the time programmed in the "Power Save On" field in the main configuration edit screen, it will then wake up and check for an incoming signal, if none is present it will return to sleep and repeat the cycle. If a signal is detected the radio will stay awake until a reply to the outward bound message has been returned.

When the master station or relay radios send an outward bound message, the address of the radio to which the message is being sent is checked against the min and max power save addresses, if a power saved radio is indicated a cyclic wake up message is sent for the period indicated by the programmed power save on time before the actual data message is sent, if a power saved radio is not indicated the data message is sent immediately. These parameters along with some others are also used to calculate a timeout time in the event that no reply is received. It is therefore essential that all radios in a system are programmed with the same parameters even if not power saved, otherwise communications will fail.

Note that if "DTR Shutdown" is enabled a radio remains completely shut down while DTR is inactive, it will not wake up according to the power save timer to see if any incoming messages are present. This mode should therefore only be used in conjunction with real time message scheduling.

"Host Inactivity Time" defines a time limit for the Modbus or RFT Routing Protocol device to assert DTR in response to RI, if this time limit is exceeded RI is dropped and the radio sends back a reply indicating the destination device failed to respond and the link is cancelled. This time is also used to define the time limit for the connected device (e.g. an RTU) to reply to the incoming message, if the time limit is not exceeded the reply is sent back to the master station and RI is dropped.

"Routing Table Enable" is a checkbox which allows the user to activate the routing table for the selected protocol.

The **"Edit Routing Table"** button appears for all protocols which support store & forward routing of messages and open up the routing table for editing when clicked. It will be greyed out if the "Routing Table Enable" checkbox has not been activated.
To edit an entry in the table, highlight the row for the device address concerned (which may be either a radio or a connected device such as an RTU), then type the intermediate repeater site addresses into the entry field separated by commas and click on "Change". Addresses should be entered in the order in which they are connected, starting from the Master Station and going to the Outstation.
As an example, if the device with protocol address 4 is physically connected to the radio with radio address 34, and radio 34 is accessed from the base station via relay radios 23, then the row for address 4 should be loaded with the route "23,34" as shown in the screenshot above.
If no routing table is loaded or a protocol address cannot be found in the routing table the radio assumes that the destination radio address is the same as the protocol address and that no relays are required. This can be taken advantage of in simple schemes where no more than one device is connected to any one radio.
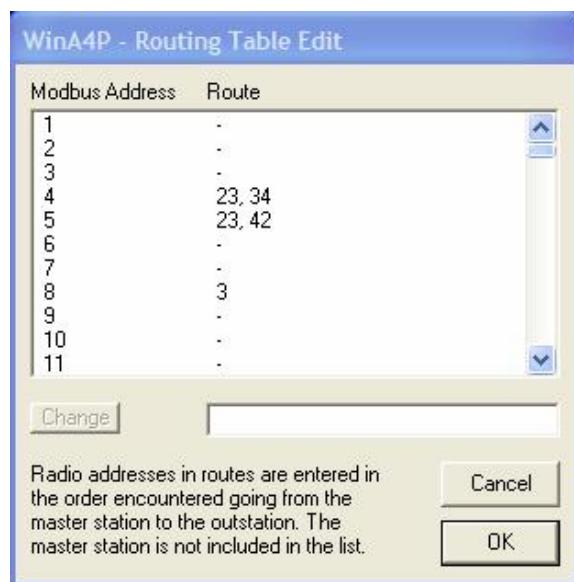
"Address Byte Offset" field is only available when using "RF Technologies Routing" Protocol and can be set to any number in the range 0 –255. This specifies the position of the address in the protocol field. A setting of 0 specifies zero offset, i.e. the address is the first byte in the message, an offset of 6 specifies the 7th message byte and so on. 16 bit addressing or more is not supported as a maximum of only 256 destinations can be supported by the routing table. If the protocol message format does use 16 bit addressing specify the offset for the least significant byte and try to ensure that no two devices use the same l.s.b. in their address.
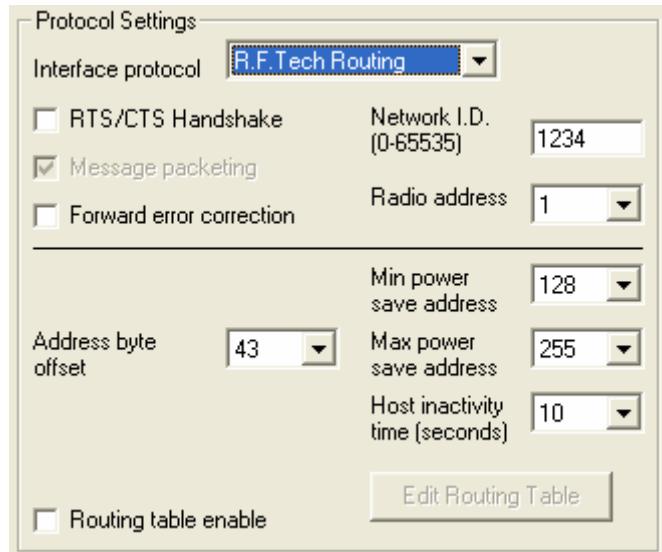
"Auto Answer Time" field is only available for Hayes AT protocol. If a radio receives a request to set up a link with itself as the destination it will raise RI to wake up its host, if auto answer is disabled ("AUTO ANSWER TIME"=0), it will wait for the "HOST INACTIVITY TIME" for the host to accept the call by raising DTR and issuing an ATO command, DSR will be raised in immediate response to DTR. If auto answer is enabled the radio will wait for the number of seconds programmed as the "AUTO ANSWER TIME", it will then enter transparent mode automatically but only if DTR has been raised. In either scenario DCD is raised as soon as transparent mode is entered and the calling radio is informed that the link is valid. The link will normally be terminated by the calling party, the radio will inform its host that this has happened by dropping DCD, the host should then use the AT escape code to terminate transparent mode or drop DTR. If DTR is not active DSR will be dropped and the radio will return to sleep.
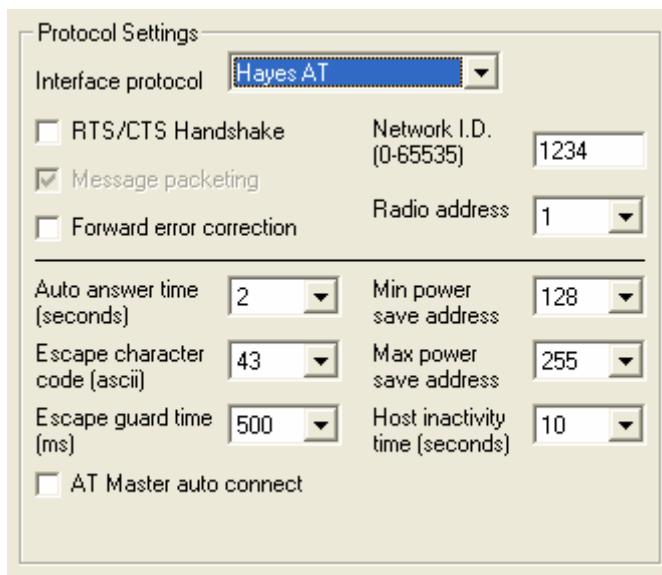
"Escape Character Code" field is only available for Hayes AT protocol and allows the user to define the desired escape code.

"Escape Guard Time" field is only available for Hayes AT protocol and sets the time in 20ms units required to separate the escape code sequence from other data.

"AT Master Auto Connect" checkbox is only available for Hayes AT protocol and activates "AT Master Auto Connect" if ticked.

5.3.3.4 Interface

For ZRT models with combined RS232/RS485/RS232 serial interfaces, there is an area to select the required serial interface configuration.

Using the 2 pull-down boxes, the combinations which can be selected are:-

RS232	Full Duplex
RS485 (or RS422)	Full Duplex (4-wire)
RS485 (or RS422)	Half Duplex (2-wire)

If the channel selection switches on the front panel are set to "00" to select programming modes, the interface will automatically revert to RS232, even if RS485 mode is selected. This is to allow connection to a PC for programming without requiring an interface converter.

5.3.4 Channel Frequencies

The Channel Data Edit screen is displayed when "Channel Frequencies" is selected from the main edit menu. It also appears when the "Edit/View Channels" button on he Edit Main Configuration" screen is pressed.

The channel numbers shown correspond to the channel switch settings on the radio modem.

Up to 32 channels may be edited in discrete channel selection mode, and up to 80 channels may be viewed, but not edited, in incremental mode. In incremental mode, the channels are fully defined by the start frequencies and increment programmed on the main configuration screen and are displayed for information purposes only.
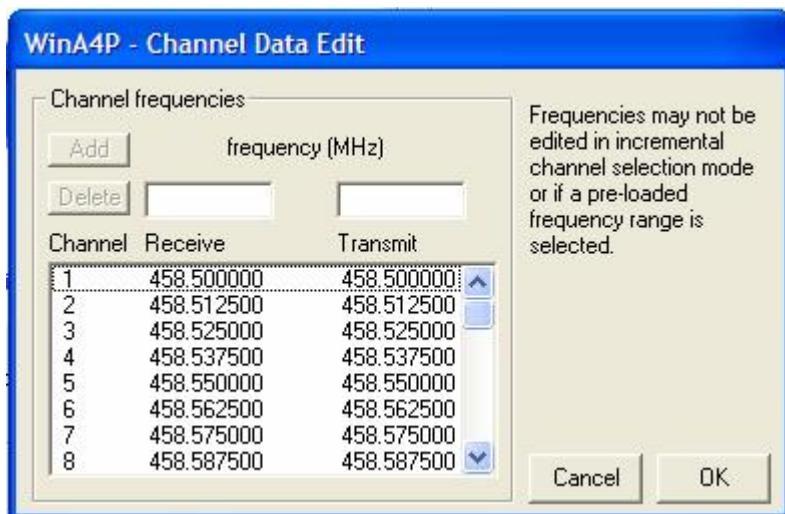
In discrete mode, the program will allow you to edit the data in the frequency table. To add a new channel, highlight the position in the table where you would like to add the new channel, type the required TX and RX frequencies in the small entry fields, then click on the "Add" button. To delete a channel, simply highlight the relevant row in the table, then click on the delete button (or press "Delete" on the keyboard).
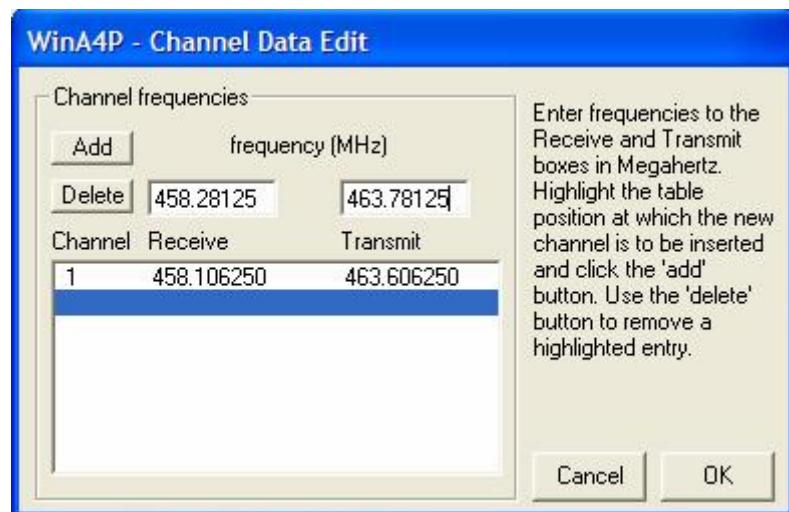
5.4   TOOLS MENU

5.4.1   Calibrate Radio (also allows RSSI monitoring)

The calibration and test window which opens if you select this item is primarily used for factory programming and in certain cases, workshop re-alignment. It also allows receive signal level to be measured on any programmed channel. In the standard-user version of the software, many of the facilities have been inhibited. Selected parameters can be checked and temporarily changed, but the storage of calibration values, alteration of serial number, etc. is disabled. Only the Line Input Level & Line Output Level settings (applicable to ART, URT, XRT only) can be stored by the normal user.

Options not applicable to the radio being tested will be greyed out.

⚠ Caution:-   In many of the tests, the transmitter may operate. Ensure that you are conducting the tests in an environment where transmission on full power will be safe and legal, and that the RF port of the radio is connected to a suitable matched load before pressing the button to start a test. The Tx tests operate using whichever frequency is set as channel 1 in the configuration saved in the radio.
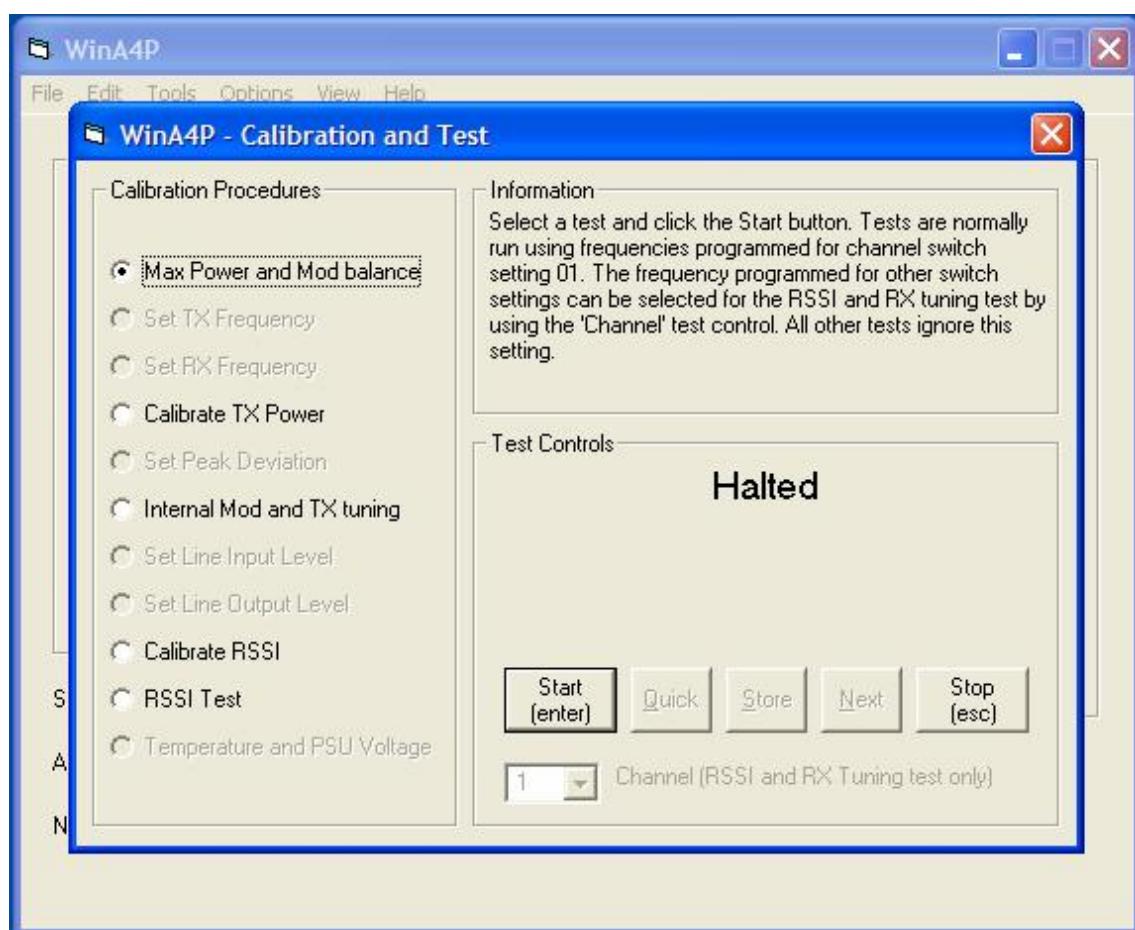
5.4.1.1   Max Power and Mod Balance

This selects the maximum power for TX alignment and modulates the Transmitter with a 50Hz square wave to test the balance of the modulation point. When the Start button is clicked, the radio will transmit on full power on Channel 1. Ensure that the radio RF port is connected into a suitably matched load before starting test.

5.4.1.2   Set TX Frequency

This option is only available for ART and XRT radios.

It adjusts the transmitter's frequency by varying the voltage to the transmitter VCTCXO.

It is normally set to the mid point (around 50% on the scale), the frequency is then set up as accurately as possible with the variable capacitor in the VCTCXO and then fine tuned with the PC control. This enables later electronic adjustment to be carried out via a PC or over the radio link. In the user version of the software, the oscillator can be electronically tuned with the PC to confirm correct operation, but the tuning value cannot be stored in the radio. The capacitor should NOT be adjusted using the standard user-version of the software.

5.4.1.3   Set RX Frequency

This option is only available for ART and XRT radios.

It adjusts the receiver's frequency by varying the voltage to the receiver VCTCXO.

It is normally set to the mid point (around 50% on the scale), the frequency is then set up as accurately as possible with the variable capacitor in the VCTCXO and then fine tuned with the PC control. This enables later electronic adjustment to be carried out via a PC or over the radio link. In the user version of the software, the oscillator can be electronically tuned with the PC to confirm correct operation, but the tuning value cannot be stored in the radio. The capacitor should NOT be adjusted using the standard user-version of the software.

5.4.1.4   Calibrate TX Power

Following the on-screen instructions, the operator adjusts the power output using the PC until the requested power levels are measured on an external instrument. These level settings are stored in the radio and used to calibrate the particular RF power profile of the individual product. This profile is then used to accurately select the required RF power level via the PC program or over the radio link.

5.4.1.5   Set Peak Deviation

This allows the peak deviation level to be set for the required channel spacing. The level of an internally generated 1kHz test signal is adjusted while the output from the radio is connected to a suitable deviation meter.

5.4.1.6   Internal Mod and TX Tuning

The internal modulation level adjustment sets the normal modulation level for the product when using the internal modem. The level of an internally generated 1kHz test signal is adjusted while the output from the radio is connected to a suitable deviation meter.

5.4.1.7   Set Line Input Level

This option is only available on ART, URT and XRT Series radios which have line inputs and outputs. It allows the line input level to be adjusted between –20 and +3dBm. Default input level setting to give 1.5kHz deviation is -13dBm for a 1kHz external test tone.

5.4.1.8   Set Line Output Level

This option is only available on ART, URT and XRT Series radios which have line inputs and outputs. It allows the line output level to be adjusted between –20 and +3dBm. Standard test input signal is 1kHz modulation at 1.5kHz deviation and the default output level setting is -13dBm.

5.4.1.9   Calibrate RSSI (& RX Tuning)

With a single generator connected to the radio modem, the operator adjusts the output level as requested by the program and each level is entered into the products memory.

These levels are used to build up a calibration profile of the RSSI response of individual products. The profile is then used to accurately measure the RSSI level of the received signal and display the value in dBμV on a PC.

5.4.1.10   RSSI (& RX Tuning) Test
Will read the incoming signal level (RSSI) and will display the value within the range -15 to +30dBµV for antenna alignment and range testing. A conversion table to assist in converting between dBm, dBµV and µV is included at the end of this manual.

For this option, the pull-down window allowing you to select the desired test channel number is activated. This allows the receive level on any programmed channel to be monitored which is useful for testing and for antenna alignment etc. Select the channel on which you wish to measure the receive level before pressing the Start button.
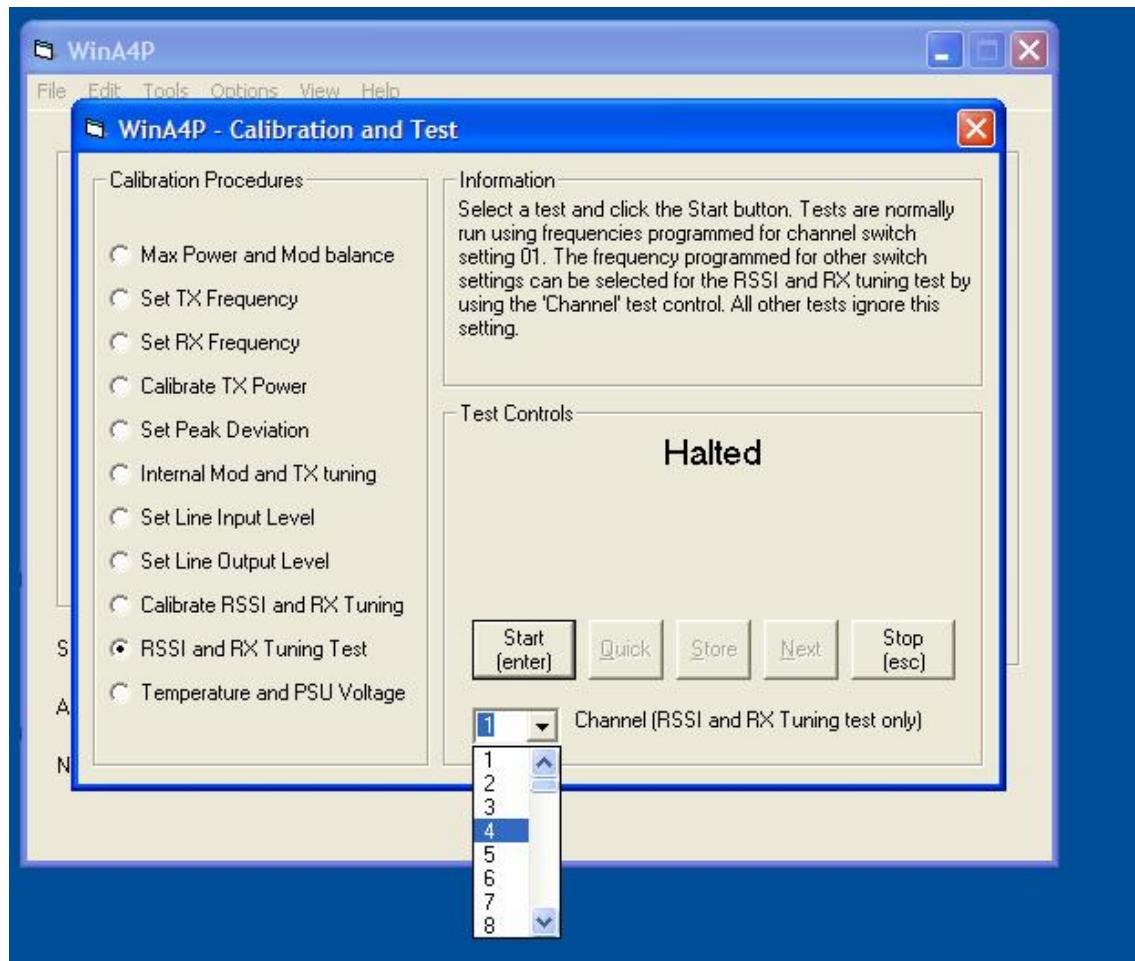
When you click the Start button on screen (or press the Enter key), the receive signal level will be shown as a bar-graph with a digital readout above it.
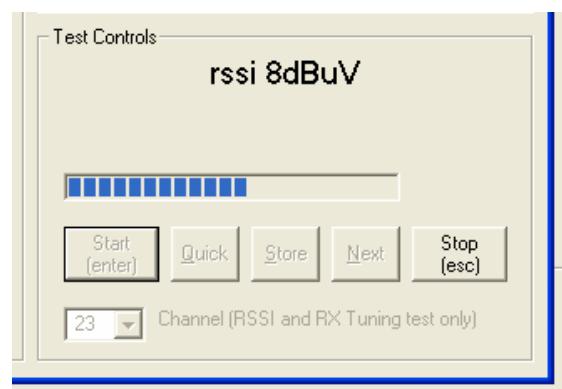
5.4.2   Network Manager

This option, which will become available in future releases of the software, applies when the program is on a PC connected to a master station in a scanning network, rather than used on a local connection to a radio. It enables the user to remotely program the radio and configure the network over the radio links, it also contains some very powerful diagnostic and re-alignment features.

5.4.3   RSSI Monitor

This test function allows the RSSI to be monitored in real time while the radio is in service carrying live traffic. It will only work with ART and XRT radios with internal firmware version 4.5 or higher (used in units manufactured after October 2007). The SRT, URT and ZRT modems do not currently support this feature, although a similar but less comprehensive RSSI indicator is available in the "Calibrate Radio" menu on those models.

For this real-time "RSSI Monitor" feature to work, the computer running WinA4P must be connected to the front panel RS232 management port on an XRT or to the I2C port on an ART through a suitable RS232 to I2C adaptor. The radio should be in normal operation with the desired operating channel set on the front panel switches.

It is not designed to work when connected to the main data port with the radio in configuration mode. In this situation it is necessary to use the alternative RSSI test in the "Calibrate Radio" menu.

The screen shows 3 horizontal bar indicators, one showing the instantaneous receive level, one showing a moving average of the RSSI and one with "peak hold" to show the highest recent level. The averaging period for the moving average graph and the hold time for the peak hold graph are set with slider controls.
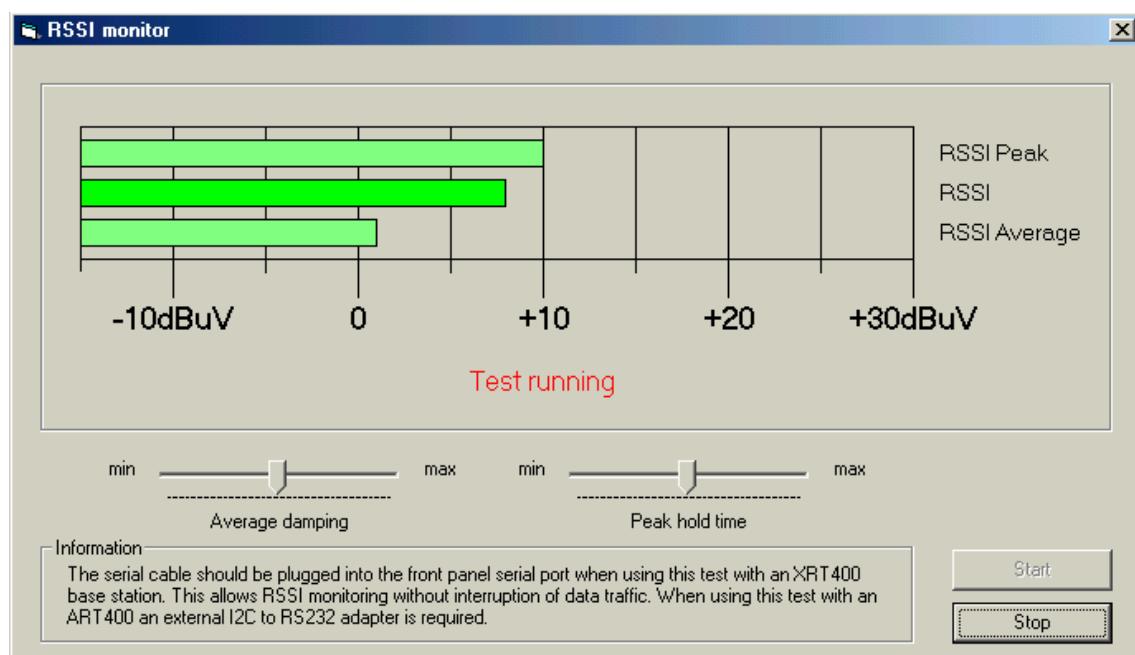
5.4.4   Generate Carrier

This test function will only work on radios with internal firmware version 4.5 or higher (used in units manufactured after October 2007).

When selected, it allows the operator to initiate a test transmission on any of the pre-programmed channels at a range of selectable transmit powers. If you leave the settings in this screen at "default", then the test transmission will go out on the channel selected by the

switches on the front panel of the unit at the power programmed into the unit. If you select values other than default, then the selected values will over-ride the normal settings for the duration of the test.

When you press the Start/Stop Carrier button, the radio will start transmitting and the box on the right will change to show that the carrier is ON and will also show the selected channel and power. Pressing the Start/Stop Carrier button again will stop the test transmission.
Note that you are advised to "Read" the radio before using this function to ensure that the channel settings selected agree with those programmed in the radio.

When the "Enable Modulation" box is ticked, the test transmission is modulated with the equivalent of an "All 1s" data signal. If the box is not ticked, then an un-modulated carrier is sent.
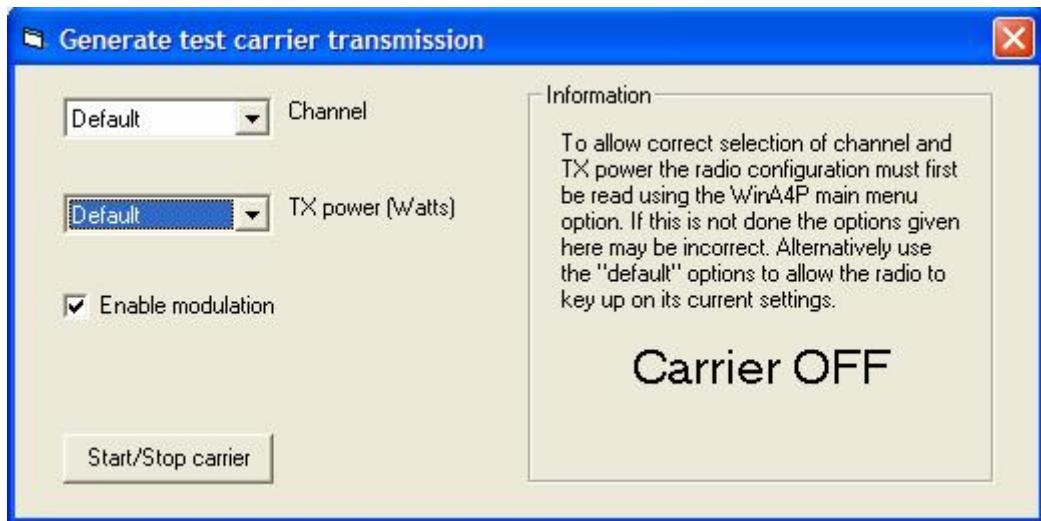
5.4.5   Ping-Pong Test
This option, which will become available in future releases of the software, allows the generation and checking of test transmissions over a link involving two radios. The test program can be configured as a master, which originates a string of configurable messages and checks that they are accurately repeated back to it from the far end of the test link, or as a slave, which operates at the far end of the link and listens for transmissions, which it then echoes back to the originating end of the test link. On machines with dual serial ports it is possible to set up the test program so that one port is the master and the second port on the same machine is the slave.
The test program can also be set up to simply transmit blocks of test data at programmed times or to just listen for received data and display it when it is received.

5.4.6   Firmware Download
This option, which will become available in future releases of the software, allows the radio firmware to be locally upgraded using the configuration program. Firmware download will be available to all radio models having firmware version 3.3 or later.

5.4.7   Verify Product & Firmware
This option will become available in future releases of the software and will perform the same initial product checking exercise that you see every time you perform a read or write operation on a radio, the difference being that the display window will remain open allowing the user more time to check the result. The main purpose is to check the firmware version.

5.5 OPTIONS MENU

5.5.1 Select Comms Port

When you select this option, a small sub-window will appear with a pull-down menu allowing selection of port Com 1 to Com 16. Once the required port is selected, press OK to proceed. On most PCs with a single serial port, this port will be Com1.

5.6 VIEW MENU

5.6.1 Eeprom Data

This opens a window which allows you to view the raw hexadecimal configuration data which equates to the configuration which is visible on the main screens. These are the blocks of data which are written to (or read from) the radios. The data can be viewed in this window to assist in troubleshooting any problems, but not edited from here.

5.7 HELP MENU

5.7.1 About WinA4P

This displays a small window giving details about the program, including the version number.

5.7.2 Release Notes

Displays a text file giving release history.

6 CONVERSION TABLES

dBm	µV	dBµV
-75	39.764	32
-76	35.439	31
-77	31.585	30
-78	28.150	29
-79	25.089	28
-80	22.361	27
-81	19.929	26
-82	17.762	25
-83	15.830	24
-84	14.109	23
-85	12.574	22
-86	11.207	21
-87	9.988	20
-88	8.902	19
-89	7.934	18
-90	7.071	17
-91	6.302	16
-92	5.617	15
-93	5.006	14
-94	4.462	13
-95	3.976	12
-96	3.544	11
-97	3.159	10
-98	2.815	9
-99	2.509	8
-100	2.236	7
-101	1.993	6
-102	1.776	5
-103	1.583	4
-104	1.411	3
-105	1.257	2
-106	1.121	1
-107	0.999	0
-108	0.890	-1
-109	0.793	-2
-110	0.707	-3
-111	0.630	-4
-112	0.562	-5
-113	0.501	-6
-114	0.446	-7
-115	0.398	-8
-116	0.354	-9
-117	0.316	-10
-118	0.282	-11
-119	0.251	-12
-120	0.224	-13
-121	0.199	-14
-122	0.178	-15

7   REVISION HISTORY

Version 1.0   Released 29 September 2004
                      First release of new software.

Version 1.1   Released 14 January 2005
                      1) Release notes added to help menu.
                      2) IF offset for VHF bands corrected from -45MHz to +45MHz.
                      Previously radios programmed for VHF would indicate a synthesiser
                      lock error.
                      3) Lead in delay in all default files changed from 0 to 40ms. Previously
                      the internal modem would fail to operate correctly if radio
                      programmed using default file.

Version 1.2   Released 7 February 2005
                      1) Fixed bug from v1.1 which prevented com port selection menu from
                      being shown.

Version 1.3   Released 3 August 2005
                      1) Feature added to calibration menu to allow selection of which
                      channel to use in RSSI test.
                      2) Bar-graph and up/down test controls in calibration menu now
                      protected from over-range values returned from radios with corrupt
                      eeprom which previously caused program to crash.
                      3) Hot keys added to test routines in calibration menu.
                      4) Fixed bug which resulted in program crash when out-of range value
                      entered in the TX Timeout Timer field.
                      5) Pre-loaded frequencies for UK MPT1411 proposed new bandplan
                      deleted (disabled) since new bandplan abandoned.

Version 1.4   Released 18 January 2006
                      1) Extended range of programmable UHF frequencies

Version 1.5   Released 28 April 2006
                      1) 0.5 to 10W Power range added to support 10W versions.

Version 1.6   Released 4 May 2006
                      1) 350-512MHz band changed to 404-485MHz, 350-410MHz band
                      added. Previous band definition could result in out of range pll code
                      calculation warning. N.B. radios programmed with frequencies below
                      404MHz using earlier software versions will cause WinA4P to report an
                      error when reading the radios. These radios must be re-programmed
                      with the newer version to correct the band information.

Version 1.7   Released 18 January 2007
                      1) Support for RS485 version of ZRT radio added.

Version 1.8   Released 19 January 2007
                      1) Bug fixed in setting of serial port 7/8 bit format. This setting was
                      incorrectly read from the radio signal setting instead of the serial port
                      setting causing alteration of the radio signal 7/8 bit selection to set the
                      serial port format as well. Altering the serial port setting had no effect.

Version 1.9   Released 1 March 2007

1) Interface type (RS232/RS485/RS422) and half/full duplex selection added for issue B RS485 ZRT.

2) RTS/CTS handshake option is now suppressed only if RS485 selected.

3) ZRT and ZRT485 now have MODBUS and rftech routing protocol options enabled.

4) ETSI 868 MHz band title changed to PAN EURO 868 MHz, frequency range changed from 11 incremental channels starting at 869.4 MHz to discrete channels from 863.0 to 870.0 Mhz.

Version 2.0   Released 12 October 2007

1) RSSI monitor and CW generator tests added to Tools menu.

2) Now supports up to 16 com ports rather than just 4.

3) Bug fixed that caused "run time error 5" when out of range power or start frequency values entered in main configuration menu.

4) Selection of 7 bit format for radio modulation now inhibited if any packet protocol options selected..

Known Outstanding Issues :-

1)   The following Menu Items have not yet been implemented:-
- Tools / Network Manager
- Tools / Ping-Pong Test
- Tools / Firmware Download
- Tools / Verify Product & Firmware

2)   The following protocols have not yet been fully implemented:-
- DNP3
- IEC870

3)   Help screens have not yet been included.

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