Applicable to Models:

9005 (P25)				

General

A very-simple P25-Digital repeater can be created using two Simoco SRM9000 Transceivers, each fitted with the P25 option.

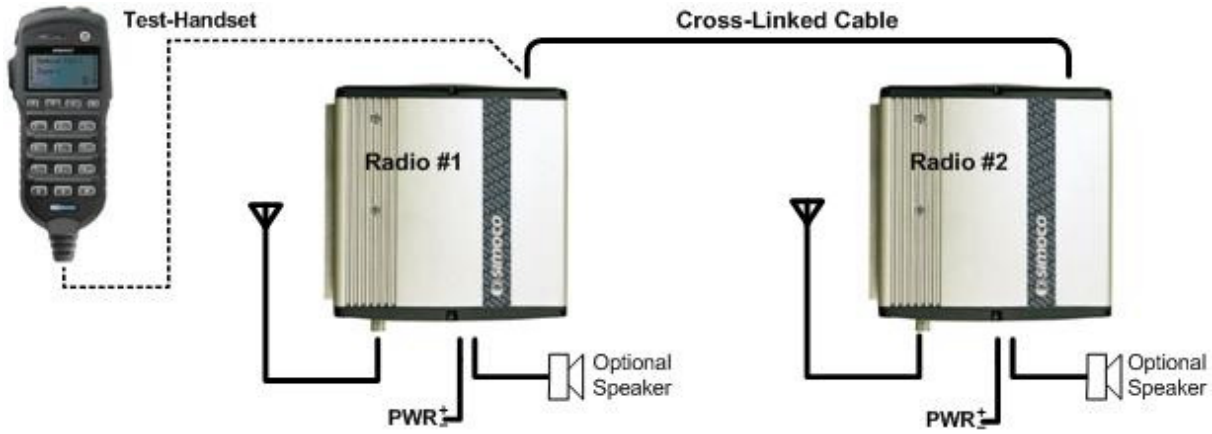
This repeater will only repeat P25-Digital signals. Analogue signals are not recognized.

These radios are connected at the "raw" P25 data interface. As such, they repeat signals without interpreting them, and hence can repeat encrypted information without needing to have any encryption-key information loaded.

The repeater can be configured to insert a specified repeater NAC code on the repeated signal.

This Application Note describes the simplest P25-Repeater configuration possible.

Repeater



Two Transceivers can be connected together via their front connectors using the Cross-linked Cable. No Microphone or Control Unit is connected during normal operation. A signal received on one Radio will be transmitted on the other Radio.

The P25 signal is transferred from the Receiving Radio to the Transmitting Radio in raw data format. This allows complete transparent repeat of voice and encrypted signals, without the radios needing to decrypt the signals.

On each radio, the channel can be selected by unplugging the Cross-linked Cable and plugging in a SRM9022 Controller-Mic (Test Handset) unit. With the Handset connected:

- The operating channel can be selected.
- The channel can be checked for acceptable reception by using the Handset to transmit on the selected channel (and listen to received signal if a Loudspeaker is connected).

The Handset should be unplugged while the radio is still switched ON. This will leave the radio in the ON state. Selected settings are permanently retained in FLASH when (actually ~10 seconds after) the Handset is removed.

The received signal can be heard if the optional Loudspeaker is connected.

The Loudspeaker volume level can be set by the Handset.

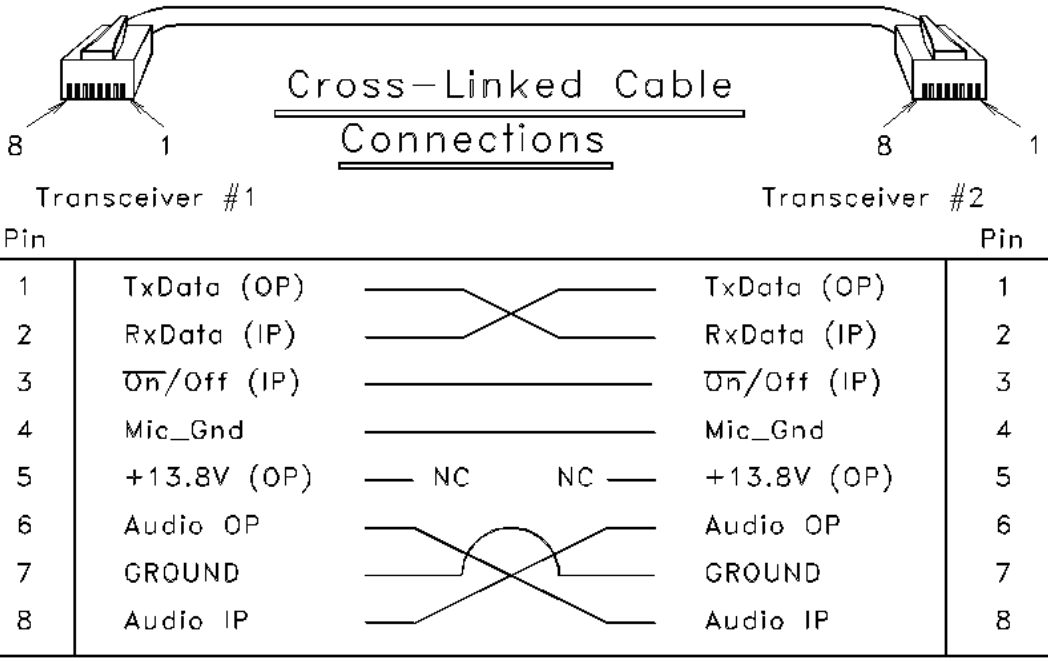
Decrypted audio will only be heard if the Receiving Radio contains the correct Decryption-Key – otherwise the audio will sound garbled.

Data and Voice delay through the Repeater is approximately 400 ms.

Authorisation-Codes need to be entered into each of the two Radios to enable the P25-Repeat SW function. These Codes can be ordered as MA-P25RPTR1, and the Codes loaded into the radio as described at end of this document.

Cross-Linked Cable (Part Number: MAR-XLCABLE)

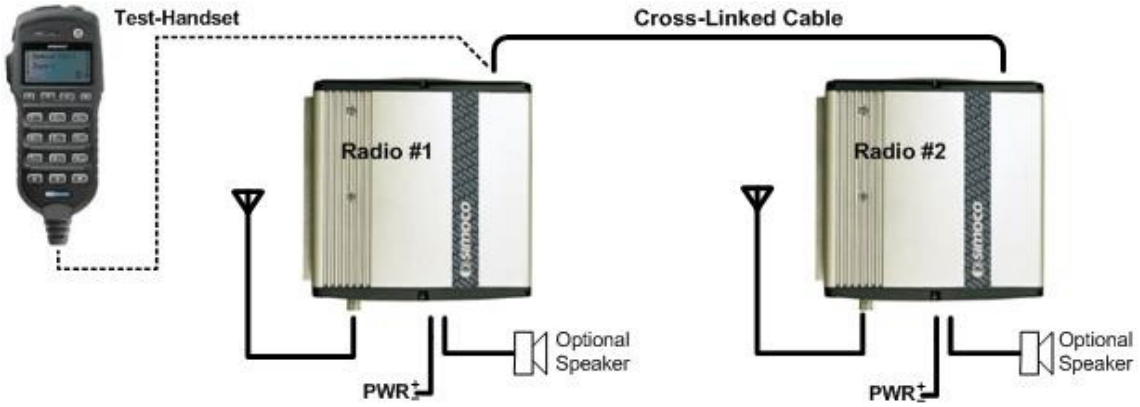
The cross-linked cable simply swaps the Tx/Rx Data lines (enabling the two Transceivers to communicate), and pass data between them.



When the Cross-Linked Cable is connected to both Transceivers, they communicate with each other and begin to operate in a “Back-to-Back” repeater mode.

The P25-Repeater does not use the Audio IP/OP lines. All information is passed over the Tx/Rx Data lines.

Repeater Setup – Single Direction: Radio#1(Rx) → Radio#2(Tx)



Radio#1 is the Receiver	Radio#2 is the Transmitter
Optional Speaker may be fitted for local monitoring of received signals.	Note: Optional Speaker is not required for this configuration. However it may be used for checking radio operation when the Test-Handset is connected.

For a "Repeater Radio pair" the set up is as described above and below:

- Using the Test Handset temporarily connected to each radio in turn, select:
  - Rx-Channel (e.g. Channel-1) on Radio#1.
  - Tx-Channel (e.g. Channel-2) on Radio#2.
- Radios will sound a Beep + Bip, Bip tone (through the Optional Speaker) at switch-on. The "Beep" is the normal switch-on indication, and the "Bip, Bip" tone indicates that the two radios are operating in Repeater mode. [1]
- A P25 signal received on Radio#1 will be retransmitted on Radio#2.
- There is no "Hang Time" applicable for a P25 repeater. However, the minimum Tx is ~0.3 sec, which occurs when only a few valid P25 frames are received (e.g. If Terminal User taps the PTT button).
- Only signals which are valid (correct NAC, TGID, Encryption Key, etc) will be heard through the Optional Speaker.

Audio level is determined by the "Volume" setting. This setting does not affect the repeated signal.

[1] If the "Bip, Bip" tone is not heard, check that:

- Both radios are fitted with P25 Option Boards and correct SW is installed (see below).
- Both radios have been "Authorised" for Repeater Operation – See Authorisation Section at end of this doc.
- If "Bip, Bip" tone is still not heard, check cabling.

Minimum SW: Radio Startup and P25 SW V5.59; MAB SW V2.16.13; and P25 FPP V4.43.

TO SET CONFIGURATION FOR RADIO#1 (RECEIVER):

To set the configuration for Radio#1 (Receiver), carry out the following:

1. Use the Simoco P25 FPP to create a NEW Jobfile (File > New), and set the parameters as per **Table 1** below.

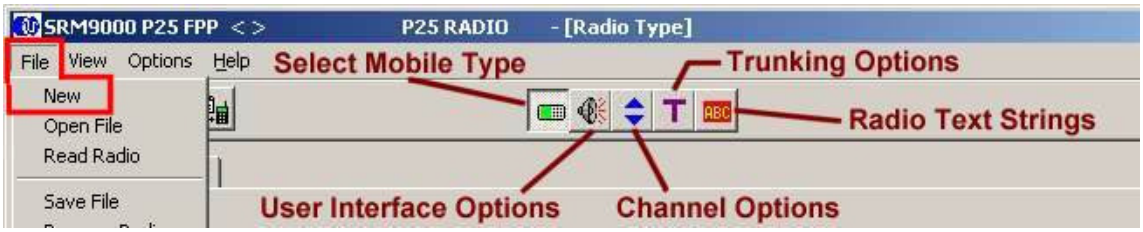
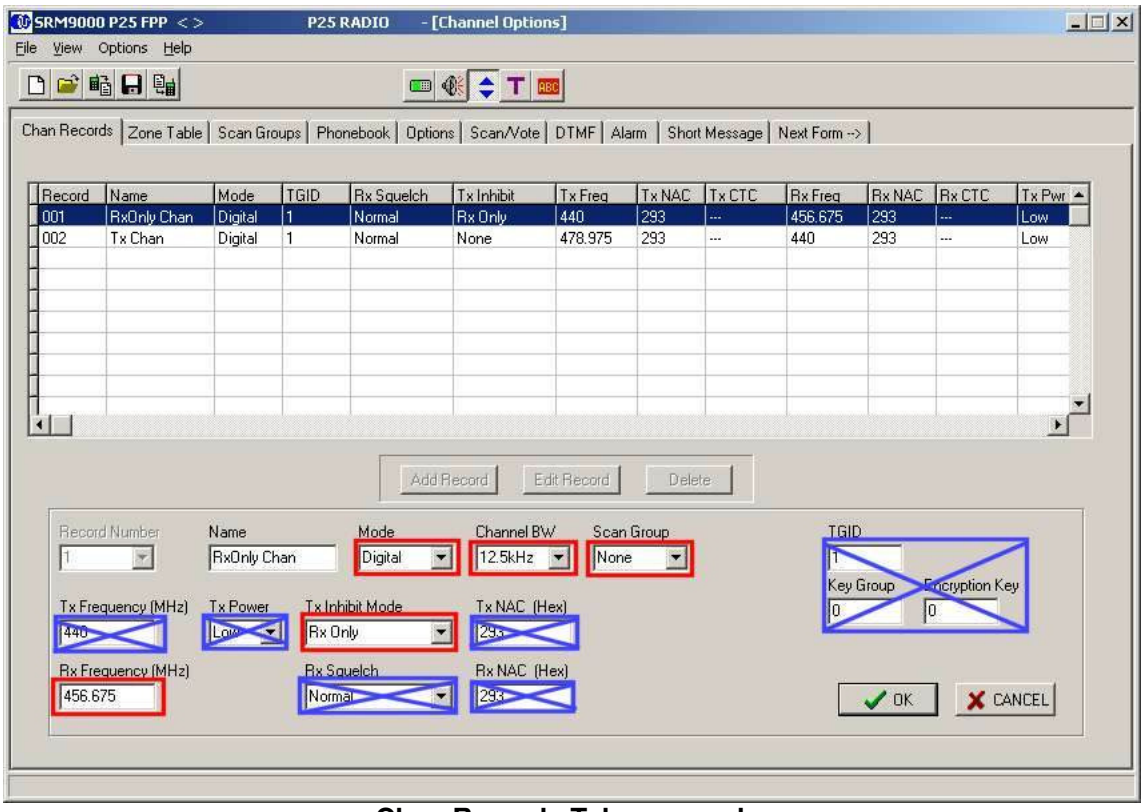


Table 1. P25 FPP New Jobfile Parameters.

FPP Form	Tab(s)	Parameter/Setting/Comment
Select Mobile Type	Radio	Radio Type = SRM9022 Frequency = as required for your application and to suit radio
User Interface Options	User Options Audio Keys Menus Input/Output Audio Levels	Unchanged
Channel Options	Chan Records	Assign one or more Rx-Only channels (see example overleaf)
	Zone Table	Assign a Zone with all Channels in it (see example screenshot overleaf)
	Scan Groups Phonebook Options Scan/Vote DTMF Alarm Short Message	Unchanged
Trunking Options	All tabs	Unchanged
Radio Text Strings	All tabs	Unchanged

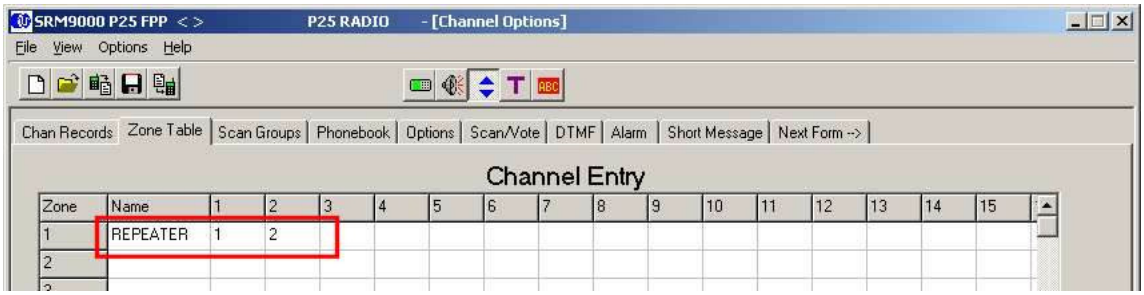
2. On the 'Chan Records' Tab, set the parameters as follows (see example screenshot overleaf):

- Set '**Mode**' to 'Digital'.
- The '**Channel BW**' should be set to suit the Channel.
- Set '**Scan Group**' to 'None'.
- The '**Rx Frequency**' should be set to suit the Channel.
- Set '**Tx Inhibit Mode**' to 'Rx Only'.
- All remaining parameters are ignored. (Exception: RxNAC, TGID, KeyGroup and Encryption Key parameters affect what is heard from the Radios Loudspeaker).



Chan Records Tab – example.

3. On the 'Zone' Tab, set up a zone with all the channels in it (see example screenshot below).

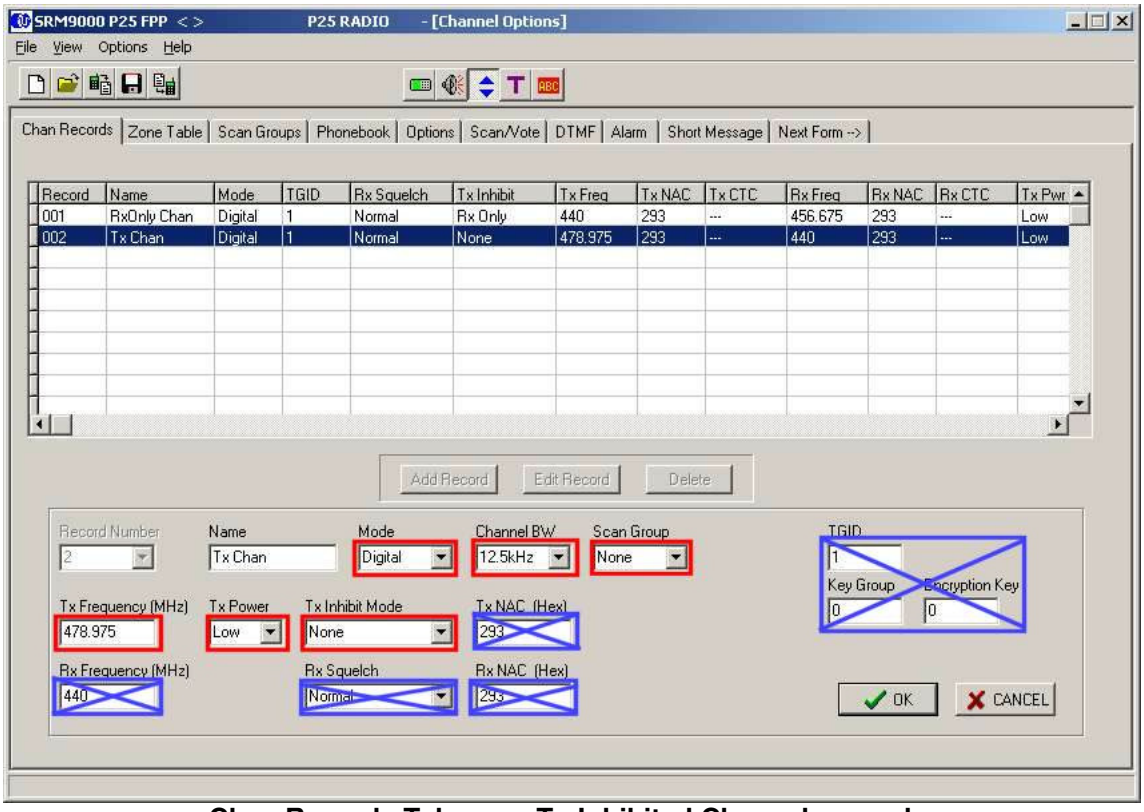


Zone Tab – example.

TO SET CONFIGURATION FOR RADIO#2 (TRANSMITTER)

To set the configuration for Radio#2 (Transmitter), carry out the following:

1. Use the same configuration as for Receiver Radio, but with a non-Tx-Inhibited Channel. (See example screenshot below).

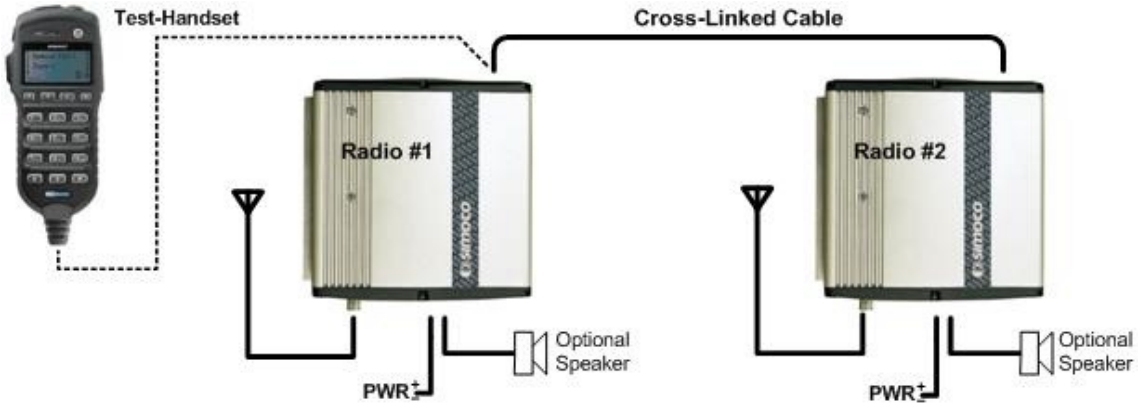


Chan Records Tab - non-Tx-Inhibited Channel example.

2. On the 'Chan Records' Tab, set the parameters as follows:

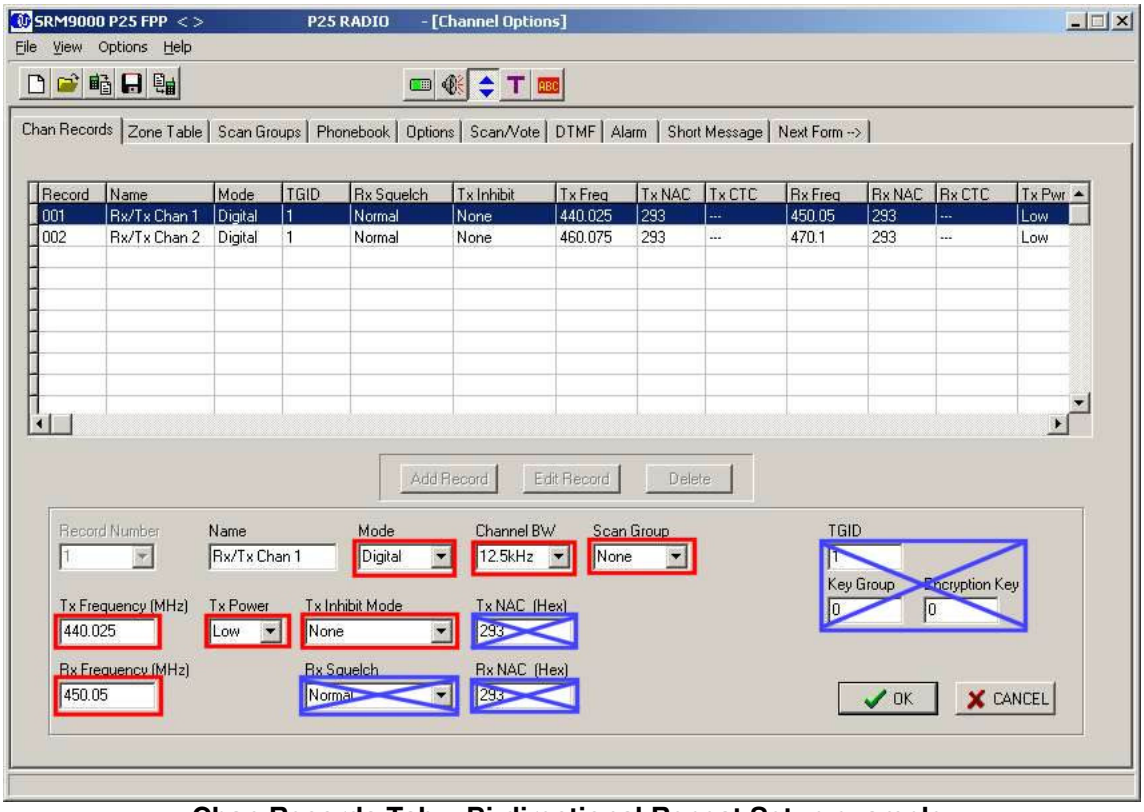
   - Set '**Mode**' to 'Digital'.
   - The '**Channel BW**' should be set to suit the Channel.
   - Set '**Scan Group**' to 'None'.
   - The '**Tx Frequency**' should be set to suit the Channel.
   - The '**Tx Power**' should be set as desired.
   - Set '**Tx Inhibit Mode**' to 'None'.
   - Set '**TX NAC**' to either '$F7F' to repeat incoming received NAC or to the NAC code to be used for repeater transmit.
   - All remaining parameters are ignored. (Exception: TGID, KeyGroup and Encryption Key parameters are used when the Test Handset is used to transmit on the radio).

Repeater Setup – Bi-Directional Repeat



In this setup, P25 signals are repeated in both directions in a half-duplex manner.

The setup for this arrangement is essentially the same as above, but with each Channel Record enabled for both Rx and Tx as shown below.



Chan Records Tab – Bi-directional Repeat Setup example.

Loading Repeater Authorisation-Codes

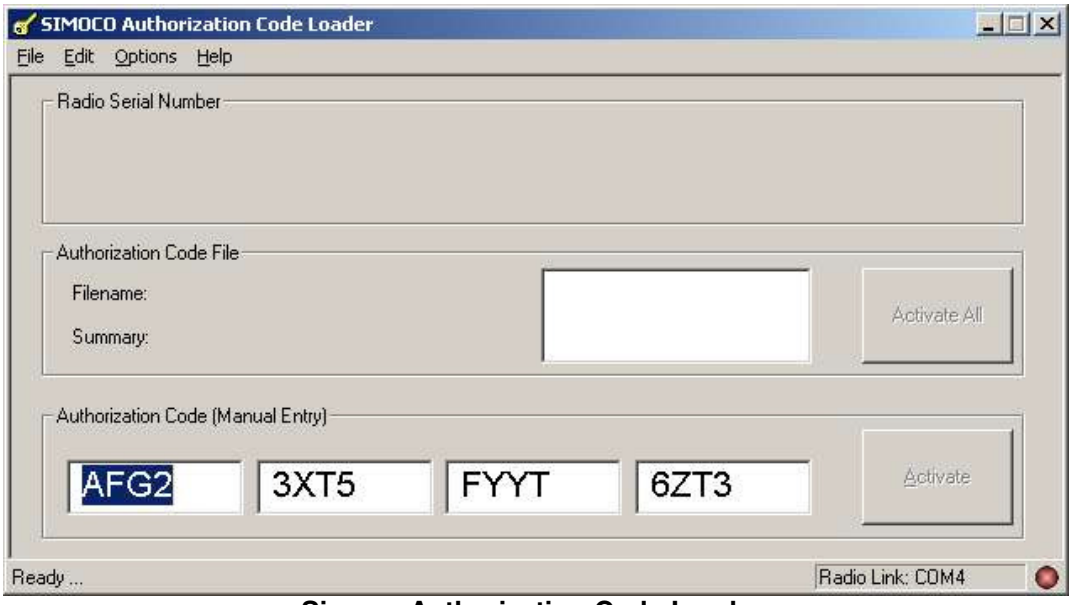
The P25-Repeat function is SW protected, and can only be unlocked by loading appropriate Authorisation-Codes into each radio.

These codes can be obtained from your local Simoco Dealer by ordering the MA P25RPTR1 option for each radio. Radio Serial Numbers need to be supplied when ordering this option.

Note.

Authorised P25 Conventional mode is a prerequisite for the Simple Repeater function (order code MA-P25CONV).

When Authorisation-Codes are provided, they can be loaded into the radio using the 'Simoco Authorization Code Loader' application (see below).



Simoco Authorization Code Loader.

The Radio is connected to the PC via a standard Programming Lead.

The provided Authorisation Code is entered into the 'Authorization Code Manual Entry' field.

The 'Activate' button is pressed to load the code into the radio.

Notes

(i). The 'Activate' button is only enabled when the entered code is for the Serial Number of the connected Radio (which appears in the upper part of the application window).

(ii). Both Radios in the Repeater need to be "Authorised" for the Repeat function to work.

For further information contact either of the following:	
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