

# SIMPLEST BACK-TO-BACK RADIO REPEATER

Applicable to models:

9005				

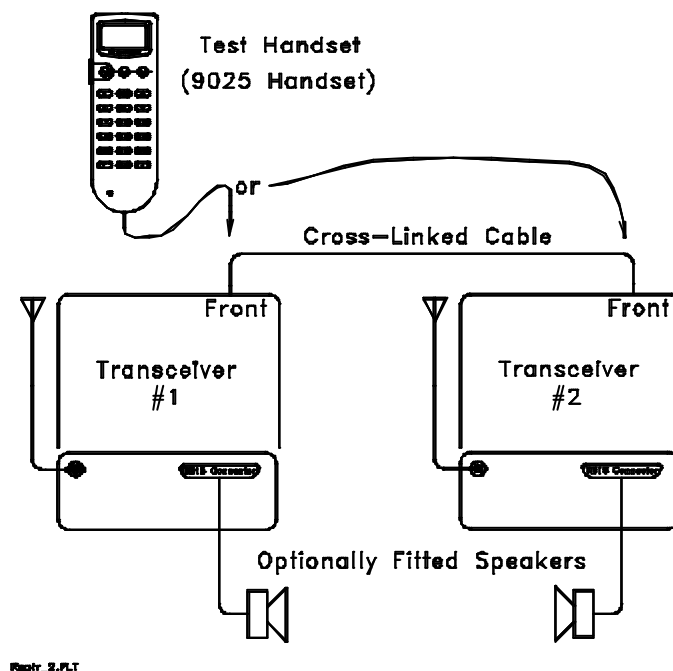
## General

The purpose of back-to-back Transceivers is to allow signals received on one radio to be retransmitted on a second radio - either as a link (dedicated Receiver connected to dedicated Transmitter) or as a bidirectional Repeater (either radio can act as Receiver and/or Transmitter).

This Application Note describes the simplest repeater configuration possible.

## Repeater

Picture = Reprtr\_2.PLT



In its simplest form 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 Transceiver will be transmitted on the other Transceiver (subject to valid CTCSS, and Transmit channel must not be Receive-only).

On each radio, the channel can be selected by unplugging the Cross-linked Cable and plugging in a SRM9025 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 Receive and Transmit on the selected channel.
- ◇ The Repeater audio level can be adjusted (Nominal Volume level of '15').

The Handset should be unplugged while the radio is still switched ON. This will leave the radio in the ON state. Settings selected by the Handset are permanently retained in FLASH when the Handset is removed.

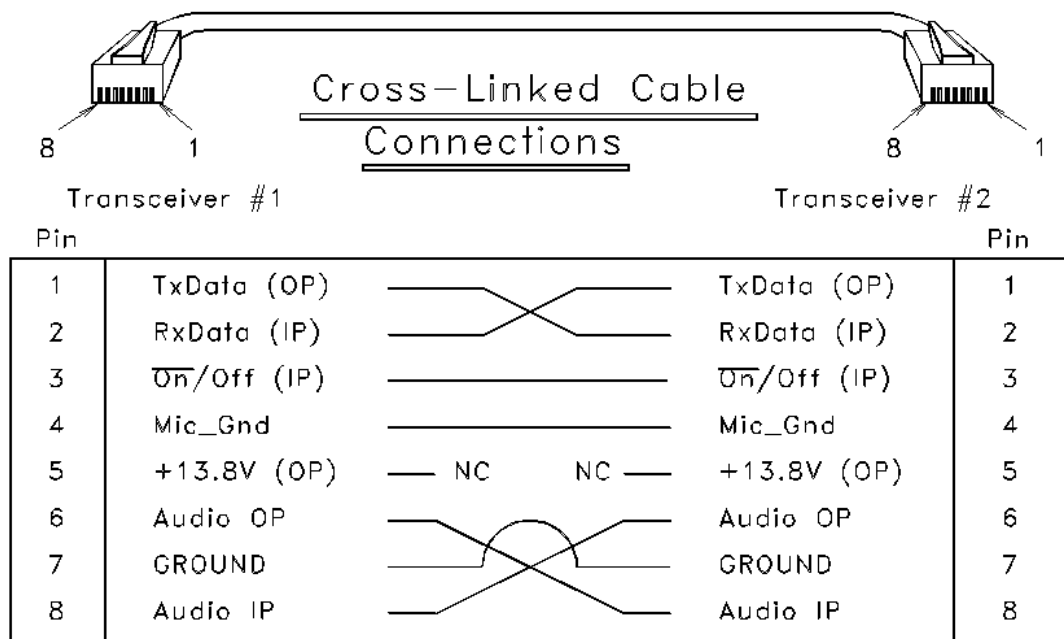
The received signal will sound through the optional Loudspeaker. Note the Loudspeaker volume level is fixed by the setting selected as the output level for the other Transceiver.

Setting a **Volume Level of '15'** (using the Test Handset connected to the receiving radio) will result in a repeater gain of approximately unity.

## Cross-Linked Cable (Part Number : 9503-000-00018)

The cross-linked cable simply swaps the Tx/Rx Data lines (enabling the two Transceivers to communicate), and cross-connects the Receive and Mic Audio lines so that the audio signals can pass between the Transceivers.

Picture = Reprtr\_2p.PLT



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.

In Back-to-Back mode any valid signal (carrier and privacy tone) received by one radio will be routed to the other radio and retransmitted.

## Bi-directional Repeater Configuration

If both Transceivers are left on a normal channel (ie. with both Receive and Transmit enabled), then they will act as Bidirectional Repeaters.

eg: Transceiver #1 may be:

The screenshot shows the 'Channel Editor' dialog box. At the top, 'Channel Number' is 7 and 'Name' is 'Repeater'. Below this are two tabs: 'Ch Options' and 'Selcall'. The 'Ch Options' tab is active. It contains two main sections: 'Receiver' and 'Transmitter'. The 'Receiver' section has 'Frequency (MHz)' set to 146.0575 and 'CTCSS Tone' set to 'E - 123.0 Hz'. The 'Transmitter' section has 'Frequency (MHz)' set to 172.0425, 'CTCSS Tone' set to 'E - 123.0 Hz', and 'Power' set to 'High'. To the right of these sections is an 'Options' box with three checkboxes: 'Hidden', 'Community Repeater', and 'Transmit Disabled', all of which are unchecked. Below the 'Options' box is a 'Channel Bandwidth' dropdown set to '25 kHz'. At the bottom of the dialog are 'OK' and 'Cancel' buttons.

Field	Value
Channel Number	7
Name	Repeater
Receiver Frequency (MHz)	146.0575
Receiver CTCSS Tone	E - 123.0 Hz
Transmitter Frequency (MHz)	172.0425
Transmitter CTCSS Tone	E - 123.0 Hz
Transmitter Power	High
Channel Bandwidth	25 kHz

Similarly for the second Transceiver with different frequencies.

## Link Configuration

Links can be set up in various configurations, depending on the channels selected on each Transceiver. eg:

<u>Transceiver #1</u>	<u>Transceiver #2</u>	<u>Comment</u>
Rx-Only Channel	Tx-Only Channel	Rx on #1, Tx on #2
Rx-Only Channel	Normal Channel	Rx on #1, Tx on #2
Normal Channel	Tx-Only Channel	Rx on #1, Tx on #2
Normal Channel	Normal Channel	Bi-directional Repeater (see above)

### ***Receive-Only Channels***

If a Transceiver is left on a Receive-only channel, then it will not Transmit.  
ie. It will ignore Transmit requests from the other Transceiver.

Receive-Only Channels can be set up by ticking the "Transmit Disabled" box as shown below:

The screenshot shows the 'Channel Editor' dialog box. At the top, 'Channel Number' is 5 and 'Name' is 'Rx-Only'. Below this are two tabs: 'Ch Options' and 'Selcall'. The 'Ch Options' tab is active. It contains three main sections: 'Receiver', 'Transmitter', and 'Options'. The 'Receiver' section has 'Frequency (MHz)' set to 136 and 'CTCSS Tone' set to 'E - 123.0 Hz'. The 'Transmitter' section has 'Frequency (MHz)' empty, 'CTCSS Tone' set to 'Disabled', and 'Power' set to 'Low'. The 'Options' section has three checkboxes: 'Hidden' (unchecked), 'Community Repeater' (unchecked), and 'Transmit Disabled' (checked). Below these is 'Channel Bandwidth' set to '12.5 kHz'. At the bottom are 'OK' and 'Cancel' buttons.

### ***Transmit-Only Channels***

If a Transceiver is left on a Transmit-only channel, then it will only transmit when told to by the other transceiver (or external PTT). ie It will not find a valid Receive signal.

Transmit-Only Channels are created by setting the selcall "Rx-Lockout" function with no Selcall Decodes active. eg:

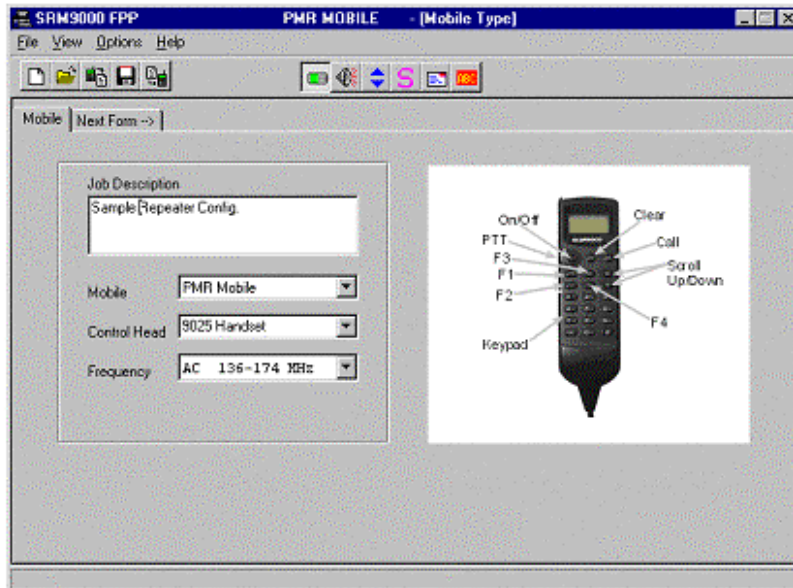
The Channel Editor dialog box is shown with the 'Selcall' tab selected. The 'Channel Number' is 6 and the 'Name' is 'Tx-Only'. The 'Receiver' section has 'Frequency (MHz)' set to 136 and 'CTCSS Tone' set to 'E - 123.0 Hz'. The 'Transmitter' section has 'Frequency (MHz)' set to 146, 'CTCSS Tone' set to 'E - 123.0 Hz', and 'Power' set to 'High'. The 'Options' section has 'Hidden', 'Community Repeater', and 'Transmit Disabled' all unchecked. The 'Channel Bandwidth' is set to '25 kHz'. At the bottom are 'OK' and 'Cancel' buttons.

The Channel Editor dialog box is shown with the 'Selcall' tab selected. The 'Channel Number' is 6 and the 'Name' is 'Tx-Only'. The 'Selcall Enabled' checkbox is checked. The 'Open Selcall' checkbox is unchecked. The 'Rx Lockout' checkbox is checked. The 'Tx Lockout' checkbox is unchecked. The 'Selcall Encode' field is set to 0. The 'Active Decodes' section has eight checkboxes, all of which are unchecked: Decode 1, Decode 2, Decode 3, Decode 4, Decode 5, Decode 6, Decode 7, and Decode 8. At the bottom are 'OK' and 'Cancel' buttons.

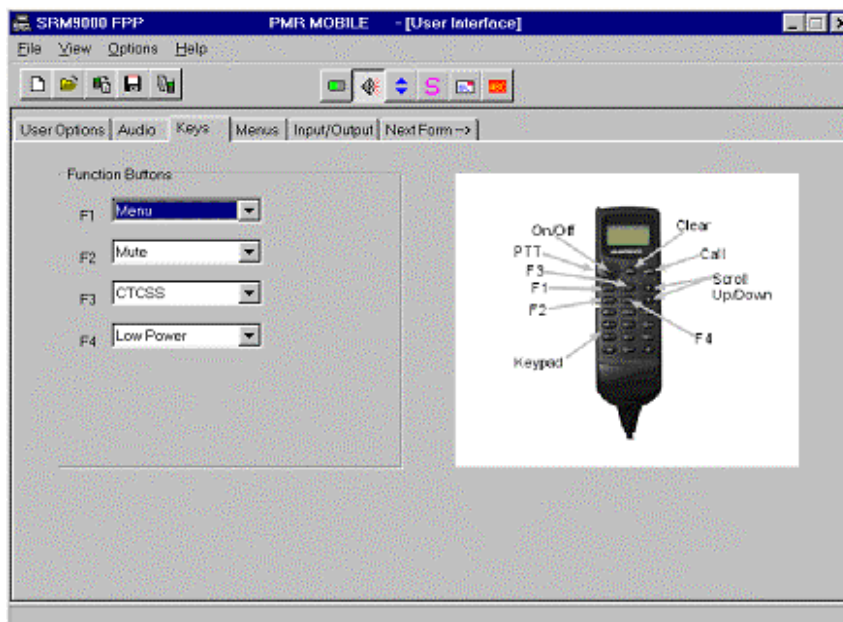
## Programming Suggestion

To make testing and setup of the Transceivers easier, the following functions could be assigned to the Transceiver:

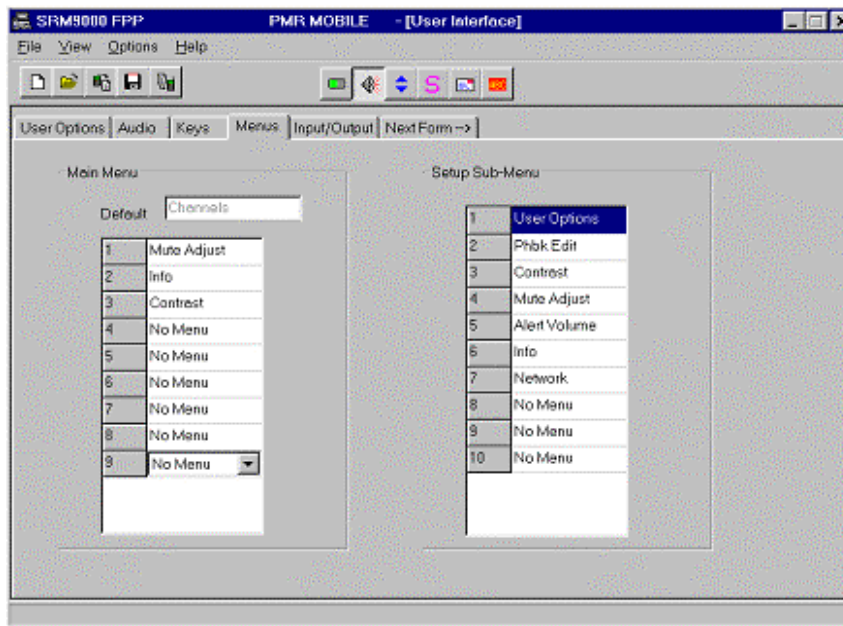
Set the Transceiver up as a SRM9025:



Setup the **Function Buttons** so you can adjust or monitor critical parameters. eg:



Set up the **Menus** so you have access to most functions. eg:



Remember you can access the “Setup Sub-Menu” list using the “ \*52# ” dialstring from the keypad.

**IMPORTANT NOTE :** Ensure that temporary Mute/CTCSS/Low-Power selections are not active when the Test Handset is removed. Settings are permanently retained in FLASH and will remain in effect until changed again by a Handset.



## Local Indicators and Alarms

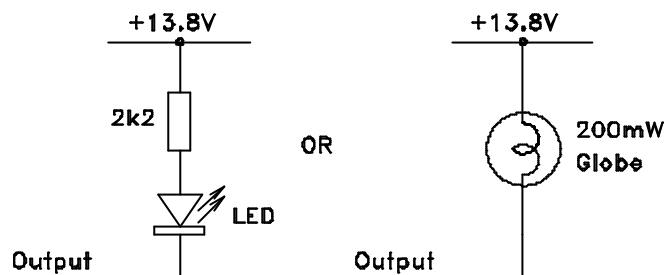
### ***Receive or Transmit Indication***

The DB15-Connector Output0 line (Pin 8) can be programmed to switch when certain events occur. eg:

- Low when Carrier detected
- Low when Valid Signal (Carrier + CTCSS) detected
- Low when Transmitting

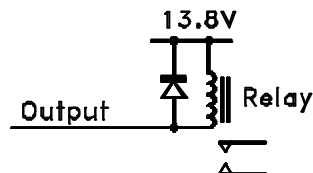
If desired these outputs could be wired to an indicator to show the state of the radio.

Picture = IO\_LED.PLT



### ***External Control***

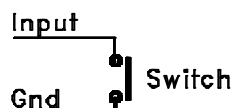
The Output0 line could equally well be used to control a pump (or other device). The line can be SET when a selcall sequence is received, and then CLEARed when a second (different) selcall is received. eg. Picture = IO\_Relay.PLT



For this example Output0 would be programmed for "Decode 1" operation. This would Set the line (Low) when Decode-1 is received and Clear the Line (High) when the Reset Decode is received.

### ***Alarm Input (Send Selcall on Tx radio using Input0)***

The DB15-Connector, Input0 line (pin 7) on a radio capable of transmitting, could be used to monitor an alarm switch and send a selcall. eg. Picture = IO\_Swi.PLT



For this example Input0 could be programmed "Active-Low" and to "Special Encode 1". This would send the Encode-1 selcall when the switch was closed.