SRP 9100 Series

FM VHF/UHF Portable

Radio Transceiver

SERVICE MANUAL

TNM-M-E-0012

ISSUE 1.22

June 2004

Quality System
Quality Endorsed Company

TMC Radio
TMC RADIO PTY LTD

TMC Radio

SRP9100 Series FM VHF/UHF Portable Transceiver   TNM-M-E-0012 ~ Iss 1.21

Declaration

The performance figures quoted are subject to normal manufacturing and service tolerances. The right is reserved to alter the equipment described in this manual in the light of future technical development.

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Document History

Issue	Date	Comments
Draft A-1	2004-01-10	Initial issue for Review
1.21	2004-05-15	Official Release
1.22	2004-06-24	Replaceable parts BOM corrected

List of Associated Publications

Document No.	Description	Issue
TNM-U-E-0045	SRP9100 Brief User Guide	1
TNM-U-E-0047	SRP9100 Operating Instructions PMR	1
TNM-U-E-0048	SRP9100 Operating Instructions Trunked	1

Warnings and Cautions

WARNING

The Power Amplifier Module may use semiconductor devices containing Beryllium Oxide. Dust from this oxide is toxic and, if inhaled or skin contact is made, can be hazardous to health.

No danger can arise from normal handling, but no attempt should be made to break open or tamper with these devices in any way.

These items should not be discarded with industrial or domestic waste.

WARNING

SRP9100 radio equipment is to be connected to TMC approved chargers and accessories only.

WARNING

Do not dispose of batteries in a fire or expose them to high temperatures.

WARNING

Do not operate your radio, without a handsfree kit, whilst driving a vehicle.

WARNING

Do not operate your radio in an explosive atmosphere. Obey the "Turn Off Two-way Radios" signs where these are posted, e.g. on a petrol station forecourt.

Caution

Preparing the radio for alignment will erase from the radio all customer PMR and Trunking configuration data (channel, signalling information etc). The only data retained by the Alignment Tool is the factory alignment data for the radio (DAC settings for TX power, front-end tuning etc).

GLOSSARY OF TERMS

A summary of common radio terms and some other terms used in this document, and their meanings, are given below.

ADC	Analogue to Digital Converter.
AFC	Automatic Frequency Control.
AGC	Automatic Gain Control.
Alarm	A selcall sequence sent from subscriber equipment to indicate an Emergency situation. When activated the radio will enter a repeating sequence consisting of an Alarm Live Transmit Time and an Alarm Dead Receive Time.
ANN	Abbreviation for Algorithmic Network Numbering. This is the numbering system where the numbers presented to the radio user can be mapped directly to the MPT1327 PFIX/IDENTs and vice versa by use of a fixed algorithm in combination with some other customisation parameters. See also FPP and MEP.
Auto Interrogate	An Acknowledge identity sent as a response to an individual reset call.
Automatic Power	Feature whereby the transmit power is automatically set to a level determined by the level of the received signal. This is used to extend the battery life of a Portable.
Background Hunting	The searching for an alternative and 'better' control channel whilst already on a valid control channel.
BCAST	MPT1327 broadcast message. Used to transmit information about the trunked radio system to radio units.
Busy	The state of a channel such that:

- For a non-signalling channel - if Busy this means that the carrier is above squelch.
- For a channel with CTCSS/DCS - if Busy this means a signal is being received with either no CTCSS tone / DCS code or the correct CTCSS tone /DCS code.
- For a channel with Selcall - if busy this means a closed channel where the signal is above squelch.

A feature that equates to 'Do Not Disturb' such that the radio will reject all non-emergency calls. This feature can be activated using the busy key (if assigned) or from a menu; it is reset to disabled at switch on.

CCSC	Control Channel System Codeword.
CLIM	Call Limit Time; time limit on calls made. Normally this is defined by the Call Time Limit parameter but can by overridden by the TSC depending upon the setting of TSCLIM.
CLIME	Emergency Call Limit Timer.
Closed	A state where transmit and receive are not allowed until a Selcall message to open the channel has been received. A Closed Channel is one that defaults (when selected or after timed reset) to its closed state. Contrast with Open. Normally a Closed channel would have Selcall Mute and PTT Inhibit would be enabled.
CODEC	COde (Analogue to Digital Converter) / DECode (Digital to Analogue Converter).
Community Repeater	A communications set-up whereby different groups of radios can operate by using only one base station. This is achieved by the use of CTCSS tone signalling such that each group has a different CTCSS tone (encode and decode) and radios can

only communicate with other radios in their group. Only one group of radios can use the base station at any one time.

CRU	Central Repair Unit
CTCSS	CTCSS stands for Continuous Tone Controlled Squelch System. A continuous tone (lower than the audio range of the receiver) is modulated onto the carrier as well as other signalling or voice traffic. Compare with DCS. Only receivers which have been instructed to recognise the same CTCSS tone are able to receive the transmissions, since the squelch of receivers looking for different CTCSS tones prevents the audio from being heard. This provides a simple method of sending messages to selected receivers only and allows several different networks to use the same frequencies. CTCSS is also known as Tone Lock or Tone Squelch.
DAC	Digital to Analogue Converter.
Dash (-) digits	Digits known as 'No Tone' digits used in Selcall Identities.
DCS	Digital Coded Squelch system is based on sending a continuous stream of binary codewords using, low deviation, direct frequency shift keying. Only receivers which have been instructed to recognise the same DCS sequence are able to open their squelch and receive the associated speech transmissions. This provides a simple method of sending messages to selected receivers only and allows several different networks to use the same frequencies.
Decode	Reception of signalling. Either Selcall where encoded tone frequencies are decoded and identified as specific tones digits or CTCSS/DCS where tones are analysed to see if the channel should be opened.
DSP	Digital Signal Processor.
DTMF	Abbreviation of Dual Tone Multi-Frequency signalling. Used to dial into Telephone networks using tone dialling.
Dual Watch	A facility that enables the Radio to periodically monitor another channel for a signal above squelch. Typically applications are checking an emergency channel whilst on another channel.
Economiser	A process by which the Receiver is powered down whilst there is no received signal. Periodically the receiver is powered up to check for such a signal. This is used to extend the battery life of a Portable.
Encode	Transmission of signalling. Either Selcall where selcall tone digits are encoded into tone frequencies or CTCSS/DCS where tones modulated onto the channel's carrier.
ETS	European Technical Standard.
FFSK	Fast Frequency Shift Keying. This is a signalling system for the transfer of digital information. It works by using one of two audio tones to represent data being transmitted.
Fleet	A group of units formed such that only a shortened form of dialling (2 or 3 digits) is required between them. These groups are normally assigned contiguous idents.
FOACSU	Full Off Air Call Set Up. A method of call set-up where the calling party has to manually answer the incoming call before the trunking system will allocate a traffic channel to the call. This reduces the loading on traffic channels as it prevents them being allocated to calls when the called party is not present to deal with the call.
FPGA	Field Programmable Gate Array.
FPP	Field Personality Programmer.

Hash (#) digits	These digits are used for two purposes:
	• For Selcall identities (encode and decode) - known as User Id digits. These digits are replaced by the user id entered at switch on (if enabled)
	• Use in DTMF dialled strings - their use is network dependent to access special services.
IDENT	A 13 bit number used for Identification purposes. Associated with a Prefix (PFIX) this forms a 20 bit address which is used for identification purposes in signalling between the radio and the trunking system.
Identity	Name given to a sequence of tones which is used in sequential tone signalling. See Valid Selcall Digits.
Idle State	The state of the radio when it is not in a call.
Include Calls	These types of calls are used to allow a 3rd party to join into an existing call.
Link Establishment Time	A delay incorporated into the start of every selective call or DTMF transmission which allows for the finite delay of the radio equipment in responding to any radio signal. This includes both the commencement time of the originating transmitter and the response time of the receiver.
Locked	A state of a channel whereby it is not possible to change channels using the normal up/down keys on the channel menu until the OK key is pressed. See Auto Channel Selection Lock.
Modifier	Part of a dialled string that modifies the nature of the call made to a number (e.g. dialling "*9" before the number that is to be dialled will modify the call to be an emergency call).
MPT1327	A signalling standard for Trunked Private Land Mobile Radio Systems. Defined for systems in the UK but also used outside the UK. Issued January 1988.
MPT1343	A System Interface Specification for commercial Trunking networks. Defined for systems in the UK but also used outside the UK. Issued January 1988.
Noise Blanker	A circuit designed to reduce automotive ignition interference.
Open	A state where transmit and receive are allowed. The channel is no longer open when reset. Contrast with Closed.
	Normally an Open channel would not have Selcall Mute and PTT Inhibit would be disabled.
PABX	Private Automatic Branch Exchange.
PFIX	The 7 most significant bits of an MPT1327 address number. Normally same fleet units have same prefix. Relates to individual and group address numbers.
PLL	Phased Locked Loop.
PMR	Private Mobile Radio (not normally trunked).
Priority Channel	A channel in a search group that is scanned between every other channel.
PSTN	Public Switched Telephone Network
PTT	Press To Talk. This is the term given to the operators key normally used to commence transmitting a message.
PTT Inhibit	A state whereby transmission using the PTT is not allowed. Also know as Tx Lockout.
Queuing	The storing of a Selcall Identity for later transmission.

If inhibited from transmitting a selcall sequence because the channel is busy then the radio can queue the Send 1 / Send 2 sequence for later transmission. When a radio unit is in Queuing mode all incoming calls are stored automatically in a queue for later examination. The caller is given an indication that the call has been queued by the called party. The queue will contain the identity of the caller and the status value received (if a status call). Up to 20 calls may be queued. The Queuing mode may be selected using the Modes Menu.

Note: Connecting a MAP27 device to a radio that is in queuing mode will disable queuing. All incoming calls will then be routed both to the radio user interface and to the MAP27 device connected to the radio. Also known as Logging Mode

Reference Frequency	Normally this is generated from a high stability crystal oscillator reference and is divided digitally in a frequency synthesiser for comparison with other frequency sources, e.g. a VCO.
Registration	Registration is a technique used to ensure that the trunking system knows the location of radio units that are using the system. This allows the system to set-up calls quickly without having to search the whole system for the called radio.
Repeat Tone	A selcall tone that is used to replace repeated tones. Fixed at tone E. Example: An identity entered as '12333' would be sent by the radio as '123E3'.
Reset	Resetting is caused by Three Tone Reset, a Remote Reset, and an Individual reset or a Group reset (Call Types in Decode Identity). When a radio is reset the effect on the radio will be as follows:

- Any Call Alerts will be stopped
- The Call LED flashing will stop
- If the channel is in Open mode then the channel is closed
- The PTT is optionally inhibited (see PTT Inhibit After Reset Sequence).
- In searching - if paused on a selcall channel then searching resumes
- If the Acknowledge property of a Decode Identity is set to 'Auto Interrogate' or 'Transpond & Auto Interrogate' then the Auto Interrogate encode identity is transmitted.

RSSI	Received Signal Strength Indicator.
Scanning	Process of switching between the channels in the nominated search group in cyclic sequence, stopping when the search condition (which may be to look for either a free or a busy channel) is satisfied.
SDM	Short Data Message.
Selcall	Selective Calling - a system of signalling which allows 'dialling up' of specific mobiles, portables and controllers. Such a system may be used to pass messages as a data message to a specific user or group of users. It can be used to provide remote switching facilities and to provide access control into community repeaters or similar devices.
Selcall Mute	A state of the audio gate whereby the loudspeaker is muted (closed).
Selcall System	<u>Sel</u>ective <u>Call</u>ing, uses a tone sequence at the start, and end, of a call to control which members of a fleet react to the transmission.
SFM	Short Form Memory.
Simplex	Mode of operation whereby the radio operates as a conventional fixed channel radio outside the Trunking network.
Squelch	System used to prevent weak, unintelligible signals and random noise from being heard by a radio operator while still allowing intelligible signals to be received

normally. This is accomplished by the use of a threshold below which any received signals are ignored. Only signals whose signal-to-noise ratio is above the squelch level cause the audio circuits of the radio to be enabled, with the result that only satisfactory signals are received. The squelch level is specified in SINAD.

Star (*) digits
Digits known as Status or Message digits. These digits are used for three purposes:

- Status Digits for Selcall Identities
- Wildcard digits in Status strings
- Use in DTMF dialled strings - their use is network dependent to access special services.

Status
A feature whereby a radio's status (or usually the status of the radio's user) can be transmitted and a status message from other radios can be displayed. This operates through status digits in selcall identities. Either in Encode Identities or Decode Identities as follows:

Encode Identities: Status digits within the identity are used to transmit the current situation of the radio's user (E.g. "Out To Lunch").

Decode Identities: Status digits are looked up in a table (Status Menu) for possible messages to display.

TCXO
Temperature Compensated Crystal Oscillator.

Three Tone Reset
This is a system whereby a call to a user automatically reset all other users in a group.

Example: a call to user '12345' would call 12345 and reset all other users on this channel with an identity 123nn where n can be any digit 0-9, A-F.

Timed Reset
Facility that causes the Radio, after a certain period of time, to restore current channel to its initial condition e.g. if it was previously searching it will resume searching.

TMR
Trunked Mobile Radio.

Transpond
An Acknowledge identity sent as a response to an individual call.

Tx Inhibit
A facility which prevents the user from transmitting,(other than alarms), while the channel is Busy.

UMP
User Memory Plug. A special device which contains the customisation data for the radio. If this is removed then this can cause the radio to behave in a number of ways.

VCO
Voltage Controlled Oscillator.

Vote
Method used to compare the signal strength on a current channel with another specified channel and then to choose the channel having the stronger signal.

VOX
Voice Operated Transmit.

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APPENDIX B ~ ANCILLARIES

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1. INTRODUCTION

1.1 GENERAL

The SRP9100 series of FM portable radio transceivers are designed for conventional PMR and Trunked operation in VHF and UHF radio systems.

The transceiver is available in two functional variants. The variants are as follows:

Description	PMR/Trunked
Portable Transceiver with no keypad	SRP9120
Portable Transceiver with keypad	SRP9130

1.2 SCOPE

This manual provides technical specifications, description and servicing details for the SRP9100 series of portable radio transceivers together with the related accessories.

Unless specifically stated otherwise, the text and illustrations refer to all versions in the series.

1.3 DESCRIPTION

The design concept utilises wide band analogue techniques for RF transmit and receive circuitry with digital signal processing for narrow and wideband modulation and demodulation. Electronic tuning is used throughout the portable to eliminate manual tuning and level adjustment.

A Digital Signal Processor (DSP) and a Field Programmable Gate Array (FPGA) are used with other dedicated devices in the SRP9100 to perform the following functions under software control:

- Frequency Synthesis of all operating frequencies.
- Modulation and demodulation of 10/12.5/20/25kHz FM signals on a per channel basis.
- Modem functionality for specified data modulation schemes.
- Filtering, pre-emphasis, de-emphasis, limiting, compression, muting, CTCSS, Selcall or any other frequency or level dependent signal modification.
- Serial communications with the Control Ancillaries, Field Programmer and Alignment Tool.
- Tuning Control data for TX and RX.

The SRP9100 Transceiver comprises a rugged cast internal lightweight magnesium alloy chassis, which houses two printed circuit board assemblies and provides all heatsinking requirements. The battery slides and locks into the chassis. The chassis is enclosed in a high impact polycarbonate ABS plastic case that retains the speaker, keypad and display.

The buttons, connectors and antenna are sealed against moisture and dust ingress by gaskets around keys and display or bungs in the case of the external connectors.

The main PCB assembly comprises a multi-layer board containing all the RF and control circuitry. The display or man-machine interface (MMI) board is connected via a miniature connector to the main board. A flex strip connects the speaker and microphone to the main board. Provision is made for optional plug-in accessories in the radio (e.g. for encryption).

Several battery capacities and technologies are available to suit the endurance requirements of the portable application.

The antenna is connected to the radio via an SMA plug that is mounted into the radio chassis. The antenna flange provides it with additional rigidity when seated on the radio body.

1.4   PRODUCT VARIANTS AND FACILITIES

Product variants and facilities are detailed in Table 1-1, Table 1-2 and Table 1-3.

Table 1-1 Common Features for All Variants

Feature:	Model:	9120	9130
Keys		7 Function keys. All keys can be customised.	7 Function keys. All keys can be customised
Keypad		-	12 button numeric keypad
Display		LCD 12 character with bit mapped section and fixed icons.	LCD 12 character with bit mapped section and fixed icons.
Volume		Rotary control	Rotary control
Indicators		Tri-colour LEDs	Tri-colour LEDs
Facility connector		Yes	Yes
Frequency Bands		66-88MHz, 136-174MHz, 208-245MHz, 335-375MHz, 400-450MHz, 440-500MHz, 470-530MHz	
Channel Spacing		10/12.5/20/25kHz	
Menu driven		Yes Limited selections	Yes
Customisable Menus		Yes	Yes

Table 1-2 Conventional-PMR Variants

Feature: Model:	9120	9130
Channels	200	1000
Signalling	CTCSS / DCS Selcall/FFSK/DTMF	CTCSS / DCS/Selcall/FFSK/DTMF
Text Messaging	FFSK test messaging display Selcall status messaging	FFSK text messaging display Selcall status messaging
Attack Operation	Yes	Yes
DTMF Encode	Pre defined Encodes via function keys	Free form encodes via keypad Pre defined Encodes via function keys
PTT Limit Timer with warning beeps	Yes	Yes
PTT Inhibit on Busy	Yes	Yes
Scanning	100 groups with up to 15 channels per group.	240 groups with up to 15 channels per group. 4 user defined scan groups.
Voting	Up to 50 groups consisting of up to 16 channels per group.	Up to 200 groups consisting of up to 16 channels per group.
Priority Scanning	Yes	Yes
Nuisance Delete	-	Yes
Multiax	Yes	Yes
Phonebook	Yes	Yes

Table 1-3 Trunked Variants

Feature: Model:	9120	9130
Channels	1024 channels in 50 sub-bands	
Frequency Bands	Specifically : 136-174MHz, 400-450MHz (and possible in all other bands)	
Background Hunt and Vote-Now	Yes	Yes
MPT1343 dialstrings	Yes	Yes
ANN Numbering	Yes	Yes
Phonebook Memories	250	250
User Phonebook	Recall entries configured by FPP only.	Recall and edit.
Alpha Status List	Yes	Yes
SDM/EDMs	Yes	Yes
NPDs	Yes	Yes
Attack Operation	Yes	Yes

1.5 SOFTWARE VERSIONS AND NAMING

There are various associated items of Software (SW) required for the SRP9100 radio and programmer to operate. This section simply defines the naming rules of the SW files to allow identification and conformity.

This allows different versions of SW to be distributed and co-exist without confusion.

The SRP9100 Transceiver has three items of SW for PMR, Trunking and Alignment.

1.5.1 Filename Structure

Basically the Filename Structure is defined as follows:

- 2-character Application code
- 2-character SW Type code
- 3-character version number
- File Extension as required.

E.g.   **91Tm103.BIN**

          91P_105.BIN

          91S_103.BIN

1.5.2 Application Code

This identifies the application the SW was initially designed for:

          91   =   Standard SRP9100 Software

1.5.3 Software Type Code

This identifies different types of SW within an application.

          Tm   =   Trunk MPT

          Ta   =   Trunk ANN

          P_   =   Conventional PMR code

          S_   =   Start-up code (for alignment and start-up)

          Bo   =   Transceiver Boot-code

          Bc   =   Transceiver Boot-Backup-code

          Bf   =   Transceiver FPGA-code

          Ba   =   Transceiver FPGA-Backup-code

Note. The above file names are not stored within the code. As a consequence, when the radio is read by the FPP, the FPP will display version numbers and release dates for the Backup, Startup, PMR, TMR and DMAP codes. The Bootloader, FPGA Backup and FPGA codes show release dates only.

1.5.4 Version Number

This is a 3-digit number allocated by Engineering to identify the SW version.

E.g.   103   =   Version 1.03

1.5.5 Exclusions

The Programmer SW does not follow the above rules, as it is a PC based Program and its version number can be easily identified by starting the SW. Later releases of SW will be backward compatible, unless deliberately not so, in which case a different directory structure/path may be implemented.

1.5.6 Displaying Software Versions

Each Transceiver SW code file (e.g. 91Tm258.BIN, etc.) contains version information about itself and possibly compatible Programming SW.

For **Radio SW saved on Disk**, this information can be displayed via the Programmer function:

> **Options : Upgrade_Software : Get_File**
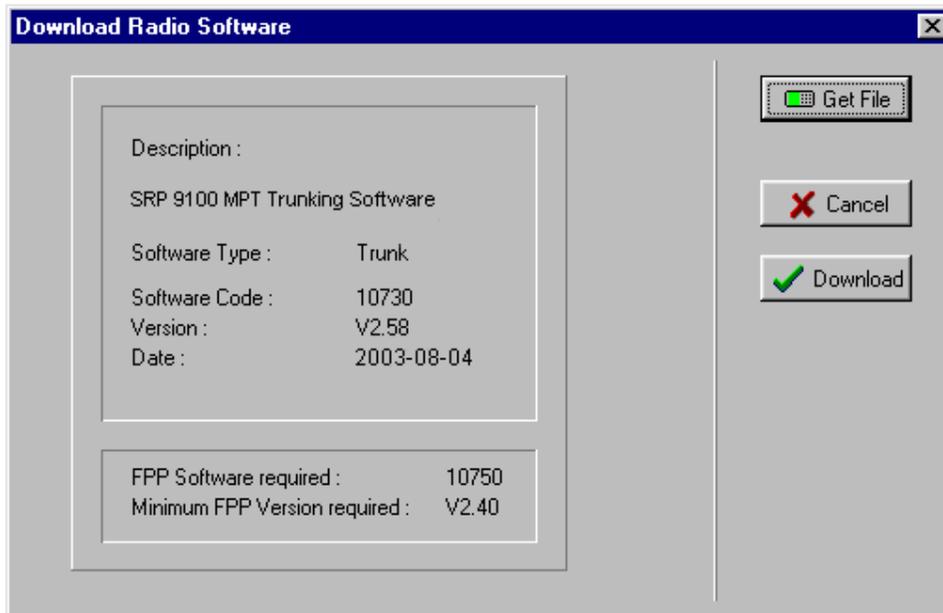
For **Software loaded in the radio**, information can be read from the Transceiver and displayed via the Programmer function:

> **Options : Radio_Information**
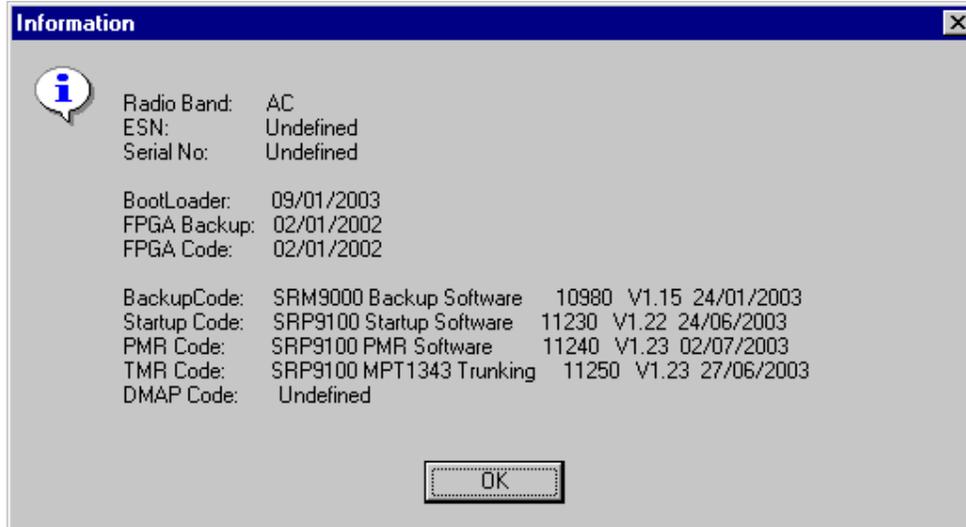
The portable software version can be read from the portable display if required by accessing the **Set-up** menu and then choosing **Radio Info** and selecting the software version on the radio.

1.5.7   Automatic Version Upgrade Prompting

When a configuration is downloaded to the Transceiver, the Programmer performs a brief check on the SW currently installed in the radio.   If a later version of SW exists (on PC hard disk) then the Programmer will prompt the user with the following message:
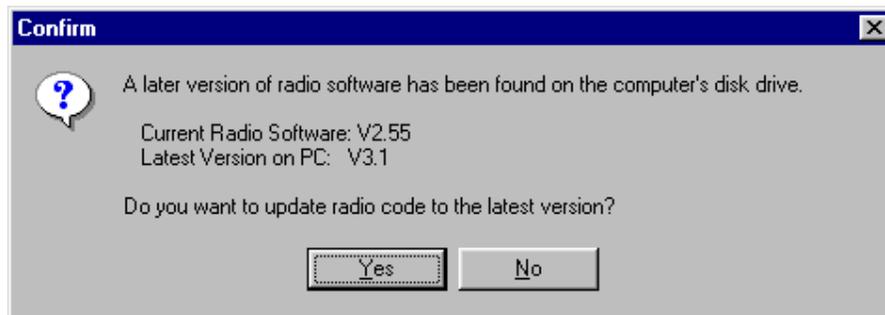
If **YES** is selected, the Transceiver Radio code is updated before the new configuration is downloaded.

If **NO** is selected, only the configuration is downloaded.

It is strongly recommended to select "Yes" when this message is shown.

This only applies for standard SRP9100 SW - i.e. for Start-up-Code (91S_….BIN), Trunking-Code (91Ta…, 91Tm…, 91Tb…, 91Td….BIN) and PMR-Code (91P_….BIN).

This process also updates the Start-up-Code code to ensure it is compatible with the loaded PMR or Trunk-Code.

Note: If the …\StandardFPP\RadioSW folder contains no files, then the above check will not be performed.

1.5.8   Transceiver SW Description, Start-up and Backup-Software

The SRP9100 Transceiver software is split into the following separate modules:

- Bootloader and Backup Software
- Start-Up Software
- FPGA and FPGA-Backup Software (FPGA = Field Programmable Gate Array)
- Mainline PMR Software
- Mainline Trunk Software

When the Transceiver starts, it basically performs the following steps:

- Initial execution starts with the Bootloader code, which attempts to load the Start-Up Software (if Start-Up checksum is bad, then the Backup Software is loaded.)
- Start-Up Software then downloads the FPGA code (or FPGA-Backup code if FPGA checksum is bad) to the FPGA device. If both FPGA and FPGA-Backup checksums are bad then the radio is not operational and serial communication is not possible.
- Start-Up Software then reads the On/Off switch line and compares these with saved parameters to determine if the radio should be continue to power-up or switch itself off again.
- Start-Up software then attempts to load either PMR or Trunk Mainline Software (dependent on saved parameter) and switches execution to complete the power-up process and start normal operation.

If the Mainline Software cannot be loaded, or a Jobfile configuration has not been loaded (e.g. non-existent or checksum fail) then execution switches to Backup Software until the error is corrected (e.g. by FPPing the radio).

There are three states that the radio can end up in after switch-on:

- Mainline Trunk Software or Mainline PMR Software (normal power-up)
  If the radio does not have a valid Jobfile configuration loaded, then it will display a "No PMR Cfg" or "No TMR Cfg" message.
- Start-Up Software (characterised by "Alignment Mode" shown on the display). This is also the code that is running when the radio is being aligned using the Alignment Tool.
- Backup Software (via various paths from above.)

1.5.9   Wailing Siren (Boot-up Software Corrupted)

A "WAILING SIREN" sound is emitted from the Loudspeaker while the radio is running in Boot Backup Software. In this mode the FPP can be used to re-load a Jobfile, or re-load Start-Up or Mainline Operating Software.

Simply writing a Jobfile to the radio should allow the FPP to determine and update the offending software – however there may be instances where the FPP cannot determine this and the Start-Up and Mainline Software should be updated manually. This can be done using the *FPP* : *Upgrade_Software*: *Get_File* … then *Download*. Both Start-Up Software (filename = *91kS_xxx.BIN*) and Mainline PMR (91kP_xxx.BIN) or Trunk (91kTxxxx.BIN) should be loaded if the FPP cannot automatically fix the problem. The wailing siren should stop once the problem is fixed.

Note 1: Holding down the alarm key and PTT key when power is applied to the radio will also force the radio to start-up in Backup Software. This may be useful in some situations.

Note 2: Should these steps fail to restore the set and the Wailing Siren cease, the radio will need to be returned to a Level 3 Service Centre for FLASH replacement.

1.6   ADJUSTMENT AND ALIGNMENT

There are no internal adjustments in the SRP9100. Re-programming and alignment is performed using software tools. For testing, a special test jig is required so that the radio PCB can be powered and input/output accessible. This test jig has a dummy battery and a connector that plugs into the top of the radio so that the jig controls PTT and provides access to audio in and out.

As the radio has no internal adjustments, there is no need to have the radio PCBs powered while out of the chassis. Field repair of the PCBs is not recommended as specialised equipment is required to fault find and repair the boards.

1.7   SPECIFICATION

1.7.1   General

Operation
Single or two frequency simplex (half-duplex).

Modulation
Frequency modulation (phase) F3E or FFSK.

Battery Voltage
7.2V DC (nominal)

Current Consumption

	All measurements at 7.2 Volts
Radio off	<120uA
Standby(squelched):	<120mA

RX Audio O/P:

500mW	<320mA

Transmit:	66-88MHz	136-174MHz	174-400MHz	400-530MHz
1W	<0.7A	<0.8A	<1.0A	<1.0A
5W	<1.8A	<2.2A	<2.2A	<2.5A

Frequency Bands

Band	Frequency Range	Band	Frequency Range
E0	66 - 88 MHz	TK	400 - 450MHz
AC	136 - 174MHz	UW	440 - 500MHz
KM	208 -245MHz	WR	470 - 530MHz
R1	335 - 375MHz		

Switching Bandwidth
Radio covers the complete band without retuning

Channel Spacing
10/12.5 / 20 / 25kHz

Frequency Stability
Better than ±2.5 ppm

1 ~ INTRODUCTION

Dimensions (mm)	**Height**	**Width**	**Depth**
Radio excluding antenna	147mm	68mm	43 mm
	exc. vol. control		inc. std. battery

Weight

Radio only	221g
Battery NiCD 1600mAH	238g
Battery NIMH 2100mAH	250g
Battery NiMH 2700mAH	280g
Antenna E0	30g
Antenna UW	19g

Battery Endurance > 10 hours, high transmit power, 2700mAh battery, 90:5:5 duty cycle

Conformance Approvals

	ETS	EN 300 086 *
* pending in some cases		EN 300 113 *
		EN 300 489 *
		EN 300 219 *
	Australia	AS4295 *

1.7.2   Transmitter

Power Output Any two 2 levels programmable from

0.5, 1, 2, 2.5, 4 or 5 W

Transmitter Rise Time Less than 40 ms

Duty Cycle 1 minute transmit : 4 minutes receive

Spurious Emissions < 0.25uW   (9kHz to 1GHz)

< 1.0uW   (1GHz to 4GHz))

Residual Noise 60% deviation. CCITT Weighted

25kHz Channel Spacing	>45dB
12.5kHz Channel Spacing	>40dB

Audio Frequency Distortion ≤ 3% (at 60% deviation)

Audio Frequency Response 300 to 3000Hz* +1dB -3dB

Figures apply for a flat audio response or a 6dB/octave pre-emphasis curve

(*2550Hz 12.5kHz channel spacing)

1.7.3 Receiver

Sensitivity	≤ 0.3µV PD (-117.5dBm) for 12dB SINAD
	≤ 0.5µV PD for 20 dB Quieting.

Adjacent Channel Selectivity	25kHz Channel Spacing	> 73dB (AS4295)	>70dB (ETS)
	12.5kHz Channel Spacing	> 65dB (AS4295)	>60dB (ETS)
Intermodulation Rejection		> 70dB (AS4295)	>65dB (ETS)

Spurious Response Rejection	> 75dB (AS4295)
	>70dB (ETS)
Blocking	> 95dB (AS4295/ ETS)
Conducted Spurious Emissions	< 2nW (-57dBm) 9kHz to 1GHz (ETS)
	< 20nW (-47dBm) 1GHz to 4GHz
FM Residual Noise (CCITT weighted)	25kHz : > 45dB
	12.5kHz : > 40dB
Mute Range	Typically 6 to 25dB SINAD
	Typical setting 10 to 12dB SINAD
Mute Response Time	<30mS (no CTCSS)
	add 200mS for CTCSS
Voting Response Time	Searches at 50ms/channel
Audio Distortion	500mW into 16 Ω at < 5% distortion
Audio Frequency Response	300 to 3000Hz*, +1dB to -3dB
	Figures apply for a flat audio response or a 6dB/octave de-emphasis curve (*2550Hz for 12.5kHz channel spacing)

1.7.4   Signalling

1.7.4.1 CTCSS

All 38 standard CTCSS Tones are supported as per the table below.

Identifier	Frequency	Identifier	Frequency	Identifier	Frequency
Q	67.0	C	107.2	0	167.9
R	71.9	L	110.9	1	173.8
S	74.4	D	114.8	2	179.9
T	77.0	M	118.8	3	186.2
U	79.7	E	123.0	4	192.8
I	82.5	N	127.3	5	203.5
V	85.4	F	131.8	6	210.7
A	88.5	O	136.5	7	218.1
W	91.5	G	141.3	8	885.7
J	94.8	P	146.2	9	223.6
=	97.4	H	151.4	*	241.8
B	100	X	156.7	#	250.3
K	103.5	Y	162.2	' '	NONE

Encoder

Tone Deviation:

25kHz channel spacing	500 to 750Hz
20kHz channel spacing	400 to 600Hz
12.5kHz channel spacing	250 to 375Hz
Tone Distortion	Less than 5.0%
Frequency Error	Less than ±0.5%

Decoder

Bandwidth	Not greater than ±3.0%
Deviation Sensitivity	Less than 6.0% of system deviation (for decode with full RF quieting)
Noise Immunity	Less than 500ms dropout per minute at 10dB sinad (CTCSS tone deviation 10% of system deviation. RF deviation 60% at 1000Hz).
False Decode Rate	Less than 5 false decodes per minute (no carrier input)
Talkoff	For no dropouts in one minute, interfering tone at 90% of system deviation (CTCSS tone at 10% of system deviation).

	Full quieting signal:	310Hz to 3000Hz
	20dB sinad RF signal:	320Hz to 3000Hz
	12dB sinad RF signal:	350Hz to 3000Hz

Response Time	Less than 250ms (full quieting/tone >100Hz)
	Less than 350ms (full quieting/tone <100Hz)
De-Response Time	Less than 250ms
Reverse Tone Burst	none

1.7.4.2 FFSK

1200 Baud: 1200 / 1800 Hz MPT1317 based

2400 Baud: 1200 / 2400 Hz MPT1317 based

1.7.4.3 Selcall

The following tone sets are supported as per tables below:

- ST-500:   CCIR, EEA, ZVEI, DZVEI, EIA
- ST500/CML: ZVEI_3, DZVEI
- CML: CCIR, EEA, ZVEI
- SIGTEC: CCIR, CCIRH, EEA, ZVEI_1, XVEI_2, ZVEI_3, NATEL, EIA
- SEPAC: CCIR, EEA, ZVEI_1, ZVEI_2, ZVEI_3, EIA

Selcall Tone Frequency Table

Tone	CML CCIR	ST500 CCIR	SIGTEC CCIR	SIGTEC CCIRH	SEPAC CCIR	CML EEA	ST500 EEA	SIGTEC EEA
0	1981	1981	1981	1981	1981	1981	1981	1981
1	1124	1124	1124	1124	1124	1124	1124	1124
2	1197	1197	1197	1197	1197	1197	1197	1197
3	1275	1275	1275	1275	1275	1275	1275	1275
4	1358	1358	1358	1358	1358	1358	1358	1358
5	1446	1446	1446	1446	1446	1446	1446	1446
6	1540	1540	1540	1540	1540	1540	1540	1540
7	1640	1640	1640	1640	1640	1640	1640	1640
8	1747	1747	1747	1747	1747	1747	1747	1747
9	1860	1860	1860	1860	1860	1860	1860	1860
A	2400	1055	2110	2400	2400	1055	1055	2110
B	930	....	2400	930	1055	930	....	1055
C	2247	2400	1055	2247	2247	2247	2400	2400
D	991	....	2247	991	991	991	....	2247
E	2110	2110	930	2110	2110	2110	2110	930
F	....	....	991	1055	....	....	....	991

Tone	SEPAC EEA	CML ZVEI	ST500 ZVEI	SIGTEC ZVEI-1	SEPAC ZVEI-1	SIGTEC ZVEI-2	SEPAC ZVEI-2	SIGTEC ZVEI-3
0	1981	2400	2400	2400	2400	2400	2400	2200
1	1124	1060	1060	1060	1060	1060	1060	970
2	1197	1160	1160	1160	1160	1160	1160	1060
3	1275	1270	1270	1270	1270	1270	1270	1160
4	1358	1400	1400	1400	1400	1400	1400	1270
5	1446	1530	1446	1446	1446	1446	1446	1400
6	1540	1670	1670	1670	1670	1670	1670	1530
7	1640	1830	1830	1830	1830	1830	1830	1670
8	1747	2000	2000	2000	2000	2000	2000	1830
9	1860	2200	2200	2200	2200	2200	2200	2000
A	1055	2800	970	2600	2800	970	885	2400
B	970	810	....	2800	970	885	741	885
C	2247	970	2800	741	885	741	2600	741
D	2400	886	....	970	....	2600	....	2600
E	2110	2600	2600	810	2600	2800	970	2800
F	....	....	....	886	....	600	....	600

Tone	SEPAC ZVEI-3	ST500/CML ZVEI-3	DZVEI	ST500 DZVEI	SIGTEC NATEL	SIGTEC EIA	SEPAC EIA	ST500 EIA
0	2200	2400	2200	2200	1633	600	600	600
1	970	1060	970	970	631	741	741	741
2	1060	1160	1060	1060	697	882	882	882
3	1160	1270	1160	1160	770	1023	1023	1023
4	1270	1400	1270	1270	852	1164	1164	1164
5	1400	1530	1400	1400	941	1305	1305	1305
6	1530	1670	1530	1530	1040	1446	1446	1446
7	1670	1830	1670	1670	1209	1587	1587	1587
8	1830	2000	1830	1830	1336	1728	1728	1728
9	2000	2200	2000	2000	1477	1869	1869	1869
A	885	885	2600	825	1805	459	2151	2151
B	741	....	....	....	1995	2151	1091	....
C	2600	810	886	2600	1300	2600	2400	2010
D	....	....	810	....	1700	2010	....	....
E	2400	970	2400	2400	2175	2433	459	459
F	....	....	....	....	2937	2292	....	....

Selcall Tone Periods

The Selcall tone period:

4 pre-set lengths selectable: 20ms and 30 seconds in 1ms increments.

1.7.4.4 DTMF

DTMF Encode supported via keypad:

TONES	1209Hz	1336Hz	1477Hz
697Hz	1	2	3
770Hz	4	5	6
852Hz	7	8	9
941Hz	*	0	#

Tone Period, programmable: 0 - 2550 mSec in 10mS steps

Inter-Tone Period, programmable: 0 - 2550 mSec in 10mS steps

Link Establishment Time, programmable: 0 - 10000 mSec in 10mS steps.

Tx Hang Time, programmable: 0 - 9999 mSec in 10mS steps.

Side-Tone in Loudspeaker: selectable via programmer

1 ~ INTRODUCTION

1.7.4.5 DCS

Data rate	134 bits per second, frequency modulated
	7.46ms/bit
	171.6ms per codeword continuously repeating
Deviation	0.5kHz for 12.5kHz systems
	1kHz for 25kHz systems
Codeword size	23 bits comprising:
	8 bits - DCS code (3 octal digits 000-777)
	3 bits - Fixed octal code 4
	11 bits - CRC (error detection) code
Available Codes	104 codes from 512 theoretically possible codes – see below
Turn off code	200ms 134Hz tone at PTT release

DCS Codes can be Transmitted "Normal" or "Inverted" (programmable).

The radio can Receive DCS codes in either Transmitted "Normal" or "Inverted" or both (selectable via programmer).

Valid DCS Codes				
023	132	255	413	612
025	134	261	423	624
026	143	263	431	627
031	145	265	432	631
032	152	266	445	632
036	155	271	446	654
043	156	274	452	662
047	162	306	454	664
051	165	311	455	703
053	172	315	462	712
054	174	325	464	723
065	205	331	465	731
071	212	332	466	732
072	223	343	503	734
073	225	346	506	743
074	226	351	516	754
114	243	356	523	
115	244	364	526	
116	245	365	532	
122	246	371	546	
125	251	411	565	
131	252	412	606	

1.7.5 Environmental

Note: Operation of the equipment is possible beyond the limits stated but is not guaranteed.

Operational Temperature

-30°C to +60°C

Storage Temperature

-40°C to +80°C

Vibration Specification

IEC 68-2-6 with additional frequency acceleration from 60 – 150 Hz

Cold

IEC 68-2-1 Test 5 hours at -30°C

Dry Heat

IEC 68-2-2 Test 5 hours at +60°C

Damp Heat Cycle

IEC 68-2-30 Test 2 cycles at +40°C

Product Sealing

IEC529 rating IP54

(Intentionally Blank)

2. SERVICE PHILOSOPHY

2.1 SERVICE CONCEPT

The SRP9100 series has been designed to provide low cost trunked and non-trunked analogue, portable transceivers, using common core electronics, software and interfacing. It is a requirement that once the customer has purchased equipment, TMC Radio can follow this by providing an ongoing, high level of customer support together with a competitive and professional servicing activity.

There are three levels of service available:

Level	Activity	Recommended Spares	Recommended Test Equipment
1	Replacement of complete transceiver/antenna/fuses Reprogramming	Antennas, Fuses Ancillaries	Multimeter P.C. Radio software Programmer
2	Replacement of PCB or mechanical component replacement, Cosmetic repair	Listed in Level 2 Spares Schedule	As above + service aids and test equipment
3	Repair by PCB or mechanical component replacement, Cosmetic repair. Repair of Radio PCB to component level in CRU.	Listed in Level 2 Spares Schedule Radio PCB components only available to CRU.	As above + service aids and test equipment

2.2 WARRANTY

Initially, the normal 12-month warranty will apply to all radios and ancillaries**.**

2.2.1 Service Within and Out Of Warranty

The field Service Level for the SRP9100 portable is LEVEL 2, PCB replacement.

LEVEL 2 service, PCB (only) and case part replacement, will be carried out in field repair workshops, or the Central Repair Unit (CRU) if required.

LEVEL 3 Service (Radio PCB component level repair) will ONLY be carried out in the Central Repair Unit. For this, the complete radio must be returned to the CRU.

A PCB replacement program may be offered by the CRU in some countries.

2.2.2 Ancillary Items

All ancillary items are Level 1 service.

These items should be replaced if faulty; they are non-repairable, and non-returnable to the CRU.

2.3 SOFTWARE POLICY

Software provided by TMC Radio shall remain the Company's property, or that of its licensors and the customer recognises the confidential nature of the rights owned by the Company.

The customer is granted a personal, non-exclusive, non-transferable limited right of use of such software in machine-readable form in direct connection with the equipment for which it was supplied only.

In certain circumstances the customer may be required to enter into a separate licence agreement and pay a licence fee, which will be negotiated at the time of the contract.

The customer undertakes not to disclose any part of the software to third parties without the Company's written consent, nor to copy or modify any software. The Company may, at its discretion, carry out minor modifications to software. Major modifications may be undertaken under a separate agreement, and will be charged separately.

All software is covered by a warranty of 3 months from delivery, and within this warranty period the Company will correct errors or defects, or at its option, arrange free-of-charge replacement against return of defective material.

Other than in the clause above, the Company makes no representations or warranties, expressed or implied such, by way of example, but not of limitation regarding merchantable quality or fitness for any particular purpose, or that the software is error free, the Company does not accept liability with respect to any claims for loss of profits or of contracts, or of any other loss of any kind whatsoever on account of use of software and copies thereof.

3. DISASSEMBLY

Remove the Battery

(1) Depress the spring-loaded battery latch to release the battery.

(2) Slide the battery down the radio to disengage the retaining lugs.

(3) Lift the battery away from the radio.
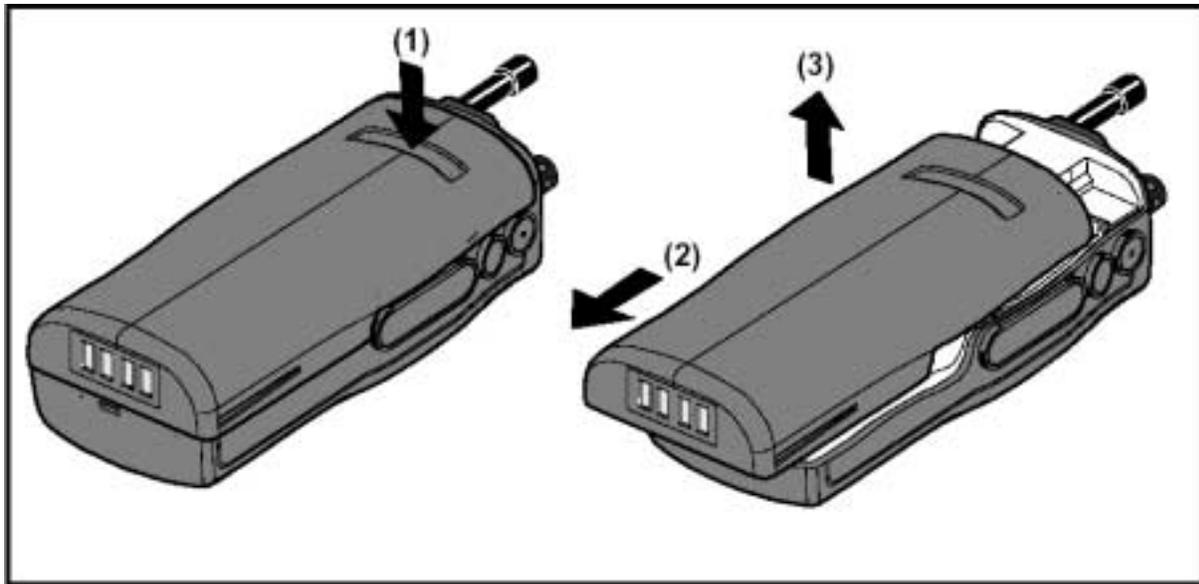
Figure 1 Battery Removal

Remove the Antenna and On/Off/Volume Control Knob

(1) Unscrew and remove the antenna.

(2) Remove the lanyard ring (if fitted).

(3) The On/Off/Volume control knob is a friction fit. Pull the knob from its spindle.

(4) Remove the smart interface cover from the smart interface jacks and the antenna boss.

Remove the Metal Frame Assembly

(1) Use a small, flat bladed screwdriver to release the cast metal frame assembly from the bottom of the front casing. This action releases the radio PCB from the MMI PCB.

(2) Gently ease the frame assembly out of the front casing taking care not to damage the two flexi-circuits. (lift the bottom of the frame so that it just clears the plastic casing, then gently slide the frame away from the top of the casing until it is released from the casing). Caution: The loudspeaker / microphone flexi-circuit connects the radio PCB (attached to the metal frame) and the loudspeaker / microphone assembly (attached to the front casing). The flexi-circuit must be released from the connector on the radio PCB before the frame can be lifted clear of the front casing. Also ensure that the volume control/top connector assembly stay retained within the chassis and does not fall out.

(3) Slide out the locking drawer of connector, S6, (on the radio PCB) to release the flexi-circuit. Use a very small bladed screwdriver.

(4) Remove the flexi-circuit from connector, S6.

(5) Lift the frame away from the front casing. At this stage the radio PCB and metal screen are still attached to the frame.
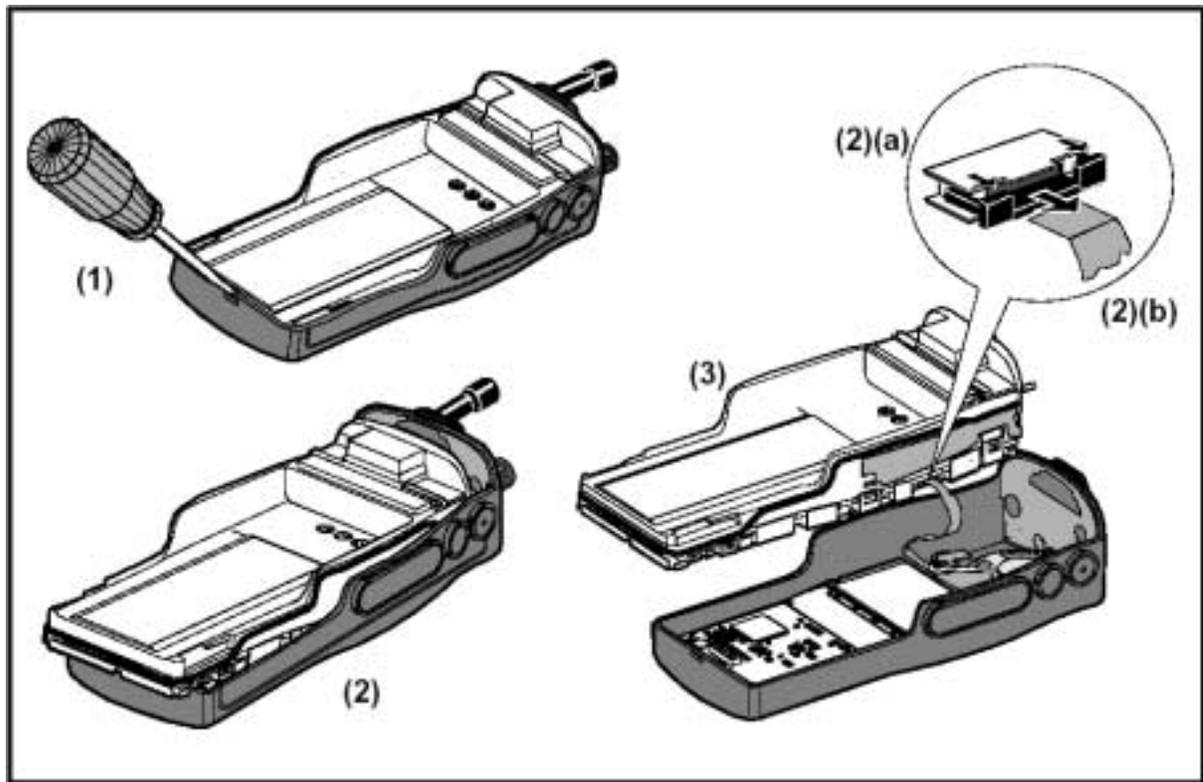
Figure 2 Removal of Chassis

Remove the Metal Screen from the Radio PCB and Frame Assembly

(1) Use a small, flat bladed screwdriver to release the seven spring tabs on the metal screen. Note: Releasing three spring tabs on one side and the one at the top of the metal screen should be sufficient to remove the metal screen.

(2) Lift the metal screen away from the radio PCB and frame assembly.

Remove the Speaker and Microphone

(1) Remove the speaker retaining clip.

(2) Lift the speaker / microphone assembly away from the front casing taking care not to damage the flexi-circuit.
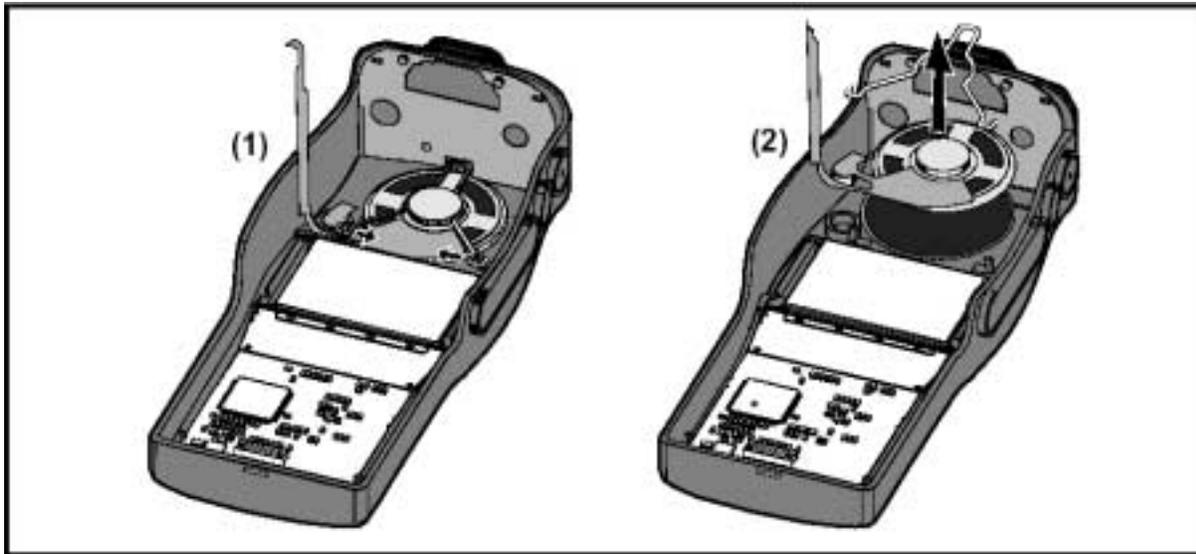
Figure 3 Removal of Speaker and Microphone

Remove the MMI PCB

The MMI PCB is held in place by four plastic lugs on the front casing.

(1) Using a small flat bladed screwdriver, exert slight sideways and upwards pressure on the edge of the PCB (close to one of the top retaining lugs) whilst exerting slight outward deflection of the casing side walls (A). This will release the PCB from the retaining lugs.

(2) Lift the MMI PCB and LCD display assembly away from the front casing.
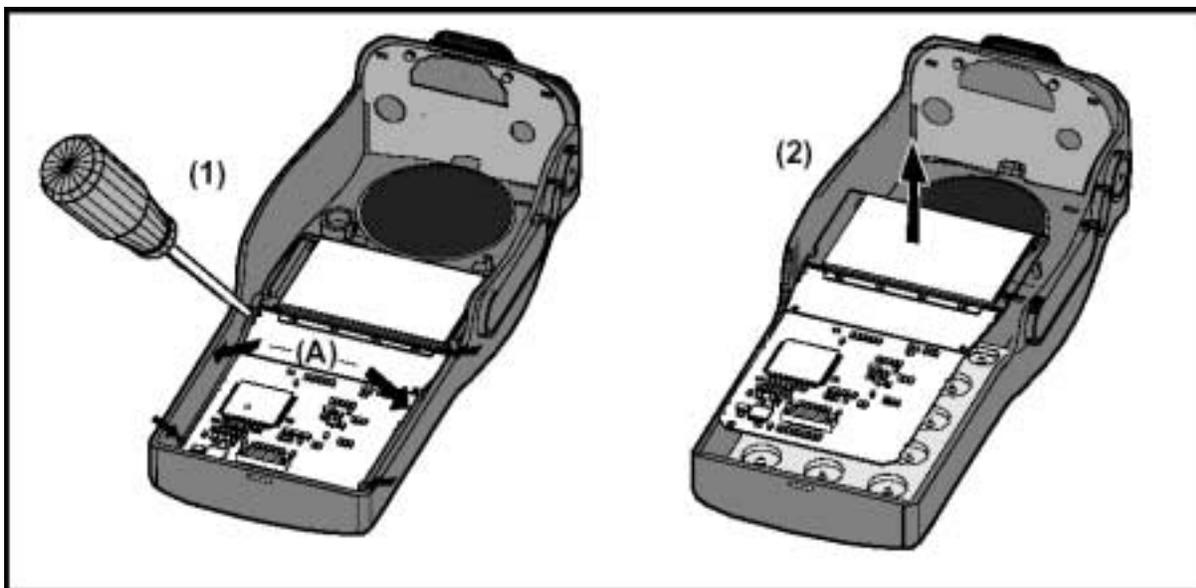
Figure 4 Removal of MMI Assembly

Remove the Switch Mat

The switch mat was held in place by the MMI PCB. Lift the switch mat clear of the casing.

RE-ASSEMBLY

Re-assembly is the reverse of dis-assembly. However:

(1) Examine the various seals before re-assembly and replace with new items if necessary.

(2) Slight outward deflection of the case walls will ease re-assembly of the MMI PCB behind the retaining lugs.

(3) Care must be taken when reconnecting the flexi-circuits to ensure that they are correctly aligned before pressing home the locking drawers on the connectors.

(4) Ensure that the metal screen is fitted to the PCB / frame assembly before the assembly is fitted to the casing.

(5) To prevent damage to the frame seal, use a thin, flat piece of plastic (or other material) in a 'shoehorn' action between the bottom inside of the front case and the frame / PCB assembly as the assembly is pushed home. Carefully remove the piece of plastic (or other material) after the frame / PCB assembly has been fitted to the front case.

4. TECHNICAL DESCRIPTION

4.1 RECEIVER

Refer to Figure 4-1. Description based on UW band

4.1.1 Front-End Filters and RF Amplifier

The receiver input signal from the antenna passes through the antenna filter comprising L582, L583, L584, L585 and associated tuning capacitors. With the portable in receive mode, diodes D540, D541 and D580 in the antenna switch are reverse biased allowing the receiver input signal to be coupled through to the front end with minimal loss. The overall insertion loss of the antenna filter and switch is approximately 0.8dB. Front end selectivity is provided by varactor tuned bandpass filters at the input and output of the RF amplifier.

A noise blanker is also fitted to E0 band radios. The noise blanker samples the received signal and gates the 45MHz signal in the IF stage in the event that high level noise transients are received. Due to inherent time delays in the bandpass filters prior to the blanking gate, gating synchronisation occurs before the transients can adversely affect the following stages.

Front-end tuning voltages are derived from the alignment data stored in flash memory in the radio. The DSP processes this data to optimise front end tuning relative to the programmed channel frequencies that may be changed at any time without re-aligning the radio.

To achieve the required varactor tuning range an arrangement of positive and negative bias power supplies is used to provide a total bias across the varactors of up to 14.0VDC. A fixed 2.5V positive bias derived from the 5V0 supply using voltage divider R429/430. The tuning bias is applied to the cathodes of the varactor diodes D401 to D413.

The TUNE 1 to 4 voltages are derived from pulse width modulated outputs from the FPGA and integrated by R305/C304, R307/C306, R310/C309, R313/C312. These voltage levels are derived from processed flash memory data and are dependent on channel frequency. They vary between +0.1 and +3.0V and are then passed through temperature compensated level translators Q404 to Q411 where they are converted to amplified (-0.5 to -11.5V) negative equivalents of the original levels. These negative tuning voltages are then applied to the anodes of the front end tuning varactor diodes D401 to D413. The -12.0V rail of the level translators is generated by U904D/E with D903-D906 providing the required voltage multiplier function.

The RF amplifier stage comprises a low noise transistor amplifier (Q400) that is designed to provide excellent intermodulation and blocking performance across the full operating range. The gain of this stage is typically 17dB for both UHF and VHF versions.

4.1.2 First Mixer and IF Section

The output of the last front-end bandpass filter is coupled into single balanced mixer T400/D415 which converts the RF signal to an IF frequency of 45MHz. The local oscillator injection level is typically +8dBm at T400 pin 1 with low side injection used for UHF and high side for VHF.

Following the mixer is IF amplifier Q401 that provides approximately 15dB of gain and in association with its output circuitry presents the required load conditions to the 4 pole 45MHz crystal filter Z401A/B. This filter provides the initial stage of adjacent channel filtering.

4.1.3 Quadrature Demodulator

Additional IF gain of approximately 45dB occurs at U400 which is a dedicated IF AGC amplifier/Quadrature Demodulator configured for single ended input and output operation. The AGC voltage for U400 is derived from the RSSI function of the DSP via a PWM output on the FPGA. The onset of AGC operation occurs when RF input signal level at the antenna exceeds -90dBm.

Conversion of the 45MHz IF signal to I and Q baseband signals is carried out by the demodulator section of U400. The 90MHz local oscillator signal is generated by VCO Q402 that is phase locked by the auxiliary PLL output of U701 via feedback signal AUX LO2.
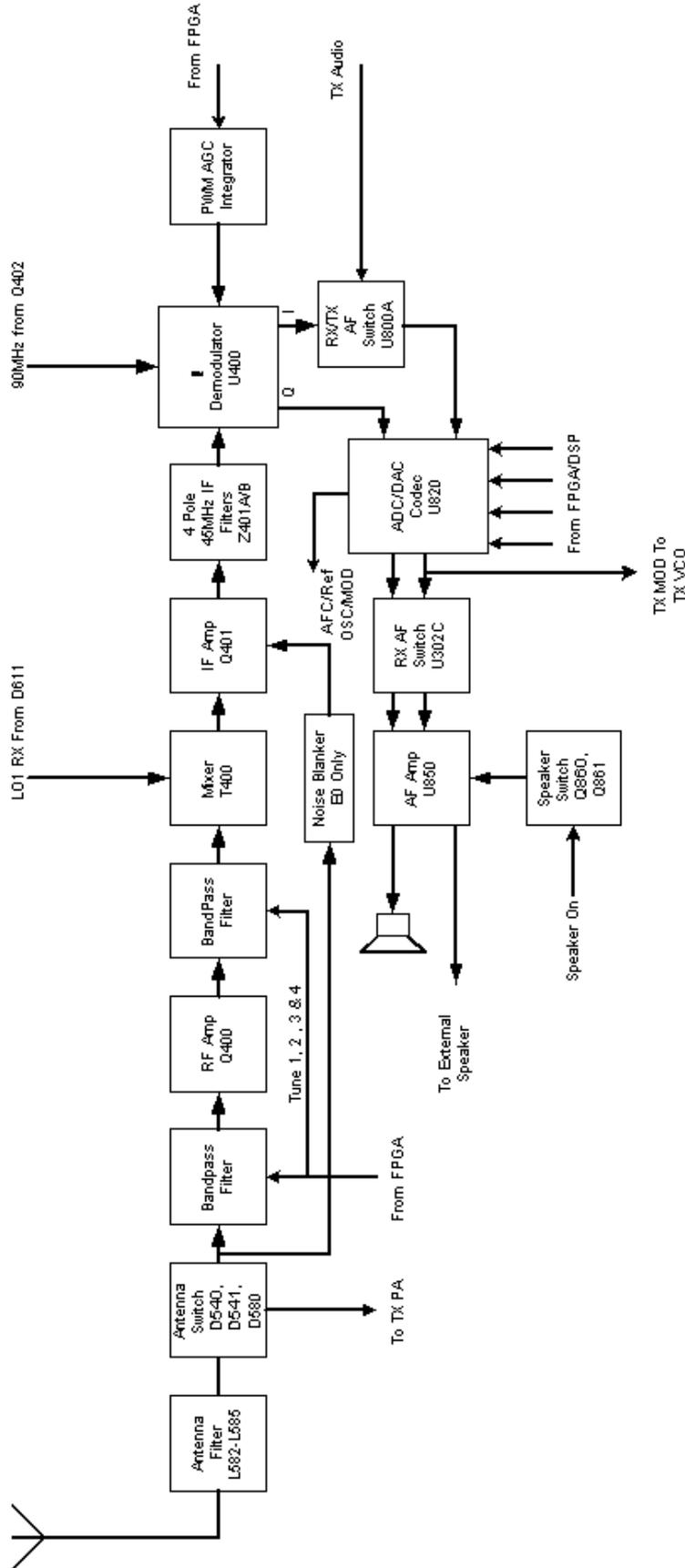
Figure 4-1 VHF/UHF Receiver Block Diagram

4.1.4 Receiver Audio Processing

All receiver audio processing and filtering functions are performed by the CODEC U820 under the control of the DSP.

The receiver I and Q analogue baseband signals are converted to digital signals by the CODEC ADC before being applied to a series of digital filters which provide the final stage of adjacent channel filtering, high pass and low pass filtering and mute noise processing for narrow and wideband operation. The processed signals are then converted to analogue audio signals by the CODEC DAC and are applied to conventional dual speaker amplifier U850-1.

Dual audio amplifier U850 provides an audio output level of up to 500mW watts into the 16 ohm speaker. The carrier and signalling mute functions are performed by Q860/861 under DSP control. De-emphasis to the audio is performed within the DSP.

Flat audio can be obtained on the portable's options connector. Switch U302B can select either flat or de-emphasised audio from the CODEC DAC U820. The selected audio is applied to the other half of the audio amplifier U850-2 that drives the options connector audio.

4.2 TRANSMITTER

Refer to Figure 3-2.

4.2.1 Drivers and PA Stages

The RF output level from the VCO T/R switch D611 is typically +8dBm. TX buffers Q550/Q560 increase this level by approximately 6dB (136-530MHz) and 9dB (66-88MHz) and also provides a high degree of VCO isolation from the TX output.

The PA module requires a drive power of approximately 14dBm (136-530MHz) and 17dBm (66-88MHz). The module contains power control cicuitry and power amplifier MOSFETs to provide the required output power.

Note. Care should be taken during servicing since if for any reason the drive power is lost, while the power control voltage is high, the current into the PA may exceed its specification. Therefore, the current should be monitored at all times and preset to as low as required. The radio has additional inbuilt safeguards, but these should not be relied on in case they have been modified.

Power output settings are derived from alignment data stored in flash memory during the initial factory alignment. The DSP processes this data to optimise the power output level relative to the programmed channel frequencies that may be changed at any time without retuning the radio.

PA current is monitored via comparator U520B and applied via analogue gate U800B to U301C which is configured as an ADC. This samples the voltage after which it is passed to the FPGA for further processing.

4.2.2 Power Control

Output power is stabilised by a power control feedback loop. A printed circuit transmission line, D510 and associated components comprise the power detector. Comparator U520A and associated components provide the power setting and control functions. Forward power is sampled by the power detector and applied as a DC voltage to the inverting input of op-amp U520A. The TX PWR voltage which is a DC voltage proportional to the programmed TX power setting is applied to the non-inverting input of the op-amp. The TX PWR voltage originates from the FPGA as a PWM signal and is integrated for application to the op-amp.

PA module output level changes due to supply voltage, load or temperature variations are detected and applied to the op-amp which proportionally adjusts the PA pre-driver supply, and therefore the PA drive level. High temperature protection is provided by thermistor R532 that progressively reduces the power level if the PA module temperature becomes excessive.

4.2.3 Antenna Changeover and Harmonic Filter

The antenna changeover circuit consisting of pin diodes D580/D540/D541 is switched by Q541/Q542 and associated circuitry allowing the transmitter output to be coupled to the antenna while providing isolation for the receiver input. With the transmitter switched on, the diodes are forward biased allowing power to be coupled through to the antenna and isolating the receiver by grounding its input at C588. The short circuit at the receiver input is transformed to an effective open circuit by L583, which minimises transmitter loading. With the transmitter switched off the diodes are reverse biased allowing the receiver input signal to reach the receiver front end with minimal loading and loss. The harmonic rejection low pass filter comprises L582/L584/L585 and associated capacitors.

4.2.4 Transmitter Audio Processing

The internal microphone unit comprising an electret microphone provides 5mV RMS (nominal) at the microphone input (INT MIC) which provides approximately 60% of maximum system deviation. U800C is a control gate for the microphone audio signals.

EXT MOD is the external audio options and data input that is controlled by gate U800C. The EXT MOD input level is the same as the microphone input for the same programmed gain setting.

U800A provides CODEC input switching which selects either the receiver I signal or transmitter audio/data signals depending on the TX/RX mode. All pre-emphasis, filtering, compression and limiting processes for narrow and wideband operation are carried out in the DSP after digitisation by the CODEC (U820). The processed transmitter audio/data from the CODEC output at VOUTL is applied to the VCO as a modulation signal.

Figure 4-2 VHF/UHF Transmitter Block Diagram

FREQUENCY SYNTHESISER

4.2.5 General

Refer to Figure 3-3.

The SRP9100 frequency synthesiser consists of individual transmitter and receiver voltage controlled oscillators, loop filter, varactor negative bias generator, reference oscillator/phase modulator and an integrated, dual phase locked loop device U701.

4.2.6 PLL

The PLL device contains two prescalers, programmable dividers and phase comparators to provide a main and auxiliary PLL. The main PLL of U701 controls the frequency of the TX/RX VCOs via Control Voltage outputs at pins 2 and 3 and VCO Feedback to pin 6. The auxiliary PLL is used to control the receiver 90MHz second local oscillator via the Control Voltage output at pin 17 and VCO Feedback to pin 15. The PLL operation involves the division of the 14.4MHz reference oscillator frequency by divider U710 and the internal divider of U701 down to a lower frequency that corresponds to a sub-multiple of the radio channel spacing of 5kHz, 6.25kHz or 7.5kHz. The VCO frequency is sampled and divided down to the same frequency after which it is phase compared to the reference. Any error produces an offset to the Control Voltage output that is used to correct the VCO frequency. A valid lock detect output is derived from pin 20 and is sampled by the FPGA during transmit. If an unlocked signal is detected the radio will switch back to receive mode.

4.2.7 VCO

The transmitter and receiver VCOs use low noise JFET transistors (Q600 RX, Q602 TX) and inductors L602 (RX), L608 (TX) to generate the signals for the required band coverage. Electronic tuning is provided by varactor diodes D600 to D608 with their control voltages derived from the Loop Filter, PLL and Negative Bias Generator. VCO selection and timing is controlled by the DSP via the RX and TX power supplies and applied through switches Q601 (RX) and Q603 (TX). VCO buffer Q604/605 isolates the VCO from load variations and active power supply filter Q615 minimises supply related noise. A PLL feedback signal is sampled from the VCO buffer output via buffer Q607.

4.2.8 Negative Bias Generator and Loop Filter

A positive and negative varactor bias supply similar to the front-end varactor arrangement has been used to achieve the required broadband tuning range of the VCOs. PLL device U701 is programmed to deliver a nominal +2.5V output from phase detector/charge pump CPPF/CPP regardless of the channel frequency selected. Loop filter C719/722/734 and R721/724/734 filter this voltage to remove synthesiser noise and reference products. The resulting low noise voltage is applied to the cathode side of the VCO varactor tuning diodes as a positive bias voltage. The negative bias supply originates as a positive DC voltage (0.1V to 3.0V) at the DAC output of U701 (DOUT) with a level related to the programmed frequencies of the radio. The voltage is inverted to an amplified negative polarity by Q700 to Q703 of up to –16VDC. The -16V rail of this supply is generated by U904E/D with D903 to D906 providing the voltage multiplying effect needed to achieve -16V. After filtering, the negative VCO tuning voltage VCAP BIAS is then applied directly to the VCO varactor anodes.

4.2.9 Phase Modulator

The modulation path for audio, data and higher frequency CTCSS signals is via D609 and its associated components in the TX VCO. The reference input to the PLL (FXTAL) provides the low frequency modulation path in conjunction with phase modulator Q711 to Q716. U760B is a low pass filter that provides 6dB per octave attenuation to frequencies above approximately 10Hz. Q711 to Q713 provide a linear ramp function derived from a differentiated 225kHz (VHF) or 450kHz output from the programmable divider U710. Q714 to Q716 provide a Schmitt trigger function that triggers when the ramp and modulation signal levels coincide. The resulting output from Q714 is a phase modulated signal corrected to give a flat frequency response above 10Hz by the function of U760B.

Modulation balance adjustment is carried out using an FPGA generated PWM voltage applied to the ramp generator. This voltage is derived from flash memory after being stored during alignment. A DAC output from the Alignment Tool is applied to ramp generator Q711 to Q713 via the MOD BAL line to set the low frequency modulation level at the four test frequencies.

4.2.10   Reference Oscillator

TCXO U700 determines the overall frequency stability and frequency setting of the radio. The frequency setting is achieved by adjusting its ADJ voltage with the Alignment Tool. In addition, the ADJ input is used in a frequency control loop with the receiver I and Q signals to provide receiver AFC. U700 operates at 14.4MHz and is specified at $\pm$2.0ppm frequency stability over the temperature range -25° to +75°C.
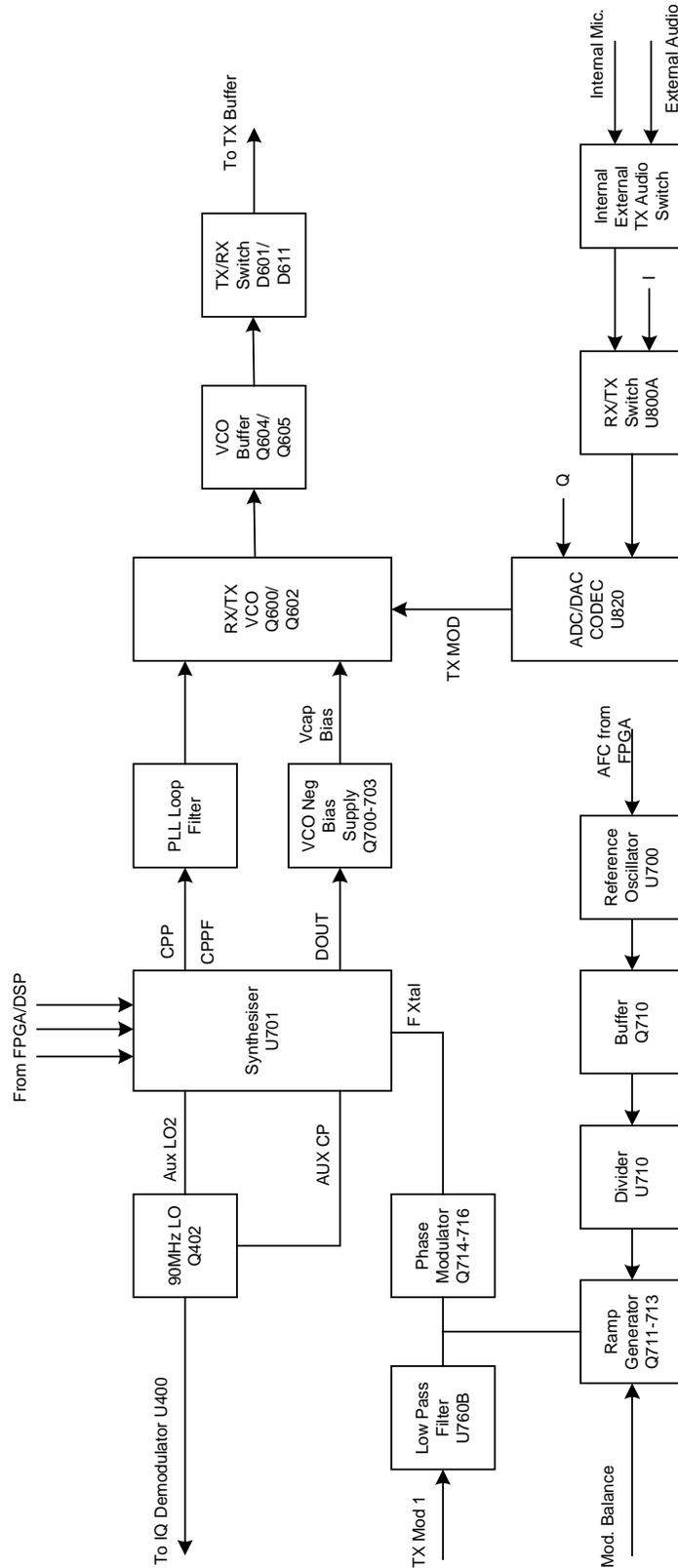
Figure 4-3 VHF/UHF Synthesiser, Block Diagram

4.3 CONTROL

Refer to Figure 3-4.

4.3.1 DSP and FPGA

The SRP9100 transceiver operates under the control of a DSP (U201) and FPGA (U300) combination that together with a number of other dedicated devices perform all the operational and processing functions required by the radio. The FPGA is configured by the DSP under software control to provide the following functions:

- Channel set-up of all operating frequencies
- Modulation processing and filtering
- De-modulation processing and filtering
- TX power output reference
- Receiver front end tuning
- Serial communications with alignment tool, microphone and control head
- Modem functionality for data modulation
- All signalling / CTCSS generation and decoding
- DSP clock offset control
- Receiver muting control
- TX / RX switching
- PLL detect

4.3.2 DSP Clock Oscillator

The DSP is clocked by a 15.360MHz oscillator, consisting of crystal X200 and an internal DSP oscillator. Q220 forms a crystal switching circuit with C205 which when activated by a command from the FPGA steers the oscillator away from potential interfering frequencies.

4.3.3 FPGA PWM

The FPGA must supply several analogue signals to control radio tuning. It does this with several Pulse Width Modulated (PWM) outputs.

The front-end tune signals (TUNE1-TUNE4) originate from the FPGA in the form of PWM signals. The values for these signals are stored in flash memory from radio alignment and selected depending on the channel that the radio is currently tuned to. These signals are integrated by RC networks to provide the analogue tuning voltages that are ultimately applied to the tuning varacap diodes.

Other analogue PWM derived signals used are transmitter power (TX PWR), receiver AGC voltage (AGC), LEDs (RED/GREEN) and modulation balance (MOD BAL).

Analogue inputs are monitored by comparators and a ramp generator that is derived from a PWM signal at the FPGA. Four comparators, U301A-D have their non-inverting inputs connected to a ramp voltage generator.

Analogue voltages to be monitored such as PLL Loop Voltage (LOOP VOLTS), key detect (KEY_DET), battery voltage (BAT SENSE), transmitter current (TX CURRENT), volume level (VOLUME) and external sense (EXT SENSE) are connected to the inverting inputs. The analogue voltages are compared with the ramp voltage as it increases and the comparator switches at the point where the input voltages exceeds the ramp. The FPGA compares the time that this occurs with the PWM signal and converts it to a value.

4.4 MEMORY

Memory consists of the internal DSP memory and an external 4MB non-volatile Flash Memory U202. When power is off, program and data is retained in Flash Memory. At power-on, a boot program downloads the DSP's program from Flash Memory to its internal RAM for faster program execution and access to data.
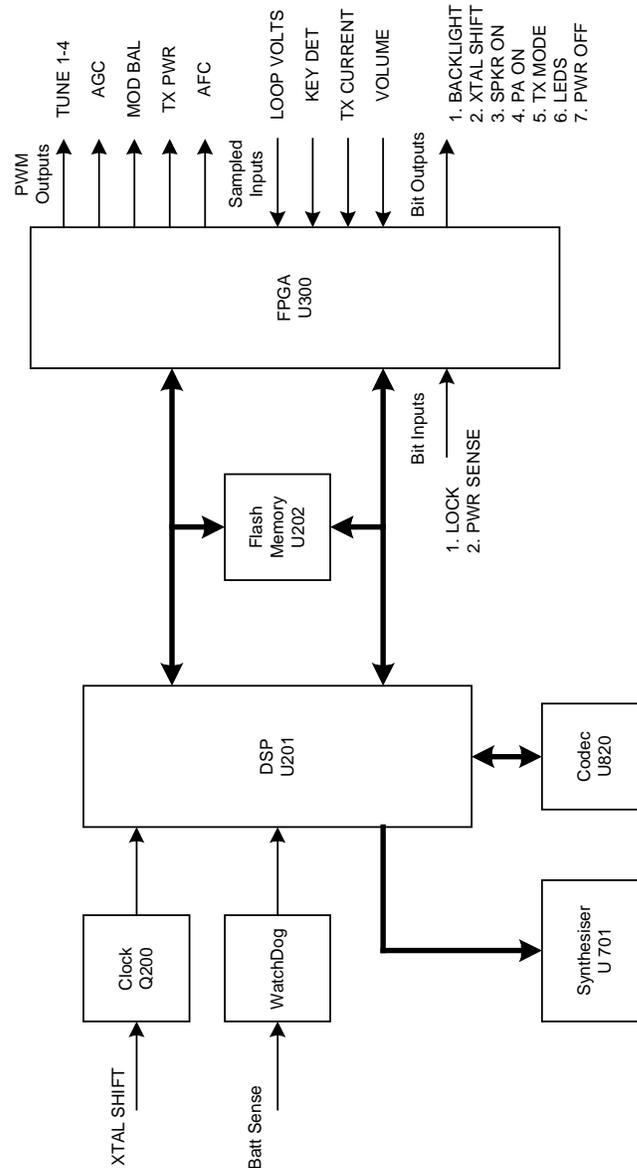
Figure 4-4 VHF/UHF Control Block Diagram

4.5 POWER SUPPLIES

4.5.1 Power On Function

The raw battery supply of between 6.0 and 9.6 volts is applied to the FET switch Q900 after the battery fuse. Q900 is driven by transistors Q908 and Q909.

The on-off switch is connected between unswitched fused battery and PWR_ON. When the switch is turned on, a DC pulse is applied to Q908 that turns on the main FET switch Q900 for a short time. In this time, the radio DSP samples the PWR SENSE line and determines the state of the on-off switch.

If the on-off switch is on, the DSP raises the PWR OFF line and latches the main FET on, which maintains power to the radio circuitry. If the on-off switch is sensed going low by the DSP via the PWR_SENSE line, the DSP will save radio settings and then lower the PWR OFF line, turning off the main FET switch.

4.5.2   Power Supplies

The following is a list of the SRP9100 power supplies and some of the devices and circuits they supply.

4.5.2.1 +5V Regulator U900

This regulator can be powered down by a STBY signal from the FPGA. Supplies RX PSU and TX PSU are switched via Q903 and Q904. Circuits supplied by U900 are as follows.

- Synthesiser reference oscillator, divider and phase modulator
- VCO Varicap driver
- Switched RX PSU to VCO output switch
- Switched TX PSU to TX VCO enable/Rx VCO disable
- Switched TX PSU to Transmit Buffer Amplifiers
- Switched RX PSU to Receive front end and mixer
- 90MHz local oscillator Q402

4.5.2.2 +5V Regulator U901

- Transmit and receive VCOs
- PLL U701
- Analogue gates U302, U800
- Op amp U760
- 3.3V sub regulator Q910

4.5.2.3 +3.3V Regulator U902/Q918

- PLL Synthesiser IC U701
- DSP U201
- Flash memory U202
- FPGA U300
- ADC CODEC U1, U820

4.5.2.4 +2.5V Regulator U903

- DSP U201
- FPGA U300

4.5.2.5 Negative Power Supply U904E/F

Provides -16V output (-16V)

- VCO Varicap tuning drivers

-12V Output (-12V)

- Front end Varicap tuning drivers

4.5.2.6 Switched Battery

- Transmit Power Amplifier
- Speaker Amplifier

4.6 KEYBOARD AND DISPLAY (MMI)

Keypad Press Detection

Electronically, the keypad keys are arranged in a matrix of 3 rows and 7 columns.

The rows are driven directly by two processor port signals KEY_ROW1 and KEY_ROW2 which are normally in the low state. Transistors TR910-916 generate a unique voltage on KEY_DET3 for each column. Any key in the same column generates the same voltage.

For example, if key "1" (S903) is pressed TR913 turns on and sets up a voltage on KEY_DET3 according to the value of R932, R971 on the MMI board and R15 on the main radio board. This generates a processor interrupt on PTT3. The processor then goes through a process of deactivating the keypad rows selectively until it deduces which row the key press is in. The KEY_DET3 voltage which initiated the interrupt identifies which column the key press is in.

Processor Interface to LCD Display

The LCD display is driven by LCD driver chip IC901. The driver chip interfaces to the processor via an 8-bit data bus with the write cycle being controlled by LCD_CS and the LCD register select line controlled by processor address line A20. The processor is only able to write to the LCD driver.

Signal Name	Use	Signal Type
DATA (0:7)	Eight lines, processor data	0V or 5V
A(20)	Low duty cycle, display address selection	0V or 5V
BLITE	Backlight enable	0V OFF, 5V ON
nLCD_CS	Display enable	0V or 5V, active low
nKEY_ROW 1-2	Local keypad enables	0V or 5V, active low
KEY_DET3	Voltage proportional to keypress	0V to 5V
AF_PSU	Supply	5V nominal
0VA	Ground	0V
nWR	Write line(for future use)	0V write, 5V read

Four function keys are located below the display:

Legend	Function
M	Activate menu
–	Scroll down through channels (or menu, if active)
+	Scroll up through channels (or menu, if active)
OK	Confirm choice or action (ie. Enter).

The SRP9130 has 12 additional keys (supported by the daughter board) arranged as a DTMF keypad.
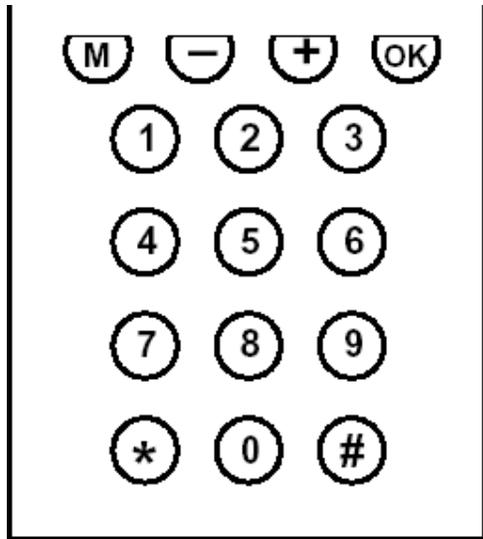
Figure 5 Keypad Layout

Backlighting

The LCD and keypad backlighting LEDs, D904 to D918, are turned on by the processor port signal, BLITE, via driver TR909.

5. ALIGNMENT (LEVEL 3 SERVICE ONLY)

This procedure is applicable to all versions of **SRP9100** portable transceivers.

Caution

Preparing the radio for alignment will erase from the radio all customer PMR and Trunking configuration data (channel, signalling information etc). The only data retained by the Alignment Tool is the factory alignment data for the radio (DAC settings for TX power, front-end tuning etc).

Using the Alignment Tool will allow changes to the original factory alignment and will invalidate all warranties and guarantees unless performed by an authorised level 3 service centre.

If the radio contains customer configuration data that must be retained, you *must first* use the SRP9100 Configuration Programmer (FPP) software to read the radio and save the data on an FPP file *before* commencing with the alignment procedure.

When the Alignment is completed, use the SRP9100 Field Personality Programmer (FPP) software to retrieve this stored data from the FPP file and write it back to the radio.

It is preferred that the radio remain installed in its cast and ABS case so that appropriate shielding and battery supply are maintained.

5.1 TEST EQUIPMENT

1.	Radio transceiver test set	CMT, 52/82 or similar.
2.	Variable DC power supply	6 to 7.5V at 2.5 amps
3.	Oscilloscope	20 MHz bandwidth minimum
4.	SRP9100 Programming & Alignment Lead	P/N PA-PRLD
5.	SRP9100 Radio Test Interface Unit OR	P/N PA-RTIU
	See simple interface circuit in Fig 5.1	
6.	Personal Computer	486 DX 66 or better.
		Operating system Windows 95 or later. Minimum RAM - 16MB. 5MB free hard disk space. Floppy drive - 1.44MB. Mouse and serial port required
7.	SRP9100 Alignment Tool	Computer Software file
8.	SRP9100 Configuration Programmer (FPP)	Computer Software file
9.	SRP9100 Battery Simulator	
10.	Antenna Adaptor for Portable	PA-ACON
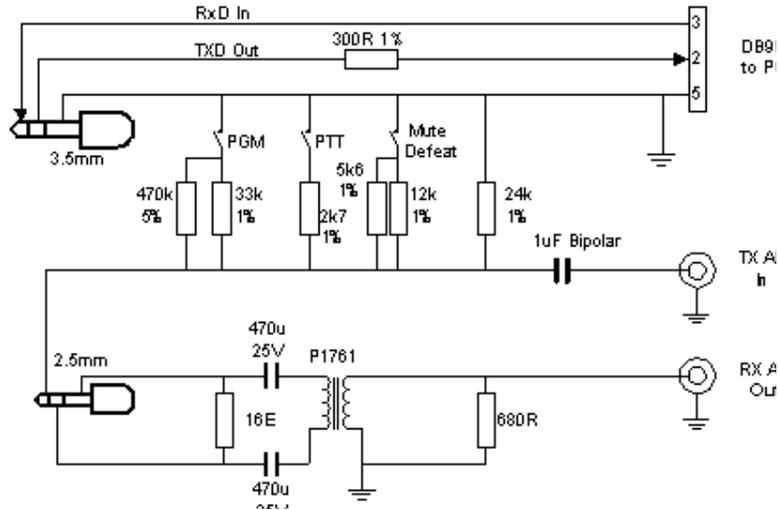
Figure 5-1 SRP9100 Radio Test Interface Unit

Notes for test jig:

1. The PGM switch places the portable in program mode.

2. The PTT switch activates transmit on the portable.

3. The Mute Defeat switch defeats CTCSS, Selcall and Carrier mute.

4. Interface data levels are TTL with RS232 polarity, although should work with most personal computers.

5. 16E resistor simulates speaker load.

6. Only one switch can be active at a time. For instance, It is not possible to place the radio in programming mode with the PGM switch and then PTT with the PTT switch.

5.2   TEST SET-UP
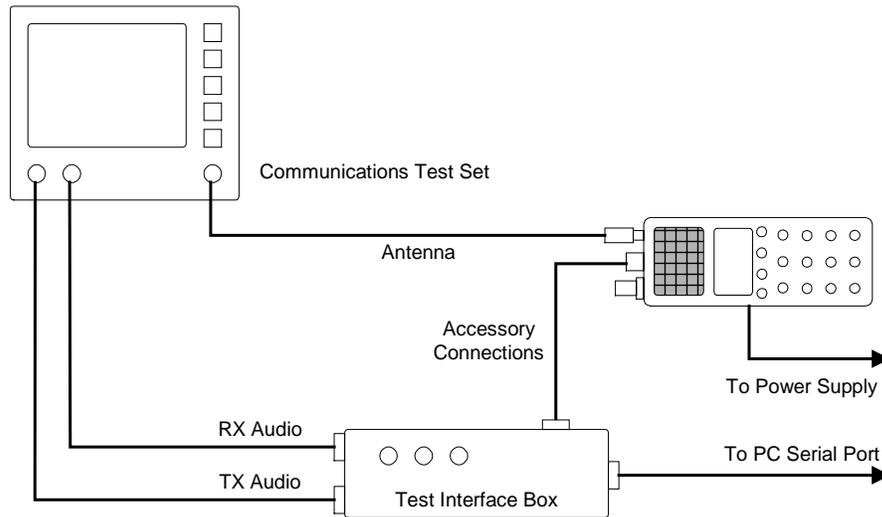
Figure 5-2 Test Set-up

Notes:

1.   Connect the radio to the test equipment as shown in Figure above.

2.   Use an adaptor (P/N PA-ACON) to provide a coaxial socket termination for the antenna.

3.   A battery simulator is used to supply power to the portable. This is an empty battery pack with external DC connections.

5.2.1   COMMS Set up

1.   Copy the SRP9100 Alignment Tool Computer Software file to the PC hard drive and run the program

The Alignment Tool Opening Menu is displayed.
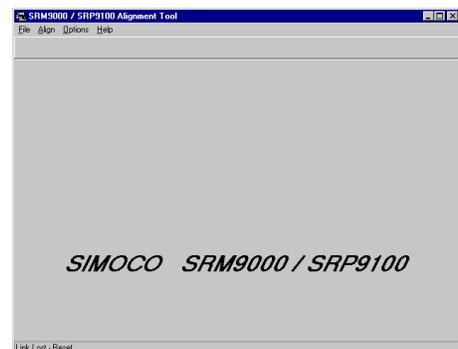
2.   Go to the **Options** menu and choose **Comms Setup.**
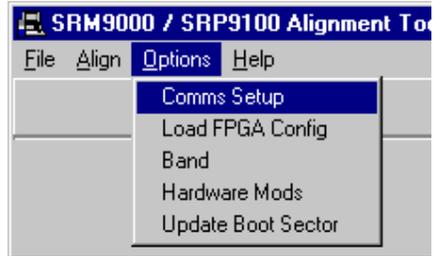
3.   The **Comms Setup** dialogue box is displayed.

    Select the Comms Port setting appropriate to the configuration of your PC and choose ✔**OK**.

    (Usually COM1)
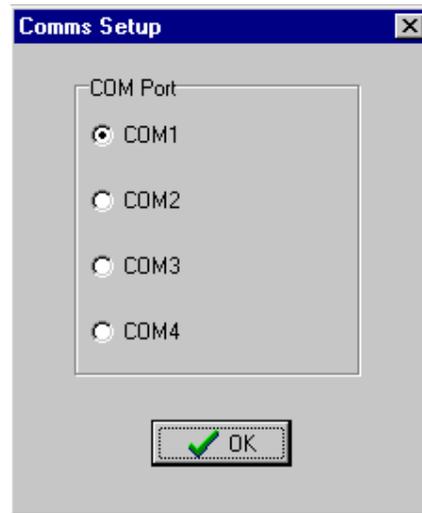
5.2.2 Radio Preparation

Radio parameters are to be aligned sequentially as detailed in this procedure.

1. At the Opening Menu, select the *Align Menu* and choose *Prepare/Read Radio*.

2. The *WARNING* is displayed.

   Choose *No* if you want to save the configuration and use the FPP software to read and save the data to a file.
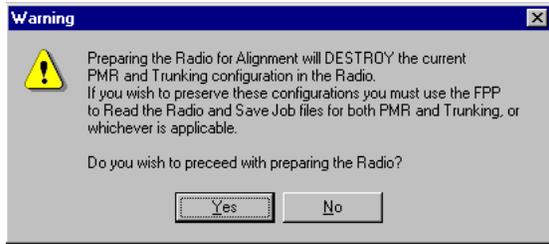
   Choose *Yes* if you want to proceed and go to step 3.

3. The radio alignment data is read (indicated by percentage bar) and stored.
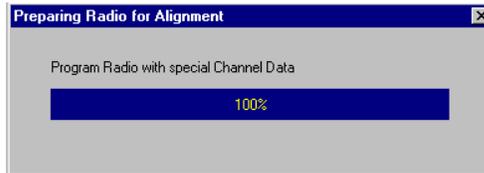
   The test alignment data is downloaded into the radio.

Note: In test alignment mode the radio is configured only for 12.5 kHz channel spacing, therefore all alignment is carried out at 12.5 kHz levels. When the radio is configured with the FPP for other channel spacings, the deviation related levels are calculated on a per channel basis by the radio software.

5.2.3 Alignment Procedure

Radio alignment must be done in the sequence detailed in the following paragraphs. This alignment assumes that the radio is functioning normally.

5.2.3.1 VCO DAC Alignment
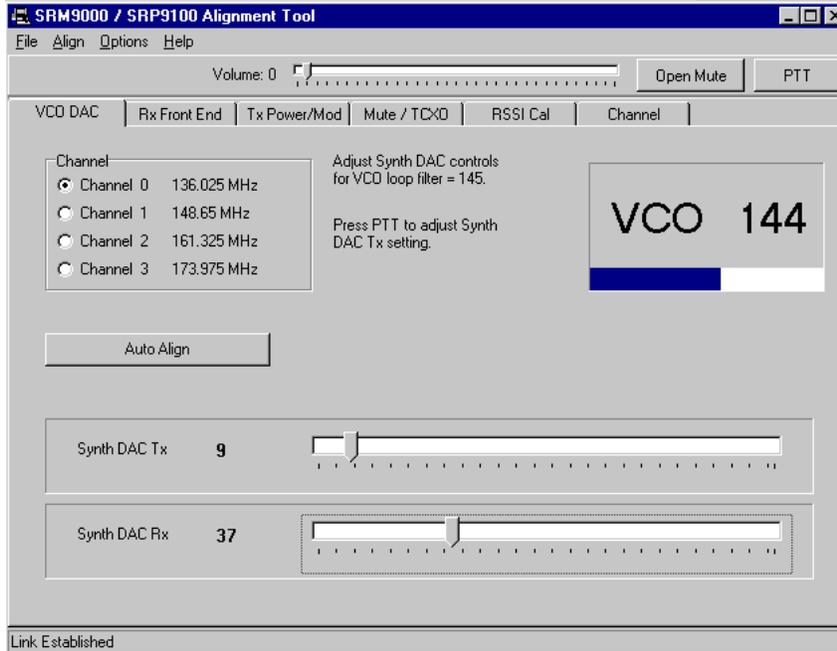
1. Select the *VCO DAC* page and choose Channel 0.

    The channel number and frequency will be highlighted.

2. Select the ***Synth DAC Rx*** slider (slider will be highlighted) and (using the left/right arrow keys or the mouse) adjust for a VCO reading as close to 145 as possible (must be between 140 and 150).

3. Repeat Step 2 for the remaining 3 Channels (1, 2 & 3 in turn).

    Note. The Auto Align function can also be used for steps 2 and 3.

4. Select Channel 0.

5. Select ***PTT*** and adjust the ***Synth DAC Tx*** slider for a VCO reading as close to 145 as possible (must be between 140 and 150).

6. Repeat Step 5 for the remaining 3 Channels (1, 2, & 3).

    Note. The Auto Align function can also be used for steps 5 and 6.

7. Release the ***PTT***.

5.2.3.2 TCXO (Radio Netting Adjustment)
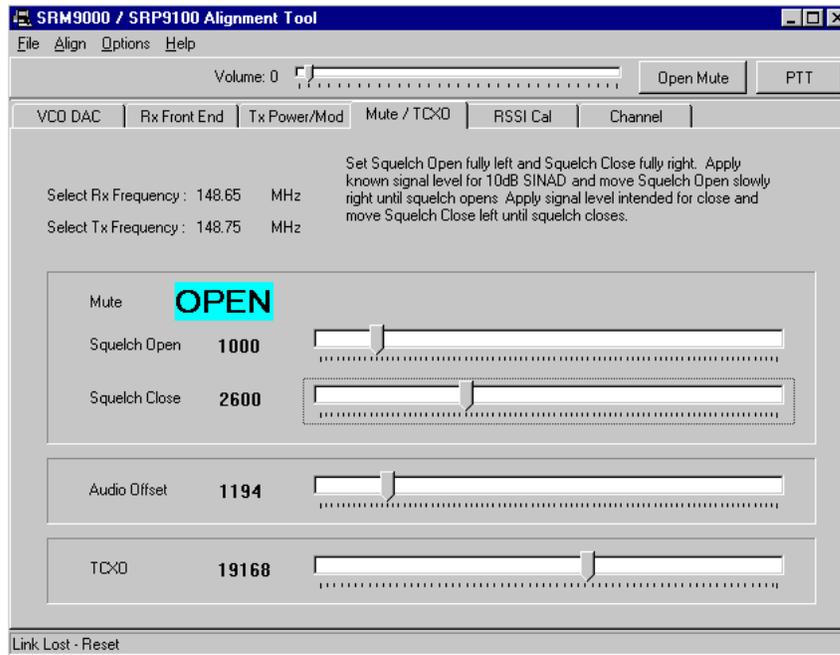
1. Select the **Mute/TCXO** page.

2. Select **PTT**.

3. Adjust the **TCXO** slider to ensure that the transmit frequency error is within 50Hz for the selected channel (to be measured on the RF Test Set frequency counter).

5.2.3.3 RX Front End
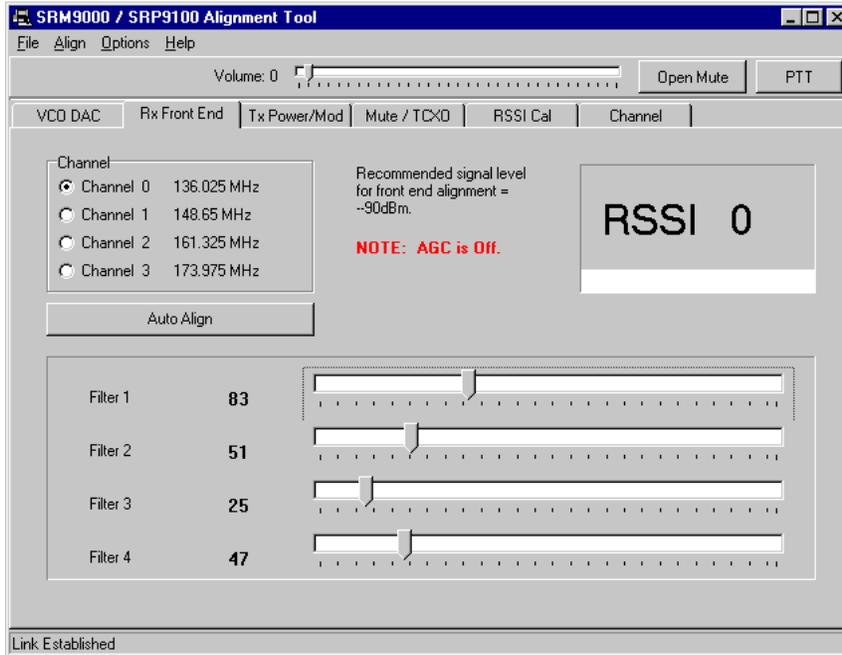
1. Ensure that the TCX0 Alignment has been done before proceeding with this section.

2. Select the **Rx Front End** Page

3. Select **Open Mute**.

4. Set the **Volume** slider to 15.

    Speaker audio should now be visible on the CRO, if required readjust the **Volume** slider to a suitable level.

5. Select **Channel 0**

6. Set the Signal Generator to the Channel 0 carrier frequency, with a 1000Hz modulation signal, a deviation of ±2 kHz and an RF level of -90dBm.

    The RSSI bar chart display should now be (typically) well above a reading of 20 - if so, jump to step 9.

7. If the RSSI is not visible or is very low, Manual Tuning may be required. To do this, adjust the four Filter sliders (1-4) in combination for the maximum RSSI reading or for the best sinad reading. Proceed to step 9 when an RSSI of better than 20 is achieved.

    Note: For optimum results, the sliders should be adjusted to be approximately in line.

8. Select **Auto Align**.

    The front end will be tuned automatically.

9. Verify that the receiver sensitivity is better than -117.5dBm for 12dB sinad. (Sensitivity is typically -120dBm).

10. Repeat Steps 7 to 10 for the remaining 3 Channels (1, 2, & 3).

### 5.2.3.4 Mute/Audio Offset Adjustment
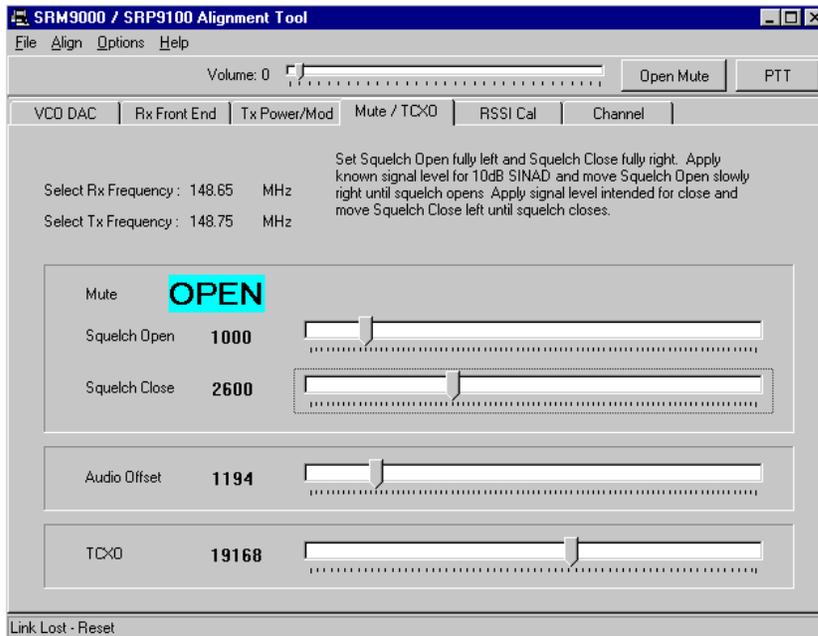
1. Select the **Mute/Channel** page, and ensure that the **Mute Open** option is selected.

2. Normally, the squelch open DAC setting should be set to 1000 and the squelch closed DAC setting should be set to 2600. However, if further adjustment is required, proceed with the following steps.

3. Set the RF signal generator to the receiver alignment frequency, and adjust the RF level such that the desired mute opening sinad (typically 10dB sinad) is achieved.

4. Select **Mute Closed** and remove the RF input from the radio**.**

5. Select the **Mute/TCXO** page

6. Set the **Squelch Open** and **Squelch Close** sliders to the fully left position. This ensures the receiver will be muted.

7. Set the **Squelch Close** slider to the fully right position.

8. Reconnect the RF input to the radio.

9. Adjust the **Squelch Open** slider to the right until the mute opens.

10. Reduce the Signal Generator output level by approximately 2dB (or by an amount equal to the desired mute hysteresis level).

11. Adjust the **Squelch Close** slider to the left until the mute closes.

12. The mute should now open and closes at the desired RF levels.

13. Monitor the portable receive standby current with no audio with an accurate multimeter OR preferably measure the DC voltage across the speaker.

14. Move the **Audio Offset** to achieve a dip in current consumption of the radio OR voltage across the speaker. The current will dip at one point and then rise again at a DAC setting of approximately 1000. Find the dip and leave this setting. The procedure is similar for voltage measurement except that it should be adjusted to 0V ±10mV.

5.2.3.5 RSSI
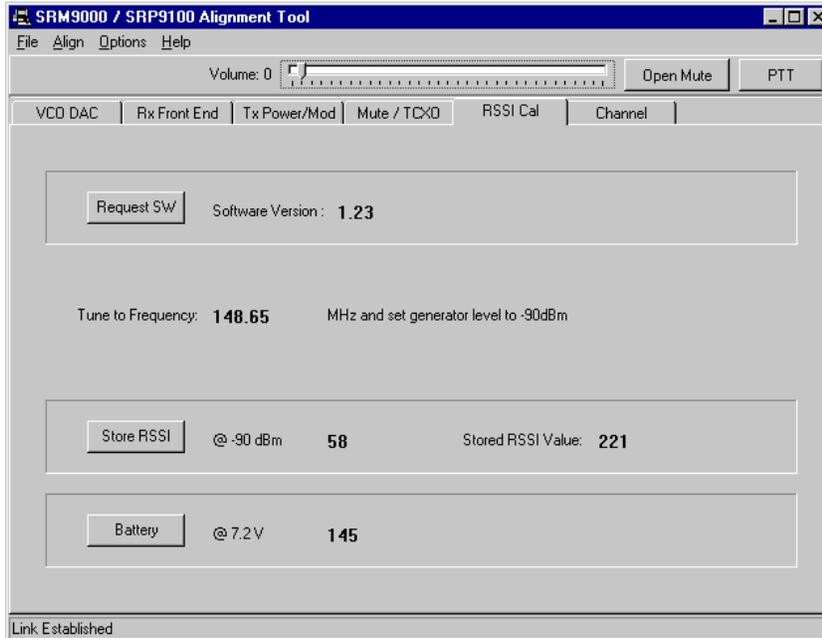
1. Select the **RSSI Cal** page.

2. Set the Signal Generator for a RF output level of -90dBm at the specified frequency.

3. Activate the **RSSI** button.

    The receiver RSSI threshold setting is calibrated.

4. Monitor the battery voltage at the simulated battery terminals with an accurate multimeter.

5. Adjust the power supply so that the voltage reads exactly 7.2V ±5mV.

6. Click the **Battery** button to store the calibration.

5.2.3.6 TX Power
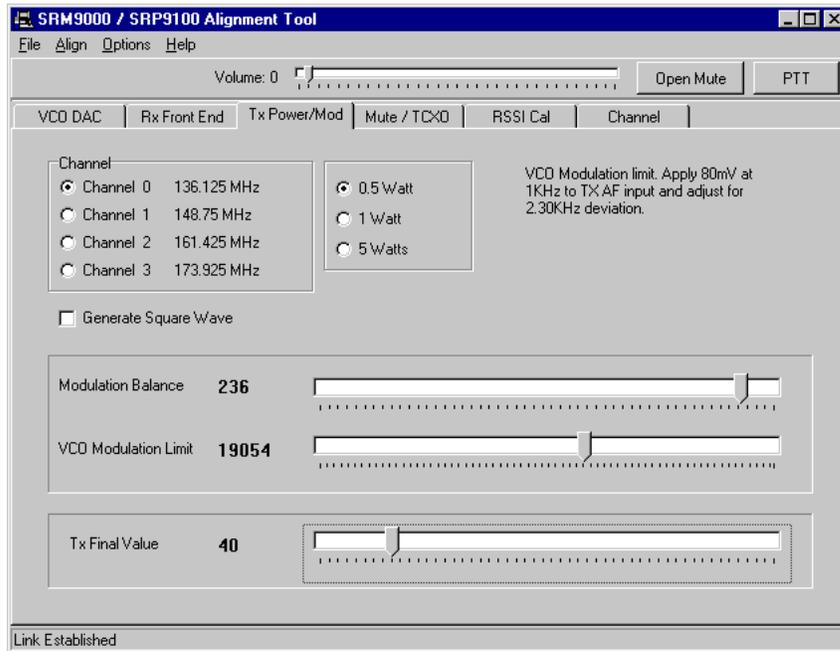
1. Select **Tx Power/Mod** page.

2. Select **Channel 0**.

3. Select the **0.5W**-power level.

4. Press the **PTT** button.

5. Adjust the **Tx Final Value** slider for a power output of 0.5W.

   Note that he supply current is less than 1A.

6. Select the **1W**-power level.

7. Adjust the **Tx Final Value** slider for a power output of 1W.

8. Select the **5W** power level.

9. Adjust the **Tx Final Value** slider for a power output of 5W.

10. Release the **PTT** button.

11. Repeat steps 2 to 10 inclusive for the remaining 3 Channels (1, 2, & 3).

5.2.3.7 Modulation
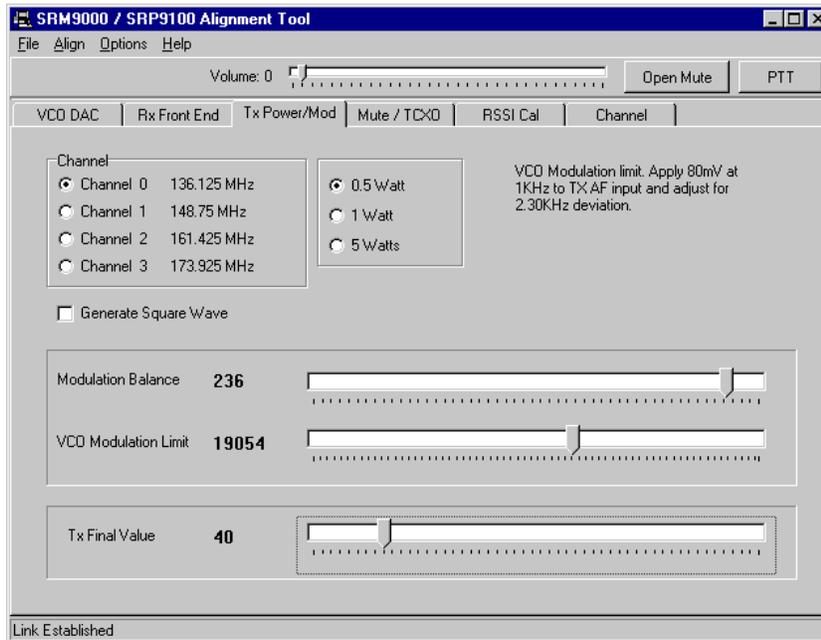
1. Select **Tx Power/Mod** page.

2. Select **Channel 0**.

3. Select the **0.5W** power level.

4. Set the microphone input signal from the Audio Generator to 1000Hz at 50mV RMS.

5. Adjust the **VCO Modulation Limit** slider for a deviation of ±2.25kHz

6. Reduce the microphone input level to 5mV RMS and check that the deviation is within the range ±1.25 kHz to ±1.75 kHz.

7. Repeat steps 2 to 7 inclusive for the remaining 3 Channels (1, 2, & 3).

8. Remove the microphone audio input signal

9. Select the **Generate Square Wave** function.

10. Select **PTT** and, while viewing the de-modulated signal on the transceiver test set oscilloscope, adjust the **Modulation Balance** slider for the best square wave symmetry.

    Note. DC coupling is required on the scope for optimum setting accuracy.

11. Repeat steps 8 to 11 inclusive for the remaining 3 Channels (1, 2, & 3).

5.2.3.8 Programming

When all channels have been aligned the radio is programmed with the new alignment data:

1. Select *Align* and choose *Write Alignment*.

2. A warning message is displayed.
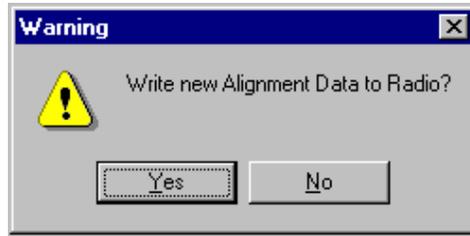
3. Choose *Yes*.

   New alignment data is written to the radio.
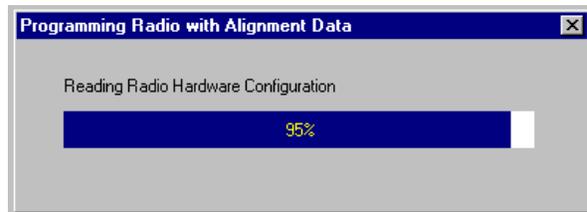
5.2.3.9 Customers Radio Configuration Data

If the Customers Radio Configuration Data was stored in an FPP file, use the SRP9100 Configuration Programmer to write this data to the radio.

6. REPLACEABLE PARTS

The parts listed in this section are considered to those most likely to need replacement due to physical damage to the radio.

Figure 6-1 Replaceable Parts

6.1 COMMON PARTS

Ident	Description	Quantity per Assembly	Part Number
	SRP9100 Brief User Guide		TNM-U-E-0046
	KNOB VOLUME,ON/OFF TP		3513 903 01184
	SEAL TWIN JACK SKT TP (for accessory jacks)		3513 905 82561
	MAT SW SRP1000 COMPLEX TP (keypad mat 9130)		6102 310 00141
	MAT SW SRP1000 SIMPLE TP (keypad mat 9120)		6102 310 00151
	FRONT CASE COMPLEX SRP9100		6102 350 12081-1
	FRONT CASE SIMPLE SRP9100		6102 350 12091-1
	WINDOW LCD SRP9100		6102 310 00101
	FLEXI-CIRCUIT TOP CTL		3513 908 02883
	CASE FRONT COMPLEX (front case plastics only 9130)		3513 900 92214
	CASE FRONT SIMPLE (front case plastics only 9120)		3513 900 92204
	MIC ELECTRET WM-62BT		2422 549 42817
	LOUDSPEAKER 16R TO36S23 SERIES		3513 993 55004
	GASKET LCD TP		3513 902 10442
	LABEL FRONT TP		6102 303 00021
	CLIP RETN LOUDSPEAKER TP		3513 900 62202
	FLEXI-CIRCUIT MIC/SPKR (connects mic and speaker)		3513 908 02891
	CLOTH LOUDSPEAKER TP		3513 900 62161
	ACTUATOR PTT TP BLACK		6102 310 00131
	ACTUATOR SIDE KEY B TP BLACK		6102 310 00121
	ACTUATOR SIDE KEY A TP BLACK		6102 310 00111
	SEAL ACTUATOR TP		3513 905 81791
	SEAL LOUDSPEAKER TP		3513 905 81801
	HELICAL ANTENNA E0 BAND (66-88 MHz) SRP8000/9100		PA-AHE0
	HELICAL ANTENNA HIGH PERFORMANCE E0 BAND (66-88 MHz) SRP8000/9100		PA-AHE0-HIGH
	HELICAL ANTENNA TK BAND (400-440 MHz) SRP8000/9100		PA-AHTK
	HELICAL ANTENNA U0 BAND (440-470 MHz) SRP8000/9100		PA-AHU0
	WHIP ANTENNA R1 BAND (335-375 MHz) SRP8000/9100		PA-AWR1
	WHIP ANTENNA TK BAND (400-440 MHz) SRP8000/9100		PA-AWTK
	WHIP ANTENNA U0 BAND (440-470 MHz)		PA-AWU0

Ident	Description	Quantity per Assembly	Part Number
	SRP8000/9100		
	BATTERY SRP8000/9100 NICAD 1.6AH		PA-BATH
	BATTERY SRP8000/9100 NIMH 2.1AH		PA-BATN
	BATTERY SRP8000/9100 NIMH 2.7AH		PA-BATB
	LEAD PROGRAMMING SRP8000		PA-PRLD
	RADIO TEST INTERFACE UNIT SRP8000		PA-RTIU

6.2 ACCESSORIES

Description	Part Number
CASE LEATHER LIGHTWEIGHT WITH BELT LOOP SRP8000/9100	PA-CLEL
CASE LEATHER LIGHTWEIGHT WITH BELT CLIP SRP8000/9100	PA-CLET
CASE LEATHER HEAVY DUTY WITH BELT LOOP SRP8000/9100	PA-CLHL
HEADSET VOX LIGHTWEIGHT + CLAMP SRP8000/9100	PA-HSCL
HEADSET VOX LIGHTWEIGHT + STEEL LOOP CLAMP SRP8000/9100	PA-HSET
HEADSET NON-VOX MIDWEIGHT + STEEL LOOP CLAMP SRP8000/9100	PA-HSFM
ACCESSORY CORD CURLY (UNTERMINATED) SRP8000/9100	PA-LDCY
ACCESSORY CORD STRAIGHT (UNTERMINATED) SRP8000/9100	PA-LDST
LAPEL SPKR/MIC LIGHT DUTY + CLAMP SRP8000/9100	PA-LMCL
LAPEL SPKR/MIC MEDIUM DUTY + CLAMP SRP8000/9100	PA-LMCM
EARPIECE - LOW PROFILE SRP8000/9100	PA-LMEP
LAPEL SPKR/MIC HEAVY DUTY + CLAMP SRP8000/9100	PA-SFMC
LAPEL SPKR/MIC HEAVY DUTY SRP8000/9100	PA-SMFM
SHOULDER STRAP FOR PA-CLHL	PA-STRP
USER MEMORY PLUG (UMP) SRP8000	PA-USMP
VEHICLE MOUNT CHARGER ADAPTOR SRP8000/9100	PA-VEHA
EXTERNAL ANTENNA ADAPTOR	PA-ACON

APPENDIX A - ACCESSORY CONNECTOR

The following table details the connections on the accessory connector.

Connection	Signal Name	Use	Signal type	Direction
2.5mm Tip	MIC1	Multi-function, audio in, ancillary type voltage and key press voltage.	0-5V	To Radio
2.5mm Ring	EXT_LS1A	Balanced Speaker Drive	Nominal Mid Supply	To Accessory
2.5mm Sleeve	EXT_LS1B	Balanced Speaker Drive	Nominal Mid Supply	To Accessory
3.5mm Tip	RXD1_IN	RS232 RxD or IIC SDA or trickle charge input.	0V to 5V 0V or –12V Space 5V or +12V Mark	Bi-directional
3.5mm Ring	TXD1_OUT	RS232 TxD or IIC SCL or 5V supply output (50mAmaximum.)	0-5V	To Radio
3.5mm Sleeve	0VA	Ground	0V	To Accessory

Table 4 Accessory Connector

APPENDIX B - ACCESSORIES

Lapel Speaker Microphone
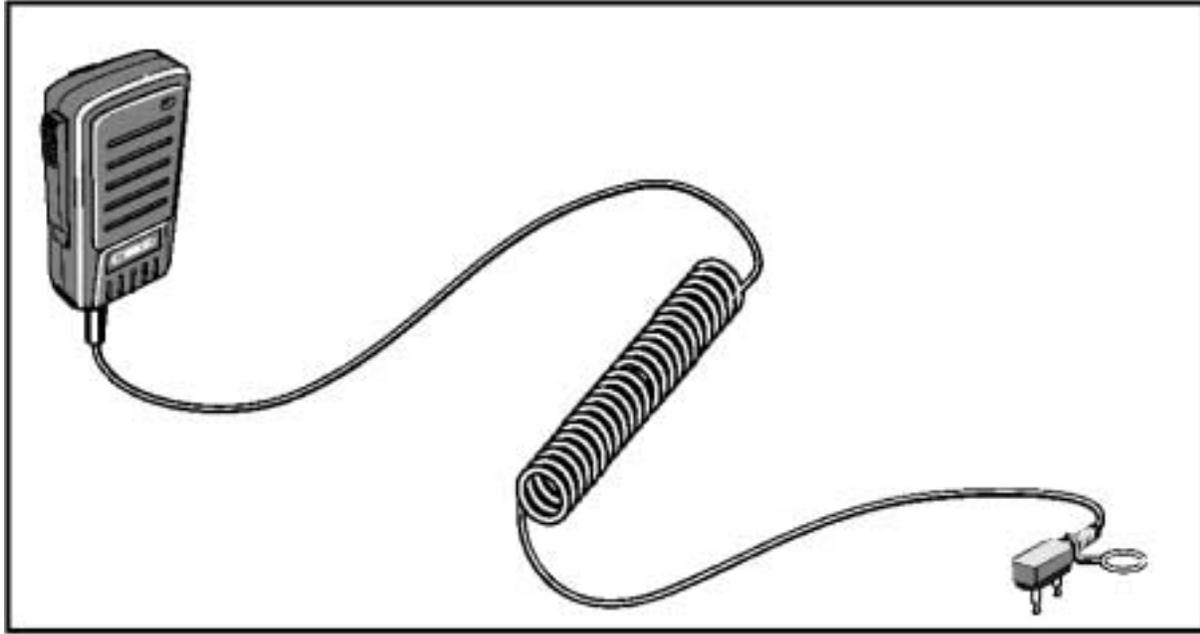
Figure 2 Lapel Speaker Microphone

Introduction

The lapel loudspeaker / microphone is a robust, lightweight, unit with an integral press-to-talk (PTT) switch and a headset socket. The unit connects to the portable radio via a 1.5m 'curly' cable with a 2.5mm (J1) and 3.5mm (J2) stereo jack plugs mounted in a single moulding.

Specification

Maximum circuit current	10mA
Type	Electret
Impedance	2kΩ (nominal)
Sensitivity	−64dB ±4dB at 1kHz (0dB = 1V / µbar).
Sensitivity variation relative to 1kHz over frequency range	Less than +10dB, −2dB, 300 Hz to 4kHz
PTT switch	Push to transmit
DC voltage overshoot during switching periods	Within 2% of nominal voltage

PTT 'click' suppress circuit:

DC voltage establishment time for active PTT voltage	Less than 5ms to reach 95% of the nominal PTT
DC voltage established time for PTT release	50ms ±20% to reach 95% of the nominal PTT release voltage

Loudspeaker

Impedance	16Ω ±2Ω

| Power rating | 0.3W nominal, 0.5W maximum |
| Headset socket | 3.5mm - loudspeaker disconnected when jack inserted |

Environmental:

| Operating temperature range | −20°C to +55°C |
| Storage temperature range | −40°C to +80°C |
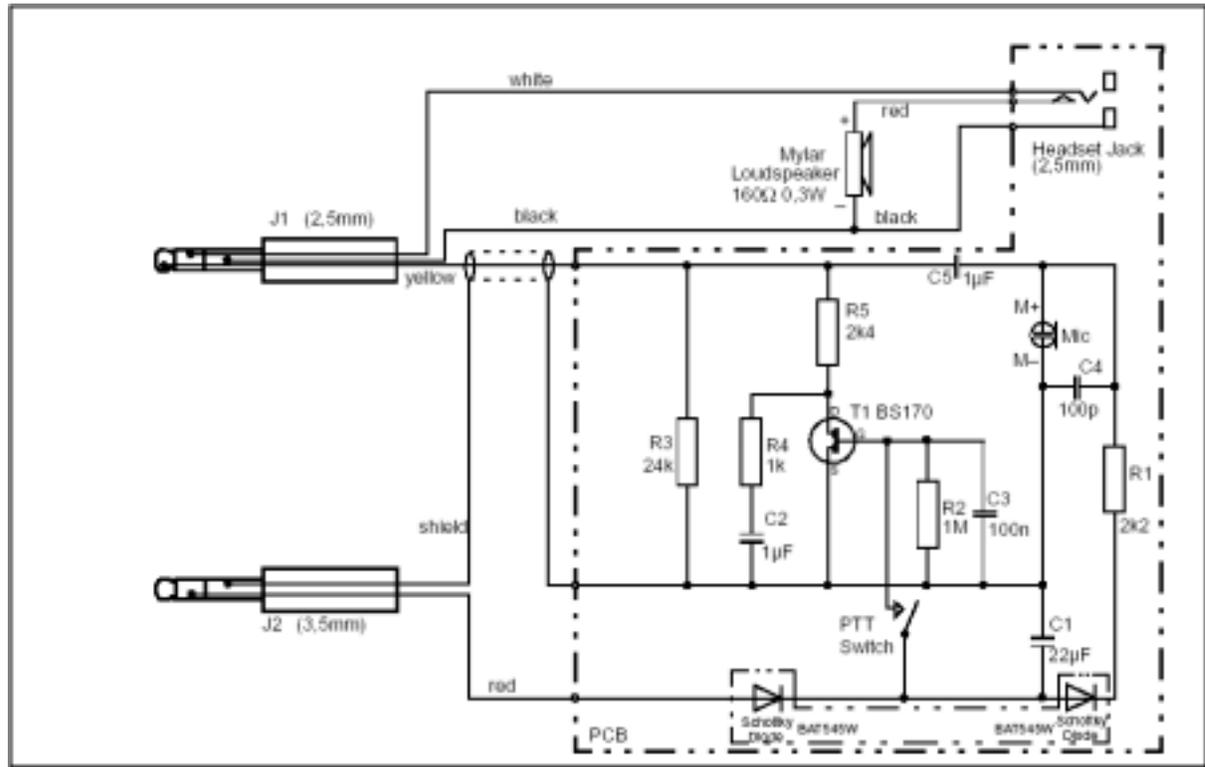
Figure 3 Lapel Speaker Microphone Circuit

OPERATION

Ancillary Type

R3 defines the ancillary as a Lapel Speaker / Microphone.

Microphone

The microphone connects to the radio via the tip of the 2,5mm stereo jack (J1) and is powered via the ring and sleeve of the 3.5mm stereo jack (J2) on the cord assembly.

When the Lapel Speaker / Microphone is connected to the radio, the radio's microphone is switched out of circuit.

Operation of the PTT switch brings into circuit the electret microphone, which is powered from a rectified and filtered DC supply from the radio. R5 is used to generate a PTT interrupt to the radio.

Speech is superimposed onto this voltage on using the microphone with the PTT switch pressed.

Loudspeaker

The loudspeaker connects to the radio via the ring and sleeve of the 2.5mm stereo jack (J1) on the cord assembly.

When the Lapel Speaker / Microphone is connected to the radio, receive audio is routed to the ancillary loudspeaker and not to the radio's.

The Lapel Speaker / Microphone supports the use of a remote headset.