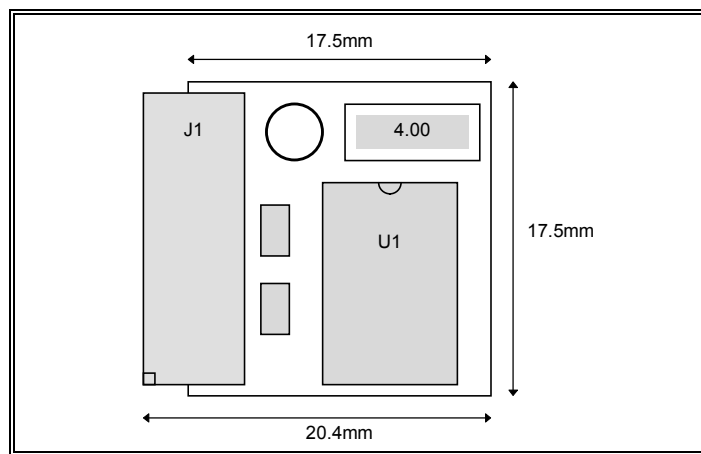




ANI1, ANI1-D, ANI1-DS Selcall & DTMF ANI Modules Application Note.



Not to Scale

Release History	Rev 1.0	26/2/1996	Preliminary Apps Note
	Rev 1.1	14/6/1996	Cct diagram & Programming
	Rev 1.2	22/8/1996	Additional DTMF Information
	Rev 1.3	18/7/1997	New loom colours



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1.0 Introduction

The Pentone ANI1 is an exceptionally compact multi-tone SelCall module with ANI and Emergency sequence encoding in any required toneset. The ANI1-D provides identical functionality to the ANI1 but uses the DTMF international tone signalling standard, and can therefore be used for direct dialling into a PABX or the PSTN system. The ANI1-DS provides the flexibility of re-programming the unit so that each encode may be either SelCall or DTMF.

Throughout the rest of this document, where the ANI1 is discussed, the information also applies to the ANI1-D and ANI1-DS Modules unless the difference is specifically stated.

The ANI1 requires a 5 volt supply from the radio and interfaces to the radio Rx, Tx, and control circuitry via CMOS compatible logic. The module can be connected to PTT and Emergency switches and will also monitor the Squelch or Busy state of the radio. The module outputs user information via a range of alert tones.

The ANI1 supports a wide range of signalling and control functions including:-

- Fully Programmable ANI transponding.
- Multi function Emergency or Status Sequence encoding.
- Optional PTT Time Out and Penalty modes.
- Optional Busy Monitoring for Channel Lockout.

The ANI1 is configured using simple menu-driven PC software via an interface box from the serial port. Configuration is fully software controlled, requiring no links or switches to be set on the board.

The ANI1 programming model allows a remarkable degree of flexibility in message composition and tone sequences are not limited to 5 tones. The module is thus fully compatible with complex systems requiring multiple repeater access tones and multiple tone sequences.

2.0 Operation

ANI Transponding

ANI generation is activated by a press of the PTT Switch. ANI encode may be programmed at the start, end, and/or randomly during the PTT active state.

A programmable ANI timer allows a gap to be set between ANI encodes.

Emergency/Status

A completely separate Encode sequence is programmable to provide an Emergency transpond. Emergency transpond is initiated by a press of the Emergency Switch. A programmable delay on this switch prevents accidental keying.

The Emergency sequence will be transmitted at fixed or random intervals during. The number of repeat transmissions may be set from 1-20. The Emergency mode may be cancelled by cycling the transceiver Off and On, or when all repeat transmissions have been sent.

The Busy state is monitored before attempting to transmit the Emergency Sequence, and if busy the transceiver will re-try after a random delay. On the second attempt at transmission, the Busy state is ignored.

Alternatively this sequence may be used for Status encode, if the repeat attempts are set to one.

PTT Time Out Timer

This timer monitors PTT operation on the transceiver, and disables PTT after a programmable period. A warning 'Beep' is optionally programmable 5 seconds before the timer expires. For this feature to operate, the ANI1 must be connected in a broken PTT configuration.

Busy Lockout

The Busy Lockout feature allows the ANI1 to prevent PTT from keying the transmitter during channel busy conditions. For this feature to operate, the Busy line must be connected, and PTT must be connected in a broken configuration.

3.0 Installation

Handling Precautions

The ANI1 uses static-sensitive CMOS devices and is therefore supplied in an anti-static bag. To prevent damage to the module normal Electrostatic Discharge Precautions should be employed at all stages of the fitting process.

Connector

The ANI1 module is fitted with a Hirose 1.25mm pitch connector and is supplied complete with plugable wiring loom. This allows the module to be removed from an installation for re-programming. Replacement looms are available from Pentone (order code ANIC12). The connector part numbers are

DF13-12S-1.25C	12 way socket
DF13-2630-SCF	CRIMP

Power Requirements

The ANI1 requires a single 5 volt dc supply @ <4.0 mA (typ). Additional current will be drawn dependant on the radio installation.

Mounting The Module

Ensure that there is adequate clearance around the ANI1 and stick the module into the radio using a double-sided sticky pad. Do not install the ANI1 into areas of the radio where it may be subject to unnecessarily high RF fields or temperatures.

Programming The Module

The ANI1 may be programmed either before or after installation into a radio. Programming is accomplished using a PC type computer and Pentone Programming Adapter described below.

4.0 Radio Interface Connector

The Connector Pin Descriptions are shown below.

Pin	Old Colour	New Colour	Name	Type	Function
1	White	Red	5v		5 Volt Regulated Supply
2	Red	Brown	EMERG	IP	Emergency Switch
3	Black	Black	Gnd		Ground Connection
4	Brown	Green Stripe	TONES	OP	Analogue Tones Out
5	Green	Orange	ALERT	OP TTL	Alert Tones Out
6	Grey	Orange Stripe	AMP_EN	OP TTL	Enable Audio Amp
7	Yellow	Blue	PTT_IN	IP	PTT Switch
8	Orange	Blue Stripe	PTT_OUT	OP OC	PTT drive if PTT lockout required
9	Red		PGM_EN	IP	Not Used, do not Connect this pin
10	Grey	Grey	MIC_MUTE	OP OC	Microphone Mute
11	Violet		NC		
12	Blue	White	BUSY	IP TTL	Radio Busy indication

Detailed Pin Description

Pin 1 5V

The ANI1 receives regulated 5V dc through this pin.

Pin 2 EMERG

This input monitors the Emergency or Send switch on the radio. The Pin has a 100k pull up to 5v.

Pin 3 GND

This is the signal ground.

Pin 4 TONES

The TONES output should be connected to a summing point in the radios Tx Audio path. If it is connected after the radio's limiter stage then a series resistor may be required to limit the deviation.

Pin 5 ALERT

The ALERT output should be connected to a summing point in the radios Rx Audio path. It should be connected before the audio amplifier. The amplifier must either be permanently on, or must be capable of being enabled with the AMP EN signal (CON1/6).

Pin 6 AMP EN

The AMP EN output is a programmable Active High or Low signal, used to enable the radios Audio amplifier during alert tone generation. If the radio does not support this feature then it should be left unconnected. Care must be taken to ensure that the radio is able to drive the audio amplifier independently.

Pin 7 PTT IP

This connection is an active Low line that monitors the radios PTT switch. If the radios PTT line cannot be broken then this line is commoned with PTT OUT (CON1/8). In this case Tx time-outs etc. are not available.

Pin 8 PTT OUT

The PTT OUT output is an active Low signal which is used to enable the transmitter when tones are being transmitted.

Pin 9 PGM_EN

This Pin is only used during Factory Configuration.

Pin 10 MIC MUTE

This is an open collector output signal used to inhibit the microphone during SelCall generation by clamping the microphone signal. MIC MUTE is programmable to pull high or low and should be connected to the Tx Audio path at a suitable point before the TONE output.

Pin 11 NC

There is no internal connection to this Pin

Pin 12 BUSY

This input is programmable Active High or Low and is used to signal to the ANI1 that the channel is busy and that transmissions should not take place. This should be connected to Squelch or Digitally Controlled Squelch within the Radio. If this facility is not used then the BUSY line should be left unconnected and programmed to be active Low.

Transceiver Connection Details

A variety of connection methods are available depending on the host transceiver and required functions. Two common methods are outlined below.

Simple ANI

This Connection method allows for ANI encode only.

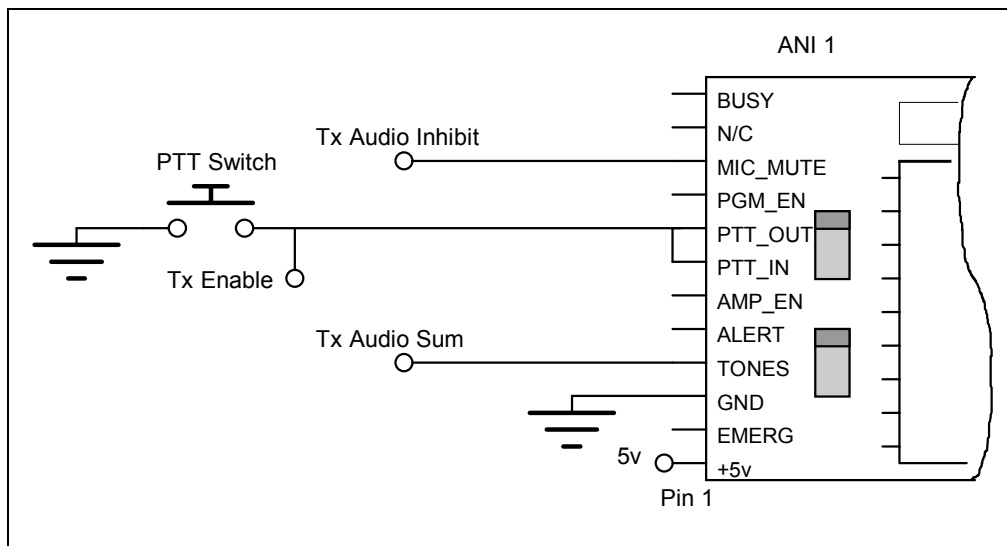


figure 1

Full Function ANI, Emergency and PTT lockout

This Connection Method allows for ANI and Emergency Sequence Encode, along with Busy and Time out Timer Lockout facilities for PTT.

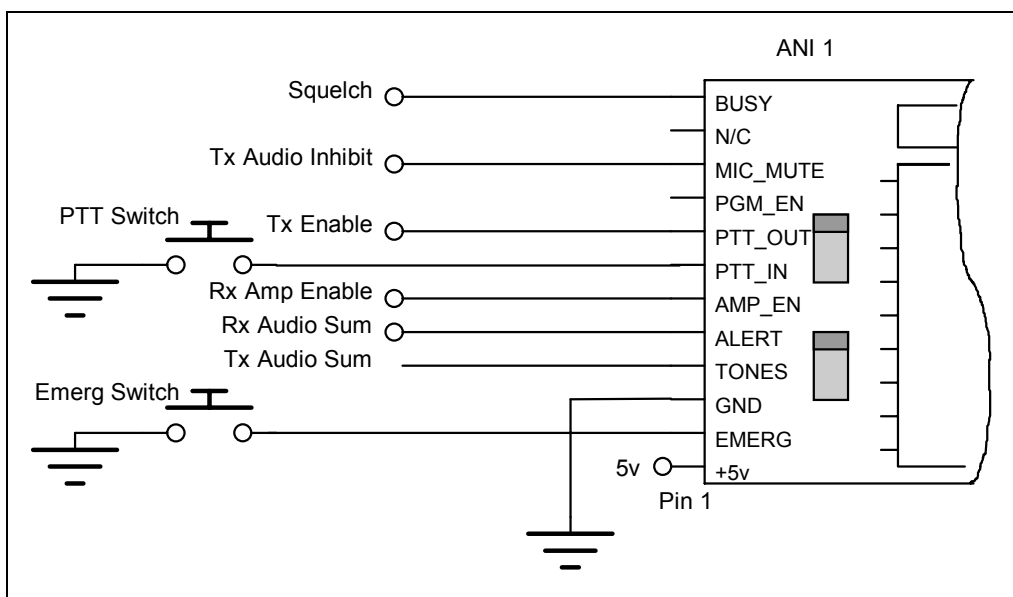


figure 2

5.0 Programming the ANI1

Programming the ANI1 is achieved by sending serial data over Pin 7 (PTT_IN) to program the on board non-volatile Memory. Reading of the ANI1 is accomplished via Pin 6 (AMP_ENABLE). Since the PTT_IN line is often available via a connector it is thus possible to program the ANI1 either before or after integration into the target transceiver. Reading and verification is only possible if a connection to the AMP_ENABLE line is available.

Connecting the Programming Adapter

Pentone Supply a programming adapter lead (PPA) which will convert the RS232 levels into the appropriate signals for driving the ANI1 Module. The PPA is supplied with a Hirose 12 way connector to connect to the ANI1.

The ANI1 is normally supplied fitted with a 12 way Hirose connector and, where this is accessible (e.g. before the ANI1 has been mounted into the transceiver) the PPA will mate directly with this connector allowing all read / write operations.

If the Hirose connector is not fitted, or is inaccessible (e.g. after the ANI1 has been mounted into the transceiver) then programming can be achieved over the PTT line. The user must make up a lead to connect from the Mini-DIN connector on the PPA to the ANI1, or to the transceivers PTT and AMP_ENABLE connectors. Where AMP_ENABLE is not externally available on the transceiver it will still be possible to program the ANI1 via the PTT_IN line.

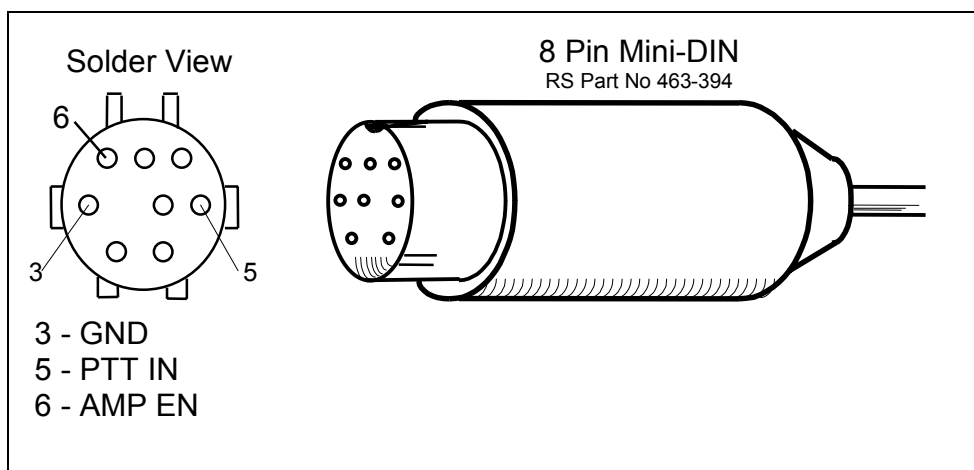


figure 4

Selcall & DTMF Programming Software

The ANI1 is a very flexible unit which may be programmed to operate in a variety of different ways according to the users requirements. The ANI1 derives its flexibility of operation from the programmable parameters coded into non-volatile memory before installation into the host transceiver. The SCPROG software allows the installer to edit a set of parameters which may then be downloaded to the ANI1 via the programming cable. The SCPROG software is a simple to use, menu driven system which allows for loading, saving and editing of the ANI1 parameters before they are programmed into the ANI1.

Overview

This Section of the Applications note should be read in conjunction with the SCPROG software.

To run the software insert the SCPROG disk into drive A: and enter,

```
A:
SCPORG
```

The software will enter the Main Menu which allows the following options:

Main Menu

- F. File Menu
- P. Programming Menu
- E. Edit Parameters Menu
- C. Configuration Menu
- X. Exit

The **File Menu** option allows Parameter files to be loaded from disk, saved to disk or output to a printer.

The **Programming Menu** allows the Parameter set to be downloaded to the ANI1 via the programming cable, if the 12 way programming cable is used, or connection is made to the AMP Enable pin then the parameter set may be retrieved, or verified with a pre-programmed ANI1.

Selecting **Edit Parameters** allows the setting and modifying of all the programmable parameters of the ANI1 on three input screens. The input screens may be selected using the **PGUP** and **PGDN** keys, and individual parameter fields may be selected using the cursor **UP** and **DOWN** keys.

The **Configuration Menu** allows the software to be set up to program the appropriate version of ANI1. This is to allow for future improvements in facilities and O.E.M versions. Version 1.46 Programming Software supports the programming of ANI1 Versions A1.02, and A2.03.

Select **Exit** to return to DOS.

Parameter Files

The complete configuration for an ANI1 may be saved to disk in a parameter file. This allows the user to set up the desired configuration for a particular application and save this information to disk. If more ANI1s are required for similar applications, the configuration may be loaded from disk and edited as required before downloading to the ANI1.

e.g. If a set of transceivers is required for a fleet, with similar operation, but different ANI and Emergency sequences, the programming operation may be as follows:-

1. Set up all the parameters required for the first transceiver in the fleet.
2. Set up the ANI and Emergency sequence for this transceiver.
3. Download the parameters to the first ANI1.
4. Save the Parameter File to disk.
5. For each successive transceiver in the fleet, load the initial Parameter file from disk.
6. Modify the ANI and Emergency Sequences as appropriate.
7. Download the Parameters to the ANI1.
8. Save the Parameters to disk for future use.

It is recommended that a copy of the Parameter file for each ANI1 programmed is kept on disk for future reference. The complete set of parameters may be output to a printer if a paper copy of the ANI1 configuration is required.

Editing the Parameters

The ANI1 Parameter Set is divided into two functional sections, each section has one edit screen which may be filled in by the installer. The two sections are as follows:

1. Toneset & Encoder Operation.
2. System Operation and Timing.

When the Edit Parameters option is selected from the main menu, the Toneset input page is displayed. Use **PGUP** and **PGDN** to select the other input pages.

Toneset & Encoder Operation

This edit page allows the user to select the required toneset for SelCall encode and to define the encode sequences and operation of ANI and Emergency. The toneset may be selected from a range of international standards, or tailored to specific requirements. Tone duration may be set in increments of 10mS.

The following international tonesets are pre-programmed for ease of selection.

1. **CCIR** - CCIR with 100ms, 70ms or 40ms tone length
2. **EEA** - EEA toneset, 40ms tone length.
3. **ZVEI1** - ZVEI1 toneset 70ms tone length
4. **ZVEI2** - ZVEI2 toneset 70ms tone length
5. **ZVEI3** - ZVEI3 toneset 70ms tone length
6. **PZVEI** - PZVEI toneset 70ms tone length
7. **NATEL** - Natel toneset 70ms tone length
8. **USER** - User defined toneset may be set up as required.

PTT/ANI and Emergency operation may be defined as follows.

1. **PTT/ANI** Operation specifies the encode action to be taken on PTT. ANI may be at Start, End, Start and End, or at Random intervals during PTT action. Busy lockout may be used to prevent the transmitter from being keyed during channel Busy periods. A programmable ANI delay may be set to limit the Selcall traffic.
The ANI1-D, and ANI1-DS also allow the selection of DTMF encoding for the PTT action.
2. **Emergency** Operation specifies the action to be taken when the Emergency key is pressed. Busy Lockout prevents the emergency sequence from being transmitted during channel busy periods. A programmable Hold Off Delay prevents accidental transmission of the Emergency sequence. The Emergency sequence may be repeated, at random intervals, up to 15 times or forever. The Emergency mode will be cancelled when the unit is switched off. The ANI1-D, and ANI1-DS also allow the selection of DTMF encoding for the Emergency action.

System Operation and Timing

This menu allows the installer to specify the way in which the ANI1 interfaces to the transceiver. The following programmable features are supported:

1. **Alert Tones** may be enabled or disabled. If power up tones are enabled, a double 'beep' is heard when the unit receives power. Penalty tones alert the user to channel busy or timeout timer penalty situations if the transmitter is disabled. TOT Warning tones alert the user that the time out timer is about to expire. Emergency tones sound when the emergency key is pressed.
2. The 'Side Tones' Option causes Alert tones to be mixed onto the SelCall tones audio path. When this option is active the AMP_EN line follows the MIC_MUTE line.
3. The **Conversation timer** is used to limit the operators use of PTT. When the time out timer expires PTT_OUT is switched off for the TOT Penalty Period. If TOT warning is enabled, a low beep is generated 5 seconds before the time out timer expires. For the time out timer to function, the transceiver PTT line must be broken and fed through the ANI1 via PTT_IN and PTT_OUT.
4. The **Lead in Delay** is the time required for the transmitter to stabilise before SelCall sequence is transmitted. PTT will be pulled LOW for this period, before any Encode Sequence is transmitted.
5. **I/O Active States** allow some of the ANI1's input and output lines to be configured as active low or high depending upon the particular installation requirements.

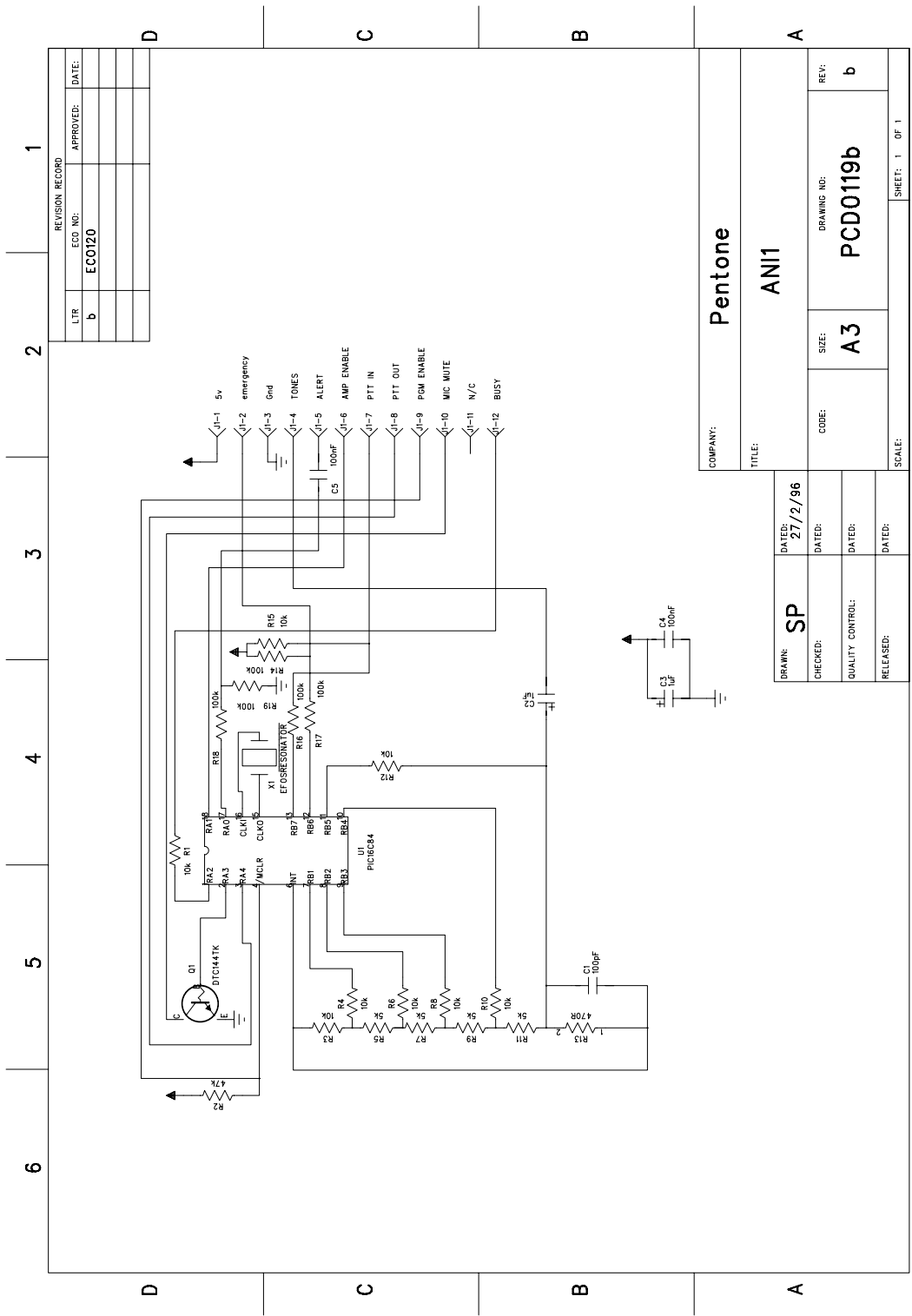
Downloading to the ANI1

When all the parameters have been set up as required they may be downloaded to the ANI1 via the programming adapter supplied. The ANI1 should be attached to the programming lead via the 12 way connector. During programming the ANI1 derives its supply from the programming cable and does not require any other connections to be made.

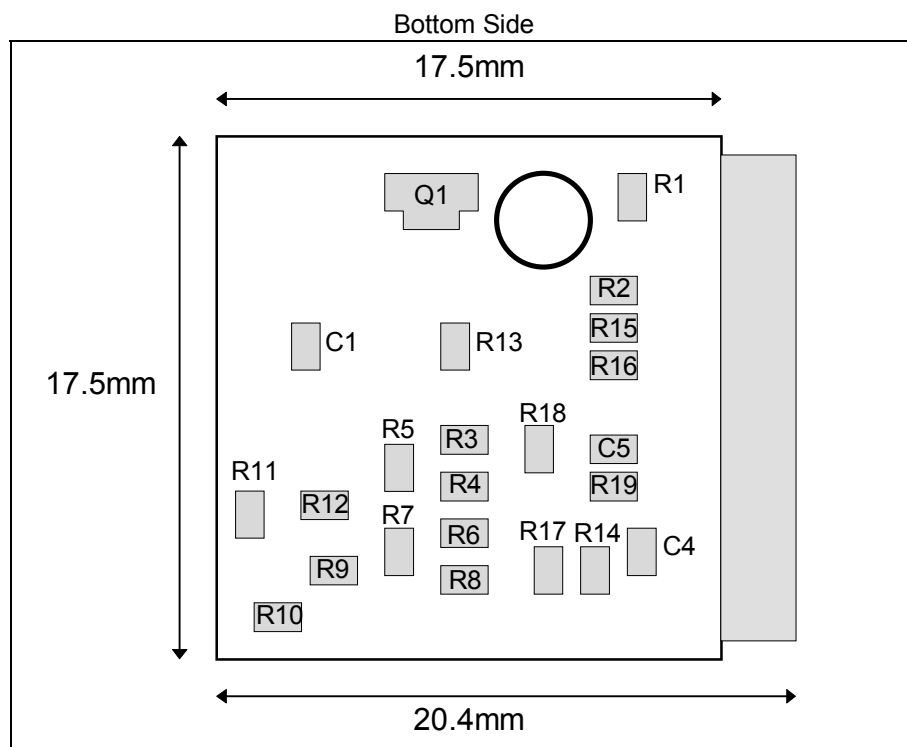
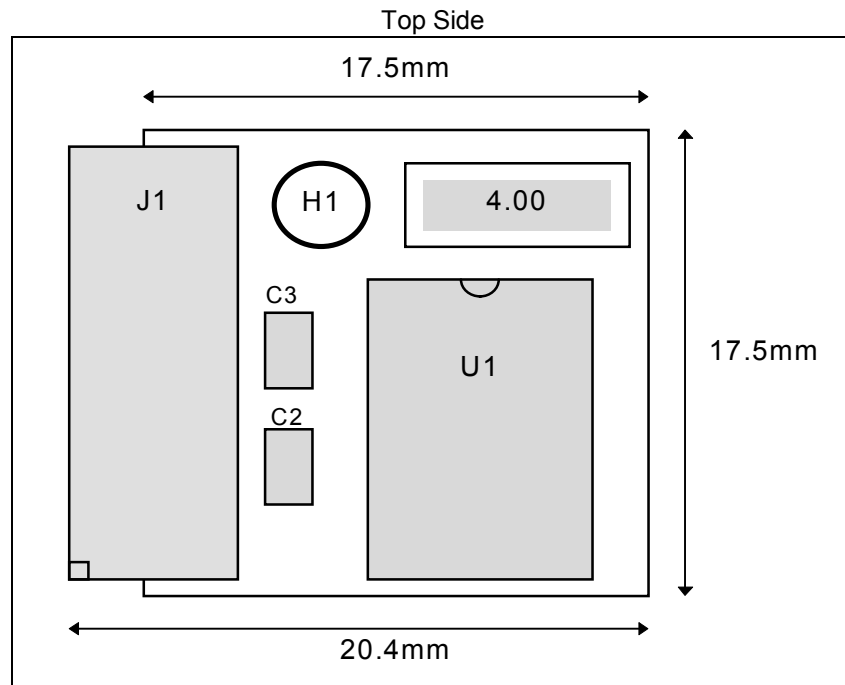
From the SCPROG Main Menu select Programming Menu and Download. The parameter set will be downloaded. If the ANI1 is connected to the PPA programming lead via the 12 way connector the parameters may also be read from a pre-programmed board, or verified. The results of this verification are displayed on the screen. NB Verification is not possible if the Field Programming configuration is used.

NOTE Please ensure that connection is made to a Serial port of the PC, **NOT** the parallel port.

Appendix 1. Circuit Diagram



Appendix 2 Layout Diagrams



Appendix 3 Specifications

Absolute Maximum Ratings

Exceeding the maximum rating can result in module damage. Operation of the module outside the operating limits is not implied.

Supply Voltage	4.5V to 5.5V
Operating Temperature Range	-10 to +80 deg. Celcius Note1
	-20 to +80 deg. Celsius Note2
Storage Temperature Range	-20 to +85 deg. Celsius

Operating Limits

All module characteristics are measured under the following conditions unless otherwise specified:

Vin = 5.0 Volts, Temp = 20 deg. Celsius

Characteristic	Note	Min.	Typ.	Max.	Unit
Supply Voltage (Vin)		4.5	5.0	5.5	V
Operating Current	1		4.0		mA
Standby Current			2.5		mA
Current Limit (PTT/Mute O/P's)				50.0	mA
Tone Out Level			308		mVrms
Tone Out Accuracy				Note1 +/-0.5 Note2 +/- 1	%
Alert tone o/p level			2.5		Vp-p
Logic "1" in		3.5		5.5	V
Logic "0" in		0		1.0	V
Logic "1" out		Vin-0.7			V
Logic "0" out				0.6	V
On Board Clock			4.0		MHz
VDD start voltage to guarantee reset			VSS (0.0)		V
VDD rise time to guarantee reset		0.05	0.1		V/ms

NOTES

1. Additional current will be drawn from the ANI1 dependant on the radio installation.

