multitone

TECHNICAL MANUAL

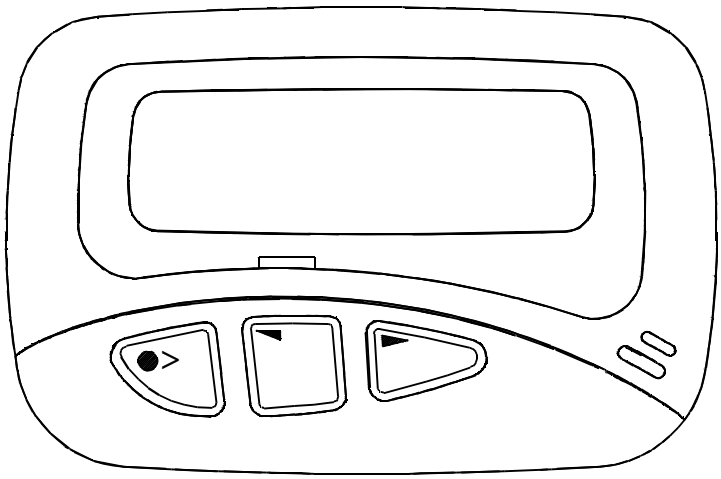
for

RADIO PAGING RECEIVERS

MODEL TLA 852

and

MODEL FLA 872



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FCC & IC Statement Of Compliance

This device complies with FCC Part 15 & Industry Canada RSS210 regulations. Operation is subject to the following two conditions:- (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Unauthorised modification to this equipment, will void the user's authority to operate the device under the terms of the above regulations.

SAFETY SUMMARY

The following information applies to both operating and servicing personnel. General Warnings and Cautions will be found throughout the manual, where they apply, which refer to the applicable part of this summary.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in equipment damage.

 **WARNING** 

THE RECEIVER SHOULD NOT BE CARRIED INTO AREAS WHERE EXPLOSIVE GASES, OR DUST MAY BE PRESENT.

CAUTION

STATIC SENSITIVE DEVICES ARE USED WITHIN THIS EQUIPMENT. CARE MUST BE USED TO ENSURE DAMAGE TO THESE DEVICES IS NOT CAUSED BY HIGH LEVELS OF STATIC ELECTRICITY. SPARE BOARDS OR COMPONENTS SHOULD BE STORED IN ANTI-STATIC PACKAGING WHEN NOT INSTALLED IN THE EQUIPMENT.

PROTECT THE RECEIVER FROM LIQUIDS, STRONG MAGNETIC FIELDS AND EXTREME TEMPERATURES. DO NOT LEAVE THE RECEIVER EXPOSED TO STRONG SUNLIGHT. AREAS SUCH AS WINDOW LEDGES ARE TO BE AVOIDED.

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SECTION 1

INTRODUCTION & SPECIFICATION

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1.1 INTRODUCTION

The MultitoneTLA 852 and FLA 872 Radio Paging Receivers are VHF receivers which receive messages sent in CCIR Radiopaging Code No.1 (RPC1).

The front panel of the unit has a Liquid Crystal Display (LCD) to display messages and other information. The three buttons on the front panel are used to control the functions of the unit.

The LCD of the TLA 852 can show a maximum of two lines of 20 alphanumeric characters; the FLA 872 has the option of showing a maximum of four lines of 20 characters, or two lines of double height characters. The displays can also show a maximum of seven symbols in a line.

If the TLA 852 receives a message that is longer than 40 characters, it displays the first 40 and stores the excess. The front panel buttons are used to transfer the stored part of the message to the screen as required. Similarly, if the FLA 872 receives a message which has more than 80 characters (40 characters in double height mode) the excess characters are stored.

Message alert is provided by an audible beep tone or by the unit vibrating. The buttons are used to select the preferred alert.

Power for the unit is supplied by a single AAA battery. A door on the rear of the unit gives access to the battery.

A back-up supply for the unit is available when the battery is changed. The back-up supply is provided by a large-value capacitor mounted on the decoder board in the unit. The capacitor, when fully charged, can maintain data in the unit for more than 5 minutes.

The unit case is a two-piece plastic moulding secured by two cross-head screws. A lanyard is supplied with the unit which can be fastened to the case and the attached clip used to secure the unit to a suitable object.

1.2 FEATURES

The unit has these features:

- Displays two lines of 20 characters - TLA 852 (four lines - FLA 872)
- Message Store
- Information Service Messages (Optional)
- Display Backlight
- Date/Time Display
- Selectable Alert - Audible Beep or Vibration
- Alarm
- Out of Range Indication (Optional)
- Timed-off Mode
- Low Battery Warning
- Battery Economy

1.3 SPECIFICATIONS

1.3.1 Receiver Performance

Frequency Range:	138MHz through 174.1MHz
Frequency Bands:	
	Band 1: 138.000MHz - 143.499MHz
	Band 2: 143.500MHz - 148.999MHz
	Band 3: 149.000MHz - 154.999MHz
	Band 4: 155.000MHz - 160.999MHz
	Band 5: 161.000MHz - 167.499MHz
	Band 6: 167.500MHz - 174.100MHz
Channel Spacing:	10/12.5/25kHz
Intermediate Frequencies:	21.4MHz and 455kHz
Crystal Frequencies:	
Local Oscillator:	Carrier Frequency minus 21.4MHz
2nd Oscillator:	20.945MHz

Sensitivity:

The sensitivity figures quoted in Table 1 assume an ambient temperature in the range 18°C through 25°C. The battery voltage should be above the low battery trigger point of approximately 1.15 volts. At temperatures between the ambient and maximum / minimum, performance is at an intermediate value. At temperature extremes degradation of sensitivity shall not exceed 6dB.

Table 1.1: Sensitivity Figures

MEASUREMENT MODE	BEST POSITION, TYPICAL	TEM CELL (dBm), TYPICAL	BAUD RATE
On Pole	12dBµVm^{-1} 14dBµVm^{-1} 20dBµVm^{-1}	-106dBm -104dBm -101dBm	512 1200 2400

NOTE: *The following performance figures are typical for an ambient temperature range of 15°C through 35°C.*

Adjacent Channel Selectivity:	>78dB
Image Response:	>70dB
Spurious Response:	>70dB
Intermodulation Response:	>62dB
Co-channel Rejection:	>-6dB

1.3.2 **Power Supply**

Battery Type:	Alkaline AAA (1.5 Volts Nominal)
Typical Battery Life:	800hrs

1.3.3 **Code Format**

The Code Type is CCIR Radio Paging Code No.1 POCSAG

1.3.4 **Memory**

Capacity:	The units can accept messages to a maximum of 1024 characters. They can store a maximum of 32 read or unread messages and six archive messages.
Recall:	Stored messages can be retrieved in any order.

1.3.5 **Displays, Controls and Alerts**

Liquid Crystal Display:	TLA 852: Two lines of text. FLA 872: Four lines of text.
Control Buttons:	Three push-buttons (Select, Left and Right) on the front panel of the unit, control all the functions of the pager.
Display Illumination:	The display illumination is selected ON or OFF from the Display Options Screen, by using the front panel control buttons.
Audible Alert:	Various tone patterns can be selected or muted from the Alert Options Screen, by using the front panel control buttons.
Vibration:	The vibration alert can be set to ON or OFF by using the front panel controls.

1.3.6 **Operational Environment**

The unit will operate to specification within these limits:

Operating Temperature:	-10°C through +55°C
Storage Temperature:	-20°C through +60°C

NOTE: *There may be some degradation of display performance below* 0°C.

1.3.7 **Physical Characteristics**

Dimensions:	Width: 75mm Height: 48mm Depth: 17mm
Weight:	60g (with battery)

SECTION 2

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WARNING

DO NOT TAKE THE PAGER INTO AREAS WHERE EXPLOSIVE GASES, OR DUST MAY BE PRESENT.

CAUTION

PROTECT THE PAGER FROM LIQUIDS, STRONG MAGNETIC FIELDS AND EXTREME TEMPERATURES. DO NOT LEAVE THE PAGER EXPOSED TO STRONG SUNLIGHT.

2.1 CONTROLS AND INDICATORS

Refer to Figure 2.1 for the identification and location of the controls and display associated with the TLA 852 and FLA 872.

Note: In Germany, Style A (aerofoil) case is only for T Mobile use.

In the United Kingdom, Style B (oval) case is only for use by Vodafone Paging.

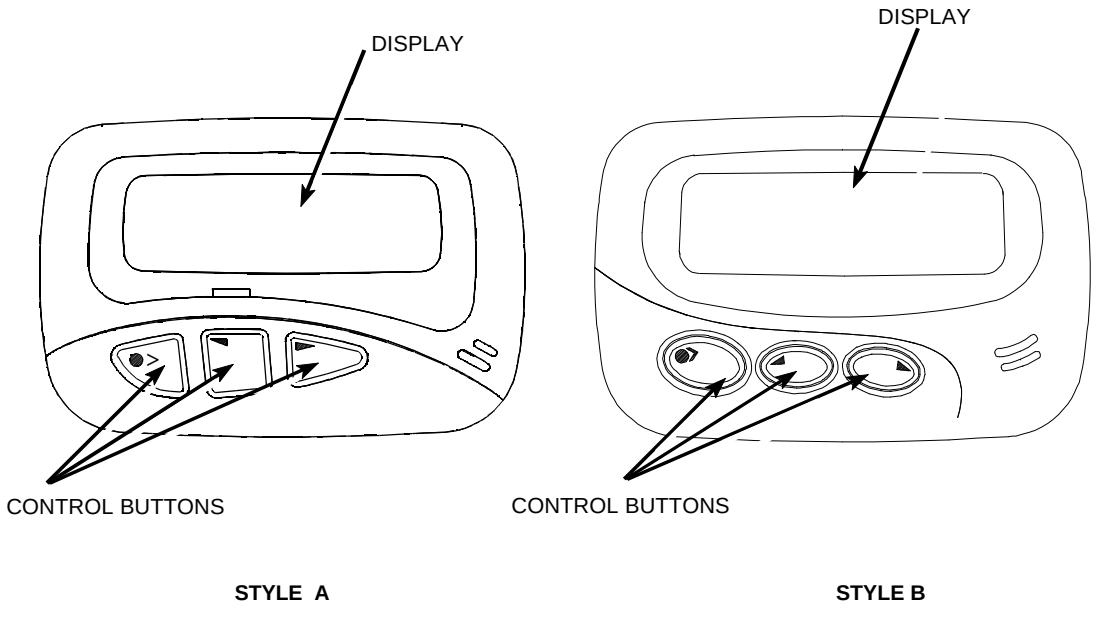


Figure 2.1: Controls and Display

2.1.1 **Display**

The Liquid Crystal Display (LCD) in the TLA 852 shows two lines of characters. The FLA 872 shows four lines of characters (or two lines of double height characters) . Each line can have a maximum of 20 characters. Both units can also show a maximum of seven symbols in a line. Lamps (Electro-luminescent (EL) option also available - FLA Series only) are incorporated in the unit, to illuminate the display when required.

2.1.2 **Controls**

The three push-buttons have these functions:

O>	Selects the unit functions
◁	Moves the cursor to the left
▷	Moves the cursor to the right

2.2 **OPERATING INSTRUCTIONS**

2.2.1 **General**

The operation of most functions of the TLA 852 and the FLA 872 is identical. Where differences occur, both operations are described.

2.2.2 **Switching the Unit ON**

When the battery is installed in the unit, the display shows the time and date on the bottom line and the status symbols on the top line. The display stays on until the battery is removed or the ‘OFF’ mode is selected.

If the unit is in the ‘OFF’ mode, push and hold the O> button until the Audio and Vibrate Alerts operate. The display then shows a message for a short time before the time and date show. This is the ‘standby’ screen.

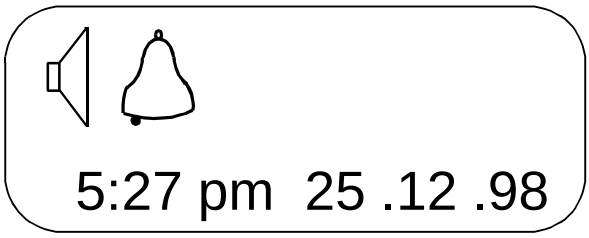
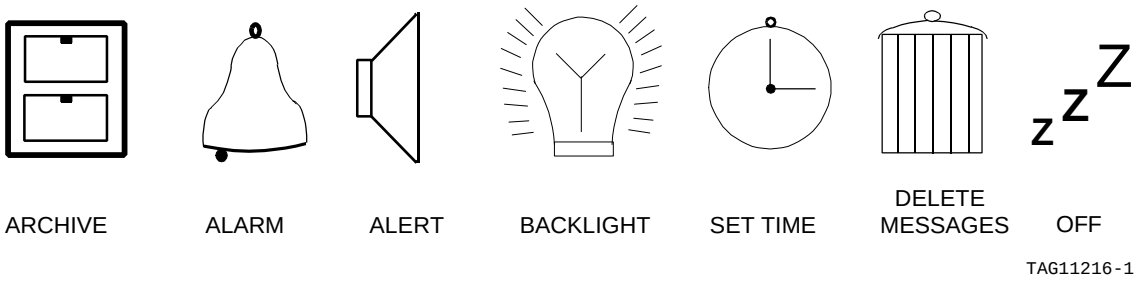


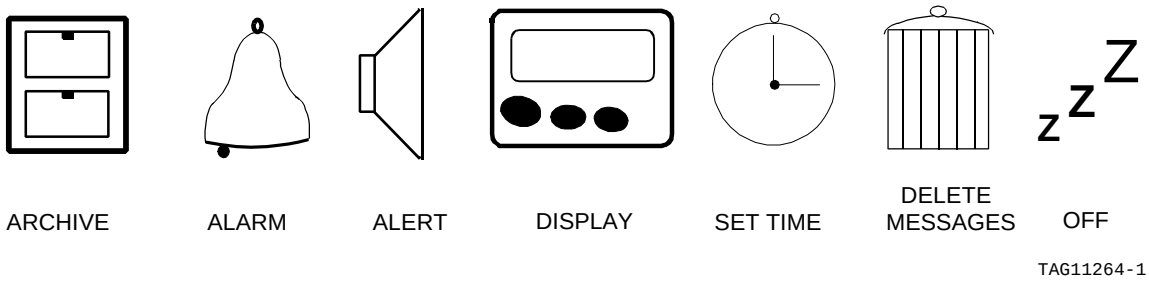
Figure 2.2: Standby Screen

2.2.3 **Setting the Options**

Make sure that the unit is ON and that the display shows the standby screen. Push and release the O> button. The display will show seven symbols. These are:



TLA 852 Option Screen



FLA 872 Option Screen

Figure 2.3: Option Screen Symbols

Push the ▷ or the ◁ button to choose the required symbol (the symbol flashes as it is chosen) then push the O> button to select the function.

Paragraphs 2.2.4 through 2.2.12 give the function and operation of each symbol.

2.2.4 **Archive**

a) **General**

The operator can use this option to archive received messages and also to view messages in the archive store.

b) **Archiving Messages**

Select the required message and view the complete message by pressing the O> button. After the last screen of the message is displayed, push the ▷ or the ◁ button to choose the archive symbol.

When the archive symbol flashes, push the O> button. The display shows the archive symbol plus a flashing **?**. Push the O> button again to transfer the message to the archive memory.

If the archive is full, the 'memory full' symbol  will flash. A message must be deleted from the archive memory before the new message can be saved.

c) **Viewing Archived Messages**

To view the messages in the archive memory select the archive symbol on the options screen and push the O> button. Push the ◁ button to select the most recent message. Push the ▷ or the ◁ button to scroll through the messages. If the message is more than one screen long push the O> button to display the next screen.

NOTE: If there are no information services available in the unit, push the ◁ button to select the archive directly from the standby screen.

To return to the standby screen, push and hold the O> button for one second or wait for the unit to time-out and show the standby screen.

2.2.5 **Alarm**

The alarm can be set to operate once at any time in a twenty four hour period. To set the alarm, first select the alarm function on the option screen as shown in paragraph 2.2.3.

Use the ◁ or ▷ buttons to choose the alarm ON or alarm OFF symbol.

When the alarm is set to OFF, the  symbol shows and the alarm time is not shown.

When the alarm is set to ON and the alarm time is reached, the standby screen will show a flashing alarm symbol and the alert will operate for eight seconds. To stop the alert within the eight second period, push any button.

To set the alarm time, set the alarm to ON. The display shows the alarm symbol and also shows the time the alarm is set to sound.

To change the time:

a) Push the O> button and the hour numbers flash. Use the ◁ or ▷ buttons to set the required hour.

b) Push the O> button again and the tens of minutes number flashes. Set the required figure with the ◁ or ▷ buttons, then push the O> button to make the minutes number flash. Set the required figure with the ◁ or ▷ buttons.

c) To return to the standby screen, push and hold the O> button for one second or wait for the unit to time-out. The screen now shows the alarm symbol to indicate that the alarm is set.

2.2.6 **Alert**

The alert can be set to one of nine options; seven audible, vibrate or 'no alert'.

To set the alert, first select the alert function on the option screen as shown in paragraph 2.2.3

a) When the alert screen shows, use the ◁ or ▷ buttons to select an alert (as each alert is selected, the associated tone sounds or the vibrate operates. To stop the alert, push any button).

b) When the required alert is selected, push the O> button for one second or wait for the unit to timeout.

c) The display returns to the standby screen and shows the alert symbol.

If the vibrate alert is selected, the display shows 

When the audible alert is selected, the display shows 

When 'no alert' is selected, the display shows 

The alert can be quickly set ON or OFF from the standby screen by pushing and holding the O> button for three seconds.

2.2.7 **Display Backlight (TLA 852)**

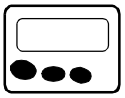
The unit display has a backlight which allows the display to be read in low-light conditions.

To operate the backlight, first select the backlight function on the option screen as shown in paragraph 2.2.3

When the backlight screen shows, use the ◁ or ▷ buttons to select the backlight ON or OFF.

To return to the standby screen, push and hold the O> button for one second or wait for the unit to time-out.

2.2.8 **Display Options (FLA 872)**



Choose this option to show the display options screen. This shows two options :

a) To change the height of the message characters ABC (refer to paragraph 2.2.9)

b) To operate the backlight  (refer to paragraph 2.2.10)

2.2.9 **Changing the Height of the Characters**

When the display option screen is selected, the screen shows the two symbols with the ABC symbol flashing.

There are two heights of character available; single height, which allows four lines of a message to show on the screen, and double height, which shows two lines of a message in large characters.

To change the character height, push the ◁ or ▷ buttons until the required height shows on the screen.

To return to the standby screen, push and hold the O> button for one second or wait for the unit to time-out.

2.2.10 **Display Backlight (FLA 872)**

Select the display option screen, then push the O> button to choose the backlight function.

Use the ◁ or ▷ buttons to select the backlight ON  or OFF  .

To return to the standby screen, push and hold the O> button for one second or wait for the unit to time-out.

2.2.11 **Setting the Time and Date and Timed-off Time**

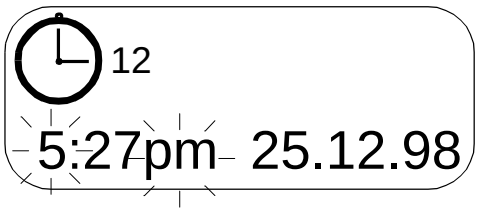
To set the time and date or the timed-off time, first select the set time function on the option screen, as shown in paragraph 2.2.3 The set time screen then shows two options:

a) Setting Time and Date  (Refer to paragraph A).

b) Setting Timed-off Time  (Refer to paragraph B).

A) Setting Time and Date

a) Use the ◁ or ▷ buttons to choose the Setting Time and Date symbol  then push the O> button.



b) The screen shows the time and date with the hour numbers flashing. If the clock is set to the 12 hour mode, the ‘am/pm’ characters also flash.

c) Use the ◁ or ▷ buttons to set the required hour.

d) Push the O> button again and the tens of minutes number flashes. Set the required figure with the ◁ or ▷ buttons.

e) Push the O> button to make the minutes number flash. Set the required figure with the ◁ or ▷ buttons.

f) Push the O> button again and the date 'day' numbers flash. Use the ◁ or ▷ buttons to set the required figures.

g) Push the O> button again and the 'months' numbers flash. Set the required figure with the ◁ or ▷ buttons.

h) Push the O> button again to make the 'year' numbers flash. Set the required figure with the ◁ or ▷ buttons.

i) Push the O> button to select the 12 or 24 hour mode. Use the ◁ or ▷ buttons to set the required mode.

j) When the display shows the required time and date, push the O> button for one second to return to the standby screen, or wait for the unit to time-out.

B) Setting Timed-off Time

This option sets the pager OFF and ON at preset times (e.g. overnight). To select this option :

k) Select the Set Time screen as shown in paragraph 2.2.11.

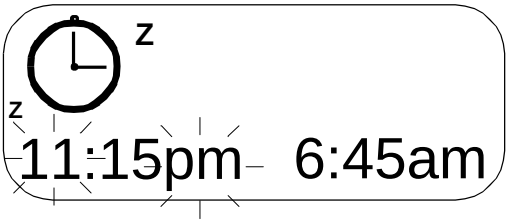
l) Use the ◁ or ▷ buttons to choose the  symbol then push the O> button. The display shows the Timed-off edit screen.

m) To set the Timed-off option to OFF, push the ◁ or ▷ buttons until the start and stop times do not show.

n) To set the Timed-off option to ON, push the ◁ or ▷ buttons until the start and stop times show on the display.

o) To change the START and STOP times:

   i) Set the Timed-off option to ON, then push the O> button. The first numbers (Start Time hours) flash. If the clock is set to the 12 hour mode, the 'am/pm' characters also flash.



ii) Push the ◁ or ▷ buttons to select the required hour.

iii) Push the O> button to select the next number (tens of minutes) then push the ◁ or ▷ buttons to select the required number.

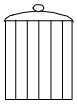
iv) Push the O> button again to select the next number (minutes) then push the ◁ or ▷ buttons to select the required number.

v) Push the O> button again to select the next number (Stop Time hours).

vi) Repeat operation ii) through iv) to set the required Stop Time hours and minutes.

vii) To return to the standby screen, push and hold the O> button for one second or wait for the unit to time-out.

2.2.12 **Deleting Messages**



a) **Deleting Stored or Archived Messages**

To delete any message in the store or archive memories of the pager.

Select the message with the ◁ or ▷ buttons. Use the O> button to read the complete message.

When the last screen is displayed, push the O> button then use the ◁ or ▷ buttons to select the delete  symbol.

Push the O> button. The display shows the delete symbol plus a flashing **?**

Push the O> button to delete the message.

b) **Deleting All Stored Messages**

All the messages in the store memory (but not those in the archive memory) can be deleted in one operation.

Push the O> button to show the seven option symbols.

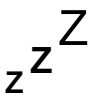
Use the ◁ or ▷ buttons to choose the  symbol.

Push the O> button to select the function.

The display shows the  symbol plus a flashing **?** symbol.

Push the O> button to delete all the messages.

2.2.13 Switching the Unit OFF



The pager can be switched OFF (sleep mode) but the pager cannot receive messages while it is set to this state.

To switch the pager OFF, select the OFF function on the option screen as shown in paragraph 2.3.3

The display shows the  symbol plus a flashing **?** symbol.

Push the O> button to set the pager to OFF.

The screen goes blank.

2.3 RECEIVING AND STORING MESSAGES

2.3.1 Receiving a Message

When the pager receives a new message the first part of the message shows on the display and the alert operates for eight seconds.

Push any button to acknowledge receipt of the message and to stop the alert.

If the call is not acknowledged the pager will give a short alert every five minutes for a maximum period of one hour.

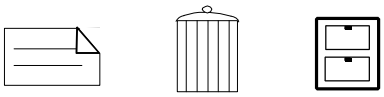
To display the message, push the ▷ button. If the message is longer than the screen can show, push the O> button to show the next part of the message.

To return to the standby screen, push and hold the O> button for one second or wait for the unit to time-out. If the message has not been read, the standby screen will show the 'message' symbol.

2.3.2 Reviewing Stored Messages

To display the received messages, starting with the newest message, push the ▷ button. To scroll through the messages, use the ◁ or ▷ buttons. If the message is longer than the screen can show, push the O> button to show the next part of the message.

When the last part of the message is shown, push the O> button. The display shows three symbols:



To read the message again, use the ◁ or ▷ buttons to select the first symbol then push the O> button.

To delete the message, use the ◁ or ▷ buttons to select the second symbol then push the O> button. The display shows the delete symbol plus a flashing **?** symbol. Push the O> button again to delete the message.

To put the message in the Archive Store, use the ◁ or ▷ buttons to select the third symbol then push the O> button. The display shows the archive symbol plus a flashing **?**. Push the O> button again to transfer the message to the Archive Store.

To return to the standby screen at any time, push and hold the O> button for one second or wait for the unit to time-out.

The unit memory can hold a maximum of 20 messages. When this number is reached the standby screen shows the memory full symbol.

If a new message is received when the memory is full, the oldest message is deleted.

2.3.3 **Archiving Messages**

Messages can be protected by transferring them to the Archive Store. Refer to paragraph 2.3.4 or paragraph 2.4.2. for the procedure.

2.3.4 **Reviewing Information Service Messages (Optional Feature)**

When this feature is available, the standby screen shows the symbol when the pager receives an Information Service message.

To select the Information Service menu, push the ◁ button when the screen shows the standby display.

The information menu screen shows a maximum of eight number symbols, each enclosed within a circle. Numbers which have unread Information Service messages have a thicker circle.

Use the ◁ or ▷ buttons to choose the required service number then push the O> button to show the message.

To review other messages on the same service, push the ◁ or ▷ buttons until the required message shows.

To return to the Information Services menu push the O> button repeatedly until the menu shows.

To put an information service message into the Archive Store, use the procedure given in paragraph 2.3.4.

2.3.5 **No Service (Optional Feature)**

When this feature is available, the standby screen shows the No Service symbol if the pager cannot receive signals from the paging network.

2.4 LOW BATTERY

2.4.1 Low Battery Warning

When the battery needs replacing, the pager sounds an alert and the low battery symbol shows on the standby screen.

2.4.2 Replacing the Battery

a) Refer to Figure 2.4. Use a thumbnail to press down on the battery door lock on the back of the unit. Hold the door lock down and push the battery door in the direction shown. Rotate the door as shown in Figure 2.4 to gain access to the battery.

b) Remove the old battery.

c) Refer to the diagram in the battery compartment and install the new battery.

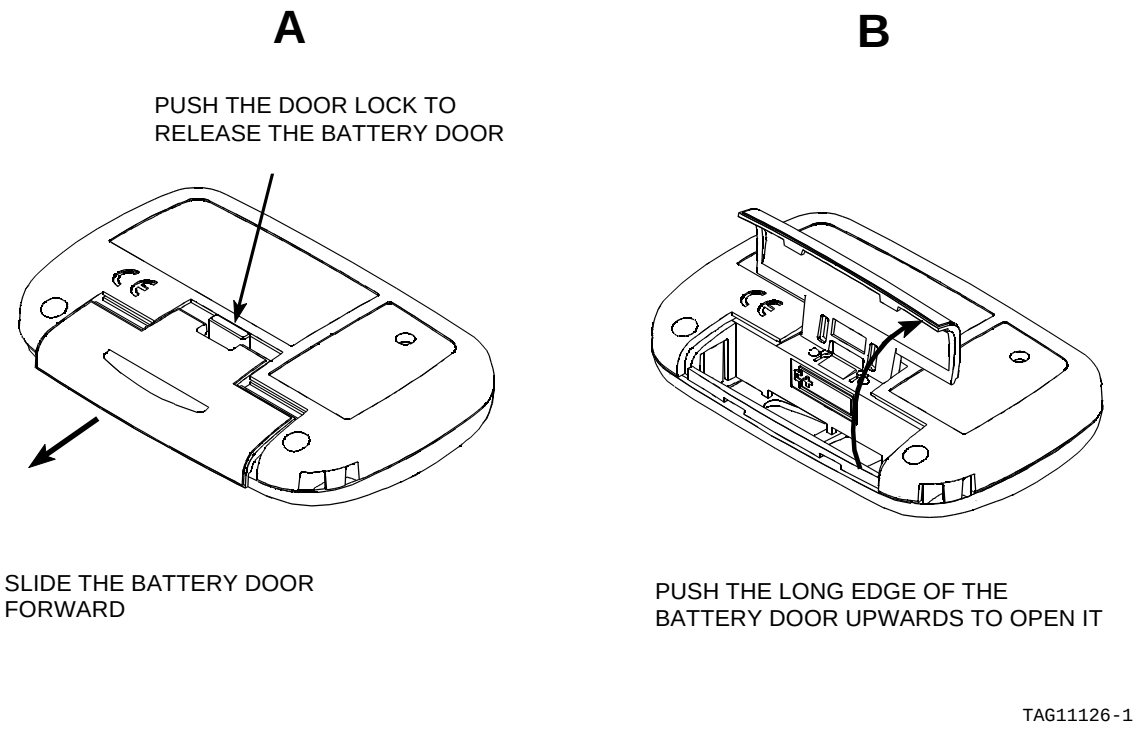


Figure 2.4: Opening the Battery Door

2.5 **LANYARD ASSEMBLY**

Figure 2.5 shows the method of assembling the lanyard to the unit.

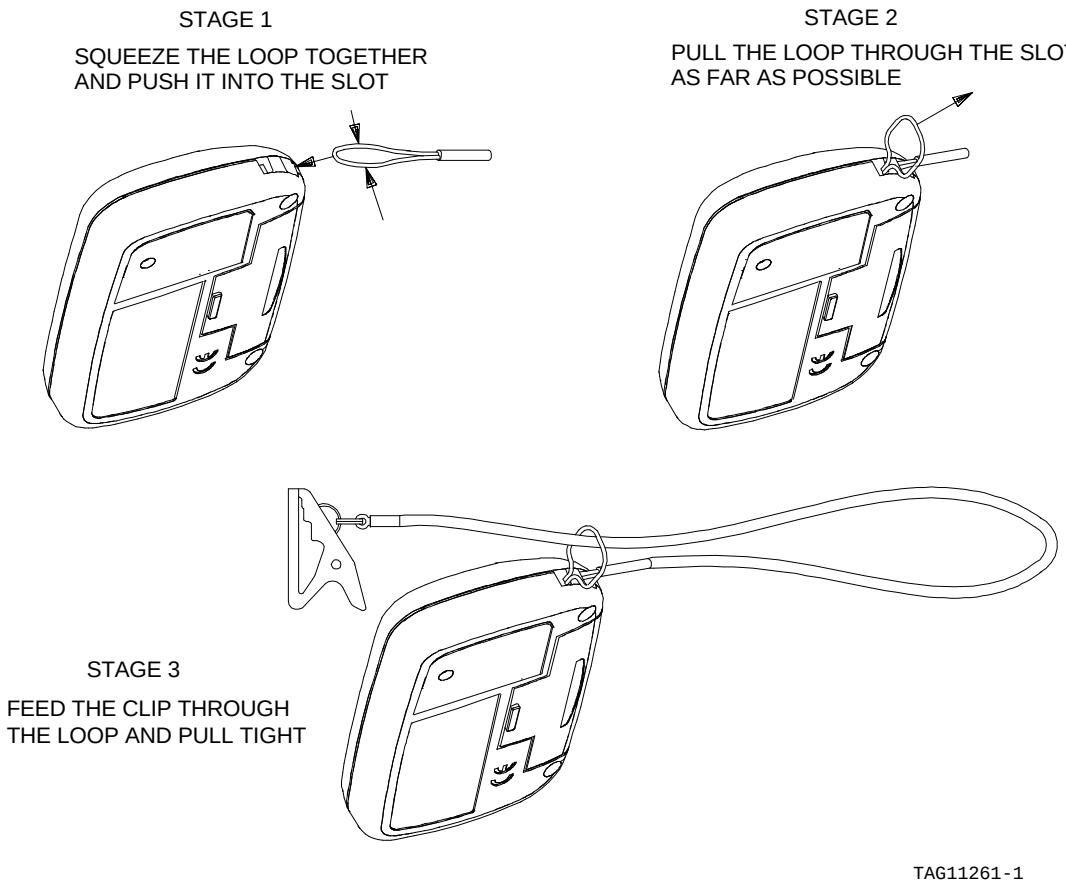


Figure 2.5: Lanyard Assembly

SECTION 3

TECHNICAL DESCRIPTION

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3.1 CIRCUIT SUMMARY

The TLA 852 and FLA 872 radio paging receivers each consist of two Printed Circuit Board (PCB) assemblies contained in a plastic case.

The case is constructed in two main parts, the case front and the case back. A cover on the back of the unit provides access to the battery compartment.

The two boards in the case are:

a) The Radio Board which has the Dual Conversion Receiver, the POCSAG Decoder, the 1 volt regulator and the audio alert output circuit and transducer.

b) The Decoder Board which has the microprocessor, the EPROM, the SRAM, the Liquid Crystal Display Module, the LCD illumination, the vibrate motor and the primary and backup power supplies.

The block diagram of the functional areas of the units is shown in Figure 3.1. Refer to Section 7 for the circuit diagrams and board layout information.

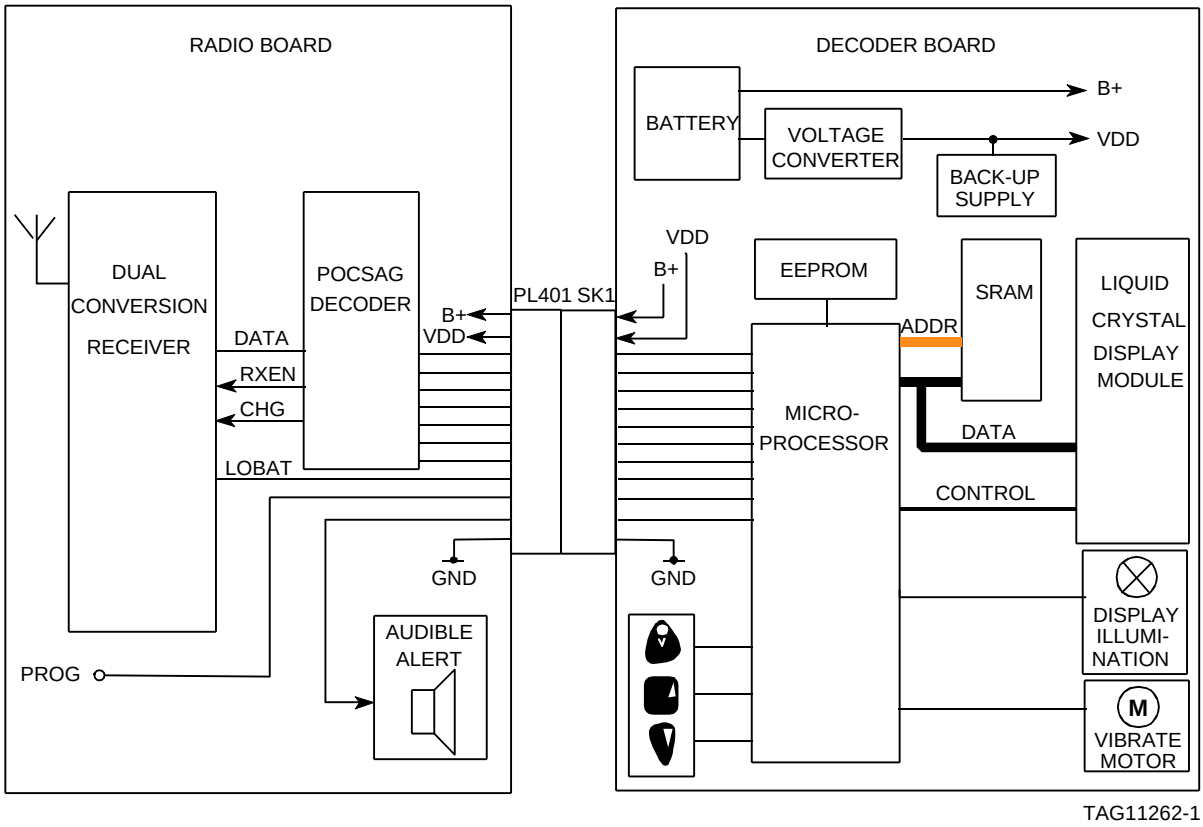

Figure 3.1: TLA 852/FLA 872 Block Diagram

The RF signal enters the aerial and is fed to the dual conversion superheterodyne receiver. The signal is demodulated from RF to audio frequency digital form and is then fed to the decoder. This results in the received data activating the memory, display and the selected audible alert or vibrate alert.

To prolong the life of the battery, the receiver operates in battery economy mode. When the unit is in standby mode, the receiver is powered up at regular intervals (equivalent to once per batch) to allow the POCSAG decoder to search for pre-amble. While the unit is receiving preamble on its allocated channel, the receiver remains powered up. This allows the POCSAG decoder to search for a SYNC word. When the SYNC word is found, 'batch lock' is achieved. In batch lock the receiver is only powered up during the allocated frame to allow the POCSAG decoder to search for its address. If the address is found, the receiver stays ON for the duration of the message.

3.2 DUAL CONVERSION RECEIVER

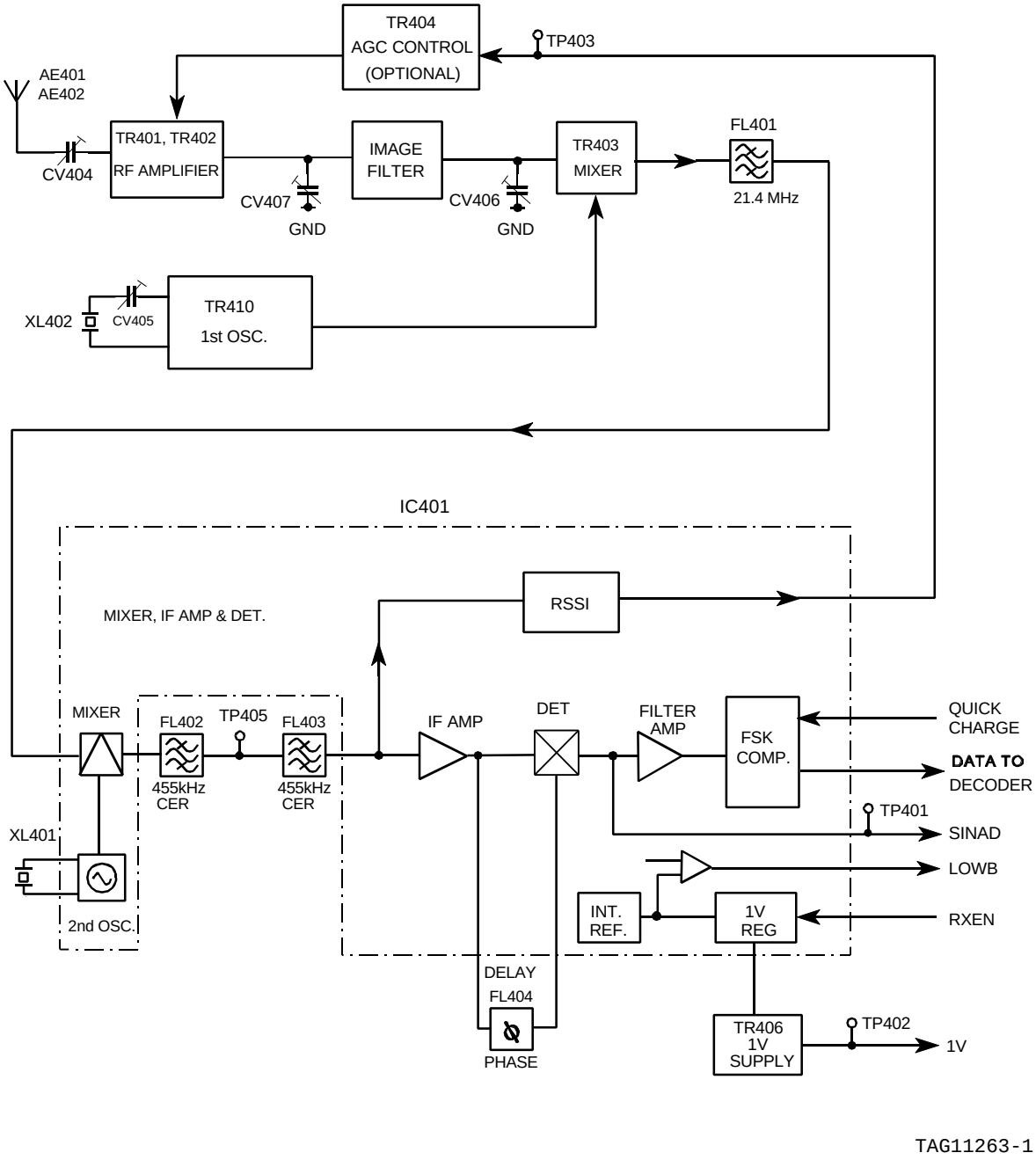

Figure 3.2: Receiver Block Diagram

The incoming RF signal is received by the aerial AE401/AE402 which is tuned by CV404. Capacitors C401, C405 and inductor L416 provide matching to RF amplifier TR401, TR402. The amplifier, typically, yields a voltage gain of 20 dB. R401 and R402 provide DC bias.

The output from the RF amplifier passes through an image filter which provides these functions:

a) Attenuation of signals outside the required band.

b) Attenuation of the first image frequency.

c) Matches the output impedance of the RF amplifier to the input impedance of the mixer stage.

L401 and CV407 form a parallel tuned circuit with the resonant frequency set to the carrier frequency.

L407 forms a series resonant circuit which provides a notch filter at the image frequency.

The local oscillator comprises transistor TR410, crystal XL402 and associated components. Frequency adjustment is by CV405. The local oscillator frequency is calculated as follows:

fx = carrier frequency minus 21.4MHz

where *fx* is the crystal frequency in MHz.

C452, C453, C494 and R439 provide decoupling of the supply rail to give good adjacent channel performance. The local oscillator signal is coupled to the mixer circuit by C465.

The mixer circuit, TR403 and associated components, receives the RF output of the image filter. The RF signal is mixed with the local oscillator output to produce a 21.4MHz product. This is matched to the filter, FL401, by L406, C495 and R412. FL401 has a bandwidth of ±7.5kHz at the 3dB points.

The output from FL401 is matched by C485, R444 and L410 to IC401 pin 24. IC401 is a combined IF mixer / local oscillator / detector.

The second oscillator runs at 20.945MHz and, with the exception of XL401 and its tuning capacitors C407, C408, is built into the IC. As the second oscillator is not trimmed, small frequency errors are absorbed when tuning the first local oscillator.

The input at pin 24 is applied to the internal second mixer, and is mixed with the second oscillator output to produce a 455kHz 2nd IF signal at pin 3. The IF signal then passes through two ceramic filters FL403 and FL402 which remove unwanted mixer products and provide further selectivity.

The output from FL403 is split: one output connects through C444 to pin 6 of IC401 and the IF amplifier; the other optionally connects to the Received Signal Strength Indicator (RSSI) circuit in IC401 through C454, R426 and pin 5.

Due to the characteristics of filters FL401, FL402 and FL403, the signal at the input to the IF amplifier has amplitude modulation (AM). The AM must be removed before the signal reaches the detector stage. This is performed by the IF amplifier in IC401 which has very high gain and is designed to limit the amplitude of the signal to remove the AM component and give a 'square' output. C479 and C480 provide de-coupling for the IF amplifier.

The output from the IF amplifier passes to the detector in IC401. This circuit is a Quadrature Demodulator which has two inputs. One input connects directly to the IF amplifier, the other receives the signal from the IF amplifier through a phase delay circuit connected to pins 9 and 10 of the IC. The phase delay depends on the frequency of the IF signal and is 90 degrees at the centre frequency of the unit's allocated channel. The phase shift is provided by ceramic discriminator FL404, capacitor C426 and resistor R416. C425 is a de-coupling capacitor.

The RSSI circuit in IC401 provides an optional Automatic Gain Control (AGC) signal for the receiver. The circuit detects the received signal strength and gives a DC current out. R426 sets the level at which the circuit starts to operate. The value of 68 kilohms sets it to approximately 16 dB above the noise floor. The DC output from pin 22 of the IC connects to the AGC control circuit. When there is no RSSI output, transistor TR404 is biased off and keeps the RF amplifier at full gain. At strong signal levels the output from the RSSI causes TR404 to gradually start conducting, thus reducing the gain of the RF amplifier. C451 determines the rise and fall times of the AGC.

The output from the detector stage, pin 11, gives an audio output to TP401. This test point is used in the final stages of production to align the receiver circuits. TP 401 is also used to program the decoder section of the unit. Pin 11 of IC401 also connects through R425, R429 and R428 to pin 12. These resistors together with capacitors C448, C483, C484 and the internal filter amplifier of IC401 form the data filter; a unity-gain, low-pass filter which reduces high frequency noise.

The output of the data filter connects internally to the FSK Comparator. The data output of the comparator, from pin 18, connects to the POCSAG Decoder, IC402, pin 4. A logic signal from IC402, pin 2 to IC401, pin 16 controls the Fast/Slow charge of the FSK Comparator. At switch-on the logic level is high and the circuit is set to Fast Charge to allow the voltage on capacitor C492 to be set to the voltage level on C486. The logic level at pin 16 is then set low which sets the comparator to normal operation.

3.3 DECODER

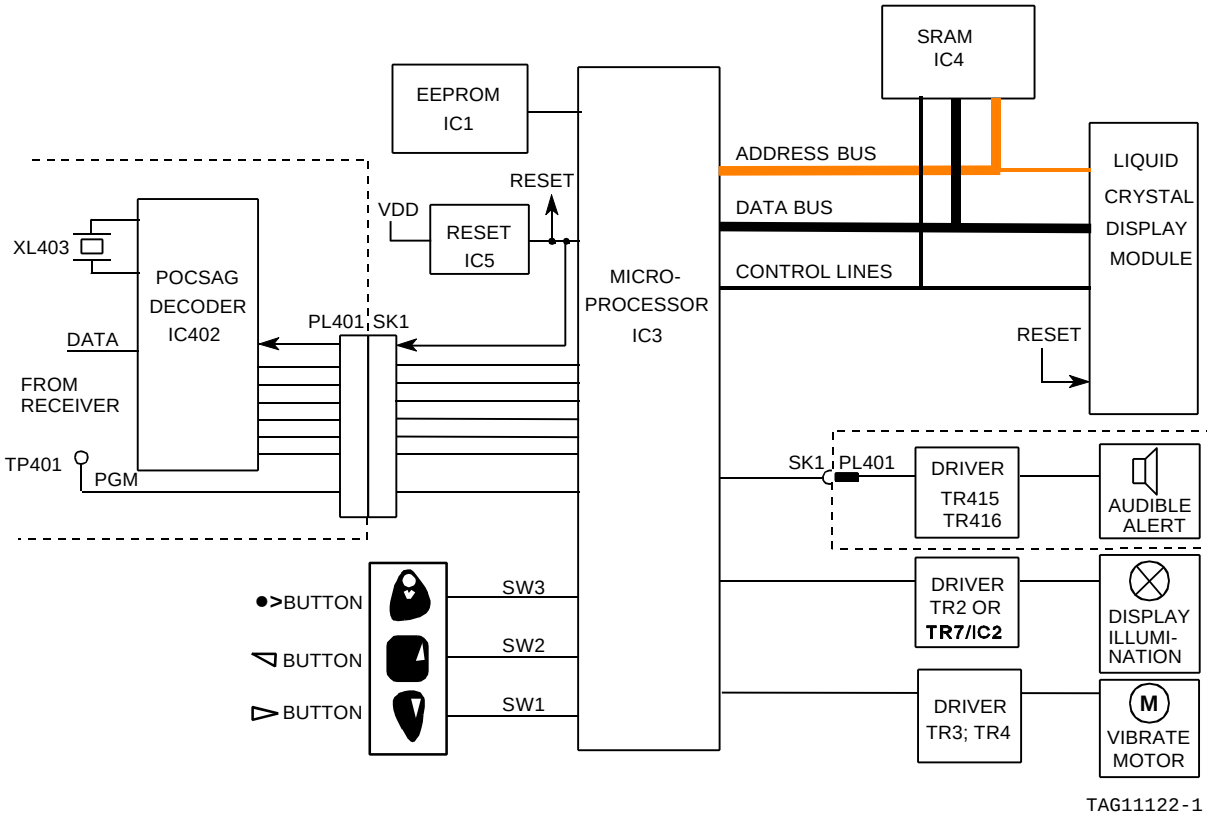

Figure 3.3: Decoder Block Diagram

3.3.1 General

The Decoder comprises the POCSAG decoder, Microprocessor, EEPROM, SRAM message memory and switches, plus support components and a separate LCD module. The signal from the receiver is processed by IC402, the POCSAG decoder, and the decoded data passed to the microprocessor. The microprocessor stores the information in the SRAM, IC4, before activating the selected alert and sending the message data to the LCD module for display. The EEPROM holds information applicable to the unit.

3.3.2 POCSAG Decoder

The POCSAG decoder, IC402, is located on the Radio Board of the unit and connects to the microprocessor, IC3, through PL40I / SK1. Pin 4 of IC402 receives the data signal from IC401. IC402 decodes the information and sends it, four bytes at a time, to the microprocessor, IC3. IC402 uses the SCK clock pulses from IC3, pin 59, to transfer the data on the SDO line, IC402, pin 13.

When no signals are received by the unit, the system goes into a standby mode to reduce power consumption. In this mode, a pulse from IC402 pin 1 (BS1), sets the receiver circuits ON for a brief period every 0.5s - 1s, depending upon Baud rate, to check for a preamble signal. If such a signal is received, followed by a valid address and message, a signal is sent from IC402, pin 15 (ATTN) to alert the microprocessor.

Pin 9 (CLK0) provides clock pulses to operate the microprocessor while it is in standby mode.

Pin 11 (AREA) goes high when a valid signal is received.

Pin 14 (SDI) receives program information from the microprocessor.

Pin 2 (BS2) controls the 'fast charge' operation of the FSK comparator in IC401.

3.3.3 **Microprocessor**

The microprocessor controls the functions of the unit. A 4.19MHz clock, controlled by XL2, provides the basic timing for the system.

Data received from IC402 is processed by the microprocessor and stored in the SRAM chip, IC4. The microprocessor then causes the selected Alert to operate and sends the message to the LCD module ~~for~~ display. Outputs from pin 5 (LCD-CS), pin 39 (AD17), pin 38 (AD16) and pin 60 (WR) control the transfer of data to the LCD module on the databus. Outputs from pins 2 and 7 control the operation of the audio alert and the vibrate motor.

IC3 also controls the internal functions of the system, displaying the symbols and changing the modes when selected by the three buttons on the front of the unit.

3.3.4 **EEPROM**

The EEPROM (IC1) holds information applicable to the unit, such as: Serial Number; RIC codes; Radio parameters. The information is sent to the microprocessor through the serial data link, pins 62, 63 and 64.

3.3.5 **SRAM**

The SRAM (IC4) is a 256k device which can store up to 32k of 8-bit information. Address lines AD00 through AD14 and control lines RAM-CE and WR from the microprocessor, control the flow of data in and out of the device on the databus.

3.3.6 **LCD Module**

The LCD Module produces the required characters and the symbols for the integral display. Address lines AD16 and AD17 and control lines LCD-CS and WR from the microprocessor, control the flow of data to the device on the databus.

C20 and C21 are part of the internal DC/DC converter of the module's negative bias supply.

R11, R12, R13, C17 and C22 through C25 are part of the circuit which controls the voltage to the LCD driver.

3.3.7 **Display Illumination**

Two miniature lamps are used to illuminate the LCD display. The lamps are selected ON or OFF using the buttons on the front panel. The 'Lamp ON/OFF' signal, which comes from pin 8 of the microprocessor, controls transistor TR2 in the lamp circuit of the TLA852, or TR7/IC2 for the EL display in the FLA 872.

3.3.8 **Alerts**

a) **Audible Alert (Beep)**

The transducer, SP401, and the driver circuits TR415 and TR416, are located on the radio board. The audible alert signal from IC3, pin 2 connects to TR415 through SK1/PL401 pin14. The alert can be selected ON or OFF using the buttons on the front panel.

b) **Vibrate Alert**

The vibrate motor is operated by transistors TR3 and TR4 on the decoder board. The vibrate alert signal from IC3, pin 7 connects to pin 1 of TR3. The alert can be selected ON or OFF using the buttons on the front panel.

3.4 **POWER SUPPLIES**

The primary power supply for the unit is a single 1.5 volt, AAA battery (BAT1). The supply from the battery (B+) connects directly to the display illumination and vibrate motor circuits, that require relatively high currents. B+ also connects to the radio board through SK1/PL401, pin 9 and to the voltage converter, IC6, on the decoder board.

IC6 and its associated components supply the +3.1 volts (VDD) for the unit. TR5, T1, C9, C11, C26, R10 and D1 form an oscillator giving a frequency between 5kHz and 20kHz. The output is rectified by D1 and smoothed by C12. IC6 samples the voltage and if it exceeds 3.1 volts, IC6 causes TR6 to switch off and stop the oscillator. When the pager circuits take current, the voltage drops and the oscillator is turned on again. This produces a sawtooth voltage on the 3 volt rail which gives less RF noise than other converter circuits.

In addition to supplying the 3.1 volts, the circuit charges the backup supply (BAT2) through resistor R6. Double diode D2 provides isolation for the two circuits.

IC5 monitors the voltage of V_{DD} and resets the decoder circuits if the voltage drops to a level that would cause data corruption.

Transistor TR1, connected to pins 6 and 15 of IC3, detects the battery voltage. If BAT1 is removed, the drop in B+ causes transistor TR1 to switch OFF which sets the microprocessor to low-current mode. In this mode BAT2 supplies sufficient power to keep the microprocessor and the SRAM operational for up to 60 minutes.

The 1 volt supply for the receiver circuits is provided by transistor TR406 and its associated components. The circuit is a series regulator and is maintained within specification by a control circuit in IC401.

SECTION 4

INSTALLATION AND COMMISSIONING

There are no installation and commissioning procedures for the Radio Paging Receiver Models TLA 852 and FLA 872.

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SECTION 5

SERVICING

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CAUTION

STATIC SENSITIVE DEVICES ARE USED IN THIS EQUIPMENT. TAKE CARE DAMAGE IS NOT CAUSED TO THESE DEVICES BY HIGH LEVELS OF STATIC ELECTRICITY.

5.1 SERVICE POLICY

Except for Routine Maintenance, repairs are only to be performed by qualified personnel in authorised workshops.

The unit can be repaired to component level. The display module is a disposable item. If any screening cans are removed for access to components, they must be refitted flush to the printed circuit board.

5.2 ROUTINE MAINTENANCE

This is limited to battery replacement and surface cleaning of the outer case. Clean the case with a lint free cloth moistened with soapy water. Do not use spirit or other solvents as they can damage the case.

5.3 WORKSHOP PROVISIONS

Repair workshops must be free from hostile radio interference or otherwise equipped with Faraday cages. Suitable equipment must be available to remove and install the surface mounted components which are used in this unit.

5.4 TEST EQUIPMENT, TOOLS AND ANCILLARIES

5.4.1 Test Equipment

The following test equipment is required:

- IBM PC or compatible personal computer
- Programming Software P669H
- P645 Test Encoder
- P645A POCSAG Test Encoder Software
- RF Signal Generator
- Oscilloscope
- Millivoltmeter with high impedance, low capacitance probe
- Alignment and Fault-Finding Jig P671, P671A, P671B
- SINAD Meter
- AC Millivoltmeter
- Digital Multimeter

5.4.2 **Tools and Ancillaries**

The following tools and ancillaries are required:

- DC Power Supply, 1-1.5 volts.
- Cross-point Screwdriver
- Surface Mount Handling Tools
- Anti-static Workstation

5.5 **DISASSEMBLY**

5.5.1 **Case Removal**

a) Refer to Figure 5.1. Use a thumbnail to press down on the battery door lock on the back of the unit. Hold the door lock down and push the battery door in the direction shown. Rotate the door as shown in Figure 5.1 to get access to the battery.

b) Remove the battery.

c) Remove the two, 2.2mm x 6mm cross-head screws from the Case Back.

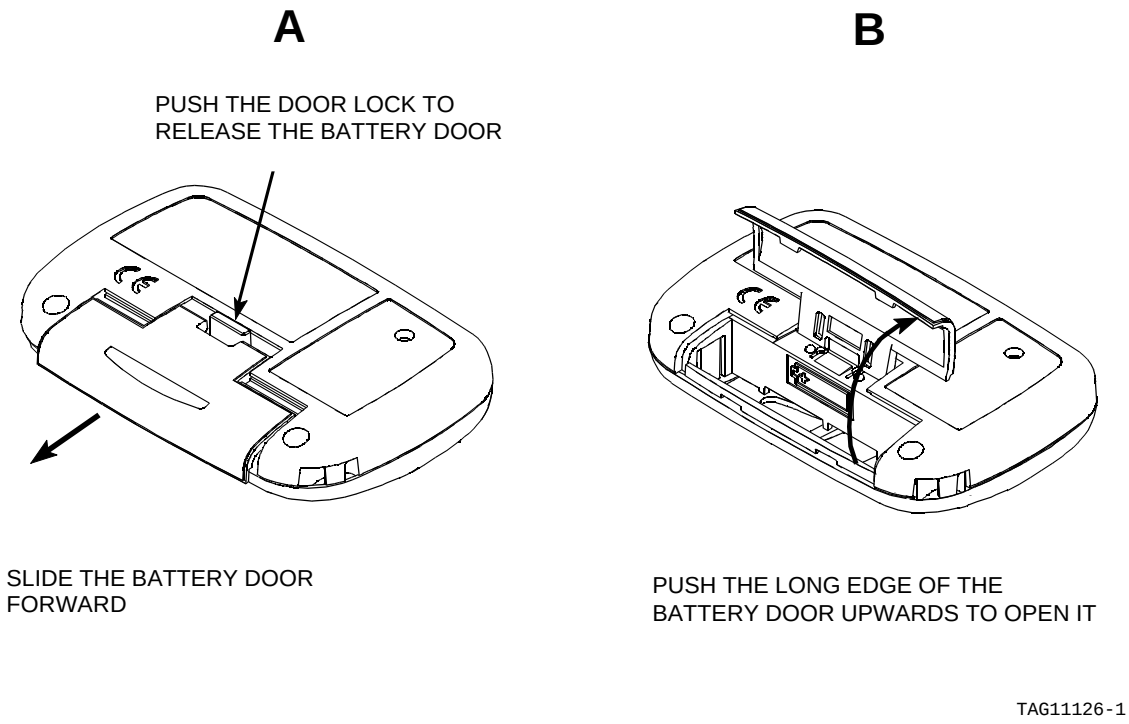


Figure 5.1: Battery Door

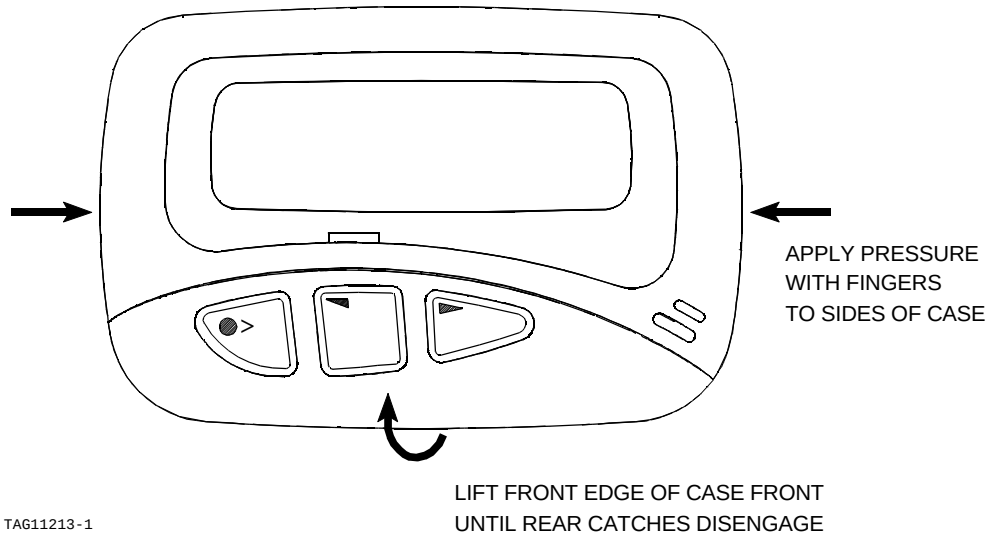


Figure 5.2: Case Front Removal

d) Remove the Case Back by applying pressure to the sides of the case, as shown in Figure 5.2, and lifting the front edge of the Case Front until the rear catches disengage.

5.5.2 Board Assembly Removal

a) Remove the Case Back (see paragraph 5.5.1).

b) Carefully lift the Board Assembly at the long edge next to the LCD Module. When the edge of the Board Assembly is clear of the case, pull the assembly away from the case.

5.5.3 Board Separation

a) Remove the Board Assembly from the case (see paragraphs 5.5.1 and 5.5.2).

b) Carefully pull the front edge of the boards apart to disconnect the connector between the boards.

c) Pull the Decoder Board forward to release the LCD Module from under the aerial.

d) To get access to the Radio Board components, remove the rubber mat.

5.5.4 **LCD Module Removal**

a) Remove the Board Assembly from the case (see paragraphs 5.5.1 and 5.5.2) and separate the Decoder Board from the Radio Board (see paragraphs 5.5.3., a) through c)).

b) Release the two module pins from the holes in the Decoder Board and carefully fold the module away from the board to get access to the flexible cable.

c) Use the Anti-static Workstation and the correct soldering tools to disconnect the flexible cable from the board.

5.5.5 **Vibrate Motor Removal**

a) Remove the Board Assembly from the case (see paragraphs 5.5.1 and 5.5.2) and separate the Decoder Board from the Radio Board (see paragraphs 5.5.3., a) through c)).

b) Use the Anti-static Workstation and the correct soldering tools to disconnect the two wires from the board.

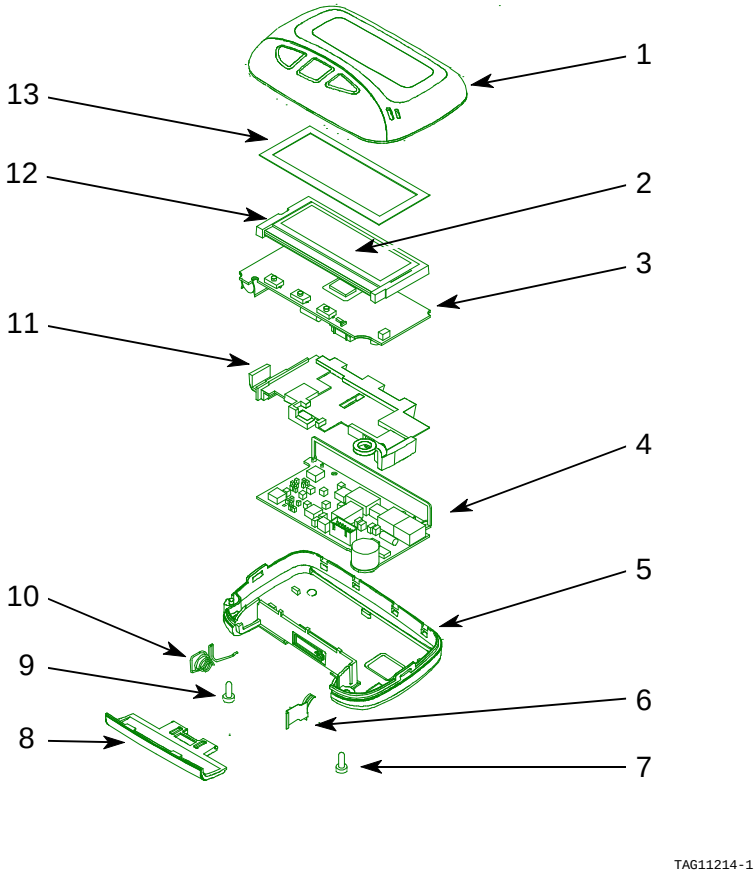
c) Use a screwdriver to lever the Vibrate Motor carefully from the clip.

5.5.6 **Battery Contacts Removal**

a) Remove the Board Assembly from the case (see paragraphs 5.5.1 and 5.5.2).

b) Pull the contacts out of their slots in the Case Back.

5.6 ASSEMBLY



1. Case Front Assembly
2. LED Display
3. Decoder Board Assembly
4. Radio Board Assembly
5. Case Back Assembly
6. Battery Positive Contact
7. Case Fixing Screw
8. Battery Door
9. Case Fixing Screw
10. Battery Negative Contact
11. Rubber Mat
12. Moulding Bezel LCD
13. Display Gasket

Figure 5.3: Exploded View of Unit

5.6.1 Battery Terminal Installation

a) Refer to Figure 5.3 for the correct orientation of the terminal.

b) Push the terminal into the slot in the Case Back.

5.6.2 Vibrate Motor Installation

a) Install the Vibrate Motor in the clip.

b) Use the Anti-static Workstation and the correct soldering tools to connect the two wires to the Decoder Board.

5.6.3 **LCD Module Installation**

a) Use the Anti-static Workstation and the correct soldering tools to connect the flexible cable to the Decoder Board.

b) Carefully fold the flexible cable and install the two pins on the rear of the module in the holes on the Decoder Board.

5.6.4 **Board Assembly**

a) Make sure that the Rubber Mat is correctly installed on the Radio Board.

b) Put the Decoder Board on the Rubber Mat. Make sure that the four small extensions at the rear of the LED Module are located under the aerial.

c) Align SKT1 with PL401 and carefully press the two boards together until the connectors are fully connected.

5.6.5 **Board Assembly Installation**

a) Slide the Board Assembly into the Case Back.

b) Make sure that the Battery Connector ‘fingers’ are in the correct position under the Decoder Board.

c) Push down on the front edge of the board and slide the board under the small extensions on the Case Back.

d) Push the rear edge of the Board Assembly into the Case Back.

5.6.6 **Case Assembly**

a) Install the Case Front on the Case Back by applying pressure to the sides of the case and pushing the rear edges of the case together until the catches snap in place.

b) Install the two 2.2mm x 6mm screws in the Case Back.

c) Open the Battery Door and install the battery.

d) Close the Battery Door and push it towards the top of the unit until it locks.

5.7 FAULT FINDING

5.7.1 General

Refer to the Fault Finding Guide (Figures 5.5 through 5.7) and the information given in Tables 5.1 through 5.8 and Figures 5.8 through 5.10 to help resolve problems. Alignment information is in paragraph 5.8. Programming information is given in paragraph 5.9.

Faults can be caused by user negligence. Always check the unit for these faults:

a) Damage to the Case or LCD

b) Water damage

c) Corrosion damage or leaking battery

Any metal parts which are corroded must be removed. Clean the affected area of the Board assembly with a non-corrosive contact cleaner. Dry the area with a low-pressure flow of warm air (40 °C through 50 °C). Install new parts.

5.7.2 Fault Diagnosis

Put a known good battery in the unit and switch ON the unit. Refer to the Fault-Finding Guide (Figures 5.5 through 5.7). If it is suspected that the Decoder Board is faulty, proceed as follows:

a) Remove the Board Assembly from the case (see paragraphs 5.5.1 and 5.5.2).

b) Separate the Decoder Board from the Radio Board (see paragraph 5.5.3).

c) Disable the Battery Economy function by fitting a 0 ohm resistor in the position for R456 (side 2 of the radio board near IC402).

d) Use the 14-way lead (supplied with the P671B) to connect the two boards (refer to Figure 5.4)

e) Put the boards on an anti-static mat and connect a 1.5 volt supply to the Decoder Board. Switch ON the power supply.

f) Connect a ’10-times’ probe to the oscilloscope and measure the points given in Table 5.4. Compare the waveforms on the oscilloscope with those shown in Figure 5.9.

5.7.3 Power Supply Voltage Adjustment

There is no adjustment for the 1 volt, 1.5 volts or 3 volts power supplies.

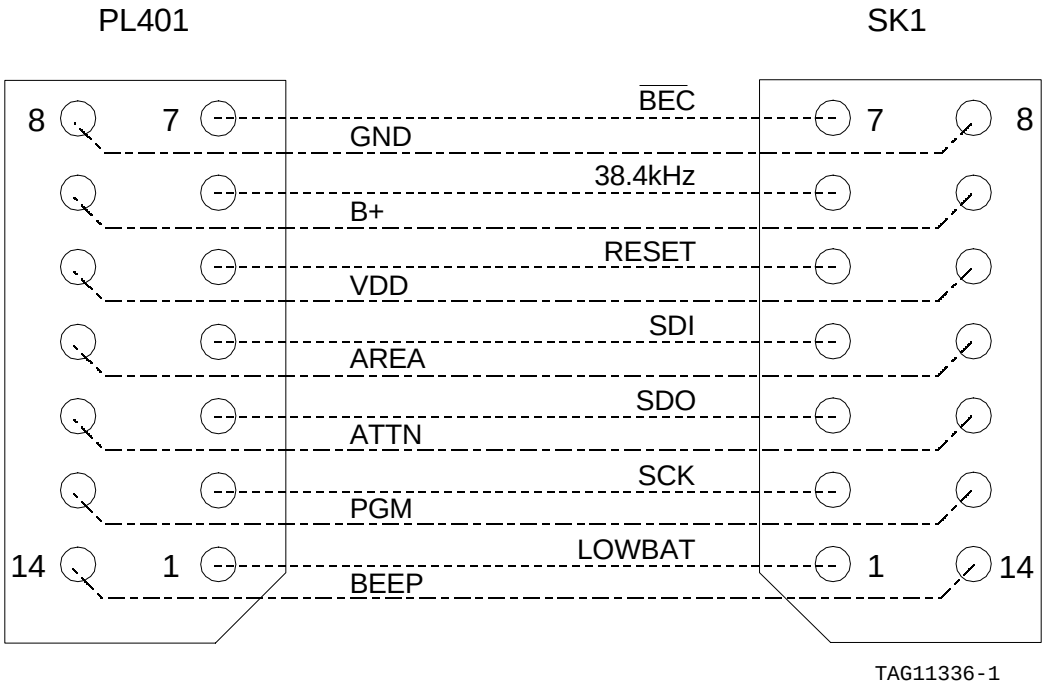


Figure 5.4: Connections between Radio Board and Decoder Board

5.7.4 **Battery-Low Circuit Test**

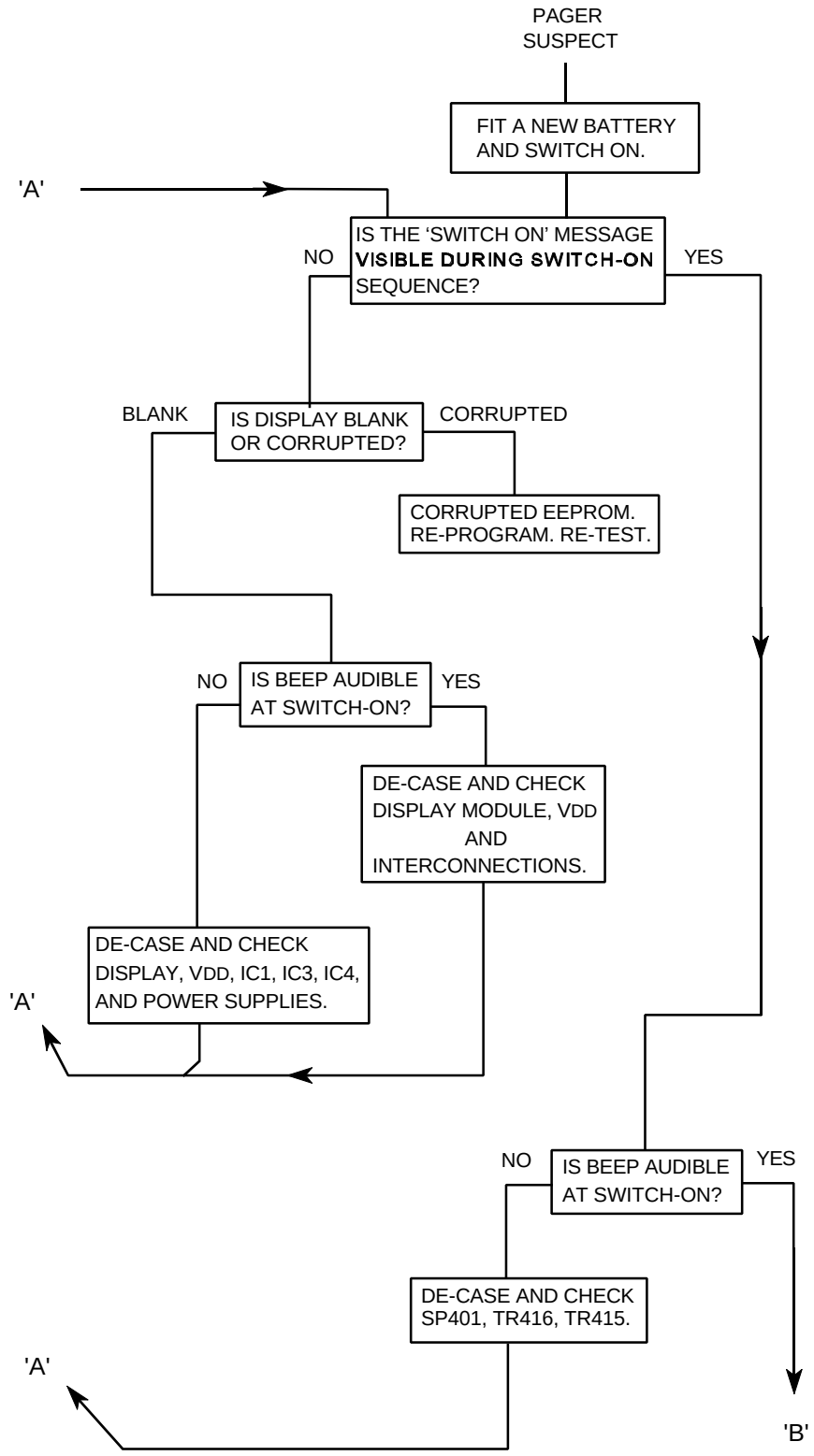
To check the Battery-Low circuit:

a) Connect the variable DC power supply to the unit and set the output to 0.9 volts.

b) Switch ON the unit. The unit should go through the normal ‘start-up’ procedure (beep and vibrate for one second and show the programmable switch-on message for three seconds). After approximately two minutes the low battery symbol will appear.

c) Switch OFF the unit but do not switch OFF or disconnect the variable DC power supply. Set the output of the variable DC power supply to 1.2 volts.

d) Switch ON the unit. Make sure that the unit goes through the normal ‘start-up’ procedure.



TAG11127-1

Figure 5.5: Fault Finding Guide (Sheet 1 of 3)

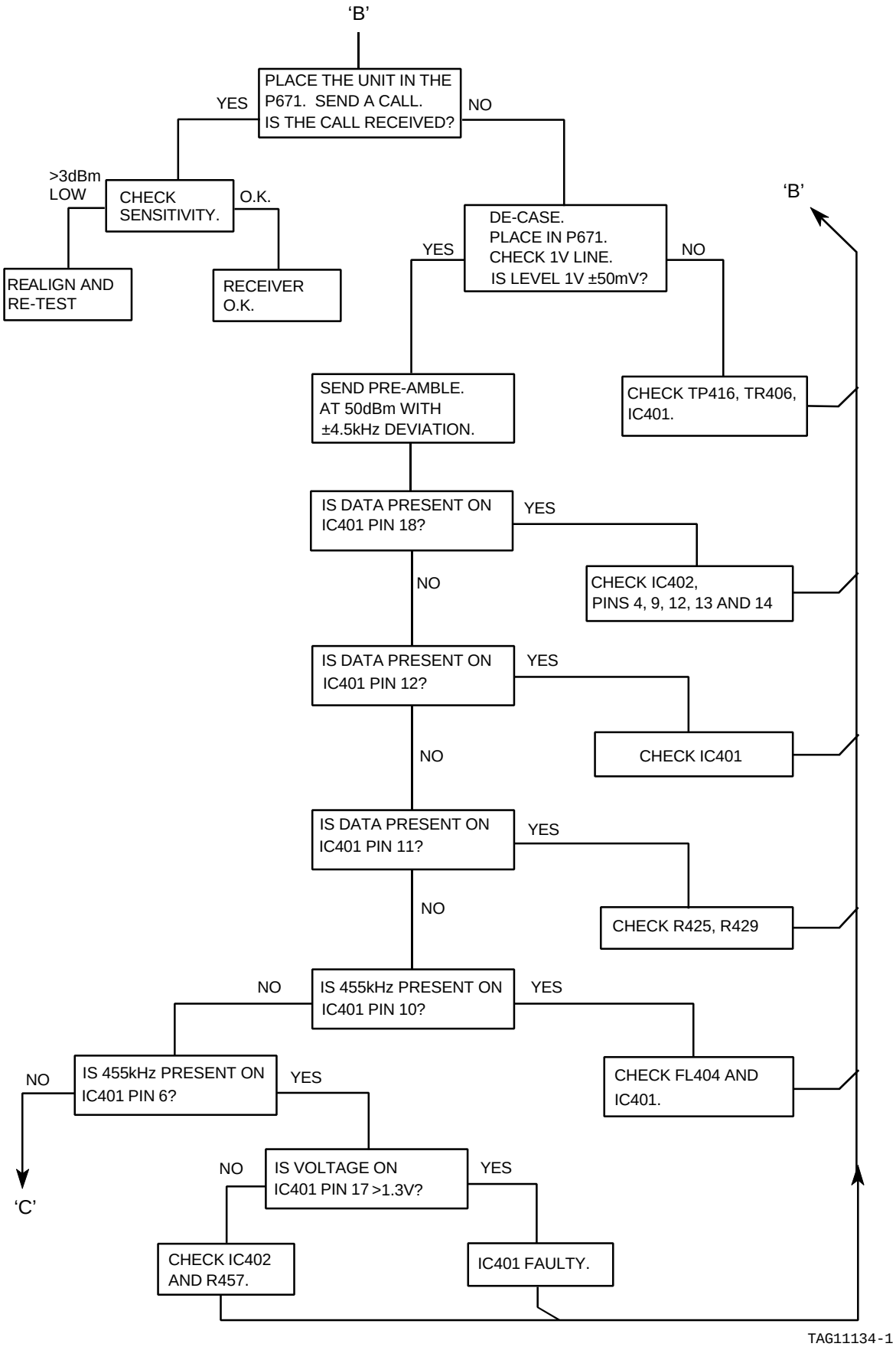
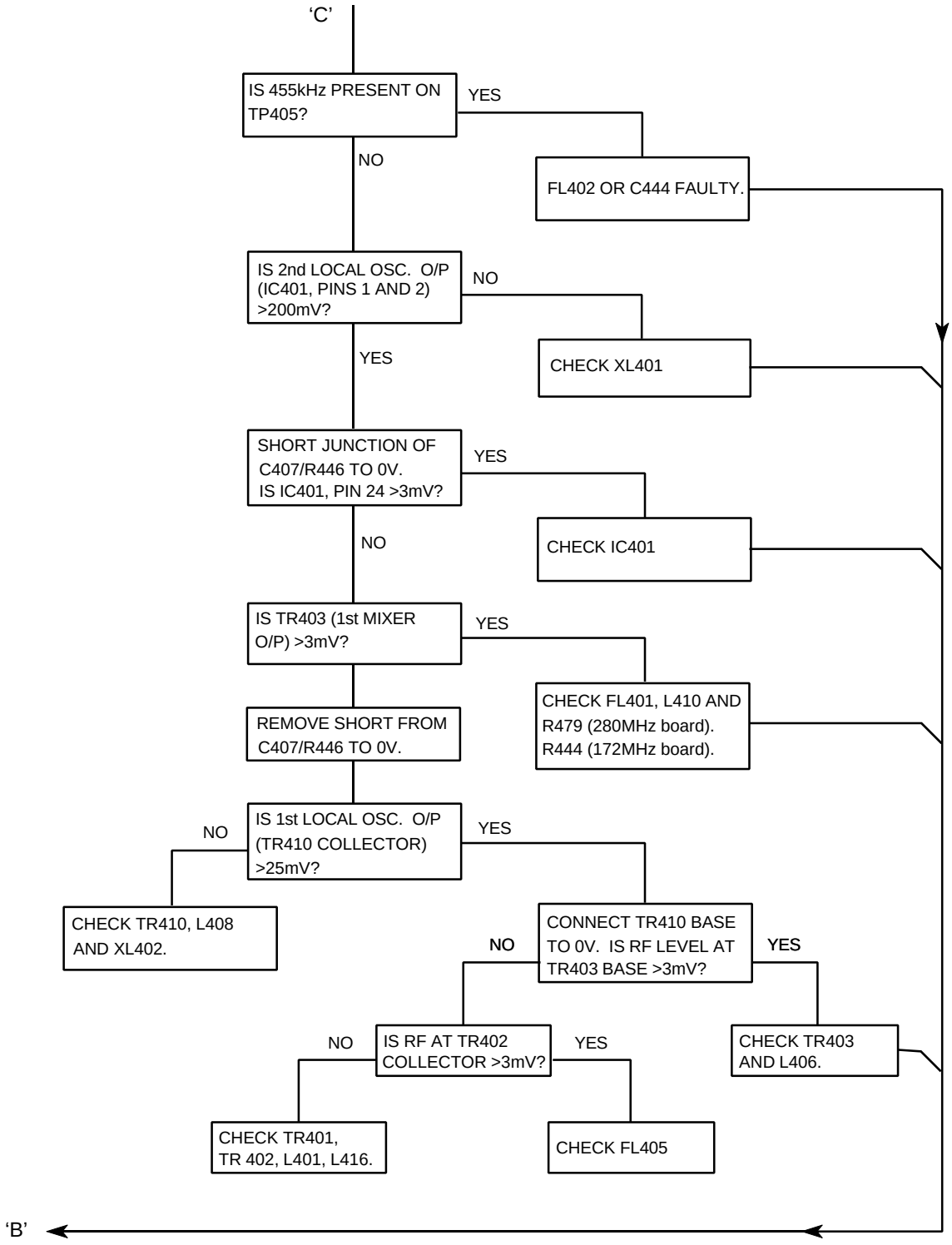


Figure 5.6: Fault Finding Guide (Sheet 2 of 3)



TAG11339-1

Figure 5.7: Fault Finding Guide (Sheet 3 of 3)

Table 5.1: Radio Board DC Voltage Levels

COMPONENT	COLLECTOR	BASE	EMITTER	COMMENTS
TR401	0.29	0.73	0	RF Amplifier
TR402	0.87	1.02	0.29	RF Amplifier
TR403	0.845	0.678	0	First Mixer
TR404	0.733	0.015	0	AGC Switch
TR406	1.018	0.791	1.4	1V Series Regulator
TR410	0.95	0.937	0.264	First Local Oscillator
TR415	1.4	-	0	Beep Enable
TR416	1.4	-	0	Transducer Driver

NOTE: *All radio board measurements were taken with the receiver turned on. The battery terminal voltage was 1.4 volts, the 1 volt line was 1.019 volts and battery economy was disabled. Voltages may vary by ±20mV.*

Table 5.2: Radio Board Test Points

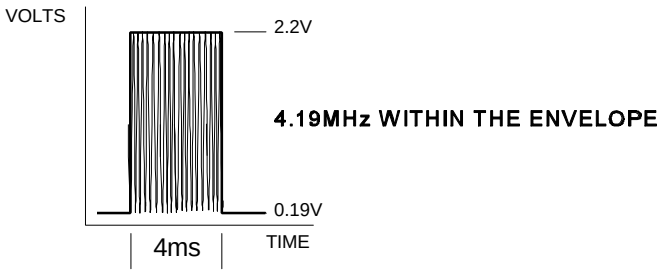
TEST POINT	DESCRIPTION	VOLTAGE / SIGNAL
401	SINAD Output	0.56Volts
402	Radio Supply	1Volt
403	RSSI (AGC)	0.060Volts
404	Radio Ground	0Volts
405	Second IF	455kHz
406	Radio Ground	0Volts
414	Radio Ground	0Volts
416	Battery +	1.4Volts
418	Radio Ground	0Volts

Table 5.3: Decoder Board DC Levels

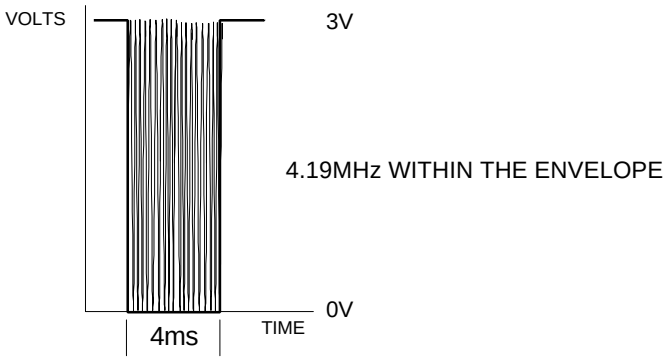
DEVICE	COLLECTOR	BASE	EMITTER	REMARKS
TR1	3.00	3.00	1.4	Battery Disconnect Monitor
TR2	-	3.00	1.4	Backlight Driver
TR3	1.4	-	-	Vibrate Enable
TR4	1.4	-	-	Vibrate Motor Drive
C5	0.19dc	2.2 V p-p 4ms wide		XL2 4.19MHz
R1/C4	3.00			
R35	1.49dc	3.0V p-p		CLKO 38.4kHz
IC402 pin9	1.49dc	3.0V p-p		XL403 38.4kHz (Radio Board)
IC5	3.00 (pin 1)	3.00 (pin 2)	0 (pin 3)	Reset
IC6	1.4 (pin 1)	3.00 (pin 2)	1.4 (pin 5)	VDD Supply

Table 5.4: Decoder Board Test Sequence

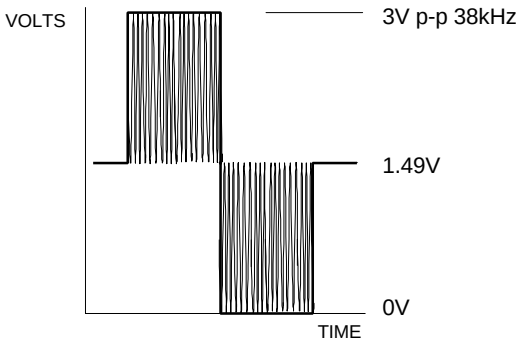
STEP	TEST POINT	REMARKS
1	R23	VDD
2	R35	38.4kHz POCSAG Clock
3	R1	4.19MHz Microprocessor Clock (every 500ms)



WAVEFORM AT C5



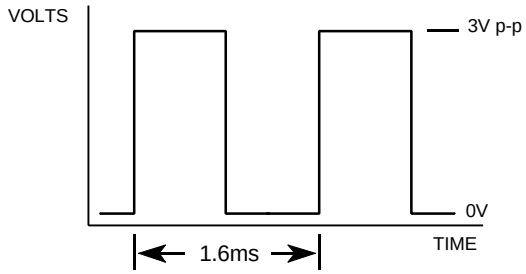
WAVEFORM AT R1/C4



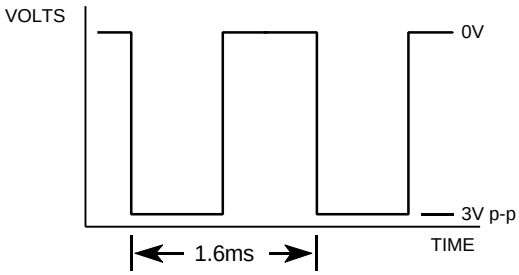
WAVEFORM AT R35 AND IC402, PIN9

TAG11333-1

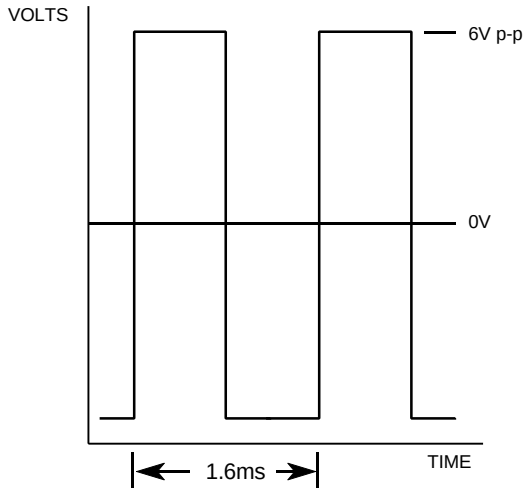
Figure 5.8: Decoder Board Waveforms



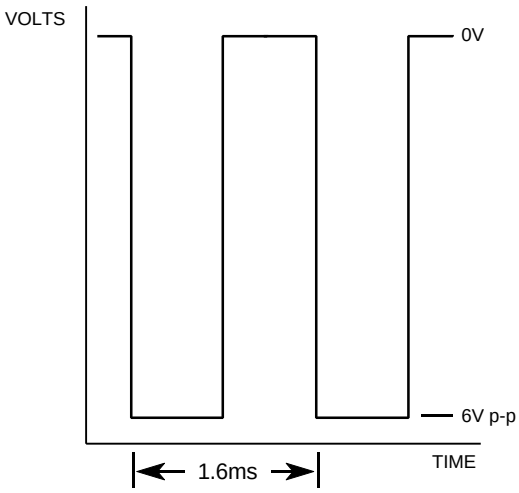
WAVEFORM AT PIN 38



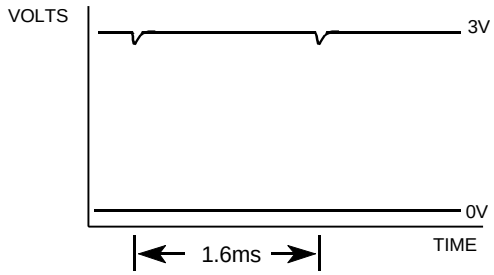
WAVEFORM AT PIN 39



WAVEFORM AT PIN 40



WAVEFORM AT PIN 41



WAVEFORM AT PIN 45

TAG11132-1

Figure 5.9: Display Module Waveforms

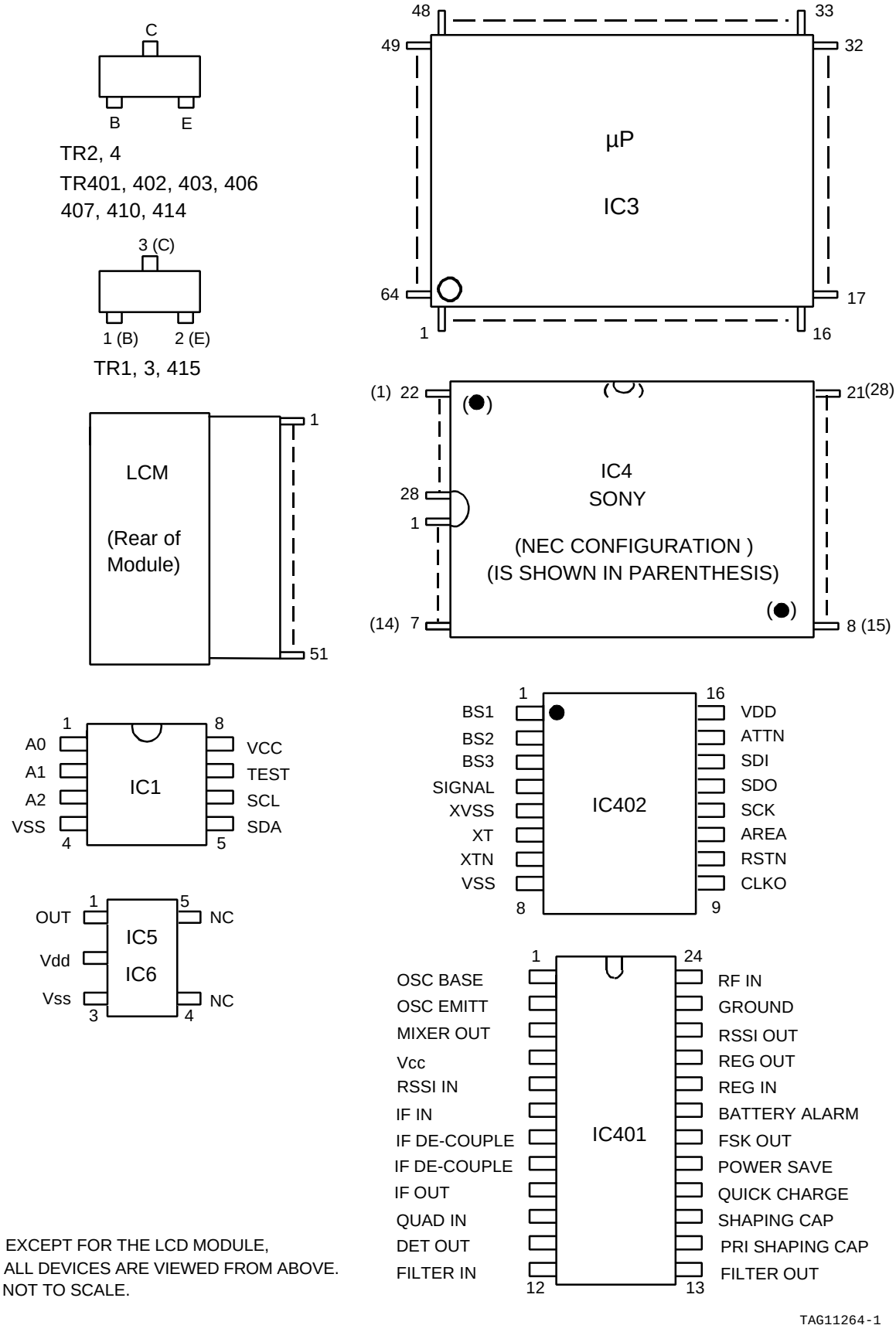


Figure 5.10: Semiconductor Connection Details

Table 5.5: IC3 Microprocessor Pin Connections

Pin Number	Pin Name	Description
1	P30	PGM - programming input
2	P31	BEEP - output signal
3	P32	ROM-CE - CGROM (IC2) chip enable
4	P33	RAM-CE - SRAM (IC4) chip enable
5	P34	LCD-CS - Display chip select
6	P35	µP (IC3) low current mode switch
7	P36	Vibrate Motor - output signal
8	P37	Lamp - output signal
9	VSS	Ground
10-12	P40-P42	SW1-SW3 - input signal
13,14,16,17	NC	Not Used
15	P45	µP (IC3) low current mode switch
18-23,25-34,38,39	P50-P57,P60-P67,P02,P03	Address lines AD00-AD17
24	VSS	Ground
35	RESET	µP reset - input signal
36	P00	AREA (No valid data) - input signal
37	P01	ATTN (Valid data) - input signal
40	VDD	VDD
41	X2	Xtal oscillator
42	X1	Xtal oscillator
43,46	VPP/IC,AVSS	Ground
44	NC	Not Used
45	P04/XT1	POCSAG clock - input signal
47-54	D00-D07	Data lines
55	AVDD	VDD
56	AVR	Ground
57	P20	SDO - Data input signal
58	P21	SDI - µP info. to POCSAG decoder
59	P22	SCK - Data transfer clock
60	$\overline{WR}$	Display and RAM - Read/write control
61	P24	LOWBAT - output signal
62,63,64	P25,P26,P27	Serial Data input from EEPROM (IC1)

Table 5.6: IC4 RAM Pin Connections

Pin Number	Pin Name	Description
1	A14	Address line AD14
2	A12	Address line AD12
3	A7	Address line AD07
4	A6	Address line AD06
5	A5	Address line AD05
6	A4	Address line AD04
7	A3	Address line AD03
8	A2	Address line AD02
9	A1	Address line AD01
10	A0	Address line AD00
11	D0	Data line D00
12	D1	Data line D01
13	D2	Data line D02
14	VSS	Ground
15	D3	Data line D03
16	D4	Data line D04
17	D5	Data line D05
18	D6	Data line D06
19	D7	Data line D07
20	CE	RAM-CE - chip enable input
21	A10	Address line AD10
22	OE	Ground
23	A11	Address line AD11
24	A9	Address line AD09
25	A8	Address line AD08
26	A13	Address line AD13
27	WE	$\overline{WR}$ - RAM read/write control
28	VDD	VDD

Table 5.7: LCD Display Pin Connections

Pin Number	Pin Name	Description
1	NC	Not Connected
2-6	V5-V1	LCD driver supply voltages
7	VDD	VDD
8	M/S	VDD
9	RESET	Reset - input signal
10	SCL	VDD
11	SI	VDD
12	P/S	VDD
13	CS1	LCD-CS - chip select
14	CS2	VDD
15	C86	Ground
16	A0	AD16 - display address input signal
17	$\overline{WR}$	$\overline{WR}$ - LCD write enable input signal
18	$\overline{RD}$	AD17 - read enable input signal
19	VSS	Ground
20-27	D0-D7	D00-D07 - Data lines
28-31	DYO, CLO, SYN, FR	Not Used
32	CL	Ground
33	OSC1	LCD Oscillator
34	OSC2	LCD Oscillator
35-37	T2, T1, VSS	Ground
38	CAP1+	DC/DC voltage converter capacitor 1
39	CAP1-	DC/DC voltage converter capacitor 1
40	CAP2+	DC/DC voltage converter capacitor 2
41	CAP2-	DC/DC voltage converter capacitor 2
42	VOUT	DC/DC voltage converter output
43	V5	LCD driver supply voltage
44	VR	Voltage adjustment terminal
45	VDD	VDD
46-50	V1-V5	LCD driver supply voltages
51	NC	Not Connected

5.8 RADIO ALIGNMENT PROCEDURE

5.8.1 Preparation

a) Remove the Board Assembly from the Case (see paragraph 5.5.2).

b) Install a 0 ohm resistor or a shorting link in the position for R456, to disable the BEC.

c) Disable the AGC circuit by connecting TP403 to 0 volts. Alternatively, lift R409.

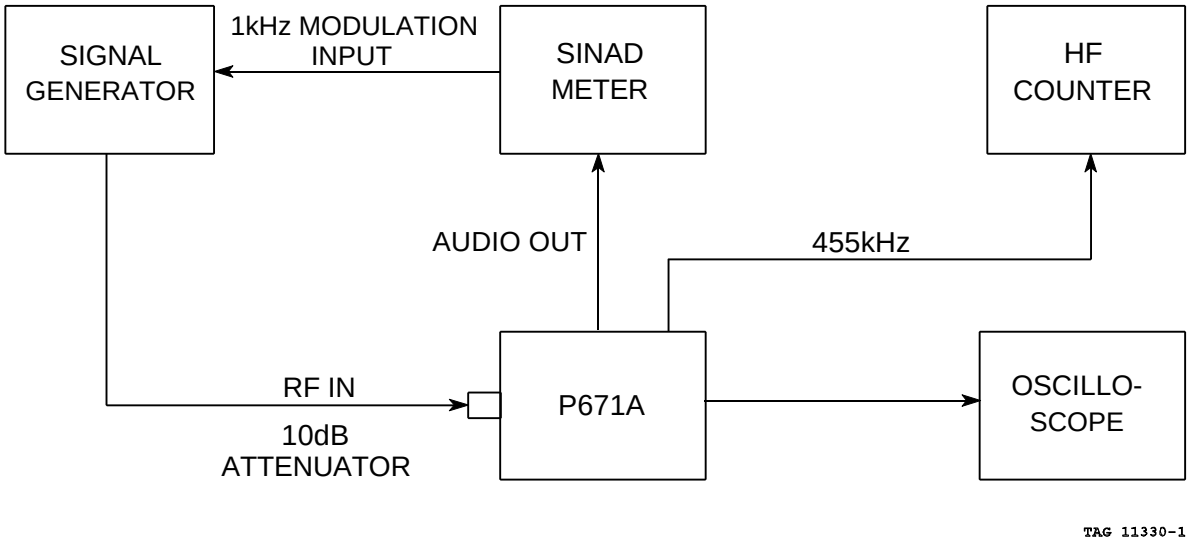


Figure 5.11: Radio Alignment Test Equipment

5.8.2 Alignment Procedure

a) Configure the test equipment as shown in Figure 5.11. Set the signal generator to the channel frequency with an output of -10dBm.

b) Put the Board Assembly in the tray of the P671A Alignment Jig and connect the frequency counter probe to TP405. Adjust CV405 to give a reading of 455kHz ±50Hz at the frequency counter.

c) Adjust CV406 for maximum amplitude of the 455kHz signal on the oscilloscope. A minimum of 500 millivolts should be achieved.

d) Remove the AGC disable and assemble the Board Assembly in the case. Remove the right hand label from the case back to expose the aerial trimmer.

e) Put a known good battery in the unit (but leave the battery door off). Put the unit in the P671A jig, fold the jig arm over the unit and lock the arm in position.

f) Connect the SINAD meter to the alignment pins on the P671A (refer to Figure 5.12)

g) Set the modulation of 1kHz to a deviation of 3 kHz and switch it ON. Adjust CV404 to give 12dB sinad with minimum RF input. A reading of -98dB should be achieved.

NOTE: ***Do not disturb the aerial*** *during the next operation*.

h) Carefully remove the Board Assembly from the case. Remove the BEC disable 0 ohm resistor or the shorting link from R456 position. Carefully assemble the Board Assembly in the case and put a new label on the case back to cover the aerial trimmer access hole.

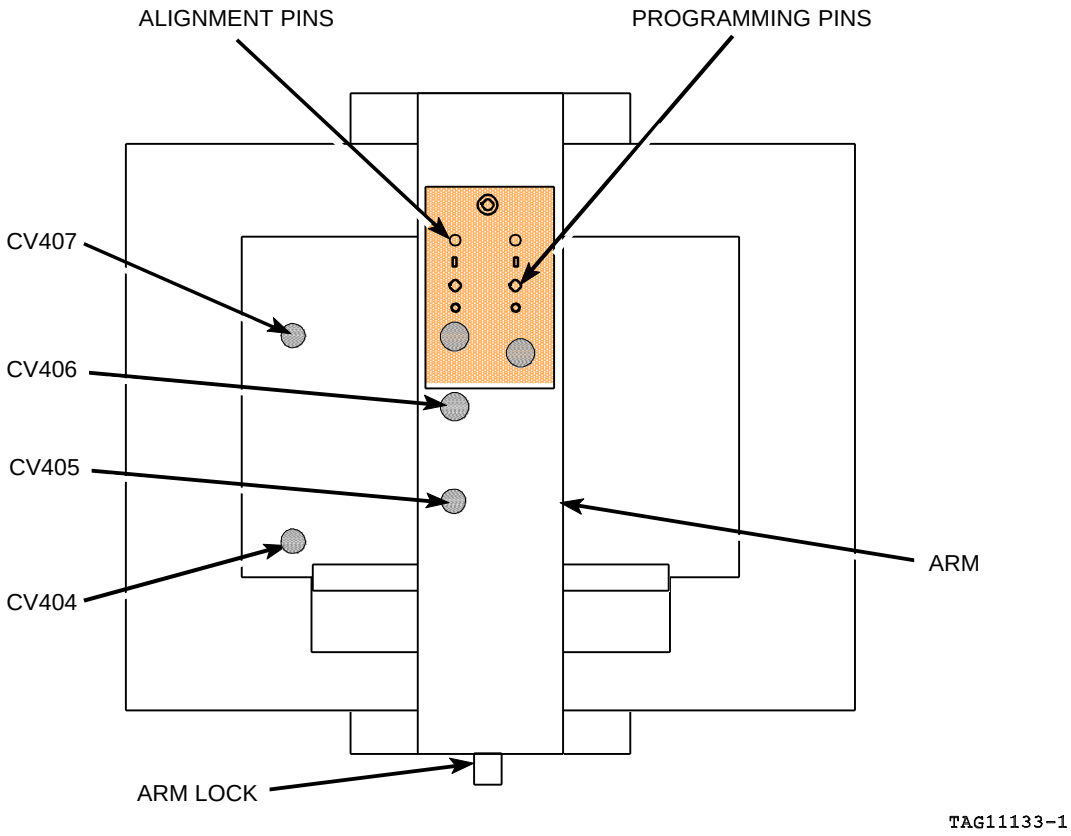


Figure 5.12: P671A Showing the Tuning Points

5.8.3 **Pager Sensitivity Measurement (Coarse)**

To determine the pager sensitivity, configure the test equipment as shown in Figure 5.13 and do the procedure given in sub-paragraphs a) through e).

NOTE: *This is only an indication of sensitivity,which is dependent on the unit under test being in a noise free environment.*

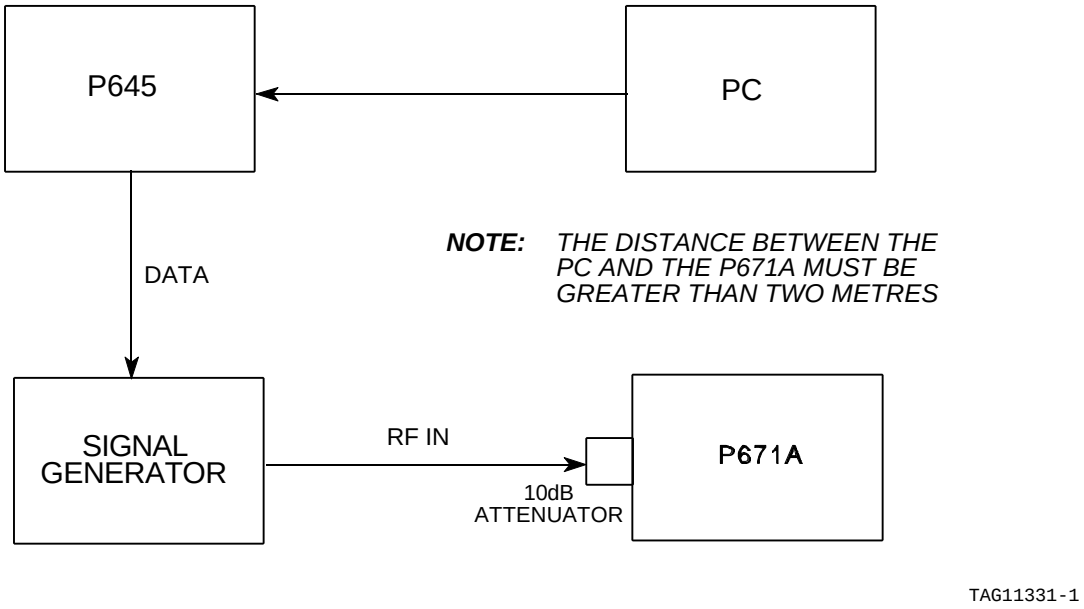


Figure 5.13: Configuration for Coarse Sensitivity Measurement

a) Set the signal generator to the channel frequency, at a deviation of 4.5kHz and an output level of -85dBm.

b) Install a known good battery in the pager and switch it ON.

c) Put the pager in the P671A and send a sensitivity call from the P645. Increase the signal generator output level, if necessary, to obtain a correctly received call.

d) Reduce the RF level in 1dB steps until the pager receives less than three calls in five.

e) Increase the RF level in 1dB steps until five consecutive calls are received. An output level of -98dBm should be acheived.

5.8.4 **Pager Sensitivity Measurement (Fine)**

Configure the equipment as described in paragraph 5.8.3 but connect a P800 TEM cell instead of the P671A. Follow the steps given in the TEM Cell Instructions for the IEC method. Place the pager in the polystyrene block (refer to Figure 5.14) positioned centrally in the TEM Cell, with the display facing the input end. A level of -103dBm or better should be achieved.

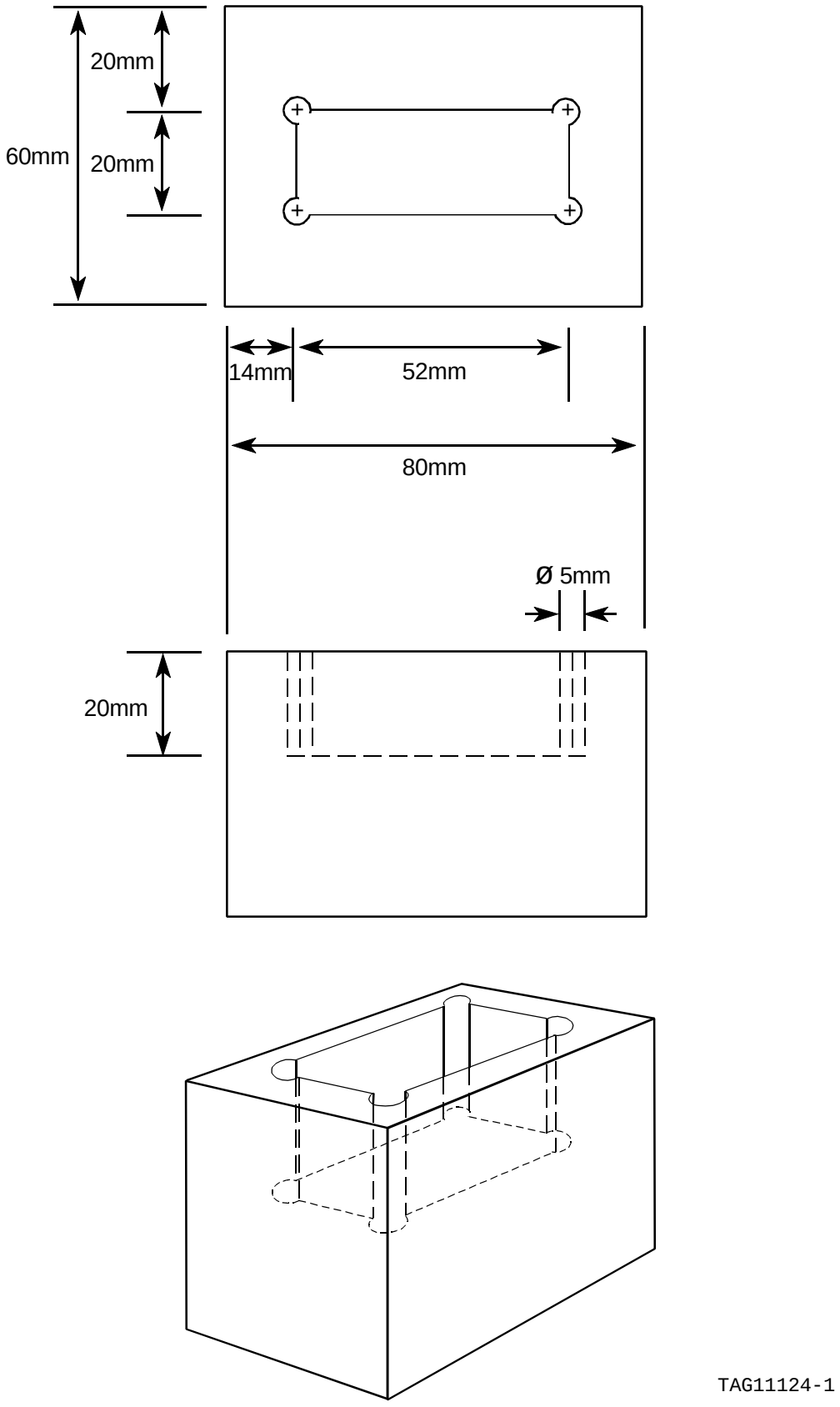


Figure 5.14: Polystyrene Block for TEM Cell Test - Dimensions

5.9 PROGRAMMING

5.9.1 General

The pager contains an EEPROM which holds unique data. The data may be altered as shown in the following paragraphs.

5.9.2 Equipment

The following equipment is required:

- P671A Alignment Jig
- P669H Programming Software
- Programming Cable
- IBM PC or equivalent

5.9.3 Procedure

Program the receiver as follows:

a) Remove the Battery Door from the Case Back.

b) Put the unit face down in the tray of the P671A, lower the arm over the unit and lock the arm in position.

c) Use the Progamming Cable to connect the programming pins of the P671A to the PC serial port. Refer to Figure 5.15 and connect the correct coloured wire to each programming pin.

d) Read the ‘Readme’ file contained in the relevant programming software. The ‘readme’ file describes how to use the programming facility.

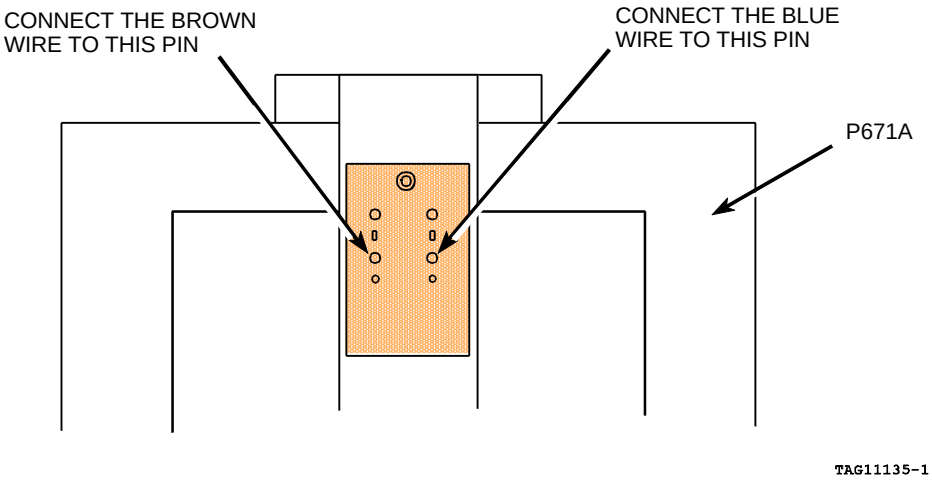


Figure 5.15: Programming Lead Connections

SECTION 6

SPARE PARTS LIST

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CAUTION

STATIC SENSITIVE DEVICES ARE USED IN THIS EQUIPMENT. CARE MUST BE TAKEN WHEN HANDLING THESE DEVICES AS THEY MAY BE DAMAGED BY HIGH LEVELS OF STATIC ELECTRICITY.

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART No.

6.1 FREQUENCY BAND INFORMATION

BAND 1	138.000	-	143.499 MHZ
BAND 2	143.500	-	148.999 MHZ
BAND 3	149.000	-	154.999 MHZ
BAND 4	155.000	-	160.999 MHZ
BAND 5	161.000	-	167.499 MHZ
BAND 6	167.500	-	174.100 MHz

6.2 ASSEMBLIES

6.2.1 Modules

DECODER ASSEMBLY	0201-0954

6.2.2 Case Parts and Battery

CASE FRONT, RESTYLE, BLACK	0301-0911
CASE FRONT, BLACK	0301-0922
CASE FRONT, SOFT BLACK	0801-0303
CASE FRONT, RESTYLE, BLUE	0301-0906
CASE FRONT, BLUE	0301-0917
CASE FRONT, SOFT BURG99	0801-0302
CASE FRONT, GREY, OMPT	0301-0923
WINDOW, MULTITONE, NEW LOGO	0961-5986
WINDOW, MULTITONE	0961-5014
WINDOW, VODAFONE	0961-5962
WINDOW, ZAP!	0961-5828
WINDOW, FLAIR	0961-5639
WINDOW, OMPT MOROCCO	0961-5529
WINDOW, SYSTEL	0961-5764
WINDOW, ENERGONET, TLA 852	0961-5611
WINDOW, ENERGONET, FLA 872	0961-5794
CASE BACK MOULDING, BLACK	0801-0150
CASE BACK MOULDING, BLUE	0801-0145
BATTERY DOOR MOULDING, BLACK	0801-0160
BATTERY DOOR MOULDING, BLUE	0801-0155
BUTTON TLA STYLE 2 BLK CHEV	0801-0186
HOLSTER, BLACK	0801-0277
HOLSTER, BLACK, VODAFONE	0801-0345
BATTERY ALKALINE "AAA"	5601-0006

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART No.

6.2.3 Miscellaneous

	BATTERY CONTACT +VE	7361-4862
	BATTERY CONTACT -VE SPRING	7361-4861
	LANYARD (ELASTICATED)	7961-5055
	GASKET, DISPLAY SEAL	2561-5007
	SPACER MOULDING RUBBER VHF	0861-5209
	SCREW 2.2mm x 6mm PAN HEAD, S/TAP	8216-2296

6.3 RADIO BOARD COMPONENTS

6.3.1 Capacitors

C403,410,412,414,472,473,484	CHIP 10n ±10% 50V	3327-0025
C404,406,453,481	CHIP 220p ±5% 50V	3326-0031
C407	CHIP 27p ±5% 50V	3326-0020
C408,485,495	CHIP 22p ±5% 50V	3326-0019
C418,423,425,444,450,452,469,	CHIP 100n ±10% 16V	3332-0014
C471,474,479,480	CHIP 100n ±10% 16V	3332-0014
C426	CHIP 33p ±5% 50V	3326-0021
C436,493,494,496	CHIP 22µ ±20% 4V	3412-0005
C448	CHIP 3n3 ±10% 50V	3327-0019
C449	CHIP 22n +80-20% 50V	3328-0009
C470	CHIP 1µ -20/+80% 16V	3301-0277
C483	CHIP 560p	3326-0036
C486	CHIP 68n	3332-0012
C490	CHIP 47µ ±20% 6.3V	3412-0110
C492	CHIP 4.7µ 6.3V	3412-0104
CV404,405,406,407	TRIMMER 10p, REAR ADJUSTMENT	3502-0018

6.3.2 Banded Capacitors

CCT REF	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6
C401,445	100p	100p	100p	100p	100p	100p
C405, 455, 466	12p	12p	10p	10p	6p8	6p8
C409	LINK	LINK	LINK	LINK	LINK	LINK
C432	3p9	3p9	3p9	3p9	3p9	3p9
C446	1p	1p	1p	1p	1p	1p
C465	4p7	4p7	4p7	4p7	4p7	4p7
C467	18p	15p	12p	10p	8p2	6p8

DESCRIPTION	PART No.	DESCRIPTION	PART No.
1p ±0.25% 50V	3326-0015	12p ±5% 50V	3326-0016
3p9 ±0.25p 50V	3326-0010	15p ±0p5 50V	3326-0017
4p7 ± 0p25 50V	3326-0011	18p ±0p5 50V	3326-0018
6p8 50V	3326-0013	100p ±5% 50V	3326-0027
8p2 50V	3326-0014		
10p ±0p5 50V	3326-0015	LINK (RES CHIP 0S)	3115-0001

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART No.

6.3.3 Crystal and Filters

FL401	CRYSTAL FILTER 21.4MHz	4001-0025
FL402, 403	CERAMIC FILTER, SMD, 10/12.5kHz	4018-0004
FL402, 403	CERAMIC FILTER, SMD, 20/25kHz	4018-0002
FL404	FILTER CHIP CDBC455CX25-TC	4003-0005
XL401	CRYSTAL 20.945MHz	3915-0017
XL402	CRYSTAL, GENERIC SPEC	3948-*
XL402	CRYSTAL, GENERIC SPEC	3950-*
XL403	MICRO CRYSTAL MX1V-TL 76.8 kHz	3922-0012

* QUOTE CHANNEL FREQUENCY TO SIX DECIMAL PLACES

6.3.4 Inductors

CCT REF	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6
L401	82n	82n	68n	68n	68n	56n
L406, 410	2µ2	2µ2	2µ2	2µ2	2µ2	2µ2
L407	100n	100n	100n	100n	100n	100n
L408	330n	330n	270n	270n	270n	270n
L409	560n	560n	470n	470n	390n	390n
L416	68n	68n	56n	56n	47n	47n
L417	47n	47n	39n	39n	33n	33n
L418	N/F	N/F	N/F	N/F	N/F	N/F

DESCRIPTION	PART No.		
2µ2 ±10%	4103-0233	68n ±10%	4117-0020
39n ±10%	4117-0017	82n ±10%	4117-0021
47n ±10%	4117-0018		
56n ±10%	4117-0019		

DESCRIPTION	PART No.
100n ±5%	4103-0254
270n ±5%	4103-0264
330n ±5%	4103-0266
390n ±5%	4103-0268
470n ±5%	4103-0270
560n ±5%	4103-0272

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART No.

6.3.5 Resistors

R5, 8, 472-478	CHIP 0S 62m5W	3115-0001
R401,403,439,470	CHIP 100S ±5% 62m5W	3115-0050
R402,405	CHIP 18k ±5% 62m5w	3115-0104
R404,438	CHIP 680S ±5% 62m5W	3115-0070
R406	CHIP 1k ±5% 62m5W	3115-0074
R408	CHIP 330S ±5% 62m5W	3115-0062
R410	CHIP 33S ±5% 62m5W	3115-0110
R412	CHIP 3k3 ±5% 62m5w	3115-0086
R416	CHIP 82k, 10/12.5kHz	3115-0120
R416	CHIP 39k ±5% 62m5, 20/25kHz	3115-0112
R420,455,457,471	CHIP 100k ±5% 62m5W	3115-0122
R425, 428, 429	CHIP 180k ±5% (512 BAUD)	3115-0128
R425, 428, 429	CHIP 82k (1200 BAUD)	3115-0120
R425, 428, 429	CHIP 39k ±5% (2400 BAUD)	3115-0112
R434,446	CHIP 15k ±5% 62m5W	3115-0102
R440	CHIP 220S ±5% 62m5W	3115-0058
R443	CHIP 5k6 ±5% 62m5W	3115-0092
R444	CHIP 2K7 ±5% 62m5W	3115-0084
R458,459	CHIP 10S ±5% 62m5W	3115-0026

6.3.6 Semiconductors

IC401	IC TK14590V	3825-0002
IC402	IC POCSAG DECODER	3820-0025
TR401,402,403,410	TRANSISTOR NE85619	3601-0013
TR406	TRANS PNP. BC808-40W	3602-0058
TR415	TRANS RN1305	3611-0002
TR416	TRANS 2SD1757KS	3602-0038

6.3.7 Miscellaneous

AE401	AERIAL, TOP, VHF	5561-5254
AE402	AERIAL, BOTTOM, VHF	5561-5255
PL401	HEADER 14-WAY	4332-0002
SP401	TRANSDUCER	5004-0007

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART No.

6.4 DECODER BOARD COMPONENTS

6.4.1 Capacitors

C3,6,8,10,14,19,20-25	CHIP 100n ±10% 16V	3332-0014
C4,5	CHIP 27p ±5% 50v	3326-0020
C9,11	CHIP 1n ±10% 50V	3327-0013
C12,15	CHIP 47µ ±20% 6V3	3412-0110
C13	CHIP 100p ±5% 50v	3326-0027
C17,18,26	CHIP 1µ -20/+80% 16V	3301-0277
C 28 (FLA)	CHIP 100n ±10% 16V	3332-0014
C 29 (FLA)	CHIP 180p ±5% 50V	3326-0030

6.4.2 Resistors

R1	CHIP 1k5 ±5% 62m5W	3115-0078
R2-5,18,19,29	CHIP 100k ±5% 62m5W	3115-0122
R6,7,17,26,27,30, 31,34-36	CHIP 10k ±5% 62m5W	3115-0098
R8	CHIP 47Ω ±5% 62m5W	3115-0042
R9	CHIP 1k ±5% 62m5W	3115-0074
R10	CHIP 18k ±5% 62m5w	3115-0104
R11,21,22	CHIP 470k ±2% 62m5W	3118-0138
R12,20	CHIP 150k ±2%	3118-0126
R13	CHIP 680k ±2%	3118-0142
R14,28	CHIP 1M ±2% 0603	3118-0146
R15,16	CHIP 220Ω ±5% 62m5W	3115-0058
R23,24,25,99,103	CHIP 100Ω ±5% 62m5W	3115-0050

6.4.3 Semiconductors

D1	DIODE, CHIP BAT 74	3710-0002
D4	DIODE RB715F	3710-0005
D2 (FLA)	DIODE, CHIP BAV 99	3703-0001
IC1	IC 512X8 EEPROM	3818-0006
IC2 (FLA)	IC SP4425 EL LAMP DRIVER	3818-0027
IC4	IC 32KX8 SRAM	3821-0009
IC5,6	IC VOLTAGE DETECTOR 2V0	6003-0011
TR1	CHIP TRANS DTC115TUA	3611-0004
TR2,6,7	TRANS PNP. BC808-40W	3602-0058
TR3	TRANS RN1305	3611-0002
TR4,5	TRANS 2SD1757KS	3602-0038
TR7 (FLA)	TRANS PNP BC808-40W	3601-0058

6.4.4 **Banded Component: IC3**

	TLA 852	**FLA 872**
STANDARD (LATIN)	0501-0224	0501-0211 (OTP) 3835-0017 (MASKED)
STANDARD (CYRILLIC)	3835-0012	0501-0212 (OTP) 3835-0018 (MASKED)
"ZAP!" (MASKED)	3835-0020	
Z-PAGE	0501-0228	
MOROCCO	0501-0198 (OTP) 3835-0010 (MASKED)	

6.4.5 **Miscellaneous**

ITEM/CIRCUIT REFERENCE	**DESCRIPTION**	**PART No.**
BAT2	CAPACITOR, POLYESTER, PAS621L-VL5	3331-0002
LP1,2	LAMP HE1-5VXXMA	5202-0007
SK1	HEADER DUAL ROW RECEPT14WAYSMD	4449-0002
SW1,2,3	SWITCH SMD KSR221G	4202-0026
T1	TOROID SERIES 5CT	5301-0001
L25	INDUCTOR 680FH 20%	4124-0018
XL1	CRYSTAL 4.194304MHz SMD	3915-0019
	DIFFUSER, DISPLAY	2361-5008
	DISPLAY LCD EMC-A0861-1(EPSON)	5206-0019
	LABEL DISPLAY BLANK TLA850	2061-5108
	MOULDING, LCD BEZEL (EPSON)	0861-4878
EL1	ELECTRO-LUMINESCENT PANEL	5261-6071
	MOTOR VIBRATE (WITH BRACKET)	6502-0007

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SECTION 7

DIAGRAMS

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7.10	Decoder Board With EL Display (FLA) Component Layout Side 2 (PCB 3061-5880 Iss. 1)	0261-5879 Iss. 1 Sht. 2	7-21/22

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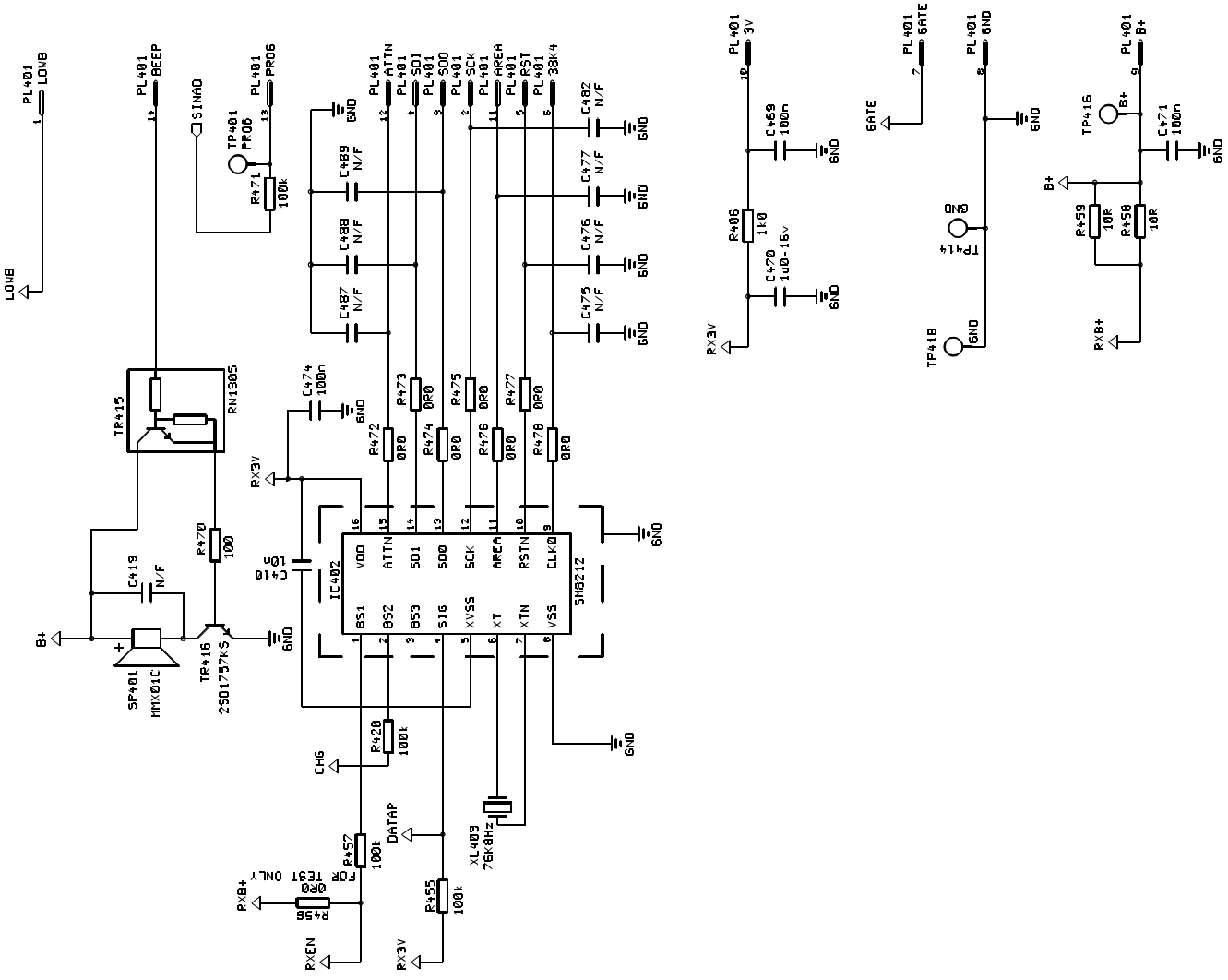

PL401 LOWB
PL401 BEEP
SINAD
TP401 PROG
PL401 PROG
R471 100k
LOWB
TR415
RN1305
C419 N/F
R470 100
SP401 MMX01C
TR416 2SD1757KS
B+
GND
C474 100n
C410 10n
IC402
VDD
BS1
BS2
BS3
SIG
XVSS
XT
XTN
VSS
ATTN
SDI
SDO
SCK
AREA
RSTN
CLKO
SM8212
RX3V
R472 0R0
R473 0R0
R474 0R0
R475 0R0
R476 0R0
R477 0R0
R478 0R0
C489 N/F
C488 N/F
C487 N/F
C482 N/F
C477 N/F
C476 N/F
C475 N/F
PL401 ATTN
PL401 SDI
PL401 SDO
PL401 SCK
PL401 AREA
PL401 RST
PL401 38K4
R420 100k
CHG
R452 100k
DATAP
R455 100k
R456 0R0 FOR TEST ONLY
RXB+
RXEN
RX3V
XL403 76.8MHz
PL401 3V
C469 100n
R406 1k0
C470 1u0-16V
PL401 GATE
GATE
TP414 GND
PL401 GND
TP418 GND
TP416 B+
PL401 B+
C471 100n
R459 10R
R458 10R
RXB+

Figure 7.2: Radio Board Circuit Diagram (Sheet 2 of 2)

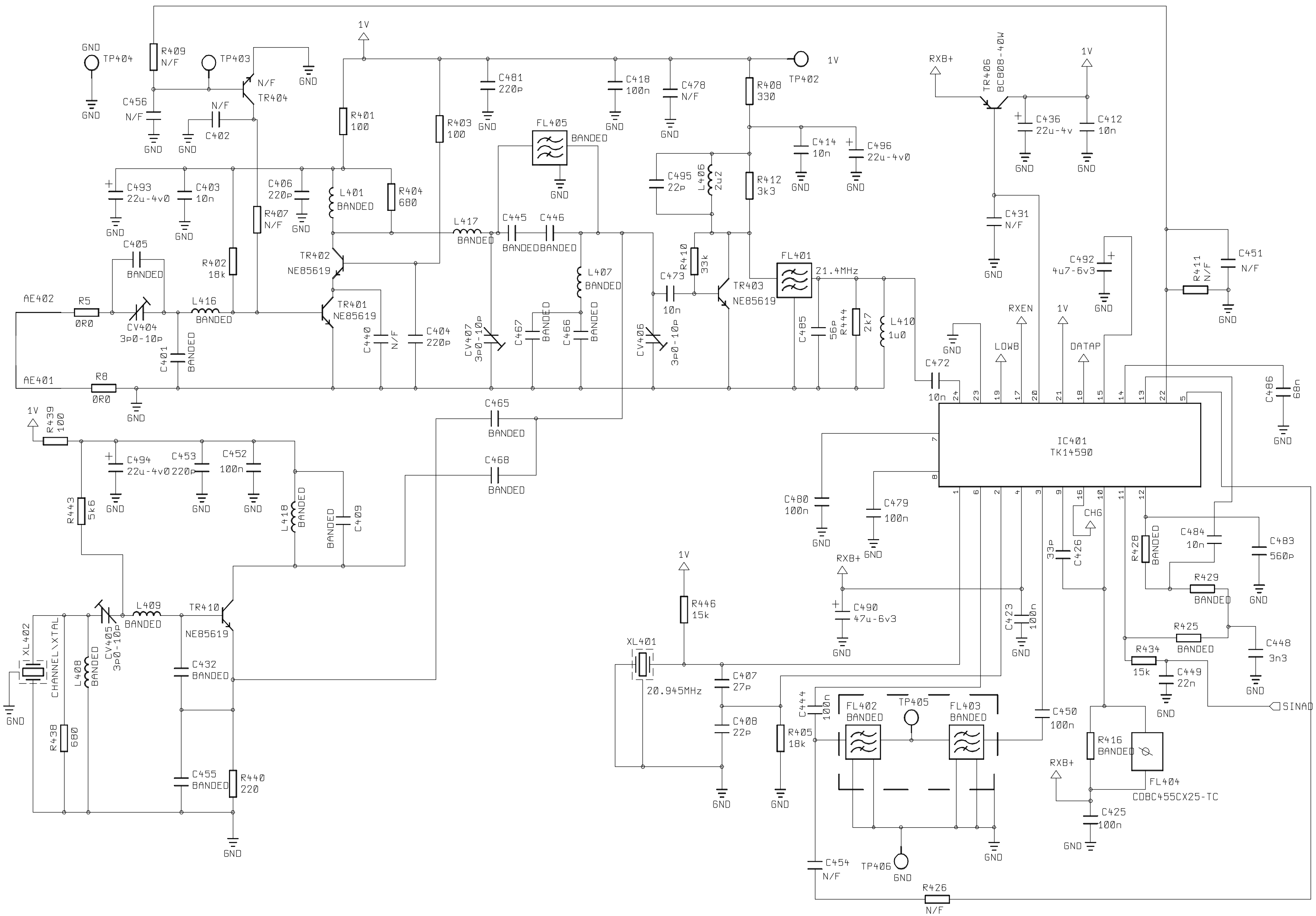
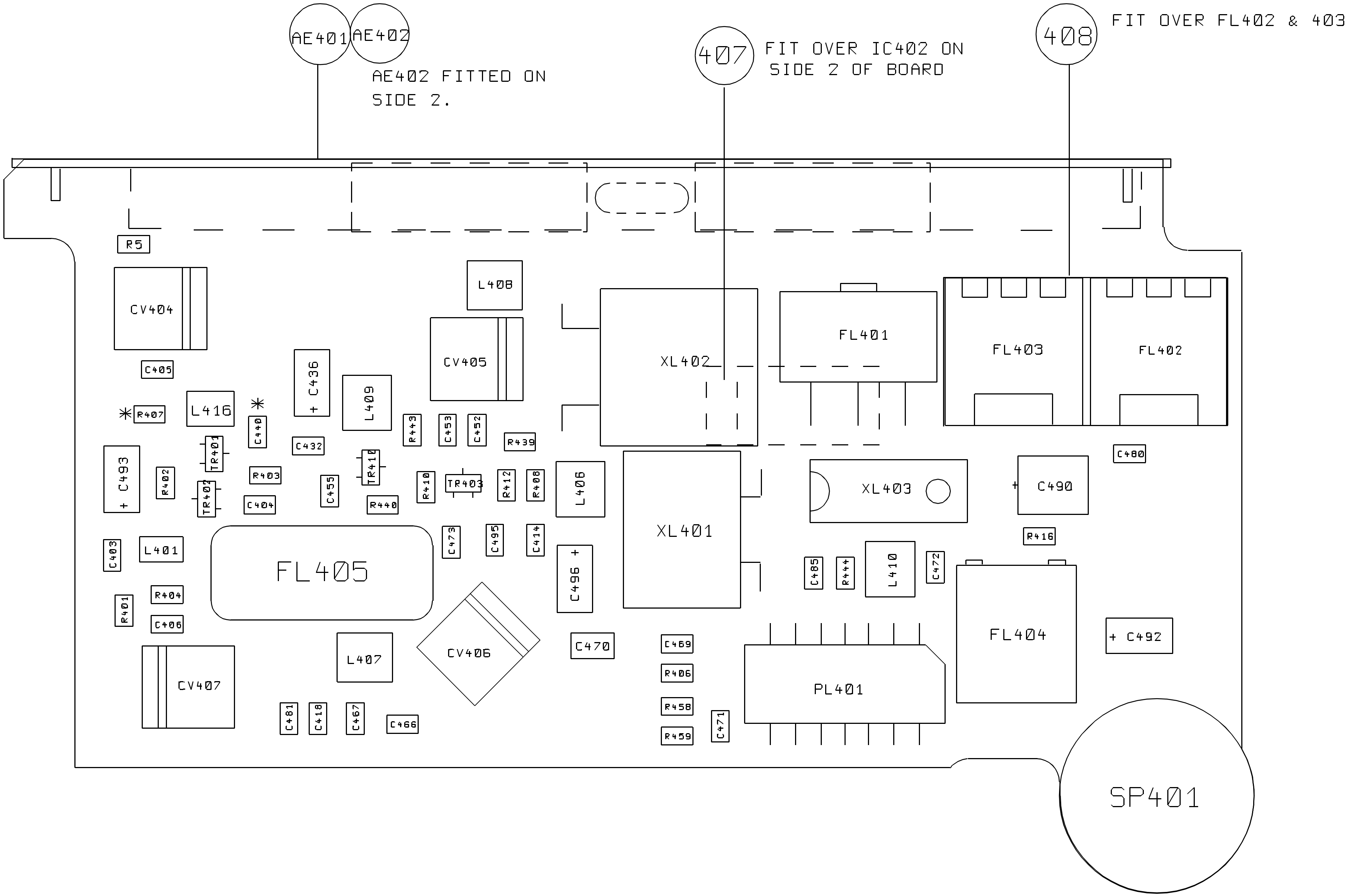
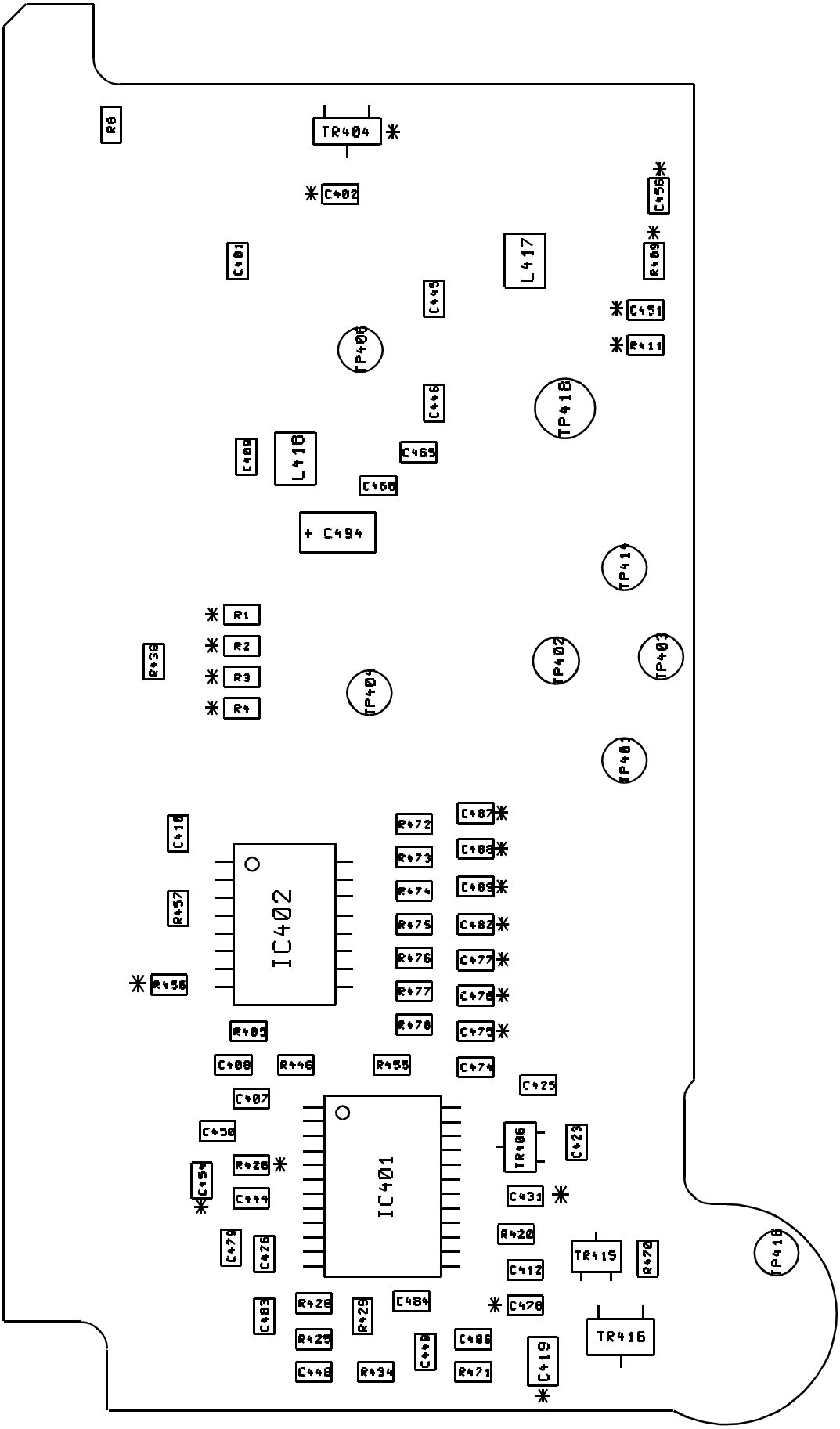
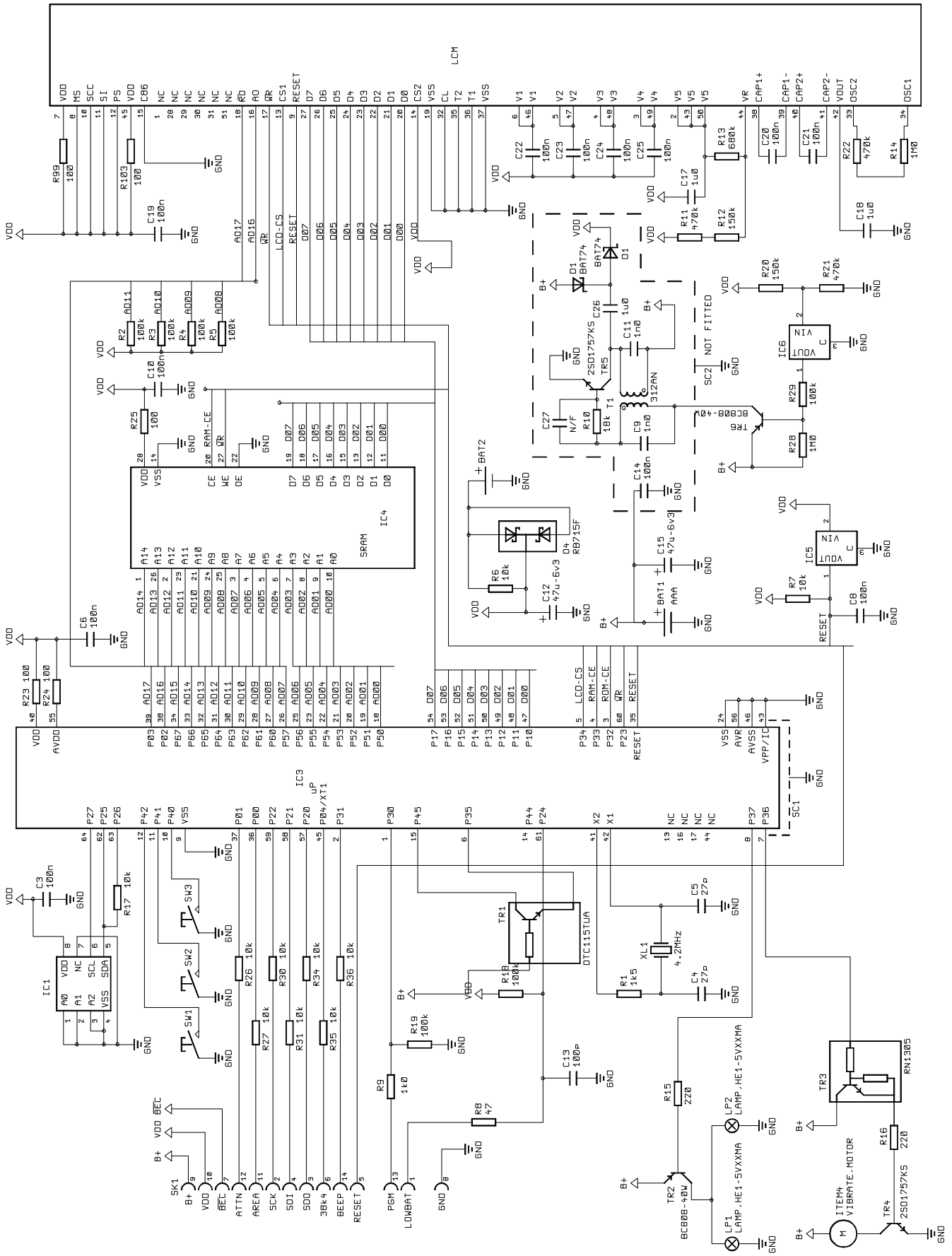
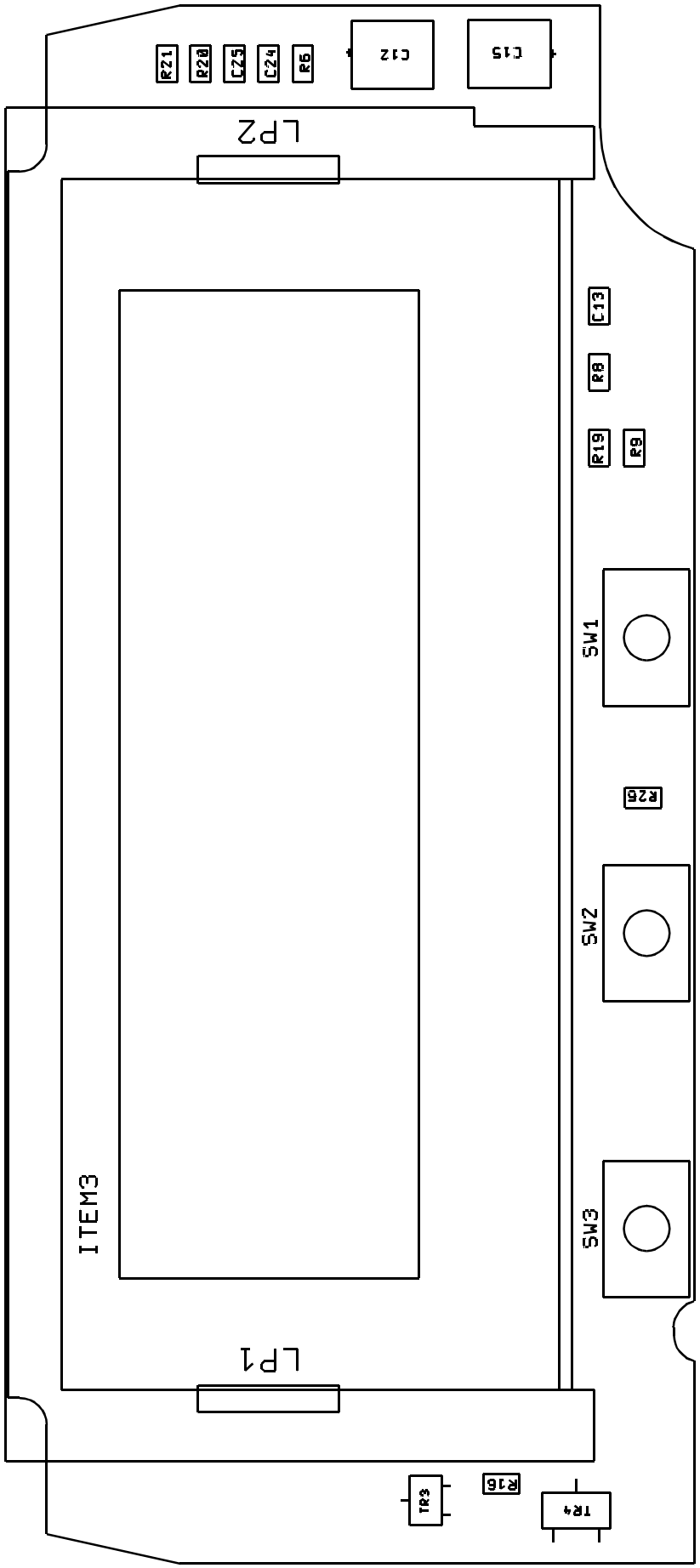


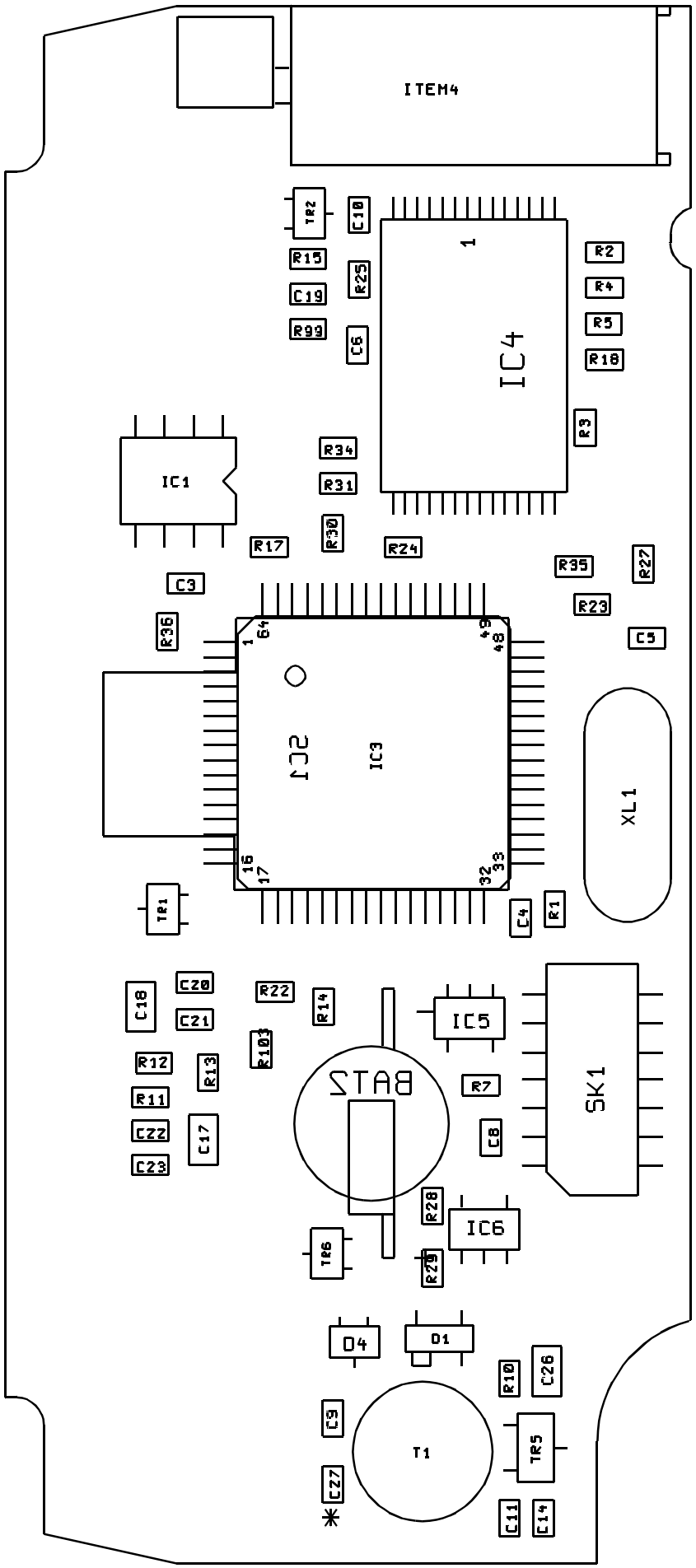
Figure 7.3: Radio Board Component Layout - Side 1




R8
TR404
C402
C401
L417
C456
R409
C451
R411
C445
TP406
C446
TP418
C409
L418
C465
C466
+ C494
TP414
R1
R2
R3
R4
R438
TP402
TP403
TP404
TP401
C410
R457
R456
IC402
R472
R473
R474
R475
R476
R477
R478
C487
C488
C489
C482
C477
C476
C475
R405
C408
R446
R455
C474
C425
C407
C456
R426
C434
C444
C479
C428
IC401
TR406
C423
C431
R420
C412
TR415
R470
TP416
C483
R428
R429
C484
C478
R425
C448
R434
C449
C486
R471
C419
TR416


LCM
IC4
SRAM
IC3
uP
IC1
IC5
IC6
SC1
SC2
NOT FITTED
LCD-CS
RESET
RAM-CE
ROM-CE
LAMP.HE1-5VXXMA
VIBRATE.MOTOR
BC808-40W
2SD1757KS
DTC115TUA
RN1305
BAT1
BAT2
VDD
GND
B+


R21
R20
C25
C24
R6
C12
C15
LP2
C13
R8
R19
R9
SW1
R26
SW2
ITEM3
SW3
LP1
TR3
R16
TR4


ITEM4
TR2
C10
R13
C19
R99
R25
C6
1
IC4
R2
R4
R5
R18
R3
IC1
R34
R31
R30
R17
R24
R35
R27
R23
C3
R36
C5
64
1
49
48
IC2
IC3
XL1
16
17
32
33
TR1
C4
R1
C20
C21
C18
R22
R14
R103
IC5
R12
R13
R11
C22
C23
C17
STA8
R7
C8
SK1
R28
IC6
TR6
R29
D4
D1
R10
C26
C9
T1
TR5
C27
C11
C14

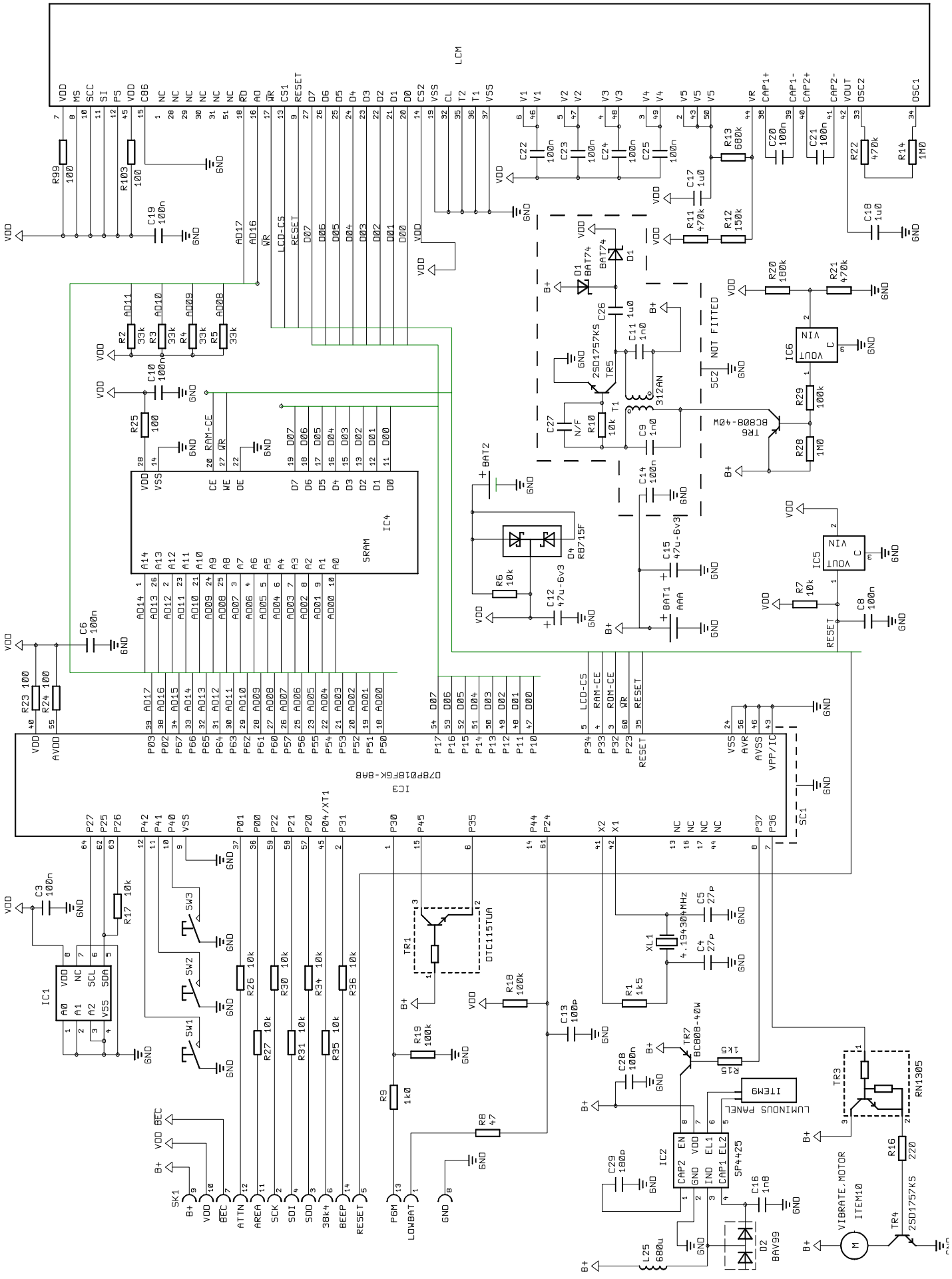

LCM
SRAM
IC4
IC3
D78P018FGK-8A8
IC1
IC2
IC5
IC6
SP4425
TR1
DTC115TUA
TR2
2SD1757KS
TR3
RN1305
TR4
2SD1757KS
TR5
2SD1757KS
TR6
BC808-40W
TR7
BC808-40W
D1
BAT74
D2
BAV99
D4
RB715F
BAT1
AAA
BAT2
XL1
4.194304MHz
T1
312AN
LUMINOUS PANEL
ITEM9
VIBRATE.MOTOR
ITEM10
SW1
SW2
SW3
SK1
NOT FITTED
VDD
GND
B+
RAM-CE
LCD-CS
RESET
ROM-CE
SCL
SDA
ATTN
AREA
SCK
SDI
SDO
3BK+
BEEP
PGM
LOWBAT

Figure 7.9: Decoder Board + EL Display (FLA)
Component Layout Side 1

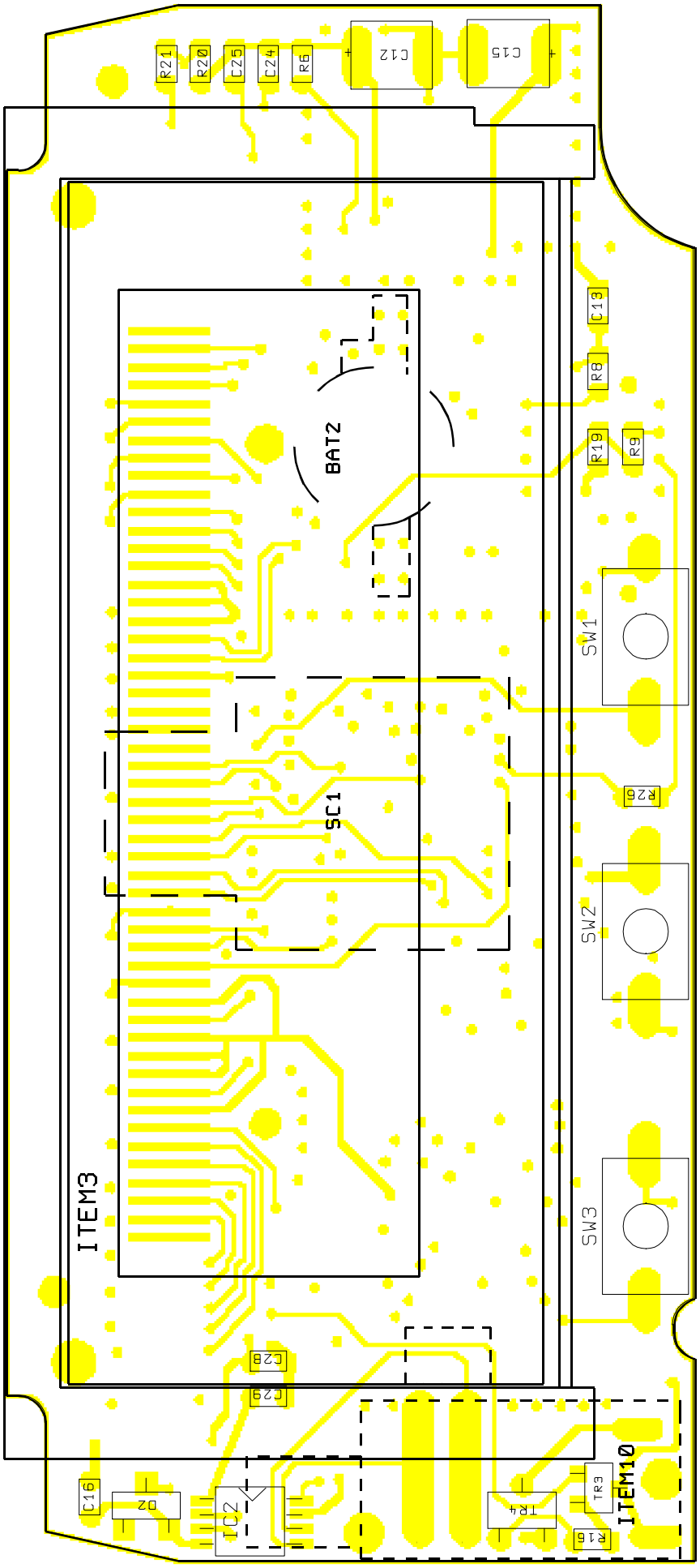


Figure 7.10: Decoder Board + EL Display (FLA)
Component Layout Side 2