



OPERATOR'S MANUAL

SCOUT

MODEL 555
Portable HF Transceiver

TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>PAGE</u>
TABLE OF CONTENTS	i
LIST OF ILLUSTRATIONS	ii
SPECIFICATIONS	iii
INTRODUCTION	iv
UNPACKING	v
 1. INSTALLATION	
1-1 POWER SUPPLY	1-1
1-2 ANTENNA	1-1
1-3 MICROPHONE	1-1
1-4 CW KEY	1-2
1-5 STATION GROUND	1-2
1-6 TEN-TEC ACCESSORIES FOR SCOUT	1-2
1-7 COMMERCIAL CONNECTORS AND ADAPTORS	1-3
1-8 INSTALLING OPTIONAL NOISE BLANKER MODEL 297	1-3
 2. OPERATING INSTRUCTIONS	
2-1 GETTING STARTED - INITIAL CONTROL SETTINGS	2-1
2-2 MAIN TUNING	2-1
2-3 FREQUENCY READOUT	2-1
2-4 BAND SELECTION	2-1
2-5 USING THE METER	2-1
2-6 GETTING ON THE AIR	2-2
2-7 SSB OPERATION	2-2
2-8 CW OPERATION	2-2
2-9 TRANSMIT POWER OUTPUT	2-2
2-10 FRONT PANEL CONTROLS	2-2
2-11 REAR PANEL CONNECTIONS AND CONTROLS	2-4
2-12 "RISC" MICROPROCESSOR AND "FLS" FREQUENCY LOCK SYSTEM	2-4
2-13 SHORTWAVE IMAGES AND I-F FEEDTHROUGH	2-5
 3. CIRCUIT DESCRIPTIONS AND ILLUSTRATIONS	
3-1 RECEIVER, CONTROL BOARD (81644)	3-1
3-2 I.F. AUDIO S/A (81646)	3-7
3-3 LLD/ALC (81707) 556, (81725) 555	3-11
3-4 50W PA S/A (81643)	3-15
3-5 PTO S/A (81647)	3-16
3-6 BAND MODULES (81679-81687)	3-17
3-7 LED DISPLAY BOARD (81651)	3-21
3-8 FREQUENCY COUNTER LOGIC BOARD (81650)	3-22
3-9 NOISE BLANKER (81697)	3-26

LIST OF ILLUSTRATIONS

<u>FIGURE</u>	<u>PAGE</u>
1-1 DC POWER CABLE CONNECTIONS	1-1
1-2 MICROPHONE CONNECTION	1-2
1-3 BUILT-IN ELECTRONIC KEYS CONNECTION	1-3
2-1 MODEL 555 FRONT AND MODULE VIEW	2-6
2-2 MODEL 555 TOP AND BOTTOM VIEW	2-7
3-1 RECEIVER CONTROL BOARD COMPONENT LAYOUT (81644)	3-3
3-2 RECEIVER CONTROL BOARD SCHEMATIC (81644)	3-4
3-3 NOTCH FILTER SCHEMATIC (81662)	3-6
3-4 VARIABLE BANDWIDTH FILTER SCHEMATIC (81532)	3-6
3-5 I.F. AUDIO COMPONENT LAYOUT (81646)	3-8
3-6 I.F. AUDIO SCHEMATIC (81646)	3-9
3-7 LLD/ALC COMPONENT LAYOUT (81707) 556, (81725) 555	3-12
3-8 LLD/ALC SCHEMATIC (81707) 556, (81725) 555	3-13
3-9 50W PA S/A COMPONENT LAYOUT (81643)	3-15
3-10 50W PA S/A SCHEMATIC (81643)	3-15
3-11 PTO S/A COMPONENT LAYOUT (81647)	3-16
3-12 PTO S/A SCHEMATIC (81647)	3-16
3-13 BAND MODULES (81679-87) & L.P. FILTER (81663-71) COMP.	3-17
3-14 L.O. MODULES SCHEMATIC (81679-85)	3-18
3-15 L.O. MODULES SCHEMATIC (81686-87)	3-19
3-16 L.P. FILTER SCHEMATIC (81663-71)	3-20
3-17 LED DISPLAY BOARD COMPONENT LAYOUT (81651)	3-21
3-18 LED DISPLAY BOARD SCHEMATIC (81651)	3-21
3-19 FREQUENCY COUNTER LOGIC BOARD COMP. LAYOUT (81650)	3-24
3-20 FREQUENCY COUNTER LOGIC BOARD SCHEMATIC (81650)	3-25
3-21 NOISE BLANKER COMPONENT LAYOUT (81697)	3-26
3-22 NOISE BLANKER SCHEMATIC (81697)	3-27
3-23 MAIN WIRING DIAGRAM FOR MODEL 555	3-28

MODEL 555 SPECIFICATIONS

GENERAL

Modes	CW, LSB, USB (Normal sideband for the band in use)
Frequency Range	All ham bands 160 through 10 meters (28.0-29.0 MHz) available through plug-in modules. Overshoot at upper and lower band edges.
Display	4 digit to 100 Hz resolution, .56" LED
Frequency Control	Permeability tuned oscillator (PTO) mixed with a crystal oscillator for each band.
Offset Tuning	+/- 1 kHz nominal - receive
Frequency Accuracy	+/- 100 Hz @ 25 deg. C.
Antenna	50 ohms unbalanced.
Power Required	@ 12-14 VDC; 600 ma receive, 10A transmit @ 50 watts out, 4.5 A @ 5 watts out.
Construction	G10 epoxy glass boards, most field replaceable. Molded plastic front panel, aluminum chassis, steel top and bottom.
Dimensions	HWD 2.5" x 7.25" x 9.75" - 6.4 x 18.4 x 24.8 cm
Weight	5 lbs, 3 oz. (2.4 kg) (without module)

TRANSMITTER

RF Output	50 watts, factory set. ALC controlled. Internal adjustment 5-50 watts. Nominal 15 watts in TUNE position.
DC Input	125 watts maximum @ 14 volts. SSB and CW duty cycle only.
Microphone Input	200 to 100K ohms, accepts microphones with 5 mv (-62db) output. Polarizing voltage provided for electrets.
T/R Switching	PTT on SSB, QSK on CW
Iambic Keyer	Adjustable 5 - 50 WPM. Curtis type B, 15% fixed weighting. (See section 2-7 for explanation of type B)
CW Offset	750 Hz
Metering	SWR or FWD power, rear panel switched.
SSB Generation	Balanced modulator, 9 pole crystal filter.
Carrier Suppression	-45 dB typical

UNWANTED SIDEBAND	-45 dB typical at 1.5 kHz tone.
THIRD ORDER INTERMOD	30 dB below two tone @ 50 watts PEP.

RECEIVER

SENSITIVITY	.35 uV typical for 10 dB @ 2.5 kHz bandwidth.
SELECTIVITY	"Jones" 9 pole crystal filter, front panel adjustable, 500 Hz to 2.5 kHz. Patent #5051711.
DYNAMIC RANGE	85 dB @ 2.5 kHz bandwidth at 20 kHz spacing.
THIRD ORDER INTERCEPT	+1 dBm
NOISE FLOOR	-126 dBm typical
S-METER	Calibrated for 50 uV at S9
I-F FREQUENCY	6.144 MHz
NOISE BLANKER	Optional plug-in board
AUDIO	1 watt @ 4 ohms with less than 2% distortion.
SPEAKER	3 inch

INTRODUCTION

SCOUT, Model 555, is a combination of modern microprocessor technology and simple, dependable circuitry to produce an inexpensive amateur transceiver. Single conversion architecture for the transmitter and receiver, mono-band operation with plug-in modules for band change, and a minimum of controls increase dependability and lower cost. A large LED display is used for ease of viewing the operating frequency. An illuminated meter indicates receive signal strength, power output and SWR.

Plug-in band modules are available to cover all amateur bands from 160 meters through 10 meters. Front panel controls are AF gain, IF bandwidth, MIC gain and RIT. Main tuning is accomplished with a VFO covering 2.2 - 2.7 MHz. Optional noise blanker, mobile mount, AC power supplies and other accessories are available as listed in Section 1-6.

UNPACKING

Examine your SCOUT for signs of shipping damage. Should any damage be apparent, notify the delivering carrier immediately, stating the full extent of the damage.

Retain all damaged cartons. Liability for shipping damage rests with the carrier. It is recommended you keep the shipping carton and fillers in the event that storage, moving, or reshipment becomes necessary.

The following hardware and accessories are packed with your transceiver. Make sure that you have not overlooked anything.

1 -#35263	1/8" Stereo plug for iambic keyer paddles or key
1 -#38040	.050" Allen Wrench
1 -#86067	Cable w/12 Amp In-Line Fuse
1 -#74020	Warranty Card
1 -#74237	Operator's Manual
1 -#35057	MIC Connector
1 -#74247	SCOUT Q/A

If any of the previous items are missing, contact TEN-TEC for replacements:

Repair Department.....	423-428-0364
Switchboard.....	423-453-7172
FAX.....	423-428-4483

CHAPTER 1

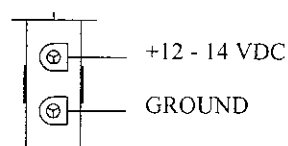
INSTALLATION

1-1 POWERSUPPLY SCOUT is designed for a 12-14V dc, negative ground system. Since neither over voltage nor over current protection are incorporated in the transceiver, care should be taken in selecting the power source. The source should be capable of supplying 10 to 12 amperes for SCOUT.

A pre-assembled DC power cord is provided in the packing kit. The cord includes a 12 amp fuse in-line.

If your installation requires use of a different power cord than the one supplied it is essential that an in-line fuse be included. This is the only fuse protection for the SCOUT.

When preparing your own power cord, terminate as shown in Figure 1-1.



REAR VIEW OF TRANSCEIVER

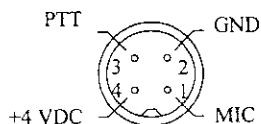
FIGURE 1-1
DC POWER
CABLE CONNECTIONS

NOTE: ALWAYS ENABLE THE POWER SOURCE FIRST AND THEN THE TRANSCEIVER.

IF THE SYSTEM IS SUPPORTED BY A GENERATOR OR ALTERNATOR, ALWAYS START THE RECHARGING DEVICE BEFORE TURNING ON THE TRANSCEIVER. THIS ALLOWS THE VOLTAGE TO STABILIZE. WHEN SHUTTING DOWN, TURN THE TRANSCEIVER OFF FIRST. SERIOUS DAMAGE TO THE TRANSCEIVER CAN OCCUR IF THIS SEQUENCE IS NOT FOLLOWED.

1-2 ANTENNA The transmitter is protected from instantaneous damage from load impedances ranging from a dead short to an open circuit. This does not mean that the equipment should be operated for a lengthy time into these impedances, just that no damage will occur if it is inadvertently operated into an open or short circuit. Operation at, or near, full power is allowed with an unbalanced (coax fed) load impedance of 25 to 100 ohms or an SWR up to 2:1. Antennas with higher SWR, or single wire and balanced feed-line types, will require the use of an external tuner for best results.

1-3 MICROPHONE Any TEN-TEC microphone, using our 4 pin connector, may be used without modification. Any dynamic, ceramic, crystal or electret type microphone with an impedance of 200 to 100,000 ohms may be used. Electret types, and others with built-in preamplifiers, require dc voltage. This is available at the MIC input connector, as shown in Figure 1.2.



FRONT VIEW OF 555

FIGURE 1-2 MICROPHONE CONNECTION

The microphone cable must be shielded to prevent RF feedback. A connector is supplied in the packing kit.

1-4 CW KEY Any external keyer that provides a closure to ground (with a key line that rests at a positive voltage) will work satisfactorily. An external keyer or straight key may be connected to the rear panel 1/8" KEY jack. There is also a built-in iambic keyer, with a fixed weighting of 15%, and adjustable speed over the range of 5 to 50 WPM. Any paddle type designed for use with an electronic keyer may be used. Connection is through a standard 1/8" stereo headphone plug (in packing kit). This plugs into the rear panel KEY PADDLES as shown in Figure 1-3.

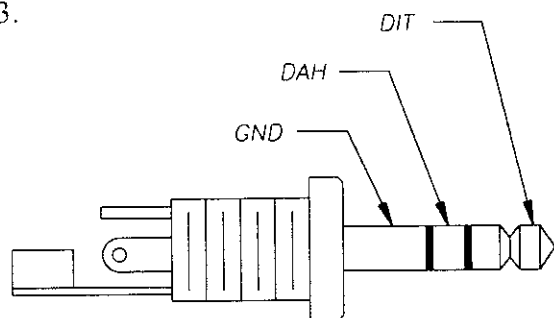


FIGURE 1-3
BUILT-IN ELECTRONIC KEYER
CONNECTION

1-5 STATION GROUND A good ground system is essential for optimum operation of any transmitter. The best practical system is to bond all station equipment together and make a single point connection to a buried eight foot ground rod. Use a heavy flat braid conductor, as short as possible. If you are not using a linear amplifier, a less ideal ground may suffice. Grounding to the copper cold water supply line is usually acceptable.

Antenna type and proximity to the station is also a factor. If the antenna is reasonably positioned, away from the station, the electrical supply ground system may be adequate. Suspect your station ground system if experiencing RFI problems.

1-6 TEN-TEC ACCESSORIES FOR SCOUT

- 801--- 160 meter plug-in band module
- 802--- 80 meter plug-in band module
- 803--- 40 meter plug-in band module
- 804--- 30 meter plug-in band module
- 805--- 20 meter plug-in band module
- 806--- 17 meter plug-in band module
- 807--- 15 meter plug-in band module
- 808--- 12 meter plug-in band module
- 809--- 10 meter plug-in band module
(28.0 - 29.0 MHz)
- 239--- Dummy Load
- 291--- 200 watt antenna tuner
- 296--- Mobile Mount
- 297--- Noise Blanker
- 607--- Weighted key paddle
- 701--- Handheld Mike, Electret with coiled cord and 4 pin connector
- 705--- Desk Mike, Electret with coiled cord and 4 pin connector
- 937--- Power Supply - Matches SCOUT, 115 VAC input; 13.8 VDC, 11A out @ 50% duty, 7A continuous.
- 35057 4 pin mike connector
- 80-573 Spare, 2 pin DC connector
- 306--- Adapts 4 pin TEN-TEC power supplies to 2 pin for SCOUT.

1-7 COMMERCIAL CONNECTORS AND ADAPTORS

The following items available from a local Radio Shack store may also be helpful when connecting accessories to the SCOUT.

<u>RS #</u>	<u>Description</u>
274-284	3 conductor (stereo) 1/8" (3.5mm) phone plug (KEY PADDLES)
274-286	2 conductor (mono) 1/8" (3.5 mm) phone plug (KEY)
274-1569	DC power connector 5.5mm OD x 2.1 mm ID (AUX 13.5v)
274-330	Adaptor plugs into 1/8" mono, accepts PHONO plug (use of older TEN-TEC keyers)
274-366	Adaptor plugs into 1/8" stereo, accepts 1/4" stereo plug (use your present key paddles without changing connector)

1-8 INSTALLING OPTIONAL NOISE

BLANKER MODEL 297 Remove the two (2) screws on the left side and two (2) screws on the right side of the transceiver. The top and bottom covers are now loose and may be removed.

Set the rig with front panel facing you. Locate the large open space on the right rear corner of the circuit board. Mount the noise blanker to the three (3) threaded standoffs using screws provided in the blanker packing kit.

Plug one end of coax cable #18 into socket #18 on the blanker and the other end into coax socket #18 located at the left rear edge of the large circuit board. The socket is directly in front of the meter switch on the rear panel.

Plug one end of cable #8 into socket #8 on the blanker. Plug the other end into socket #8 also located near the rear edge of the large circuit board.

Plug one end of cable #42 into socket #42 on the blanker. Route the other end of cable to the opposite side of the transceiver at a convenient place along the rear edge of the large circuit board. Turn the rig over. Plug this end into socket #42 on the large circuit board on this side of rig.

CHAPTER 2

OPERATING INSTRUCTIONS

2-1 GETTING STARTED - INITIAL CONTROL SETTINGS

AF GAIN-----9 o'clock
IF BW-----Full Clockwise
MIC gain-----9 o'clock
RIT-----12 o'clock
FWD/SWR (on rear panel)-----SWR
TUNE/OFF/N.B.-----OFF
SPEED/OFF/RIT-----OFF
ON/OFF-----ON

2-2 MAIN TUNING You will notice the main tuning knob requires a slight effort to rotate as you tune up and down the band. This is normal as it turns a variable inductor reminiscent of earlier radio designs. This is a permeability tuned oscillator, or PTO for short. This PTO has a modern addition called "FLS", frequency lock system. FLS automatically compensates for PTO drift. The system is described in greater detail in SECTION 2-12 for the interested reader.

2-3 FREQUENCY READOUT The four digit LED readout displays the actual frequency of the received signal (minus the MHz digit). The MHz digit is printed on each individual plug-in band module and indicates the band in use. Exercise caution when transmitting CW near a band edge. The actual transmitted signal is 750 Hz below the displayed frequency on 160, 80, 40 and 30 meters. The transmitted signal is 750 Hz above the displayed frequency on 20, 17, 15, 12 and 10 meters.

When tuning slowly up or down most bands you may notice the kHz digit change from the expected 141.8 to 741.8. This will only occur

at two or three 100 Hz segments near this frequency and returns to normal as soon as you tune above or below.

2-4 BAND SELECTION Amateur bands from 160 meters through 10 meters are selected by plugging the appropriate module (as indicated by the MHz digit printed on the module) in the front panel. Care should be exercised when inserting the modules. Make certain that the card edge connections are on the right side of the module and the MHz digit is in the upper right corner, then carefully insert the module until it is seated. The 10 meter module includes a slide switch to select either the 28-28.5 MHz or 28.5-29 MHz band segment. Pull on the bottom of the release lever to remove a module.

NOTE: Be certain the band module is fully seated. If digital display shows "142.0" and main tuning knob has no effect, the band module is not fully seated.

2-5 USING THE METER There are three scales on the front panel meter. They are provided as a convenience and not intended to provide instrument grade accuracy.

S-METER is the top scale S1 through S9, with S9 calibrated for a signal of 50 μ V. S-Meter is active at all times in receive mode.

FORWARD power is the middle scale marked 5, 10, 20, 30, 50. Active in transmit with rear panel switch in FWD.

SCOUT indicates power output directly in watts. Example: Reading of 50 equals 50 watts.

SWR is the bottom scale and active in transmit with rear panel switch in SWR. The left most dot indicates 1:1 SWR. The second dot is 2:1 and all readings further to the right are greater than 2:1 SWR.

2-6 GETTING ON THE AIR Before transmitting, connect a suitable resonant antenna. Place the TUNE switch in TUNE and check the SWR reading. A reading of 2:1 or less is recommended. Transmit power is approximately 15 watts in TUNE position.

2-7 SSB OPERATION Transceiver is designed to operate on upper sideband (USB) from 14-30 MHz and on lower sideband (LSB) from 1.8 - 10 MHz. The correct sideband is chosen by the band module. There is no mode switch. Simply connect a microphone, press the PTT switch, on your mike, and adjust the MIC gain until the ALC light flashes on voice peaks.

2-8 CW OPERATION There is no mode switch. Simply plug a keyer into the KEY jack or your favorite paddles into the KEY PADDLES jack and you are ready for CW operation. When the key is closed you are transmitting, and when the key is open you are receiving. The transceiver operates full break-in only and cannot be altered without circuit modification.

The internal keyer is designed to emulate iambic operation. The weighting is factory set to approximately 15%. The keyer speed will be 25 words per minute (WPM) when the transceiver is first turned on. Keyer speed is indicated by the middle two digits of the frequency display when the SPEED function is selected. If a speed change is desired, simply place the front panel switch in SPEED and reduce the speed by hitting the DAH paddle

or increase the speed by hitting the DIT paddle. Speed changes 1 WPM for each dit or dah. There is no internal battery back up so the keyer speed will reset to 25 WPM every time the transceiver is turned on.

Keyer operation is Curtis, type B. If you squeeze both paddles simultaneously, then release, the keyer will complete the character (DIT or DAH) in progress and send one opposite character.

SIDETONE The CW sidetone volume is adjustable. An access hole is provided on the bottom cover to make this adjustment. A small jeweler's screwdriver or alignment tool is needed. The sidetone frequency is fixed at 750 Hz and is not adjustable.

2-9 TRANSMIT POWER OUTPUT

Power output is factory set at 50 watts.

Power output is approximately 15 watts when using TUNE to check an antenna or make antenna tuner adjustments.

(Power may be reduced to as low as 5 watts through the access hole on the bottom cover labeled RF POWER.)

2-10 FRONT PANEL CONTROLS

AF GAIN—Controls the audio level. Set the control to a comfortable listening level for either speaker or headphones.

IF BW—Selectivity is determined by the nine pole patented "Jones" filter (patent #5051711). The IF BW control sets the IF bandwidth from approximately 500 Hz at full counterclockwise

to 2500 Hz at full clockwise. Rotation of the IF-BW control from the 2500 Hz setting will continually reduce the high frequency response. In the full counterclockwise position, the audio response will be approximately 300-800 Hz. The transmit bandwidth is automatically set to 2500 Hz regardless of the setting of the IF-BW control.

MIC GAIN: For SSB operation, while speaking into the microphone in a normal voice, advance the MIC control until the ALC LED flashes on voice peaks. The MIC control varies the amount of audio applied to the transmit balanced modulator.

RIT: (receiver incremental tuning) is selected by the front panel switch. This knob is normally positioned at 12 o'clock for zero offset and can be turned clockwise or counterclockwise to help clarify received signals. The frequency display reflects the change made by the RIT control. Range available is ± 1 kHz.

TUNE-OFF-NB: TUNE places the transmitter in operation and is used to check SWR or power output. Power output is approximately 15 watts and accuracy of the SWR meter scale is maintained. N.B. selects the noise blanker (if installed) to remove general spike noise.

SPEED-OFF-RIT: SPEED is used to set the internal keyer speed. The speed is indicated by the two center digits of the frequency display. The speed is changed by hitting the dah paddle to decrease the speed and dit paddle to increase speed. The speed changes one word per minute for each dit or dah. There is no internal battery back up and the keyer speed will reset to 25 WPM each time the transceiver is turned on. The center position, OFF, disables RIT. Move switch to RIT to enable range adjustment of ± 1 kHz.

ON/OFF: Master power switch.

NOTE: If the power is inadvertently turned ON with TUNE switch actuated, digital readout may display FFFF. Turn power off, turn TUNE off and re-apply power to return to normal operation.

MIC: The microphone circuit has been designed for low impedance microphones with a minimum 5 mv output. Transistorized microphones may also be used, providing their output level is adjusted so that the input stages of the SCOUT are not overdriven. The cable, which should provide shielding for all leads, is terminated with a standard 4 pin microphone plug. Failure to shield both microphone and PTT leads may result in RF getting into the audio circuits. Connections to the plug are as shown in FIGURE 1-2.

AUDIO: This jack is a standard 1/4 inch STEREO phone connector. This allows the use of inexpensive stereo headphones, mono communications phones or external speaker. When a connector is fully inserted, the internal speaker is disconnected.

When using mono phones or speaker you may do one of the following:

- Only insert mono plug half way (the internal speaker remains active)
- Use a stereo-to-mono adaptor
- Change mono plug on phones or speaker to a stereo plug.

Audio levels between the internal speaker and external headphones will be approximately equal if 600 ohm phones are used. If 4 to 16 ohm phones are used, the audio level will have to be reduced or a pad placed in the headphone plug.

2-11 REAR PANEL CONNECTIONS AND CONTROLS

+13.5 VDC This two pin connector is the input for the primary dc power. See Page 1-1, Figure 1-1 for wiring information.

GND Ground post to be attached to the station ground.

KEY Connection for an independent, external CW key or keyer.

KEY PADDLES Connection for external paddles to operate built-in electronic keyer. See page 1-2, Figure 1-3 for wiring information.

AUX +13.5 V Any accessory that operates at 13.5 volts, less than 2 amperes, can be powered from this jack. Turn power off before connecting to or disconnecting from this jack.

NOTE: Power to this jack is not controlled by front panel ON/OFF switch. Whenever voltage is applied to the main DC cable it will be present at the AUX +13.5V jack.

ANTENNA This connector mates with a PL 259 style plug. Use any 50 ohm coaxial feedline to connect antennas, tuners or amplifiers to the SCOUT.

FUSE SCOUT uses an AGC 12 amp fuse, connected in-line with the standard DC cable supplied. The fuse works in conjunction with an internal reverse polarity diode to protect the transceiver from overcurrent or reverse polarity supply voltage.

METER Switch. Selects either FWD forward power or SWR on the meter when in transmit.

SCOUT AND LINEAR AMPLIFIERS The power output of 50 watts drive is marginal for most linear amplifiers on the market.

Automatic switching circuitry is not included on the rear panel. If control of a linear is desired, a transmit control voltage is available internally and may be brought out by the skilled user to operate a relay that could control a linear. See circuit description for Control Board (81644) for further details.

2-12 "RISC" MICROPROCESSOR AND "FLS" FREQUENCY LOCK SYSTEM

The SCOUT incorporates a "RISC" (Reduced Instruction Set Computer) microprocessor to accomplish three tasks:

- 1) Manage the LED digital display. The microprocessor controls the gating of the frequency counter and reads the frequency of the local oscillator. It then adds or subtracts the BFO frequency and displays the frequency of operation.
- 2) Emulate a Curtis type B, iambic keyer adjustable from 5-50 WPM.
- 3) The most complex task performed by the microprocessor is "FLS" or frequency lock system. It is a unique mix of time tested tunable oscillator design with modern microprocessor power to significantly improve frequency stability of these economical oscillators.

The main frequency determining element in the SCOUT is the permeability tuned oscillator. The oscillator is mixed with a crystal to provide the correct injection frequency for the selected band. The tunable oscillator covers a range of 2.2 - 2.7 MHz with a slight over run on each end of the tuning range. Since this oscillator is not synthesized (locked to a sub multiple of a crystal reference) it is subject to frequency variation with temperature changes (Drift).

The microprocessor compares each frequency reading with the previous reading and if

the difference is in excess of a preset amount, it automatically corrects the PTO by means of a varactor.

Frequency counter accuracy depends on the stability and accuracy of the reference crystal and will be approximately ± 100 Hz. This correction system provides significantly improved stability compared to earlier PTO designs but does not eliminate all drift.

When you finish tuning a signal, the microprocessor waits for approximately two seconds before allowing the system to lock. This allows the operator to make fine adjustments to the frequency without the microprocessor thinking it's drift and correcting. The frequency reading is then stored in a register for reference. The microprocessor compares each new reading with the reference reading and if the difference is in excess of a preset amount, it automatically corrects the PTO by means of a varactor diode. The theoretical stability is to ± 10 Hz compared with the frequency counter reading.

Since RIT is used intentionally to make small frequency corrections, a circuit was added to detect any movement of the RIT control and shut off the lock feature. This is indicated in the display by the right hand decimal point being lit when the system is not locked.

The maximum amount of drift correction is approximately ± 600 Hz. The drift correction system is reset when any tuning is done or if the power is turned off and then back on.

If frequency drift is within 10 Hz of the previous reading, there is no correction. If it is greater than 10 Hz but less than 40 Hz, the microprocessor will correct. Readings are taken every 200 ms. If the reading is outside the ± 40 Hz window, the microprocessor assumes you are tuning and will reset the window. In SSB transmit, frequency correction operates as it does in receive.

CW operation is more complex. If the internal keyer is being used, it will take preference over any other operation. There will be no correction during CW transmit but since it is a QSK

system, corrections are made between characters, words and any other pauses. To minimize error when transmitting CW, the correction window is increased from ± 40 Hz to ± 100 Hz. When the transmission is over, the frequency is compared to the reference and, if less than 100 Hz, is corrected. After the correction, the window is reset to the ± 40 Hz value. There may be times during long transmissions and with very high speed CW where the drift may exceed the window and be reset to a new value instead of being corrected to the original frequency.

2-13 SHORTWAVE IMAGES AND I-F FEEDTHROUGH

An image is a weak unwanted reception of strong shortwave signals outside the band. I-F feedthrough is a strong signal operating at a receiver's intermediate frequency leaking through its front end circuitry. Many modern up-conversion radio designs virtually eliminate shortwave images and I-F feedthrough.

SCOUT uses a relatively low I-F at 6.144 MHz and you may hear shortwave images under some conditions. You may hear images of 16 meter shortwave broadcast stations (17.7 - 17.9 MHz) when tuning the 18 MHz ham band. They can be strong when using a high gain antenna. They are so close to the rig's 18 MHz coverage that the front end filtering can barely reject them. Less intrusive may be images of 31 meter shortwave stations (9.6 - 10 MHz) when tuning the 14 MHz ham band. The greater frequency difference between 9.6 MHz and 14 MHz is an advantage. Designing the SCOUT to eliminate these images would have significantly increased the price class of the radio.

For the interested student, images appear according to the relationship: $2f_{XO} + 2f_{PTO} - f_i$ where f_{XO} is the band module's crystal oscillator frequency, f_{PTO} is the PTO frequency, and f_i is the I-F (6.144 MHz).



FIGURE 2-1 MODEL 555 FRONT VIEW

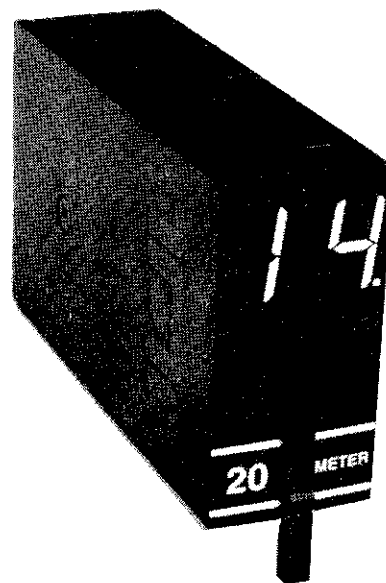


FIGURE 2-2 SAMPLE OF PLUG-IN BAND MODULE

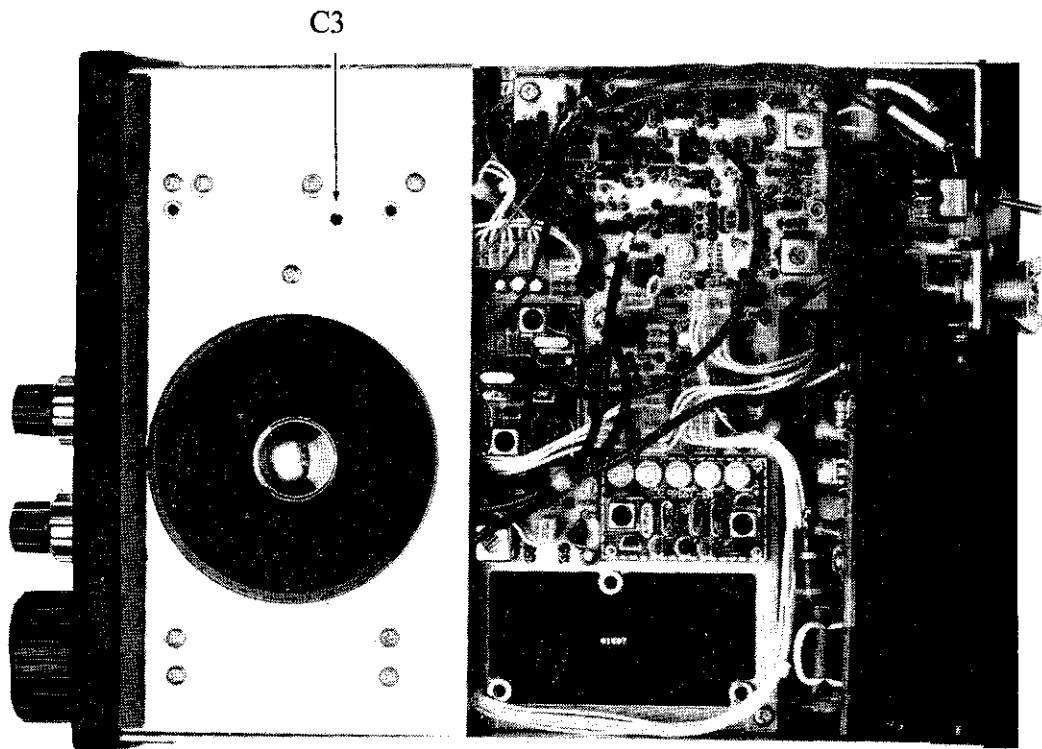


FIGURE 2-3 MODEL 555 TOP VIEW

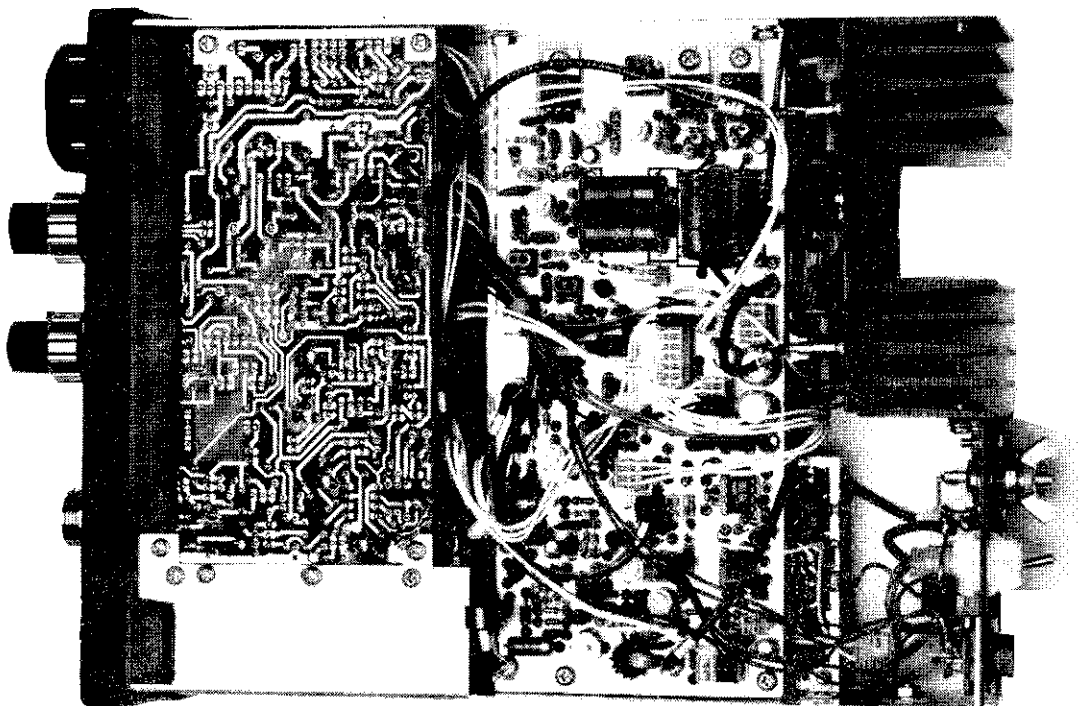


FIGURE 2-4 MODEL 555 BOTTOM VIEW

CHAPTER 3

CIRCUIT DESCRIPTIONS AND ILLUSTRATIONS

3-1 RECEIVER CONTROL BOARD (81644)

The local oscillator, from the band module (connector 2), is amplified to +10 dBm by Q16 and Q15, and serves both transmit and receive mixers. The received signal, from the band module, is amplified by Q1, mixed to the I.F. frequency and processed through the noise blanker gate and filtering. I.F. output is available at 20. In transmit, the I.F. signal is mixed with the local oscillator, amplified by Q14 and is available at connector 1. Diode D1 and transistor Q1 are used for T/R switching. In receive, the emitter voltage of Q1 back biases diode D1 ("T" voltage not present). In transmit, the emitter voltage disappears and "T" voltage forward biases D1.

RF AMPLIFIER: Q1 is a noiseless feedback rf amplifier. The circuit provides an excellent noise figure and dynamic range at reasonable values of collector current.

MIXER: Both the transmit and receive mixers are diode quad type.

IF AMPLIFIER/NOISE BLANKER GATE: Q2 amplifies the mixed signal while providing an excellent termination to the mixer I.F. port. An output for the noise blanker accessory is available at connector 18. The noise blanker gate is composed of four pin diodes, D2 through D5.

ALIGNMENT: L2 and L3 are resonated at the I.F. frequency. Connect a signal generator to the antenna input, and an AC voltmeter to the audio output. Adjust the signal generator frequency for a reading on the voltmeter and the amplitude so that the AGC is not activated. Tune L2 and L3 for a maximum. The peak is very broad.

I.F. FILTERS AND ISOLATION AMPLIFIER: There are two crystal filters in the SCOUT, a four pole variable bandwidth (Jones Filter) and the other a five pole fixed bandwidth filter. The fixed bandwidth filter has a notch at the BFO frequency to improve the unwanted sideband rejection. Amplifier Q6 provides isolation and gain to preserve the noise figure of the receiver.

ALIGNMENT: Connect a signal generator to the antenna input and an AC voltmeter to the audio output. Adjust the signal generator frequency for a reading on the voltmeter and the amplitude so that the AGC is not activated. Tune L5 for maximum.

CONTROL VOLTAGES: Transistors Q9, Q10, Q11, Q12, and Q13 along with voltage regulator LM2940T provide all the necessary voltages for controlling the transceiver. The 10 volt regulated voltage is used for all circuits except for RF and AF power amplifiers. Transistors Q12 and Q13 develop the transmit voltages while transistors Q9, Q10 and Q11 develop the receive voltages. Diodes D12 and D13 determine whether the transmission will be CW or SSB. Connector A is provided for the skilled technician who wishes to make circuit modifications to key a linear. Circuitry to control linear amplifiers is not provided for in the SCOUT as it is shipped from the factory. A skilled technician can use one of these two methods to key an amplifier:

- For use with TEN-TEC amplifiers: The jack used should be a 1/8" diameter, two circuit "stereo" type with a switch provision to short the two terminals when the plug is removed. If your jack doesn't have the shorting provision, a 1/8" stereo plug with the two terminals jumpered must be inserted in order for the SCOUT to transmit with no linear connected.

If the jack is to be placed in the rear panel, the best place to drill the mounting hole is between the ANTENNA connector and the GND bolt, using the "N" in GND as a center. Use caution when drilling the hole as not to damage any internal components. The hole size will be determined by the size required by your jack.

- Locate the Receiver Control Board (81644) on the top side of the radio. Then locate connector "A" (see component layout). This plug has a jumper which will be removed and replaced with a two conductor cable that connects to the newly mounted jack. Pin 1 of the plug is "TXOUT" and connects to the "RING" terminal of the jack. Pin 2 of the plug is "TX ENABLE" and connects to the "TIP" terminal of the jack.

- The connecting cable between the SCOUT and linear must be shielded. The "TIP" of the plug will connect to the "KEY OUT" jack on the linear and the "RING" of the plug will connect to the "KEY IN" jack of the linear.

- If the SCOUT will not transmit nor activate the linear, try reversing the KEY IN and KEY OUT cables on the linear.

2) For use with other types of amplifiers which require grounding for activation.

- Several parts will be required for this modification other than a 1/8" jack (this jack can be mono or stereo): 1- MPSU10 transistor and 1- 4.7K, 1/4 watt resistor.

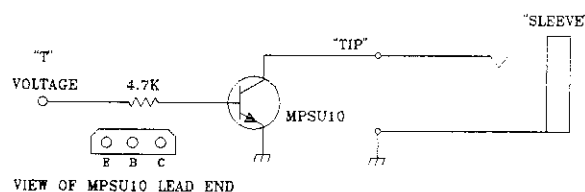
- Mount the linear connecting jack as in the above procedure or use a cable with a jack on the end of it and run it through the rivet hole on the rear panel. Only one shielded wire is needed.

- Locate the LLD/ALC board (81645) on the bottom side of the SCOUT. Next, locate the "T" voltage terminal which connects to the final amplifier via a white wire that is soldered directly to the terminal. This terminal is located near connector #55 (see component layout).

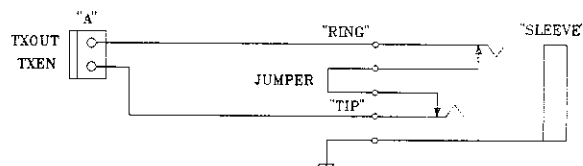
- Trim both leads of the 4.7K resistor to about 1". Using the schematic below and the board component layout as a guide, solder one end of the 4.7K resistor to the base ("B" lead) of the MPSU10 transistor. Next, solder the other end of the 4.7K resistor to the "T" terminal. Then solder the emitter lead ("E" lead) to the top ground foil at a convenient location near the "T" terminal. Put the collector lead ("C" lead) to the MPSU10 to the other end of the linear keying jack. If a stereo version of the jack is used, be sure to connect this wire to the "TIP" terminal.

- The connecting cable between the radio and the linear must be shielded. The rating of the MPSU10 keying transistor is 300 volts at 500mA (DC only).

Wiring for Non TEN-TEC linear



Wiring for TEN-TEC linear



RIT: Transistors Q7 and Q8 along with diodes D9, and D10 steer the offset voltage between transmit and receive and between RIT on and RIT off. With RIT off, the voltage to the RIT varactor in the PTO comes from R31. With RIT on, the voltage at connector 13 causes Q7 to short the voltage at R31 and allow the voltage at RIT potentiometer, connected to 14, to control the varactor in the PTO.

ALIGNMENT: Center the RIT control. Turn RIT on and tune in a CW signal. Turn RIT off and adjust R31 for the same tone you had when the RIT was on.

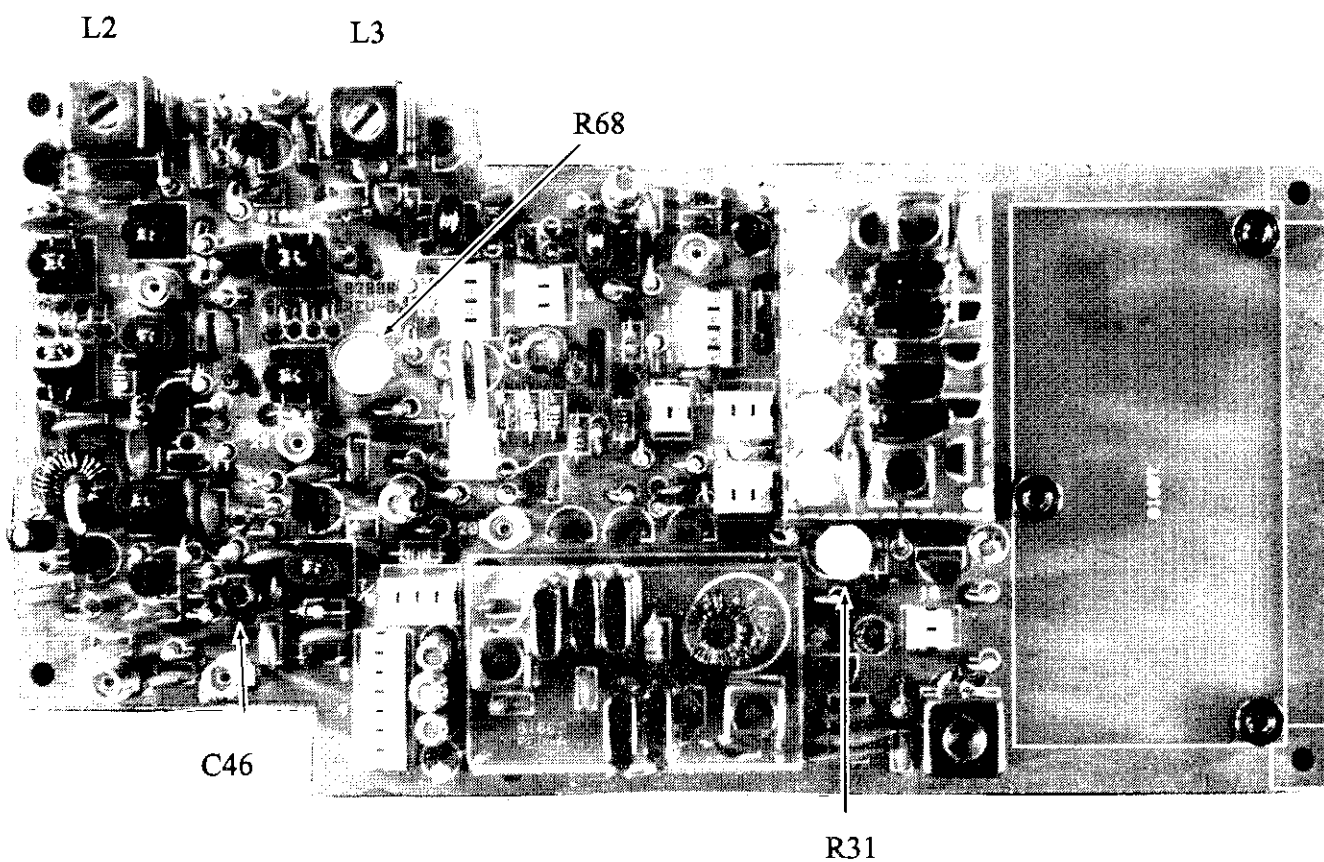
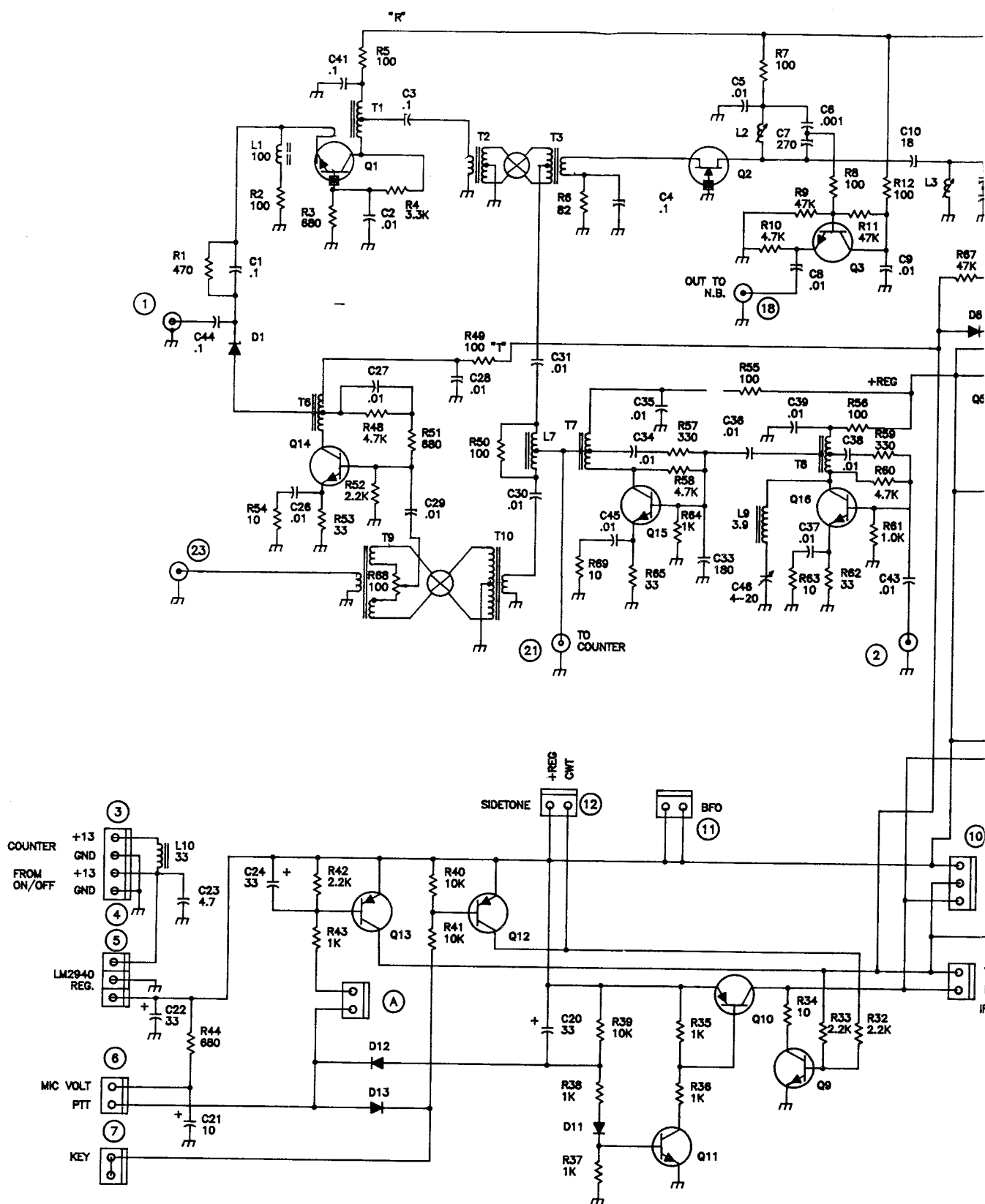


FIGURE 3-1 RECEIVER CONTROL BOARD COMPONENT LAYOUT (81644)



REFERENCE DESIGNATORS LAST USED

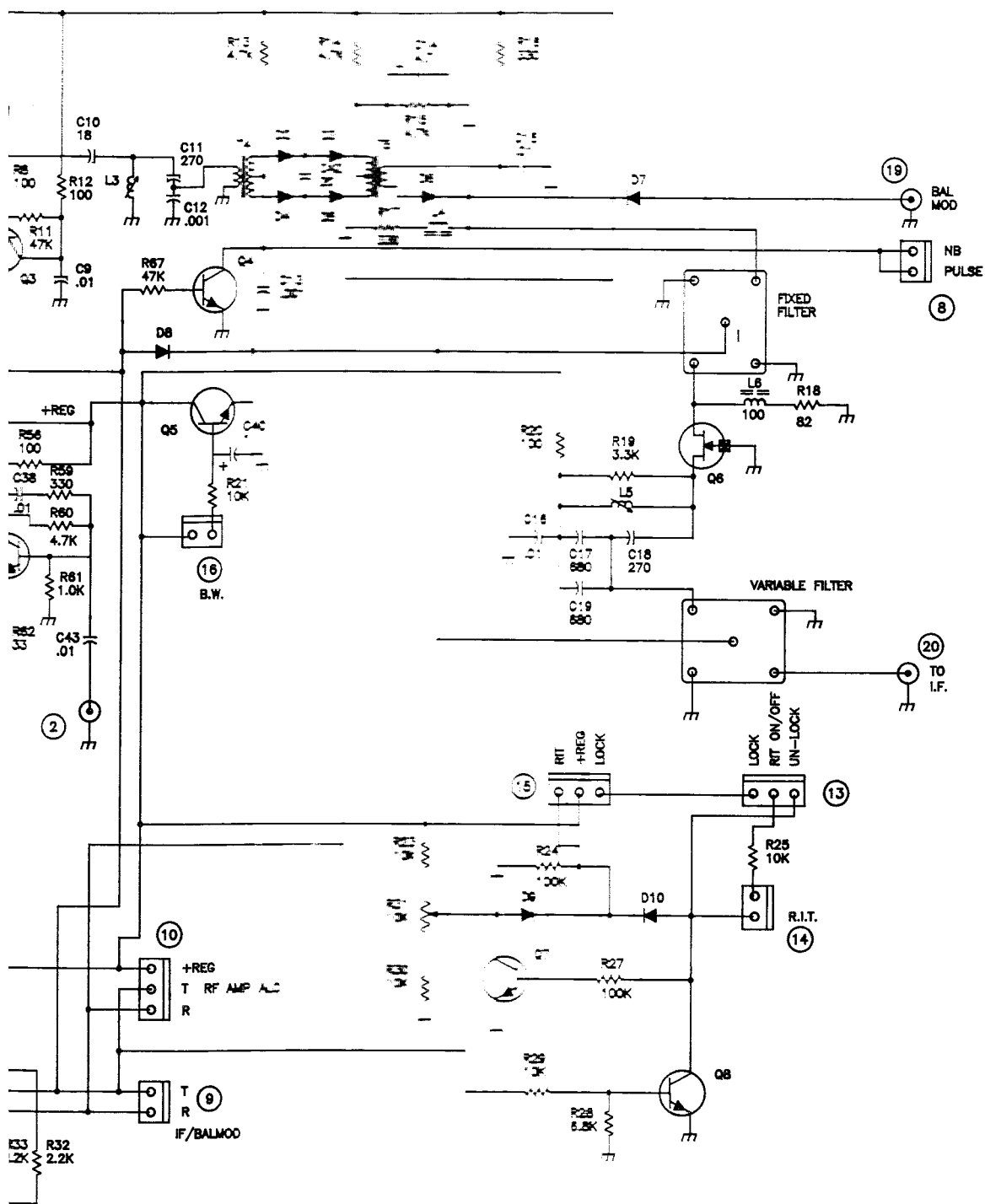
C46,D13,L10,Q16,R69,T10

NOTE: UNLESS OTHERWISE SPECIFIED

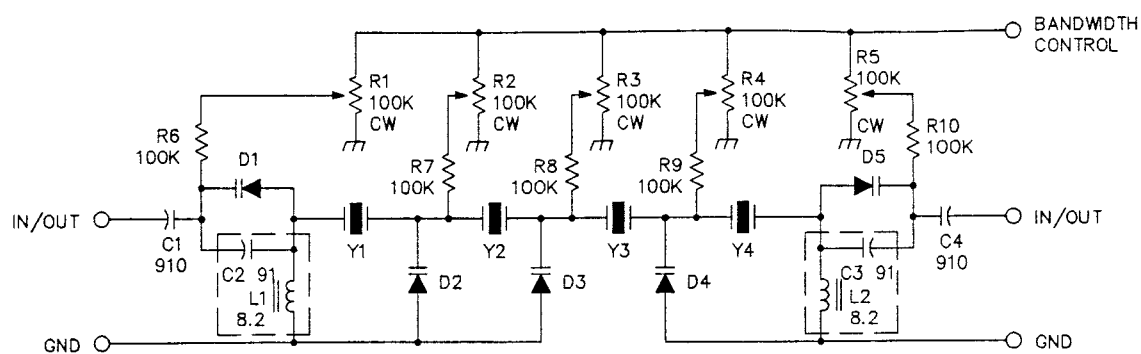
- 1)CAPACITANCE IN PICOFARADS (pf)
- 2)INDUCTANCE IN MICRO-HENRYS (μH)
- 3)RESISTANCE IN OHMS ±5% 1/8w

D1-D5 : BAT-4
D6, D7 :
D8-D13 : IN414

FIGURE 3-2 RECEIVER CONTROL BOAR



BAT-482	2N4124
IN4148	MPS6514
	J-310
	2N5087
	MJE370



REFERENCE DESIGNATORS LAST USED	
C4, R10, D5, L2, Y4	

NOTE: UNLESS OTHERWISE SPECIFIED
 1) CAPACITANCE IN PICO FARADS (pf)
 2) INDUCTANCE IN MICRO-HENRYS (μ H)
 3) RESISTANCE IN OHMS $\pm 5\%$ 1/4w

D1-D4 SANYO SVC321SP
 Y1-Y4 6.144 MHz

REV. B
 5-30-91

FIGURE 3-3 VARIABLE BANDWIDTH FILTER SCHEMATIC (81532)

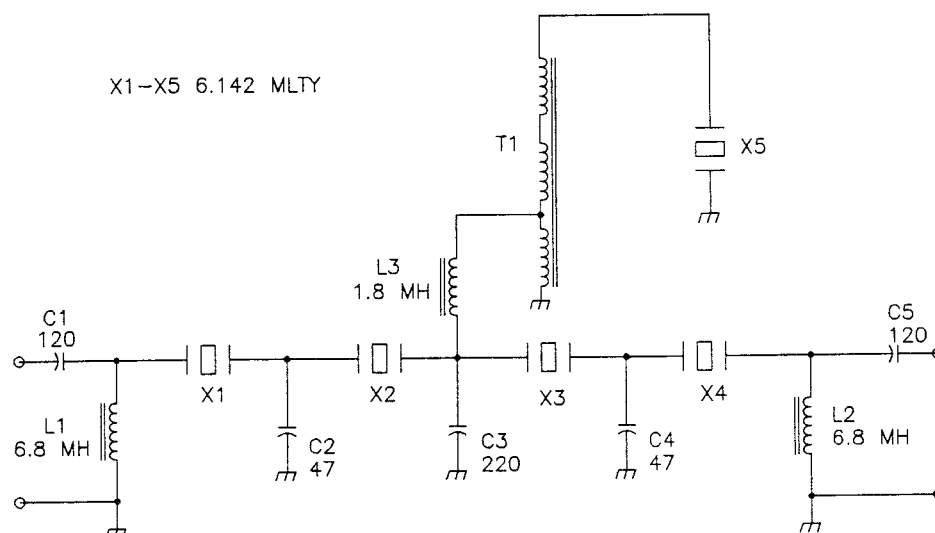


FIGURE 3-4 FIXED FILTER SCHEMATIC (81662)

3-2 I.F. AUDIO S/A (81646)

The I.F. AUDIO module contains a two stage I.F. amplifier, product detector, audio power amplifier, BFO, balanced modulator and sidetone. The major gain in the receiver is developed on this circuit board.

I.F. AMPLIFIER: The 6.142 MHz signal is applied to the first amplifier by way of connector 20. The signal is amplified in U1 and U2, transistor Q2 buffers the amplifier stage from the product detector U3. The recovered audio drives the power amplifier U5. Q2 is necessary to provide a low impedance to drive the AGC and product detector.

ALIGNMENT: Set the transceiver to 14.000 MHz and connect a signal generator, set for 14.000 MHz, to the antenna connector. Connect a meter to measure the audio output. Keep the signal generator output as low as possible so that the AGC is not activated. Adjust L1 and L2 for a maximum reading. Be sure to reduce the signal, if necessary, to keep it below activating the AGC.

AGC: The I.F. signal is rectified by the voltage doubler, D2,D3. Transistor Q4 provides a low impedance to rapidly charge the AGC time constant capacitor C19 (fast attack). Transistor Q5 is an emitter follower and allows a high impedance load on the time constant capacitor and low impedance drive for the AGC pin on the I.F. amplifiers. Capacitor C19 may be changed to suit individual tastes in AGC action. Increasing the value will cause the AGC to be slower, decreasing the value will cause the AGC action to be faster.

S-METER: Integrated circuit U6-A amplifies the AGC voltage and drives the S-meter. Potentiometer R72 sets the zero point on the S-meter, and potentiometer R76

sets the scale values.

ALIGNMENT: Disconnect any antenna or signal generator from the ANTENNA connector. Adjust R72 to the position just before the needle starts to read up scale. Connect a signal generator to the ANTENNA connector and set for 50 microvolts, adjust R76 for a reading of S-9.

SIDETONE: Transistor Q12, components C60,C59,C58,C57,R64,R63,R62, and the input impedance of Q12 form a phase shift audio oscillator. The oscillator operates at a frequency of 750 Hz and is keyed by the CWT voltage and transistor Q11. The sidetone frequency is set by the components. The amplitude is adjusted by R70, which is accessible through a hole in the bottom of the transceiver.

BFO & BALANCED MOD: Crystal oscillator Q3 provides the correct frequencies for the product detector and the balanced modulator. Crystal Y1, L4, and C36 determine the frequency. Diode D4 switches the frequency to the proper value for CW offset (750 Hz). The carrier is applied to the product detector U3 and balanced modulator U4. Carrier balance is achieved by R37 and R39. Carrier output is available at connector 19. U6-B is used for a microphone amplifier. The input impedance is 100,000 ohms and will handle most popular microphones. Transistor Q8 unbalances U4 for CW operation and adjusts the bias on pin 7 for the proper amplitude.

ALIGNMENT: Connect a frequency counter to the junction of resistor R29 and R31. Place rig in CW transmit and adjust L4 for a frequency of 6.142750 MHz. Return to the receive mode and adjust C36 for a frequency of 6.142000 MHz. Connect an oscilloscope to connector 19. Place rig into CW transmit and tune T2 for maximum. Place rig into SSB and adjust R37 and R39 for a minimum reading on the oscilloscope.

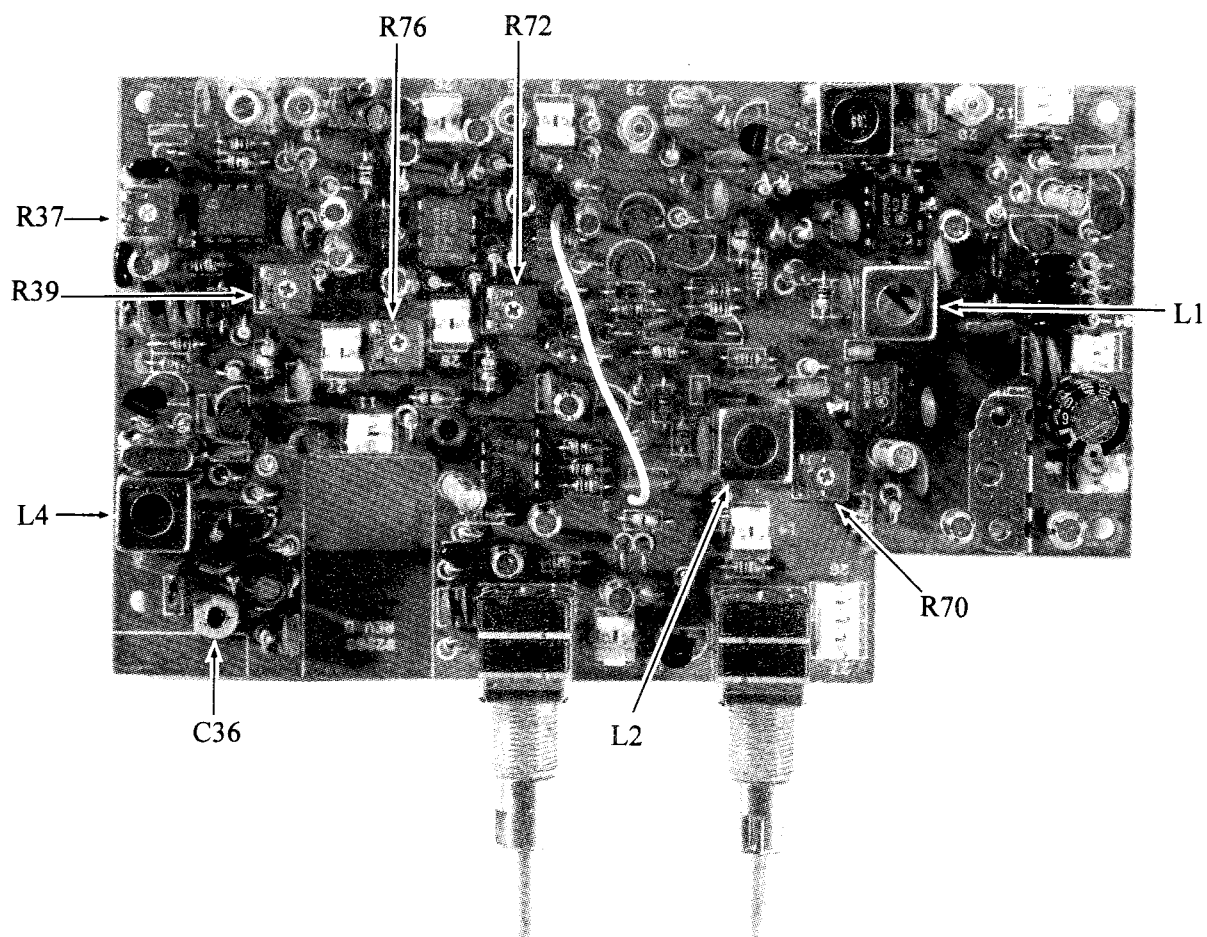
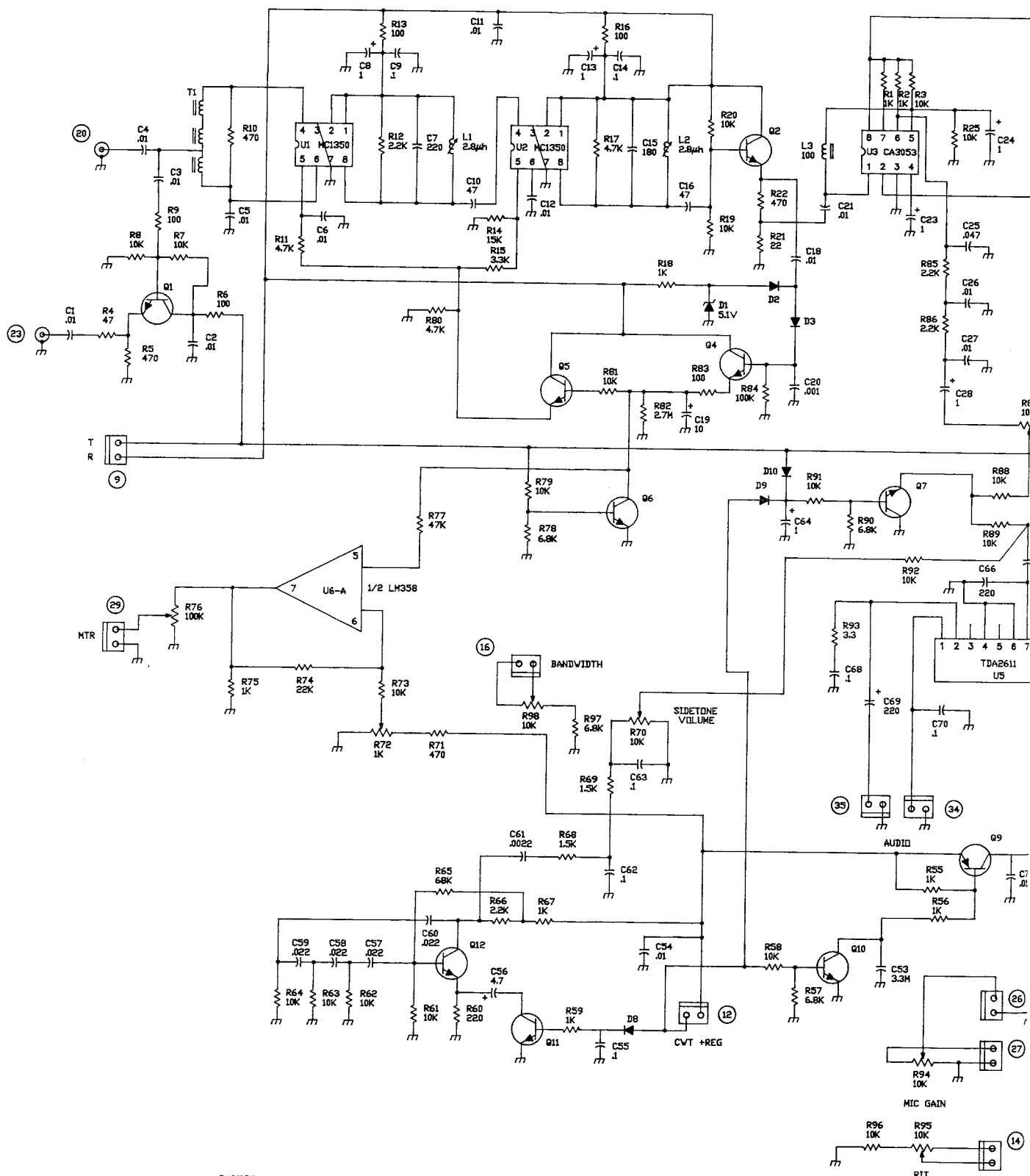


FIGURE 3-5 I.F. AUDIO COMPONENT LAYOUT (81646)



REFERENCE DESIGNATORS LAST USED
C72, R98, Q12, D10, T2, L7, Y1, U6

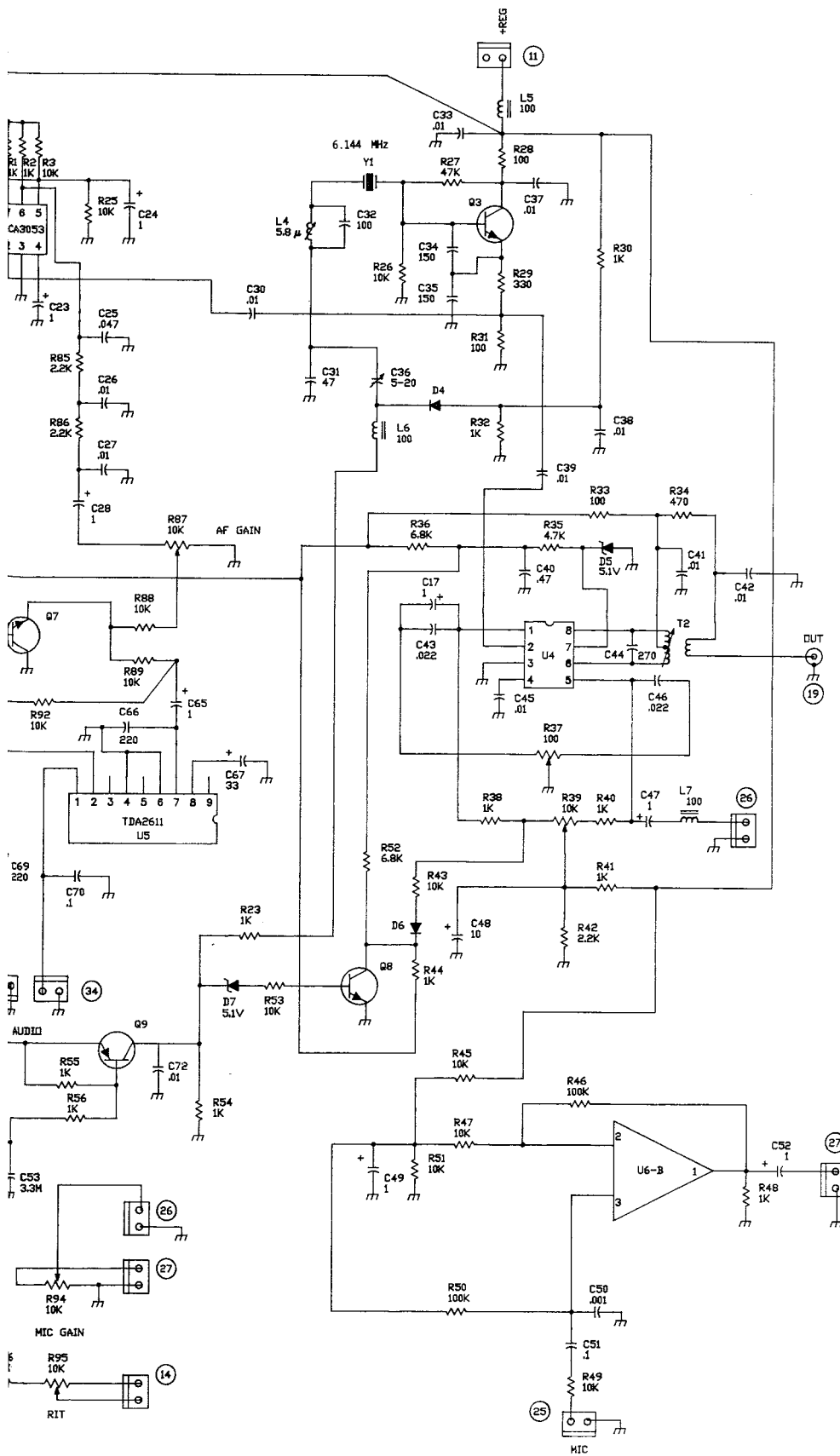
NOTE: UNLESS OTHERWISE SPECIFIED
1) CAPACITORS IN MICROFARADS (μF)
2) INDUCTORS IN MICROHENRYS (μH)
3) RESISTORS IN OHMS ±5% 1/4watt

D1, D5, D7 : IN751A
D2, D3, D6, D8, D9, D10 : IN4148
D4 : BA-482

Q1-Q3 : 2N4124
Q4-Q8 : MPS5614
Q9 : 2N5087
Q10-Q12 : MPS5614

U1, U2 : MC1350
U3, U4 : CA3053
U5 : TDA2611
U6 : LM358

FIGURE 3-6 I.F. AUDIO SCHEMATIC (81646)



MATIC (81646)

3-9/3-10 BLANK

3-3 LLD/ALC (81725)

The LLD/ALC module amplifies the transmit signal, provides ALC, an SWR bridge and a circuit to determine if the RIT control is being used so that the frequency lock circuit can be disabled. Forward power and SWR are also available at connector 41.

LOW LEVEL TRANSMIT: Low level transmit signal from the transmit mixer/amplifier is applied to connector 54. Pin Diodes D13,D14 form an ALC attenuator. Transistors Q7,Q10,Q11 and Q12 amplify the transmit signal to approximately 3 watts.

ALIGNMENT: Remove connector 56 and connect a 0 to 1 Amp meter across the 2 pins. Place the SCOUT in transmit and rotate potentiometer R61 for a minimum reading. Adjust potentiometer R61 for an increase of 50 ma. Be sure and replace the jumper plug in connector 56.

SWR/TR: Output from the 50 watt amplifier is connected to the antenna through the SWR bridge (connectors 37 and 38). The SWR bridge produces a voltage proportional to the forward power, which is directed to both the forward power output (Connector 41) and the ALC attenuator. The SWR voltage, developed by D7, is also available at connector 41.

Diodes D3, D4 and D9, D10 disconnect the receive antenna from the 50 watt power amplifier during transmit. Diodes D1 and D2 are a voltage doubler rectifying the rf power and biasing D3 and D4 off during transmit. Diode D5 shorts any residual signal to ground while D9 and D10 open the receive line. In receive, the above actions are reversed and transistor Q1 applies receive bias to D3, D4 and D9, D10 connecting the receiver.

ALIGNMENT:

SWR/FORWARD POWER: Connect a suitable dummy load to the antenna connector. Place the transceiver on 20 meters and close the key jack. (Do not use TUNE position). Switch to SWR (switch on the rear panel) and tune C4 f or a null. Connect a 25 ohm dummy load and adjust R12 for a reading of 2:1 on the meter. Switch to FORWARD POWER (switch on the rear panel) and adjust R14 for a reading of 50.

ALC: Connect a power meter and dummy load to the antenna connector. Place the transceiver in CW (close key jack) and adjust R21 for a reading of 50 watts.

RIT LOCK DETECT: RIT is generally used for small adjustments of frequency (a very low hertz per second variation). The microprocessor senses this as a frequency drift rather than a conscious adjustment of frequency and corrects to a previous reading. This may never allow the operator to set the frequency to the desired note or most natural sounding voice. Transistor Q6, IC U3 and U2 form an RIT detect circuit that enables the microprocessor to disable the frequency lock circuit when the RIT is being used. The base of Q6 is connected to the RIT voltage and is a buffer to the input of U3A. The emitter of Q6 is connected through a capacitor to the input of U3A. Any variation in the voltage (such as would occur if RIT is used) drives the high gain amplifiers U3A and U3B to the positive rail or to ground. The output is connected to a comparator, U2A and U2B. The output of the comparator is sampled by the microprocessor and when low, the microprocessor will unlock the frequency circuit allowing for fine tuning with the RIT control.

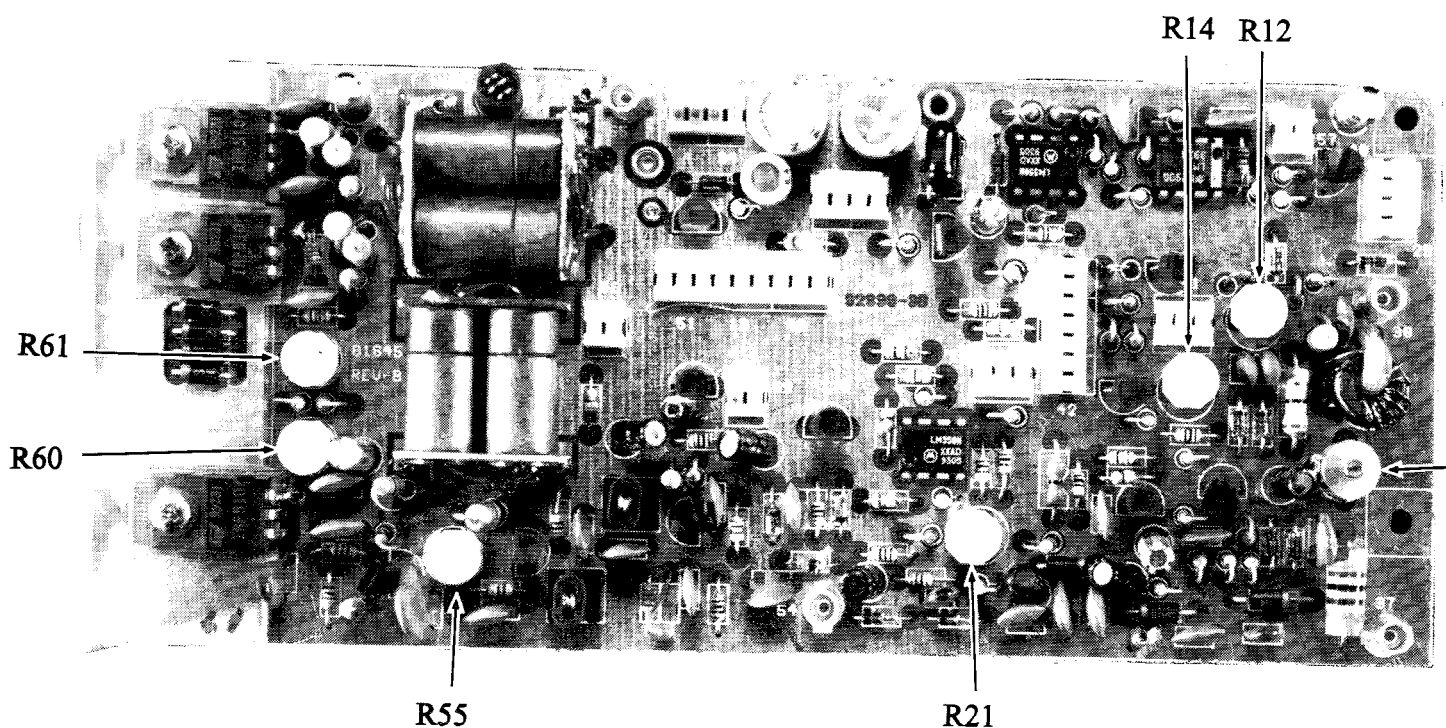


FIGURE 3-7 LLD/ALC COMPONENT LAYOUT (81725)

REFERENCE DESIGNATORS LAST USED
C43,R74,Q15,D23,T5,L10

NOTE: UNLESS OTHERWISE SPECIFIED
1) CAPACITORS IN MICROFARADS (μ F)
2) INDUCTORS IN MICROHENRYS (μ H)
3) RESISTORS IN OHMS $\pm 5\%$ 1/4watt

D1,D2,D6,D7,D8,D11,D12,D20,D21,D23-IN4148
D3,D4,D5-IN4007
D16,D17,D18-IN4002
D9,D10-BA482
D13,D14-ISV80
D15-IN751A
D22-BAT41

Q1-2N6519
Q2,Q3,Q4,Q5,Q6,Q13,Q14-MPS6514
Q7-2N4124
Q9-MPSU01
Q10,Q11,Q12-2SC2166
Q15-2N5087
U1,U3-LM358
U2

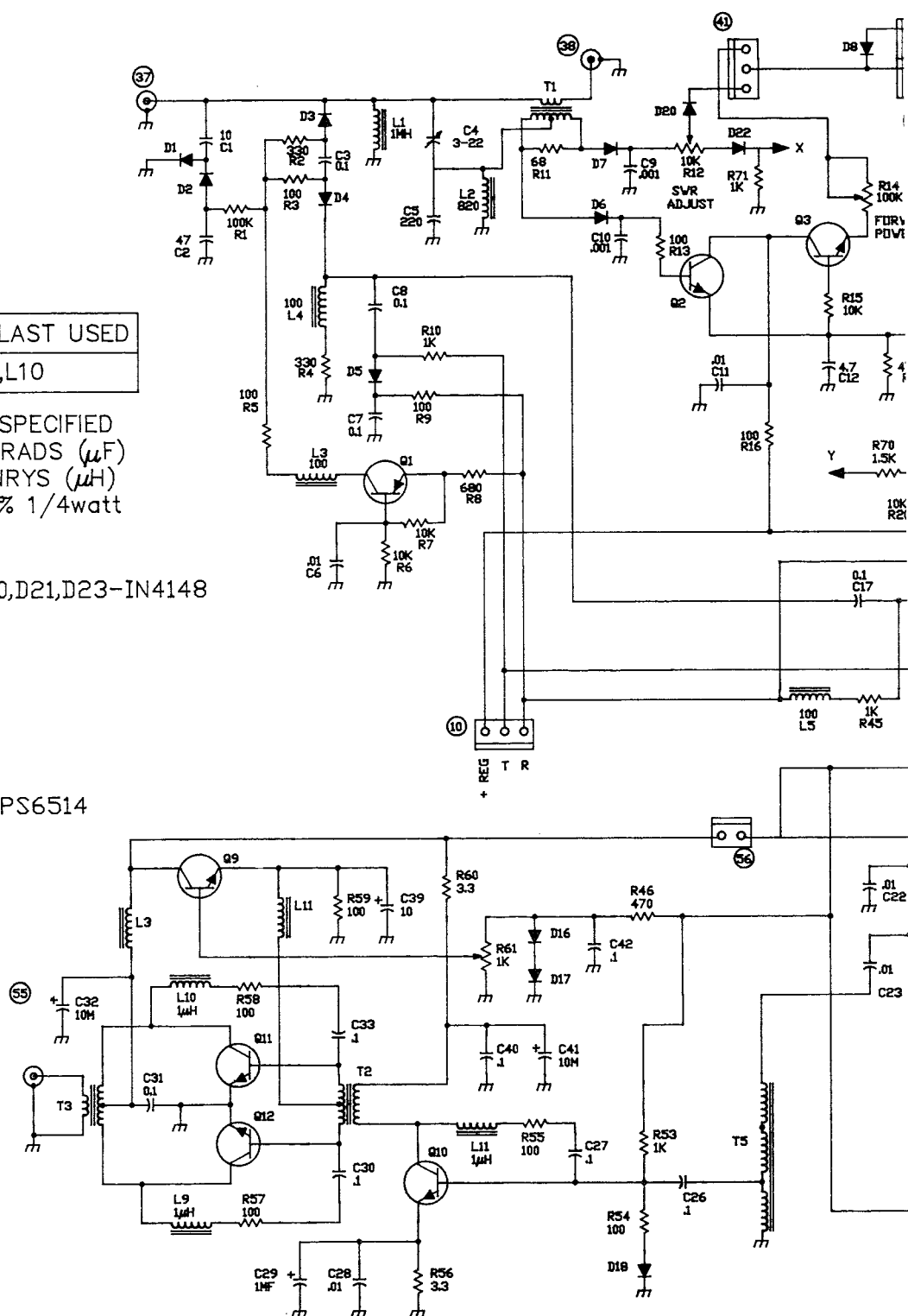
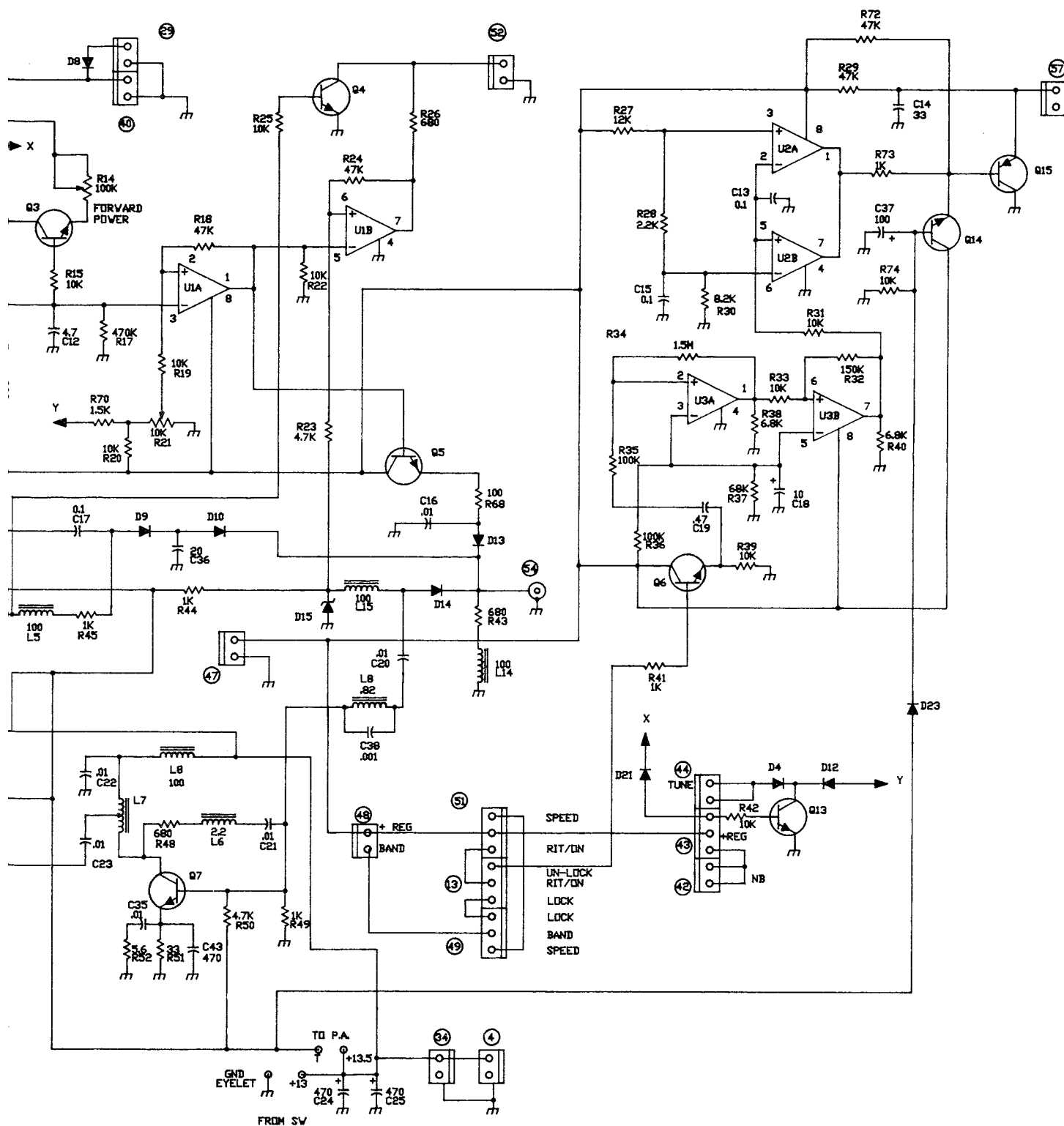


FIGURE 3-8 LLD/ALC S

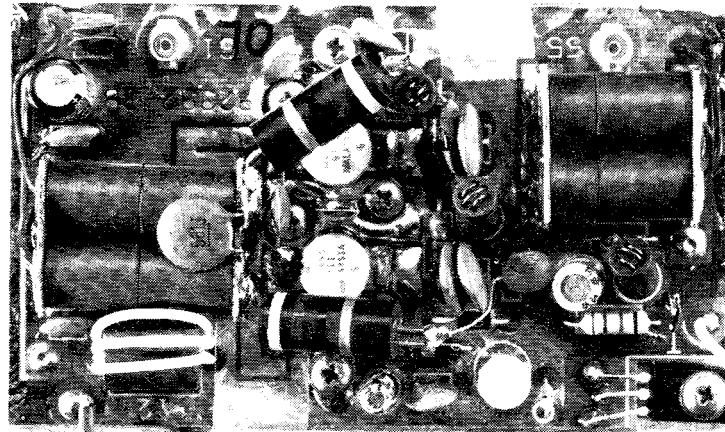


D/ALC SCHEMATIC (81645)

3-4 50 W PA S/A (81643)

This module increases the transmit power to 50 watts on the SCOUT. Transistors Q1 and Q2 form a broadband push pull amplifier. Transistor Q3, along with the bias regulating diodes D1 and D2 deliver the proper bias to the amplifier. C5, L5, L6, and C6 form a matching network to match the output of the amplifier to the transformer. L1, L2, C2, C3, R1, and R3 match the input of the amplifier and level the gain over the bands covered by the amplifier.

ALIGNMENT: Temporarily disconnect RF drive from the connector at T1. Place an ammeter in series with the +13.8 volt lead and, with the "T" voltage on, adjust control R6 for a reading of 300 ma.



R6

FIGURE 3-9 50W PA S/A COMPONENT LAYOUT (81643)

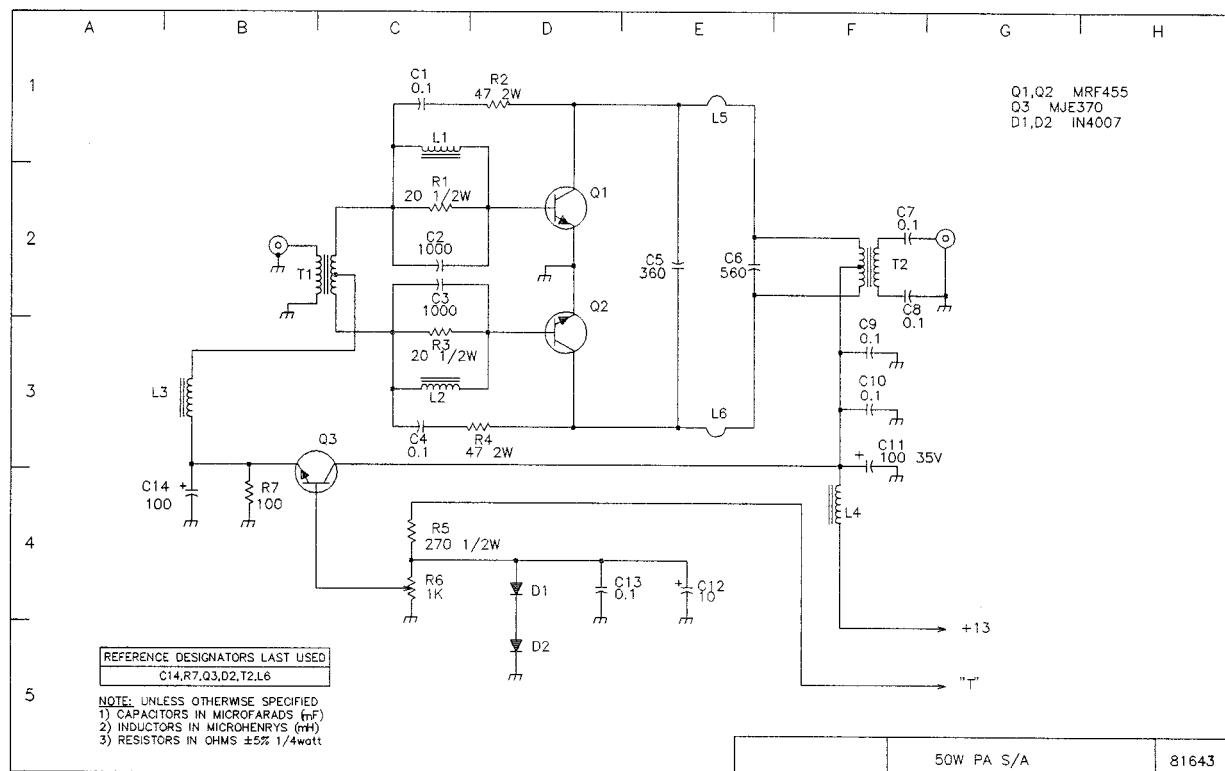


FIGURE 3-10 50W PA S/A SCHEMATIC (81643)

3-5 PTO S/A (81647)

This module provides the frequency control for the transceiver. Transistor Q1 is a grounded base oscillator and transistor Q2 is a buffer/amplifier. The output is further buffered by the 10 dB pad formed by R12, R13, and R14. Varactor D1 is driven by the lock circuit from the logic module. D1 provides the frequency correction if the main oscillator drifts. Varactor D2 is driven by the RIT circuit and provides the offset tuning.

Tuning is accomplished by varying the inductance of the main oscillator coil. Varying inductance is obtained by inserting a powdered iron core inside the coil. Tuning rate is approximately 30 Hz per revolution at the low end of each band and approximately 20 Hz per revolution at the high end of each band.

ALIGNMENT: The frequency range and tuning rate have been set at the factory and there are no adjustments.

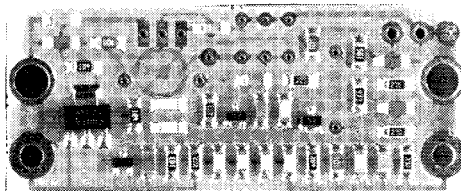


FIGURE 3-11 PTO S/A COMPONENT LAYOUT (81647)

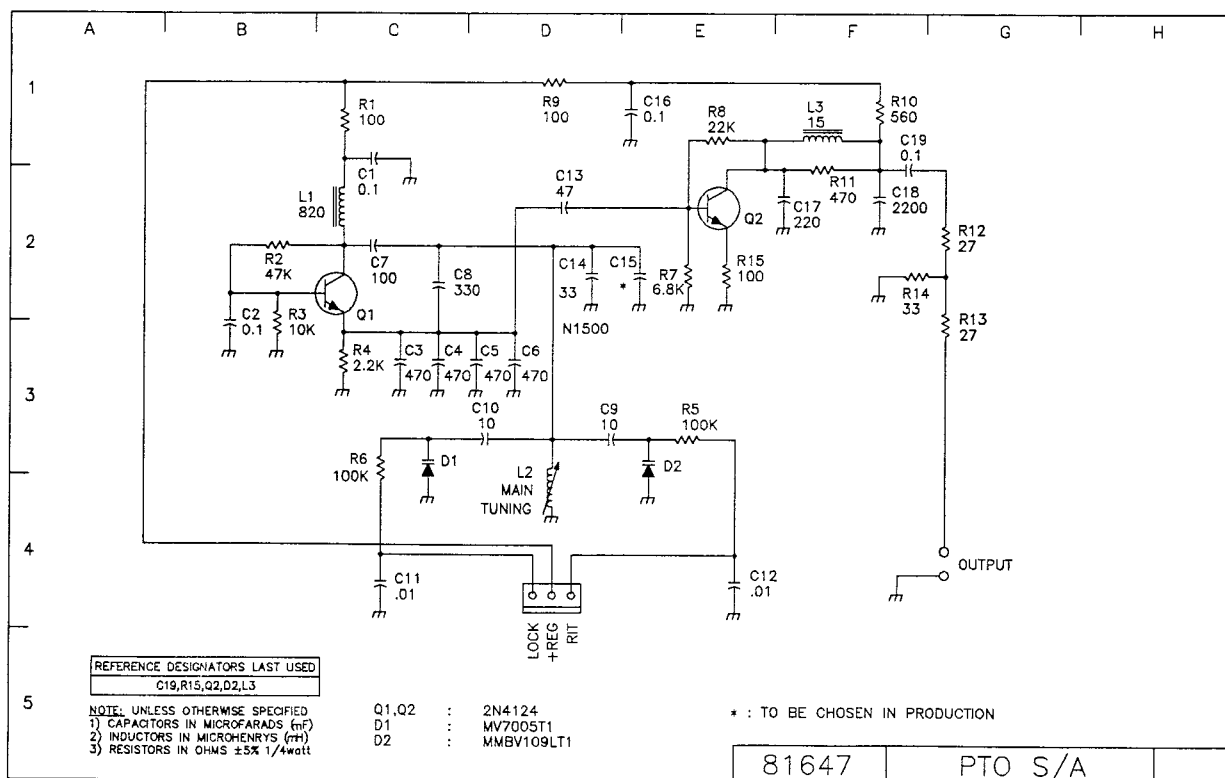


FIGURE 3-12 PTO S/A SCHEMATIC (81647)

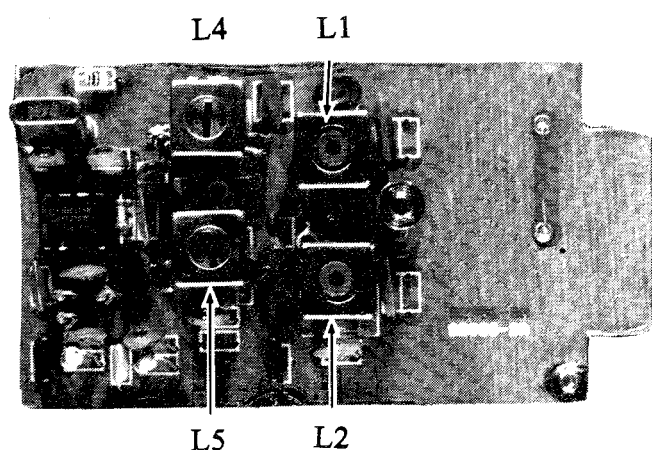
3-6 BAND MODULES (81679-81687)

General: Each amateur band is selected by inserting the appropriate module in the front of the SCOUT. Each module contains a mixer/crystal oscillator to convert the PTO to the correct local oscillator frequency, a fixed tuned circuit to cover the band selected and a low pass filter for the power amplifier.

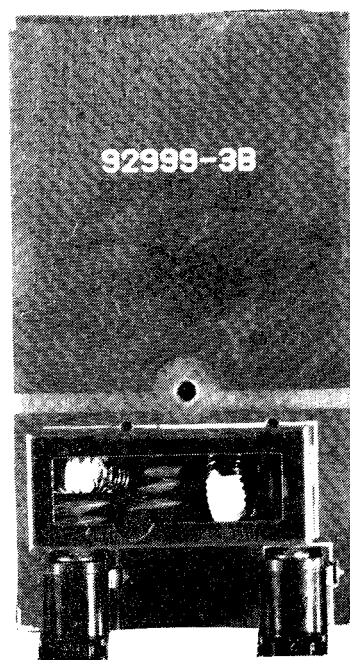
Fifty watts passes through the low pass filter so shielding and grounding become critical to keep the transmit frequency out of the PTO and local oscillator. For all modules from 80 meters through 10 meters a 3.0 MHz low pass filter is placed in the PTO line to keep the operating frequency out of the mixer. On 160 meters a 2.5 MHz high pass filter is used and the PTO frequency from 2.5 to 2.7 covers the 1.8 MHz to 2.0 MHz band.

All modules use an integrated circuit for an oscillator/mixer. The correct frequency for the local oscillator is selected from the mixer by a band pass circuit. Another band pass circuit is used in the antenna of the receiver and after the transmit mixer. The band pass circuit is automatically switched from receive to transmit function.

ALIGNMENT: Connect a sweep generator to the band pass circuit and adjust the coils for the proper band coverage. The loss should not exceed 2 dB. Set the PTO to the center of the range and a spectrum analyzer to the L. O. output and adjust the coils for maximum output. Check the band edges to be sure the output is flat across the band. If not, readjust the coils slightly to obtain a flat pass band. The output of the L. O. should be approximately -20 dBm.

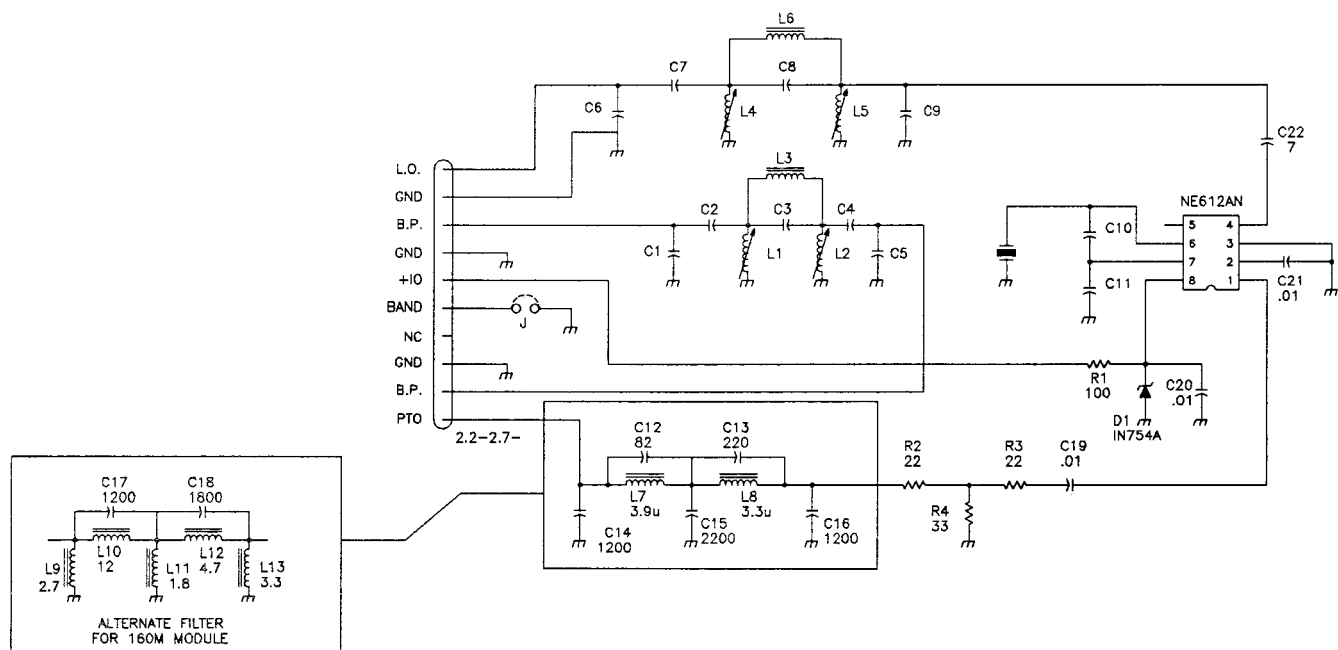


TYPICAL



TYPICAL

FIGURE 3-13 BAND MODULES (81679-91687) AND L.P. FILTER (81663-81671)

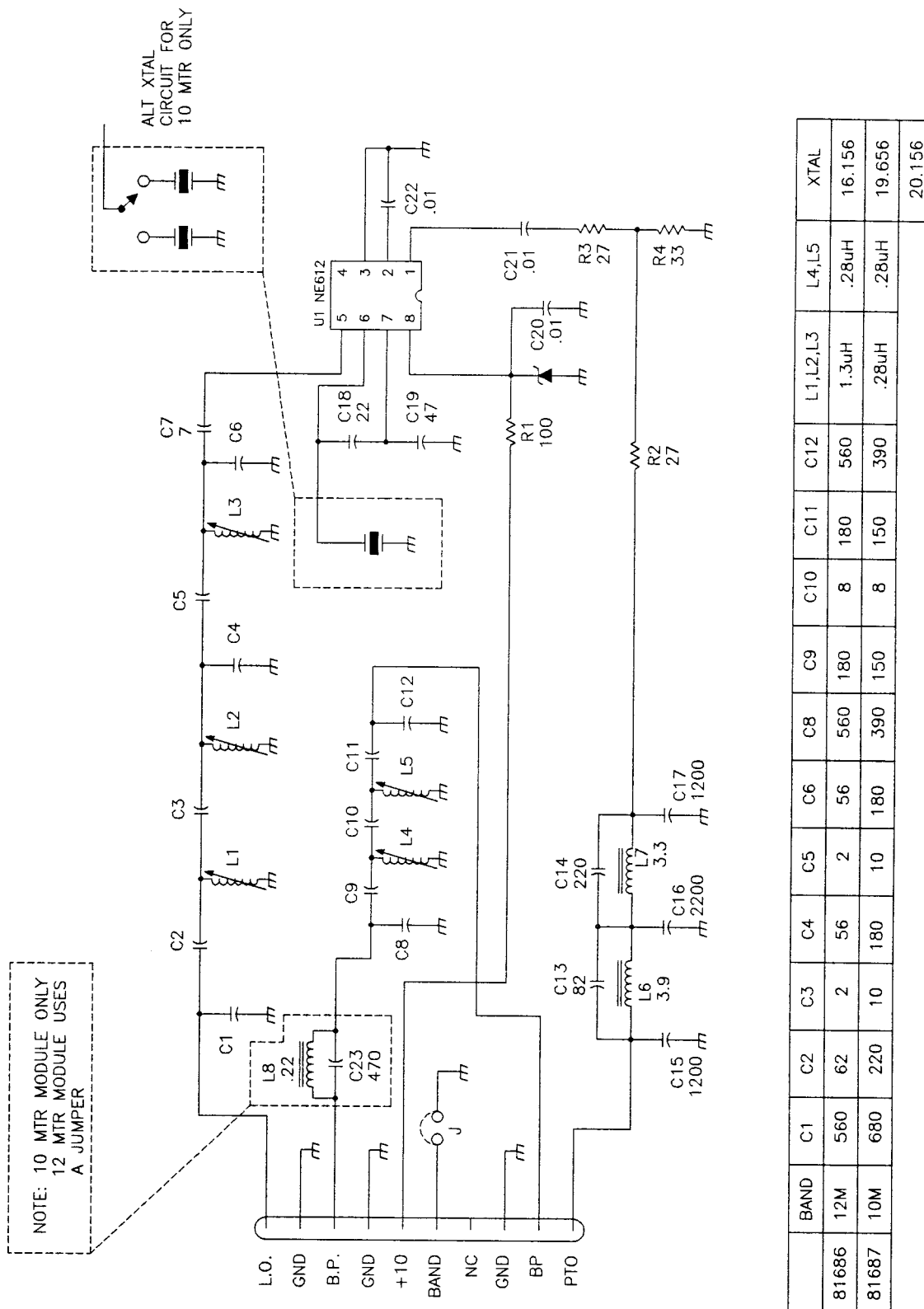


	BAND	C1	C2	C3	L3	C4	C5	L1 & L2	C6	C7	C8	C9	L4 & L5	L6	C10	C11	XTAL
81679	160M	3300	1500	150	-0-	1500	3300	5.8uh	750	150	8	120	2.8uh	-0-	20	150	5.444
81680	80M	1200	470	33	18u	470	1200	5.8uh	750	100	5	82	2.8uh	-0-	22	100	7.444
81681	40M	470//360	220	15	15u	220	470//360	2.8uh	470//360	120	5	100	1.3uh	-0-	22	47	10.944
81682	30M	470//470	220	12	-0-	220	470//470	1.3uh	560	82	3	68	1.3uh	-0-	22	47	13.944
81683	20M	680	120	5	10u	120	680	1.3uh	470//360	150	8	120	2.8uh	-0-	100	220	5.656
81684	17M	390	62	3	-0-	62	390	1.3uh	750	150	7	120	1.3uh	-0-	22	47	9.656
81685	15M	560	270	15	-0-	270	560	.28uh	560	100	5	82	1.3uh	-0-	22	47	12.656

REFERENCE DESIGNATORS LAST USED
C22,R4,L13

NOTE: UNLESS OTHERWISE SPECIFIED
1) CAPACITORS IN MICROFARADS (µF)
2) INDUCTORS IN MICROHENRYS (µH)
3) RESISTORS IN OHMS ±5% 1/4watt

FIGURE 3-14 BAND MODULES SCHEMATIC (81679-85)

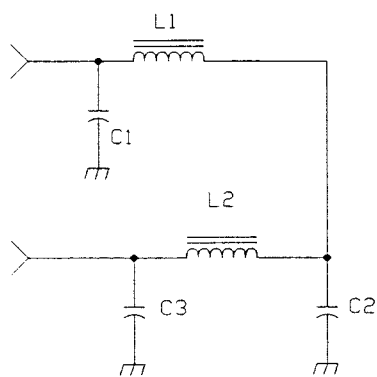


	BAND	C1	C2	C3	C4	C5	C6	C8	C9	C10	C11	C12	L1,L2,L3	L4,L5	XTAL
81686	12M	560	62	2	56	2	56	560	180	8	180	560	1.3uH	.28uH	16.156
81687	10M	680	220	10	180	10	180	390	150	8	150	390	.28uH	.28uH	19.656
															20.156

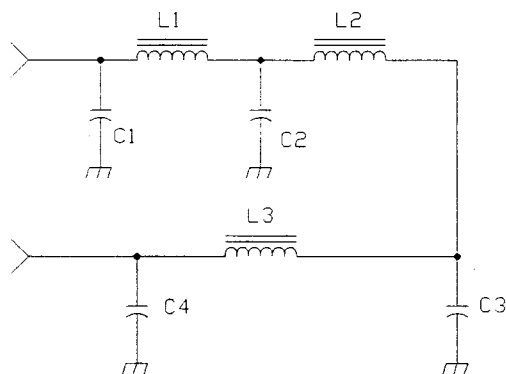
REFERENCE DESIGNATORS LAST USED
C23,R4,L8

NOTE: UNLESS OTHERWISE SPECIFIED
1) CAPACITORS IN MICROFARADS (µF)
2) INDUCTORS IN MICROHENRYS (µH)
3) RESISTORS IN OHMS ±5% 1/4watt

FIGURE 3-15 BAND MODULES SCHEMATIC (81686-87)



	BAND	C1	C2	C3	L1,L2
81663	160M	1500	2480	1500	$4.4\mu\text{H}$
81664	80M	940	1500	940	$2.5\mu\text{H}$
81665	40M	470	830	470	$1.4\mu\text{H}$
81666	30M	330	560	330	$1.0\mu\text{H}$
81667	20M	220	390	220	$.65\mu\text{H}$



	BAND	C1	C2	C3	C4	L1,L2,L3
81668	17M	180	360	360	180	$.44\mu\text{H}$
81669	15M	150	330	330	150	$.38\mu\text{H}$
81670	12M	130	270	270	130	$.32\mu\text{H}$
81671	10M	100	220	220	100	$.28\mu\text{H}$

FIGURE 3-16 L.P. FILTER SCHEMATIC (81663-71)

3-7 LED DISPLAY BOARD (81651)

This board contains an integrated four (4) digit, seven segment LED display configured for multiplexed operation. The display is driven by U1, which is a surface mounted I.C. mounted on the back of the LED Display Board assembly. Resistor R1 sets the segment operating current for the display. Capacitor C1 filters the +5 volt supply line. All necessary timing, multiplexing and control circuits are contained in U1, which receives the required display data serially via the DATA, CLK, and EN pins.

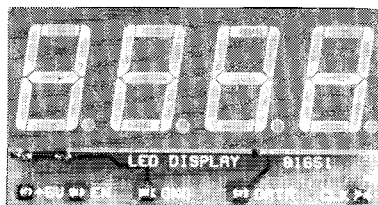


FIGURE 3-17 LED DISPLAY BOARD COMPONENT LAYOUT (81651)

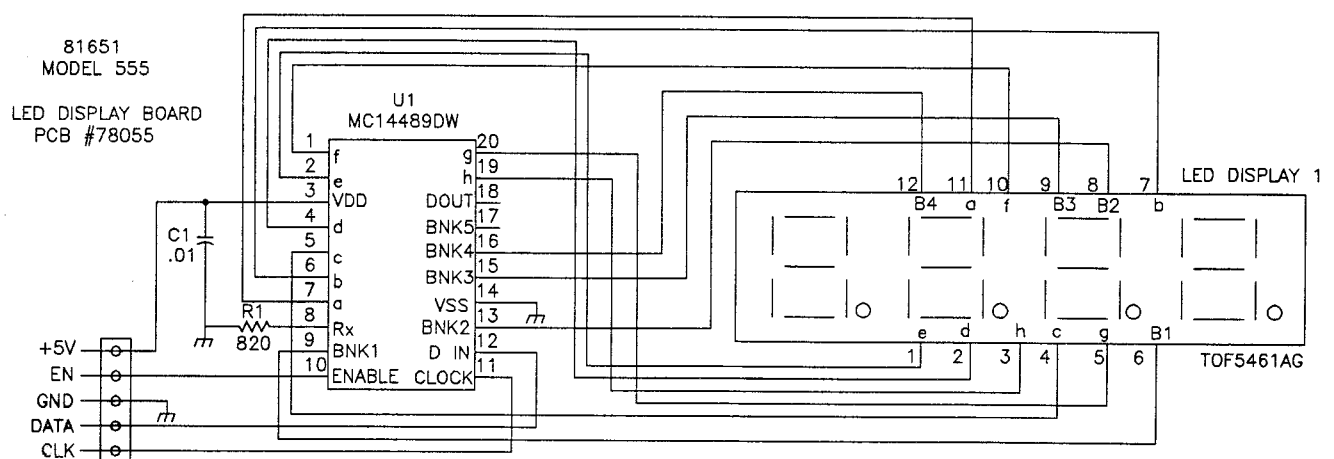


FIGURE 3-18 LED DISPLAY BOARD SCHEMATIC (81651)

3-8 Frequency Counter Logic Board (81650)

This board contains a microprocessor controlled four decade frequency counter, built-in electronic keyer, and LED display control functions. The heart of the system is U1, a high speed RISC based microprocessor, which operates using the 4.0 MHz crystal X1, providing an internal bus frequency of 1.0 MHz. U1 contains 2K bytes of ROM and 80 bytes of RAM, along with a timer and 21 I/O control lines.

The transceiver injection frequency to be measured is applied via connector 21 to input amplifier Q2. Input signal levels of at least -10 dbm will provide a reliable signal level for counting. The output of Q2 is sent to Q4, a common base amplifier, which acts as a buffer and provides improved isolation between the input and logic gates. The output of Q4 is coupled via C5 to NAND gate U6c. This gate conditions and squares up the input rf signal and passes it on the gate U6d via D1. The input bias for U6c is determined by resistor R7. U6d also receives a gating signal generated by U1. This gating signal determines how long the input frequency is applied to the dual decade counter, U5. Two gating periods are generated by the software in U1, a 100 mS gate for resolution down to 10 Hz, and a 10 mS gate providing resolution of the input frequency down to 100 Hz. Even though the display only reads out to the nearest 100 Hz, the 10 Hz resolution is required for improved accuracy and is used to calculate the adjustments to the PTO used in the Frequency Lock System. A reset pulse appears on pin 15 of U1 and is used to clear the decade counters before each new count. The output of the first dual decade counter, U5, is connected to the input of the following dual decade counter U4, thus providing four decades of counting accuracy. The BCD data from the decade counters is applied to the inputs of multiplexers

U2 and U3, which allow sixteen (16) lines of data from the decade counters to be time multiplexed down to only eight data lines which are read by microprocessor U1. Control of U2 and U3 is provided through pin 17 of U1.

The extracted frequency data, along with the BAND information from connector 49, is processed by U1, and the result is sent serially, using the CLK, DATA, and EN lines, to the LED display driver mounted on the back of the LED display board.

The built-in electronic keyer is activated by closure to ground on the DIT and DAH lines of connector 57. The software in U1 determines proper on and off times, based on the keyer speed setting, and activates keying transistor Q5, which grounds the KEY OUT pin on connector 59 for each dit and dah. A KEY IN signal on connector 57 is also monitored by U1 for use with an external keyer. When KEY IN is grounded by an external key closure, U1 turns on Q5, thus providing a keying signal at KEY OUT on connector 59. The speed of the built-in keyer is adjusted using a front panel mounted toggle switch, along with external keyer paddles plugged into a connector on the rear panel. Setting the front panel switch to the SPEED position places a positive voltage on the SPEED pin of connector 49. This turns on transistor Q3 providing a low to pin 13 of U1. This pin is monitored by U1, when not being used for gating control, to sense the SPEED switch setting. Activating the SPEED adjust routine suspends frequency counting, and the current keyer speed in words per minute (WPM) is shown on the LED display. While SPEED is displayed, pressing the DIT paddle (grounding the DIT line) of the external keyer paddles will cause the speed to increment in one WPM steps pressing the DAH line will decrease the displayed speed value in one WPM steps. The keyer SPEED can range between 5 and 50 WPM. The power

on default is 25 WPM. (Note: the SPEED value is not remembered when power is turned off. If you desire a speed other than 25 WPM, you must reset the SPEED each time you turn the transceiver on). Once you have set the desired Speed, place the front panel switch in the OFF or RIT position.

When the front panel switch is placed in the RIT position the offset tuning circuits are activated, allowing you to set the amount of frequency offset using the RIT control on the front panel. With RIT enabled, changes in the RIT control setting might be interpreted by the microprocessor as a frequency drift of the VFO thus requiring corrective action by the Frequency Lock System. This would defeat the offset control and thus must be prevented. Whenever the RIT control is adjusted, a logic low signal appears on the RXO pin of connector 57, telling U1 that an offset adjustment is taking place. When this occurs U1 suspends all corrections to the VFO. A short time after the RXO pin goes high, U1 enables the Frequency Lock System and all operations return to normal.

The RXO signal which appears on connector 57 is sent to gate U6a, which also receives the counter reset pulse from U1. Output of U6a is inverted by U6b and applied via diode D2 to pin 17 of U1. During the counter reset period, U1 reads the state of pin 17 to determine the state of the RXO pin.

The Frequency Lock System (FLS) is a software algorithm contained in U1 which analyzes the frequency changes occurring in the transceiver. The frequency counter measures the injection frequency of the transceiver. This value includes the VFO and the Plug-In Band Modules. Therefore the FLS compensates for any drift in either the VFO or the crystals used in each Band Module.

The FLS uses frequency information with a resolution to 10 Hz for correction. If the FLS determines that the frequency is drifting upwards, then pin 16 of U1 is pulsed low. If the frequency drift is downwards, pin 16 of U1 is pulsed upwards. If the frequency is stable, pin 16 of U1 is placed in a tri-state (input high impedance) condition. Voltage changes on pin 16 are filtered by R13 and C9, C10, and then sent to a varactor diode in the VFO via the LOCK pin on connector 49. Capacitors C9, C10 also assure that when power is first turned on, the LOCK control voltage will be approximately centered in its' range.

Voltage regulator U7 is mounted to the top cover of the counter assembly and provides a regulated +5 volts to the logic and display circuits.

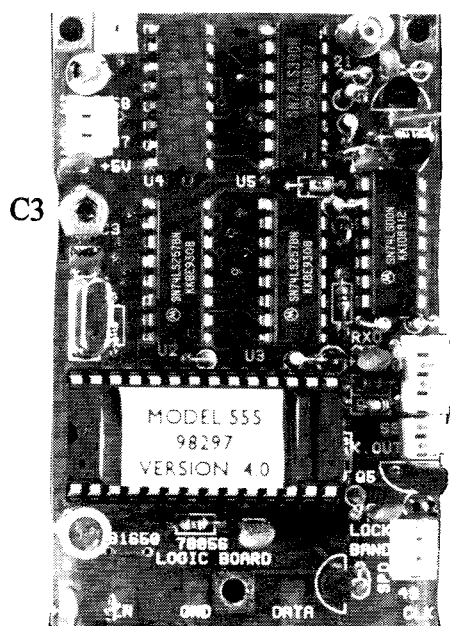


FIG. 3-19 FREQUENCY COUNTER LOGIC BOARD COMPONENT LAYOUT
(81650)

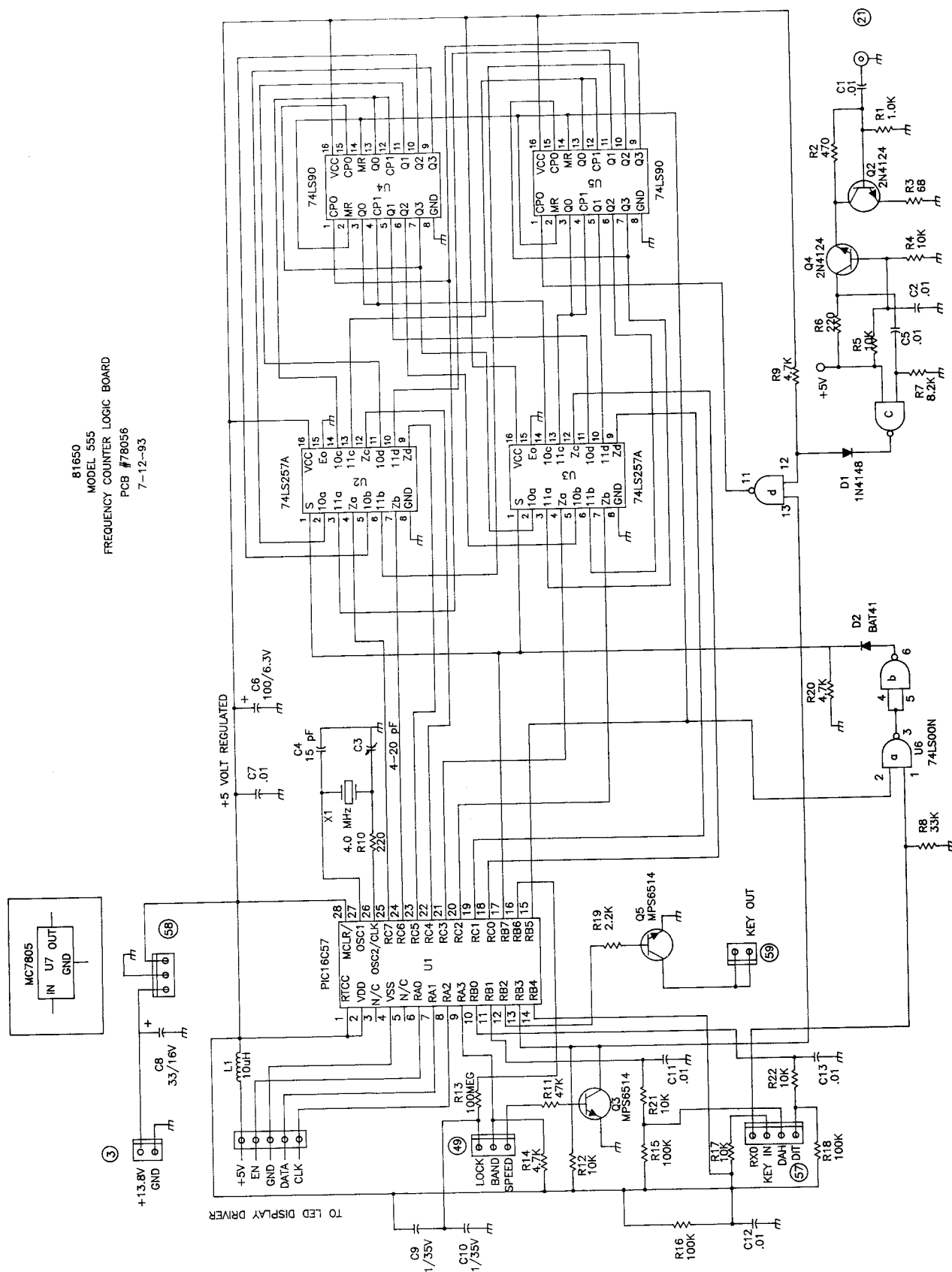


FIGURE 3-20 FREQUENCY COUNTER LOGIC BOARD SCHEMATIC (81650)

3-9 NOISE BLANKER (81697)

The I.F. signal plus noise is available from connector 18 on the Receiver Control Board (81644). The signal and noise are amplified, separated and the detected noise pulse is applied to the noise blanker gate located on 81644.

Operation: U1 and U2 amplify the signal and noise. Q1,Q2 develop an agc voltage that is applied to the amplifier stages keeping them in the linear region of amplification. Q1,Q2 are also configured to separate the noise pulse from the signal. R12,C13 form a very slow attack agc time constant. This will not allow the noise to develop

an agc voltage. A signal that is present for any length of time will develop an agc voltage and reduce the gain of the amplifiers. The constants in the agc circuit set the level of a steady state signal, at the output pin of U2, so that it will be just below the point of conduction in Q3. Any noise pulse riding on the signal will drive Q3 into conduction. C14 removes any residual RF and provides the noise pulse to Q4,Q5.

Alignment: Connect an oscilloscope to the collector of Q3. Apply a very small noise pulse to the antenna and tune L1/L2 for maximum noise pulse as indicated on the scope.

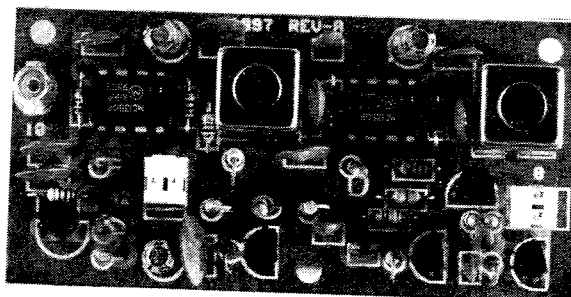
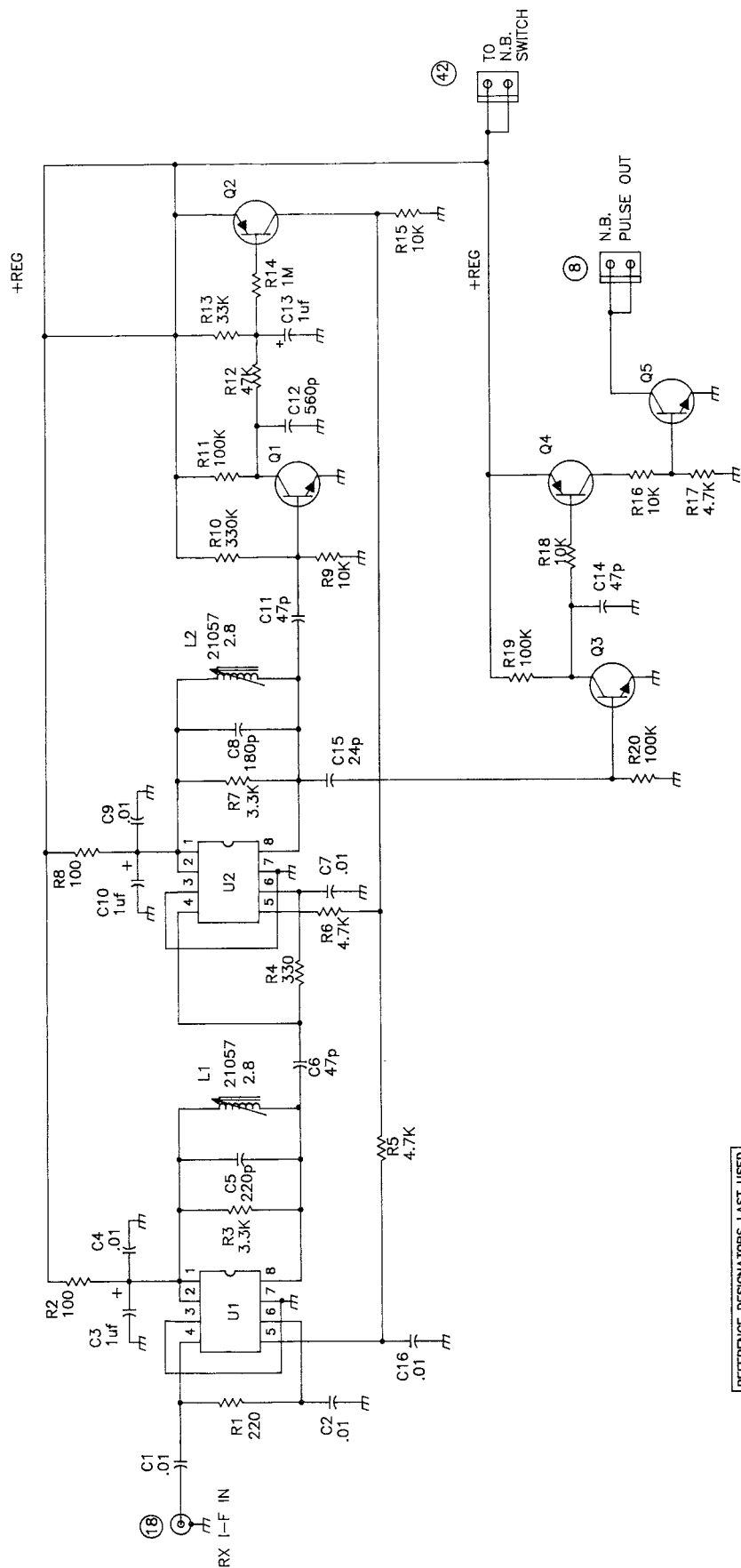


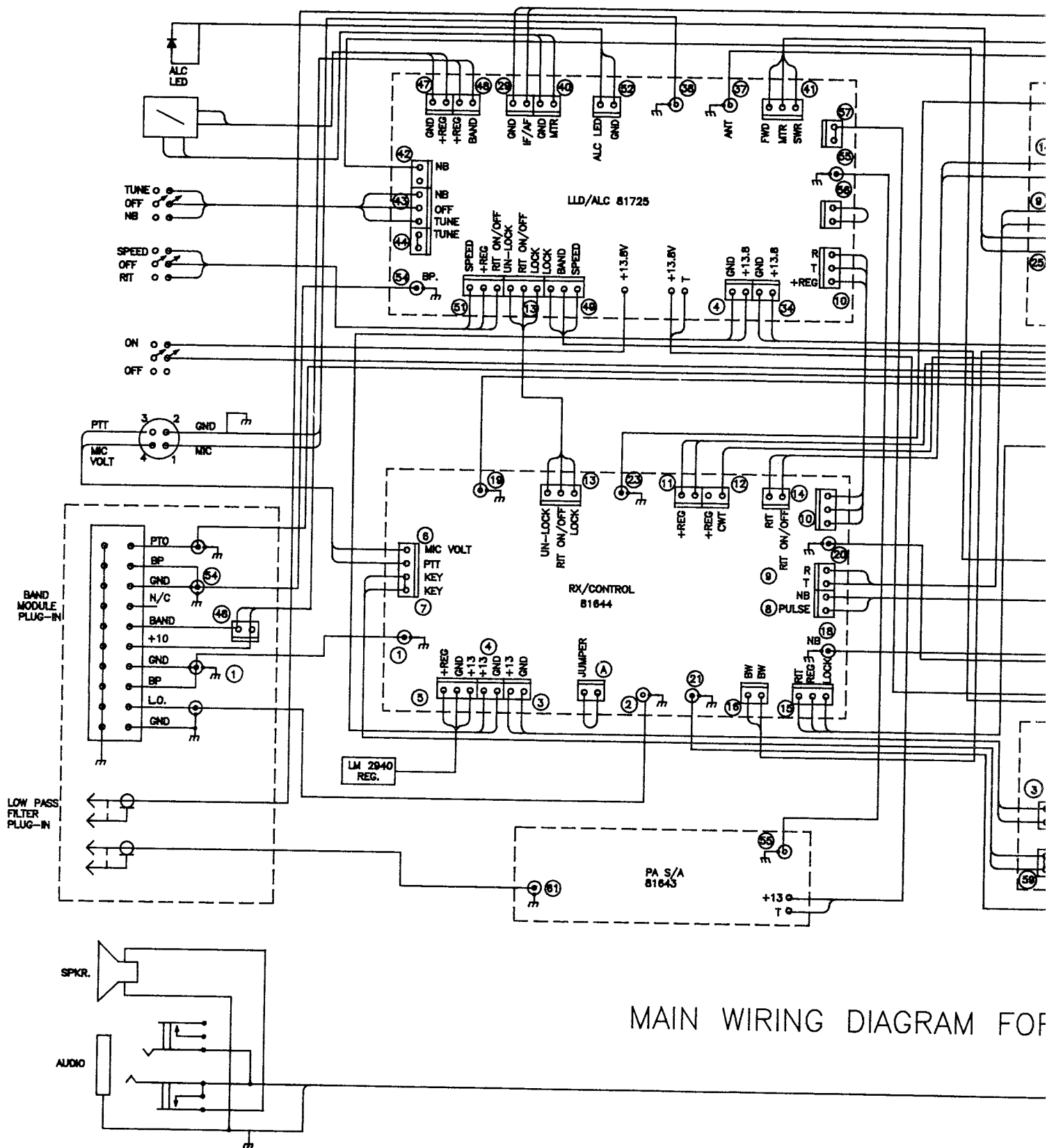
FIGURE 3-21 NOISE BLANKER COMPONENT LAYOUT (81697)



U1, U2 MC1350
Q1, Q3, Q5 MPS6514
Q2, Q4 2N5087

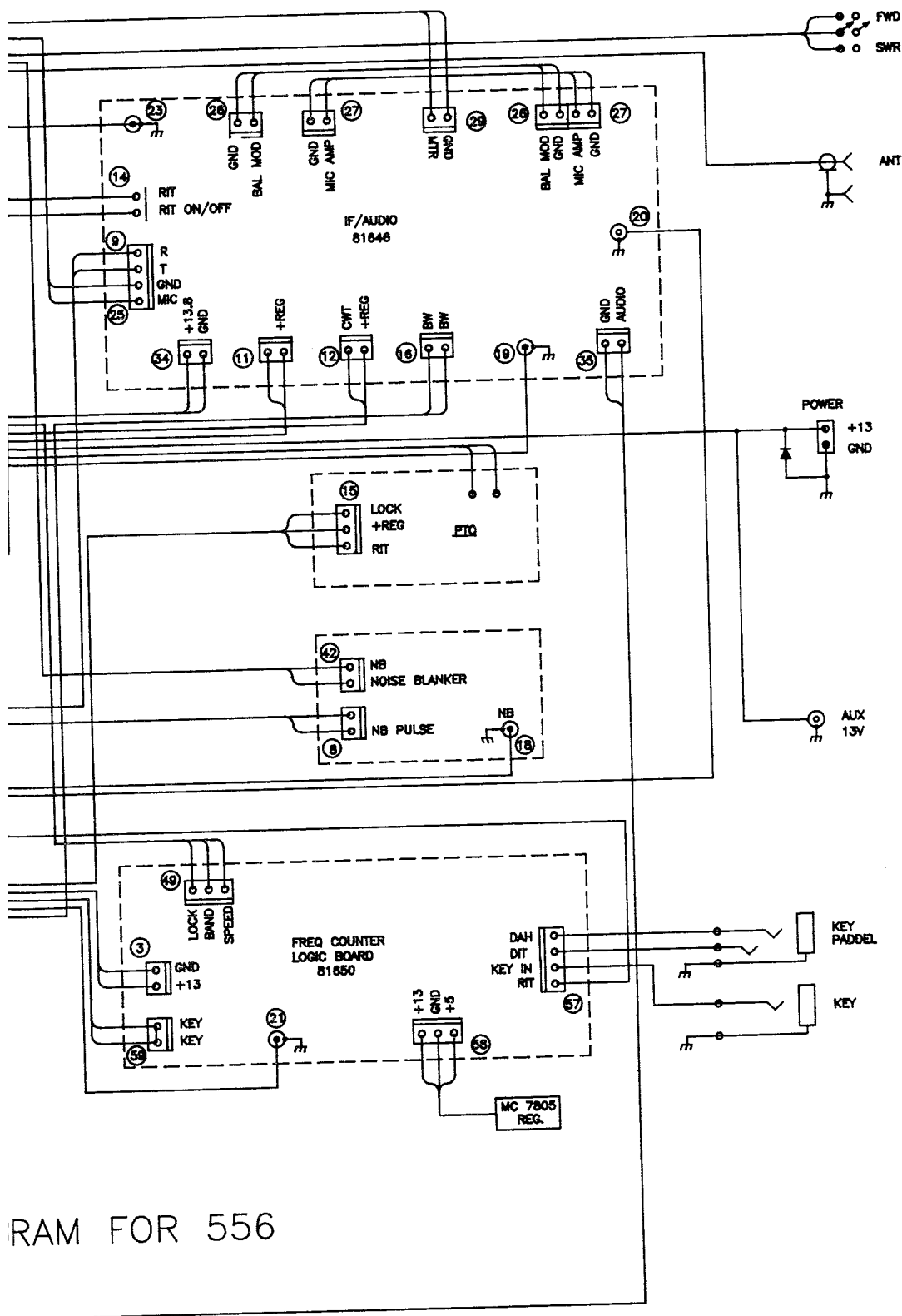
REFERENCE DESIGNATORS LAST USED
C16, L2, R20, Q5, U2
NOTE: UNLESS OTHERWISE SPECIFIED
1) CAPACITORS IN MICROFARADS (μF)
2) INDUCTORS IN MICROHENRYS (μH)
3) RESISTORS IN OHMS ±5% 1/4WATT

FIGURE 3-22 NOISE BLANKER SCHEMATIC (81697)



MAIN WIRING DIAGRAM FOR

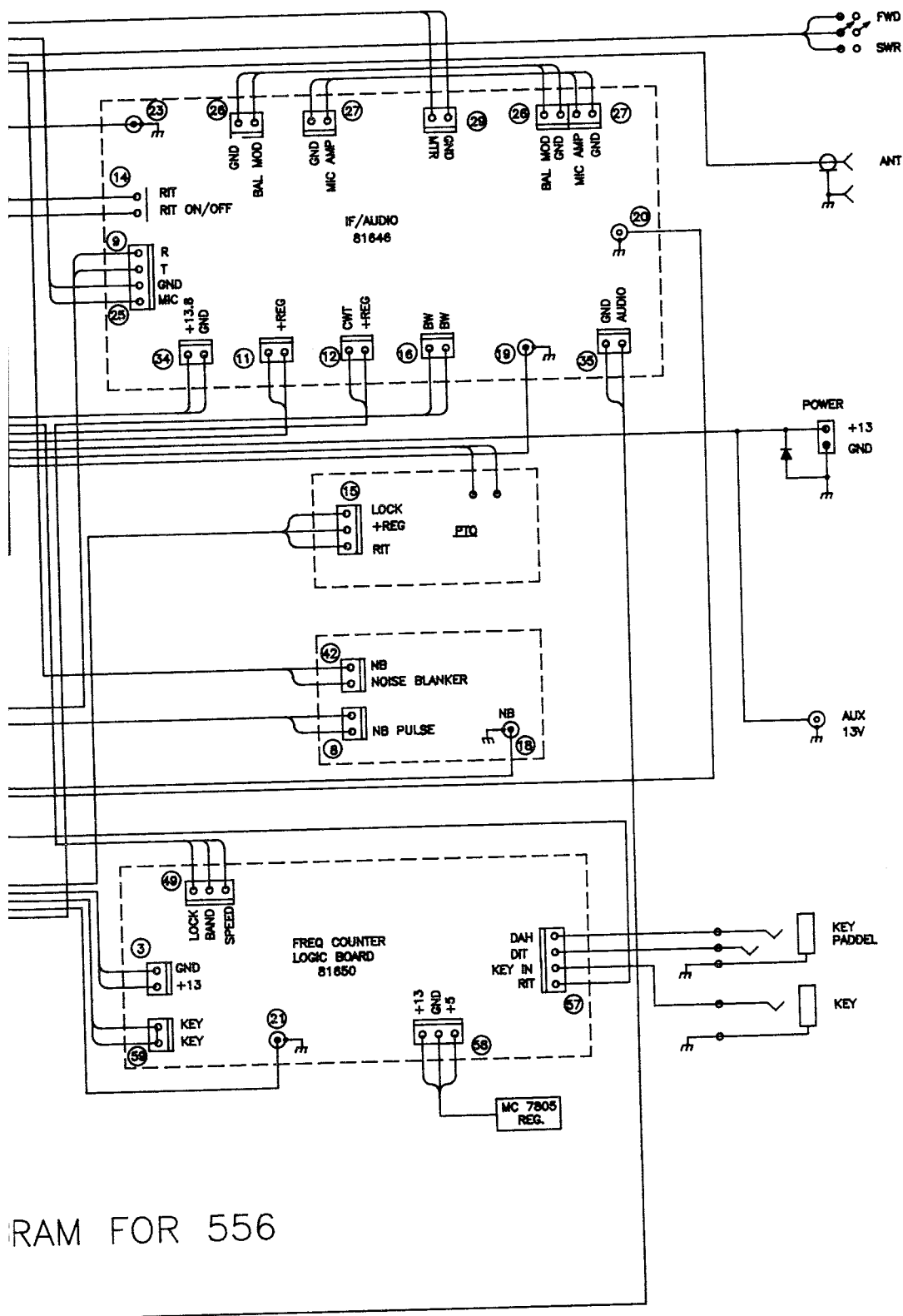
FIGURE 3-23 MAIN WIRING DIAGRAM FOR



RAM FOR 556

GRAM MODEL 556

3-30/3-31 BLANK



GRAM FOR 556

GRAM MODEL 556

3-30/3-31 BLANK

TEN-TEC, Inc.
1185 Dolly Parton Parkway
Sevierville, TN 37862

CUSTOMER SERVICE TELEPHONE
423-428-0364

LIMITED WARRANTY AND SERVICE POLICY, U.S.A.

TEN-TEC, Inc. warrants this product to be free from defects in material and workmanship for a period of one year from the date of purchase, under these conditions:

1. THIS WARRANTY APPLIES ONLY TO THE ORIGINAL OWNER. It is important that the warranty registration card be sent to us promptly to establish you as the owner of record. This will also insure that any bulletins pertaining to this equipment will be sent to you.
2. READ THE MANUAL THOROUGHLY. This warranty does not cover damage resulting from improper operation. Developing a thorough understanding of this equipment is your responsibility.
3. IF TROUBLE DEVELOPS we recommend that you contact our customer service group direct. The selling dealer is not obligated by us to perform service in or out of warranty. It has been our experience that factory direct service is expeditious and usually results in less down-time on the equipment. Some dealers do offer warranty service and of course, have our complete support.
4. WE ENCOURAGE SELF HELP. Taking the covers off does not void the warranty. In many cases our customer service technicians, with your help, can identify a faulty circuit board. In these cases we will send you a replacement board which you can change out. This will be shipped on a 30 day memo billing and when the defective board is returned, we will issue credit.
5. EQUIPMENT RETURNED TO THE FACTORY must be properly packaged, preferably in the original shipping carton. You pay the freight to us and we prepay surface freight back to you.
6. EXCLUSIONS. This warranty does not cover damage resulting from misuse, lightning, excess voltages, polarity errors or damage resulting from modifications not recommended or approved by Ten-Tec. In the event of transportation damage a claim must be filed with the carrier. Under no circumstances is Ten-Tec liable for consequential damages to persons or property caused by the use of this equipment.
7. TEN-TEC RESERVES the right to make design changes without any obligation to modify equipment previously manufactured.
8. THIS WARRANTY is given in lieu of any other warranty, expressed or implied.

SERVICE OUTSIDE OF THE U.S.A.

Many of our dealers provide warranty service on the equipment they sell. Many of them also provide out of warranty service on all equipment whether they sold it or not. If your dealer does not provide service or is not conveniently located, follow the procedure outlined above. Equipment returned to us will be given the same attention as domestic customers but all freight expense, customs and broker fees will be paid by you.