

# HAMTRONICS® R100 VHF FM RECEIVER: ASSEMBLY, INSTALLATION, OPERATION, & MAINTENANCE

## Note about page numbers.

In order to accommodate various bands, this manual has extra pages you may not receive for your version. The two meter version will have pages numbered 1 through 7. Other bands may have a higher number page substituted for the two meter parts list page, so pages may not all be consecutive.

## FUNCTIONAL DESCRIPTION.

The R100 is a commercial-grade single-channel vhf fm receiver available in models for various bands, both in kit form and factory wired and tested.

The R100 features a front end with low-noise dual gate fet's and triple-tuned circuits for excellent sensitivity and rejection of out-of-band interference. It has an 8-pole crystal filter with steep skirts plus a ceramic filter for close channel spacing or repeater operation. The i-f selectivity, for instance, is down over 100dB at  $\pm 12$  kHz away from the carrier, which is 40-50 dB better than most transceivers.

A new positive-acting, wide-range squelch circuit locks onto fading signals. The R100 has output terminals for low-level squelched audio and discriminator audio as well as speaker audio and a COS logic signal from the squelch circuit.

## ASSEMBLY.

### General Information.

☛ *Note that vhf equipment requires precise construction using short, direct leads. Seat parts as close to the board as possible without over-stressing the leads.*

Be sure to follow instructions as given and don't arbitrarily do things differently.

When installing resistors and diodes that are mounted vertically, be sure to orient the body as shown by large circles in parts location diagram.

☛ *Static handling precautions are required for the fet's. The small geometry and high impedances make FET's heat and static sensitive; so be careful. It is good to discharge your hand to a grounded metal object just before picking up a transistor, and the use of a grounded soldering iron is mandatory.*

### Assembly Procedure.

a. Set board on bench or in holding jig oriented as shown.

b. Install phono jack J1, orienting the center lug toward the inside of the board where the large pad is located under the board. Bend the center tab over against the foil, and solder all tabs under board.

c. Install FET's Q1 & Q2 from top of

board. ORIENT THEM AS SHOWN with the long drain lead positioned as indicated. Note that the LETTERING MUST BE UP, not against the board. Gently bend the leads of the fet's at right angles, and insert into the holes in the board. Seat the transistors as close to board as possible without straining leads. Solder leads under board.

d. The crystal filters must be installed with uncoded ends to the outside world and the terminals which are connected to each other all with matching color dots. The idea is to connect these tandem filters in the circuit in the same sequence as they were matched at the factory. Start with either filter having only one color dot. Install in position FL1 with color dot to the right as shown.

e. Install the filter with the matching color dot in position FL2 so that matching color dots on FL1 and FL2 are adjacent to each other.

f. Likewise, install FL3 with upper color dot to match right-hand dot on FL2. Then, install FL4 with only one remaining color dot adjacent to matching color dot on FL3.

g. Install ferrite beads Z1-Z4, and solder leads to board.

h. Install diodes CR1 and CR2, observing polarity. Note that the banded ends of the diodes should be down.

i. Install transistors Q3-Q5 and voltage regulator U3, observing proper orientation.

j. U1 and U2 have a dot over pin 1 or a notch in that end for identification as shown in diagram. Solder the ic's in place, being careful about polarity.

*Also note that using a socket is not recommended for i-f amplifier U1 because of the extra inductance the socket would add to the high frequency circuits, and audio output ic U2 needs to be heatsunk to the ground plane on the board. Therefore, ic sockets have not been supplied.*

k. Install electrolytic capacitors, observing polarity.

l. Install slug tuned coils and transformers as shown, and install coil shields. The 2½ turn (red) coils come with shields already on the coils; however, in some cases, the shield must be removed and rotated 90° in order to fit holes in pc board. The 6½ turn (blue) coils have shields supplied separately.

*Note: Wait to install L3 after all other parts are installed. It is easier to install adjacent capacitors before L3 is mounted.*

m. Make sure the coils and shields are fully seated, and solder both shield lugs. (Do not bend lugs over, but you can bend the coil leads over a little to hold them in place while soldering.)

o. Install socket pins at Y1. Cut socket

pins from carrier strip close to body. Rock them while firmly pressing into board. They will snap in place. Solder lightly under board (to avoid solder filling crystal sockets).

p. Install all remaining components as per location diagram and parts list. Leave the top leads of R3, R7, R13, and R18 about 1/8" high to act as test points. R4 and R5 each use two 6.8K resistors tack soldered together at the top to give 14K total resistance.

q. Install pots R10 and R20. They should be held in position while soldering so shafts are at right angles to board, thereby minimizing strain on leads when pots are later secured to front panel.

r. Install L3.

s. Check over all parts and solder connections. If you are missing any parts, check to see if you have other parts left over. You may have installed a wrong value somewhere; so recheck all values looking for the missing parts. Color codes and printed numbers are difficult to read on many small parts, so special care is sometimes needed to avoid mix-ups. Note that on certain models, some parts may be marked "not used" in the parts list.

## CRYSTALS.

The channel crystal plugs into sockets on the board. We can supply crystals for any frequency desired. We recommend that any new crystals be ordered directly from us to be sure that they will perform properly over the -30 to +60°C range for which the unit was designed. If you do order elsewhere, be sure to supply the following specs.

The receiver uses 32 pF parallel resonant crystals in HC-25/u holders. Crystals operate in the fundamental mode. The crystal frequency is as noted in the table below. Frequency tolerance is .001%. If you use an OV-1 crystal oven, specify a crystal with a 60°C breakpoint.

*Note: If your crystal has a metal base, avoid pushing the crystal down tight against the sockets. After installing a crystal, simply lift it slightly to be sure the base doesn't touch*

### Specifications of Interest

**Frequency Range:** R100-50, 46-54 MHz  
R100-72, 72-76MHz  
R100-144, 140-175 MHz  
R100-220, 216-225 MHz

**Sensitivity (12dB SINAD):** 0.15uV

**Squelch Sensitivity:** 0.1uV

**Selectivity:**  $\pm 12$  kHz at -100dB

**Modulation Acceptance:**  $\pm 7.5$  kHz

**IF Filters:** 8 pole 10.7 MHz crystal filter plus 455 kHz ceramic filter.

**Audio Output:** 2 Watts (8 ohms).

**Operating Power:** +13.6Vdc at 45-120 mA, depending on audio level.

**Size:** 4 in. W x 3-7/16 in. D (plus pot. shafts)

the sockets. If you use a crystal oven, when you install it, push it down over the crystal and stop pushing when you feel the oven contact the top of the crystal.

#### Crystal Frequency Formula

R100-50, 46-54 MHz	-----	(F-10.7)/3
R100-72, 72-76MHz	-----	(F-10.7)/4
R100-144, 140-175 MHz	-----	(F-10.7)/9
R100-220, 216-225 MHz	-----	(F-10.7)/12

## INSTALLATION.

### Power Connections.

The receiver operates on +13.6 Vdc at about 120 mA peak with full audio. Current drain with no audio is only about 45 mA. A crystal oven adds about 450 mA peak current drain when cold and only about 25 mA when warm. A well regulated power supply should be used.

Be sure that the power source does not carry high voltage or reverse polarity transients on the line, since semiconductors in the receiver can be damaged. The positive power supply lead should be connected to the receiver at terminal E3, and the negative power lead should be connected to the ground plane of the board through the mounting hardware or the shield of the coaxial cable. Be sure to observe polarity!

### Speaker.

An 8-ohm loudspeaker should be connected to E2 with ground return through the mounting hardware. Use of lower impedance speaker or shorting of speaker terminal can result in ic damage. The receiver can also drive higher impedances, like 1K to 10K input impedances of COR boards, etc. There is no need to load down the output to 8 ohms.

*Note that the audio output ic is designed to be heatsunk to the pc board through the many ground pins on the ic. When running moderately low audio levels as most applications require, it is no problem to use an ic socket; so we have provided one for your convenience. If you will be running high audio levels, check to see if the ic is getting hot. If so, you should remove the ic socket, and solder the LM-380N-8 ic directly to the board for better heatsinking.*

### Antenna Connections.

The antenna connection should be made to the pc board with an RCA plug of the low-loss type made for rf. We sell good RCA plugs with cable clamp. See A5 plug on website.

If you want to extend the antenna connection to a panel connector, we recommend using a short length of RG-174/u coax with the plug and keep the pigtailed very short.

We do **not** recommend trying to use direct coax soldered to board or another type of connector. The method designed into the board results in lowest loss practical. When soldering the cable, keep the stripped ends as

short as possible.

☛ We recommend you always use antennas with a matching network which provides a dc ground on the driven element. This reduces chances of static buildup damaging the input stage of the receiver as well as providing safety for the building and other equipment.

## OPTIONS.

### Repeater Use.

E4 provides a COS (carrier operated switch) output which may be connected to a COR module to turn a transmitter on and off. The output level is about 8V unscelched and 0V scelched. There is a resistor in series with the output to limit current. Therefore, the voltage that appears at the COR board will depend on the load resistance at the input of that board. For best results, be sure that the input resistance of the COR board is at least 47K. If the input resistance is too low, no damage to the receiver will occur; but the squelch circuit hysteresis will be affected.

If your repeater controller uses discriminator audio, rather than the speaker output, filtered discriminator audio is available at E5. The level is about 2V p-p. *Note that discriminator audio is not de-emphasized.* If you need audio which is squelched, take it from Repeater Audio terminal E1.

If your controller uses low level audio and has a high input impedance (20K or higher), squelched audio can be obtained from E1 independent of the VOLUME control.

### Discriminator Meter.

If you wish to use a discriminator meter and you are handy in designing with op-amps, you can run a sample of the dc voltage at DISCRIMINATOR output terminal E5 to one input of an op-amp and tie the other input to a voltage divider pot set to provide a reference voltage of about +3.3Vdc.

### S-Meter.

There is no s-meter function, as such, available in i-f amplifier ic's made for professional receivers; however, a signal strength indication is available at test point TP-2. This voltage is a function of the noise level detected in the squelch circuit. It also varies with SQUELCH control setting. With the SQUELCH set to where the squelch just closes, the dc voltage at TP-2 is about -0.55V with no signal and +0.75 with full quieting signal. You can tap off this test point with a high-impedance circuit, such as an op-amp, to drive a meter or a computerized repeater controller.

### Subaudible Tone Decoder.

To use our TD-5 Subaudible Tone Decoder or a similar module, connect its audio input to DISCRIMINATOR terminal E5. If you want to use it to mute the audio (instead of inhibiting a repeater transmitter as is normally done),

connect the mute output of the TD-5 to E1 on the receiver.

## ALIGNMENT.

Equipment needed for alignment is an fet voltmeter, an rf signal generator, a regulated 13.6Vdc power supply with a 0-200 mA meter internally or externally connected in the supply line.

The slug tuned coils in the receiver should be adjusted with the proper aluminum .062" square tuning tool to avoid cracking the powdered iron slugs. The variable capacitor should be adjusted with a plastic tool with a small metal bit on the end. Tools are available for adjusting the rf coils (model A28) and variable capacitor (model A2).

The SQUELCH pot should be set fully counterclockwise. The VOLUME pot should be set just a little clockwise.

a. Install channel crystal in socket.

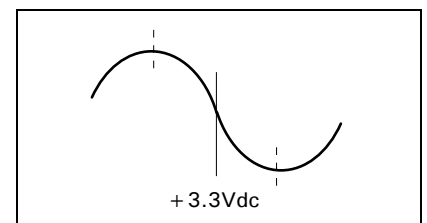
b. Connect speaker and +13.6 Vdc. You should hear white noise.

c. Connect dc voltmeter to TP-1 (top lead of R7 on left side of board). Adjust first L7, then L6 and L7 alternately for maximum response. (Approx. +1 to 2 Vdc typical.)

d. Connect stable signal generator to TP-4 (the top lead of R3), using coax clip lead. Connect coax shield to pcb ground. Set generator to exactly 10.7000 MHz. Use a frequency counter or synthesized signal generator. Set level just high enough for full quieting. At 2 uV, you should notice some quieting, but you need something near full quieting for the test.

e. Connect dc voltmeter to TP-3 (top lead of R18 on right side of board). Adjust discriminator transformer L10 for +3.3Vdc. Note that the transformer is fairly close from the factory and usually only requires less than ¼ turn in either direction.

☛ Be careful not to turn the slug tight against either the top or bottom because the winding of the transformer can be broken. The tuning response is an S-curve; so if you turn the slug several turns, you may think you are going in the proper direction even though you are tuning further away from center frequency.



f. Connect signal generator to J1 using a coax cable with RCA plug. Adjust signal generator to exact channel frequency, and turn output level up fairly high (full quieting). Adjust frequency trimmer capacitor C15 to net the crystal to channel frequency, indicated by

+3.3Vdc at test point TP-3.

► If you can't find the signal at all, tune your signal generator up and down the band slightly. Also check that oscillator is peaked as per step c. If your crystal has the wrong load correlation or is slightly out of tolerance, you may be able to compensate by changing the value of C16 so C15 can net the crystal on frequency. The piston capacitor tuning range is restricted to provide best frequency stability; so sometimes it may be necessary to change the fixed capacitor. The proper adjustment results in +3.3Vdc, the same as preset for the exact 10.700 MHz i-f frequency earlier.

Maximum capacitance (lowest frequency) occurs with the piston screwed in all the way, and minimum capacitance (highest frequency) is with the piston all the way up. Be careful not to completely remove the piston. If the piston screw becomes a little tight (squeaky), you can apply a small amount of silicone oil to the threads.

**Note:** There are two methods of adjusting the mixer and front end. One is to use an fet voltmeter with test point TP-2, which is the top lead of R13. The voltage at this point is proportional to the amount of noise detected in the squelch circuit; so it gives an indication of the quieting of the receiver. With SQUELCH control fully ccw, the dc voltage at TP-2 varies from -0.5 Vdc with no signal (full noise) to +0.8 Vdc with full quieting signal.

The other method is to use a regular professional SINAD meter and a tone modulated signal.

In either case, a weak to moderate signal is required to observe any change in noise. If the signal is too strong, there will be no change in the reading as tuning progresses; so keep the signal generator turned down as receiver sensitivity increases during tuning.

If you use TP-2 with a voltmeter, the signal can be modulated or unmodulated. If you use a SINAD meter, the standard method is a 1000 Hz tone with 3 kHz deviation.

g. Connect fet dc voltmeter to TP-2 (top lead of R13). Set signal generator for relatively weak signal, one which shows some change in the dc voltage indication at TP2. Alternately peak multiplier coils L8 and L9 until no further improvement can be made.

h. Likewise, alternately adjust rf amplifier coils L1-L4 until no further improvement can be made.

When properly tuned, sensitivity should be about 0.15 to 0.2  $\mu$ V for 12 dB SINAD.

• Mixer output transformer L5 normally should not be adjusted. It is usually set exactly where it should be right from the factory. The purpose of the adjustment is to provide proper loading for the crystal filter, and if misadjusted, ripple in the filter response will result in a little distortion of the detected audio. If it becomes necessary to adjust L5, tune the signal generator accurately on fre-

quency with about 3kHz fm deviation using a 1000 Hz tone. In order of preference, use either a SINAD meter, an oscilloscope, or just your ears, and fine tune L5 for minimum distortion of the detected audio.

## TROUBLESHOOTING.

The usual troubleshooting techniques of checking dc voltages and signal tracing work well in troubleshooting the receiver. DC voltage charts and a list of typical audio levels are given to act as a guide to troubleshooting. Although voltages may vary widely from set to set and under various operating and measurement conditions, the indications may be helpful when used in a logical troubleshooting procedure.

The most common troubles in all kits are interchanged components, cold solder joints, and solder splashes. Another common trouble is blown transistors and ic's due to reverse polarity or power line transients. Remember if you encounter problems during initial testing that it is easy to install parts in the wrong place. Don't take anything for granted. Double check everything in the event of trouble.

### Signal Tracing.

If the receiver is completely dead, try a 10.700 MHz signal applied to TP-4 (the top lead of R3), using coax clip lead. Connect coax shield to pcb ground. Set level just high enough for full quieting. At 2  $\mu$ V, you should notice some quieting, but you need something near full quieting for the test.

You can also connect the 10.700 MHz clip lead through a blocking capacitor to various sections of the crystal filter to see if there is a large loss of signal across one of the filter sections. Also, check the 10.245 MHz oscillator with a scope or by listening with an hf receiver or service monitor.

A signal generator on the channel frequency can be injected at various points in the front end. If the mixer is more sensitive than the rf amplifier, the rf stage is suspect. Check the dc voltages looking for a damaged fet, which can occur due to transients or reverse polarity on the dc power line. Also, it is possible to have the input gate (gate 1) of the rf amplifier fet damaged by high static charges or high levels of rf on the antenna line, with no apparent change in dc voltages, since the input gate is normally at dc ground.

If audio is present at the volume control but not at the speaker, the audio ic may have been damaged by reverse polarity or a transient on the B+ line. This is fairly common with lightning damage.

If no audio is present on the volume control, the squelch circuit may not be operating properly. Check the dc voltages, and look for noise in the 10 kHz region, which should be present at the top lead of R14 (U1-pin 11) with no input signal. (Between pins 10 and 11 of U1 is an op-amp active filter tuned to 10

kHz.)

### Current Drain.

Power line current drain normally is about 45mA with volume turned down or squelched and up to 120 mA with full audio output.

If the current drain is approximately 100 mA with no audio output, check to see if voltage regulator U3 is hot. If so, and the voltage on the 8V line is low, there is a short circuit on the +8Vdc line somewhere and U3 is limiting the short circuit current to 100mA to protect the receiver from further damage. If you clear the short circuit, the voltage should rise again. U3 should not be damaged by short circuits on its output line; however, it may be damaged by reverse voltage or high transient voltages.

### Test Point Indications.

The following measurements are typical of those found at the three built-in test points used for alignment. They can vary considerably without necessarily indicating a problem, however; so use with other findings to analyze problems, don't jump to conclusions.

#### Oscillator Test Point 1

Approx. +1 to 2 Vdc with osc running and output tuned circuits aligned. Varies as L6 and L7 are aligned. 0Vdc with oscillator not running or coils not properly aligned. *Not used on 50 MHz model.*

#### Signal Strength Test Point 2

With SQUELCH control fully ccw, the dc voltage at TP-2 varies from -0.5 Vdc with no signal (full noise) to +0.8 Vdc with full quieting signal.

With the SQUELCH control set to where the squelch just closes, the dc voltage at TP-2 varies from about -0.55V with no signal to +0.75 with full quieting signal

#### Discriminator Test Point 3

Varies with frequency of input signal. Voltage at this point normally is adjusted for +3.3Vdc with a signal exactly on frequency. Can vary a little without being a problem.

### Typical Dc Voltages.

The following dc levels were measured with an fet voltmeter on a sample unit with +13.6 Vdc power applied. All voltages may vary considerably without necessarily indicating trouble. The chart should be used with a logical troubleshooting plan.

All voltages are positive with respect to ground except as indicated. Voltages are measured with no signal applied but with crystal(s) installed and oscillator(s) running properly and with squelch open unless otherwise specified.

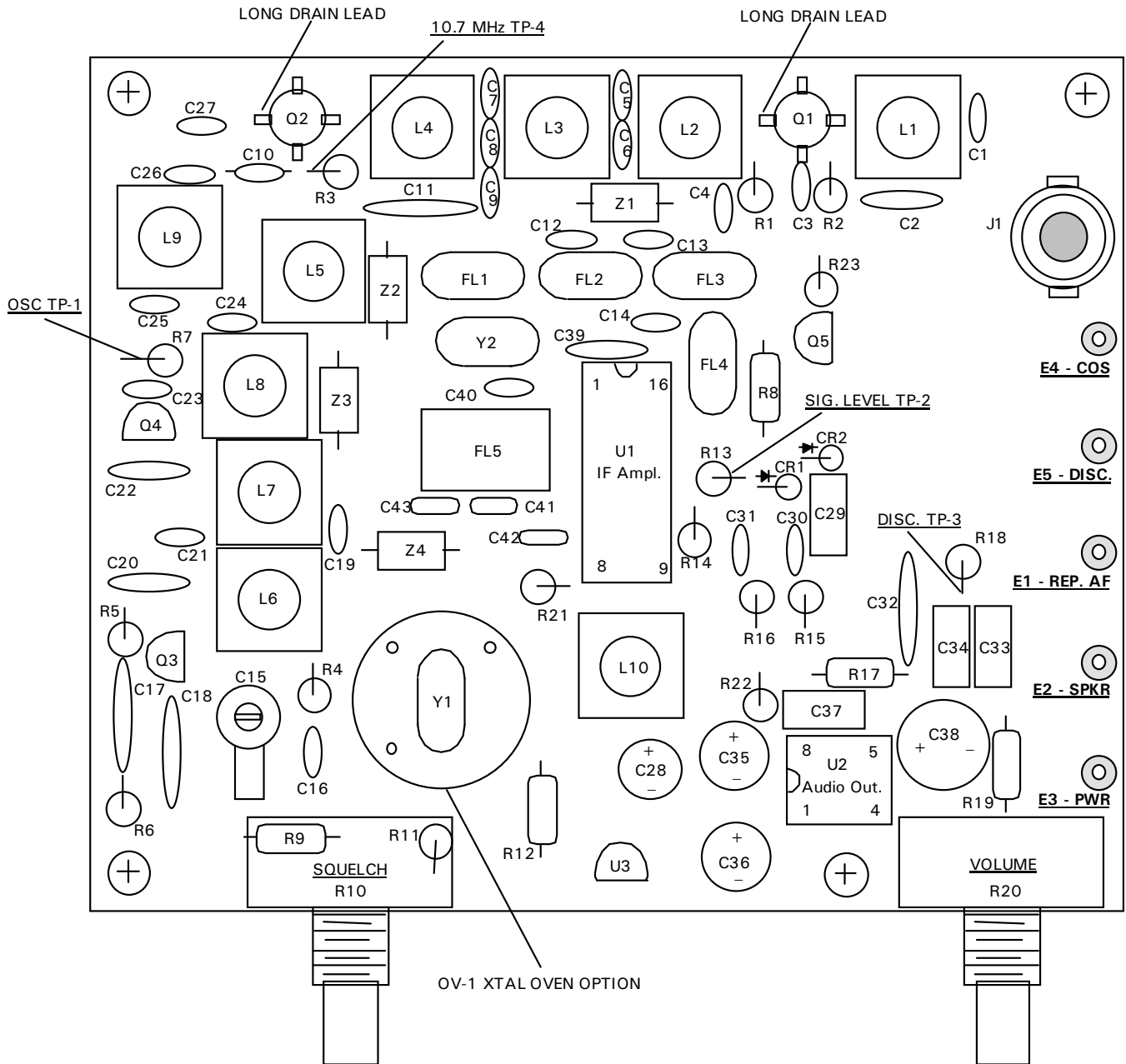
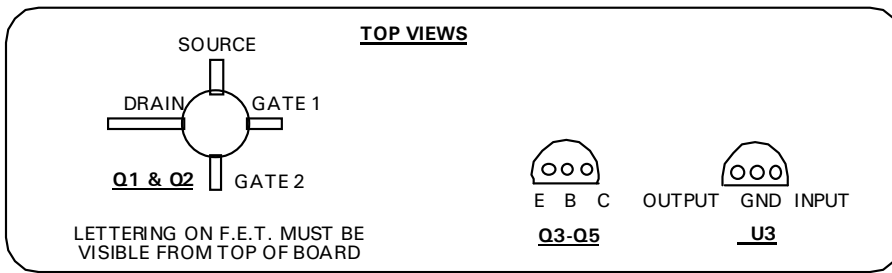
XSTR	Cond.	E(S)	B(G1)	C(D)	G2
Q1		0	0	8	4
Q2		0	0	8	0
Q3	w/xtal	4.4	3.5	8	-
	no xtal	3.2	3.9	8	-
Q4	drive	1 - 2	0	8	-
	no drive	0	0	8	-
Q5	sq open	0	0	8	
	sq closed	0	0.66	0.1	

IC Measurements		
U1-1: 7.8V	U1-10:	U2-1: 0V
U1-2: 7.4V	0.75V	U2-2:
U1-3: 7.6V	U1-11:	0.5V
U1-4: 8V	1.45V U1-	U2-3: 0V
U1-5: 7.6	12: 0.8V	U2-4: 0V
U1-6: 7.6V	(with	U2-5: 0V
U1-7: 7.6V	sqelch just	U2-6: 7V
U1-8: 8V	closed)	U2-7:
U1-9: 3.3V	U1-13:	13.6V
(On freq.;	0V (sq	U2-8:
Varies	open),	6.8V
w/freq)	7.6V	
	(sq closed)	
	U1-14: 0V	
	U1-15: 0V	
	U1-16: 1.8V	

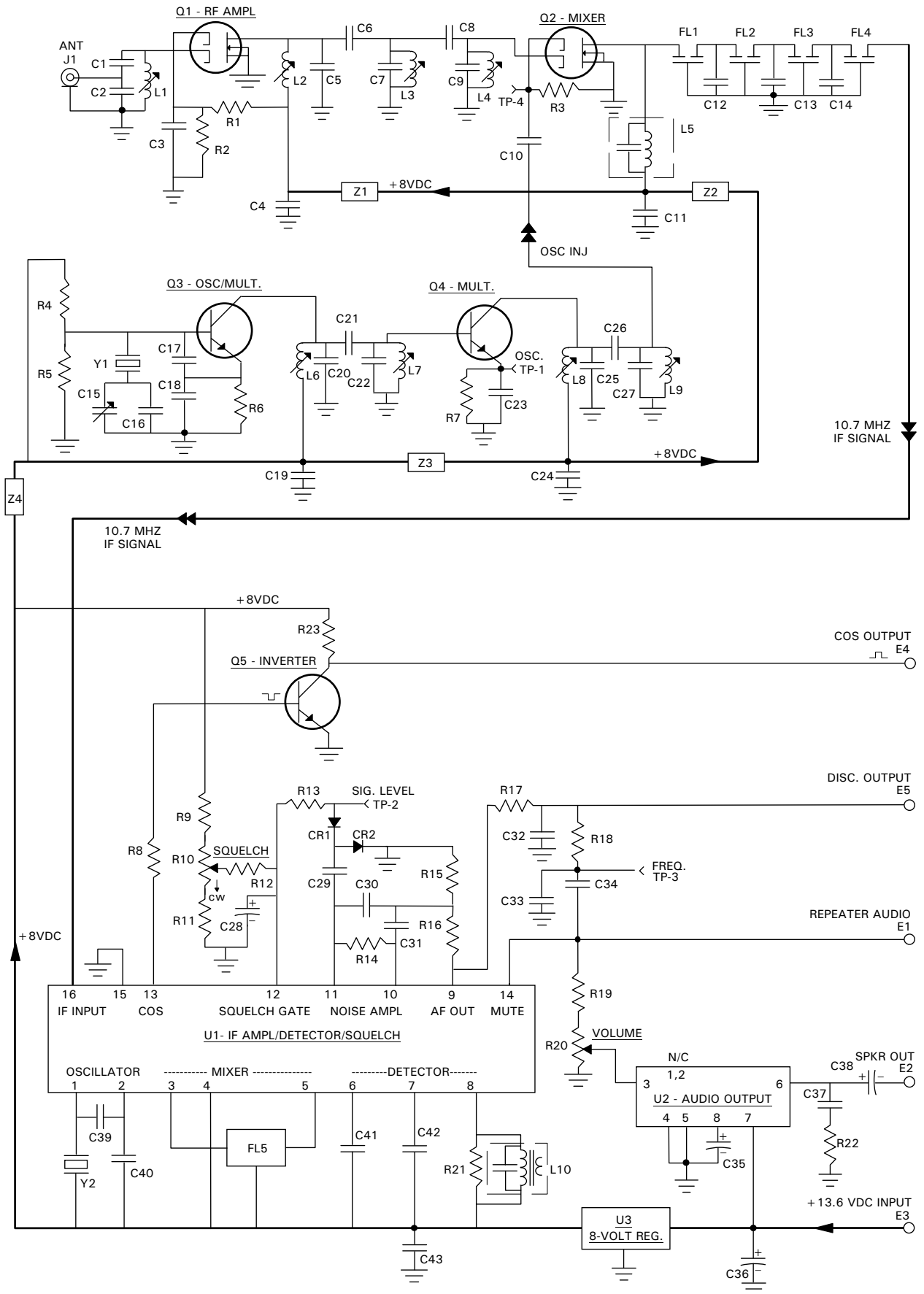
### Typical Audio Levels.

Following are rough measurements of audio circuits, using an oscilloscope. Measurements were taken with no input signal, just white noise so conditions can be reproduced easily.

Audio Test Point	Normal Level
U1-9 (Discriminator)	3V p-p audio
E5 (Disc Output)	2V p-p audio
TP-3	100mV p-p audio
E1 (Repeater Output)	100mV p-p audio
U1-11, top of R14 (noise ampl output)	2V p-p noise
Top of Vol Cont R20	100mV p-p audio
U2-3 (af ampl input)	0 to 100mV p-p (depends on volume control)
U2-6 or E2 (speaker ampl output)	0 to 3V p-p audio



**Figure 1. R100 Receiver. Component Location Diagram**



**Figure 2. R100 Receiver, Schematic Diagram**

## PARTS LIST FOR R100 RECEIVER, FOR 140-152 MHZ

(Values for higher frequencies in commercial band shown at end of parts list. These parts normally are not supplied in kits except on special order.)

Ref #	Value	(marking)
C1	15 pf np0	
C2	56 pf np0	
C3-C4	680pf	
C5	15 pf np0	
C6	not used *	
C7	18 pf np0	
C8	not used *	
C9	15 pf np0	
C10	2 pf np0	
C11	.01 uf (103)	
C12	8 pf	
C13	7 pf	
C14	8 pf	
C15	Piston trimmer, 2-11.2 pf	
C16	39 pf np0	
C17-C18	150 pf 1206 chip cap ***	
C19	680pf	
C20	82 pf np0	
C21	2 pf	
C22	68 pf np0	
C23-C24	680pf	
C25	18 pf np0	
C26	0.5 pf chip cap ***	
C27	20 pf np0	
C28	0.47 uf electrolytic	
C29	0.15 uf polyester (red)	
C30-C31	.001 uf (102, 1nM, or 1nK)	
C32-C33	.01 uf (103)	
C34	0.15 uf polyester (red)	
C35	10 uf electrolytic	
C36	47 uf electrolytic	
C37	0.15 uf polyester (red)	
C38	470 uf electrolytic	
C39	68 pf np0	
C40	220 pf (221)	
C41-C43	0.1 uf monolithic (104)	
CR1-CR2	1N4148 ( p/n may not be marked)	
FL1-FL4	10.7 MHz matched xtal filter set	
FL5	455 kHz ceramic filter, 20 kHz bw (blue)	

J1	RCA jack
L1-L4	2-1/2 turns (red)
L5	10.7 MHz IF transformer, p/n 7A-691F or T1005
L6-L7	6-1/2 turns (blue)
L8-L9	2-1/2 turns (red)
L10	455kHz IF transformer p/n T1003
Q1-Q2	N.E.C. 3SK122 or Philips BF-988 dual-gate mos fet (⚡ static handling precautions required)
Q3-Q5	2N5770
R1-R3	100K
R4-R5	15K
R6	680Ω
R7	1K
R8	68K
R9	68K
R10	100K panel-mount pot.
R11	68K
R12	100K
R13	68K
R14	330K
R15	680Ω
R16	4.7k
R17	1K
R18	27K
R19	100K
R20	100K panel-mount pot.
R21	68K
R22	3.3Ω (orn-orn-gold-gold)
R23	27K
U1	MC-3361P IF Ampl/ Det/Squelch
U2	LM380N-8 Audio Amplifier
U3	78L08 Voltage Regulator
Y1	Channel Crystal (see text)
Y2	10.245 MHz, 62 pf, parallel-resonant IF xtal
Z1-Z4	Ferrite Beads, double long

### Note:

\* On this band, there is sufficient coupling between pads on the board so no extra capacitance is needed for C6 and C8.

\*\*\* Note: disc cap is no longer available in this value. Carefully tack solder surface mount capacitor on bottom of board. Hold it carefully with tweezers to avoid dropping it.

### ► Values for 152-165 MHz, for frequency sensitive parts.

C1	12 pf np0
C2	47 pf np0
C5	12 pf np0
C7	15 pf np0
C9	12 pf np0
C20	68 pf np0
C22	56 pf np0
C25	12 pf np0
C27	18 pf np0
► Values for 165-175 MHz, for frequency sensitive parts.	
C1	12 pf np0
C2	47 pf np0
C5	12 pf np0
C7	15 pf np0
C9	12 pf np0
C20	62 pf np0
C22	56 pf np0
C25	12 pf np0
C27	15 pf np0

**PARTS LIST FOR HUBBELL  
R100 RECEIVER, FOR 72-76  
MHZ (NOT USED ANY MORE)**

Ref #	Value	(marking)
C1	33 pf np0	
C2	100 pf	
C3-C4	680pf	
C5	22 pf np0	
C6	0.5 pf chip cap ***	
C7	27 pf np0	
C8	0.5 pf chip cap ***	
C9	22 pf np0	
C10	2 pf np0	
C11	.01 uf (103)	
C12	8 pf	
C13	7 pf	
C14	8 pf	
C15	Piston trimmer, 2-11.2 pf	
C16	39 pf np0	
C17-C18	150 pf 1206 chip cap ***	
C19	680pf	
C20	150 pf np0 (151)	
C21	3 pf	
C22	150 pf np0 (151)	
C23-C24	680pf	
C25	33 pf np0	
C26	0.5 pf chip cap ***	
C27	39 pf np0	
C28	0.47 uf electrolytic	
C29	0.15 uf polyester (red)	
C30-C31	.001 uf (102, 1nM, or 1nK)	
C32-C33	.01 uf (103)	
C34	0.15 uf polyester (red)	
C35	10 uf electrolytic	
C36	47 uf electrolytic	
C37	0.15 uf polyester (red)	
C38	470 uf electrolytic	
C39	68 pf np0	
C40	220 pf (221)	
C41-C43	0.1 uf monolithic (104)	
CR1-CR2	1N4148 ( p/n may not be marked)	
FL1-FL4	see mods	
FL5	see mods	

J1	RCA jack
L1-L4	6½ turns (blue)
L5	10.7 MHz IF transformer, p/n 7A-691F or T1005
L6-L9	6½ turns (blue)
L10	455kHz IF transformer p/n 831-5 or YMC-15002 or T1003
Q1-Q2	N.E.C. 3SK122 or Philips BF-988 dual-gate mos fet (⚡static handling precautions required)
Q3-Q5	2N5770
R1-R3	100K
R4-R5	14K *
R6	680Ω
R7	1K
R8	68K
R9	68K
R10	100K panel-mount pot.
R11	68K
R12	100K
R13	68K
R14	330K
R15	680Ω
R16	4.7K
R17	1K
R18	27K
R19	100K
R20	100K panel-mount pot.
R21	68K
R22	3.3Ω (orn-orn-gold-gold)
R23	27K
U1	MC-3361P IF Ampl/ Det/Squelch
U2	LM380N-8 Audio Amplifier
U3	78L08 Voltage Regulator
Y1	Channel Crystal (see text)
Y2	10.245 MHz, 62 pf, parallel-resonant IF xtal
Z1-Z4	Ferrite Beads, double long

\*\*\* Note: disc cap is no longer available in this value. Carefully tack solder surface mount capacitor on bottom of board. Hold it carefully with tweezers to avoid dropping it.

**DATA FILTER MODS.**

This column provides information on modifications for using this receiver for fsk data reception. It is intended to give specific information on parts.

**PARTS INCLUDED.**

1 ea. 10.7MA ceramic filter\*

1 ea. LT455B ceramic filter

\*Note: The crystal filters normally used in a receiver kit are not supplied when this option is ordered.

**RECEIVER MODIFICATIONS.**

If you are building a kit, please mark the parts list with the following changes before beginning construction and use the attached parts location view in place of the one which comes with the kit. If you ordered a wired unit, these changes have already been made.

a. Remove or do not install regular i-f filters FL1-FL4 and capacitors between sections of the crystal filter, which are C12-C14 for the R100, C11-C13 for the R451, or C41-C43 for the R302 or R305 Receivers.

b. In positions for FL1, FL2, and FL3, install pieces of bus wire (lead clippings from some components) between the two end holes (don't use center ground hole). Make the jumpers as short as possible to minimize inductance.

c. Install "10.7MA" ceramic filter (small 3 lead device) in position FL4. You may have to use something like a dental pick to enlarge the holes slightly, but don't remove the plating within the hole.

d. Install LT455B ceramic filter in position FL5.



## PARTS LIST FOR REGULAR R100 RECEIVER, FOR 72-76 MHZ

Ref #	Value	(marking)	
C1	33 pf np0		J1 RCA jack
C2	100 pf		L1-L4 6½ turns (blue)
C3-C4	680pf		L5 10.7 MHz IF transformer, p/n 7A-691F or T1005
C5	22 pf np0		L6-L9 6½ turns (blue)
C6	0.5 pf chip cap ***		L10 455kHz IF transformer p/n 831-5 or YMC-15002 or T1003
C7	27 pf np0		Q1-Q2 N.E.C. 3SK122 or Philips BF-988 dual-gate mos fet (⚠ <i>static handling pre- cautions required</i> )
C8	0.5 pf chip cap ***		Q3-Q5 2N5770
C9	22 pf np0		R1-R3 100K
C10	2 pf np0		R4-R5 15K
C11	.01 uf (103)		R6 680Ω
C12	8 pf		R7 1K
C13	7 pf		R8 68K
C14	8 pf		R9 68K
C15	Piston trimmer, 2-11.2 pf		R10 100K panel-mount pot.
C16	39 pf np0		R11 68K
C17-C18	150 pf 1206 chip cap ***		R12 100K
C19	680pf		R13 68K
C20	150 pf np0 (151)		R14 330K
C21	3 pf		R15 680Ω
C22	150 pf np0 (151)		R16 4.7K
C23-C24	680pf		R17 1K
C25	33 pf np0		R18 27K
C26	0.5 pf chip cap ***		R19 100K
C27	39 pf np0		R20 100K panel-mount pot.
C28	0.47 uf electrolytic		R21 68K
C29	0.15 uf polyester (red)		R22 3.3Ω (orn-orn-gold-gold)
C30-C31	.001 uf (102, 1nM, or 1nK)		R23 27K
C32-C33	.01 uf (103)		U1 MC-3361P IF Ampl/ Det/Squelch
C34	0.15 uf polyester (red)		U2 LM380N-8 Audio Amplifier
C35	10 uf electrolytic		U3 78L08 Voltage Regulator
C36	47 uf electrolytic		Y1 Channel Crystal (see text)
C37	0.15 uf polyester (red)		Y2 10.245 MHz, 62 pf, parallel-resonant IF xtal
C38	470 uf electrolytic		Z1-Z4 Ferrite Beads, double long
C39	68 pf np0		
C40	220 pf (221)		
C41-C43	0.1 uf monolithic (104)		
CR1-CR2	1N4148 ( p/n may not be marked)		
FL1-FL4	10.7 MHz matched xtal filter set		
FL5	455 kHz ceramic filter, 20 kHz bw (blue)		

\*\*\* Note: disc cap is no longer available in this value. Carefully tack solder surface mount capacitor on bottom of board. Hold it carefully with tweezers to avoid dropping it.

**PARTS LIST FOR R100  
RECEIVER, FOR 216-225  
MHZ**

Ref #	Value	(marking)
C1	3 pf np0	
C2	not used	
C3-C4	680pf	
C5	5 pf np0	
C6	not used *	
C7	6 pf np0	
C8	not used *	
C9	0.5 pf chip cap ***	
C10	6 pf np0	
C11	.01 uf (103)	
C12	8 pf	
C13	7 pf	
C14	8 pf	
C15	Piston trimmer, 2-11.2 pf	
C16	39 pf np0	
C17-C18	150 pf 1206 chip cap ***	
C19	680pf	
C20	62 pf np0	
C21	1 pf	
C22	56 pf np0	
C23-C24	100 pf (101)	
C25	4 pf np0	
C26	not used	
C27	6 pf np0	
C28	0.47 uf electrolytic	
C29	0.15 uf polyester (red)	
C30-C31	.001 uf (102, 1nM, or 1nK)	
C32-C33	.01 uf (103)	
C34	0.15 uf polyester (red)	
C35	10 uf electrolytic	
C36	47 uf electrolytic	
C37	0.15 uf polyester (red)	
C38	470 uf electrolytic	
C39	68 pf np0	
C40	220 pf (221)	
C41-C43	0.1 uf monolithic (104)	
CR1-CR2	1N4148 ( p/n may not be marked)	
FL1-FL4	10.7 MHz matched xtal filter set	
FL5	455 kHz ceramic filter, 20 kHz bw	
J1	RCA jack	
L1-L4	2-1/2 turns (red)	
L5	10.7 MHz IF transformer, p/n 7A-691F or T1005	
L6-L7	6-1/2 turns (blue)	
L8-L9	2-1/2 turns (red)	
L10	455kHz IF transformer p/n 831-5 or YMC-15002 or T1003	
Q1-Q2	N.E.C. 3SK122 or Philips BF-988 dual-gate mos fet (⚡ static handling precautions required)	
Q3-Q5	2N5770	
R1-R3	100K	
R4-R5	15K	
R6	680Ω	
R7	1K	
R8	68K	
R9	68K	
R10	100K panel-mount pot.	
R11	68K	
R12	100K	
R13	68K	
R14	330K	
R15	680Ω	
R16	4.7K	
R17	1K	
R18	27K	
R19	100K	
R20	100K panel-mount pot.	
R21	68K	
R22	3.3Ω (orn-orn-gold-gold)	
R23	27K	
U1	MC-3361P IF Ampl/Det/Squelch	
U2	LM380N-8 Audio Amplifier	
U3	78L08 Voltage Regulator	
Y1	Channel Crystal (see text)	
Y2	10.245 MHz, 62 pf, parallel-resonant IF xtal	
Z1-Z4	Ferrite Beads, double long	

Note:

\* On this band, there is sufficient coupling between pads on the board so no extra capacitance is needed for C6 and C8.

\*\*\* Note: disc cap is no longer available in this value. Carefully tack solder surface mount capacitor on bottom of board. Hold it carefully with tweezers to avoid dropping it.

## PARTS LIST FOR R100 RECEIVER, FOR 46-54 MHZ

Ref #	Value	(marking)
C1	82 pf np0	
C2	150 pf np0 (151)	
C3-C4	.001 uf (102, 1nM, or 1nK)	
C5	56 pf np0	
C6	1 pf	
C7	62 pf np0	
C8	1 pf	
C9	56 pf np0	
C10	6 pf np0	
C11	.01 uf (103)	
C12	8 pf	
C13	7 pf	
C14	8 pf	
C15	Piston trimmer, 2-11.2 pf	
C16	39 pf np0	
C17-C18	150 pf 1206 chip cap ***	
C19	.001 uf (102, 1nM, or 1nK)	
C20	82 pf np0	
C21	2 pf	
C22	82 pf np0	
C23	not used	
C24	.001 uf (102, 1nM, or 1nK)	
C25	82 pf np0	
C26	2 pf	
C27	82 pf np0	
C28	0.47 uf electrolytic	
C29	0.15 uf polyester (red)	
C30-C31	.001 uf (102, 1nM, or 1nK)	
C32-C33	.01 uf (103)	
C34	0.15 uf polyester (red)	
C35	10 uf electrolytic	
C36	47 uf electrolytic	
C37	0.15 uf polyester (red)	
C38	470 uf electrolytic	
C39	68 pf np0	
C40	220 pf (221)	
C41-C43	0.1 uf monolithic (104)	
C44	2 pf	
CR1-CR2	1N4148 ( p/n may not be marked)	
FL1-FL4	10.7 MHz matched xtal filter set	
FL5	455 kHz ceramic filter, 20 kHz bw (blue)	
J1	RCA jack	
L1-L4	6½ turns (blue)	
L5	10.7 MHz IF transformer, p/n 7A-691F or T1005	
L6-L9	6½ turns (blue)	
L10	455kHz IF transformer p/n 831-5 or YMC-15002 or T1003	
Q1-Q2	N.E.C. 3SK122 or Philips BF-988 dual-gate mos fet ( <b>static handling precautions required</b> )	
Q3	2N5770	
Q4	not used	
Q5	2N5770	
R1-R3	100K	
R4-R5	15K	

R6	680Ω
R7	not used
R8	68K
R9	68K
R10	100K panel-mount pot.
R11	68K
R12	100K
R13	68K
R14	330K
R15	680Ω
R16	4.7K
R17	1K
R18	27K
R19	100K
R20	100K panel-mount pot.
R21	68K
R22	3.3Ω (orn-orn-gold-gold)
R23	27K
U1	MC-3361P IF Ampl/ Det/Squelch
U2	LM380N-8 Audio Amplifier
U3	78L08 Voltage Regulator
Y1	Channel Crystal (see text)
Y2	10.245 MHz, 62 pf, parallel-resonant IF xtal
Z1-Z4	Ferrite Beads, double long

\*\*\* Note: disc cap is no longer available in this value. Carefully tack solder surface mount capacitor on bottom of board. Hold it carefully with tweezers to avoid dropping it.

### ► Note the following changes for this model:

1. R7 and C23 are not used. Q4 is replaced with C44, installed where the base and collector leads of Q4 would normally go. (See detail below.)
2. When tuning the oscillator, a change in procedure is required because this frequency scheme does not use a multiplier stage. L6-L9 are all simply peaked for maximum signal sensitivity. Skip alignment procedure step (c). In step (g), alternately peak all four coils, L6-L9, for maximum as stated for L8-L9.

