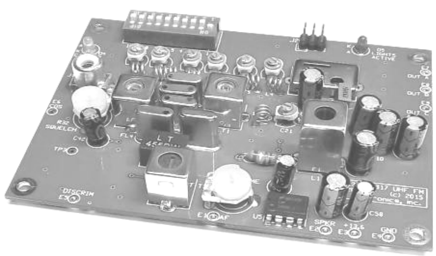
HAMTRONICS® R307 UHF FM RECEIVER: INSTALLATION, OPERATION, & MAINTENANCE



GENERAL INFORMATION.

Functional Description.

The R307 is the latest in a series of popular receivers for demanding applications which require exceptional sensitivity and selectivity. It is especially suited for repeaters, audio and data links, and remote control. It is a single-channel vhf fm receiver available in several models for reception in the 400-470 MHz range. Each model has a band of frequencies of about 5MHz, over which channel frequency is selected by dip switch.

The R307 is our 10th generation uhf fm receiver, and it packs in features you've told us are important to you during our 50 years of designing receivers. It's up to the difficult jobs you've told us you have.

The R307 retains all of the popular features Hamtronics® receivers have been noted for. It uses triple-tuned circuits in the front end and excellent crystal and ceramic filters in the i-f with steep skirts for close channel spacing or repeater operation. The i-f selectivity, for instance, is down over 100dB at ±12 kHz away from the carrier, which is 40-50 dB better than most transceivers. Low noise fet's in the front end provide good overload resistance and excellent sensitivity.

The R307 is designed for narrow-band fm with ±5 kHz deviation. Other bandwidths are available on special order. It features a positive-acting, wide-range squelch circuit and additional output terminals for low-level squelched audio and discriminator audio as well as COS.

The audio output will drive any load as low as 8Ω with up to 1 Watt continuous output. Volume and squelch are adjustable with trim pots on the pc board.

The receiver is aligned at the factory for the frequency you ordered; so you have no adjustments to do at installation.

The TCXO (temperature controlled xtal oscillator) provides a temperature stability of ±2ppm over a temperature range of -30°C to +60°C.

INSTALLATION.

Mounting.

Some form of support should be provided under the pc board, generally mounting the board with 4-40 screws and threaded standoffs to a chassis.

The receiver board relies on the mounting hardware to provide the dc and speaker ground connections to the ground plane on the board; so metal standoffs and screws should be used for mounting.

Electrical Connections.

Power and input audio or data signals should be connected to the solder pads on the pc board with #22 solid hookup wire, which can be extended to a connector or feedthrough capacitors used on the cabinet in which it is installed. Be very careful not to route the wiring near rf components on the board, for instance underneath the board.

Power Connections.

The receiver operates on +13.6 Vdc at about 100 mA peak with full audio. Current drain with no audio is only about 38 mA. 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. Be sure to observe polarity!

Speaker.

An loudspeaker with an impedance of 8Ω or greater 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, such as the 1K to 20K input impedances of repeater controller boards. There is no need to load down the output to 8 ohms.

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 pigtails 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.

OPTIONS.

Repeater Use.

E5 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 5V unsquelched and 0V squelched. 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 E4. The level is about 2V p-p. *Note that discriminator audio is not de-emphasized or squelched.* If you need audio which is squelched, take it from Repeater Audio terminal E1. Level there is about 1V p-p.

Subaudible Tone Decoder.

To use our TD-5 Subaudible Tone Decoder or a similar module, connect its audio input to DISCRIMINATOR terminal E4. 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.

Multichannel Operation.

The R306 may be programmed with more than one channel. If you ordered this option, you can change to the first alternate channel by grounding E6 or the second alternate channel by grounding E7. Grounding both terminals selects the third alternate. Ground terminals E8 and E9 are provided if you want to use jumpers, or you can use an external switch of some sort.

Table 1. Quick Specification Reference

Frequency Range:
can be supplied from 400 - 470 MHz
Sensitivity (12dB SINAD): 0.2µV
Squelch Sensitivity: 0.15µV
Normal signal bw: ±5kHz deviation
Adjacent Channel Selectivity:
±12 kHz at -100dB! (narrower bandwidth is available as an option)
Modulation Acceptance: ±7.5 kHz
Audio Output: up to 1 Watt (8 ohms).
Operating Power: +13.6Vdc at 38-100 mA, depending on audio level.
Size: 4 in. W x 2.5 in. D

ADJUSTMENTS.

Frequency Netting.

All crystals age a little over a long period of time; so it is customary to tweak any receiver back onto the precise channel frequency once a year during routine maintenance. This adjustment is called “netting”, which is a term going back to days when all stations on a network would initially adjust their VFOs to all be on the same exact frequency before operating as a net.

The adjustment should be done using an accurate service monitor or frequency counter. Of course, make sure the test equipment is exactly on frequency first by checking it against WWV or another frequency standard.

The channel frequency is trimmed precisely on frequency with a small variable capacitor, which is accessible through a hole in the top of the TCXO shield can. The proper tool is a plastic wand with a small ceramic or metal bit in the end.

To perform this adjustment, it is first necessary to verify that the discriminator is properly adjusted. Do this by connecting a dc voltmeter to TP4. Connect a signal generator set for 10.700 MHz to TP5 (left side of coil L9), and set the level for a relatively strong signal so there is very little white noise. Adjust discriminator coil T2 for 3.3Vdc. Then, reconnect the signal generator to antenna connector J1, and set it for the precise channel frequency. You can also use a strong signal on the air if you are sure it is right on frequency. Adjust the TCXO trimmer capacitor for 3.3Vdc (to match the voltage obtained with the 10.700 MHz signal).

OPERATION.

FREQUENCY SETTING.

The channel frequency is determined by frequency synthesizer circuits, which use the DIP switch in conjunction with programming in the microcontroller to set the frequency. The microcontroller reads the DIP switch information and does mathematics, applying data to the synthesizer ic. Following is a discussion of how to set the dip switch to the desired channel frequency.

NOTE: If the frequency is changed more than about ±2 MHz, a complete alignment of the receiver should be performed, as described in later text. Optimum operation only occurs if the synthesizer is adjusted to match the frequency switch setting and all the tuned amplifier circuits are peaked for the desired frequency. It is anticipated that most customers will continue to use the alignment done at the factory for the frequency they specified. There is no reason to do anything unless you need to change frequencies. Be careful not to disturb the DIP switch if you don’t need to change frequencies.

To determine what channel frequency to use, the microcontroller adds the frequency information from the dip switch to the “base” frequency. The actual “base” frequency is selected and programmed at the factory depending on the frequency range needed; so if you do not know what it is, please ask.

Dip switch settings are binary, which means each switch section has a different weighting, twice as great as the next lower section. Sections have weights such as 25 kHz, 50 kHz, 100kHz, etc., all the way up to 12.775 MHz.

When done, you might want to record the switch settings in table 3 for future reference.

We make it easy by publishing a long table of possible settings on our website. Refer to the following link and be sure to type in the underscore characters…
http://www.hamtronics.com/dipswitch_R123_R307.htm

The table online has two sections to it. The first set of listings is for a 120MHz base frequency, which our vhf receivers use. The second section can be used for this receiver, since it can be applied to any base frequency.

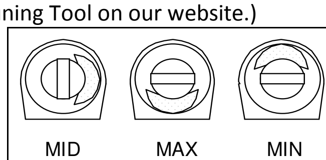
Look up the frequency, and it will give you all the binary switch settings.

ALIGNMENT.

A complete alignment is needed whenever the frequency is changed by more than about 2 MHz. Alignment ensures that the frequency synthesizer is optimized at the center of the vco range and that all stages are tuned to resonance.

Equipment needed for alignment is a sensitive dc voltmeter, a stable and accurate signal generator for the channel frequency, and a regulated 13.6Vdc power supply with a 0-200 mA meter internally or externally connected in the supply line.

The slug tuned coil should be adjusted with the proper hex tuning tool to avoid cracking the powdered iron slugs. Variable capacitors should be adjusted with a plastic tool having a small ceramic or metal bit. (See A1 Tuning Tool on our website.)



Capacitor Adjustment

Note: Meter indications used as references are typical but may vary widely due to many factors not related to performance, such as type of meter and circuit tolerances.

a. Set the SQUELCH pot fully counterclockwise and the VOLUME pot just a little clockwise.

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

c. Connect voltmeter to TP1 (insert probe tip in pad on board). Adjust vco coil L1 for +2Vdc. (Although the vco will operate over a wide range of tuning voltages from about 1V to 5V, operation is optimum if the vco is adjusted to 2V.)

d. Connect voltmeter to TP2 (insert probe tip into pad). Adjust doubler variable capacitor C21 for a peak. Note: the peak will be small.

e. Adjust buffer variable capacitor C24 for a peak. This will be just a slight peaking (increase) of the voltage.

f. Adjust C32 and C33 for a peak. Then, re-peak C21, C24, C32, and C33 to ensure they are all at maximum.

g. Connect stable signal generator to TP-2. Set generator to exactly 10.7000 MHz. Use a frequency counter or synthesized signal generator so the frequency is accurate. Set level just high enough for full quieting. At 20 µV, you should notice some quieting, but you need something near full quieting for the test (about 200µV).

h. Connect dc voltmeter to Discriminator pad E5. Adjust discriminator transformer T3 for +2.0Vdc.

💣 *Be careful not to turn the slug tight against either the top or bottom because the winding of the transformer can be broken.*

i. 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 to get some quieting.

Note: There are two methods of adjusting the mixer and front end. One is to use a voltmeter with test point TP-3. 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-3 varies from -0.5 Vdc with no signal (full noise) to +0.9 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-3 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.

j. Connect dc voltmeter to TP-3. Set signal generator for relatively weak signal, one which shows some change in the dc voltage indication at TP3. Alternately peak RF amplifier and mixer variable capacitors C29, C30, and C31 until no further improvement can be made. When properly tuned, sensitivity should be about 0.3µV for 12 dB SINAD.

💣 T1 and T2 adjust the crystal filter for minimum distortion. These are adjusted at the factory and should not be disturbed. If you must adjust them, inject a signal exactly on channel frequency with a 1000Hz tone and 5kHz deviation. Adjust alternately for minimum distortion.

Oscillator Trimming.

If you suspect that the TCXO needs adjustment, which normally it does not, proceed as follows.

a. First, perform steps g.and h. of the Channel Frequency Alignment procedure to be sure discriminator is set to frequency.

b. Set the service monitor for the exact channel frequency and inject a signal into the front end at J1 sufficient for good quieting.

c. Connect dc voltmeter to E5 as indicated for discriminator alignment above.

d. Use a 0.4 x 0.9mm ceramic tuning tool to adjust the small variable capacitor in the TCXO for +2V.

THEORY OF OPERATION.

The R307 is a frequency synthesized vhf fm receiver, the design of which was chosen because of its vastly superior squelch action compared to an am receiver. However, since am audio is not detected, the receiver does not allow listening to aircraft transmissions, although you can listen to hear if there is any interference. It is optimized only for control, not for monitoring audio in the normal sense. Refer to the schematic diagram for the following discussion.

Low noise dual-gate mos fet's are used for RF amplifier Q5 and mixer Q6. The output of the first mixer is coupled through a 10.700 MHz crystal filter to the second mixer, which is in U4.

U4 provides IF amplification, a 2nd mixer to convert to 455 kHz, an fm detector, and squelch. Ceramic filter FL5 provides additional adjacent channel selectivity at 455 kHz.

The output of the fm detector at pin 9 of U4 is applied to an active filter stage, which is peaked at 10,000 Hz, looking for noise when there is no signal. The noise output is detected by D3/D4 and drives the squelch detector input at pin 12. A variable dc voltage from SQUELCH pot R32 is also applied to pin 12 through a summing circuit to allow squelch threshold adjustment.

The COS (carrier operated squelch) signal from pin 13 drives the IRQ interrupt input on microcontroller U1 to indicate when a signal is detected. It also turns switch Q7 on and off to illuminate green LED D4 to indicate when a signal is present to allow the Squelch pot to be properly set.

The injection frequency for the first mixer is generated by vco (voltage controlled oscillator) Q2. The injection frequency is 10.700 MHz above the receive channel frequency. The output of the vco is doubled in Q3 and buffered by Q4 to minimize effects of loading and voltage variations of following stages from modulating the carrier frequency. The buffer output is applied through a double tuned circuit to the input of mixer Q6.

The frequency of the vco stage is controlled by phase locked loop synthesizer U2. A sample of the vco output is applied through the buffer stage and C2 to a prescaler in U2. The prescaler and other dividers in the synthesizer divide the sample down to 5kHz.

A reference frequency of 10.240 MHz, generated by a temperature compensated crystal oscillator (TCXO), is divided down to 5 kHz. The two 5kHz signals are compared to determine what error exists between them. The result is a slowly varying dc tuning voltage used to phase lock the vco precisely onto the desired channel frequency.

The tuning voltage is applied to carrier tune varactor diode D1, which varies its capacitance to tune the tank circuit formed by L1/C16/C17. C13 limits the tuning range of D1. The tuning voltage is applied to D1 through a third order low pass loop filter, which removes the 5kHz reference frequency from the tuning voltage to avoid whine.

Serial data to indicate the desired channel frequency and other operational characteristics of the synthesizer are applied to synthesizer U2 by microcontroller U1. Everything the synthesizer ic needs to know about the band, division schemes, channel selection, reference frequency, and oscillator options is generated by the microcontroller. Information about the base frequency of the band the receiver is to operate on and the channel within that band is calculated in the controller based on information programmed in the eprom on the controller and on channel settings done on dip switch S1. The microcontroller sends several bytes of serial data to the synthesizer, using the data, clock, and latch enable lines running between the two ic's.

Microcontroller U1 also provides the intelligence to control runway lights. It senses squelch openings at interrupt pin 1, and its three outputs drive switching transistors Q8, Q9, and Q10. These transistors are capable of driving external relays and may be used in other ways as described in the Installation section. Care must be used to avoid reverse polarity, overvoltage, and transients, all which can damage the transistors.

+13.6Vdc power for the receiver is applied at E3. U6 is a 5V regulator to provide stability and C57 and C58 eliminate noise. Additional filtering for the vco and buffer stages is provided by capacitance amplifier Q1, which uses the characteristics of an emitter follower to provide a very stiff supply, eliminating any possible noise on the power supply line.

TROUBLESHOOTING.

General.

The usual troubleshooting techniques of checking dc voltages and signal tracing with an RF voltmeter probe and oscilloscope will work well in troubleshooting the R307. 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.

Current Drain.

Power line current drain normally is about 38 mA with volume turned down or squelched and up to 100 mA with full audio output.

If the current drain is approximately 100 mA with no audio output, check to see if voltage regulator U6 is hot. If so, and the voltage on the 5V line is low, there is a short circuit on that bus somewhere and U6 is limiting the short circuit current to 100mA to protect the receiver from damage. If you clear the short circuit, the voltage should rise again. U6 should not be damaged by short circuits on its output line; however, it may be damaged by reverse voltage or high transient voltages.

Audio Output Stage.

Note that audio output ic U5 is designed to be heatsunk to the pc board through the ground pins on the ic; that is why a socket is not used.

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 U4-pin 11 with no input signal. (Between pins 10 and 11 of U4 is an op-amp active filter tuned to 10 kHz.)

RF Signal Tracing.

If the receiver is completely dead, try a 10.700 MHz signal applied to TP-3 using coax test lead. Set level just high enough for full quieting. At 1 µV, you should notice some quieting, but you need something near full quieting for the test.

You can also connect the 10.700 MHz test 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.

Synthesizer Circuits.

Following is a checklist of things to look for if the synthesizer is suspected of not performing properly.

a. Check the output frequency of the vco buffer with a frequency counter.

b. Check tuning voltage at TP1. It should be about +2.0Vdc. Actual range over which the unit will operate is about +0.5Vdc to about +4.5Vdc. However, for optimum results, the vco should be tuned to allow operation at about +2.0Vdc center voltage.

c. Check the operating voltage and bias on the vco and buffer.

d. Check the TCXO at pin 1 of the synthesizer ic. A scope should show strong signal (1.5 Vp-p) at 10.240 MHz.

e. The data, clock, and latch enable lines between the microcontroller and synthesizer ic's should show very brief and very fast activity, sending data to the synthesizer ic. Because this happens very fast, it can be difficult to see on a scope. Use 1mSec/div, 5Vdc/div, and normal trigger.

Microphonics, Hum, and Noise.

The vco and loop filter are very sensitive to hum and noise pickup from magnetic and electrical sources. Some designs use a shielded compartment for vco's. We assume the whole board will be installed in a shielded enclosure; so we elected to keep the size small by not using a separate shield on the vco. However, this means that you must use care to keep wiring away from the vco circuit. Having the board in a metal enclosure will shield these sensitive circuits from florescent lights and other strong sources of noise.

Because the frequency of a synthesizer basically results from a free running L-C oscillator, the tank circuit, especially L1, is very sensitive to microphonics from mechanical noise coupled to the coil. You should minimize any sources of vibration which might be coupled to the receiver, such as motors.

Excessive noise on the dc power supply which operates the receiver can cause noise to modulate the synthesizer output. Various regulators and filters in the receiver are designed to minimize sensitivity to wiring noise.

To varying degrees, whine from the 5kHz reference frequency may be heard on the signal under various circumstances. If the tuning voltage required to tune the vco on frequency is very high or low, near one extreme, the whine may be heard. This can also happen even when the tuning voltage is properly near the 2.0 Vdc center if there is dc loading on the loop filter. Any current loading, no matter how small, on the loop filter causes the phase detector to pump harder to maintain the tuning voltage. The result is whine on the signal. Such loading can be caused by connecting a voltmeter to TP1 for testing, and it can also be caused by moisture on the loop filter components.

Typical DC Voltages.

Tables 4-6 give dc levels measured with a sensitive dc voltmeter on a sample unit with 13.6 Vdc B+ applied. All voltages may vary considerably without necessarily indicating trouble. The charts should be used with a logical troubleshooting plan. All voltages are positive with respect to ground except as indicated.

Typical Audio Levels.

Table 7 gives rough measurements of audio levels. Measurements were taken using an oscilloscope, with no input signal, just white noise so conditions can be reproduced easily.

Table 4. Typical Test Point Voltages

TP1	Tuning V.	Normally set at 2V
TP2	Inj Level	approx. 0.3 – 0.6V
TP3	Noise det	With SQUELCH control fully ccw, varies from -0.3 Vdc with no to +0.9 Vdc full quieting.
TP4/E5	DISC	Varies with frequency of input signal. Voltage at this point normally is adjusted for +2Vdc with a signal exactly on frequency. Can vary a little without being a problem.

Table 5. Typical Xstr DC Voltages

Xstr	Stage	E(S)	B(G1)	C(D)	G2
Q1	dc filter	4.1	4.8	5	-
Q2	vco	0.9	1.6	3.8	-
Q3	doubler	0	0.7	2.4	-
Q4	buffer	0	0.7	2.4	-
Q5	RF ampl	0	0	4.6	2.3
Q6	Mixer	0	0	4.9	0.3
Q7	sq. open	0	0	5	-
	sq. closed	0	0.65	0.14	-

Table 6. Typical IC DC Voltages

U2-1	2.4	U4-1	5
U2-2	2.4	U4-2	4.4
U2-3&4	5	U4-3	4.8
U2-5	0 – 5V	U4-4	5
	(2Vtuned)	U4-5	3.8
		U4-6	3.8
U2-7	5	U4-7	3.8
U2-8	1.6	U4-8	5
U2-9	0	U4-9	2 (aligned)
U2-10	0	U4-10	0.8
U2-11	0	U4-11	2
		U4-12	0.6 (with squelch just closed)
U5-1	1.4		
U5-3	0.01	U4-13	0 (sq open)
U5-5	6		7.5 (squelch closed)
U5-6	13.6	U4-14	0
U5-7	7	U4-15	0
U5-8	1.4	U4-16	1.8

Table 7. Typical Audio Voltages

Audio Test Point	Normal Level
U4-9 (Discriminator)	3V p-p audio
E5 (Disc Output)	2V p-p audio
E1 (Repeater Output)	1V p-p audio
U4-11 (noise ampl)	3V p-p noise
CW lug of VOL cont.	400mV p-p audio
U5-3 (af ampl input)	0 to 200mV p-p
U5-5 or E2 (speaker ampl output)	0 to 7V p-p audio

PARTS LIST FOR R307 RECEIVER.

Note: Resistors and capacitors are 0805 or 0603 smt type unless noted otherwise.

Values shown are for 430-450 MHz range. Factory changes some values for other frequencie.

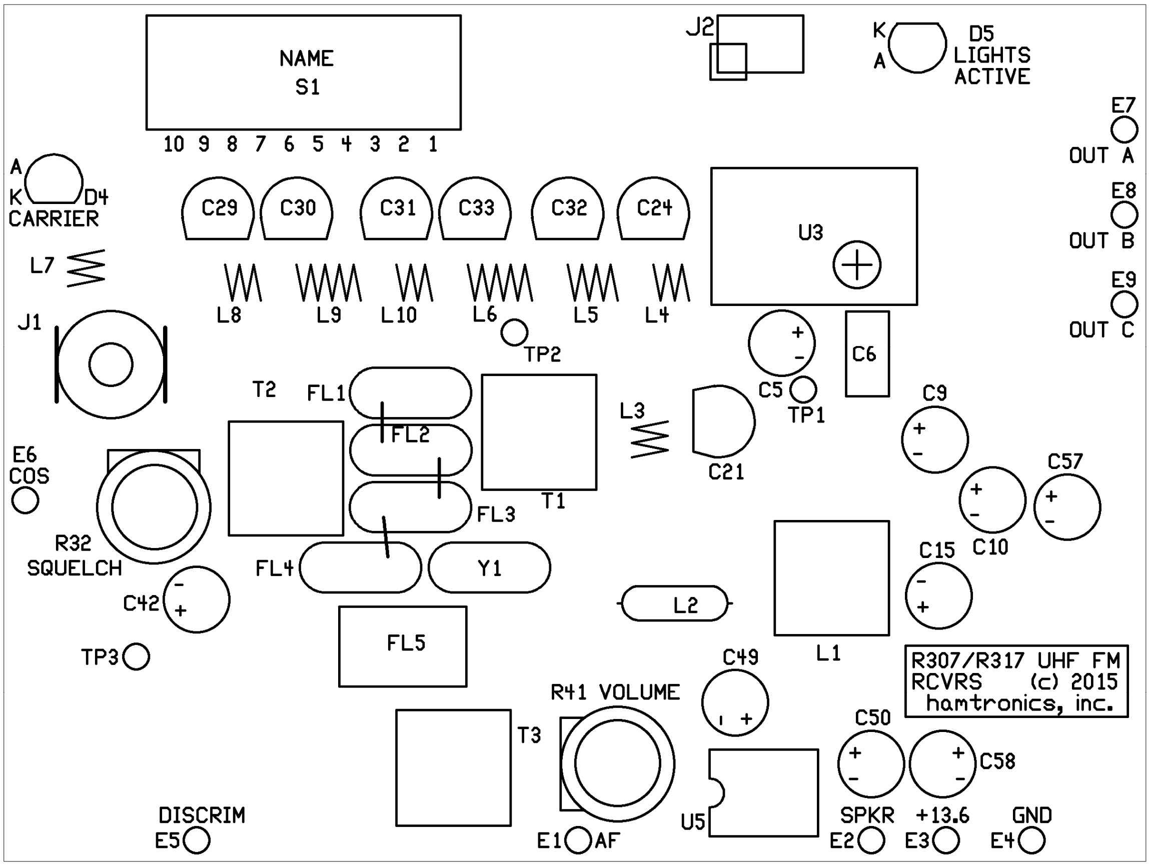
💣 Caution: IC's are static sensitive. Use appropriate handling precautions to avoid damage.

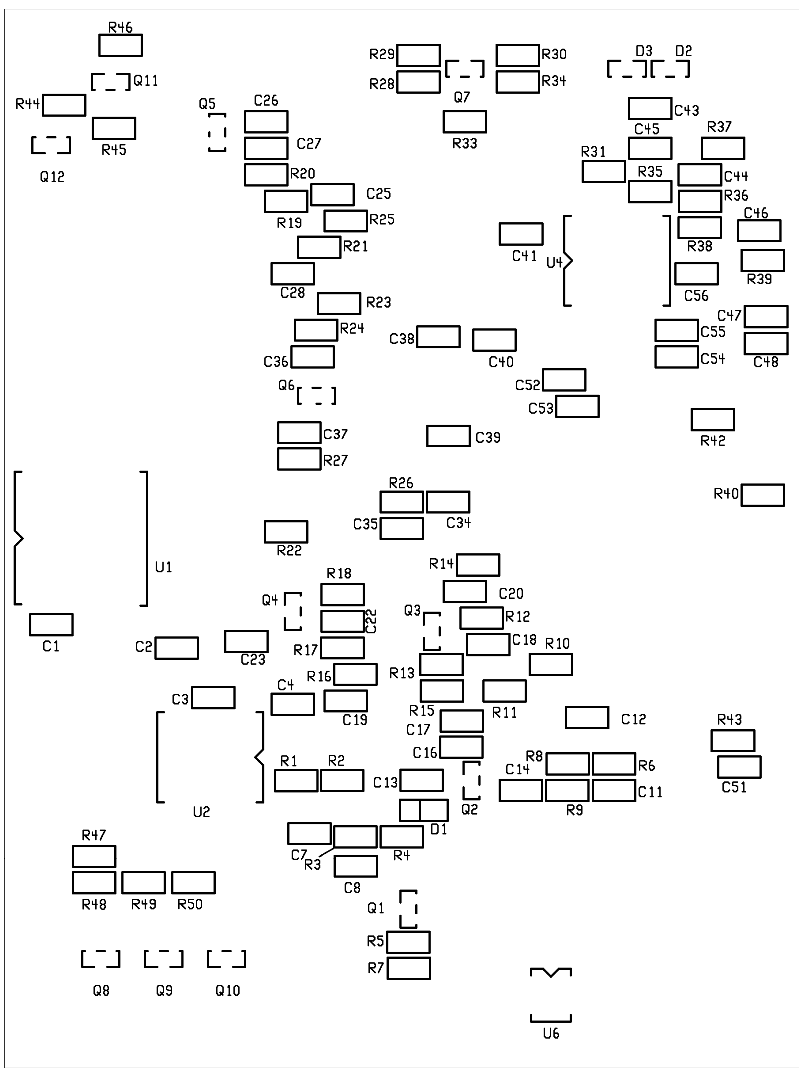
* Polarity for LED's: long lead is anode, same as electrolytic caps.

** Polarity for varicap diode D1: bar end is cathode, opposite end (anode) goes on pad next to grounding via.

*** C24, C29, C31, & C32 each have 1pf capacitor tack soldered across pads on rear of board.

Ref Desig	Value (marking)
C1	0.1µf
C2	2pf
C3	100 pf
C4	0.1µf
C5	100µf electrolytic
C6	0.15µf mylar
C7	0.01uf
C8	0.001µf
C9-C10	100µf electrolytic
C11	0.1µf
C12	390pf
C13	5pf
C14	390pf
C15	100µf electrolytic
C16	12pf
C17	47pf
C18	7pf
C19	220pf
C20	100pf
C21	4.5pf var cap
C22	2pf
C23	100pf
C24 ***	4.5pf var cap
C25	220pf
C26	5pf
C27-C28	100pf
C29 ***	4.5pf var cap
C30	4.5pf var cap
C31 ***	4.5pf var cap
C32 ***	4.5pf var cap
C33	4.5pf var cap
C34	.0047µf
C35-C37	0.001µf
C38	7pf
C39	4pf
C40	7pf
C41	0.001µf
C42	1µf electrolytic
C43	0.1µf
C44-C45	0.001µf
C46-C47	0.01µf
C48	0.1µf
C49	4.7µf electrolytic
C50	100µf electrolytic
C51	0.1µf
C52	68pf
C53	220pf
C54-C56	0.1µf
C57	100µf electrolytic
C58	1µf electrolytic
D1	BB132 varactor diode **
D2-D3	MMBT3904 (used as diode)
D4-D5	not used
D5	Red LED *
FL1-FL4	10.7MHz crystal filter (matched set of 4)
FL5	LT455DW ceramic filter
J1	RCA Jack
J2	6 pin header
L1	1½ t. slug tuned (brn)
L2	0.22µH RF choke (red-sil-orn-orn)
L3-L4	2¾ t. air wound coil
L5	3¾ t. air wound coil
L6	4¾ t. air wound coil
L7-L8	2¾ t. air wound coil
L9	4¾ t. air wound coil
L10	2¾ t. air wound coil
Q1	MMBT3904
Q2-Q4	MMBT5179
Q5-Q6	BF998 MOS FET
Q7	MMBT3904
Q8-Q12	not used
R1	27Ω
R2	15K
R3	150K
R4	10K
R5	1K
R6-R7	27Ω
R8-R9	10K
R10	180Ω
R11	27Ω
R12	10K
R13	3.9K
R14	470Ω
R15	47Ω
R16	470Ω
R17	10K
R18	3.9K
R19-R20	100K
R21	27Ω
R22	2.2K
R23	330K
R24	22K
R25	27Ω
R26	47Ω
R27	270Ω
R28	47K
R29	1K
R30	2MEG
R31	47K
R32	100K trim pot
R33	68K
R34	100K
R35	510K
R36	4.7K
R37	680Ω
R38	1K
R39	22K
R40	100K
R41	100K trim pot
R42	47K
R43	10Ω
R44	47K
R45-R50	not used
T1-T2	10.7MHz IF xfmr (T1005)
T3	455kHz IF xfmr (T1003)
U1 💣	MC9S08PA4 µP
U2 💣	LMX1501A PLL
U3 💣	10.240 MHz TCXO
U4	MC3361BPD IF ampl
U5	LM386N-1 AF output
U6	78L05ACD regulator
Y1	10.245 MHz crystal


NAME
S1
10 9 8 7 6 5 4 3 2 1
J2
K
A
D5
LIGHTS
ACTIVE
E7
OUT A
E8
OUT B
E9
OUT C
A
K
D4
CARRIER
C29
C30
C31
C33
C32
C24
U3
L7
L8
L9
L10
L6
L5
L4
TP2
J1
C5
TP1
C6
C9
T2
FL1
FL2
FL3
FL4
Y1
T1
L3
C21
E6
COS
R32
SQUELCH
C57
C10
C15
C42
L2
L1
FL5
TP3
R307/R317 UHF FM
RCVRS (c) 2015
hamtronics, inc.
C49
R41 VOLUME
T3
C50
C58
U5
DISCRIM
E5
E1
AF
SPKR
E2
+13.6
E3
GND
E4


R46
Q11
R44
R45
Q12
Q5
C26
C27
R20
C25
R19
R25
R21
C28
R23
R24
C36
Q6
C37
R27
R29
R28
Q7
R30
R34
R33
D3
D2
C43
C45
R37
R31
R35
C44
R36
C46
R38
R39
C41
U4
C56
C47
C55
C54
C48
C38
C40
C52
C53
C39
R42
R40
R26
C35
C34
R22
U1
C1
C2
C23
R18
Q4
C22
R17
R16
C4
C19
C3
R14
C20
Q3
R12
C18
R10
R13
R15
R11
C17
C16
C12
R43
C51
R1
R2
C13
R8
C14
R6
C11
R9
Q2
D1
U2
R47
C7
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R4
C8
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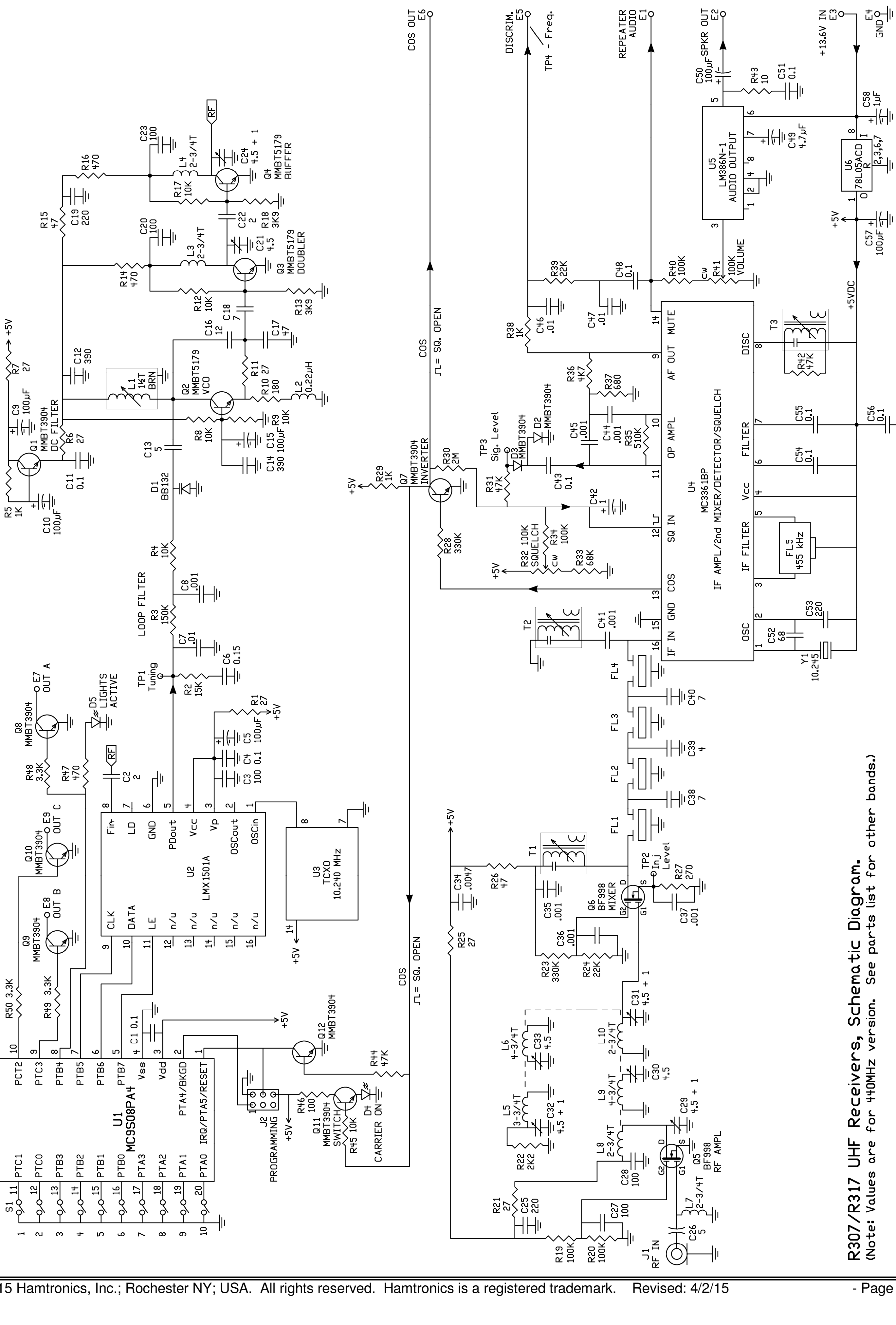
R49
R50
Q1
R5
R7
Q8
Q9
Q10
U6



R307/R317 UHF Receivers, Schematic Diagram.
(**Note:** Values are for 440MHz version. See parts list for other bands.)

