increased sideband suppression for the HT-37

Easy conversion to a filter-type sideband generator

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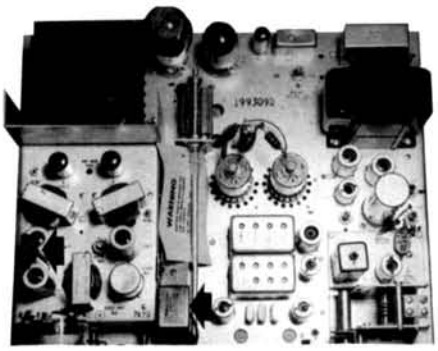
If you're an owner of a Hallicrafters HT-37 ssb transmitter, I'm sure you'll agree it has many excellent features. One area where it could be improved is in its sideband generator. The HT-37 uses the phase-shift system. It's difficult to obtain really good attenuation of the unwanted sideband with this method. The phase-shift networks are tricky to adjust and to keep adjusted. The unwanted sideband in most phasing systems is down about 30 dB, while 45 to 55 dB is not uncommon for filter systems.

The HT-37 can be modified to use a filter system for about $35.00. You should have no trouble adapting the circuit to the filter system described in the following paragraphs. You'll need the parts in **table 1.**

filter selection

After examining many available filters, I chose the McCoy Silver Sentinel. I paid



Top of the modified HT-37 chassis. Left arrow shows position of extension shaft coming up between tubes V1 and V2. Knob is shown for illustration and is installed after top cover is in place. Filter (right arrow) is mounted on a bracket and attached to one of the holes that hold the subassembly in place.

$32.95 for mine direct from the manufacturer.* Its features are listed in **table 2.** I chose this filter because its input impedance closely matched that of the circuit and didn't require any matching network. Also, its low insertion loss eliminates the need for an amplifier ahead of the mixer.

installing the filter

A check of your HT-37 schematic will show that the carrier oscillator is one-half of a 12AT7 (V2B). If you look at the top of the chassis you'll see this tube, the audio stages,

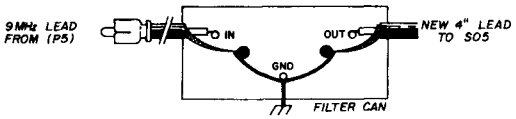


fig. 1. Underside of filter. A phono jack is soldered to the IN pin and a 4" piece of shielded lead soldered to the OUT pin with a new phono plug as shown.

balanced modulator and phasing network on a subassembly located on the left-hand side.

A shielded lead (P5) comes out of the front top of the subassembly chassis and goes to a phono jack (SO5) on top of the main chassis near the long shaft that turns the driver tuning capacitor. Pull P5 lead out and wire in the filter as shown in **fig. 1.**

* McCoy Electronics Co., Mt. Holly Springs, Pennsylvania 17065; price includes two sideband crystals. Suitable 9-MHz crystal filters are also available from Spectrum International, Box 87, Topsfield, Massachusetts 01983. The XF-9A filter, at $19.95 is a 5-pole unit; the XF-9B, an 8-pole filter (better shape factor), is $27.50; matching sideband crystals are $2.50 each.

Table I. Parts list for the HT-37 modification.

quantity	part
1	3-position rotary switch and pointer knob
1	aluminum stock for switch bracket
1	bracket for filter mount (see photo)
1	1/4- to 1/4-inch shaft coupler
1	1/4-inch shaft extension (see text)
1	McCoy crystal filter (see text)
2	25-pF trimmers
2	crystal sockets
1	phono slug and jack

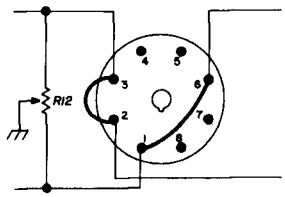
crystal switching

Before starting to work on the underside of the chassis, pull out Z1, the 90-degree phase-shift network located next to T101. It's in an octal socket and comes out just like a tube. Short pins 2 and 3, and 1 and 6 with bare hook-up wire as shown in **fig. 2A,** then plug it back in. The audio phasing network is now disabled.

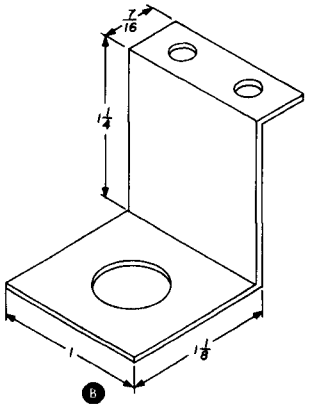
On the underside of the subassembly chassis, modify the carrier oscillator circuit as shown in **fig. 3.** Break the lead at point X and wire it to the pole of a 3-position rotary switch. Mount the switch on a bracket close to the grid of V2B.

Drill a hole large enough to pass the shaft of the rotary switch exactly between the center of V1 and V2. Extend the switch shaft with a coupler and a brass or aluminum extension shaft. Make the extension long enough so about one-half inch will fit through the cover of the transmitter when it is back on. File or turn down the diameter of the top end of this shaft sufficiently so it will

fig. 2. New connections to the phase-shift network are shown in A. Crystal switch bracket is shown in B.



A



B

fit through one of the large perforations on the top cover. The knob, of course, will be put on after the cover is in place.

With the wiring completed and the two new crystals installed, your switch should select the 8998.5-kHz crystal, 9-MHz crystal, and 9001.5-kHz crystal in that order. Now, snip L102 lead where it connects to C116; also snip RFOC capacitor lead where it connects to C117. These are green wires. The modification is now complete. The phasing networks are disconnected, and the filter, with its corresponding crystals to produce upper or lower sideband, is ready for tune-up.

Since the frequency of the 9-MHz crystal falls right in the center of the filter passband,

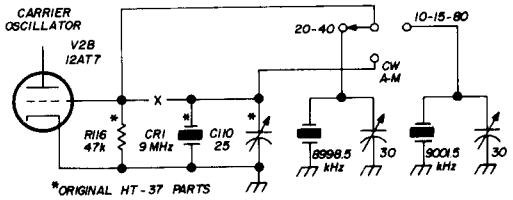


fig. 3. Modification to the carrier oscillator circuit. The lead from the grid is broken at x and connected to the arm of the three-position switch. The 9-MHz crystal and its associated trimmer are part of the original HT-37.

cw and a-m operation is undisturbed. When you operate in these modes, the new switch must be in the 9-MHz position. The upper and lower sideband positions on the main function switch on the front panel are inoperative, and either upper or lower sideband is selected by the new switch. However, the function switch must be left on upper or lower sideband simply to get it off the cw or a-m positions when operating sideband.

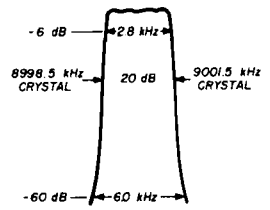
Table 2. McCoy ssb filter characteristics.

center frequency (MHz)	9.0
bandwidth (Hz)	2360
shape factor	2
sideband attenuation (dB)	45
insertion loss (dB)	2.3
input impedance (ohms)	660
crystal frequencies (kHz)	8998.5 and 9001.5

adjusting the filter slope

The manufacturer advises that the frequency of the 8998.5 and 9001.5-kHz crystals should be adjusted to fall 20 dB down the slopes of the filter. In selecting these points, the filter will work at its optimum design characteristics, pass the desired sideband fully, and suppress the unwanted sideband

fig. 4. Characteristic curve of the McCoy 9-MHz crystal filter.



most effectively. **Fig. 4** shows what the characteristic curve looks like and will give you an idea how we will find the 20-dB point on the filter slope. You don't need any fancy instruments, but you must have a vtvm with an rf probe.

After a 30-minute warm up, tune up the transmitter at 3800 kHz using the 9-MHz crystal for maximum output into a dummy load. Rebalance for maximum carrier suppression. Set your vtvm on the 100-volt scale and for minus dc. Connect your rf probe with an alligator clip to the transmitter's antenna output terminal inside the chassis. Ground the ground lead of your probe to the chassis. Select the 8998.5-kHz crystal, set the function switch on either upper or lower sideband, and set the audio control to zero. Turn the operation switch to MOX and unbalance the left carrier balance control, and at the same time, using an insulated tool, (this is essential) turn the trimmer capacitor corresponding to the 8998.5-kHz crystal for maximum output on the vtvm.

You will note, as you change the frequency by turning the trimmer, the reading will go up then level off. What is happening is that at the maximum reading, you had the crystal frequency on the top of the filter as shown in **fig. 4.** Note your maximum read-

Table 3. Crystal selection for desired sideband.

amateur band	sideband	crystal (kHz)
10 & 15	upper	9001.5
20	upper	8998.5
40	lower	8998.5
80	lower	9001.5

ing—mine read 65 volts. Whatever your maximum reading is, you must back it off to read only 10 percent of this. In my case, since 65 volts was maximum, I backed it down to 6.5 volts (change your vtvm scale for accuracy when you get the reading low

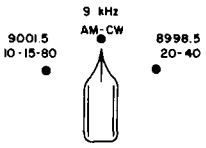


fig. 5. Label switch as shown. With this arrangement, lower sideband is selected for 40 and 80 meters and upper sideband for 10, 15 and 20.

enough). You are now 20 dB down the slope of the filter. Repeat this procedure with the 9001.5-kHz crystal. Now switch to the 9-MHz crystal and rebalance the carrier for maximum suppression. You will note that when you switch to either of the two sideband crystals, carrier suppression will be even better.

selecting the proper sideband

A process of up conversion and/or down conversion is used in the HT-37 to arrive at the operating frequency on the various ham bands. **Table 3** will assist you in selecting the proper crystal to operate on the customary sideband. Label your new selector switch as shown in **fig. 5** to correspond to the sideband used on a particular band.

No provision has been made to compensate the vfo automatically for the difference in frequency between the upper- and lower-frequency crystals if you were to switch from upper to lower sideband or vice versa on any one band. It would get rather complicated on this transmitter as the vfo frequency would have to be increased on some bands and decreased on others. It's not worth the trouble since one doesn't keep switching sidebands when working on a particular band. If you wish to change sidebands during a contact, you can shift the main tuning manually to remain on the same frequency.

Before putting the top cover back on, bracket the filter to one of the existing threaded holes that holds the subassembly shield in place as shown in the photo. In this position the filter is in the clear and away from any heat generated by the tubes.

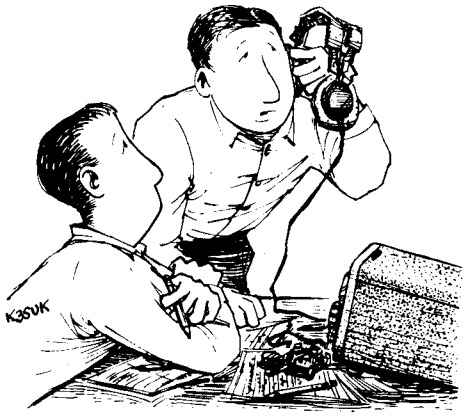
final checks

As a final check, try contacting some of your local buddies and ask them to check your quality and sideband suppression. Your unwanted sideband suppression should be at least 45 dB down. They may say your voice sounds a little different. The filter is quite sharp, and the voice frequencies passing through the filter bandpass will account for the difference. In any event you should now have a cleaner, sharper signal with practically all your power concentrated in the wanted sideband.

A word of caution—the HT-37 always had plenty of audio drive; now you have a bit more. It's very easy to flat top, and one of your best investments would be a monitor scope, if you don't already have one, so you can adjust your drive "right on the nose."

Congratulations—you are now the owner of a solidly built, modern filter-type single sideband transmitter.

ham radio



"No wonder you're having trouble with the code—that's RTTY!"