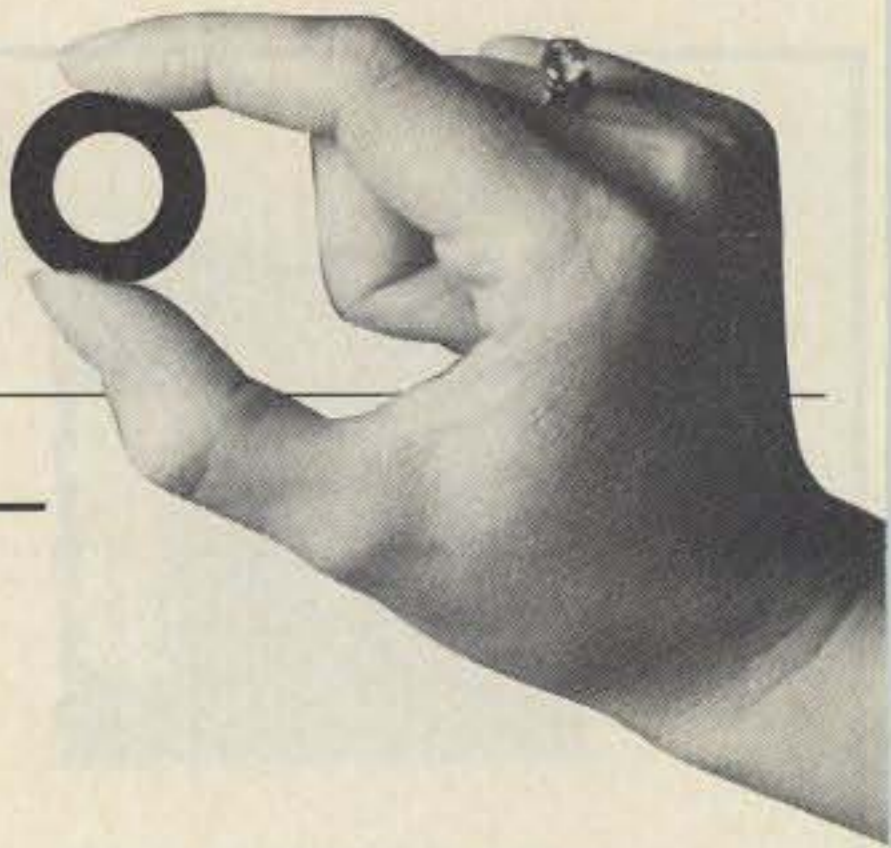


# Tune In 220



Convert GE's MASTR-PRO receiver to 220 MHz—it's as easy as winding a few coils.

As most 220-MHz repeater owners and users are well aware, there is a very limited source of high-quality commercial FM receivers for this band. The GE MASTR-PRO UHF receiver (type ER-42[X]) makes an excellent 220-MHz repeater, mobile, or base-station receiver after this relatively simple conversion, which can easily be accomplished over a weekend. The converted receiver has excellent sensitivity and front-end selectivity, and it retains all of the other qualities of the original unit.

The easiest version to convert is the 406–420-MHz unit. However, the 450–470-MHz and 470–512-MHz versions require only a little more effort. Note that some versions of the 406–420-MHz units are designed for wideband FM use ( $\pm 15$ -kHz deviation).

These units should be perfect for packet radio use in the high-speed digital "backbone" networks that are in the planning/construction stages in some parts of the country.

### Conversion

The main part of this conversion consists of replacing the coils in the helical resonators in the receiver front end. A few other minor changes can be made to optimize sensitivity after the resonator coils have been changed. Caution: Make certain the receiver is functioning properly on the original frequency before you start the conversion. If there are any problems, correct them first!

To gain ready access to the coils and to make the job of changing them easier, first

remove the frame from around the receiver casting. Remove all mounting screws, including the power and antenna connector mounting screws. Remove the cover plate from the top of the casting, exposing the resonator coils. It will also simplify the job if you remove the i-f/audio/squelch board by unplugging the cable harness from the pins on the board.

Wind new coils for all of the helical resonators according to Table 1. Use #12 bare copper wire (it need not be enamel-covered). Wind the new coils around a 1/2-inch-diameter rod and adjust the turn spacing so the coils are the same length as the original coils that are being replaced. The completed coils should have an inside diameter of about 33/64" (slightly over 1/2").

To remove the old coils and install the new ones, mount the receiver casting in a vise and direct the flame from a home-type propane torch directly at the solder mounting point of each coil. Be careful to direct the flame away from any nearby wiring. After a few seconds, the old coil will drop out of its mounting hole.

Remove the solder lugs from the tapped coils and slide them onto the replacement coils. Pre-tin the lead of the replacement coil and install it in position, being careful to center the coil in the middle of the resonator cavity. Removal of the old coils and installation of the new ones will be easier if you first either remove the tuning discs or screw them flush against the bottom of the cavity.

After all resonator coils have been changed, screw the tuning discs in toward the open end of the coils and carefully bend the coils so the discs will turn inside the coils up to about 1/2 coil turn without touching the coils. Remove the output coupling link (L432) from the last multiplier resonator and replace it with a longer link to increase the amount of coupling and LO injection (see Fig. 1). Adjust the link so it comes close to the coil without touching it.

If the original receiver was intended to tune the 450–512-MHz range, some fixed capacitors in the LO/multiplier chain will have to be changed. Replace these caps with values shown on the schematic for the 406–420-MHz version of this receiver. If your receiver is the 406–420 version, ignore this step. The

Coil #	Function	Number of Turns	Tap (Turns Above Gnd.)
L410/412	Antenna input	7-1/4	1/2
L411/413	Rf amplifier input	7-1/4	3/8
L414/419	Rf amplifier output	7	1/4
L415/420	Rf interstage	7-1/4	None
L416/421	Rf interstage	7-1/4	None
L417/422	Rf interstage	7-1/4	None
L418/423	Mixer input	7	1-1/8
L424/426	Last multiplier collector	7	3/8
L425/427	Last multiplier output to mixer	7-1/4	None

Table 1. Coil data.

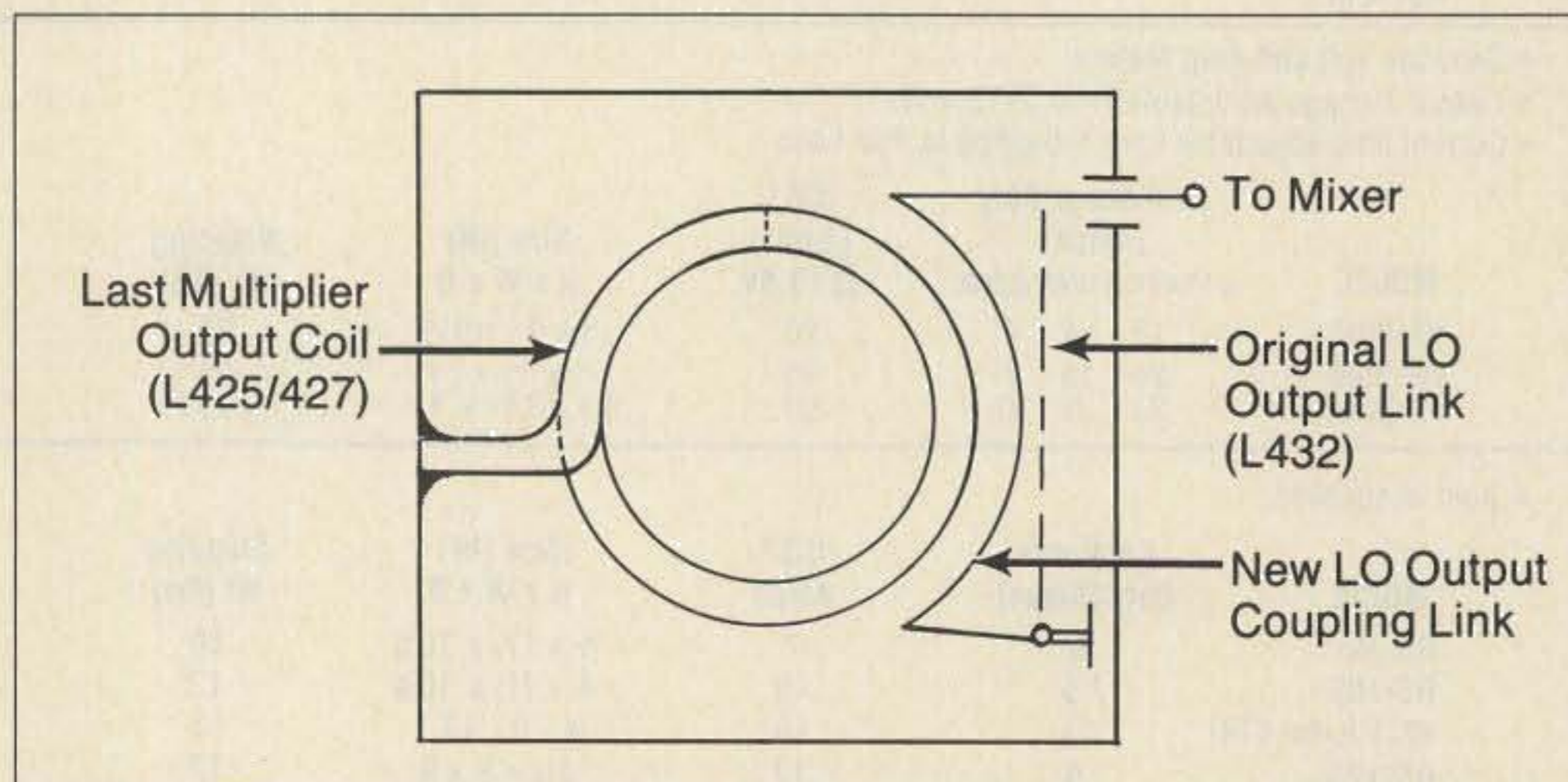


Fig. 1. Output coupling link adjustment.

caps in question are: C6/C7 or C40/C41 across T1-T2 or T7-T8 on the oscillator board (should be 39 pF), C2/C3 across L1 on the multiplier board (should be 30 pF), C5/C6 across L2 on the multiplier board (should be 6 pF), and C7/C8 across L2 on the multiplier board (should be 20 pF).

This completes the conversion process. Reassemble the receiver frame and install the i-f/audio/squelch board. Replace the cover over the helical resonators, but use only two or three screws to attach the cover if you intend to do any diddling with the coil taps.

### **Tune-up**

The crystal formula is different from the original since the last multiplier stage in the LO/multiplier chain (A413/A414 [Q2], originally an X2 multiplier) now operates straight through as a buffer. The new crystal formula is:  $F_{\text{Xtal}} = (F_{\text{Oper.}} - 12.4) / 12 \text{ MHz}$ . If you operate in the 220.5-225.0-MHz amateur band, the crystal will fall in the range of 17.3417 to 17.7167 MHz. All other crystal correlation data is unchanged.

Now align the receiver in the normal manner. You might be able to improve sensitivity by adjusting the positions of some of the coil

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taps or by adjusting the spacing of the coupling link from the output of the last multiplier resonator coil (L432) to the first mixer. The tap positions listed in Table 1 were determined by experimentation.

After you align and “diddle” with the receiver, sensitivity is about 0.25 uV for 20 dB of quieting on a U.H.S. receiver (the receiver with an rf amplifier stage—A410/A411). It has been suggested that the coupling apertures between resonator cavities may not be the correct size for minimum insertion loss/optimum selectivity at 220 MHz. I have not experimented with this and would be happy to hear from anyone who does try to optimize the coupling.

Note: Be sure to label the receiver to indicate that it has been converted, because there is no external visible evidence to reveal that the unit has been modified! Schematic diagrams or instruction manuals for these receivers are frequently available at hamfests, usually from people selling surplus FM gear.

That's it! I have converted several of these, and they all work fine. The first guinea pig is being used on the Maryland FM Association's 222.16/223.76-MHz repeater input at Jessup, Maryland, and is performing exceptionally well. I hope yours is equally successful. ■

*“When You Buy, Say 73”*