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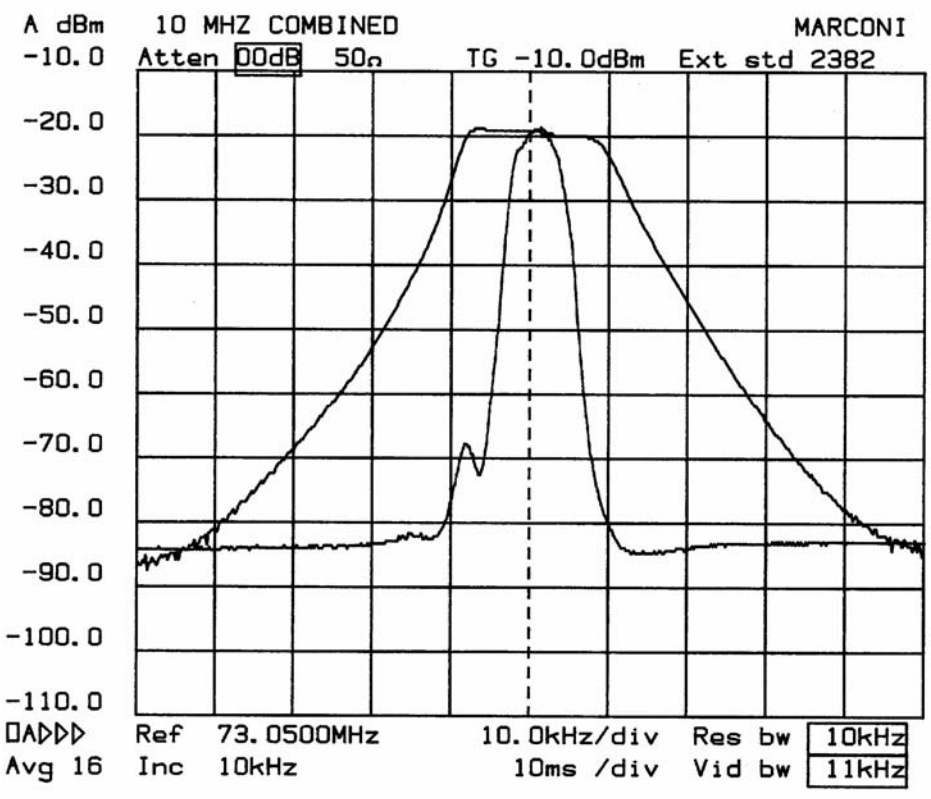
TS-850: Installing the Inrad Roofing Filter Mod

The TS-850 Roofing Filter Mod consists of a 6 pole, 4 to 5 kHz wide filter followed by a high dynamic range feedback amplifier. The amplifier provides enough gain to overcome the filter insertion loss.

The plot below shows the sweep frequency response of the front end with the Inrad roofing filter mod in place. For comparison, the OEM filter is about 20 kHz wide at the -6 dB points.



The result of the bandwidth improvement is the reduction of close in intermodulation from multiple signals. The IMD dynamic range will be improved up to 15 dB for signal spacings from 2 to 20 kHz. Also, the blocking dynamic range will be improved for close in signals.

Revised 2009-03-06

Frequently Asked Questions

1. What can you expect from this mod?

Less IMD in crowded band conditions, particularly from stations at offset frequencies of 2 to 20 kHz on either side of the operating frequency.

2. Will it defeat the noise blanker?

There will be some change in the NB performance due to the narrower bandwidth of the mod. In practice, it may not be noticeable.

3. Will this mod allow for wide band SSB, AM and FM reception?

The overall widest bandwidth will be determined by the roofing filter, which is about 5 kHz. AM and FM will be degraded, but not excessively. Normal 2400 Hz SSB will not be affected.

Description of Operation

The roofing filter mod inserts a narrow band crystal filter after the first mixer and before the OEM roofing filter. An amplifier is included to compensate for the filter loss. Reducing the bandwidth at this point in the radio helps to keep strong off-frequency signals out of the second mixer, where they can cause intermodulation. Transmission is not changed, as it does not pass through the roofing filter.

Installation Instructions

Warning: *Modern radios contain components which may be damaged by static discharge. Precautions must be taken to eliminate any static electricity buildup between the operator and the radio before any of the internal circuits are touched. If you are not familiar with the proper techniques for this, consult the Radio Amateurs Handbook.*

Warning: *This modification requires a high level of soldering skill, possibly beyond that normally possessed by the average radio amateur. Professional assistance is advised if you are not confident that you have this ability.*

Note: If you have a known test signal available before you start, note the S meter reading for the receiver. After the installation, the S meter should read about the same as before.

Preparing the Inrad Mod for Installation

1. Prepare one side of each coax cable by stripping 1/4 inch of outer covering and shield from the end. Strip approximately 1/8 inch of insulation from the center conductor.

2. Next, prepare the opposite side of each coax cable to accept a TMP connector by stripping ½ inch of outer covering and shield. Strip approximately 1/4 inch of insulation from the center conductor. Insert the center conductor into the TMP connector center pin and solder it in. Then take the dressed braid and solder it to the connector outer shield. The cables should now be ready for the installation. See Figure 1 for more information on the cable preparation.

3. Set prepared cables aside.

Preparing the Radio for Installation

If you haven't already read the instructions completely, please do so now before continuing.

1. Remove the DC power cord from the transceiver.

2. Place the radio upside down on a soft surface such as a towel, with the front panel facing you.

3. Remove the eleven screws (three on each side and five on the bottom) holding the bottom cover in place. Remove the bottom cover.

4. Remove the metal shield from the rear of the RF board on the left side by removing the four shield mounting screws.

5. Locate L59 AND L60 on the left side of the RF board near the center. This is the area for the mod once we turn the board over.

6. Starting at the rear of the RF board, remove the coax cable coded orange from CN1.

7. Remove the coax cable coded white from CN2.

8. Remove the 2 pin connector from CN12 on the IF board.

9. Remove the coax cable coded black from CN3.

10. Remove the 2 pin connector from CN17.

11. Remove the ribbon cable from CN11.

12. Remove the 9 board mounting screws fro the RF board.

13. Lift the RF board up and bend it over the front panel. Use a soft cloth or towel to cushion the board as it lies on the front panel.

14. Locate the work area between L59 and L60 on the trace side of the board. Compare it to Figure 2. Carefully remove R99 and C128. See Figure 2.

15. Examine Figure 3. The hot wire of the coax cable going to J2 on the mod is connected to the terminal of L60 which went to R99 and C128. The shield is connected to the nearby ground pad. Make sure the shield length is kept short enough to prevent unwanted shorting to any board traces. When mounting the cable, be sure to keep the cable parallel to the PCB to prevent shorting to the chassis when the board is turned over.

16. Follow the PC trace that leaves the junction of R99 and C128 to the right and then bends towards you and connects to a capacitor, C134 if you have a service manual. (This trace is in shadow in Figure 3.) Connect the second coax hot wire (connecting to J1 on the mod board) to this point as shown in Figure 3. The shield is connected to the nearby ground pad. When mounting the cable, be sure to keep the cable parallel to the PCB to prevent shorting to the chassis when the board is turned over.

17. Check that the soldering is secure before turning the board over. Dress the wires to exit in the space between the RF and IF boards.

18. Reverse the removal procedure to reinstall the PC board. Leave the ribbon cable unconnected for now. Before installing the shield, locate L92 near the center of the board, between CN3 and CN18.

19. Tack solder one end of the red wire to the side of L92 nearest the front panel.

20. Solder the other end of the red wire to the +12V pad on the mod board. Ground will return through the coax shields.

21. Replace the shield.

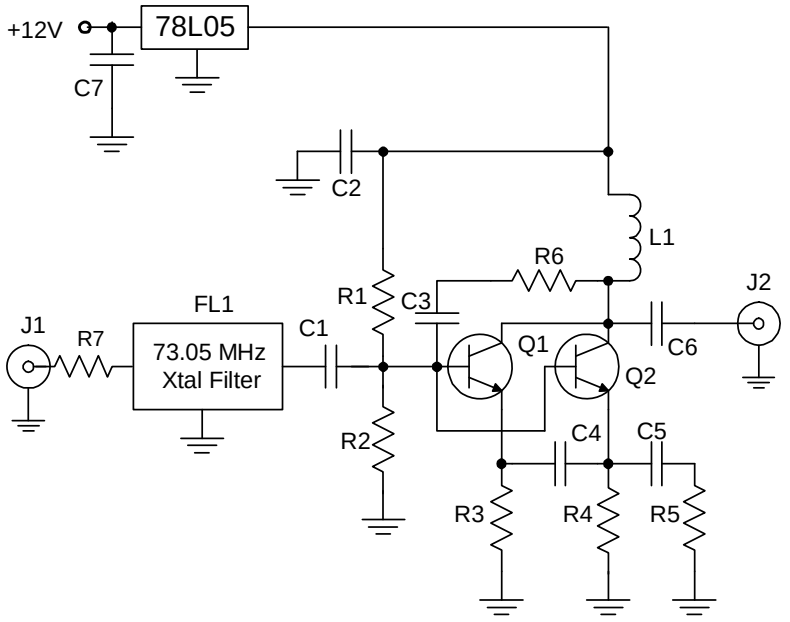
22. Figure 3 shows the installation of the mod assembly. The two stick down tie mounts should be inserted as indicated in the figure. One is placed between the RF and IF boards about ¼ inch from the shield. The second is placed nearer the front panel just past the end of the RF board.

23. Insert a tie wrap through the opening in each mount which parallels the RF board and is nearest to it.

24. Position the mod board with the filter on the right side and the rear end just a small amount forward of the shield can. Plug in the two coax cables. The one from L59 goes in J1 and the one from C134 goes in J2. Dress the many wires to the RF board side of the mod board.

25. Snug up the tie wraps to hold the mod in place. Replace the ribbon cable into the socket CN11 on the RF board.

26. Check your work. Replace the bottom cover of the radio.



C1,2,3,4,5,6	0.1uF
C7	0.47uF
L1	2.2uH
R1	3.9K
R2	2.2K
R3,4	68
R5	12
R6	220
R7	27
Q1,2	MPS5179

TS 850 Roofing Filter Mod W2VJN 2/9/2009

Parts List

- Assembled Inrad 117 board
- 2 RG-178 coax cables, 9” each
- 2 male TMP connectors
- Red and black wire-15” each, #26
- 2 tie mounts. Mouser 561-N3588
- 2 tie wraps, Mouser 561-N3506

Figure 1. Preparation of coax cable.

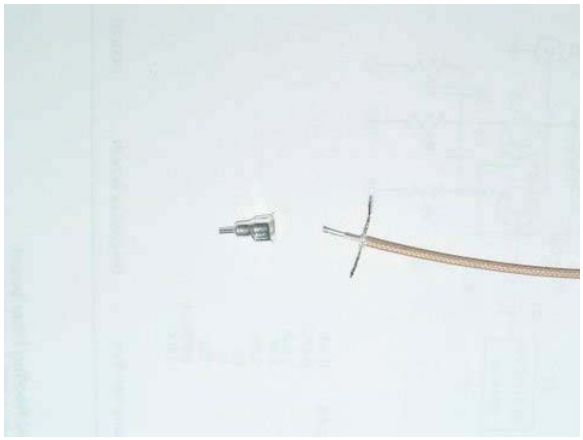


Figure 2. Area of modification. Bottom of RF PC board.

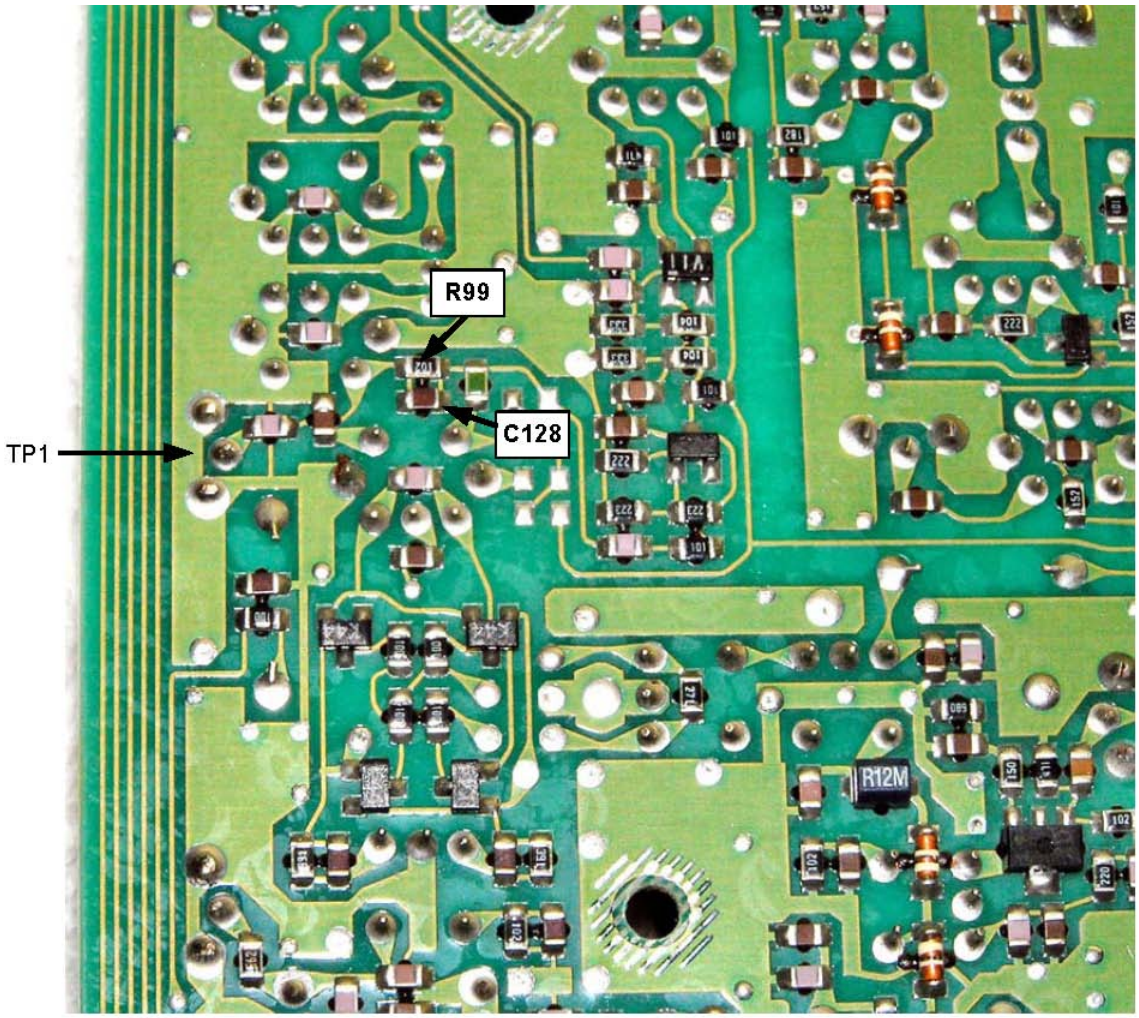


Figure 3. View of the board modification.

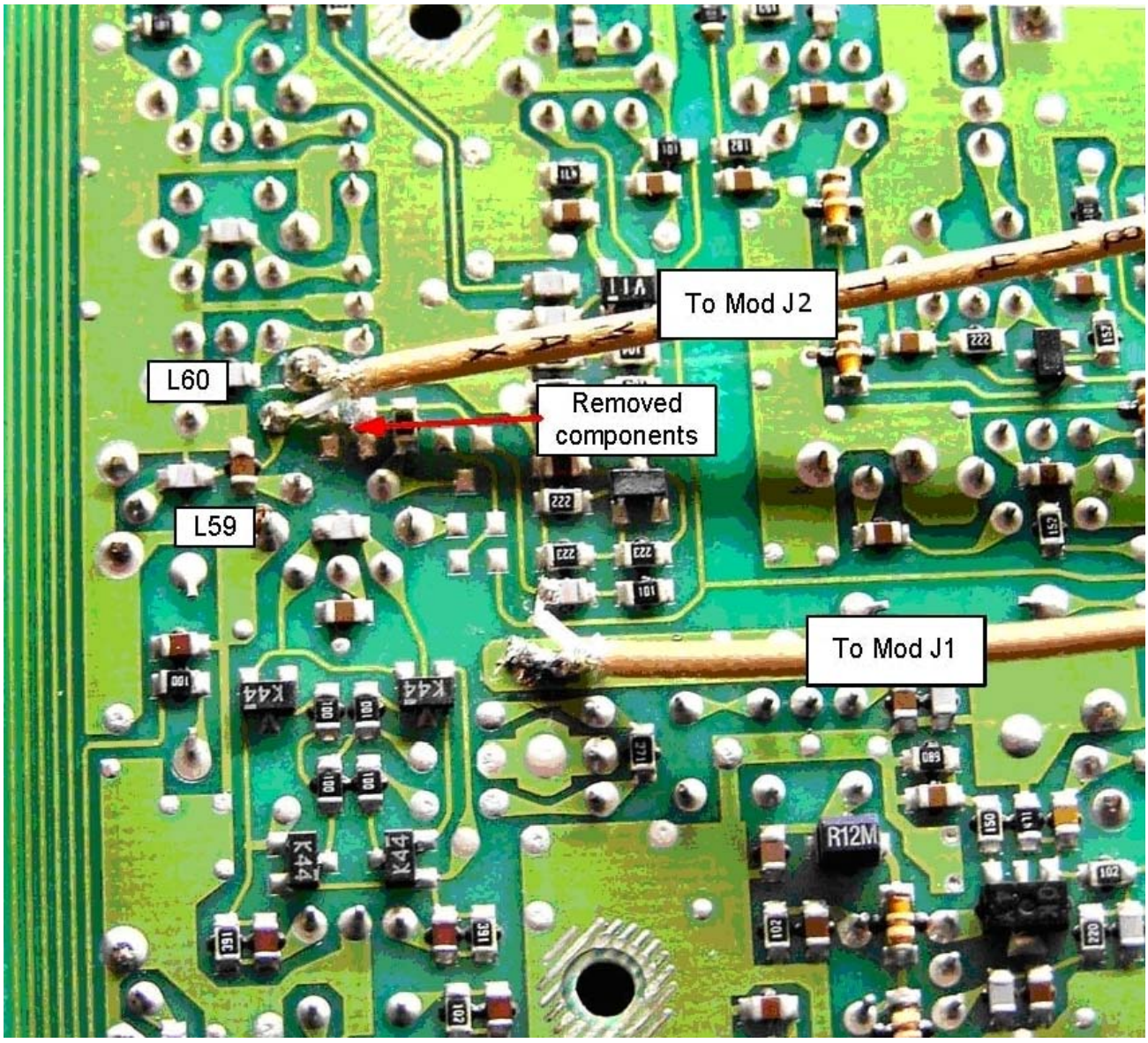


Figure 4. Completed mod.