

Improved R-390A BFO Neutralization Method  
Larry Haney, April 3, 2019  
Version 2,1-3-25.

I was finishing up the IF deck I was working on and got to the BFO Neutralization part. Many times I have thought that there must be an easier way to make this adjustment. Well, I think there is. I started by looking through the large amount of data we have online, but could not find anything easier. So, I thought, what could I do?

I started by thinking, what was the purpose for this function? Well, it is to minimize the BFO oscillator signal from infiltrating into the IF output and the AGC system (ie: minimizing the BFO signal at the V504 signal grid). This is done by feeding a small amount of 180 degree out of phase BFO signal to this grid. This is accomplished by the special tap on the primary of T503 and the 'neutralization' cap C525. The reason this is needed is that some of the BFO signal is coupled to the grid through the plate capacitance within the V504 tube. Having this correctly adjusted allows the AGC and IF output to operate correctly.

Version 2a,1-3-25.

If the BFO has been replaced with a product detector, neutralization may not be required. For the new easier method, go to page 2.  
End Version 2a.

The documented procedure does work, but there is an easier way to do it. This procedure depends on the IF being properly aligned and the BFO center frequency set to about 455 kh.

1. Disconnect the 2 signal input cables (J513 and J518) from the IF deck and turn the RF gain down about 1/2 way.

- 'OR' -

Remove the first IF tube, V501 (I think this is easier). The idea here is to stop the IF signal from getting to V504.

2. Connect your RF millivolt meter (ME-30 or alternative) to the IF output. It needs to be capable of measuring 1 millivolt full scale. If you don't have such an animal, perhaps a scope will go that low (mine does even without the amplified probe). If you have neither, all is not lost. You can connect a scope (best method) or high impedance -1.5 VDC voltmeter (poorest method) to pin 1 of V509, the AGC detector. You can use a tube test extender to do this.

3. Turn on the BFO and set it to + or - 1 kh.

4. Adjust C525 for a dip with an INSULATED tuning tool. Even if you have additional capacitance across C535 from the BFO to the audio detector (to increase the BFO injection for SSB), it should still dip.

5. It's done. Reinstall tubes and/or cables as appropriate.

6. Check it, as in 9b below on page 2.

I've tried the procedure in the books and the above in various combinations, and the resultant adjustment turns out the same. The procedure I like the best is to pull V501 and connect my millivolt meter to the IF out. This leaves all cables in tact and works great.

There you have it.

Version 2b,1-3-25.

Well, not so fast – there is a much much easier way to adjust it.

Remember, at the beginning I said that the purpose for it is to minimize the BFO oscillator signal from infiltrating into the IF output AND the AGC system.

Because when the fourth IF amplifier is NOT neutralized for the BFO oscillator signal, its signal will infiltrate both the 'IF output' and the AGC system when turned on. This means that the unwanted signal can be measured at either the IF output or the AGC output. Because measuring the AGC output is very easy, here is the neutralization procedure using that method.

Setup and adjustment:

1. Antenna: connected or not.
  2. Meter: VTVM connected to AGC on back.
  3. BFO: off and set to 0. Bandwidth = 4 KC.
  4. Tuning: on a very weak STABLE signal or none (Meter needs to read around 1-3 volts. Adjust the RF gain.). If on a signal, it must be centered on BFO at 0. If BFO is NOT neutralized and turned on, the AGC can be quite high so be careful with meter attached.
  5. AGC speed: Fast.
  6. Set meter on about -50 vdc range.
  7. Turn BFO on.
  8. Adjust BFO neutralizing capacitor for minimum reading USING an insulated tool. Reduce VTVM voltage range as necessary to maintain reasonable reading.
  9. CHECK IT:
    - a. While observing the meter, turn the BFO off. It should NOT change the reading.
    - b. The neutralizing capacitor must NOT be at its minimum or maximum (the slot should NOT be vertical (even if the BFO has additional injection capacitance)).
  10. If the checks are good, then you're Done. Otherwise, try again or fix problem.
- End Version 2b.

Regards, Larry