

Xref Versatile

Icom IC-706 MKIIG Installation Sheet

1. Overview

The XRef Versatile is a replacement Reference Oscillator for a variety of amateur transceivers, intended to be installed internally within the radio.

The board takes a 10 MHz reference signal from a GPS reference or other high-accuracy source and generates a precision reference for the radio. It also provides a backup in the case where a 10 MHz source is not available.

In the case of the Icom IC-706 MKIIG, the Reference Frequency is 30.0 MHz.

The version of the XRef that should be used with the IC-706 MKIIG is the Xref-VT with onboard TCXO. This completely replaces the radio's own reference oscillator with the TCXO being used when the external 10 MHz reference is not connected.

2. Technical Specifications

Connections to the board are shown below:



Connection	Description	Specifications
VIN	Supply for Xref	5 to 16 V 20 mA for XRef
VOSC	Not Connected	
RF	Reference frequency out to Radio.	Radio dependent
10 MHz	10 MHz Reference Input	0 to +15 dBm (0.5V to 3.6V p-p)

3. Circuit Modifications

The recommended modification uses Injection Locking to lock the radio's reference oscillator to the XRef output. This involves wrapping a coil of insulated wire around L601 and using that to inject a reference signal from the XRef board. The extract from the circuit diagram in Figure 1 shows where modification is to be made.

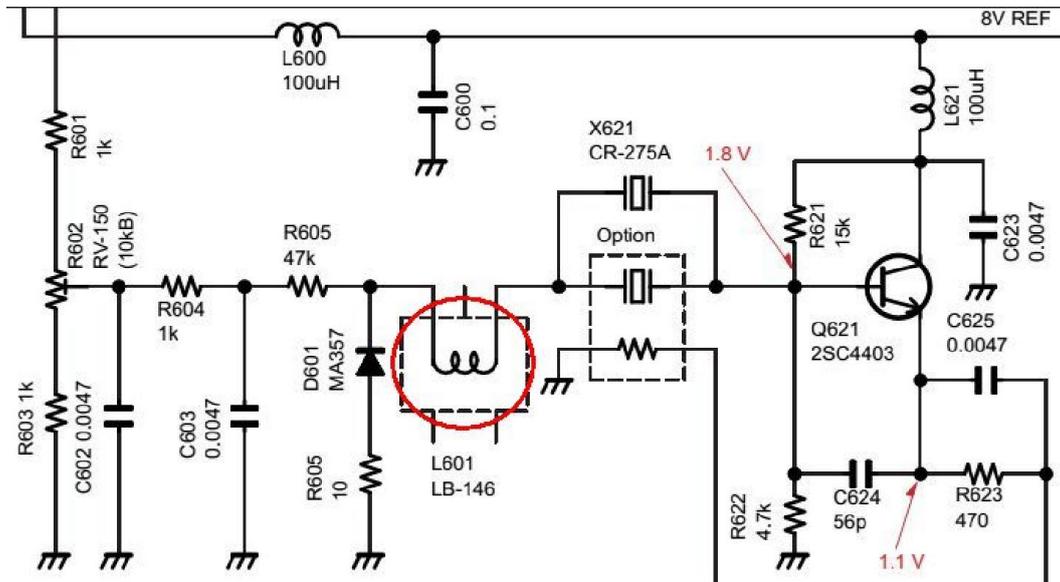


Figure 1. – Icom IC-706 MKIIG Reference Oscillator Circuit

The red circle shows L601 where the output of the Xref is coupled into the radio.

4. Installation

For this installation, you will need about 300mm of very thin coax - say RG178B or RG316. You will also need a short length of either light-gauge Enamelled Copper Wire (ECW) or single-strand, insulated hookup wire to make up the coil.

Remove both top and bottom covers of the radio. Unplug the speaker lead.

Locate the Reference Oscillator shielded area on the underside, at the front left of the radio. Remove the lid of the shielded area by carefully levering it upwards. You should now see something like that shown in Figure 2.

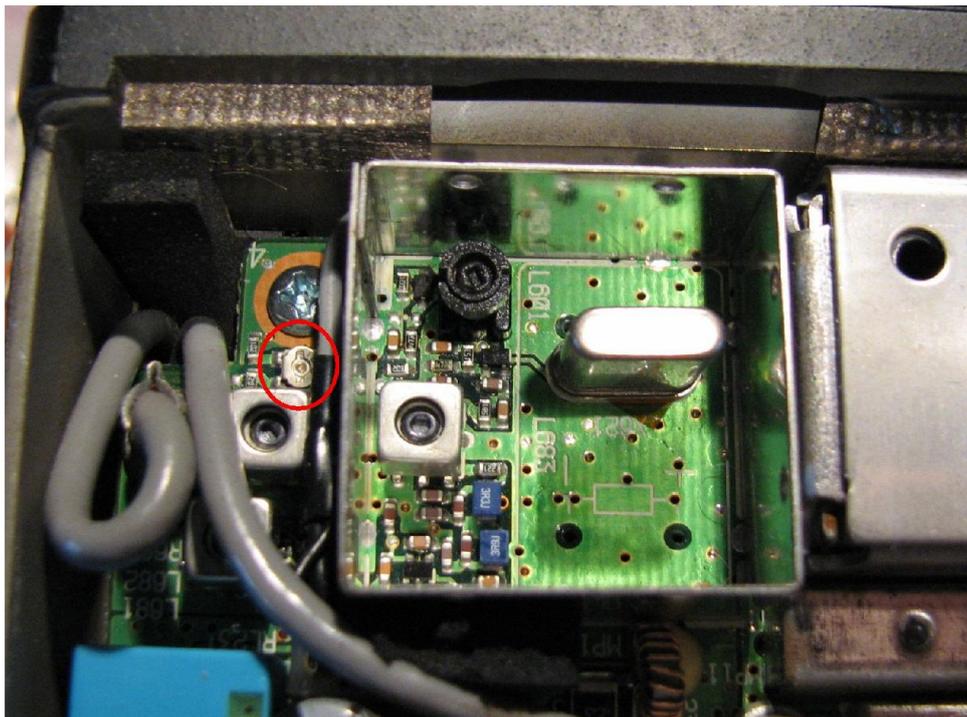


Figure 2. – Original Reference Oscillator

Note that this radio is fitted with the standard Reference Oscillator. There is an option for a High Stability crystal with heater that replaces the standard crystal. If your radio has a large metal can taking up the right hand side of the shielded area, then it is probably fitted with that option. With the option, the suggested Xref installation should still work, but you may need to modify the soldering points slightly.

L601 is located at the top left of the shielded area. In this model radio, it doesn't have a cover, making this modification possible.

Make a coil with 5-6 turns, tightly wound, slightly larger in diameter than L601. Slip the coil over L601 and solder the lower end to the ground plane of the circuit board, or the inner side of the shield.

Strip the outer of the coaxial cable back about 1cm, separate the braid and wrap into a bundle, then strip the inner back several mm. Poke the cable through the hole in the shielded enclosure, solder the braid to the enclosure and solder the inner to the end of the coil around L601. Make sure the inner won't short on the lid when it is replaced. See Figure 3 below.

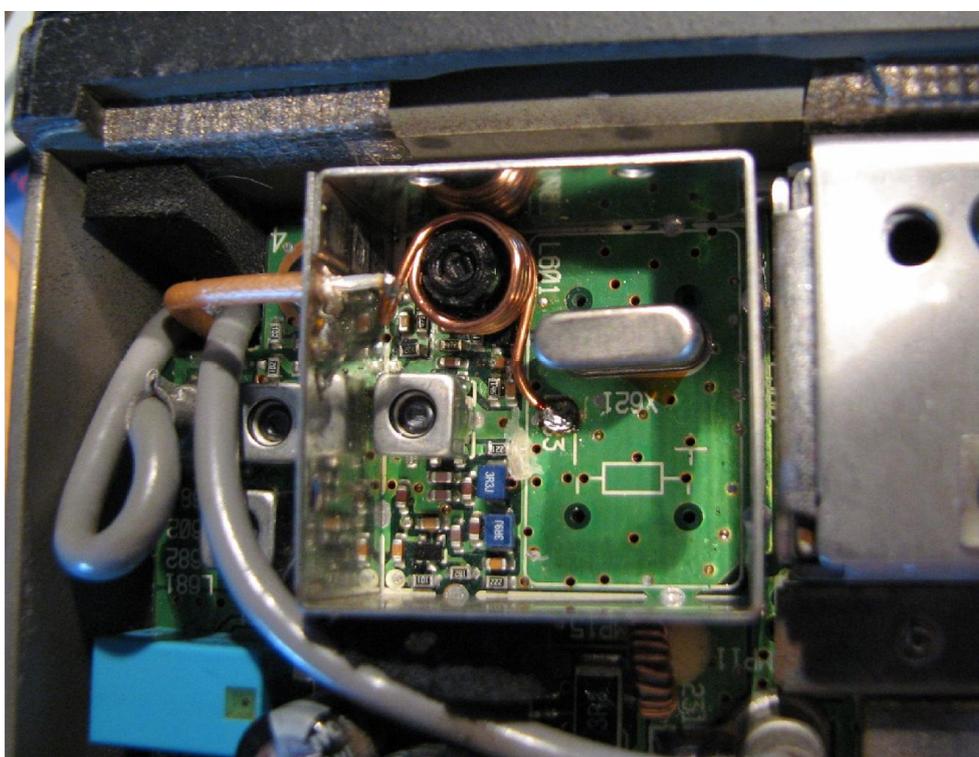


Figure 3. – Modified Reference Oscillator

Feed the other end of the coaxial cable through the opening in the corner to the top side of the radio where the Xref will be installed.

I mounted the Xref on the top side of the radio, on top of a metal enclosure and coil formers using double-sided foam adhesive tape to hold it in place. Cover the whole underside of the Xref with the tape to ensure that it is fully insulated from the metal enclosures. See Figure 4.

I fed the thin coax between the boards at the rear of the radio and through the gap between the fan and the chassis. I used very thin green coax, which can be seen in Figure 4. You may need to unscrew and lift the rear board slightly to route the coax through. Solder the thin coax to the SMA socket before mounting the socket on the back panel.

Before putting everything back together, you will most likely need to retune the radio's reference oscillator to compensate for the detuning effect of the coupling coil. Turn the radio on and, in SSB mode, tune to a beacon or carrier. You may hear a warble on the signal indicating that the radio's reference oscillator is not locked to the Xref due to it being too far off frequency. Adjust the trimpot RV-150 located next to the Reference Oscillator shielded enclosure (circled in red in Figure 2) until the signal becomes a pure tone. In my case, as I turned the RV-150 further, there was another point where the oscillator lost lock again. RV-150 was set to the midpoint of the locked range which was about 45 degrees anticlockwise from where it had originally been set.

Now test that the 10 MHz input is working. Turn off the radio, connect a 10 MHz source to the rear panel connector and turn the radio on again. The tone from the beacon may have changed slightly, due to the small difference between the TCXO and the 10 MHz reference.

Finally, re-assemble the radio and enjoy your new level of frequency accuracy and stability!

5. Operation

The board only tests for the presence of the external reference when power is first applied. Therefore, if you plug/unplug the 10 MHz lead during operation, you must cycle power to the radio for it to operate correctly.

The onboard TCXO was set to the correct frequency during testing. However, the TCXO may drift due to aging during early days of operation. The TCXO frequency is set by the multi-turn trimpot on the XRef board.

It is important that a clean source of 10 MHz be used as a reference. The board is, in effect, converting the signal you are supplying to the reference frequency of the rig, including whatever imperfections there may be. The old adage *garbage-in, garbage-out* applies here.

It is also important that the 10 MHz reference is stable in frequency before the radio is powered up. The synthesiser chip used in the Xref does a self-calibration when powered up based on the actual output frequency. If the reference frequency is varying, this calibration can fail. If using a GPSDO or Rubidium reference, wait for it to lock before switching on the radio.

6. Support

If you have any difficulties, you can contact David Smith VK3HZ either:

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- by telephone : (+613)/(03) 9013 1919