

The Channel Master 11.7 to 12.2 GHz LNB

Conversion to 10.368 GHz

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Low Noise Block Down Converters (LNBs) designed for use at the feed point of Satellite TV antennas in the 12 GHz band can be modified to function as excellent low noise receiving amplifiers (LNAs) for the amateur 10 GHz band. Typical Noise Figures of these modified units at 10 GHz are in the range of 0.8 to 1.2 dB, with gain of around 25 dB. The LNBs have waveguide input and should be used with a waveguide T/R relay, as near as possible to the antenna feed, in order to deliver optimum receiving performance. Figure 1 shows a view of a typical unmodified LNB with WR-75 waveguide input and an output "F" connector for the converted 1.0-1.5 GHz i.f. signal. The +15 to +24 volt dc input power for the LNB was simultaneously carried on the coax center conductor. The LNB has diode polarity protection for the dc input and an internal 7808 voltage regulator for the internal circuitry.



Figure 1. Unmodified LNB

There are two approaches that we have followed in modifying these units for LNA use. The difference between them is in the mounting of a new SMA output connector for the LNA output. But first, let's take a look inside the LNB. Note: If your LNB is not exactly the same as the one described here, you will probably need to make the same types of modifications in order to make it usable on 10 GHz.

First, remove the yellow cover by unscrewing the type "F" connector nut. Slight pressure on the "F" connector will push out the LNB from the yellow case. Orient the LNB assembly so that the small metal module that looks like a TTL crystal oscillator is on top. It is held in place by a plate secured by two screws. The module contains a Dielectric

Resonator Oscillator (DRO) and mixer used in the Block Converter, and is not needed for the LNA application. Orient the assembly so that the "F" connector is on the left. Remove and save the two screws holding the metal plate over the DRO/mixer module. Save this plate for use later as a template. Now remove and save the five screws holding the die-cast metal rf cover plate over the low noise microwave amp (LNA) side of the LNB assembly. See Figure 2.

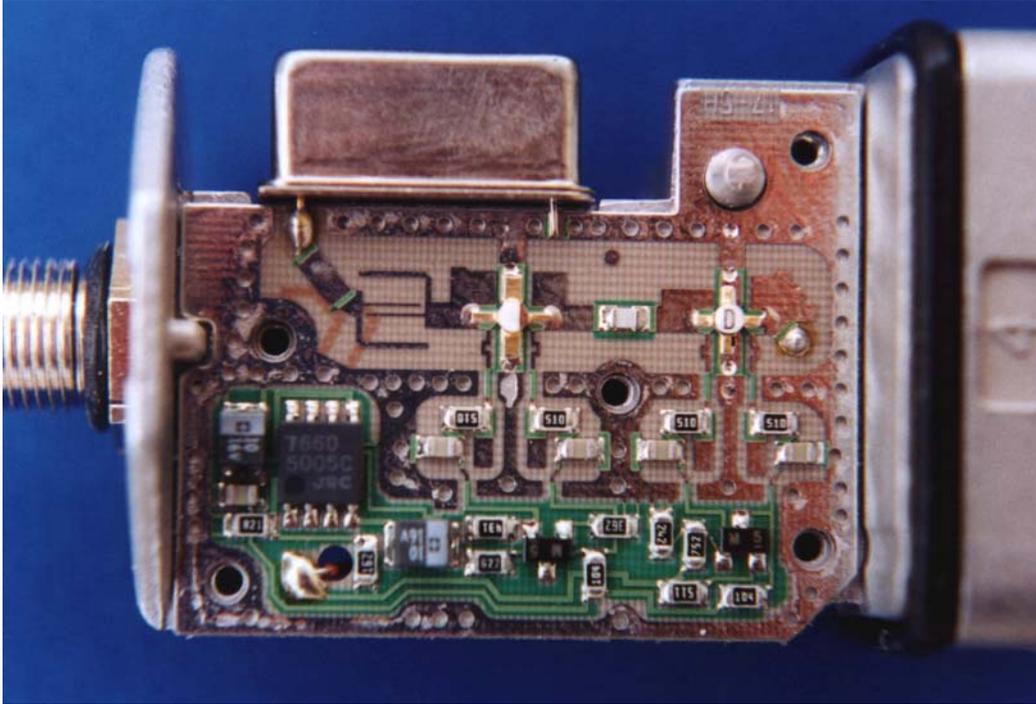


Figure 2 LNA Side prior to removing DRO/Mixer

Now unsolder the two pins connecting the DRO/mixer module to the pc boards, one on each side of the LNB. You can then remove the DRO/Mixer module. Notice that on the inner-facing side of the top edge of the die-cast metal rf cover plate, there two small channels that cleared the two pins of the DRO/Mixer which connected to the upper edge of the pc board on the LNA side of the unit. The two LNA stages can be clearly seen at the top of the LNA pc board, and the LNA 2nd amplifier output is the point at which the DRO/Mixer was previously soldered. You can see a stripline filter element that connects the amplifier to that point This is the point at which we will connect our new SMA output connector. The pc board on the opposite side of the LNB assembly will be referred to as the LNB board.

One approach to mounting the new SMA output connector involves soldering the base of the connector directly to the edge of the ground-plane foil of the LNA pc board, as shown in Figure 3.



Figure 3 with SMA output connector soldered to LNA pc board

The second and more rugged approach mounts the connector on a metal plate that is fastened to the top of the LNB housing with two screws. They fasten to the LNB metal frame in the same two holes used previously by the DRO/mixer mounting plate. See Figure 4.

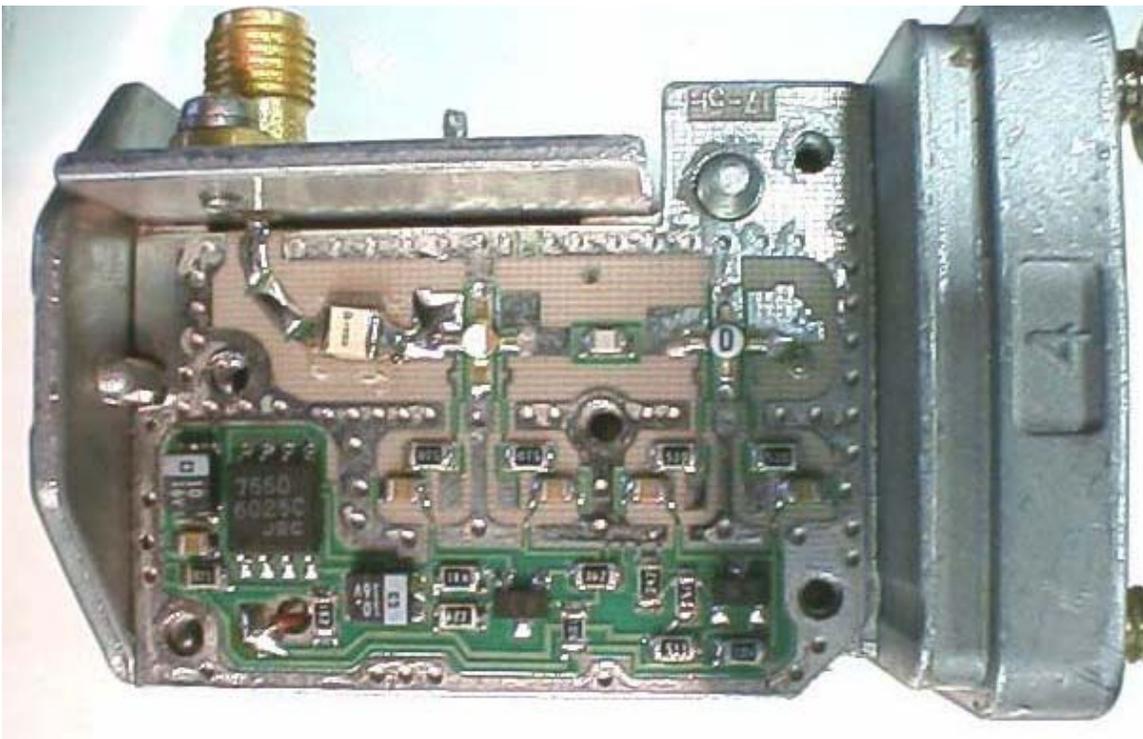


Figure 4 with SMA connector mounted on metal plate

The soldered SMA approach

To proceed with the first modification approach, Figure 3 shows where the new output SMA connector can be mounted. Solder the ground part of the SMA connector to the ground foil on the edge of the pc board. Do not over-solder as you need clearance for the die-cast rf cover plate to fit, allowing its small clearance channel to clear the SMA center pin and still provide rigid mounting for the SMA connector. Now solder the SMA center pin to the trace where the DRO/mixer was attached. This point is already dc isolated from the output stage of the LNA by the stripline output rf filter elements. Check to make sure the SMA center pin does not contact the rf cover plate when the plate is reinstalled. If it does, you will have to file out the clearance channel in the plate to avoid shorting the rf output.

Finally, unsolder the center pin of the type "F" output connector from the LNB pc board and remove the connector. Now replace it with a dc feed-through filter of miniature size, and connect its center pin to the trace on the LNB pc board where the "F" connector had been soldered. This feed-through will now be the new +12 to +15 volt dc power input connection for the modified LNA.

The mounting plate SMA approach

For this approach you need a small aluminum plate about 1/16 inch thick and 1.10 by 1.15 inches in size. Use the DRO/mixer mounting plate as a template to drill the holes so it will mount to the LNB frame. Carefully locate and drill the mounting holes for the SMA connector and the dc power feedthru as seen in Figures 5 and 6.

Be careful in mounting the connector so that the LNA rf cover plate will not short out the SMA center conductor when the plate is reinstalled. You may have to file the small pass-thru channel to insure clearance.

Although several amateurs have reported excellent LNA performance without any stripline retuning of the amplifier, It is recommended that you follow the method shown in Figure 4 at the output of the 2nd stage amplifier. Using a sharp knife, carefully scrape and eliminate the stripline output filter elements between the SMA connector and the 2nd stage output. Now bridge the remaining gap with a 0.7 to 1.3 pF ATC microwave type chip capacitor. Note: If you remove the filter you must use this coupling capacitor to maintain the dc isolation between the 2nd stage amplifier output and the SMA connector.

As in the earlier described modification approach, you should remove the "F" connector after unsoldering it from the LNB pc board, and connect the new dc feedthru to that same point on the board. The photo of Figure 5 shows several small ferrite beads on the lead from the feedthru to the pc board, to help maintain good rf filtering of external interference. Remember, this is a very sensitive and high gain amplifier at the input to your microwave system, and it will normally be in an exposed location near the antenna feed.

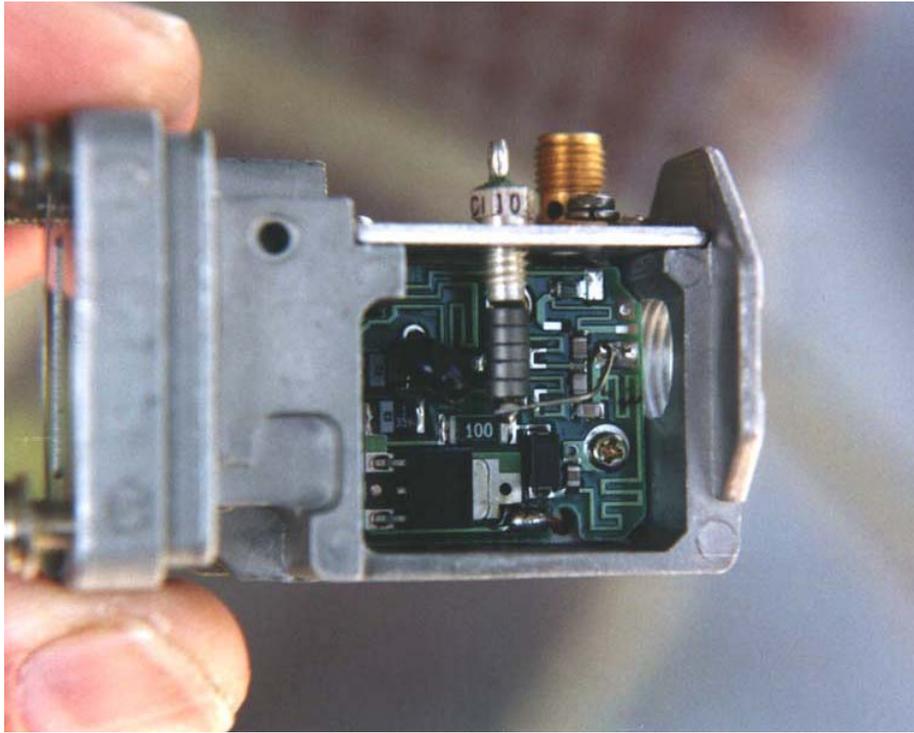


Figure 5 showing LNB pc board and dc feedthru connection



Figure 6 Top view of SMA and dc feedthru mounting plate

The LNA input waveguide input flange is WR-75. It can be modified to fit against WR-90 waveguide switches by drilling out the four mounting holes through the back of the flange mount on the LNA and cutting away the outside corner edges, allowing screws to fit the pattern of a WR-90 flange. It has been shown that as few as two screws will securely hold the LNA to a WR-90 waveguide fitting.

You will need to make a slot or opening in the yellow weather cover to provide access to the output SMA connector and dc feedthru when the cover is replaced. The assembly should then be mounted with the SMA connector pointing down to prevent moisture entry.

This mod was the result of several amateurs pooling efforts; Ed W6OYJ, Pete W6DXJ, Kerry N6IZW and myself. We are all members of the San Diego Microwave Group. Recently a large quantity of these LNB assemblies along with several other types of slightly different configurations were obtained and will be made available to other amateurs. These surplus units are pulls from service and have been tested for basic performance on a system level, for operational functionality. While the conversion of the other LNB units are different and not as easy as the unit described in this paper, the conversion remains essentially the same. Remove the LO, Mixer, and IF systems by cutting off dc power or disabling them. Couple out of the last stage RF amplifier by using the original circuit stripline isolated coupling lines. If the isolated stripline does not exist, insert a 1 pF ATC microwave type chip capacitor and test for RF preamp operation.

Please direct questions / LNB availability to Chuck Houghton, WB6IGP, 6345 Badger Lake Ave, San Diego Calif. 92119 or to clhough@pacbell.net for further information.