

AT on Rx mod for the Kenwood TS950SD transceiver (as done by YO9FZS)

If considering its cost on the used market, the TS950SD is a good transceiver, but as for many other transceivers its Antenna Tuner (AT) is used for transmit only, being switched out from the antenna line path during receive. The AT is matching the 50 ohm Tx output to the actual impedance of the antenna, but why not using this AT to match the same antenna to the 50 ohm Rx input also? The high pass characteristic of the tuner "T" network will also add to the Rx input selectivity and will improve the Rx 2nd order IMD response.

At first, I could not decide, but...

Once, using a random wire antenna on my TS950SD, I experienced 2nd order IMD products on 14 MHz band (few low level carriers spaced at 5kHz each other). Switching to the existing 14 MHz monoband vertical antenna did not show any IMD problem. I had immediately check for the 7 MHz broadcast band activity (which for Europe starts at 7100 kHz) and found many high level broadcast signals, some at over S9+60dB and located close to the ham band edge. These very large signals received by the wire antenna produced the 2nd order IMD signals on the 14MHz band. The IMD products could not be eliminated using the TS950SD's AIP feature, but they disappeared when as low as 10 dB of attenuation was introduced, which indicated that the 2nd order IMD could be produced by the Rx input filters switching diodes. In the past, I owned TS870 transceivers and found similar problem, but it could be eliminated by switching on the AT (the TS870's AT can be used for both Tx and Rx by a menu setting). This is why I decided to investigate and implement this mod to my 950SD.

Here is how to modify the TS950SD (or TS950S) for using the AT for both Tx and Rx.

I don't like to say it, but please note that doing modifications to equipment may tend to warranty void or damage and loss for which I can not be responsible. You are doing it at your own risk.

First, some observations.

The TS950SD's Tx LPF, SWR bridge, AT connections and Rx-Tx switching relay are all located on the Filter Unit (X51-3060-00) board. The Tx output from the Final Unit is applied at the CN4 connector of the Filter Unit, passed to the LPF and SWR bridge and then applied by the CN1 connector to the AT1 tuner input. The AT2 tuner output is connected at the CN2. The Rx/Tx switching is made by the K15 relay, with the output for the Rx at CN3. The SO239 antenna socket is connected to the W1 (hot) and W2 (gnd) and is switched from the Rx (CN3) to the Tx (CN2). AT1 and AT2 are routed by coaxial cables to the Filter Unit CN1 and CN2 connectors respectively.

The Tx signal flow is as below:

Tx signal => CN4 => LPF => SWR => CN1 [AT1 => Antenna Tuner => AT2] CN2 => [Rx/Tx K15 relay] => W1 => SO239 => Antenna

and the Rx signal:

Antenna => SO239 => W1 => [Rx/Tx K15 relay] => CN3 => [signal to Rx input]

You may see that for using the AT for both Tx and Rx you have to "move" the AT in the signal path from a *Tx only location* to a *common for both Rx and Tx* one, so it must be located at between the Rx/Tx relay and the SO239 socket, with the AT1 (50 ohm AT's input) connected at W1 and the AT2 AT's output at the SO239 socket. [using this way of thinking may help others to implement similar mod to transceivers which are including Tx only AT also].

The simplest way is to cut the connectors of the AT coaxial cables, to solder them at the appropriate connections points and to interconnect the CN1 and CN2. Instead of this simple way, I choose to add two small coaxial connectors (like the CN1 and CN2 ones of the Filter Unit board) at the W1/W2 connection points and at the SO239 socket respectively, an eyelet for grounding connections and a short piece of coaxial cable with mating connectors fitted at both ends (see pictures). I did so because this may afford easy return to the original configuration in case this will be needed, and I didn't like to cut those cables... [As specified, the mod can be done without the connectors, by cutting the the AT's coaxial cables connectors and direct soldering the cables, AT1 at W1/W2, AT2 at SO239 and soldering a short coaxial cable from CN1 to CN2]. Below is described the mod for using additional female coaxial connectors, without the need to cut or solder the coaxial cables of the transceiver.

For doing this mod you have to gain access to the Filter Unit inside the transceiver (near the Final Unit). Remove the TS950S covers (see the TS950S Instruction Manual, # 6-6-1, page 69) and the sub chassis (# 6-6-2 at page 70). Remove the cover of the Final and Filter units compartment (by

removing its holding screws - take care for the cable harness and for the coaxial cable connected at Drive In input!), and proceed as following.

Disconnect the AT1 (yellow mark), AT2 and Po coaxial cables from CN1, CN2 and CN4 respectively and unsolder the SO239 connector from the short wires connected at W1 and W2.
Remove the Filter Board screws.

Remove the two short wires soldered at W1 and W2 (which were connecting the SO239 antenna socket) and solder a coaxial connector in place of W1 and W2.
Solder the center contact of the coaxial connector to W1 and the shield to W2 (W2 is GND).

Install the board adding a grounding connection eyelet under the mounting screw at the near the SO239 connector. Solder the shield (GND) pin of the W1/W2 attached coaxial connector to the screw grounding tab (eyelet) and to SO239 GND pin (soldered together).

Attach another small coaxial connector to the SO239 socket ("straight connection", center to center contact and gnd to the grounding tab/eyelet, see pictures). As said, the added coaxial connectors will use for connecting the SO239 socket to the AT and the AT to the W1 and W2 respectively without the need for cutting the connectors attached at the AT coaxial cables.

Connect CN1 to CN2 by the short coaxial cable.

Attach AT1 cable to the added coaxial connector soldered at W1 and W2.

Attach AT2 cable to the added coaxial connector soldered on the SO239 socket.

Check the connections again!

Close the Final Unit compartment and the transceiver (take care at the wire harness!) and check it for Rx and Tx.

That's all.

Now, the AT location in the signal path is between the Rx/Tx relay and SO239 (antenna) and can be used for both Rx and Tx (of course, as before, it also can be switched out completely).

Please note that after doing this mod:

You may have to switch off the AT when working split cross band, other way the received signal may be attenuated by the AT.

When using the AT outside of its tuning range (or far, outside its frequency range, which usually happens at MF/LF) you may notice some Rx signal attenuation. In this case you may switch it off.

When the AT is switched in line and matching high SWR antenna, you may notice a slight improvement for the Rx sensitivity because of improved antenna matching at the Rx input port.

And the 2nd order IMD products are gone.

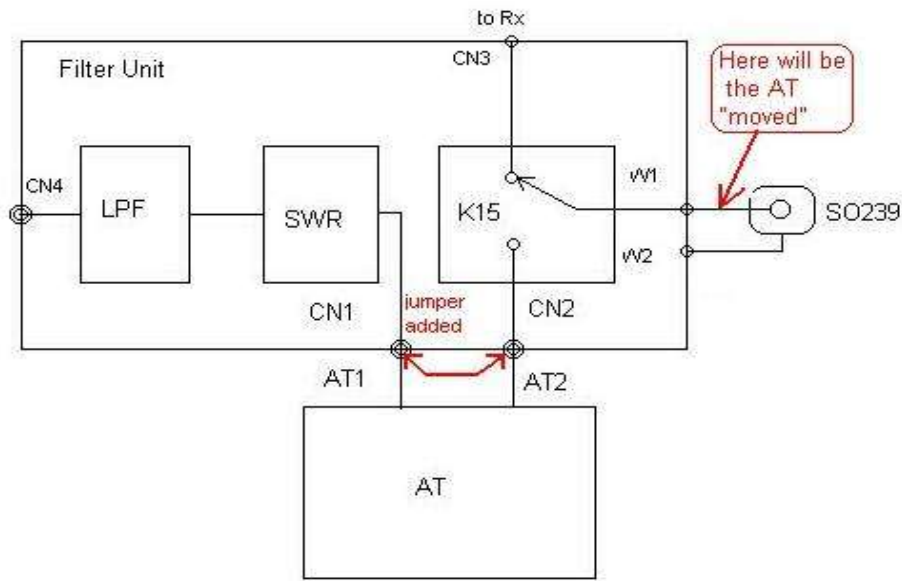
As a single picture may say more than a thousand words, few pictures are attached bellow.

Good Luck,

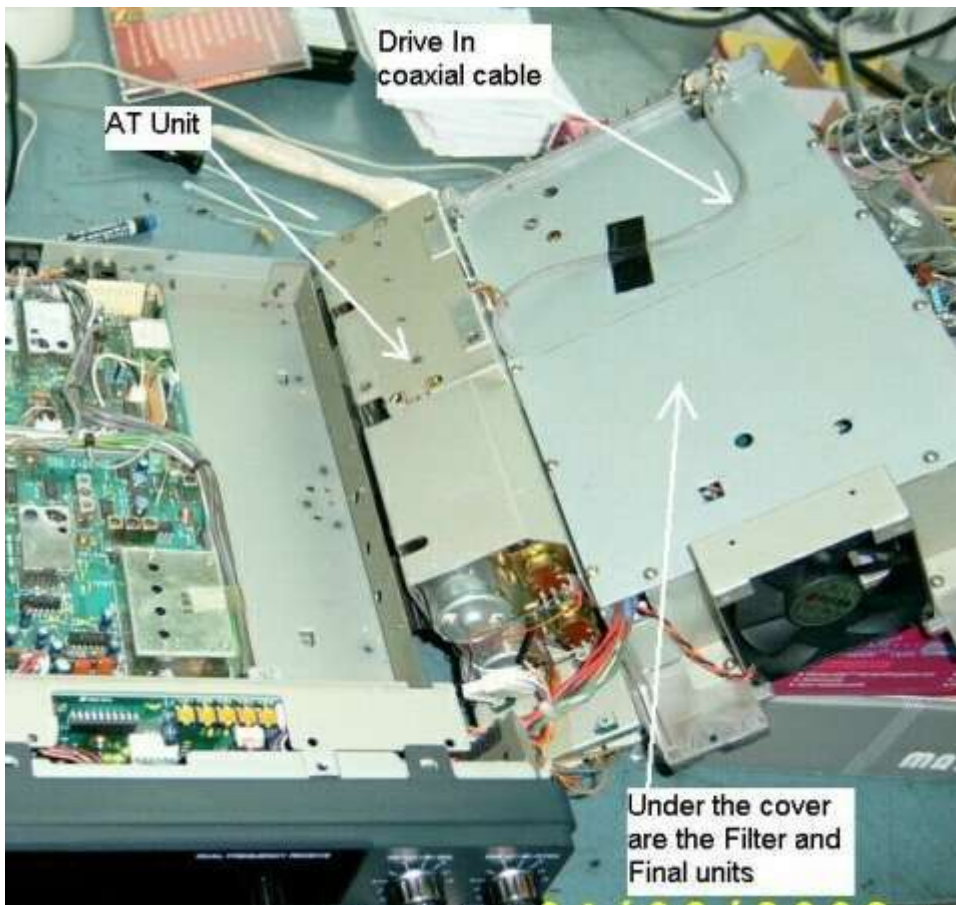
73,

Traian, YO9FZS

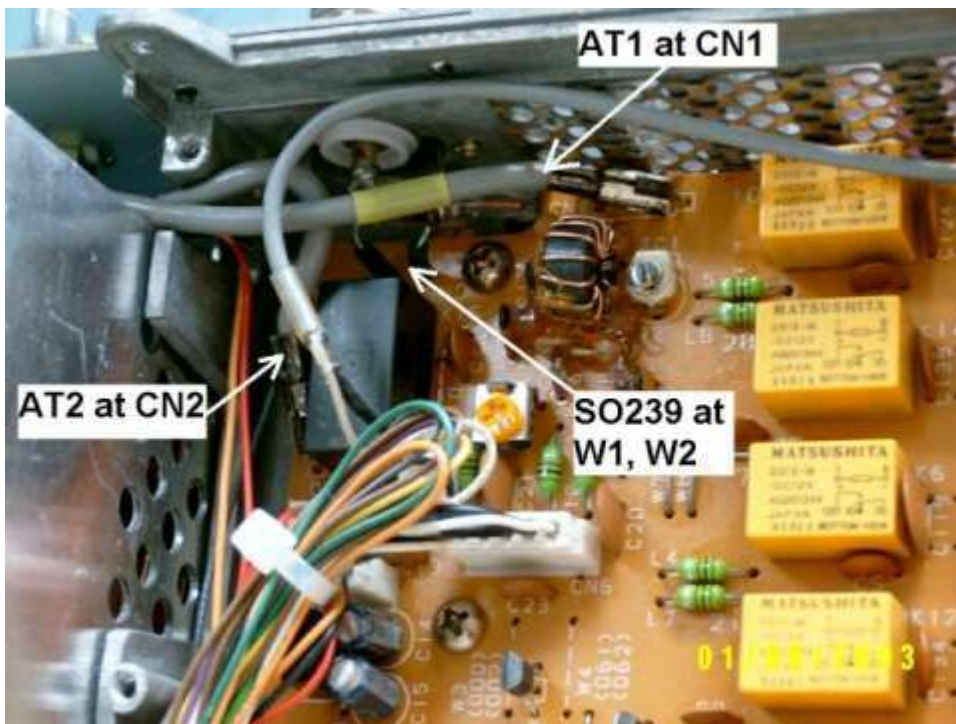
yo9fzs@office.deck.ro



Signal path diagram for the TS950SD's Rx/Tx switching area, located on the Filter Unit board



***Opening the TS950SD
You will have to do work at the Filter Unit, located under the indicated cover.***



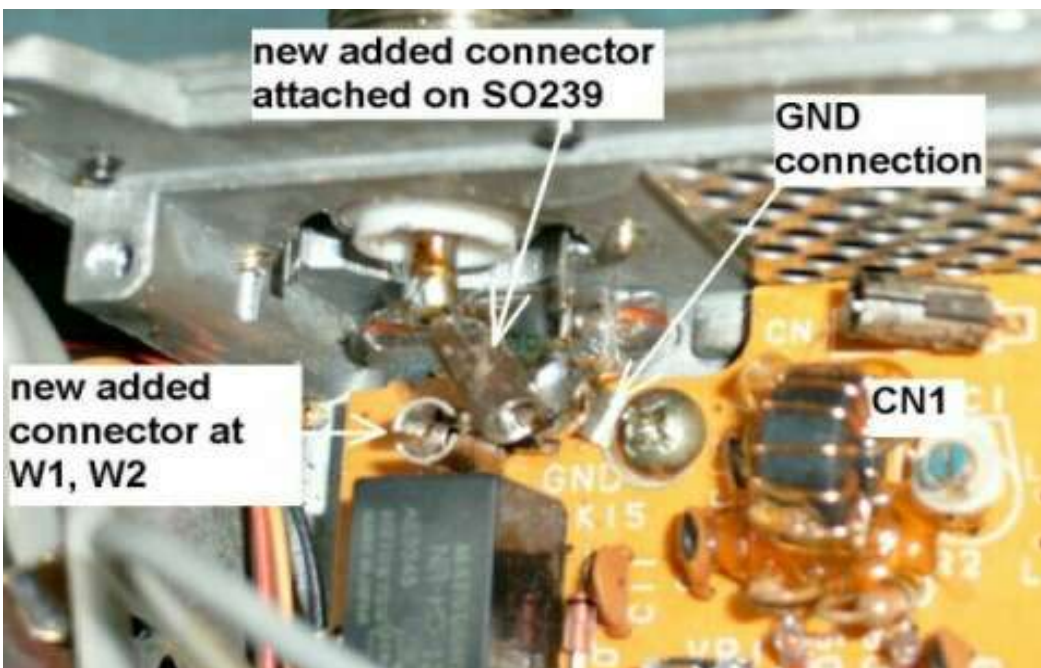
The original connections at the Rx/Tx switching area on the Filter Unit



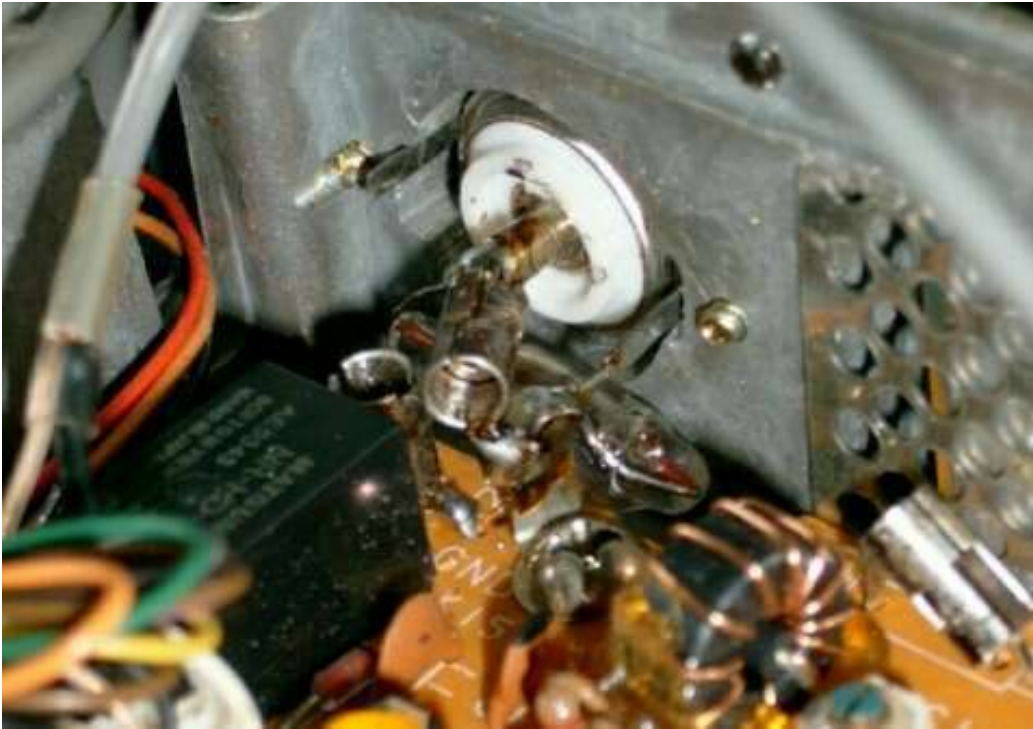
The two female coaxial connectors and the short length of coaxial cable (with male connectors) which need to be added. A grounding eyelet will also be needed.



The first coaxial connector was installed. It's center contact is soldered at W1, outer (shield) at W2 (gnd). Note its positioning. The outer contact connection will be soldered later at a grounding tab/eyelet fixed by the (later installed at the hole) screw.



The grounding tab/eyelet was added under the screw. The second coaxial connector was added at the SO239 socket (straight connection). The outer (shield) contacts of the two installed coaxial connectors and the SO239 socket shield are all soldered together at the screw grounding tab/eyelet. The same in the next picture.



CN1 was connected to the CN2 using the short coaxial cable (“jumper”) which has mating connectors fitted. The AT1 cable was connected at the W1/W2 installed coaxial connector. The AT2 cable was connected at the coaxial connector installed on the SO239 socket. Do not forget to check all again!