An RIT for the SW+Transceivers

Small Wonder Labs revised the original NExx40/SW series QRP transceivers in early 1998. All Dave's improvements were implemented in the same compact board size (7.1 x 10.1 cm, or 2.8 x 4.0 in.).

Dave's previously-designed receiver incremental tuning (RIT) for the NExx40 series used a CMOS analog switch to add extra resistors in the "ground" leg of the transceiver's tuning potentiometer to allow tuning the receive frequency slightly above and below the transmit frequency. This feature is useful for dodging interference and adjusting the receive frequency to the exact center of the IF passband.

This revised RIT has been designed on a compact board to facilitate easy installation into an existing SWxx+, SWxx, NExx or other varactor-tuned transceiver. The new board mounts onto the front panel using the board-mounted RIT potentiometer and switch. It's small 2.5 x 3.6 cm (1.0 x 1.4 in.) size fits easily into the smallest rigs. The interface is compatible with the Molex™ connectors used with the SW+ series and it can be wired easily into older SW, NExx40 and other varactor-tuned transceivers.

CIRCUIT OPERATION

Referring to the schematic diagram, the RIT circuit adds three resistors to the VFO tuning potentiometer: one (R101) between the transceiver's regulated 8 volt line and the "top" of the VFO tuning pot and two (R102 or R103) between the "bottom" of the tuning pot and ground. Either R102 or R103 is connected to the "bottom" leg, depending on whether the RIT is on or off and whether the transceiver is receiving or transmitting.

The '4066 analog switch (U101) contains four switch sections - only three are used. Any switch section turns on when its corresponding control pin (in our case pins 5, 10 or 13) is a logic '1,' or high voltage, state. Switching S101 "open" enables the RIT by setting control pin 13 'high' via the voltage through a 100K resistor (R105) from +Vr. The corresponding switch section (pins 1 and 2) closes thus connecting R103 to the bottom leg of Rtune (VFO tuning pot). Tuning R103 varies the varactor's bias voltage slightly and shifts the VFO frequency.

When the key is depressed to transmit, control pin 13 goes 'low' (i.e., ground or 0 volts) and pins 1 and 2 open to disconnect R103. Sequentially, control pin 12 goes 'low' opening switch 10-11 which raises control pin 5 to 'high' (via R104 from +Vr), closes switch 3 and 4 and connects R102 to the tuning potentiometer's bottom leg. Since R102 is a fixed resistor (called the *"centering"* resistor) it sets a *fixed* voltage on the bottom leg of Rtune. Thus the transmit frequency is controlled only by the Rtune setting - R103 has no effect. Note that the 10-11-12 switch simply reverses the logic state for the 3-4-5 switch; it is called a *logic inverter.*

Switching S101 "off" (grounding control pins 12 and 13) has the same effect as depressing the key. R102 is inserted into Rtune's bottom leg and the radio receives at the same *VFO frequency* as when it transmits.

Why is R101 there? Without R101, the tuning voltage on Rtune varies from about 8 volts (Vr) to a bit above 0 volts (set by R102). Since the varactor's capacitance variation with voltage is *nonlinear*, installing the RIT circuit without R101 gives a plus or minus 1.5 kHz RIT offset at the low end of the VFO range and much less (measured as *only* plus or minus 0.2 kHz) at the upper end. That is, varactor diode nonlinearity causes the RIT range to be greater at the lower end than at the top end of the tuning range. Introducing R101 reduces the tuning voltage change to less than the original 8 volts and the RIT range differences at the upper and lower frequencies become less. Installing, for example, a 47K resistor (about one half the value of R1) at R101 reduced the tuning voltage change to 5 volts and the RIT offset became plus or minus 1.5 kHz at the lower frequency and plus or minus 1.0 kHz at the upper frequency - a big improvement.

However adding R101 reduces the VFO tuning range because the available voltage change is now only 5 volts instead of the original 8 volts. To regain the original tuning range simply increase C8 (on the SW+ board) by about 20-50%. A precise value for the new C8 cannot be given because