



New DEM 90X-144/28 33 cm Transverter, and Transverter Kits

Specifications

Frequency range:	902/903 MHz. = 144 MHz. Or 902 MHz. = 28 Mhz.
Noise Figure and Gain:	<1.5 dB NF, > 17 dB Gain with a +5 dBm IP3 input!!
Power Output:	>1W nominal. Lower levels with different configurations
TXIF Drive level:	-20dBm to 10 watts maximum depending on configuration
DC Power requirements:	13.8 VDC nominal. 11 to 16.5 VDC operational.
DC Current drain:	500 mA to 2 Amps depending on output power level.

General Information:

Down East Microwave's new 33 cm Transverter is now available as the [DEM90X-144](#) for 144 MHz IF's or as the DEM902-28 for 28 MHz IF's. The transverter has both a RF and IF switch built in to the circuit board. The RF switch may be bypassed for separate TX and RX ports for 33 cm. The connectors are SMA only for the split TR configuration and a type "N" female for the common antenna port. The IF switch may also be bypassed if your transceiver has transverter ports that are separate. A IF drive level of up to 10 watts may be applied with any configuration. Lower drive levels may be used (-20dBm minimum) if a IF gain stage is implemented. All IF connections are BNC connectors. Keying the transverter is done by either a voltage or a ground on transmit. It is not RF sensed. The transverter has an auxiliary connection to power an external TR switch or a power amplifier. Latest improvements have been made to the low noise receive amplifier, and implementing a 1 watt power amplifier that will produce more than enough power to drive the modern MOS-FET power amplifiers. Other improvements have been made to the transverter to reduce the internal heat build up to improve frequency stability.

Transverter kits are available as either a circuit board kit, the [DEM90X-144K](#) and a complete kit, the [DEM90X-144CK](#). The 90X-144K circuit board kits are for experimenters only. The circuit board kit is complete with all components required to produce greater than 1 W transverter with the standard specified receiver performance. It can be the basis of a high powered transverter system if coupled with a high power amplifier. The PCB kit alone may be difficult to mount in a standard die cast enclosure because of the mechanical layout of the helical filters and the overall design of the printed circuit board. If you desire to build a simple to use transverter, we strongly recommend the complete kit.

A circuit board is available as the [DEM90X-144PCB](#). This circuit board is definitely for experimenters only. It comes with the complete kit document so you may review it and if you decide to purchase the complete kit, it will only cost the difference of the two.

Circuit Description:

Looking at the 90X-144 circuit board, the first thing that is noticed is the absence of the printed hairpin filters. Although they were a very important feature of the traditional "No-Tune" transverter design, they have been replaced with miniature helical filters. The good news is that the design is still "No-Tune" because the filters used do not require adjustment. The use of these filters is the reason for the increased performance of the design and the "narrowing" of the operation bandwidth of the receive converter. For technical details of the development of this transverter, please see the library section of the Down East Microwave web site.

Basic circuit improvements over the older designed 33 cm transverter are as follows.

1. A high level mixer and local oscillator output of +17dBm after it is double filtered to reduce noise in the mixer.

2. A tuned low noise PHEMT FET low noise amplifier with LC input circuitry that is biased for high third order intercept performance. This improves out of band performance (overload and IMD performance) before filtering.
3. 2 separate helical filters in the RX stage before the mixer that narrows the operation bandwidth of the transverter.
4. A high level IP3 performance second RX gain stage that will not compress before the mixer approaches overload.
5. Built in IF switching and level control of up to 10 watts of drive and for some transverter port rigs, down to as low as -20dBm .
6. Additional transmit filtering to produce second harmonic levels of under -65 dBc and local oscillator leakage of -80 dBc .
7. Additional thermal management to increase frequency stability.

The theory of operation is as follows. A local oscillator of 189.500 or 189.750 MHz is multiplied 4 X, (174.800×5 for the 28 MHz version) and is filtered and amplified to the $+17\text{dBm}$ level then injected into a high level mixer. In receive, the 33 cm signal enters through either the RX port or the common antenna port. It is amplified by a high level, tuned input PHEMT FET low noise amplifier that has approximately 15-16 dB of gain with $<1.0\text{ dB}$ noise figure. The amplified signal then passes through a 2 pole helical filter that allows approximately 15 MHz of amplified bandwidth. This signal is then amplified by a high level MMIC before being filtered by a 3 pole helical filter that further restricts the receivers operational bandwidth. This signal enters the high level mixer, is converted and exits the IF port of the mixer. It then passes through a VHF band pass filter and optional high IP3 gain stage with a variable attenuator. Then depending on the configuration, it will pass through the IF switch or not before becoming available to the 2 meter or 10 meter receiver.

On transmit, it is a reverse process. The transceiver applies a signal between -20dBm and 10 watts of drive and it is switched, amplifier/attenuated and filtered before entering into the mixer. The 33 cm transmit signal then exits the mixer and is filtered by a 3 pole helical before being switch to the transmit gain stages. It is then amplified up to approximately $+17\text{ dBm}$ before it is filtered by a 2 pole helical again to reduce all unwanted signals. At this point the 33 cm signal can be used as is at the $+13\text{ dBm}$ level or it can be amplified up to $+1\text{ watt}$ level before either exiting the TX port or the common antenna port.

