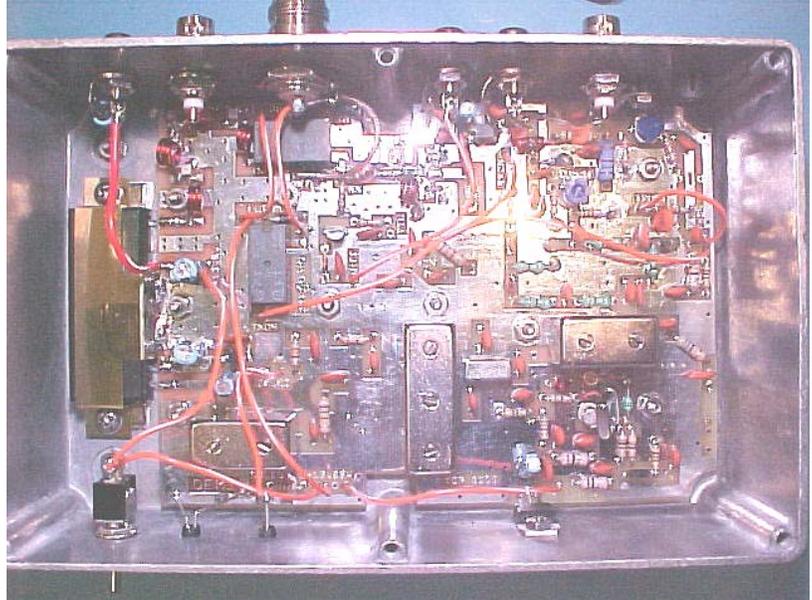




High Dynamic Range 144 MHz Transverter DEM Part Number 144-28

Product Description and Specifications

The DEM 144-28 is a 144 MHz to 28 MHz transmit and receive converter. It will operate with most High Frequency transceivers that are available on the market today. The 144-28 has a linear output power of approximately 25 watts. At full compression, the output power may reach 35 watts, but would be recommended for CW or FM operation only. On the receive side, a GaAsFET preamplifier, a high level mixer, and a 3 chamber helical filter provide a sensitive, yet over-load proof front end with superior out of band rejection. The DEM 144-28 has a built in transmit / receive relay with provisions for external switching so that adding a high power amplifier to your 144 MHz system is easy. Options have been provided for a key line input (+1 to 15VDC



TTL or PTT to ground) and isolated auxiliary contacts on either transmit or receive with a common line for many applications. The 28 MHz IF levels are adjustable on both transmit and receive and have a dynamic range of approximately 25dB. This is very useful for adjusting your maximum output power and setting the "S" meter level on your IF receiver. IF connections are via BNC connectors. The control, power, and auxiliary connections are via RCA jacks, and the 144 MHz connectors are BNC or Type 'N' (users choice). The 144-28 is housed in a 7.4" x 4.7" x 2.2" aluminum die cast box with an external 7" x 4" x 3/4" heat sink to provide cool operation under any condition. The complete kit is supplied with all hardware, connectors, machined enclosure and heat sink.

DEM 144-28 Operating Specifications

Operating Voltage	12.0 - 15.5 VDC, 13.8 nominal
Current Drain	5 amps maximum on Transmit, 350 milliamps on Receive
Output Power	Maximum 25 W linear, 35 watts compressed (FM and CW only) Output has 25 dB of adjustable range. Minimum 1 mW (0dBm) for 10 watts output power.
Maximum IF Drive Power	200 mW (+23 dBm) with 25 dB IF adjustment range
Receive Noise Figure	1.0 dB maximum, 0.8 dB nominal
Conversion Gain	+17 dB nominal (25 dB adjustable IF attenuator)

DEM 144-28 Assembly Options	DEM 144-28 Purchaser Options
External TR switching control	Transmit IF amp for < 0 dBm input
Separate Transmit and Receive ports	Receive IF amp (for extra 12 dB IF gain)
+1 to 15 V TTL or PTT ground switching	Optional LO crystal for full band operation



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Type 'N', UHF or BNC connectors on 144 MHz side

Custom options available, please call.



DOWN EAST MICROWAVE TRANSVERTER FUNCTIONS DEM144-28

Receive signals enter through a type "N" connector and depending on your configuration, pass through the TR switch (K2) or by-pass the switch and enter the RX gain stage directly through C64. The RX gain stage is designed with Q4, an ATF21186 GaAs-FET, and IC1, a broad band MAV-11A MMIC. The circuit is designed for approximately 28 dB of combined gain. Q4, having a P1dB of +17

dBm, is biased to optimize its output IP3 (3rd order intercept point) performance of +27 dBm. Since the FET is intended for microwave frequency use, it has inherent low noise figure when optimized at the frequency used in this transverter. IC1 has an output IP3 of $\cong +35$ dBm and a P1dB of +18 dBm. The amplified receive signal then passes through a three pole helical filter (F2) to eliminate out of band signals that would cause most intermodulation products in the mixer. The now filtered signal enters M1, a TUF-1H mixer, that has a 1 dB compression point of +14 dBm, but more important, an IP3 of approximately +29 dBm. This high level mixer requires a +17 dBm input that is supplied by the local oscillator after passing through a two-pole helical band pass filter (F1) to eliminate harmonics and spurious signals. The mixers IF output is then terminated into a diplexer band pass filter combination to reduce reflections back into the mixer. The IF signal produced (144 MHz. – 116 MHz = 28 MHz.) then enters an adjustable attenuator. No additional gain is designed into this system.



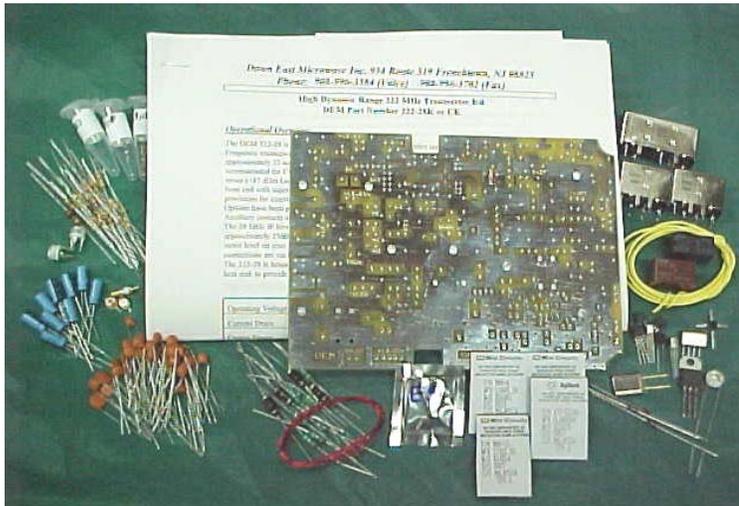
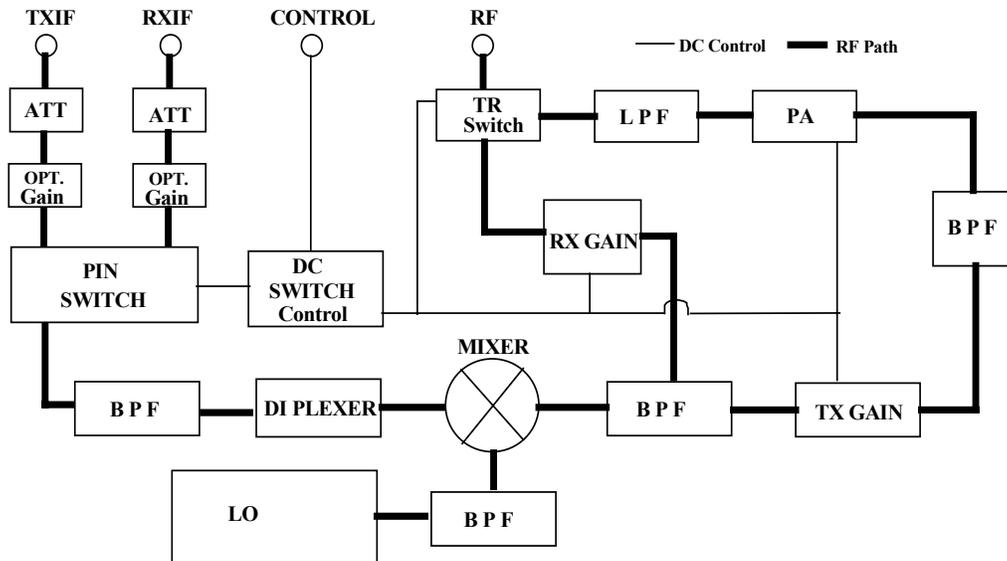
What does this all mean? If the math is done with the specifications given, it says that the weakest point in the converter system would be either the IC1 or the mixer M1 depending on the exact loss of the three pole filter (nominal 3-5 dB). When a -10 dBm (71 mV) signal is applied to the input of the transverter, it would just start to compress (either IC1 or M1) resulting a system with a IP3 output of $\cong +21$ dBm. This input level, amplified by the nominal amount of RX conversion gain (minimum of +17 dB) of the transverter, could produce a $\cong +7$ dBm output signal at the input of a 28 MHz. receiver. This is a large signal for anything but some of the newest and/or best receivers on the market. This transverter IF output level could be as much as 35 –40 dB above the compression level for most later day transceivers. The RXIF adjustable attenuator (R9, R10, and R12) can be used to reduce the gain of the transverter with little effect on the system noise figure. It has about 25 dB of range. Increasing the attenuation will decrease the dynamic range of the transverter (dB for dB) but will increase the dynamic range of your IF transceiver. It is most useful strong signal environments.

On transmit, with the proper options, any 28 MHz IF drive level from –20 dBm to 10 watts, will produce +60 watts of output power. This TX IF signal proceeds through an adjustable attenuator (25 dB range), then through the same filter diplexer combination as the receive signal. This is done with a pin diode switch which is biased in the transmit position only. Although the mixer can handle up to +14 dBm before compressing, that level is never needed or approached. The transmit signal also shares the mixer, 3 pole helical filter, and pin diode switch with the receive

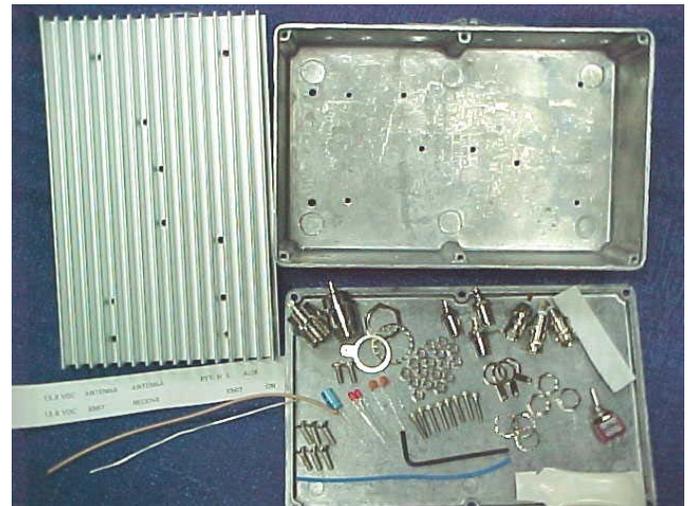


side. It then proceeds to IC 2 and IC 8. These stages have approximately 22 dB gain. The transmit signal is then filtered with a 2-pole helical band pass filter with about 3 dB insertion loss to eliminate LO signals and any other spurious. With +0 dBm entering the standard version transverter, there should be $\approx 5 - 10$ mW driving the Hybrid module. The hybrid, IC5, is a MOSFET with >40 dB gain. The output of the hybrid then enters a low pass filter to eliminate the 2nd harmonic and above spurious. The signal then enters the TR switch or exits the transverter using its own TX port.

All switching functions are controlled by either a Signal to Ground or a +1.5-15 VDC that is provided by a transceiver on transmit. The transverter is in RX mode during standby. Isolated auxiliary contacts are provided for switching external equipment such as mast mounted pre-amps, power-amps, or T/R switches and controlled by K1.



144-28K- PC Board Parts Kit



144-28CK- Parts Kit and Hardware