



**DEM Part Number 1296-28**\_\_\_\_\_

**12**\_\_\_\_\_ **MHz. Transverter,** \_\_\_\_\_ **MHz IF, SN**\_\_\_\_\_

Power Out Maximum:	500mW linear	20mW	Other	_____
Noise Figure and Gain:	1.5 dB maximum @ 17 dB conversion gain			
DC Power Requirement:	10 - 15.5 VDC @ 3 Amp			
IF Option:	Common	Split		
IF Drive Level Requirement Option:	1-250 mW	100 mW-1W	1-10W	Other_____
Keying Option:	PTT - to ground		TTL - Positive Voltage	
Aux. Connection Output Option:	TX	RX	High	Low      Open
Antenna Option:	Common		Separate TX & RX	
Frequency Offset:	_____kHz.			

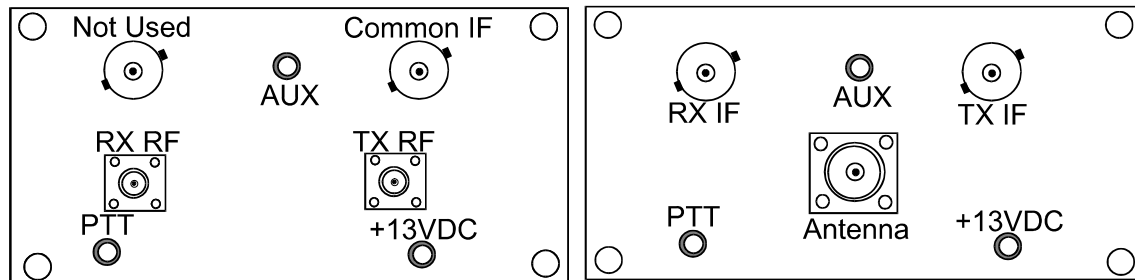
**Operational Overview**

The DEM 1296-28 is a 23 cm to 28 MHz transmit and receive converter. It has a linear output power of approximately 1/2 watts and may be achieved with as little as 10 mW or a maximum of 10 W of IF drive with the correct IF configuration. The highlight of this transverter is the receive section. The design uses a PHEMT that has a high-pass tuned input circuit biased for High IP3 output performance. It is followed by two 3 pole helical filters, a high output IP3 MMIC gain stage, and a high level mixer with a IP3 output of +30 dBm. This design provides a sensitive low noise receiver with superior out of band signal rejection that will tolerate IP3 input signals > +5 dBm! Other improvements over the previous versions of 1296 transverters are in the Local Oscillator and TX section. The base oscillator of the local oscillator circuit is housed in a shielded enclosure on the circuit board. This shield coupled with the higher frequency base oscillator operation (192 MHz), reduces the amount of spurious output while providing greater temperature stability. The transmit section has improved filtering to eliminate all other spurious emissions. The DEM 1296-28 has a built in transmit / receive relay on the RF side with provisions for external switching for adding a high power amplifier or preamplifier to your 23 cm system. The 28 MHz IF levels and options are adjustable on both transmit and receive with a dynamic range of approx. 25 dB. This is useful for adjusting your maximum output power and setting the "S" meter level on your IF receiver. The IF connections are via BNC connectors. Options have been provided for a key line input PTT-H (+1 to 15 VDC) or PTT-L (a closure to ground) and auxiliary contacts on either transmit or receive with a common line for many applications. The control, power, and auxiliary connections are via RCA jacks. The 23 cm connectors are Type 'N' or SMA if separate TX and RX ports are chosen. The 1296-28 is housed in our standard 4.125" x 1.875" x 7.75" extruded aluminum enclosure that matches all of our other microwave transverters.



### COMMON IF

### SPLIT IF



### SPLIT RF

### COMMON RF

#### Connect your transceiver to the transverter:

Interfacing the transverter to the transceiver is easy. First, review the front page configuration. If the transverter was configured for direct connection to your transceiver, (10 watts or less) follow the steps listed below. If you plan on using this transverter with any of the DEMI transverter interfaces, follow the set-up instructions of that interface. If you have ordered a custom interface configuration, you already have an idea of what you are doing. Therefore, use the directions listed below as a guideline.

1. Open the top lid of the transverter by removing the 4 top screws.
2. Connect all IF cables. The transverter may have a common IF port or two separate ports, TXIF and RXIF. Use good quality coax cable to connect the 28 MHz. ports between your transceiver and the IF connectors on the transverter.
3. Connect the "Push-to-Talk" line out of your transceiver to the transverter. It is labeled PTT-H or PTT-L on the transverter and uses a RCA connector. The correct keying type can be configured for your transceiver at time of order or you may select it in the transverter now by moving the PTT jumper.
4. If separate TX and RX ports were ordered, the internal transfer relay has been bypassed and the separate "SMA" ports are labeled RX and TX. The "ANT" port has both TX and RX functions. Connect your 23 cm antenna system or a dummy load with a power meter to the appropriate 23 cm transverter ports.
5. Connect the DC power to the transverter. It uses a RCA type connector. 13.8 volts is optimum but the transverter will operate normally from 11 to 15 volts.
6. Preset the TXIF (R20) and RXIF (R14) gain controls in the transverter. Turn both controls fully clockwise. This is maximum attenuation on Transmit and minimum attenuation on Receive.
7. Power your transceiver "ON" and leave it in the Receive mode on 28.100 MHz. This should be 1296.100 MHz. unless a frequency offset is indicated on the front page or you ordered a non-standard transverter.
8. Observe the noise level in the transceiver. If it is too high, adjust the RXIF gain control counter-clockwise until a slight noise increase is heard in the transceiver or just a slight movement in the "S" meter is detected. Power the transverter on and off to verify the change. The RXIF gain may be increased beyond this point, but it will start to degrade the dynamic range of your transceiver. Find a signal on the band or use a signal generator to determine correct frequency, or minimum signal level. If you plan on installing an external LNA, this level will change.
9. It is now recommended to test the transverter in the CW mode because most transceivers have carrier level or power level controls in this mode only. Do not use full or semi break-in if



possible. Do not use FM, SSB or AM because it may not be possible to obtain maximum output power with a transceiver in these modes. Set the carrier/output power control to minimum or "0" output power. Place the transceiver into transmit. If the PTT circuit is connected correctly, the transmit LED on the transverter will switch on. While observing a power meter on the 23 cm system, slowly increase the carrier control (with key down) or increase the power output control to the maximum TXIF drive level indicated on the front page. If you find that the transverter is not correctly set-up for your transceiver's range, go to the "IF Options" section at the end of this page and re-configure the transverter before further testing.

If the transverter is configured correctly for your transceiver, minimal power may be detected on the 23 cm power meter. Now slowly adjust the TXIF control in the transverter in a counter-clockwise direction while observing the power meter. Set it to any desired level (depending on which model you have) up to 1/2 watt.

10. You may re-adjust both RXIF and TXIF again if desired. The receive amplifier and local oscillator frequency should not need to be adjusted but you may if you wish. Do not adjust any of the helical filters unless you have access to a spectrum analyzer at the minimum.
11. Put the top on the enclosure and install the screws. Your transverter system is ready to use. Connect as you wish to use it in your 23 cm system and have fun!

## **DEM 1296 - 28 User Options and performance Improvements:**

### **Auxiliary switching contacts:**

The auxiliary contacts in K2 are labeled C (common) NO (normally open) and NC (normally closed). The C connection can be wired to ground or positive voltage such as the source +13.8 VDC. The K2 common connection will then be toggled depending on what state the transverter is in. The contacts are marked for the receive mode. The NO or NC can be wired to the AUX connector on the enclosure.

### **PTT options:**

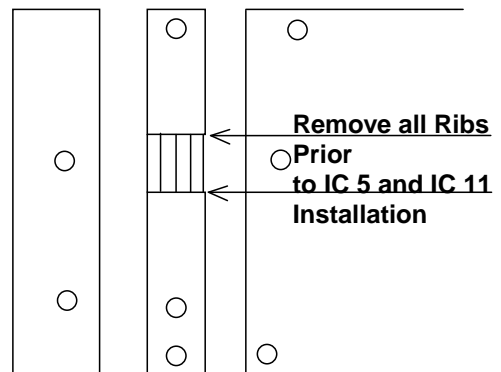
Both PTT-H and PTT-L can be changed on the topside of the board. The connections are located in the center of the board near the connector panel. Change the jumper as required from the PTT connection to either "L" (Ground to transmit) or "H" (Apply positive voltage to transmit)

### **Add an external preamplifier for noise figure improvement:**

If a better noise figure is desired, simply placing a LNA with a modest gain at the antenna will solve that problem. Understand that the addition of gain in front of this stock transverter will degrade the IMD performance, and reduce the dynamic range of the transverter by more than the amount of gain added. You may get away with doing nothing more than adjusting the RXIF gain control if you operate in a non hostile RF environment. If your LNA is a ultra low noise unit, it most likely will not have the IP3 performance the transverter has. It will overload before any component in the transverter will. So, your receive system now becomes limited by it's external LNA's performance. If you increase the gain performance of your external LNA, (25-30 dB) you may consider bypassing the transverters LNA completely because it's IP3 performance is totally controlled by the external LNA. To do so, remove L9, R31, R30 C59, and L7 from the circuit. Then connect a short piece of coax between the RX antenna and C63. Be sure to keep it as short as possible and solder the grounds.

### Install / Remove RXIF gain stages:

It is better not to use IC5 in the circuit than to add it and have to increase the attenuation of the RFIF gain control. But, for whatever reason, you may require additional gain or have too much iF gain if IC5 was installed, it can be installed or removed at any time. Be sure of your systems performance when deciding to make a change. You are also not limited to the specified ERA6 MMIC. The ERA 6 was chosen for its IP3 output performance. Using this MMIC doesn't degrade the transverters overall performance unless a external LNA is added into the system. **A higher gain MMIC will reduce the IP3 by the difference in gain and degrade the system IP3 output performance.** In the future, this MMIC type may change as better devices become available. If installing the MMIC, be sure to add or remove the correct choke and bias resistor for the desired MMIC. Cut the ribs in the circuit if required. If removing IC5, replace the circuit board opening with a large value capacitor. The RXON signal is the input voltage of the transverter (13.8VDC) so calculate the new bias resistor based on that voltage.



Only install IC11 if your TX drive level is less than 1 mW. If you elect to install IC11, the modification must be performed to the printed circuit board. Referring to the diagram above and the assembly document, remove the "Ribs" by cutting at the two indicated points with a sharp razor blade and heating with a soldering iron to remove. Proceed to install IC11 using the component placement and component list.

### Add an external power amplifier:

This is the most common addition to this transverter. There are different means in which this can be implemented. First, determine if your transverter has a common of split RF ports. To add a power amplifier to a common port transverter will require 2 additional relays on the input and output of the amplifier to allow the receive signals to bypass the power amplifier. If your transverter has separate RX and TX ports, you can add the power amplifier in the TX path and install one relay on the output. This option can be the least troublesome (less relays) and most cost effective. If you wish to change your transverter from a common to a split RF, see the "**RF Configuration options**" section below or the transverter may be returned to the factory for the modification.

Some power amplifiers have low-level drive requirements. This is accomplished by disabling the final amplifier stage in the transverter. See "**Low Power Option**" below.

To key most amplifiers, the set of auxiliary contacts in the transverter may be used. Consult the "**Auxiliary Switching Contacts**" section on the proceeding page. If in addition to, you implement an external LNA, you may consider the use of a Sequencer. Also, consider using additional filtering or adding a isolator to the system between the transverter and add on power amplifier for gain and spurious management.

**RF Configuration options:**

If you wish to change the RF connector configuration, pre-drilled rear panels are available from DEMI for a nominal fee. They can be supplied with connectors and hardware if required. After changing or modifying the connector panel, you will need to move the position of C57A, C59A, and L7A, for common antenna connection or C57B, C59B, and L7B for a split TX and RX connections. Re-tuning of the receiver section may be required.

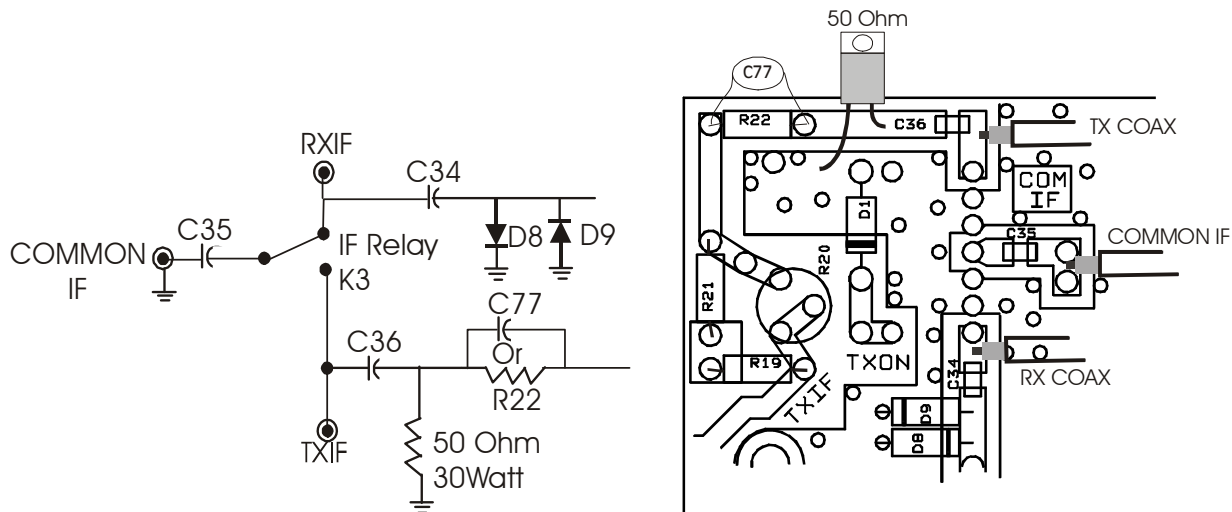
**Low Power Option:**

If you obtain a power amplifier that requires 20 mW or less drive, and you have the 1/2 watt unit, IC12, may be bypassed. Remove C55, C47, L10 and the jumper wire from the pad with C56 and the pad with R29. Install a coax between the RF pads labeled "C" on the component placement. Be sure to solder the shield to ground on both ends. Keep connection as short as possible. Adjust the output power as before with the TXIF gain control.

**IF options:**

All possible IF configurations are shown below in the supplied schematic and simplified component layout. Follow the schematic and parts matrix list for desired drive level ranges if you require a different configuration or drive level. Splitting the IF to separate TX and RX is diagrammed in the simplified component layout below. Other combinations and drive levels may work but do not exceed 10 Watts of drive level! The 50 Ohm load is rated for 30 watts but only on a heat sink. The minimum TX drive level for 1/2 watt of output on 1296 is 1 mW at 28. If you require more output power (because of a low TXIF drive level) or have less IF drive, replace R22 with a short.

	-20 dBm to 0 dBm	1-200 mW Drive	200 mW-1W Drive	1-10W Drive
C77	Not Installed	Not Installed	Not Installed	Installed
50 Ohm	Not Installed	Not Installed	Installed	Installed
R22	Replace with short	Installed	Installed	Not Installed
IC11,R16	Installed	Not Installed	Not Installed	Not Installed



**Common or Split IF Configuration**



**DEM 1296-28 Component List**

**Resistors (R) values are in Ohms and are chips unless otherwise specified.**

R1 470	R11 51	R22 220 1/4W leaded OPT	R32 51
R2 470	R12 1K 1/4 leaded	R23 1K 1/4W leaded	R33 24
R3 1.5K	R13 220 1/4W leaded	R24 330 1/4W leaded	R34 5.1K 1/4W leaded
R4 100	R14 1K POT	R25 150 1/2W leaded	R35 5.1K 1/4W leaded
R5 51	R15 220 1/4W leaded	R26 330 1/4W leaded	R36 24
R6 100	R16 330 1/4W leaded OPT	R27 51	R37 12
R7 100	R18 150 1/2W leaded OPT	R28 100	R38 12
R8 130	R19 220 1/4W leaded	R29 24	R39 470
R9 130	R20 1K POT	R30 12	R40 470
R10 56 1/2W leaded	R21 220 1/4W leaded	R31 51	

**Capacitors (C) values are in pF and are chips unless otherwise specified.**

C1 0.1μF (1210)	C22 18	C43 0.1μF (1210)	C63 33
C2 1 - 4 Piston	C23 120	C44 33	C64 0.1μF (1210)
C3 0.1μF (1210)	C25 1000	C45 33	C65 33
C4 18	C26 1000	C46 0.1μF (1210)	C66 1.0 μF Tant.
C5 22	C27 100	C47 33	C67 0.1μF (1210)
C6 0.1μF (1210)	C28 100	C48 33	C68 0.1μF (1210)
C7 1000	C29 1000	C49 33	C69 33
C8 0.1μF (1210)	C30 0.1μF (1210) OPT.	C50 3	C70 33
C9 33	C31 1000	C51 0.1μF (1210)	C71 1000
C10 1.0 μF Tant.	C32 1000	C52 1000	C73 33
C11 0.1μF (1210)	C33 0.1μF (1210) OPT.	C53 1000	C74 33
C12 33	C34 1000	C54 5 (in bag 4)	C75 0.1μF (1210)
C13 33	C35 1000	C55 33	C76 1.0 μF Tant.
C14 0.1μF (1210)	C36 1000	C56 1000	C77 1.0 pF leaded
C15 0.1μF (1210)	C37 1000	C57 A,B 33	C78 33, (8 pF OPT)
C16 33	C38 100μF leaded	C58 33	C79 1000
C17 33	C39 33	C59 A ,B 0.3-3 VAR.	C80 33
C18 33	C40 1.0 μF Tant.	C60 0.3-3 VAR.	C81 33
C20 1000	C41 33	C61 0.1μF (0805)	
C21 39	C42 33	C62 0.1μF (0805)	

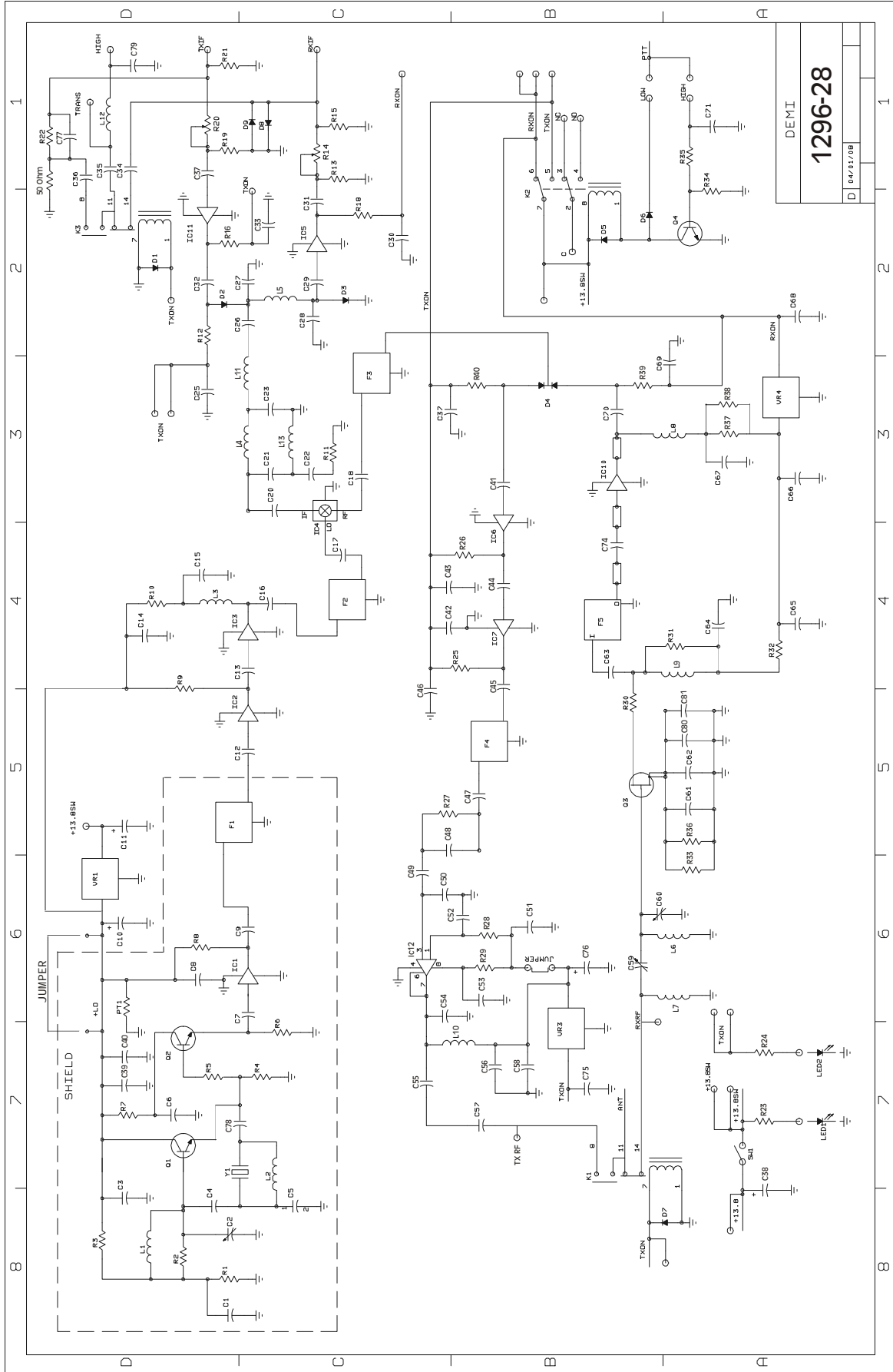
**Identify the molded chokes by body color and band colors. All others are as indicated.**

L1 4 Turns 1/8" ID #24 Wire (HW)	L8 4 T BLUE
L2 0.1 μH (Small body, Brown/Red)	L9 12 ηH (0603 chip inductor)
L3 0.33 μH (Small body, Orange/Orange)	L10 6 T BLUE
L4 0.33 μH (Orange, Orange)	L11 0.22 μH (Red, Red)
L5 12 Turns #28 Wire on T25-10 Toroid	L12 1.0μH (Brown/Black) OPT Brown Body
L6 1T, BLUE	L13 0.22 μH (Red, Red)
L7 A,B 2T, RED	

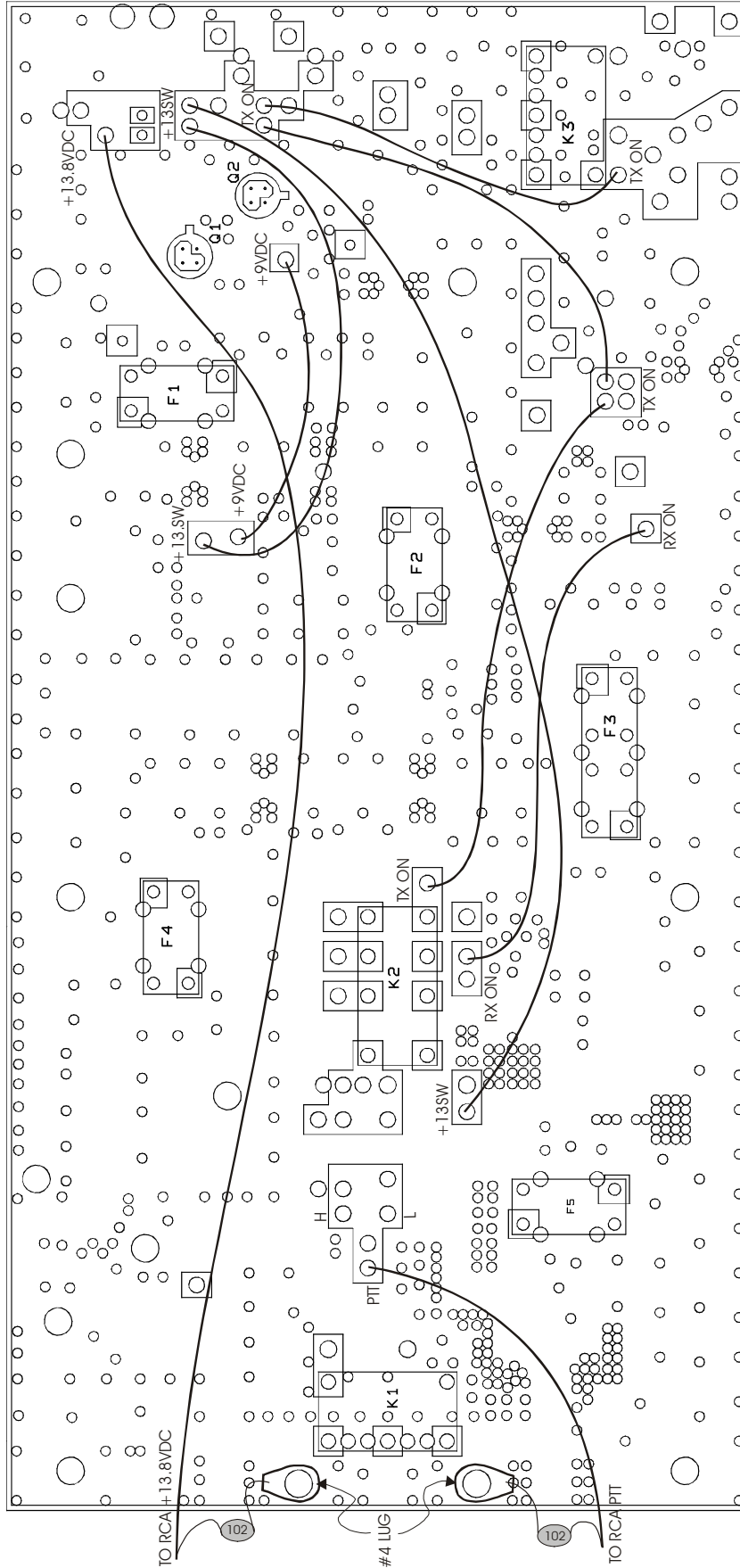


### Miscellaneous Components

Q1	2N5179	F1	1230	IC11	MAR 6 OPT.
Q2	2N5179	F2	1230	IC12	AH215- Installed
Q3	FPD 750	F3	1230	VR1	78S09 or 7809
Q4	KN2222	F4	1230	VR3	78S05 or 7805
D1	1N4000 type	F5	1230	VR4	78M05
D2	MPN3404	IC1	ERA 3	K1	G6Y-1
D3	MPN3404	IC2	ERA 2	K2	G5V-2
D4	HSMP 3814 or 3824	IC3	ERA-5	K3	G6Y-1
D5	1N4000 type	IC4	SYM-14H	PTC1	PTC 60 Thermistor
D6	1N914	IC5	ERA 6 OPT.	Y1	Crystal 181.143MHz
D7	1N4000 type	IC6	MAR 3		Crystal Brass Shield
D8	1N914	IC7	ERA-5		
D9	1N914	IC10	GALI 74		







1296 Mhz Bottom Assembly



1296-28 COMPONENT ASSEMBLY

