

DEM Part Number 1296-144 _____

12 _____ MHz. Transverter, _____ MHz IF, SN _____

Power Out Maximum:	3 W linear	10mW	Other _____		
Noise Figure and Gain:	1.5 dB maximum @ 17 dB conversion gain				
DC Power Requirement:	10 - 15.5 VDC @ 2.5 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 1296-144 is a 23 cm to 144 MHz transmit and receive converter. It has a linear output power of approximately 3 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 1296-144 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 144 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 1296-144 is housed in our standard 4.125" x 1.875" x 7.75" extruded aluminum enclosure that matches all of our other microwave transverters.



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 144 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 and RXIF 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 144.100 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 IF drive level indicted 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 between 0 and 3 watts. If a power meter is not available, you may use a current meter on the DC power line to determine if the transverter is transmitting. A maximum of 2.5 amps should be obtainable at full output power and it should vary as the TXIF control is varied. Switch the transceiver to USB and make a transmission. The power output and current drain should correlate to your speech pattern.

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 - 144 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 a way 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 L5, L31, C59, R31, and R30 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.



Another option is to remove the IF amplifier. If you need to reduce the gain by less than 10 dB, remove IC5 and R18. Then using a 1000 pF disc capacitor, place it across where IC5 was. You may then adjust the RXIF control to your desired level.

Install / Remove RXIF gain stages:

This was briefly discussed in the external preamplifier section. For whatever reason, you may require additional gain or have too much IF gain. IC5 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 supplied ERA 6 MMIC. You may choose a higher gain unit. The ERA 6 was chosen for its IP3 output performance. Using this MMIC doesn't degrade the transverters overall performance. A high gain MMIC will not only reduce the IP3 by the difference in gain but will also degrade the system if a lower IP3 output device is used. In the future, this MMIC will change as soon as something better becomes available.

If changing or removing the MMIC, be sure to add or remove the correct choke and bias resistor for the desired MMIC. The RXON signal is the same voltage that the transverter operates on so calculate the new bias resistor based on that voltage.

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 or 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 an 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 C57, C59, and L5, for common antenna connection or C57A, C59A, and L5A for a split TX and RX connections. Re-tuning of the receiver section will be required.

Low Power Option:

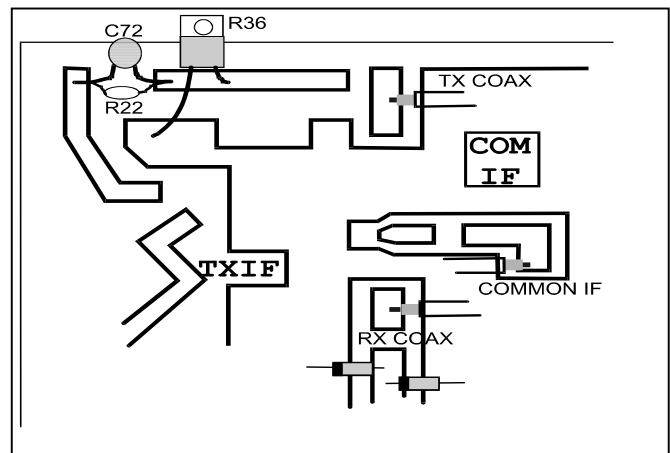
If you obtain a power amplifier that requires 20 mW or less drive, the power module, IC9, may be removed and bypassed. If you do not wish to remove IC9, you will need to lift all four pins from the connections on the PC board. Then attach a good quality miniature coax between the input and output pads of IC9. Be sure to solder the shield to ground on both ends. Keep connections 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 diagramed 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 watt of output on 1296 is 1 mW at 144. If you require more output power or have less IF drive, replace R22 with a short.

	1-250mW Drive	100mW-2W Drive	1-10W Drive
C72	Not Installed	Not Installed	1pF
R36	Not Installed	50Ω, 30W	50Ω, 30W
R22	220Ω, 1/4W	220Ω, 1/4W	Not Installed



Common or Split IF Configuration

DEM 1296 -144 Component List

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

R1 470	R9 130	R20 1K POT	R28 24
R2 1K	R10 56 1/2W leaded	R21 220 1/4W leaded	R29 24
R3 1.5K	R12 1K 1/4 leaded	R22 220 1/4W leaded	R30 12
R4 100	R13 220 1/4W leaded	R23 1K	R31 330
R5 51	R14 1K POT	R24 330 1/4W leaded	R32 12
R6 100	R15 220 1/4W leaded	R25 180 1/2W leaded	R33 1K
R7 100	R18 150 1/2W leaded	R26 1K 1/4W leaded	R34 5.1K 1/4W leaded
R8 130	R19 220 1/4W leaded	R27 470 1/4W leaded	R35 5.1K 1/4W leaded



Capacitors (C) values are in ρ F and are chips unless otherwise specified.

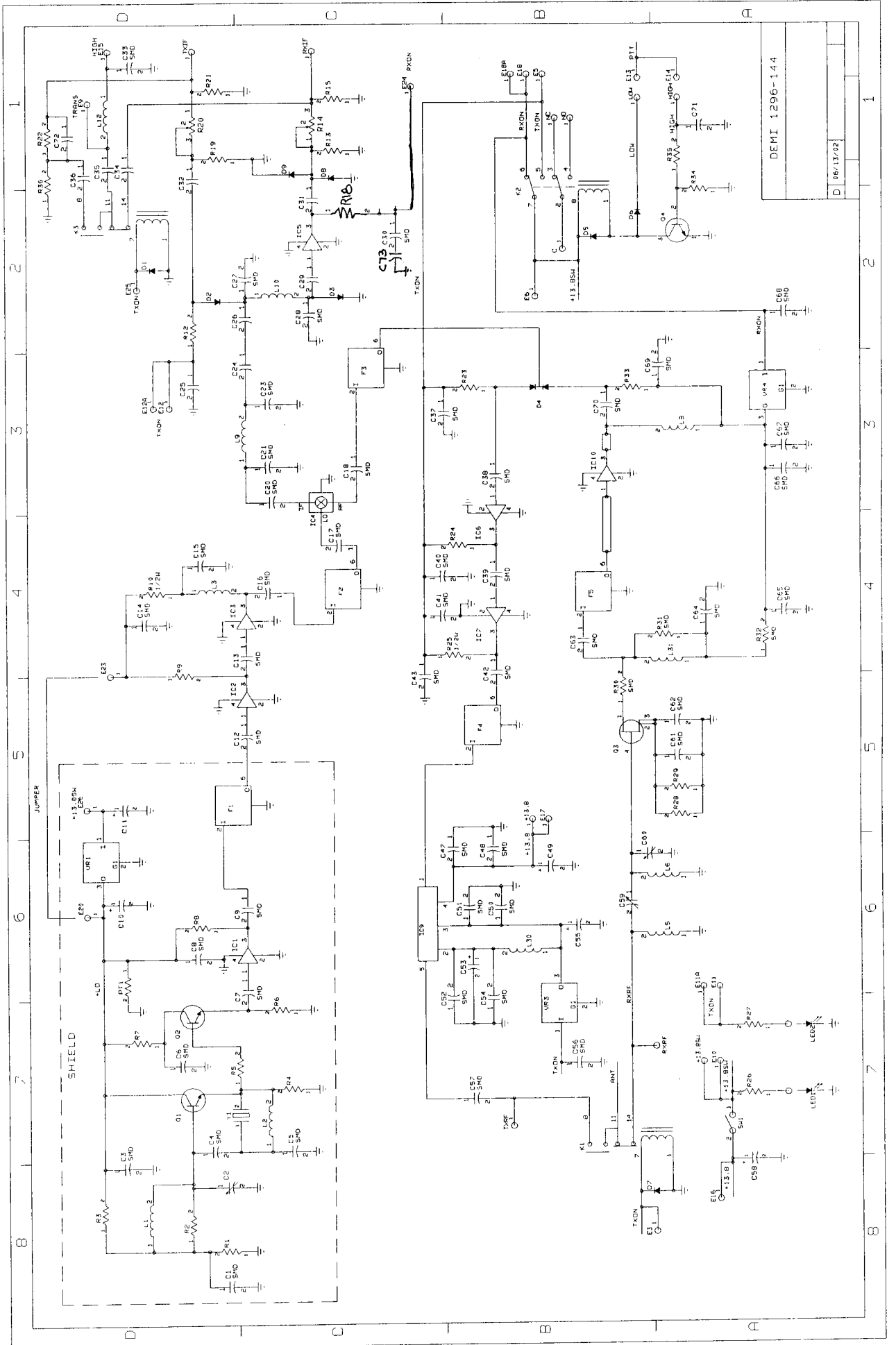
C1 0.01 μ F	C18 33	C37 0.01 μ F	C57, A 33
C2 1 - 4 Piston	C20 100	C38 33	C58 100 μ F Elect.
C3 0.01 μ F	C21 18	C39 33	C59, A 0.3-3 VAR.
C4 18	C23 18	C40 0.1 μ F	C60 0.3-3 VAR.
C5 22	C24 100	C41 33	C61 0.1 μ F 1008
C6 0.01 μ F	C25 0.01 μ F	C42 33	C62 0.1 μ F 1008
C7 0.01 μ F	C26 100	C43 0.1 μ F	C63 33
C8 0.1 μ F	C27 18	C47 0.1 μ F	C64 33
C9 33	C28 18	C48 100	C65 0.01 μ F
C10 1.0 μ F Tant.	C29 100	C49 2.2 μ F Elect.	C66 1.0 μ F Tant.
C11 0.1 μ F	C30 0.1 μ F	C50 0.1 μ F	C67 33
C12 33	C31 100	C51 100	C68 0.1 μ F
C13 33	C32 100	C52 100	C69 0.01 μ F
C14 0.1 μ F	C33 0.1 μ F OPT.	C53 1.0 μ F Tant.	C70 33
C15 0.1 μ F	C34 100	C54 0.1 μ F	C71 0.01 μ F
C16 33	C35 100	C55 1.0 μ F Tant.	C72 1 ρ F leaded
C17 33	C36 100	C56 0.1 μ F	C73 0.1 μ F

All inductors are indicated by the enamel wire size, number of turns, body color, and band colors.

L1 3 Turns 1/8" ID #24 Wire (HW)	L8 5 Turns #28 Wire (pre-wound)
L2 0.10 μ H (Small body, brown-black)	L9 5 Turns, 1/8" ID #24 WIRE (HW)
L3 6 Turns 1/8" ID #24 Wire (HW)	L10 5 Turns 1/8" ID #24 Wire (HW)
L5, A 5 Turns 0.05"ID #28 Wire (pre wound)	L12 1.0 μ H OPTIONAL (brown-black)
L6 1T, BLUE Body (pre wound)	L30 0.33 μ H(Green body, orange bands)
L6A 2T, RED Body (pre wound) optional	L31 10 η H (0603 chip inductor)

Miscellaneous Components

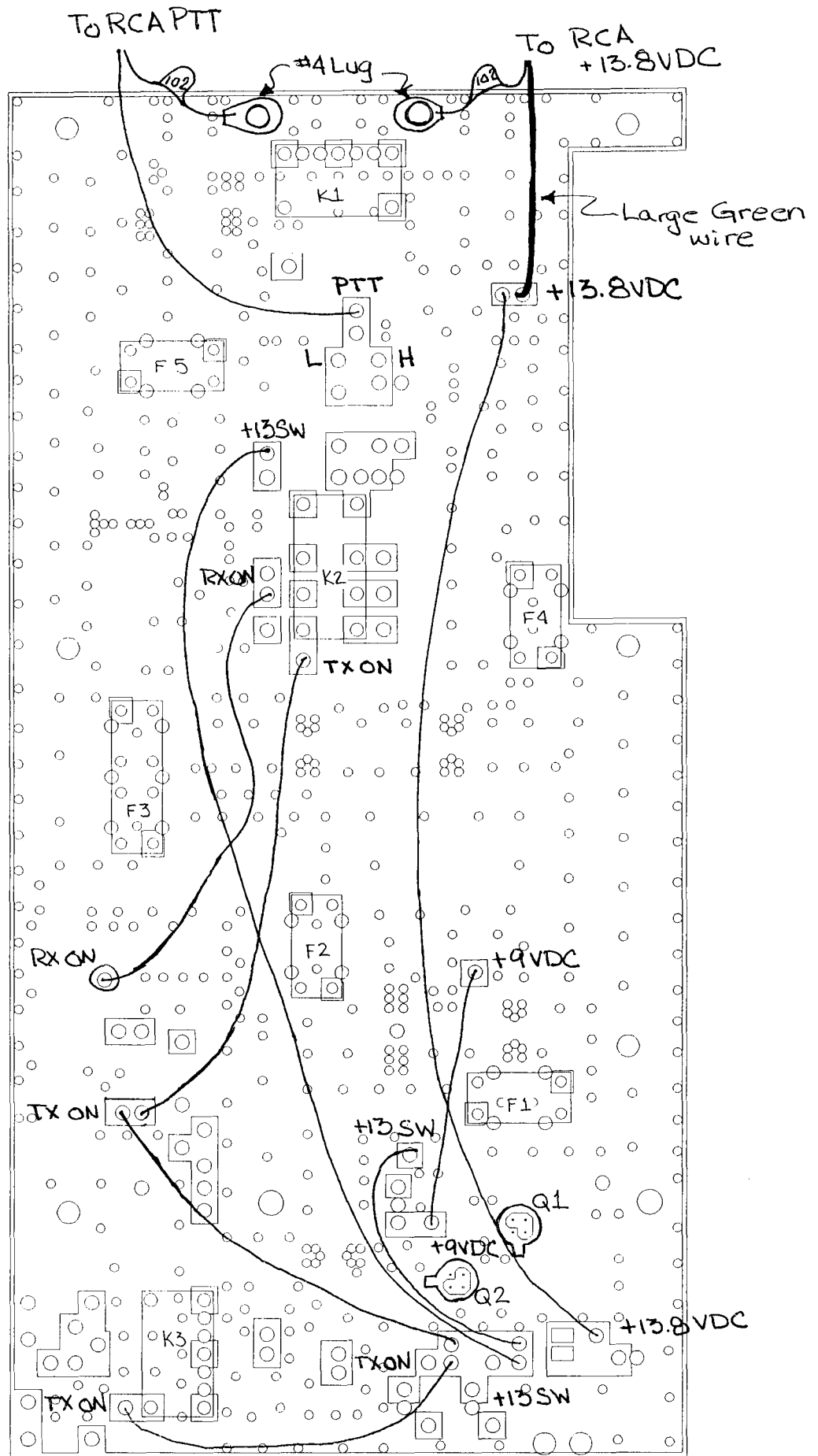
Q1 2N5179	D9 1N914	IC7 MAV11
Q2 2N5179	F1 112570C	IC9 M67715
Q3 ATF34143	F2 112570C	IC10 AH31
Q4 KN2222	F3 123080C	VR1 78S09
D1 1N4000 type	F4 123080C	VR3 78S09
D2 MPN3404	F5 123080C	VR4 78M05
D3 MPN3404	IC1 ERA3	K1 G6Y-1
D4 HSMP 3814	IC2 ERA2	K2 G5V-2
D5 1N4000 type	IC3 ERA5	K3 G6Y-1
D6 1N914	IC4 SYM-14H	PTC1 PTC 60 Thermistor
D7 1N4000 type	IC5 ERA 50	Y1 Crystal 192.000 MHz HC 18/U
D8 1N914	IC6 MAR3	



DEMI 1296-1.4.4

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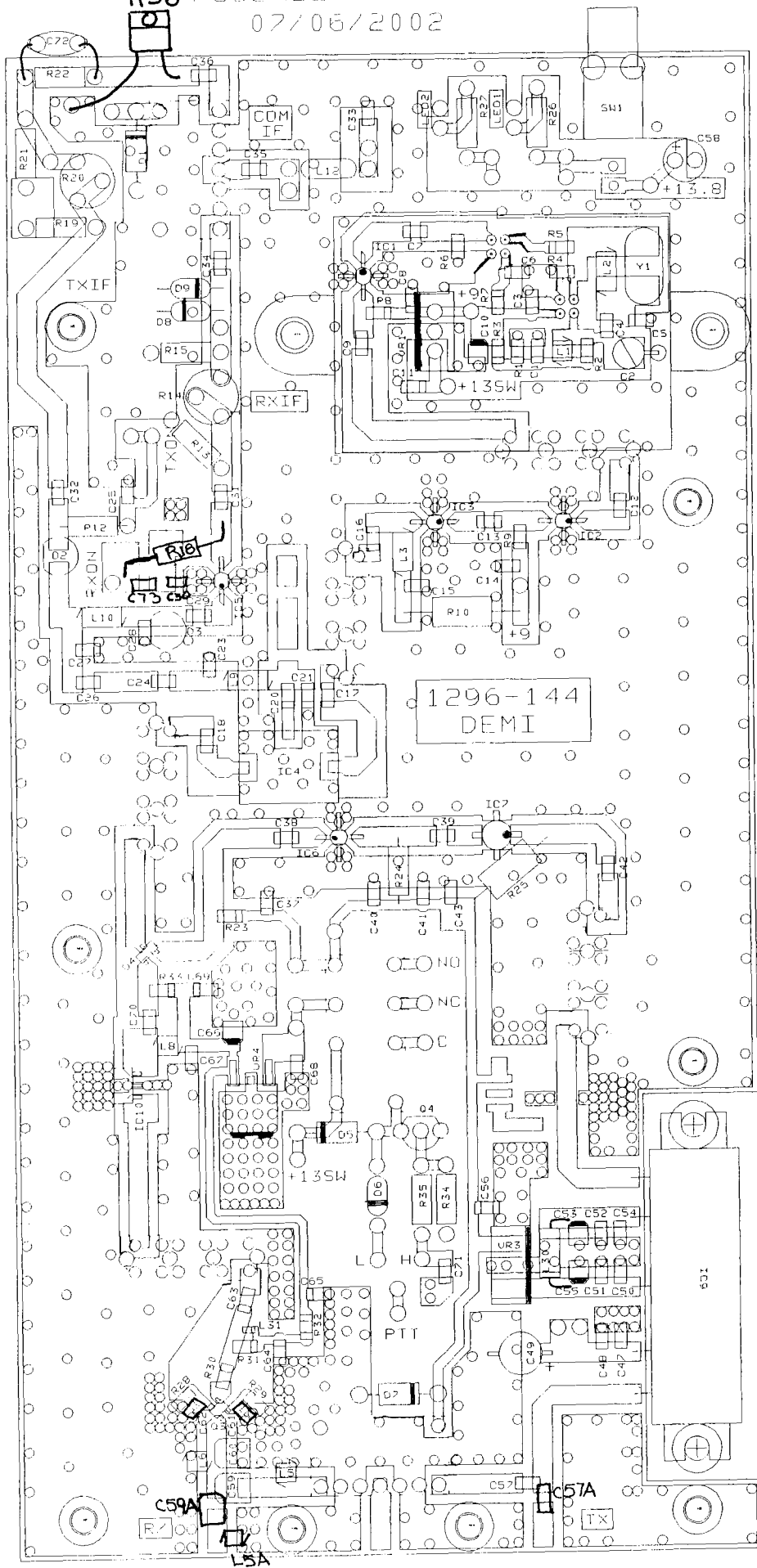
1296-144
PCB Bottom Side



1296-144

R36 ASSEMBLY DRAWING

07/06/2002



PC Board
Top Side