SPECIFICATIONS:	Tuning Range	430 - 450MHz Toko 252MXPR2537A Helical Filters
	Frequency Bandwidth	10MHz @ 1dB
	RX Gain	20dB (2 X MAR6 combination, Filters & Mixer Loss)
	Noise Figure	3.5dB Maximum (MAR6)
	Local Oscillator I/P	404MHz +10dBm, (10mW) Maximum
	RF Output	+19dBm O/P @ 430MHz for –10dBm I/P @ 28MHz
	Power Supply	TX Stages +12v 140mA, RX Stages +12v 35mA,

DESCRIPTION & FEATURES: The complete Transverter is built on a single 70 x 95mm size PC Board, & should take around 3hours to construct. A large number of surface mounted components have been used to make the Transverter compact in size, & predictable in performance. The Transverter uses pretuned Toko Helical filters which have a 1dB bandwidth of 10MHz which virtually makes the Transverter no-tune . The Transverter could be used with the addition of either an RF Relay, or PIN diode antenna switch, to have many local contacts into repeaters, or simplex on FM or SSB with a high gain antenna. The Transverter produces enough output to directly drive a high power Mitsubishi M57716 Amplifier to 10Watts PEP on SSB. The I/F that has been chosen for the Transverter is 28MHz, due to the performance requirements of L/O rejection, & the ready availability of HF transceivers. The power & I/F switching of the Transverter is best controlled by a Transverter Sequencer e.g., EME66 Kit which will give the correct RF drive level on TX, & will allow other options to be added later, including preamplifiers or coaxial relays etc.

RECEIVE CONVERTER: Refer to the circuit diagram. The RX connection on the PCB is the RF input on the Transverter. The RX signals are amplifier by a MAR6, (18dB Gain 3dB NF) RF amplifier. GasFETs like the CF739 or MGF1302 were not considered as it would make the construction of the transverter much more complex, & would not achieve much better performance than a MAR6. For better low noise performance an antenna mounted preamplifier should be used in conjunction with the transverter. The amplified signal is then filterd by a Toko 430MHz Helical filter which has a passband of 10MHz wide @ -1dB, & a loss of around -3.5dB. The filtered 430MHz signal is then amplified around 18dB by another MAR6 amplifier, & is then switched through a HSMP3824 PIN diode to another 430MHz Helical filter. The 2nd filter further cleans up the 430MHz signal before it passes through to the ADE-1 mixers input. The ADE-1 is a low cost 500MHz +7dBm double balanced mixer which has around 8dB conversion loss, & is a small surface mount package. The 430MHz input & 404MHz L/O signals are mixed by the ADE-1 to produce a 28MHz IF output signal & mixing products. A simple 50ohm 28MHz diplexer is used on the output of the mixer to provide a constant 50ohm load for all the frequencies produced by the mixing process, & only allows 28MHz, +/-5MHz signals to pass through. The IF signal then switched through a HSMP3824 PIN diode to the 28MHz RX I/F output connection. The PC Board has enough room to add an additional MAR4 amplifier to amplify the 28MHz I/F, if the HF transceiver being used is deaf.

TRANSMIT CONVERTER: Refer to the circuit diagram. For a -10dBm 28MHz input signal the transverter typically produces +19dBm (80mW) output from an ERA5 amplifier on 430MHz. Maximum input to the ADE-1 mixer on TX should not exceed 0dBm (1mW), which produces +20dBm (100mW) saturated output. Driving the mixer harder causes spurious ouput & could damage it. A Mitsubishi M57716 10Watt module typically requires +17dBm (50mW) maximum input to produce 10Watt linear SSB output, so the Transverter will quite easily drive it into saturation. A 28MHz signal is input to the TX I/F input & is switched through a HSMP3824 PIN diode & passes through the 50ohm 28MHz diplexer to the ADE-1 mixer. The 28MHz signal is mixed with the 404MHz L/O signal producing a 432MHz signal & mixing products out of the mixer. The output of the mixer is filtered by a 430MHz Helical filter which passes only the 432MHz signal & rejects the 28 & 404MHz signals & mixing products. The 432MHz signal is then switched through a HSMP3824 PIN diode to the input of an MAR3 driver amplifier. The signal is then amplified around +12dB by an MAR3 to -8.5dBm & then is further filtered by another 430MHz Helical filter to mainly further get rid of the 404MHz L/O signal so that it doesn't appear on the output of the transverter. The filtered signal is then further amplified by another MAR3 (+12dB) to 0dBm & then an ERA5 (+20dB) amplifier which produces around +19dBm, (80mW) output on 432MHz, which passes to the TX output connection.

PIN DIODE I/F SWITCHING: Has been used to lower the cost of the design by using a common Mixer & Helical filter for both the RX & TX 430MHz sections. Two HSMP3824 PIN diode pairs are used to switch the 28MHz RX & TX I/F connections to the mixer, & the 430MHz signals two & from the 430MHz RX & TX stages to the 430MHz Helical filter. Both

diode pairs are switched by the RX & TX +12volts power to the transverter depending on which mode the transverter is in**.**

OPTIONS:

1. To Increase the Strong signal handling in the Receiver there are a couple of options. The first MAR6 can be replaced with a MAV11, or taken out all together. The ADE-1 Mixer can be replaced with a ADE-1H (+17dBm Mixer). The ADE-1H is Pin compatible & all that needs to be done is to amplify the 404MHz local oscillator signal to +17dBm. There is enough room on the board to install a MAV11 amplifier before the local oscillator input to the mixer. The 3dB pad should be removed before the mixer & bridged with a wire link. **Refer to the circuit diagram for details.**

2. If your 28MHz receiver is deaf, then a MAR4 can be added to amplify the 28MHz I/F by around 8dB. There is room on the board between the HSMP3824 & RX I/F connection on the board. **Refer to the circuit diagram for details.**

CONSTRUCTION:

1. The PCB supplied is a double sided PC Board with one side being a groundplane. The board requires a number of 0.7mm wire links soldered through the board to connect the top & bottom sides of the board for earthing. The holes are shown as dark colored pads on the PCB overlay diagram.

2. Follow the PCB overlay diagrams and circuits carefully, by checking the components and placing them onto the PCB. All component leads should be kept as short as possible, using good UHF construction techniques. All components except the Helical Filters, PCB Pins, & 2 wire links are mounted on the track side of the PCB. **Do not mount the ADE-1 Mixer onto the PC board until the Local Oscillator Level has been checked in the Tune Up section.** The small surface mounted components should be mounted first followed by the larger types. When mounting conventional components, the legs of the devices are cut short, a mounted directly on the PCB like surface mount devices. To solder in the chip capacitors & resistors a pair of tweezers are used to hold them in place, soldering one side first then the other side. When installing the MAR & ERA amplifiers you need to get the shortest possible ground connection on the earth legs of these devices. It doesn't matter if the input & output legs are slightly long, but the earth legs should be kept as short as possible. It is suggested that the input & output leads are bent 90 degrees upwards & passed through the hole in the PCB from the groundplane side. Then carefully push down onto the device so that the straight earth legs are slightly bent so that the device sits inline with the PCB, then solder into place.

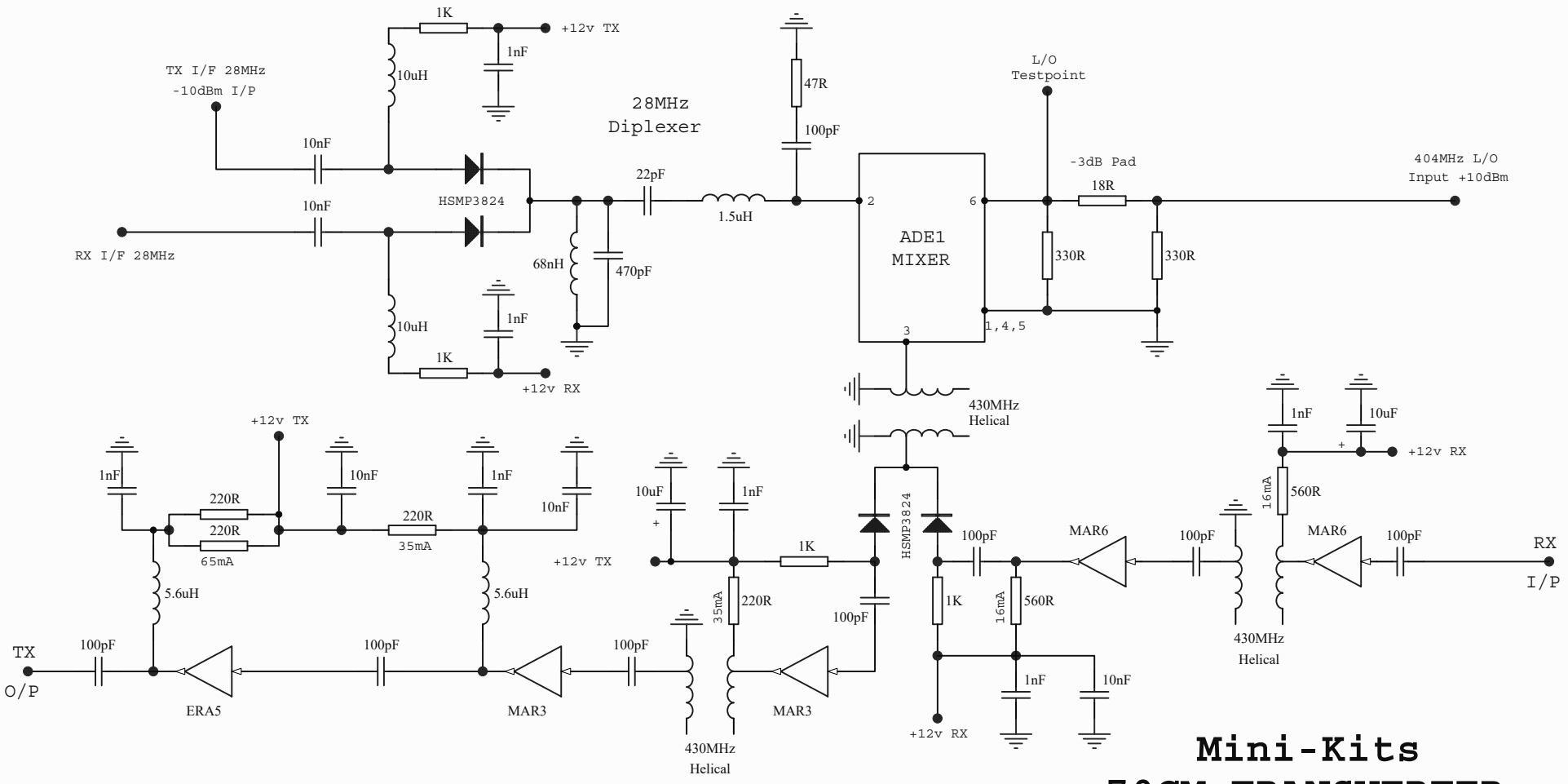
4. When installing the Toko Helical filters make sure that you mount them onto the PCB the correct way around. The input end of the helical filters are indicated by a part number marking that is stamped onto one end of the metal can. When mounting the helical closest to the mixer, mount it so that the marking end is the one that goes to the mixer. The helicals outer metal cans, should also be soldered to the earth plane of the PCB where it touches the board for a good ground connection.

5. There are two wire links that need to be fitted from the groundplane side of the PCB. Use insulated hookup wire for these as they are power connections. Connect points A to A, & B to B as per the PCB overlay diagram. Next solder in the 2 x 0.9mm PCB Pins from the groundplane side of the PCB for the TX / RX power connections to the board.

POWER CONNECTIONS: There are 2 power connections to the transverter board, +12V TX to power the Transmit section, +12V RX for the Receiver section. For control of the Transverters Power & I/F switching, it is suggested that the VK5EME66 Transverter Sequencer Kit be used. The Transverter Sequencer Kit is a good option if you are planning on adding a Preamplifier, Power Amplifier, or Antenna relays etc later on.

LOCAL OSCILLATOR: The Transverters L/O input requires a 404MHz input of +10dBm to the –3dB pad to drive the mixer correctly at +7dBm. **Excess drive could damage the Mixer.** Using the recommended EME65 400MHz Butler Oscillator you should get around +7dBm, (5mW) minimum, but typically +10dBm (10mW) typical output when tuned to maximum. The L/O should be tuned up initially into a 50ohm load, but will require retuning of the 404MHz output filter when connected to the transverter board. The Local Oscillator drive can be monitored at the L/O Test Point with either a Microwave Powermeter, or Spectrum Analyzer etc, before the mixer is soldered to the board. If you are unable to get enough 404MHz drive at the L/O testpoint for the Mixer, there is enough room on the PCB to add an additional MAR amplifier, to increase the level to +10dBm before the –3dB attenuator suitable for the +7dBm (5mW) ADE-1 mixer. The ADE-1 Mixer will work well with as little as 0dBm, (1mW) of L/O power, but typically you should be able to get close to +7dBm, (5mW). If you have too much drive level, then the –3dB attenuator should be changed to give the correct level.

TUNE UP: With the correct L/O & TX drive levels, the Transverter should operate without any adjustments to the Helical filters. The filters have a very narrow adjustment range & are wide bandwidth, (10MHz @ 1dB) so it makes it very easy to tune up the transverter with minimal test equipment.



Mini-Kits
70CM TRANSVERTER

1. Connect a suitable 430MHz Power Meter or Spectrum Analyzer to the TX output connection & adjust the 28MHz TX drive level & peak the 404MHz local oscillator ouput trimmer capacitors on the 404MHz L/Osc board for maximum TX ouput, +19dBm (50mW). The difference in the position of these trimmer capacitors now compared with tuning the 404MHz L/Osc into a 50ohm load, is due to the cable length & connectors used which are rarely a perfect 50ohm match.

2. If you have a Spectrum Analyzer then check that the 404MHz local oscillator signal is an acceptable low level on the Transverters output. Slight adjustments to the Helicals & correct TX 28MHz drive level will reduce the local oscillator to a very acceptable level

3. There is no tuning to be done in the receiver section. To peak the Transverter the Helical filters can all be adjusted slightly for maximum power output on TX, & maximum signal strength on receive.

4. Net the Local oscillator frequency by adjusting the coil on the 404MHz local oscillator board on a known beacon in RX mode, or into a frequency counter in TX mode.

POWER AMPLIFIER OPTIONS: The Transverter has been designed with an output compression of +20dBm (ERA5), which is around 3dB higher than the required (+17dBm) to drive a Mitsubishi M57716 module to produce the maximum Linear Output. On SSB the module should not be driven with more than the recommended +17dBm to produce a 10W Linear Output.

NOTE: Chip components crack easily so if you have problems getting the kit going properly, check for broken chip caps on the antenna input etc & throughout the signal paths.

PARTS LIST:

RESISTORS

1 x 18R	SMD 1206 Resistor **(1)**
1 x 47R	SMD 1206 Resistor **(1)**
4 x 220R	SMD 1206 Resistor **(0)**
2 x 330R	SMD 1206 Resistor **(2)**
2 x 560R	SMD 1206 Resistor **(2)**
4 x 1k	SMD 1206 Resistor **(0)**

CAPACITORS

1 x 22pF	SMD 0805 Chip Capacitor **(1)**
8 x 100pF	SMD 0805 Chip Capacitor **(4)**
1 x 470pF	SMD 0805 Chip Capacitor **(1)**
8 x 1nF	SMD 0805 Chip Capacitor **(2)**
6 x 10nF	SMD 0805 Chip Capacitor **(2)**
2 x 10uF	EXR Electrolytic Capacitor **(1)**

Numbers in Brackets are for the RX Only Version

INDUCTORS, RF CHOKES, FILTERS

3 x TOKO	252MXPR2537A Helical Filter **(2)**
1 x 68nH	SMD Coil (0.068uH) **(1)**
1 x 1.5uH	SMD Coil **(1)**
2 x 5.6uH	SMD Coil **(0)**
2 x 10uH	SMD Coil **(0)**

SEMICONDUCTORS

2 x HSMP-3824	SMD Pin Diode **(0)**
2 x MAR3	Mini-Circuits Amplifier **(0)**
2 x MAR6	Mini-Circuits Amplifier **(2)**
1 x ERA5	Mini-Circuits Amplifier **(0)**
1 x ADE-1	Mini-Circuits Mixer **(1)**

MISCELLANEOUS

1 x PC Board	EME104 **(1)**
1 x Instructions	EME104 **(1)**
2 x PCB Pins	1mm **(1)**

