6m to 10m Transverter (Part 1)

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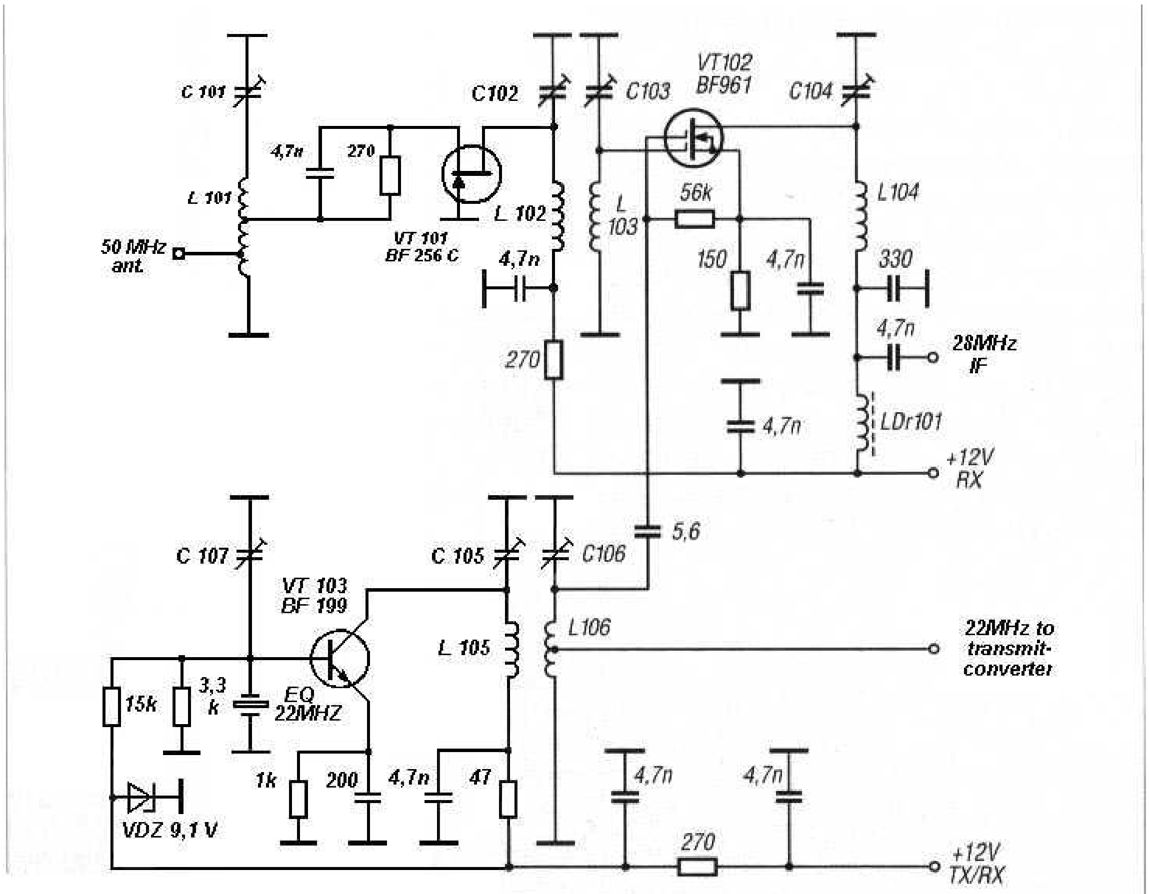
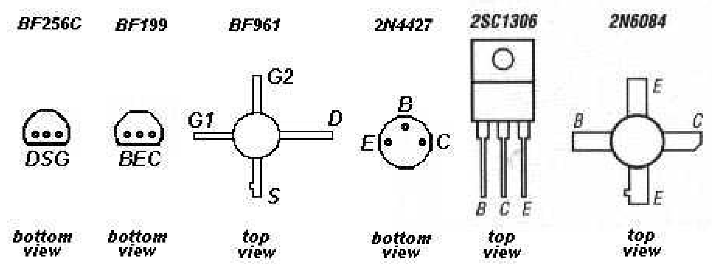
6m trancivers are quite expensive, and buying one is not the right solution in the mind of many amateurs. In the meantime there are a few manufakturers with trancivers capebel of handling this band, but what should one do with barndoor input circuits, so just update your shortwave equipment with an easy to bild transverter having all the goodies your exiter has.

Summary

The transverter has 6 stages mounted on 4 PCB´s. The reciving converter 50 MHz/28 MHz and the Lo of 22MHz (24 MHz for 4 MHz Bandwidth) build on one PCB. On the second PCB the transmitting converter containing the mixer and driving-unit with about 150mW output. On the third one is a lineramplifier to increase power to about 3 - 5 W and a lowpass-filter, and the forth PCB is an amplifier to punch up the power to about 50W.
We prefared to build this in diffrent modules so that anyone wanting to use other stages (experimenting) , could do this without any problems. You can lineup and test each unit by itself.
If someone already own`s a reciving-converter then he only needs the transmitting unit, and an oscilator with about 0.3 V peak to peak for the mixer, and so on.





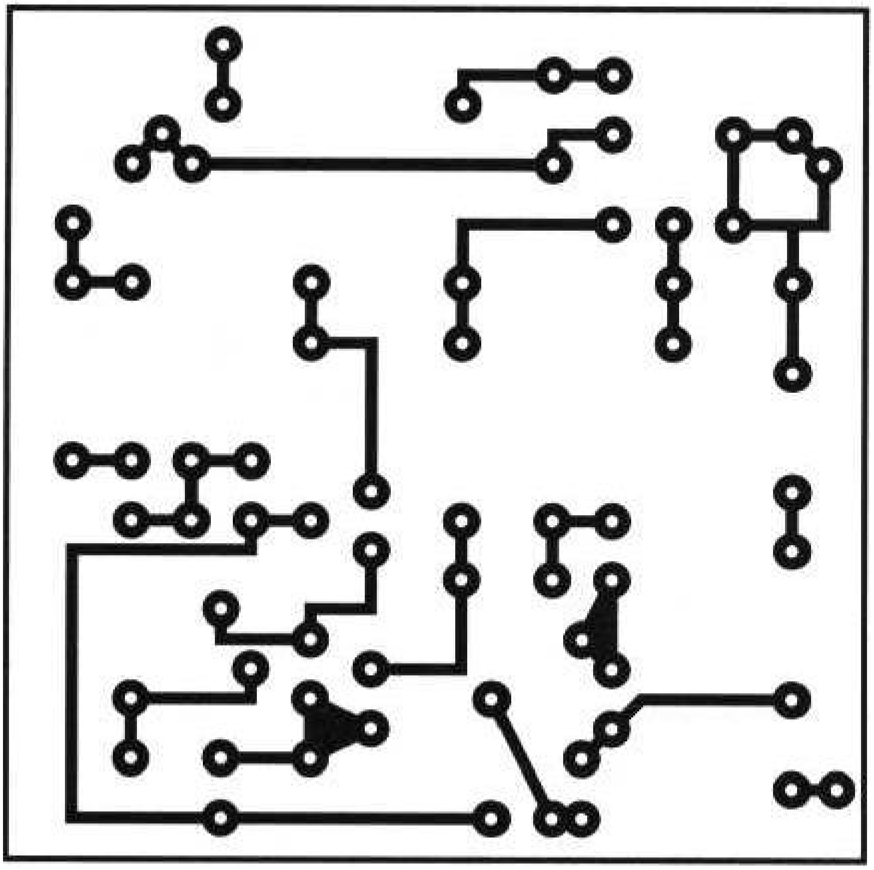
Picture 1:
scematic ol
oscillator and
reciving converter

Picture 2:
pin layout ol
transistors

The parts used are common and easy to get, no miniaturising and a lot of space on the PCB-layout, so that the use of parts from the junkbox with other dimensions could be garanteed. The shelded-boxes were bought, but they also could be made of PCB-material. The first version of this transverter was build in deadbug- design, but to make things easier we developed PCB´s.

The PCB`s are doublesided and the Rx/Tx units use the component side only for shielding and ground connections of components.It is important to clear the drilled holes from the component side so that no shortcuts are manufactured when soldering the pass trough component-connections on the etched side. The components that have to be connected to (ground / shield) are marked on the layout picture. This type of design has a lot of advantages, you have a good RF-shielding to the layoutside and it is easy possible to shield units from each other by putting walls between them.

The two amplifiers and the filter were build in an other way. We also used doblesided PCB´s but the components were placed on the layoutside, because it is easier to handle the cooling of the RF-transistors in this way.
RX/TX switching and power supply can be buildup as one prefares.

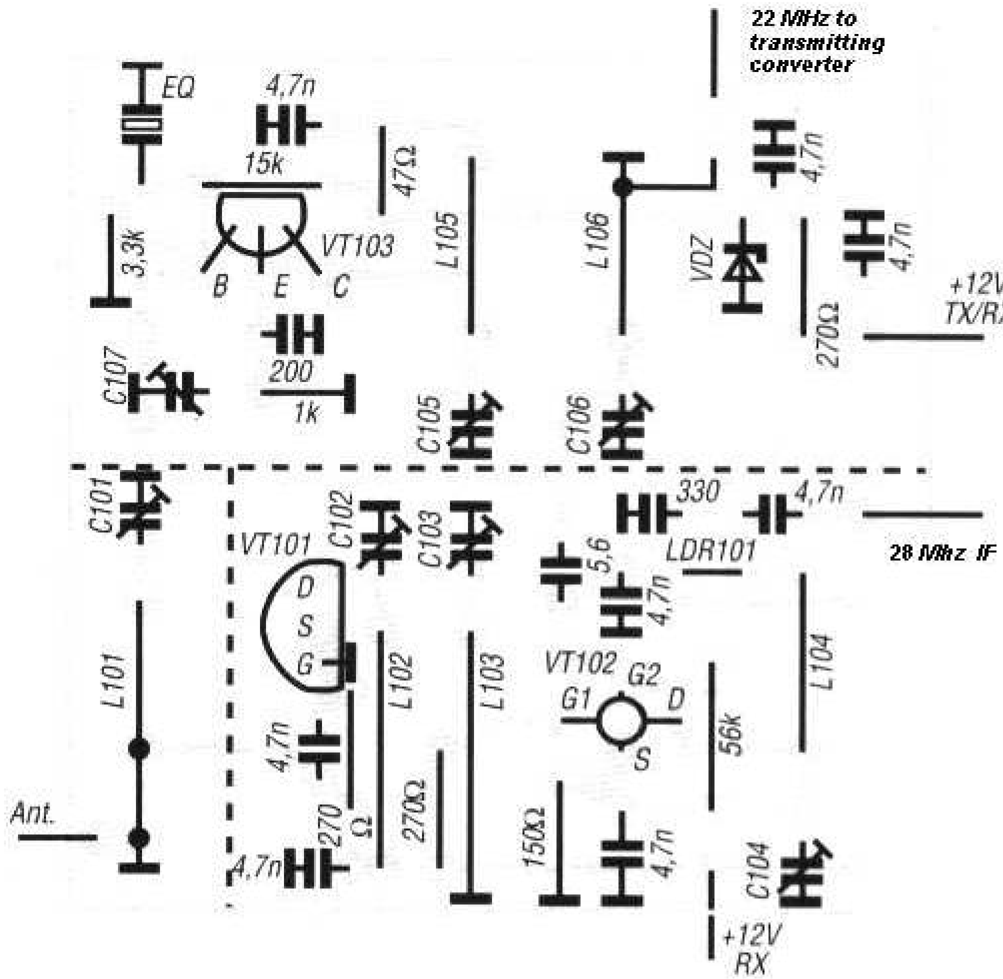


<u>The lokal oscillator (Lo)</u>
Quarz oscillator and reciving-converter are together on one PCB. The power supply connections to the units are seperated because the reciving-converter must be switched off in transmit mode as the **Lo** keeps up operation in order to supply the TX-mixer with a 22 MHz (24MHz) signal 0.3 Vp-p

The oscillator is build with a cheap 22 or 24 MHz quarz in a HC-18U case. The highgrade circuit is necessary so that it can be garanteed that the quarz swings on. Even low quality quarz from coputers can be pulled to 22 or 24MHz by tuning L105 and C107.

The output signal of the oscillaator is then passed trough a bandpass filter (C106 and L106) to reduce harmonics and spourious products. If it wouldn`t have been done in this way you would have problems with doubling the frequency to 44MHz with a much to high power to the input of the mixer, producing a very spourious signal.

The signal is beeing capasitively picked up over a 5.6pF Cap. at high impedance from the second resonant stage of the bandpass-filter and fead to the mixer in the reciving-converter. The signal for the transmitting-converter is picked up at a tap on the cold side of L106. This stage is always supplyed with 12 V DC and has a zener of 9.1V
to stabilise the voltage.



The reciving-converter

We used a low noise FET typ BF256 C (VT101) in grounded gate at the input to cancel self-oscillation . The input-stage will work stabel even if the antenna is not attached. After the FET, the signal passes trough a bandpass and is mixed with help of a dual-gate-mosfet-stage BF961 (VT102). The RX-signal is fead to gate1, and the LO to gate 2. This type of mixing is quite common and is beeing used since the last 10 jears for thease cases.
The drain is connected to a tuned Pi-filter (L104) to a frequency between 26 and 30MHz with a bandwidth of about 1 MHz dipending on the bandcovaredge and Frequency wanted. The obtained noisfaktor of about 2 dB is actually the best you can get. It isn`t neccecary Investing more time in better preformance because the noisfigure is always quite high on this band.

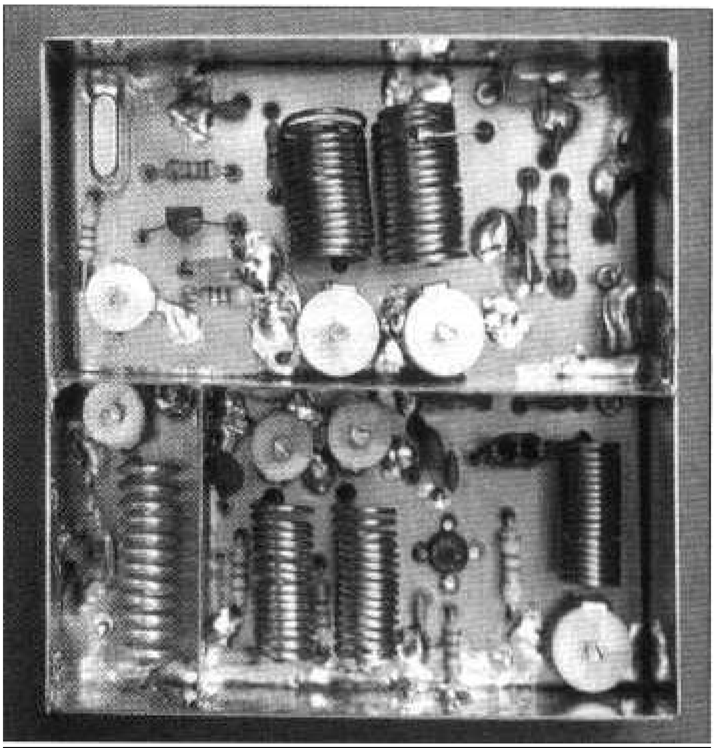
Building the oscillator and reciving-converter.

At first you should get accostomed to the connections of the transistors (see figure 2), in order not to make mistakes. Logically we start with the reciving-converter and the lokal-oscillator. The dimensions of the PCB is 71mm X 71mm (abt. 2.79 inches in square), and would fit in a standard tinned metal case of 72mm X 72mm.

At first you set the coils , all the coils are airwound ones, look at figure 4. The coils are closewound on drillshafts with a certain amount of windings and after that pulled appart to fit the drilled holes on the PCB (L101, L102 and L103). all the other coils are closewound. On the component layout-plan you also see the marks to put up the RF-shielding walls. The cover of the unit must have holes at particular areas to be capebel of tuning the unit when the cover is set on it. The other details can bee seen by studying the picture. (figure 5)

Adjusting the LO / reciving-converter unit

To make the adjusting of the unit a bit easier you can preconfigure the capasitors to the later mentioned positions, you should do this in anyway, Tuning the capacitance compleatly out or in is a sign for an error! At first give power to the oscillator only, with help of a griddip or reciver tuned to the oscillator frequency (22 or 24MHz), tune to maximum reading on the s-meter, after that tune the oscillator to the exact frequency by adjusting the paralell capacitance to the quarz. Here you should pay attention to the frequency and also to the safe initial start of oscillation as you put power to it. Now you can connect the reciving-converter to the exciter and fix the output circuit of the 28MHz (26MHz) IF to maximum noisfigure in the exciter by tuning C104, then tune C103 and C102. Attach a 6m antenna to the circuit, you must hear a change to the noise as yo do that. Search a week signal and correct the tuning of all circuits in the reaciving unit for maximum preformance. **This unit needs a shielded box.**



If you keep all values of the coils and capacitors as sugessted then you can preset the following settings of the variable-capacitors before you start tuning.
C101: 95% (about 40pF)
C102: 50% (about 22pF)
C103: 33% (about 16pF)
C104: 55% (about 50pF)
C105: 50% (about 35pF)
C106: 50% (about 35pF)
C107: dipends on quarz used in the LO

Part list for the converter and lokal oscillator.
The values of the tuning capacitors in the part list are maximum values.

C101, C102, C103, C107	plastic capacitor 7mm, 45pF (violett)
C104	plastic capacitor 10mm, 9opF (red)
C105, C106	plastic capacitor 10mm, 70pF (yellow)
EQ101	quarz 22,0000 MHz

L101	12 turns of silver coated 1mm copper wire wound on a 6mm drill shaft, taperd at the 2 and 5 turn from the cold side.
L102, L103	15 turns of 0.8mm enameld copper wire, wound on a 6mm drill Shaft
L104	18 turns of 0.8mm enameld copper wire, wound on a 6mm drill Shaft
L105	16 turns of 0.8mm enameld copper wire, wound on a 8mm drill Shaft
L106	16 turns of 0.8mm enameld copper wire, wound on a 8mm drill Shaft Taperd at 3.5 turns from cold side
LDR101	2 x 4 turns of 0.25mm enameld copper wire, wound through a broad-Band ferritbead (binocular)
VDZ	zener diode 9.1 V
VT101	FET BF 256
VT102	MOSFET BF 961
VT103	BF 199

Part list for the transmitting converter.

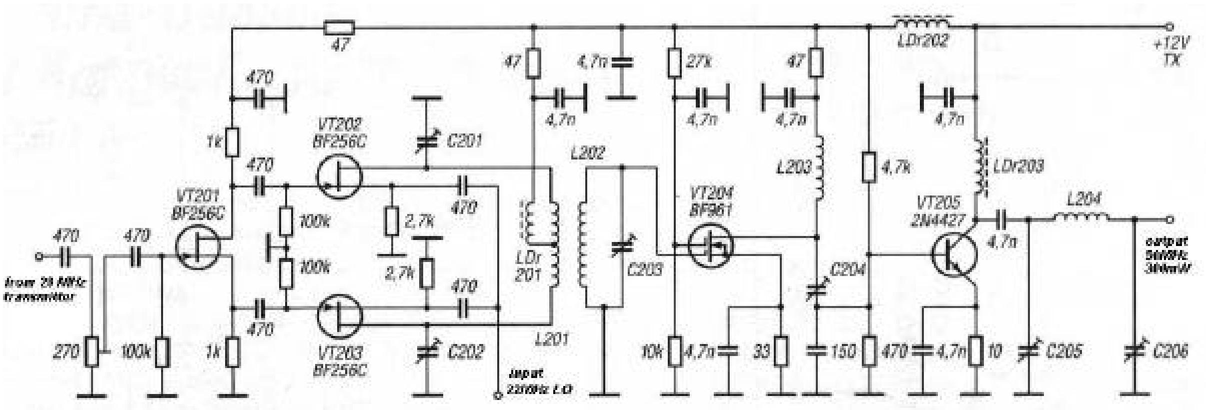
C201, C202, C203	plastic capacitor 7mm, 45pF (violett)
C204	plastic capacitor 10mm, 60pF (yellow)
C205	plastic capacitor 7mm, 60pF (black)
C206	plastic capacitor 10mm, 110pF (violett)

L201	12 turns of 1mm silvercoated copper wire, wound on a 10mm drill-shaft taperd at the center.
L202	9 turns of 1mm silvercoated copper wire, wound on a 10mm drill-shaft
L203	10 turns of 1mm enameld copper wire, wound on a 8mm drill-shaft
L204	8 turns of 1mm enameld copper wire, wound on a 8mm drill-shaft
LDR 201 and 202	5 turns of 0.2mm enameld copper wire through a ferrit bead

LDR203 2 x 4 turns of 0.25mm enameld copper wire, wound through a broad-
Band ferritbead with 2 holes (VHF-choke)

VT201, VT202, VT203	FET BF 256C or BF245C please choose only one type!
VT204	MOSFET BF 961
VT205	2N4427

<u>Look at the scematic for values of the other parts (resistors and capacitors)</u>
All resistors are 0.25 W carbon type. **(don`t use wire wound ones!!)**
All capacitors are cheramik disk type.



<u>Transmitting converter</u>

Even here, (picture 6), I choosed a easy and reliable scematic consept, without the use of a diode ring mixer or any thing similare to it because of costs and coplexity, all the parts together on this PCB are cheaper than one intigrated ring-mixer.
If you don`t overload the input of the mixing-unit, you will get a clean signal without harmonics and spourious products. If you wanted to use a IE-500 (ring-mixer) you would need a much higher LO-signal level and one more amplification stage to get it properly working.
VT201 works as a phase inverter unit in order to provide VT202 and VT203 which are setup as a push-pull stage mixer. The 28MHz (26MHz) signal is present to the gate of both transistors, and the LO-signal is added to the sorces.The advantage is, feeding the signals directly without the use of front-end resonant circuits. You only get a clean output signal of 50Mhz when the LO and exciter signals are sucsessfully supressed. This is the case when you use two identicall transistors (VT202 and VT203).
The signal then passes trough a bandpass-filter for 50MHz, to a MOSFET BF 961 (VT204) And is then added after a resonant circuit and capasitiv divider to the driver stage. The driver transistor (VT205) 2N4427 provides enough power, about 150mW, over a tunable Pi-filter to the next stage. **(to be continued)**

<u>If you download the zip-file all PCB-Layouts and this translation are included.</u>