6m to 10m Transverter (Part 2)

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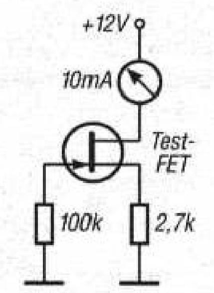
Part two considers the building of the transmitting-converter and a 3W linear-amplifier

<u>Selecting the FET´s for the transmitting-mixer:</u>

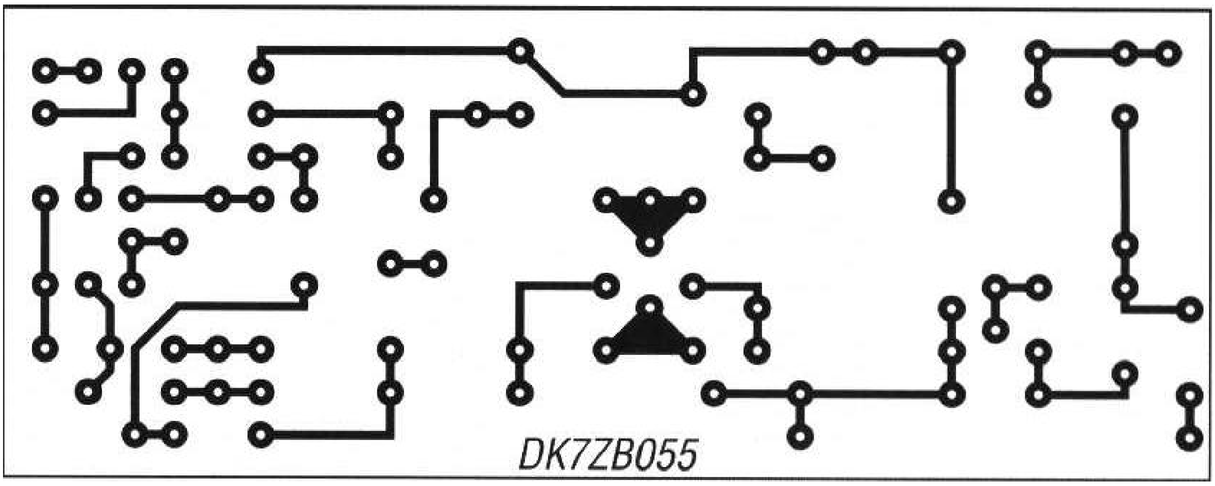
In part 1 we discribed the use of this FET-mixer, and it`s advantages to other types. This type has already been used in a 2-meter version with suchsess. The only negativ point is finding two FET´s (BF 256 C see picture 7.) with eqal values. I recomend not to balance the source currents with a variable resistor, like some developers do, because you would never get a clean mix of signals, and you would have an unbalanced and non symetrical signal to the next stage.
The FET`s are not expensive and in anyway you need 4 of them in this project, so just buy about 10 of them to select two which fit together.
To select a pair you must use the scematic shown in picture 7, the goal is to select two of them with aproximitley the same drain current, the current should be round about 2,5 to 3,5 mA with the given resistor values.

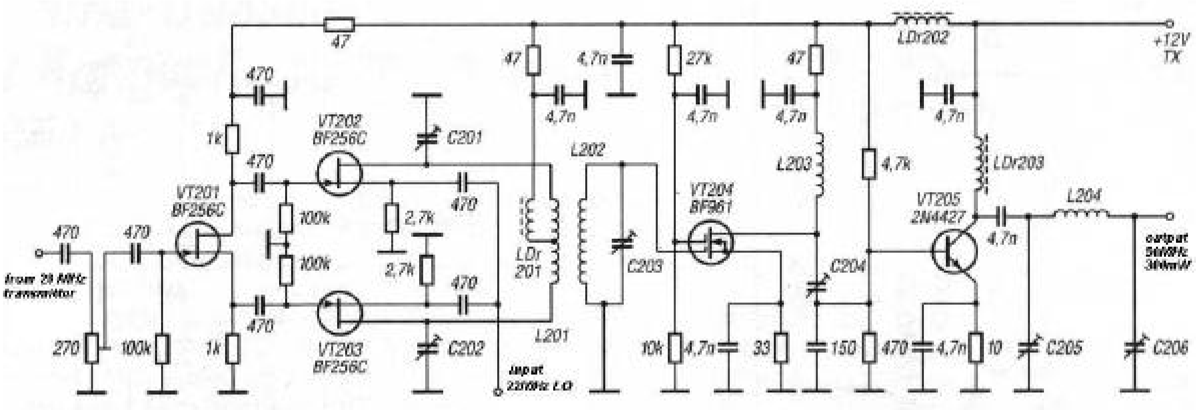


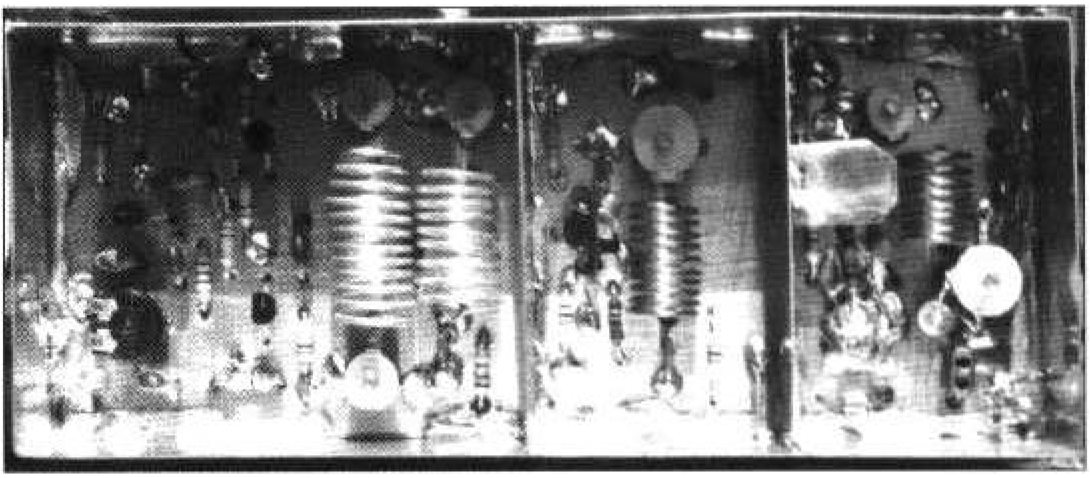
Picture 7: scematic for testing the FET´s

<u>Building the transmitting mixer:</u>

The dimensions of the double sided PCB (picture 8) are 55mm X 140mm with screening walls inbetween the stages and a screening box containing the whole unit. All the inductors are airwound and pulled appart to fit to the holes in the PCB-layout.
Logically you start at the input and build one stage after the other. Screening the stages is very important. The transistor (2N4427) dosn`t fit properly because this unit was primerly developed for a BFR 96, I fitted the transistor to the bottom side in order to keep the leads as short as possible and to fit a cooling fan to the transistor . If you shurley won`t use more then 12 V supply voltage, then it would be no problem for you to build this unit with a BFR 96. Don`t forget to cool the transistor! Attention to the case of the 2N4427, it is connected with the collector and shouldn`t touch ground!!!
Picture 8 is the PCB-layout. Picture 9 and 10 show you how this unit is put together.


DK7ZB055


47
470
1k
VT201
BF256C
VT202
BF256C
VT203
BF256C
C201
C202
100k
2,7k
270
LDr
201
L201
L202
4,7n
27k
VT204
BF961
C203
10k
33
L203
C204
150
4,7k
LDr202
+12V
TX
LDr203
VT205
2N4427
L204
10
C205
C206



Adjusting (tuning) the transmitting converter:

The tuning of the transmitting converter is a bit difficult, because you need a 6m reciver or an HF-probe to pickup the signal. Or if you own a sensitive meter (200 uA), you could use it as a fealdstrength meter in conjunction with a pickup loop, a diode and a capacitor. You must terminate the unit with a 47 Ohm 1W resistor.

If you use an ordenary HF-rig (28 MHz IF), you must attenuate the minimum possible HF-output (10 Watts) to a lower level with an attenuator described in part 3 of this project.

With a constant IF of 28 MHz and the oscillator signal of 22 (24) MHz attached to the unit You should tune for maximum reading of the signal at L1 with the two variable capacitors. The capacitors should have aproximitley the same settings.

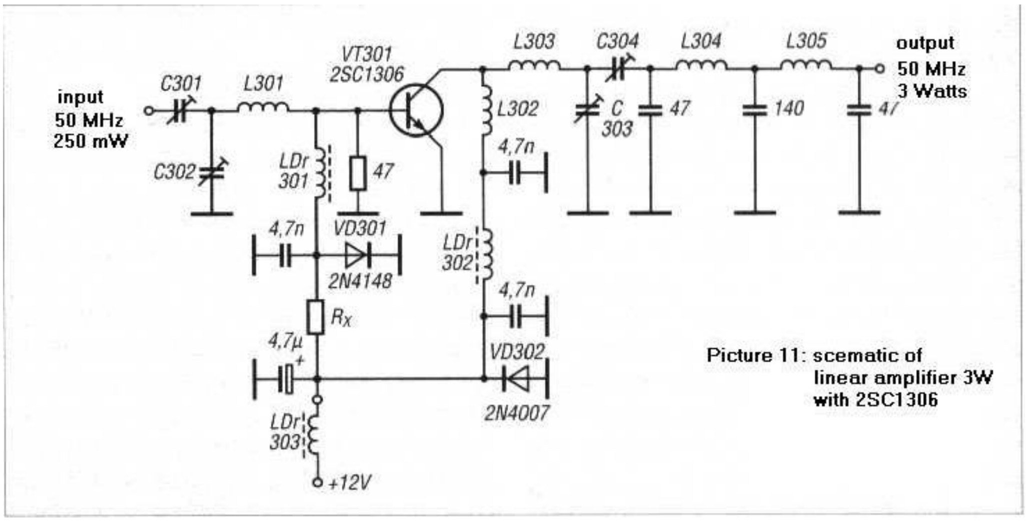
The next stages are to be tuned in a similar way. A powermeter at the output should show a significant peak. If you have another HF-reciver you can tune the first stage (at L1) for best rejektion of the oscillator frequency of 22 (24) MHz by adjusting the two capacitors of the mixer.

If you keep all values of the inductors and capacitors as sugessted then you can preset the following settings of the variable-capacitors before you start tuning.
C201: 50% (about 20pF)
C202: 50% (about 20pF)
C203: 50% (about 20pF)
C204: 66% (about 25pF)
C205: 75% (about 45pF)
C206: 66% (about 70pF)

The Liner-amplifier:

The third unit is a linear-amplifier and a low pass filter. Originally we use a CB-Type of transistor with a conviniant transit frequency responce on 50 MHz and a gain of 12 to 13 dB. You could get more if you use VHF typs but the problems of self oscillation get bigger.
The typ we used is a 2SC1306. At a drive of 100 to 200 mW you get an output of app. 3 W, and with a drive of 400mW clean and spurious free signal input you can get up to 6 Watts out. The scematic is a common VHF design

The capasitors C301, C302 and L301 are the input network to the base of the 2SC1306. The ideling current is set to app.50mA to get best linearity preformance. The forward-biasing of the transistor is preformed by the diode VD301, with the supply voltage set between 11,5 and 13,5 Volts we get an idelling current of 45 to 60 mA. L302, C303 and C304 is the output network wich transforms the output to a load of 50 Ohm. To reduce selfoscillation, L302 is a core type inductor. The supply-voltage is fead trough two chokes and blocked by three capacitors. VD302 is only for polarity protection, L304 and L305 with ist capacitors is a lowpass filter.

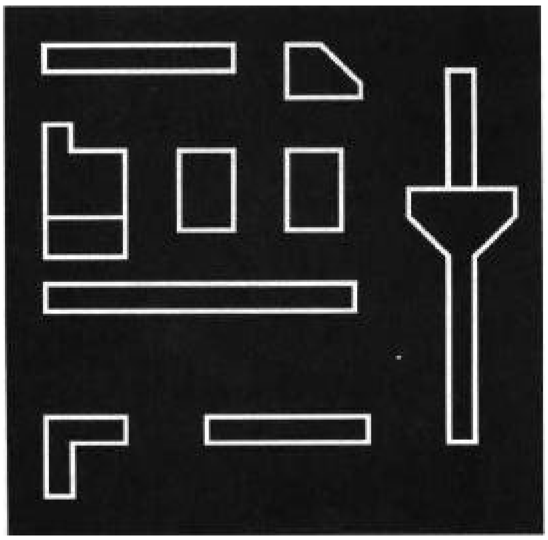


Picture 11: scematic of linear amplifier 3W with 2SC1306

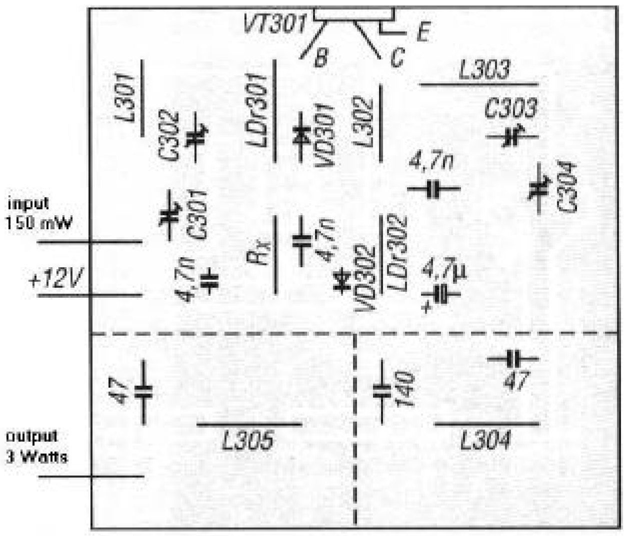
Part list of linear amplifier

C301, 302, 303 and 304	variable capacitor 90 pF 10mm (red)
L301	8 turns of 1mm enameld copper wire on a 6mm shaft
L302	10 turns of 1mm enameld copper wire on a 6mm shaft
L303	7 turns of 1mm enameld copper wire to a T 50-6 core (yellow)
L304 and L305	5 turns of 1mm enameld copper wire on a 10mm shaft
LDR301 and 303	5 turns of 0.2mm enameld copper trough a ferrit bead
LDR302	4 turns trough binocular balun or VHF-type choke VK200
VD301	si-diode 1N4148
VD302	si-diode 1N4007
VT301	2SC1306 (nec or sim...) or 2SC1971

Pay attention to the different connections of the transistors!



Picture 12 PCB 71mm X 71 mm



Picture 13 : Part layout, dotted line is the shielding

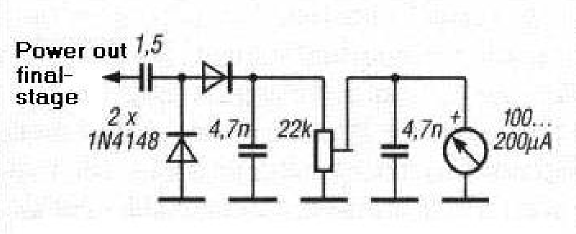
Building the linear amp.

The linear amplifier neads a shielding-box with the dimensions of 72mm X 72 mm X 50mm. You start building by first soldering the circuit-board into the case instead of the bottom cover, with ist etched side up.The components will also be solderd on this side. Next you fit in

the shielding walls.Then you bend and shape the transistor leads to fit the PCB with shortest connections as possible. Then you drill the hole in the side wall to fix the transistor. If you use an 2SC1306, you must isolate it from ground with a strip of mika and plastik skrew isolations. If you use a 2SC1971 you don`t have to do that because the emitter of the transistor is grounded in the case (pay attention to the diffrent conections of the transistors!).
Don`t forget atacching a heatsink on the outside to the transistor! The supply voltage is coneckted via a feedtrough capacitor of 1 to 10nF and a choke LDR 303 to the PCB.
Now you can place all the other parts **exept the resistor RX.**

Relativ output metering-display.

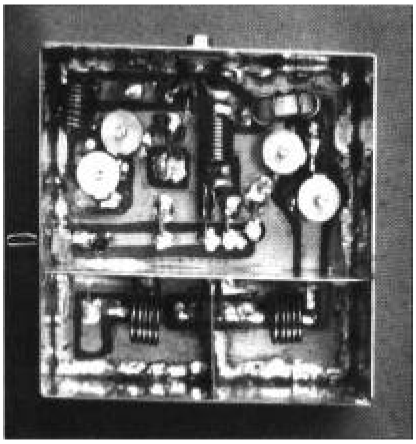
It is very easy to build a relativ power-meter, and it is quite calming to see it mouve in transmission mode. To build one just have a look at picture 14 . The meetring device must have a full skale range between 100 and 200 uA. The circuit is coneckted to the output of the amplifier over a 1,5pF capacitor and dosn`t need a PCB.



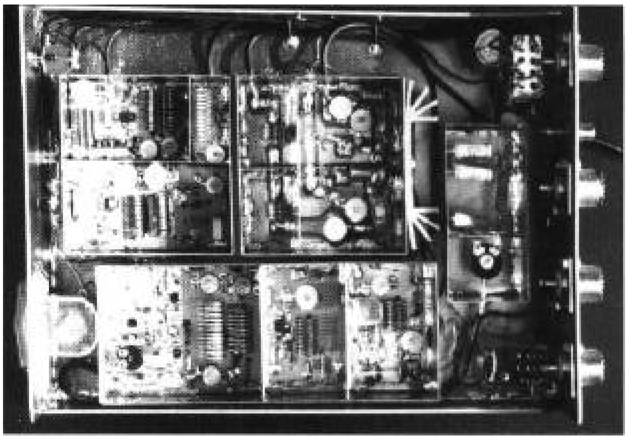
Picture 14: Power metering scematic

Adjusting the 3W linear amplifier:

Start adjustments without RX resistor, The pretuning is preformed in class B operation to a 50 ohm load (3 carbon resistors 150 ohm/2 Watt type in paralell) without connections to the lowpass filter. To eliminate problems of selfoscillation during this proscidure, implement a 2.7 ohm / 2 Watt resistor in the positiv powerline.Tune the unit to maximum power output with the variable capacitors, then make a resistor combination in series 180 ohm+ 500 ohm variable resistor for RX and set the idelling current to 50 mA. (you can replace the resistor combination trough a fixed one after mesuring the right value of the combination after adjustment) Now you can retune with C1 to C4 to maximum, coneckt the lowpass filter after removing the 50 ohm load and placing it to the output of the filter. Now you can do the final tuning.



Picture 15: the 3W linear



Picture 16: the complete transverter with all the Units in place.

(to be continued.........)