DL-QRP-AG

Tramp-8
8 Band CW Transceiver

Revision: 2.Mai 03

manual by: **FI**service Peter Zenker DL2FI email:info@qrpidee.de

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The TRAMP-8 CW Transceiver

- tentative english translation by Peter Raabye, OZ5DW, 18.04.03
Not verbatim: readability was a priority.

Designed by Peter Solf, DK1HE, devoted to DL-QRP-AG und QRPproject
Project coordination and editing: Peter Zenker, DL2FI
With support from Jürgen, DL1JGS (Prototypes, manual)
Manual by FIservice

Preface by DK1HE
When you look at contemporary QRP rigs, you will find three broad categories:
1. Monobanders (about 60%)
2. Multiband rigs, switchable by interchangeable modules (about 25 %)
3. „Real“, knob switchable multiband rigs (about 15%)

Every ham who have tried working with the first two categories in multiband setups, know the problem of fast band changes: The "we'll be in touch shortly" in another band is difficult, especially, when working portable. Often you haven't packe the "proper" transciever or the band module just isn't there in the back pack. These problems, which I have encountered myself, and the fact that DL-QRP-AG presented me with a request for a switchable multiband CW transciever, prompted me to develop one.
The basic project was a tribander with the given name Tramp 3. At Ham-Radio 2001, I had the opportunity to discuss my project with the well known QRP-AG developers Ulli/DK4SX and Helmut/DL2AVH. This resulted in a redesign of the T/R switch and the IF regulator. Thanks a lot for the good advice! Peter/DL2FI found an enclosure with optimal size for QRP work. Because of the small size of this enclosure, SMD parts were inavoidable. During the further design process, it became clear, that the systematic use of SMD technology left enough room for an 8 band design in the chosen enclosure. Tramp 8 was born!

The Tramp 8 band CW transceiver has the following characteristics:

- 8 SW bands (160m_10m) selectable from the front panel
- Thanks to modular design, expandable in sections (1_8 Band modules)
- Nice measures: 150 x 165 x 50 mm W x D x H
- Optional DDS VFO
- Optional digital frequency display
- Low power consumption by reciever (important, when running from rechargeable batteries)
- 3 section band filter in RX gives high mirror selectivity
- Double superheterodyne, first IF 4915 KHz, second IF 455 KHz
- 500 Hz crystal filter in first IF stage
- Dynamic range overall about 100 dB
- Manual adjustment of IF amplification
- AGC drawn from second IF
- Field strength display
- Two stage AF filtering with a band width of 250 Hz, center frequency adjustable
- AF output 0,5 W
- VFO range about 100 kHz
- RIT
- Transmitter output continously variable up to a max. of 8 Watts
- Transmitter soft keying - QSK!
- Output power indicator
- CW side tone
- Supply voltage 11_15V

We have tried to cover all areas in this manual. Please take the time to read the manual. The Tramp 8 isn't difficult to build, there are a few catches, though, and it will certainly be helpful to think each section over before you start building.
A large pledge to you: Please help us to make the handbook better. Write us with any suggestion for improvement, report every mistake!
PLEASE read the "builders tips" shipped with the kit, before warming up your soldering iron. This section contains important information, that could be the key to succesful completion of your kit. Take your time to work through this material.
Should you come up with any problems or suggestions for improvement, please turn to Peter, DL2FI , he'll be glad to help you.
You can reach QRPeter either (and best!) via e-mail at
support@qrpproject.de or by phone at +49(30)85961323

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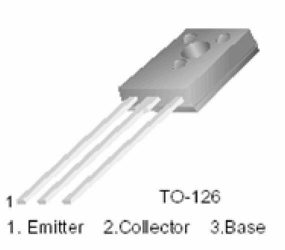
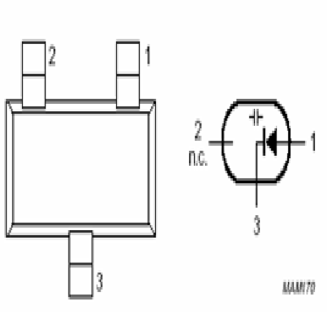
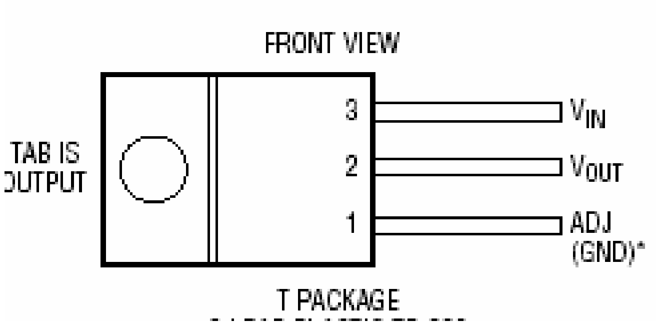


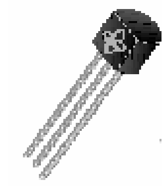
BD436



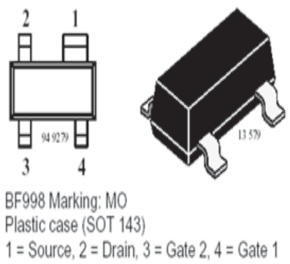
SOT23

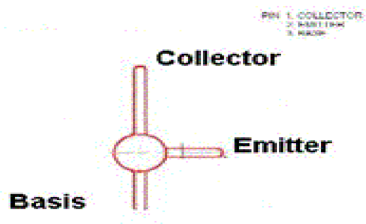


LT1086CT

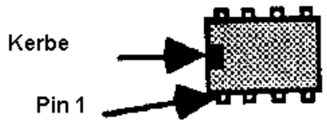


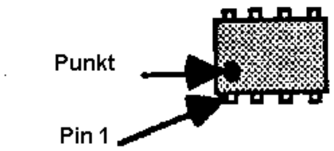
TO92





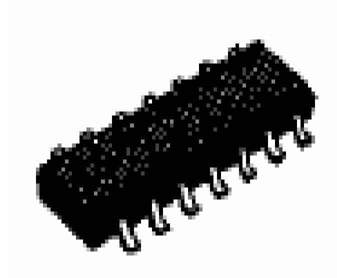
BFR96



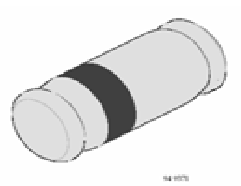


Pin 1 of DIL or DOP ICs is marked by a dot or a notch

Beware: The SOT143 casings have a thicker lead. To help orient them on the pc board, the corresponding solder spot is laid out a little larger than the rest.



SO14



SOD 80

Tantalum capacitors:
SMD Tantalum capacitors are marked on the PLUS side with a stripe.
Tantalum capacitors in drop form have a marking on the PLUS side. This is contrary to electrolytic capacitors which have a marking on the MINUS side.

General advise. IMPORTANT!
For all cylinder coils
- the complete winding must fit the lower chamber
- the ferrite cores must NOT be fitted till after soldering
- the ferrite covers should be fixed with a drop of glue
- the copper hoods when trimming has succeded. Reason: It is easier to solder out the coils for rewinding when the hoods are not yet fitted.

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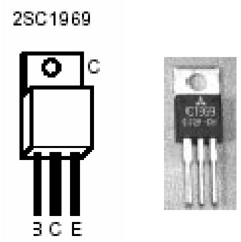
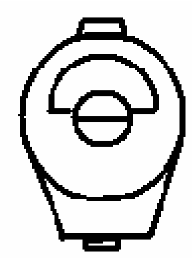




ceramic trimer cap. Drawing shows minimum

Section 1

We begin with the voltage regulators, the AF sectiona and the control logic of the Tramp 8: Let get familiar with the function of the individual stages.

Voltage regulator stages:

To make the voltage dependent parameters of the transmitter and reciever independent of the supply voltage, all critical parts are supplied from a low drop IC voltage regulator with an output of 10 Volts. This means that the completed kit will run on 11 to 15 Volts. This reduces the usability of common rechargeable batteries, as the should not be discharged below 10,8 Volts, and on the other hand won't deliver more than some 14 Volts. The +8 Volts supply from IC13 goes to the tuning voltage of the VFO. The filtering circuit R113-C134 reduces the noise on the regulator voltage. The wished frequency range of the VFO is tuned by P9 (band spread). The voltage regulater IC12 serves as a +6 Volts supply for IC1 and IC10.

Control logic

When grounding the key input at pin 21, pin 3 of IC3 goes high and switches T11 on through R36. C42 will charge quickly through R35 with the consequence that pin 4 of IC3 also goes high. The differential amplifier T9-T10 will be switched through R33-R32, that is T9 takes over the total current (T10 blocks), and turns on T7. This opens for the stabilized +10 Volts for the Transciever as the +10V 'S' supply. When the grounding is terminated, pin3 of IC3 goes low and blocks T11. C42 discharges with a time constant adjustable by P3 (T/R delay). When reaching the triggering voltage of the following nand gate, the output at pin 4 will go low and block the differential amplifier T9-T7. T10 takes over the total current and thus switches T8 on, so that the stabilized +10 Volts will become +10 Volts 'E' for the transceiver.

AF stage

The output voltage of the CW filter is passed via the volume control to the AF amplifier IC4. The stage will output 500 mW into an 8 ohm load. T13 serves for muting the AF during transmission. This will reduce keying clicks in the AF output.

Let´s start:

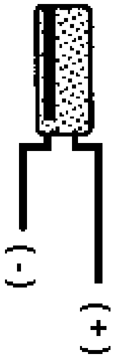
AF and control logic of the Tramp 8

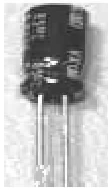
Begin by mounting the parts for the voltage controllers. Even though you read through the previous, check and double check, the parts before soldering in. A check with the parts list will help to avoid wrong placement of components. Especially important are the ceramic capacitors, which have no printed marking. You can find the place and orientation for each component from the print on the pc board and the placement diagram.
Put in all components, presented ind the diagram for the AF and control logis. There are not anything special around here.

[ ] solder in pc board pins at all places in the pc board marked by numbers.
Place low profile parts first. If you are a beginner for SMT parts, please read our little SMT manual. You will find it in the little introduction brochure shipped with any QRPproject kit. I am pretty sure, everyone will find some nice, helpfull tricks in there.

[ ]	T 8	BD436			[ ]	T 9	BC846B	SOT23
[ ]	T 10	BC846B	SOT23		[ ]	T 11	BC846B	SOT23
[ ]	T 12	BC846B	SOT23		[ ]	T 13	BC846B	SOT23
[ ]	T 14	BC846B	SOT23		[ ]	T 15	BC846B	SOT23
[ ]	D 9	1N5402			[ ]	D 11	LL4148	
[ ]	R 25	120R	0805		[ ]	R 26	820R	1206
[ ]	R 27	12k	0805		[ ]	R 28	12k	0805
[ ]	R 29	820R	0805		[ ]	R 30	10k	0805
[ ]	R 31	10k	0805		[ ]	R 32	10k	0805
[ ]	R 33	6k8	0805		[ ]	R 34	5k6	0805
[ ]	R 35	39R	0805		[ ]	R 36	18k	0805
[ ]	R 37	33k	0805		[ ]	R 38	56R	0805
[ ]	R 39	22k	0805		[ ]	R 40	100k	0805
[ ]	R 41	22k	0805		[ ]	R 42	12k	0805
[ ]	R 43	3R3	1206		[ ]	R 44	82k	0805
[ ]	R 45				[ ]	R 47	4R7	1206
[ ]	R 48	22k	0805		[ ]	R 49	12k	0805
[ ]	R 50	27k	0805		[ ]	R 51	56R	0805
[ ]	R 52	4k7	0805		[ ]	R 53	4k7	0805

[ ] R 54 8k2 0805 [ ] R 55 12k 0805
[ ] R 56 12k 0805 [ ] R 113 390R 0805
[ ] R 114 1k 1206 [ ] R 115 1k5 0805
[ ] R 116 1k 1206
[ ] P 3 100k PT6 horizontal trimmer potentiometer
[ ] P 4 250R PT6 trimmer potentiometer
[ ] P 9 5k ten turn trimmer potentiometer





Now the electrolytic capacitors. Pay attention, this one are polarized. The negative pole is marked with a minus sign. The longer leg always is the plus pole.

[ ] C85 1µF rad. [ ] C 37 470µ 16V rad.
[ ] C 48 100µF 16V rad. [ ] C 51 10µF 16V rad.
[ ] C 51 10µF 16V rad. [ ] C 47 100µF 16V rad.

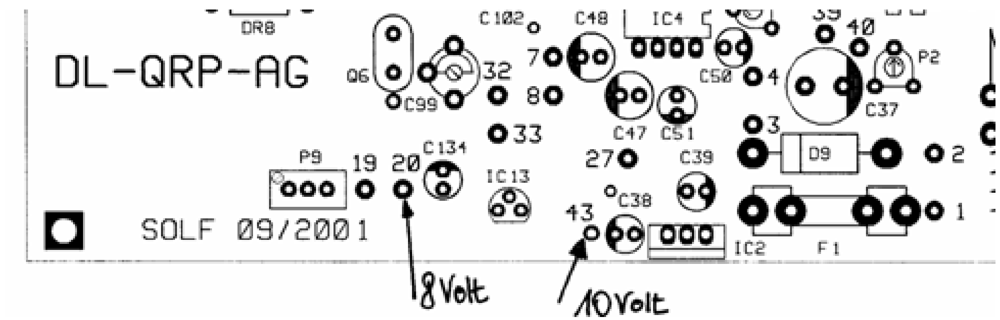
Tantalum capacitors also are polarized. They are marked with a plus sign.

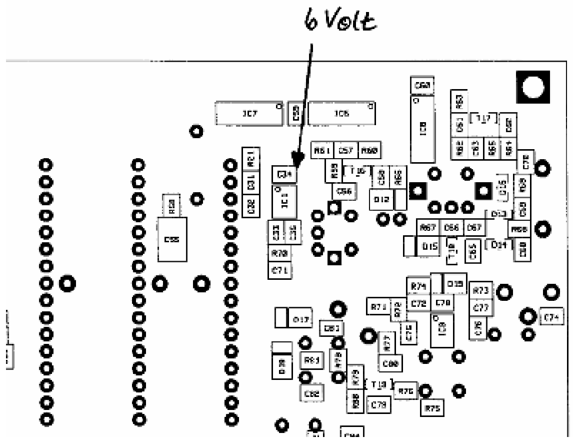
[ ] C38 6,8µ 16V Tantalum [ ] C39 6,8µ 16V Tantaluml
[ ] C 42 6,8µ 16V Tantalum [ ] C 54 1µF 16V Tantalum
[ ] C 130 1µF 16V Tantalum [ ] C 131 1µF 16V Tantalum
[ ] C 132 1µF 16V Tantalum [ ] C 133 1µF 16V Tantalum
[ ] C 134 10µF 16V Tantalum

[ ] C 45 22nF 0805 [ ] C 44 220nF Wima 1812
[ ] C 46 33nF 0805 [ ] C 49 100nF 0805
[ ] C 52 47nF 0805 [ ] C 53 1nF 0805
[ ] C 43 10nF 0805
[ ] IC 3 4093 SO14 [ ] IC 2 LT1086CT-10 TO220
[ ] IC 4 LM386 DIP 8 [ ] IC 12 78L06 TO92
[ ] IC 13 78L08 TO92 [ ] T 7 BD436
[ ] F1 F 1 socket for fuse

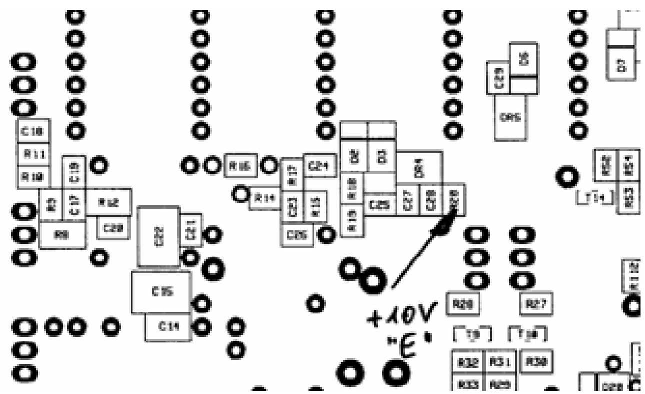
For the first test of this section, you should put a fuse of maximum 100 mA in the fuse socket and reduce the output current of your power supply to a corresponding value. The voltage should be less than 13,8 Volts.

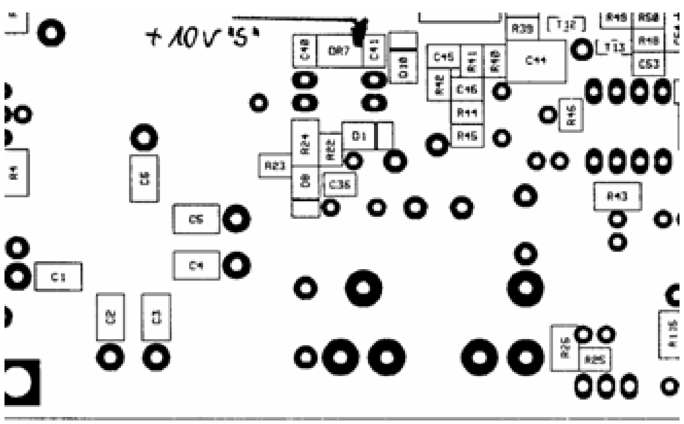
Solder in a switch or - temporarily - a shorting wire.
After switching the power on, the voltage of point 43 (quite close to the voltage controller IC2) should be 10 Volts. At point 20, 8 Volts should be available.
The output voltage of IC12 (6 Volts) should be available on the bottom of the not ground pin of C34, the pin closest to pin 8 of IC1. See the follow excerpt of the placement diagram seen from below:





When you have measured these voltages, you can try out the T/R switch and the side tone oscillator. Hook up a pair of head phones to point 7 and 8. When you touch point 6 briefly with a screwdriver (that will allways be a screwdriver to me!), you will hear a humming noise.
Next try if the +10 Volts 'E' voltage is available. You can - carefully - measure that at the collector of T8 (the middle lead), or better at the place of the later mounted R20 on the bottom side of the pc board. See the sketch below. Put trimmer potentiometer P4 at





approximately the center position and hook up a morse key from point 21 to ground. When you operate the key, you will hear the side tone in the head phones. The volume can be adjusted by P4, and isn't dependent on the volume control of the AF stage.
Now check the +10 Volts 'S' voltage, while actuating the morse key. This voltage is switched by T7, where you - again carefully - can measure it at the collector (middle transistor lead). Another measuring point is at DR7 int the following sketch:

Local oscillator

The necessary local oscillator signals for transmission and reception is created with the use of a PLL stabilized oscillator stage directly on the proper frequency. This gives a reduction of harmonics with no need for further filtering.
The stage is almost identical to the one used in the Black Forest transciever. The VCOs of the band modules are based on the T2 MOSFET, to offset the first IF (4915 kHz) to the proper output frequency. The oscillator proper is a Hartley design. D5 stabilizes the amplitude. The signal at R7 goes via the switching diode D6 to the VCO mixer via the cascode coupling of T2, This gives a good isolation of the VCO output from the oscillator resonant circuit.
The tuning diode D4 is coupled so strongly to the VCO circuit at L4-C18, that it gives the VCO range a tuning possibility. Through this measure, an safe phasing is achieved at the VCO stabilizer. The band set oscillator also found on the band module, swings by T1 and Q1 to a frequency some 3915 kHz lower as the shown lower band edge of the VCO. C14 - DR1 blocks overtone crystals from oscillating at their 1. harmonic (at least necessary in the 10 and 12 meter bands). The crystal oscillator signal at R6 is coupled to the band set - XO mixer via the switching diode D3. At IC1 VCO and band set - XO frequencies are mixed.

The mixer output resonant circuit L4-C35 selects the difference frequency and gives a VFO range of 2915-4015 kHz. The amplifying stage T16, which is inductively coupled to L4, serves to amplify the mixer output signal to a level proper for the following 128:1 divider IC6. At the output IC6 a signal close to 31 kHz is available to lead on to the frequency/phase comparator IC7. The second input of IC7 gets another 31 kHz signal from dividing the VFO frequency (3915-4015 kHz) by 128 in IC8. Depending on the direction of the difference between real (output at IC6) and wanted frequency (output at IC8) gives a proportional regulating voltage, which after filtering in the loop filter R57-R58-C55 trims the VCO, so that the two 31 kHz signals are in phase. If the VFO frequency changes, the VCO frequency will change as much. As both VCO and band set XO is changed for every band, the same VFO tuning range will do for all bands.

VFO

The VFO is a Hartley based on JFET T18. D15 is used to stabilize the amplitude. The degree of feed back is chosen, so that the lowes possible power level is achieved, and as little RF heating of the frequency determining parts as possible. The tuning diodes D13-D14 works back to back to reduce the RF amplitude changes to a minimum. The band spread is set up with C67 so, that it in conjunction with L5 it will give a tuning range of about 3915-4015 kHz. The RIT tuning diode is coupled loosely over D16, which can shift the reception frequency +/- 1,5 kHz with respect to the transmitting frequency. The following JFET buffer T17 amplifies the via C63 loosely coupled VFO signal to the level necessary to trigger IC8. At the same time it reduces influence backwards in the oscillator stage. Through R66-D112-C64 the VFO gets a highly stable and noise free supply voltage.

Now mount one of the band module pc boards with the coil and other components necessary for frequency determination. We recommend, that you begin with the 40 meter module.

[ ]	T 1	BFS20	SOT23	[ ]	T 2	BF989	SOT143
[ ]	D 3	BA679S	SOD80	[ ]	D 4	BBY40	SOT23
[ ]	D 5	LL4148	SOD80	[ ]	D 6	BA679S	SOD80

Attention: You will solder a first Xtal now. If you use too much solder it may happen, that solder gets between the Xtal case and the PCB. This will cause a short. To prevent, use the little silicon isolation pads if you can find them in the kit. Due to some problems to get them, some kits will not contain this isolation pads. If so, solder the can with a little distance to the PCB. A good trick is to use a piece of wire (a leg of a resistor will be fine) to keep the distance. Dont forget to remove the distance wire after soldering the Xtals can. This trick is good for all Xtal cans.

[ ] Q 1 Band set crystal 8,000 MHz (for the 40m band)

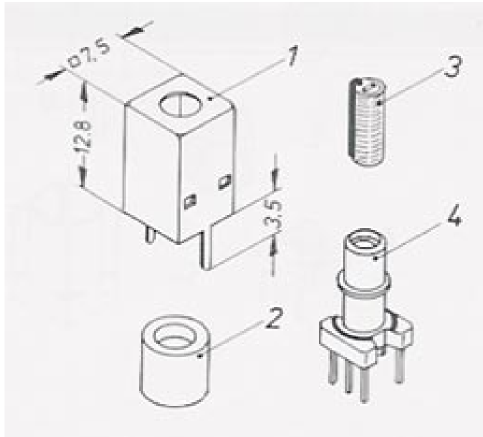
[ ]	R 3	68k	0805	[ ]	R 4	27k	0805
[ ]	R 5	1k	0805	[ ]	R 6	10R	0805
[ ]	R 7	47R	0805	[ ]	R 8	68R	0805
[ ]	R 9	100k	0805	[ ]	R 10	56k	0805
[ ]	R 11	100k	0805	[ ]	R 12	150k	0805
[ ]	C 9	film trimcap 30pF red		[ ]	C 10	33pF	0805
[ ]	C 11	220pF	0805	[ ]	C 12	150pF	0805
[ ]	C 13	entfällt		[ ]	C 14	22nF	0805
[ ]	C 15	22nF	0805	[ ]	C 16	22nF	0805
[ ]	C 17	27pF	0805	[ ]	C 18	68pF	0805
[ ]	C 19	15p	0805	[ ]	C 20	4n7	0805
[ ]	C 21	10nF	0805	[ ]	Dr 1	left out	
[ ]	Dr 2	replaced by 1n5 1206		[ ]	Dr 3	47µH	1210
[ ]	Dr 4	47µH	1210	[ ]	Dr5	47µH	1210
[ ]	connector, 16 pins						

The next will be to wind VCO coil L4. But before proceeding to that, please read the following theory:

Neosid coil kits

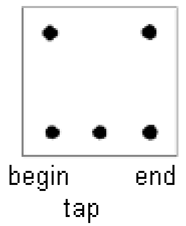
Every coil kit contains basically the coil form with 5 leads, a screen can, a ferrit core and a ferrite cover, also known as a covering core (???). For some coils the covering core is removed, but a core is always used. Further an underlay disc is used. This is used to avoid shorts from the screen can to the pc board. Many users use these discs, others throw them away and insted solders the screen with a little distance to the pc board.

The example is for the standard S7 forms, which will be used in the IF stages. For the band modules we will use Neosid coils instead, as they are a little lower.
The coils are generally wound in the lower chamber, the turns are usually wound in one layer, which means turn lies below turn. On top of means on top of, and not in in an outer layer. Be careful, that the cold end of the coils are connected to the right pin. Which is the cold end of a coil? The cold end is the end of the coil closest to ground. As we are dealing with radio frequencies, the ground connection can be direct or through a capacitor of say some 100 nF. That is equal from an RF stand point, as such a capacitor has nearly no resistance for RF.
If the lower chamber cant hold all of the turns, the rest of the turns should be wound backwards down from the top end of the first layer, as a second layer.
I recommend to look up the correct connections, and not just accept these informations. You only learns from what you do, and maybe the next kit won't have as good a manual as the Tramp manual.



1=screen can
2=covering core
3=core
4=coil form

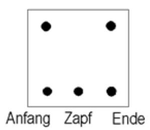
A look at the diagram shows us, that one side of the coil is directly wired to ground. This is the cold end of the primary. Now you have to find the corresponding lead of the coil form.
The picture shows a view of the leads from BELOW. Put the pc board in front of you, so that the free space for L4 is upwards. When you put the coil form in the holes for L4, and looks at it from the bottom of L4, you see something like in the drawing. Now look carefully, which pin goes to which part, and compare to the diagram: The pin at the lower left goes to graoind, that is the cold end, and the beginning of the coil. The lower middle pin goes to R8 and C16, that is the pin for the tap. The lower right pin goes to C17/C18/C19, here goes the end of the coil.
When you have located the pins, you can begin winding the coil. Take the 0,2 mm lacquered copper wire out of the bag, and straighten it by gently pulling it between thumb and index finger. Be careful not to create little bends. Tin some 2 cm of the wire end. Begin by winding from the bottom towards the top of the coil form. Put the first 2-3 turns tightly around the



starting pin. Pull the wire through the notch in the coil form after putting on 4 turns. Now comes the tap. Make a 3 cm loop on the wire, and twist it. This twisted end it put through the notch to the starting pin, where it is put around the pin three times. As close as possible to the bottom plate. Then the next 12 turns are put on top in the same direction as the first 4. Then after the 16. turn put the end of the wire through the notch to the proper pin. Tin the wire end, and put three turns around the starting pin, and cut wire (leave some 3 cms). The coils should now be fixed to the coil form. It is recommended to use a time tried method: drown the coil in bees wax. This can be bought at hobby shops. Now the wire ends can be soldered to the leads. Tin lightly, solder quickly! When the wire ends are fastened, the coil is placed in the correct holes, and solder from the pc board bottom side.
Solder time about 2 seconds per lead. Do not place the screen cans yet, that should only be done on completion of the functional test.

Put the band module aside, and finish the VFO coils and the output transformer of the PLL mixer.

The coil form for the VFO coil L5 is easily recognized, at it is the largest in the kit (type 10). This coil comes with a short trimming core F10b with a violet colour coding (GW3X6), it is the sam type as for the small coils used in the band modules.
The VFO coils is wound in the same way as the previously wound coil of the band module.

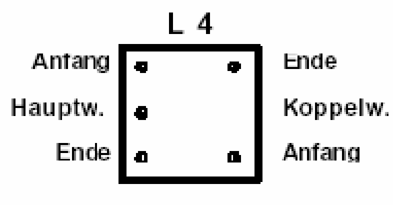


Coil L5 seen from below.

For the VFO coil use the thin 0,1 mm copper wire. The total number of turns are 60, the tap is 15 turns from the cold end, the cold end is at the bottom! Don't forget to treat the finished coil with bees wax.

Now comes the output tranformer of the PLL premixer, L4.
This transformer is as easy to wind as the previously built coils.

Begin by idenfying the proper coil form. It is one of the left ones with a larger height.
The primary has 24 turns of the 0,1 mm copper wire, previously used for the VFO coil. This winding must be placed on the coil form first. The secondary consists of 12 turns, placed on the middle of the primary.
Our building suggestion for this coil looks like this:



Coil form seen from below.

Remember to put the covering core on the coil after fixing the coils with bees wax. Stick the covering cores on with a LITTLE UHU Plus glue (or equivalent).

Now follows the frequency determining components for the main pc board. The following components must be soldered to the main pc board.

[ ]	IC 1	NE 612		[ ]	IC 6	4060	
[ ]	IC 7	4046		[ ]	IC 8	4060	
[ ]	T 16	BFS 20		[ ]	T 17	MMBF 4416	
[ ]	T 18	MMBF 4416		[ ]	D 12	BZV55 6,8	
[ ]	D 13	BBY 40		[ ]	D 14	BBY 40	
[ ]	D 15	LL 4148		[ ]	D 16	BBY 31	
[ ]	R 21	1k8	0805				
[ ]	R 57	47k	Layer resistor on top of board				
[ ]	R 58	4k7	0805	[ ]	R 59	100k 0	805
[ ]	R 60	1k5	0805	[ ]	R 61	1M	0805
[ ]	R 62	1M	0805	[ ]	R 63	1k	0805
[ ]	R 64	470R	0805	[ ]	R 65	100k	0805
[ ]	R 66	390R	0805	[ ]	R 67	100k	0805
[ ]	R 68	68k	0805	[ ]	R 69	68k	0805
[ ]	C 31	1nF	0805	[ ]	C 32	10nF	0805
[ ]	C 33	1nF	0805	[ ]	C 34	47nF	0805
[ ]	C 35	270pF	0805	[ ]	C 55	220nF	Wima 1812
[ ]	C 56	10nF	0805	[ ]	C 57	10nF	0805

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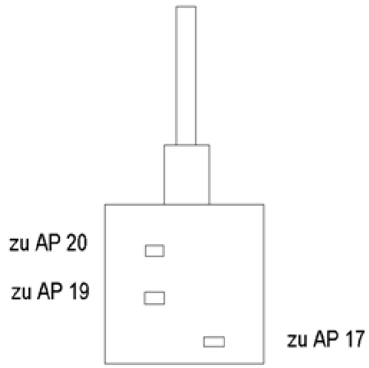
[ ]	C 58	100nF	0805	[ ]	C 59	100nF	0805
[ ]	C 60	100nF	0805	[ ]	C 61	10nF	0805
[ ]	C 62	22nF	0805	[ ]	C 63	6p8	0805
[ ]	C 64	47µF 16V	electrolytic, radial				
[ ]	C 65	22nF	0805				
[ ]	C 66	68pF	0805	[ ]	C 67	150pF	0805
[ ]	C 68	22nF	0805	[ ]	C 69	12pF	0805
[ ]	C 70	22nF	0805				
[ ]	L 4	PLL premixer output transformer					
[ ]	L 5	VFO-coil					
[ ]	16 pole edge connector (pull out surplus pins)						

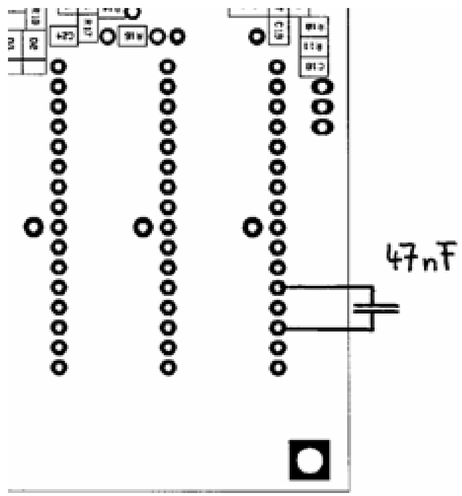
Hook up the potentiometer for the RIT (2k2), and, as it is needed for the test and trimming of the VFO, also the 10 turn trimming potentiometer, which should be hooked up to point 17, 19 and 20.
Here we'll describe a variant of the trimming of the VFO, but more ways are possible. For others, you will need further preparations.
Put the band module on its connector. Hook up the corresponding voltage (point 9...16) sot point 43, to supply voltage to the band module. Put the RIT potentiometer in center position and the 10 turn potentiometer for tuning in its leftmost position.

Now solder a capacitor of 47 nF from the last pin of the band module to ground. This is necessary, as we first with the completion and mounting of all 8 band modules have the massed parallel capacity of the C20's to suffice for the loop filter. The capacitor can be left in place with no resulting problems.

For this tuning variation, you will need an oscilloscope with a sufficing band width (the VCO of the 10 meter module swing at more than 33 MHz), and a frequency counter. When you have prepared this, set the current limiter on the power supply to 100 mA, this is more than enough. Alternatively put in a quick fuse of this value.
Check the pc boad and the band module for solder bridges, and for all components to have all leads soldered.
Switch on the power supply and check the current drawn by the application. This current should be well below 100 mA. If no current is drawn or significantly more, quickly turn off power and locate the error.

No smoke?
Congratulations, let's continue!

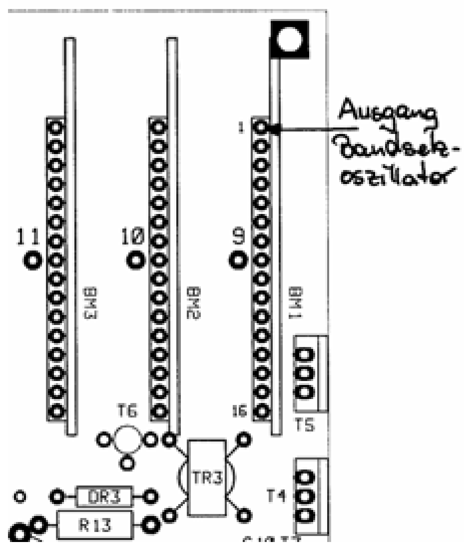


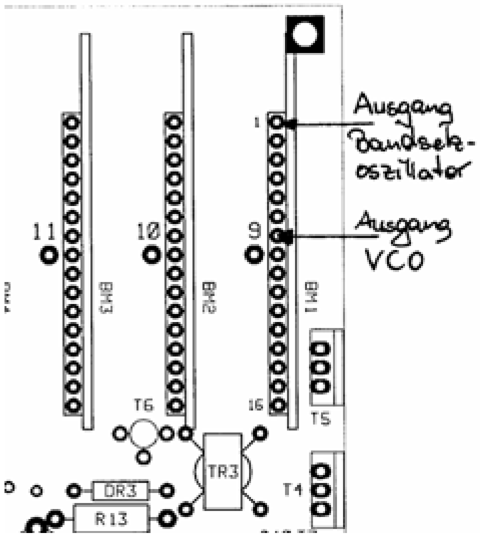


Hook up your oscilloscope to pin 7 of the band module connector and check if the VCO of the band module oscillates at all.

Here the expected voltage is 300 mV p-p, and it should be at least 200 V p-p. The frequency of this signal is not important at present. Cehck the function of the VFO on the main board

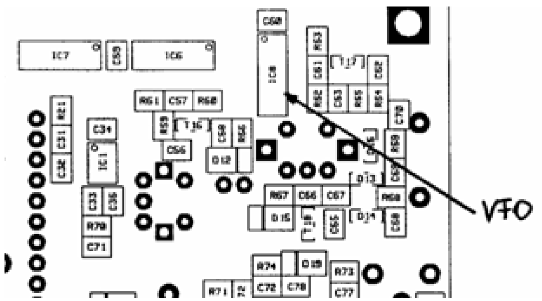
To switch on the switching diode of the band set oscillator, we need to temporarily connect the DC connection. Use a 1,8k resistor from the cathode of D6 to ground. In the finished setup, this resistor is replace by R70/R71/R72 on the main pc board.
Check the next function of the band set oscillator. Connect the probe of the oscilloscope to pin 1 of one of the free band module connector spaces. There you should find a pulsed voltage of som 30..50 mV p-p. Remove the probe of the oscilloscope and hook up your frequency counter in the same place. Trim the band set oscillator to the crystal frequency needed. The necessary change is achieved in trimming C9 on the band module.





with the oscilloscope. At pin 11 of IC((4060), you will find the amplified signal of the VFO, the signal should be sinusoid (somewhat distorted).

When you see this signal, the work with the oscilloscope should be terminated. At the last measuring point, you will now connect your frequency counter. Write down the measured frequency. Turn the tuning potentiometer to the right extreme. Also write down this frequency.
The expected value at left limit is 3915 kHz, at the right limit 4015 kHz. You'll probably not find these values. Therefore you will in the next step trim the range to 100 kHz with P9 on the top of the main pc board, as the frequency as such is unimportant. This is dependent on some details around the tuning potentiometer, but the proper width of the range is important to tune the VFO to the right frequency.
When you have reached a 100 kHz range from extreme left to extreme right on the tuning potentiometer, you will only theed the frequency counter. Turn the tuning potentiometer to the extreme left and tune slowly on the core of L5 (the large coil on the main pc board) til the oscillator runs at 3915 kHz. When turning to the extreme right, you should measure a frequency of 4015 kHz.



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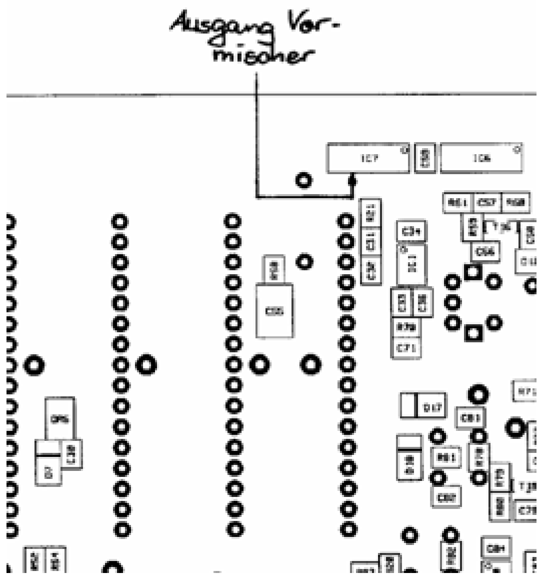
It is done!

Put the tuning potentiometer at about the middle of the band, that is at 5 turns. Locate pin 11 of IC6 (the other 4060) and check the output of the PLL premixer with your oscilloscope.

Depending on the setting of the output transformer, you should find a more or less sinusoid signal there.



Now the VFO can fill its job.
Hook up your multimeter to pin 3 of an empty band module socket. You will find either no voltage or some 10 Volts. Turn slowly and carefully with your tuning tool in the core of L4 of the band module, and notice the reading on the multimeter. The should be a point, where the measured voltage suddenly changes, ideally to some 5 Volts. Leave the multimeter on this test point and turn the tuning potentiometer slowly. The multimeter should now change to the same degree, the potentiometer does. The PLL should follow, and we now have to tune the transformer of the premixer. Set the tuning potentiometer to center position once again and hook ud the oscilloscope to the previously used pin 11 of IC6. Turn slowly and carefully on the core of L4 on the main pc board, till you get a definitive maximum. This is well marked, but not very sharp.

Congratulations!!!

Now the most important section of the Tramp 8 works.
To convince your self of that, connect the frequency count to the output of the VCO (pin 7 in one of the connectors for band modules). When you turn the tuning potentiometer, the VCO frequency should change. The frequency of the VCO is alway higher than the frequency of the band set oscillator.
Example:

Transmitting frequency	7,000 MHz
Band set oscillator	8,000 MHz
VFO	3,915 MHz
VCO	11,915 MHz

Now you are through with the heart of the Tramp 8, the VFO/PLL. Go on to the next section, the IF.

IF Section

In the IF, we use the ‘bedrock” TCA440 (IC5). Even though it is a vintage 25 years, is still has an unbeaten performance. Originally made for AM reception, it contains the following parts:

- AGC regulated input with a 40 dB dynamic range
- doubly balanced mixer with fine large signal behaviour
- oscillator stage
- 3 stage AGC regulated 455 kHz IF amplifier with a 60 dB dynamic range
- AGC derived from IF
- output for a field strength indicator

QRPProject have reserved a larger stock of these, to be able to meet demands for some time.

Via L7-C94 the 4915 kHz IF signal goes to the input of IC5. The integrated oscillator resonates with Q6 on 5368 kHz. The 455 kHz IF signal is filtered by L8-C108 and inductively coupled to the input of the IF amplifier (pin 12). The amplified 455 kHz signal is available over L9-C102. Via C103 the signal is led to the active AGC rectifier at T21. This stage works as a voltage follower and allows a quick rise in AGC at C107. A manually supplied regulating voltage is added to the dynamic AGC voltage at point 32. The input stage and the second IF amplifier are supplied with the AGC voltage in parallel, giving a dynamic range of more than 100 dB! At pin 10 of IC5, we have a DC voltage proportional to the amplitude of the recieved signal, for attachment of a field strength meter. Through P6, the field strength meter can be calibrated (up to 300 microamperes). Via a secondary on L9 1/8 of the IF voltage is coupled into the following product detector for demodulation. The MOSFET T22 works as a multiplikative mixer. The BFO signal enters gate 2 of T22 via C118. The demodulated AF signal is led via R98 to the CW filter. C121 serves as a bypass for any left over 455 kHz signals. The JFET T23 forms a Colpitts oscillator governed by the ceramic resonator Q7. D20 serves to stabilize the amplitude and to clean up the spectral purity of the BFO output signal. P5 and C115 works as an adjustable phasing network, whose variable part makes it possible to pull the 455 kHz resonator some 2 kHz. Experiments with capacitative trimmers gave unhandy values.

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Begin populating the IF section

[ ] IC 5 TCA 440 (A 244) please install only the socket, not yet the IC - this will be done later

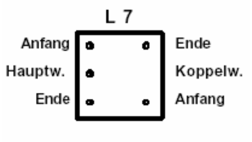
[ ]	IC 11	TL072	S08	[ ]	T 21	BC 846 B	
[ ]	T 22	BF 989		[ ]	T 23	MMBF 4416	
[ ]	T 24	BC 846 B		[ ]	D 20	LL 4148	
[ ]	D 21	LL 4148		[ ]	Q 6	5,3680	
[ ]	Q 7	CSB 455 ceramicResonator					
[ ]	R 85	18k	0805				
[ ]	R 86	8k2	0805	[ ]	R 87	1k8	0805
[ ]	R 88	39R	0805	[ ]	R 89	68k	0805
[ ]	R 90	56k	0805	[ ]	R 91	220R	0805
[ ]	R 92	100k	0805	[ ]	R 93	1k	0805
[ ]	R 94	1k5	0805	[ ]	R 95	27k	0805
[ ]	R 96	220k	0805	[ ]	R 98	1k	0805
[ ]	R 99	120R	R0805	[ ]	R 100	39k	0805
[ ]	R 101	12k	0805	[ ]	R 102	33k	0805
[ ]	R 103	39k	0805	[ ]	R 104	1k2	0805
[ ]	R 105	82k	0805	[ ]	R 106	39k	0805
[ ]	R 107	1k2	0805	[ ]	R 108	82k	0805
[ ]	R 109	10k	0805	[ ]	R 110	10k	0805
[ ]	R 111	120R	0805	[ ]	R 112	15k	0805
[ ]	P 5	2k	Minipot	[ ]	P 6	2k5	PT6-horizontal pot
[ ]	P 7	2k	Minipot	[ ]	P 8	2k	Minipot
[ ]	C 94	220pF	0805	[ ]	C 95	22nF	0805
[ ]	C 96	120pF	0805	[ ]	C 97	120pF	0805
[ ]	C 98	27pF	0805	[ ]	C 99	60pF	Filmtrimmer
[ ]	C 100	100nF	0805	[ ]	C 101	2,2µF	1206 10V Tantal
[ ]	C 102	1800pF	Styroflex 63V				
[ ]	R 88a	2k7	1206 (extra, for mounting parallel to C102)				
[ ]	C 103	10nF	0805	[ ]	C 104	100nF	0805
[ ]	C 105	22nF	0805	[ ]	C 106	47nF	0805
[ ]	C 107	4,7µF	1206 6,3V Tantal				
[ ]	C 108	1800pF	Styroflex 63V				
[ ]	C 109	10nF	0805	[ ]	C 110	100nF	0805
[ ]	C 111	100nF	0805	[ ]	C 112	4,7µF	1206 6,3V Tantal
[ ]	C 113	47nF	0805				
[ ]	C 114	10µF	16V rad. Electrolytic				

[ ]	C 115	100pF 0805	[ ]	C 116	220pF	0805
[ ]	C 117	47nF 0805	[ ]	C 118	100pF	0805
[ ]	C 119	100nF 0805	[ ]	C 121	100nF	0805
[ ]	C 122	100µF 16V rad. Electrolytic				
[ ]	C 123	15nF film 5%				
[ ]	C 124	15nF film5%				
[ ]	C 125	15nF film 5%				
[ ]	C 126	15nF film 5%				
[ ]	C 127	1µF 1206 16V Tantalum				
[ ]	C 128	100µF 16V rad. electrolxtic				
[ ]	C 129	2,2µF 1206 10V tantalum				
[ ]	C 135	100nF 0805				
[ ]	Dr8	470µH SMCC				

L8 and L9 are premade coils for the second IF, - no winding by hand!

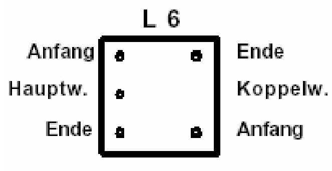
[ ]	L 8	Neosid	BV 00530700
[ ]	L 9	Neosid	BV 00530700

The input coil for the IF IC, L7, is once more a coil to wind yourself. Use the already described method.
Please identify the right coil form. It is a 7 mm form with a larger height, than the ones used for the band modules. The primary has 20 turns of the same 0,1 mm copper wire as used for the VFO coil and for the PLL premixer. This winding must be placed on the form first. Please also remember to place the wire as close to the leads of the form as possible, to reduce the distance between the pc board and the coil body.
The secondary consists of 5 turns of 0,1 mm copper wire. Our building suggestion looks like this:



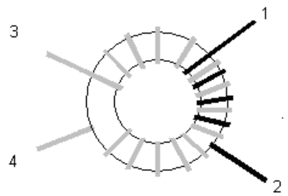
Finishing the receiver part of the main pc board.

We suggest, that you once more begin by making the necessary coils. Begin with the transformer for the receiver mixer, L6. Find the proper coil form: You need a 7 mm form with the large height. Tin the some 2 cm of 0,1 mm lacquered copper wire and wind it about three turns around the post at the lead. Then pull the wire to the upper chamber of the coil form and wind on 20 close turns, beginning from below. Then draw the wire on to the lead, tin it on a proper length and wind it around the lead and solder it to the lead.
The transformer L6 secondary is next. Tin another bit of 0,1 mm copper wire, wind 3 turns on the relevant lead and put 6 turns on the center part of the primary. Then draw the wire to the proper lead, twist it around the lead and solder it in place. Finish by fixing the turns with bees wax, and glue on the covering core. Put an isolating disc under the coil form and solder L6 to the main pc board. PLEASE DO NOT YET SOLDER IN THE SCREEN CAN.
Our building suggestion for L6 on the main board looks like this, Coil seen from below



Now make TR6, the input transformer for the reciever mixer. This transformer is wound on a black FT37-77 toroid. By now you have wound that many coils, that a toroid will pose no problem. Here are our directions:

Cut some 25 cm of 0,2 mm copper wire and tin one end. Take the core in one hand and put the soldered end through it. That is the first turn. Hold on to this wire end and the core and take the other end of the wire in the other hand. Now you have to pull the entire length of the wire through the core. Pull it tight, but take care not to scratch the lacquer on the wire. This was the second turn. You will only need 10 more. Before pulling the next turn through, remember to space the turns on the core instead of placing them close to one another. The drawing gives a clue, but doesn't show the right number of turns.
If you plan properly, you won't have to space the turns afterwards, even thought it is possible to some degree. The turns shouldn't risk cutting.
WInd the rest of the secondary, cut the free end with enough left for soldering to the pc board. I usually mark the secondary by folding back the free ends after winding the coil. Now put on the primary with its 6 turns. Do it in the same way as the secondary, just winding the primary on the existing turns of the secondary.



Example of a secondary on a toroid

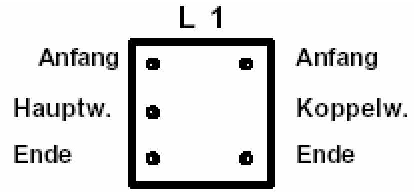
Tin the ends and solder the transformer to the main board. Put in the rest of the parts for the receiver.

[ ]	IC 10	NE612	SO8	[ ]	T 20	MMBF4416	SOT23
[ ]	D 1	LL4148	SOD80	[ ]	D 2	BA679S	SOD80
[ ]	D 3	BA679S	SOD80	[ ]	D 4	LL4148	SOD80
[ ]	D 5	LL4148	SOD80	[ ]	D 6	BZV55 C5,1	SOD80
[ ]	D 7	BZV55 C5,1	SOD80	[ ]	D 8	LL4148	SOD80
[ ]	D 18	BA679S	SOD80				
[ ]	Q 1	4915,2kHz	Filter crystal				
[ ]	Q 2	4915,2kHz	Filter crystal				
[ ]	Q 3	4915,2kHz	Filter crystal				
[ ]	Q 4	4915,2kHz	Filter crystal				
[ ]	R 20	820R 0805					
[ ]	R 22	after measurement, depends on instrument					
[ ]	R 23	330R 0805					
[ ]	R 24	1k2	1206	[ ]	R 70	1k5	0805
[ ]	R 71	180R	0805	[ ]	R 72	39R	0805
[ ]	R 82	220R	0805	[ ]	R 83	100k	0805
[ ]	R 84	1k	0805	[ ]	R 97	820R 0805	
[ ]	P 2	10k	PT6-L	Piher PT 6 horizontal			
[ ]	C 27	47nF	0805	[ ]	C 28	47nF	0805
[ ]	C 29	47nF	0805	[ ]	C 30	47nF	0805
[ ]	C 36	47nF	0805	[ ]	C 71	22nF	0805
[ ]	C 83	1nF	0805	[ ]	C 84	47nF	0805
[ ]	C 85	220pF	0805	[ ]	C 86	15pF	0805
[ ]	C 87	10nF	0805	[ ]	C 88	47nF	0805
[ ]	C 89	220pF	0805	[ ]	C 90	220pF	0805
[ ]	C 91	220pF	0805	[ ]	C 92	220pF	0805
[ ]	C 93	220pF	0805	[ ]	C 120	47nF	0805
[ ]	RL1	Reed-Rel. 12V 1xUm.		[ ]	DR4	100µH	1210
[ ]	DR5	100µH	1210	[ ]	DR6	100µH	1210

Now finish the 40 meter band module. If you chose another band, use the values for that band instead. The manual supposes that you chose 40 meters.

Finishing the 40 meter band module

The resistor, you temporarily soldered to the band module must be removed. Only a few components remain and the coils to wind. Lets begin with these.



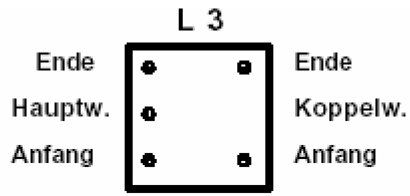
Finish L1 for the chosen band module. Follow the now known method, which we will summarize here. L1 has the hot end downwards. Our building suggestion is found to the right, seen from below. Choose the right coil form. It should be a low 7 mm form, lower than those used on the main board. Finish the primary. Use 0,1 mm copper wire. Tin the first 2 cms of wire, fix it with three turns around the lead and solder it to the lead. Begin winding as close to the bottom of the form as possible. Wind the coil with the proper number of turns and draw the wire to the bottom of the form, twist it around the lead and solder it in.

I do know, that it is a little boring to read the same instructions over and over, but it is exactly as important as boring. There isn't much room in the Tramp, and a few mm means the difference between placing all of the band modules or not.

The secondary should once more begin by tinning the wire and twisting it around the lead post. Use 0,1 mm copper wire, and begin above the top of the primary. Check the number of turns in the table for the proper band module.

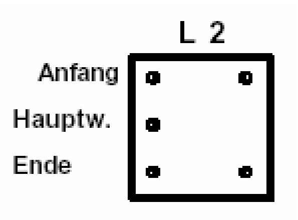
Draw the wire down to the lead after winding the proper number of turns, twist the wire 3 times around the lead post and solder it in. The secondary is NOT a second layer on the primary, but wound above the primary but in the same chamber of the form.

You have remembered to secure the turns with bees wax and glueing the covering core, right? Solder the coil to the band module. Why so much haste? Well: L1 has the same number of turns, but the leads have a different orientation. **That is why you shouldn't mix up the two coils!**



Finish L3. It has the same number of turns as the previous coil, follow the above description, but do check the building suggestion and solder the leads in the proper orientation. After finishing it, you should solder the coil on to the band module board.

Now only L2 is left. This is the simplest coil with only one turn.
OK, you know by now: tin 2 cm of wire, twist around the right lead and solder. draw the wire to the body of the form and put on the proper number of turns for the band module. Pull the wire downwards, twist it around the lead and solder it in.

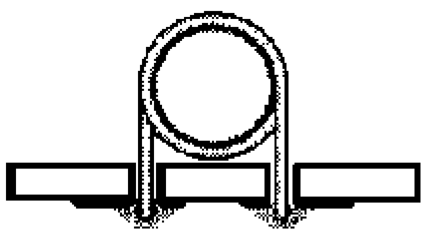


Put on the bees wax and glue in the covering core. Now put in the trimming core and the screen can. Solder L2 to the band module board. Our building suggestion looks as this, coil seen from below

This done, you only need to put in a few components and the band module is finished.

[ ]	D 1	BA679S			[ ]	D 2	BA679S	
[ ]	R 1	820R	0805		[ ]	R 2	830R 0805	
[ ]	C 1	150pF	0805		[ ]	C 2	150pF	0805
[ ]	C 3	150pF	0805		[ ]	C 4	3,9pF	0805
[ ]	C 5	3,9 pF	0805		[ ]	C 6	22nF	0805
[ ]	C 7	22nF	0805		[ ]	C 8	22nF	0805
[ ]	Dr 5	47uH	1210					

Completion of the receiver input low pass filter



Begin once more by making the needed coils. The coils of the output filter L1 to L3 all have the same value. Cut some 30 cm of 1 mm lacquered copper wire and tin one end. Take a standard drill with a diameter of 7 mm and begin by winding the wire around the body of the drill, turn by turn. Make a coil of 9, 5 turns.

Advice: the half turn is made, if you wind as shown in the drawing. If the coils are wound properly, they will be orthogonal to one another, when soldered in.
Cut the other end of the coil to a proper length and tin it. Repeat these steps for coils L2 and L3.
Fine, the receiver section is done, and you deserve a pause.

PAUSE!!!
Trimming the receiver

The IF is tuned first. For this you will need an IF signal. Lucky, those who own a grid dip meter or a measurement transmitter. A SW station, usable outside the amateur bands could be used. If you haven’t got any of these available, you could build a crystal oscillator or the QRPProject Simple Signal Generator. The crystal oscillator should be used as a measurement transmitter with an IF crystal, and with a 7030 kHz crystal as measurement transmitter for the input.

To test the IF chain, you will screw in the core of L7 and put the covering core over the coil. The covering core mus lie on the upper chamber top, and the core screwed in so far as level with the coil.

[ ] Hook up the IF amplifier, RIT and AF volume potentiometers according to the placement diagram
[ ] Hook up the 10 turn potentiometer for frequency tuning to pin 17, 19 and 20.
[ ] Put the 40 meter band module in the correct connector, as in the PLL test. (This is the connector, you temporarily fixed with a switching volta-ge):

Hook up your measurement transmitter (or crystal tester) over a link coil to L7. A link coil consists of two twisted wires, forming a loop at the end. The loop becomes the coil, the other end connects to the generator. In this way you can couple an IF signal directly to the IF chain. The crystal tester will of course need a crystal, or the generator to be tuned, for the IF frequency of som 4,913 MHz. In the crystal oscillator, the crystal should be loaded by 110 pF, to pull it to the filter center frequency.
Connect a moving coil instrument between the S meter output at pin 44 and ground.
A digital multimeter will work, but changes are more difficult to see than with a moving coil instrument.
Connect a pair of head phones between points 7 and 8.
Connect a power supply and let the Tramp heat for some 5 minutes.
At the meter you should be able to read out a voltage in the 3 Volt range.
Adjust the IF amplification potentiometer to the side, that gives a maximal

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signal. Tune L7, L8 and L9 to maximum read out at the measuring instrument.
Remove the link and change the crystal in the tester to the 7,030 MHz crystal (or tune generator to near 7,030 MHz). Feed signal to the Tramp antenna jack.
Search for the signal with the main tuning potentiometer and adjust the potentiometer so, that the measuring instrument is at a maximum. Don't focus on the frequency of the AF signal. Here it is only trimmed for maximum loudness, as the Tramp has a true AGC.
If the measured signal at the S meter is too large to find a precise maximum, the signal from the generator has to be reduced. If the signal is too weak, try to trim the three band filter coils in the band module to a maximum signal.

Now you will trim L6, L7 and L8 interchanging to a maximum read out at the measuring instrumetn. Keep checking, that the main tuning potentiometer really is at the center frequency of the signal, that is, at maximum read out.
When you think, that all circuits are at at maximum, concentrate on the tone in the head phones. Tune this with P5 to the most pleasant for you. Valid values lie between 700 and 800 Hz. If you have no idea, how this should sound, please compare it to a tone generator. On the CD of the kit, you will find a sinus generator for the sound card of a PC.
If you are not able to tune the proper tone (variation in resonator Q7), try putting in a ceramic capacitor of some 30-80 pF parallel to Q7, till the tone is close to the ideal. The BFO frequency end up the AF frequency on either side of the second IF!! Once more carefully check, that the recieved signal is exactly on the center frequency of the filter. Set P5 for the definitive BFO, and tune L6, L7 and L8 to resonance (maximum voltage at pin 44).
To optimize the integrated AF filter, you should next adjust the centre frequency of the filter with P7 and P8 to maximum volume in the head phones.
Now the input circuits of the band module must be cleaned up. They are broad enough for all three to be adjusted to a maximum instrument read out at 7,030 MHz.
Success? Good! Then an important part of the reciever is done. When connecting an antenna instead of the generator to the antenna jack, you should hear many ham radio stations in the 40 meter band.
Maybe this is a good chance for another pause. Listen a little to the band, though and enjoy the reception quality of your Tramp.
When you have listened enough, remove the supply power and all external potentiometers, to be able to build the transmitter.

We start with circuit descriptions:

Description of the transmitter:

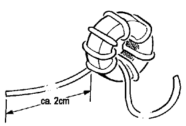
The transmitting frequency is made by mixing the actual local oscillator output with a 4.915 MHz carrier. The difference is the actual transmitting frequency. IC9 works as a doubly balanced mixer with an integrated 4,915 carrier oscillator. Through C73 the carrier is adjustable to the center frequency of the Cohn filter. C72 supplies the local oscillator signal, damped by R71-R72. The symmetric output of IC9 works into a 2:1 balun TR5. The following MOSFET T19 amplifies the mixer output by some 6 dB. A voltage supplied to one of the sources of T19 gives a transmitter output regulation. The keying of the transmitter is achieved through breaking the drain voltage of T19. The amplified mixer signal goes via TR5 to the electronic T/R switch D17-D18. When transmitting D17 is conducting and puts the mixer signal on the preselector bus. The chosen preselector will now work as a highly selective transmitter pre-filtering. All unwanted mixer products will be heavily attenuated. The selected transmitter signal will be carried on to the T/R switch at D2-D3. D2 is now conducting and puts the transmitting signal on the input at the broad band amplifier T6. The stage amplification is set to some 18 dB with R14. The stabilization of the working point is done with R15. By a dynamic current feed back in class A amplification, only very small unlinearities are introduced in the amplified output signal. The transformer TR3 in the collector of T6 serves to transform the output resistance of T6 to the input resistance of the following 2 stage power amplifier. The diagram for this stage is largely the DL_QRP_PA by DL2AVH with very small modifications:

_ The PA quiet current is adjustable by P1, and independent of the board voltage.
_ in the output stage we use the cheaper 2SC1969 transistor, which even in the 10 meter band will give an output of some 7 Watt.
_ to augment the efficiency the output tranformer TR2 is supplied with a larger core (double hole core BN43_202).

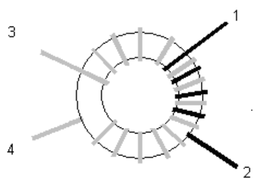
After the transmitter output transformer TR2 follows a 3 stage low pass filter with a cut off frequency of 33 MHz, which lowers spuriouses in the BC and TV band by more than 60 dB. If the transmitter is adjusted to a nominal output of 5 Watss, its linearity is so godd, that a band selective output filter is unnecessary. The level of the band harmonics are at least -35 dBc and can be reduced further by the use of an antenna tuner (which in fact is needed with broad band transistor output stages). D8 works as a measuring rectifier for the relative output meter. To avoid uncontrolled resonance in the completed transmitter output, the isolation between the transmitter output and the electronic T/R switch diode D3 be at least 70 dB during transmission. Experiments with different electronic switches showed trouble based on the high RF voltages (up to 60 Volts p-p). As the switch isn’t allowed to carry any RF current (only active by reception), the choice felle on a small Reed relay, which by making a short possible, fills the demands. The activation time of the relay is some 0,5 ms, the life expectancy some 10 million activations. Due to the small activated mass, the ticking is nearly imperceptible. The entire T/R switch is QSK enabled.

Building the transmitter.

The next part will be building the output transformer of T19, TR5. This transformer will be wound on an FT37-77 toroid, as the reciever mixer, TR6. The plan for this is simple: Cut some 25 cm of 0,2 mm copper wirer and tin one end. Take the core in your hand, and put the tinned end through the core. Hold on to this end and the core, and grip the other end of the wire with the other hand. Pull the entire wire through the core and put on the 12 turns of the primary. Remember, once more, that the turns are to be distributed over the core.



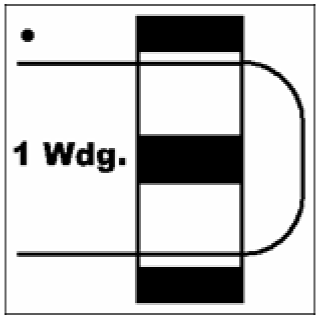
Turns shouldn’t cross. Cut the superfluous wire, but not to short, and tin the end. This completes the primary. Mark the connections, so they won’t be mixed up on soldering it to the main pc board.
Now put the 6 turns of the secondary on in the usual way. The secondary should be centered over the primary.
Solder the transformer to the main board.
Now the last toroid coil. The output transformer for the transmitter mixer, TR4. Once again follow the procedure described above, but remember that the primary should have 20 turns of 0,2 mm copper wire, and the secondary 10 turns of 0,2 mm copper wire.



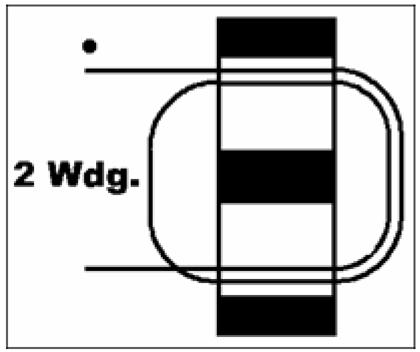
Then make the RFD DR1. You will need a toroid FT37_77 and some 30 cm 0,5 mm lacquered copper wire. Tin the end and wind 12 turns, not too loosely on the toroid.
The next components to complete are the broad band transformers TR1 and TR3. They are identical, repeat the stages in creating a transformer. These transformers are wound on double hole cores, pig noses.

First TR1

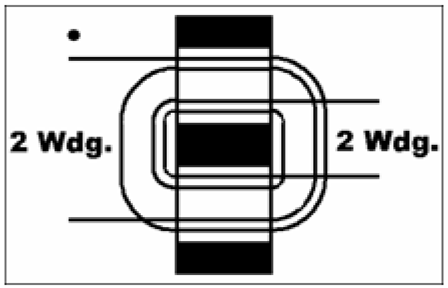
Put the pig nose in front of you, so that both holes point from left to right, and mark the left side by nail laquer or other colorant. This marking is important to avoid mixing up primary and secondary. TR1 has 4 primary turns and 2 secondary. Like in most other transformer diagrams, you will find a small point. The point shows the beginning of the winding (as for coils).
Cut a 14 cm piece of 0,2 mm wire and feed it through the pig nose as shown in the picture. A turn is completed, when the wire has passed both holes. Wind two turns: through the upper hole down and through the lower. Dont pull the wire too hard over the edges, as the lacquer is scratched quite easily. If you haven’t made any mistakes, you will find two wires protruding from the marked side.

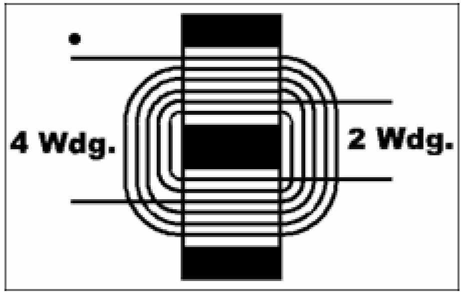


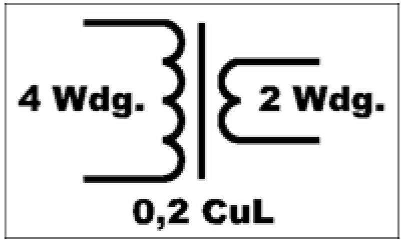
On top a short, at the bottom a longer wire. (I hope that you accept the detailed explanation. But the transformers carry the most heavy load of errors. And I have to fill in the space, to make the text fit the next picture ;-)).



Cut a piece of wire, some 6 cm long and feed this through the the pig nose twice to form another two turns. Now you have a tranformer with 2:2 turns. In the next



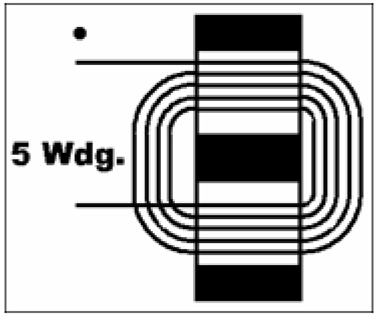




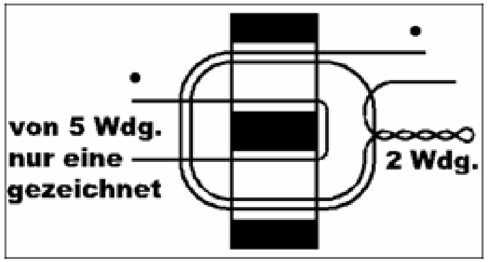
bit, you will take the end of the wire and put in another two turns on the pig nose. That gives 4 turns left with the beginning on top and two turns right. On the right, it is unimportant which wire is start or end, as the secondary is mostly symmetrical. Now you have to solder in the transformer. Put the pc board in front of you with the VFO block left and bottom. Put the transformer in place, as marked on the board, with the primary coil pointing left. Order the wires as shown on the board. The beginning of the fourth turn, top left, goes to the collector of T4, the rest will fit clockwise. Cut the wires, tin them and solder in the transformer. This is easiest, if the wires are long enough to pull them from the bottom of the pc board to fix the transformer properly to the board.

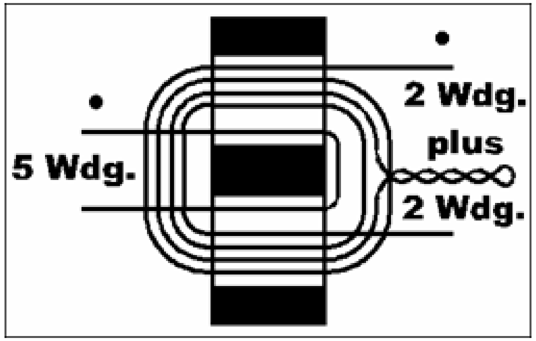
Now TR2

TR2 isn't much more difficult, but it needs a little more wire through the holes. Please be careful to avoid scraping the wires over the edges of the



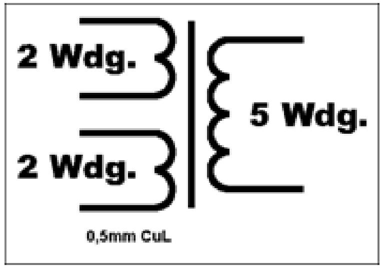
core. The TR2 primary has 2 x 2 turns and the secondary 5 turns. Cut a piece of 0,5 mm wire som 25 cm long. Begin left top and put on 5 turns. This means from left top to right top, through the lower hole, for a total of 5 turns. Naturally the the wires should be placed tighter than shown in the drawing. Be careful pulling the wires through the pig nose, - the lacquer is severed easily. Now comes the first part of the primary. Take another 15 cm piece of wire and begin exactly opposite to the beginning of the secondary. Put one turn from right to left top, then left to right bottom. Now the trick: Make a loop som 30 mm long and twist this back through the pig nose. This should look like the





drawing above. Now continue with the free end in the same direction. Top right to left, bottom left to right. This completes the second turn. The transformer should now look like the sketch below.

You will see to wires left and 3 right (when counting the twisted wire loop as a wire end). Tin all 5 ends and solder the transformer onto the pc board. Check that each wire end corresponds to the marking on the pc board.



That's that!

This done, here are the rest of the transmitter stage components.

[ ]	IC 9	NE612	SO8	[ ]	T 1	2SC1969	TO220
[ ]	T 2	2SC1969	TO220	[ ]	T 3	BD202	TO220
[ ]	T 4	2SC1971	TO220	[ ]	T 5	BD202	TO220
[ ]	T 6	BFR96(S)	SOT37	[ ]	T 19	BF990	SOT143
[ ]	D 10	LL4148	SOD80	[ ]	D 17	BA679S	SOD80
[ ]	D 19	BZV55 C6,8	SOD80	[ ]	Q 5	4915,2 kHz	
[ ]	R 1	1R	1206	[ ]	R 2	1R	1206
[ ]	R 3	1R	1206	[ ]	R 4	1R	1206
[ ]	R 5	10R	0805	[ ]	R 6	10R	0805
[ ]	R 7	5,6R	1206	[ ]	R 8	4,7R	1206
[ ]	R 9	1R	0805	[ ]	R 10	4,7R	0805
[ ]	R 11	68R	080	[ ]	R 12	820R 1206	abgl.
[ ]	R 13	270R 1Watt Metal layer		[ ]	R 14	4,7R	0805
[ ]	R 15	4,7R	0805	[ ]	R 16	3k9	0805
[ ]	R 17	560R	0805	[ ]	R 18	82R	0805

[ ]	R 19	680R	0805		[ ]	R 73	22k	0805	
[ ]	R 74	390R	0805		[ ]	R 76	39R	0805	
[ ]	R 77	56R	0805		[ ]	R 79	150k	0805	
[ ]	R 80	100k	0805		[ ]	R 81	820R 0805		
[ ]	P 1	100R	0,5W Cermet		[ ]	C 1	100pF	1206	
[ ]	C 2	100pF	1206		[ ]	C 3	100pF	1206	
[ ]	C 4	100pF	1206		[ ]	C 5	100pF	1206	
[ ]	C 6	100pF	1206		[ ]	C 7	47nF	1206	
[ ]	C 8	47nF	1206		[ ]	C 9	47nF	0805	
[ ]	C 10	47µF	16V rad. Elko		[ ]	C 11	470nF	1812	Wima
[ ]	C 12	100µF	16V rad. Elko		[ ]	C 13	47nF	1206	
[ ]	C 14	47nF	1206		[ ]	C 15	470nF	1812	Wima
[ ]	C 16	22µF	16V rad. Elko		[ ]	C 17	2200pF	0805	
[ ]	C 18	47nF	0805		[ ]	C 19	47nF	0805	
[ ]	C 20	47nF	0805		[ ]	C 21	47nF	0805	
[ ]	C 22	470nF	1812 Wima		[ ]	C 23	47nF	0805	
[ ]	C 24	47nF	0805		[ ]	C 25	47nF	0805	
[ ]	C 26	47nF	0805		[ ]	C 40	47nF	0805	
[ ]	C 41	47nF	0805		[ ]	C 72	1nF	0805	
[ ]	C 74	1nF	0805		[ ]	C 75	10nF	0805	
[ ]	C 76	220pF	0805		[ ]	C 77	220pF	0805	
[ ]	C 78	47nF	0805		[ ]	C 79	22nF	0805	
[ ]	C 80	47nF	0805		[ ]	C 81	22nF	0805	
[ ]	C 82	47nF	0805		[ ]	DR 2	47µH	SMCC	
[ ]	DR 3	47µH	SMCC		[ ]	DR 7	47µH	1210	

[ ] Unnamed modification: 1000 microF is connected from pin 43 to ground (to avoid microsecond-long power outage during first letter sent)

allready installed::

L 1	air coil	
L 2	air coil	
L 3	air coil	
TR 1	double hole core	
TR 2	BN43_202	
TR 3	double hole core	
TR 4	FT37_77	
TR 5	FT37_77	
DR1	FT37_77	12 turns 0,5 mm copper wire

Winding data for the Tramp band module for 10 meters

VCO coil L4:
Neosid filter kit 7K
13 turns 0,2 mm copper wire, tap at 3 Turns from cold end
cold end below
Covering core + adjustment core F40
Preselector coil L1=L3:
Neosid filter kit 7K
Primary 13 turns 0,2 mm copper wire, cold end above
Secondary 2 turns 0,2 mm copper wire above primary
Covering core + adjustment core F40
Preselector coil L2:
Neosid filter kit 7K
13 turns 0,2 mm copper wire, cold end above
Covering core + adjustment core F40

Winding data for the Tramp band module for 12 meters

VCO coil L4:
Neosid filter kit 7K
13 turns 0,2 mm copper wire, tap at 3 turns from cold end
cold end below
Covering core + adjustment core F40
Preselector coil L1=L3:
Neosid filter kit 7K
Primary 13 turns 0,2 mm copper wire, cold end above
Secondary 2 turns 0,2 mm copper wire above primary
Covering core + adjustment core F40
Preselector coil L2:
Neosid filter kit 7K
13 turns 0,2mm copper wire, cold end above
Covering core + adjustment core F40

Winding data for the Tramp band module for 15 meters

VCO coil L4:
Neosid filter kit 7K
14 turns 0,2 mm copper wire, tap at 3 turns from cold end
cold end below
Covering core + adjustment core F40

Preselector coil L1=L3:
Neosid filter kit 7K
Primary 14 turns 0,2 mm copper wire, cold end above
Secondary 2 turns 0,2 mm copper wire above primary
Covering core + adjustment core F40
Preselector coil L2:
Neosid filter kit 7K
14 turns 0,2 mm copper wire, cold end above
Covering core + adjustment core F40

Winding data for the Tramp band module for 17 meters

VCO coil L4:
Neosid filter kit 7K
14 turns 0,2 mm copper wire, tap at 3 turns from cold end
cold end below
Covering core + adjustment core F40
Preselector coil L1=L3:
Neosid filter kit 7K
Primary 14 turns 0,2 mm copper wire, cold end above
Secondary 2 turns 0,2 mm copper wire above primary
Covering core + adjustment core F40
Preselector coil L2:
Neosid filter kit 7K
14 turns 0,2mm copper wire, cold end above
Covering core + adjustment core F40

Winding data for the Tramp band module for 20 meters

VCO coil L4:
Neosid filter kit 7K
16 turns 0,2 mm copper wire, tap at 4 turns from cold end
cold end below
Covering core + adjustment core F40
Preselector coil L1=L3:
Neosid filter kit 7K
Primary 16 turns 0,2 mm copper wire, cold end above
Secondary 2 turns 0,2 mm copper wire above primary
Covering core + adjustment core F40
Preselector coil L2:
Neosid filter kit 7K
16 turns 0,2 mm copper wire, cold end above
Covering core + adjustment core F40

Winding data for the Tramp band module for 30 meters

VCO_Coil L4:
Neosid filter kit 7K
16 turns 0,2 mm copper wire, tap at 4 turns from cold end
cold end below
Covering core + adjustment core F40
Preselector coil L1=L3:
Neosid filter kit 7K
Primary 16 turns 0,2 mm copper wire, cold end above
Secondary 2 turns 0,2 mm copper wire above primary
Covering core + adjustment core F10b
Preselector coil L2:
Neosid filter kit 7K
16 turns 0,2 mm copper wire, cold end above
Covering core + adjustment core F10b

Winding data for the Tramp band module for 40 meters

VCO coil L4:
Neosid filter kit 7K
16 turns 0,2 mm copper wire, tap at 4 turns from cold end
cold end below
Covering core + adjustment core F10b
Preselector coil L1=L3:
Neosid filter kit 7K
Primary 20 turns 0,1 mm copper wire, cold end above
Secondary 2 turns 0,1 mm copper wire above primary
Covering core + adjustment core F10b
Preselector coil L2:
Neosid filter kit 7K
20 turns 0,1 mm copper wire, cold end above
Covering core + adjustment core F10b

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Winding data for the Tramp band module for 80 meters

VCO_Coil L4:
Neosid filter kit 7K
21 turns 0,1 mm copper wire, tap at 5 turns from cold end
cold end below
Covering core + adjustment core F10b

Preselector coil L1=L3:
Neosid filter kit 7K
Primary 28 turns 0,1 mm copper wire, cold end above
Secondary 4 turns 0,1 mm copper wire above primary
Covering core + adjustment core F2

Preselector coil L2:
Neosid filter kit 7K
28 turns 0,1 mm copper wire, cold end above
Covering core + adjustment core F2

Winding data for the Tramp main board

VFO coil L5:
Neosid filter kit 10
60 turns 0,1 mm copper wire, tap at 15 turns from cold end
coil on coil, cold end below!
Cover coils completely with bees wax
Adjustment core F10b GW3X6

PLL premixer coil L4:
Neosid filter kit 7S
Primary 24 turns 0,1 mm copper wire
Secondary 12 turns 0,1 mm copper wire on center of primary
Covering core + adjustment core F2

Output coil, receiver mixer L6:
Neosid filter kit 7S
Primary 20 turns. 0,1 mm copper wire
Secondary 6 turns. 0,1 mm copper wire centered on primary
Covering core + adjustment core F10b

Input for IF IC, L7:
Neosid filter kit 7S
Primary 20 turns 0,1 mm copper wire
Secondary 5 turns 0,1 mm copper wire centered on primary
Covering core + adjustment core F10b

Input transformer for receiver mixer TR6
Amidon tororid FT37_77
Primary: 6 turns. 0,2 mm copper wire (to D18)
Secondary: 12 Turns 0,2 mm copper wire (to IC10)
Distribute turns over the entire core

Output transformer of T19 (TR5):
Amidon toroid FT37_77
Primary: 12 turns 0,2 mm copper wire (from T19)
Secondary: 6 turns 0,2 mm copper wire (to D17)
Distribute turns over the entire core

Output transformer, transmitter mixer, TR4:
Amidon toroid FT37_77
Primary: 20 turns 0,2 mm copper wire (from IC9)
Secondary: 10 turns 0,2 mm copper wire (to R76)
Distribute turns over the entire core

Transmitter output filter L1=L2=L3:
9,5 turns unsupported 1 mm copper wire coil on coil, inner diameter 7mm

Broad band transformers TR1 = TR3
Double hole core DL_QRP_PA
Primary (to collector T6, resp. T4): 4 turns 0,2 mm copper wire
Secondary: 2 turns 0,3 mm copper wire

Transmitter output transformer TR2
Double hole core BN 43_202
Primary: 2 X 2 turns 0,5 mm copper wire
Secondary: 5 turns 0,5 mm copper wire

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Partlist Tramp Mainboard

Semiconductors

T1 2SC1969
T2 2SC1969
T3 BD202
T4 2SC1971
T5 BD202
T6 BFR96(S)
T7 BD436
T8 BD436
T9 BC846B SOT23
T10 BC846B SOT23
T11 BC846B SOT23
T12 BC846B SOT23
T13 BC846B SOT23
T14 BC846B SOT23
T15 BC846B SOT23
T16 BFS20 SOT23
T17 MMBF4416 SOT23
T18 MMBF4416 SOT23
T19 BF990 SOT143
T20 MMBF4416 SOT23
T21 BC846B SOT23
T22 BF989 SOT143
T23 MMBF4416 SOT23
T24 BC846B SOT23
D1 LL4148 SOD80
D2 BA679S SOD80
D3 BA679S SOD80
D4 LL4148 SOD80
D5 LL4148 SOD80
D6 BZV55 C5,1 SOD80
D7 BZV55 C5,1 SOD80
D8 LL4148 SOD80
D9 1N5402
D10 LL4148 SOD80
D11 LL4148 SOD80
D12 BZV55 C6,8 SOD80
D13 BBY40 SOT23
D14 BBY40 SOT23
D15 LL4148 SOD80
D16 BBY31 SOT23
D17 BA679S SOD80
D18 BA679S SOD80
D19 BZV55 C6,8 SOD80
D20 LL4148 SOD80
D21 LL4148 SOD80
IC1 NE612 SO8
IC2 LT1086CT TO220
IC3 4093 SO14
IC4 LM386 DIL8
IC5 TCA440 DIL16
IC6 4060 SO16
IC7 4046 SO16
IC8 4060 SO16
IC9 NE612 SO8
IC10 NE612 SO8
IC11 TL072 SO8
IC12 78L06 TO92
IC13 78L08 TO92

Mainboard Resistors

R1 1R 1206/MELF 0204
R3 1R 1206/MELF 0204
R4 1R 1206/MELF 0204
R5 10R 0805
R6 10R 0805
R7 5,6R 1206/MELF 020
R8 4,7R 1206/MELF 020
R9 1R 0805
R10 4,7R 0805
R11 68R 0805
R12 820R abgl.1206
R13 270R/1Watt Metalls
R14 4,7R 0805
R15 4,7R 0805
R16 3,9K 0805
R17 560R 0805
R18 82R 0805
R19 680R 0805
R20 820R 0805
R21 1,8K 0805
R21 R 1206/MELF 0204
R22 je nach Messwerk
R23 330R 0805
R24 1,2K 1206
R25 120R 0805R46 entfällt
R26 820R 1206
R27 12K 0805
R28 12K 0805
R29 820R 0805
R30 10K 0805
R31 10K 0805
R32 10K 0805
R33 6,8K 0805
R34 5,6K 0805
R35 39R 0805
R36 18K 0805
R37 33K 0805
R38 56R 0805
R39 22K 0805
R40 100K 0805
R41 22K 0805
R42 12K 0805
R43 3R 1206/MELF 020
R44 82K 0805
R45 optional
R47 4,7R 1206/MELF 020
R48 22K 0805
R49 12K 0805
R50 27K 0805
R51 56R 0805
R52 4,7K 0805
R53 4,7K 0805
R54 8,2K 0805
R55 12K 0805
R56 12K 0805
R57 47K
R58 4,7K 0805
R59 100K 0805
R60 1,5K 0805
R61 1M 0805
R62 1M 0805
R63 1K 0805
R64 470R 0805
R65 100K 0805
R66 390R 0805
R67 100K 0805
R68 68K 0805
R69 68K 0805
R70 1,5K 0805
R71 180R 0805
R72 39R 0805
R73 22K 0805
R74 390R 0805
R75 entfällt
R76 39R 0805
R77 56R 0805
R78 entfällt
R79 150K 0805
R80 100K 0805
R81 820R 0805
R82 220R 0805
R83 100K 0805
R84 1K 0805
R85 18K 0805
R86 8,2K 0805
R87 1,8K 0805
R88 39R 0805
R89 68K 0805
R90 56K 0805
R91 220R 0805

Revision: 2.Mai 03

R92	100K 0805
R93	1K 0805
R94	1,5K 0805
R95	27K 0805
R96	220K 0805
R97	820R 0805
R98	1K 0805
R99	120R 0805
R100	39K 0805
R101	12K 0805
R102	33K 0805
R103	39K 0805
R104	1,2K 0805
R105	82K 0805
R106	39K 0805
R107	1,2K 0805
R108	82K 0805
R109	10K 0805
R110	10K 0805
R111	120R 0805
R112	15K 0805
R113	390R 0805
R114	1K 1206
R115	1,5K 0805
R116	1K 1206

Mainboard Kondensatoren

C1	100pF 1206
C2	100pF 1206
C3	100pF 1206
C4	100pF 1206
C5	100pF 1206
C6	100pF 1206
C7	47nF 1206
C8	47nF 1206
C9	47nF 0805
C10	47µF 16V rad.
C11	470nF/40V/Wima 181
C12	100µF/16V rad.
C13	47nF 1206
C14	47nF 1206
C15	470nF/40V/Wima 181
C16	22µF/16V rad.
C17	2200pF 0805
C18	47nF 0805
C19	47nF 0805
C20	47nF 0805
C21	47nF 0805
C22	470nF/40V/Wima 181
C23	47nF 0805
C24	47nF 0805
C25	47nF 0805
C26	47nF 0805
C27	47nF 0805
C28	47nF 0805
C29	47nF 0805
C30	47nF 0805
C31	1nF 0805
C32	10nF 0805
C33	1nF 0805
C34	47nF 0805
C35	270pF 0805
C36	47nF 0805
C37	470µF 16V rad.
C38	6,8µF 16V Tantalpe
C39	6,8µF 16V Tantalpe
C40	47nF 0805
C41	47nF 0805
C42	6,8µF 16V Tantalpe
C43	10nF 0805
C44	220nF Wima 1812
C45	22nF 0805
C46	33nF 0805
C47	100µF 16V rad.
C48	100µF 16V rad.
C49	100nF 0805
C50	entfällt
C51	10µF 16V rad.
C52	47nF 0805
C53	1nF 0805
C54	1µF 16V Tantal Gr.
C55	220nF Wima 1812
C56	10nF 0805
C57	10nF 0805
C58	100nF 0805
C59	100nF 0805
C60	100nF 0805
C61	10nF 0805
C62	22nF 0805
C63	6,8pF 0805
C64	47µF 16V rad.
C65	22nF 0805
C66	68pF 0805
C67	150pF 0805
C68	22nF 0805
C69	12pF 0805
C70	22nF 0805
C71	22nF 0805
C72	1nF 0805
C73	entfällt
C74	1nF 0805
C75	10nF 0805
C76	220pF 0805
C77	220pF 0805
C78	47nF 0805
C79	22nF 0805
C80	47nF 0805
C81	22nF 0805
C82	47nF 0805
C83	1nF 0805
C84	47nF 0805
C85	220pF 0805
C86	15pF 0805
C87	10nF 0805
C88	47nF 0805
C89	220pF 0805
C90	220pF 0805
C91	220pF 0805
C92	220pF 0805
C93	220pF 0805
C94	220pF 0805
C95	22nF 0805
C96	120pF 0805
C97	120pF 0805
C98	27pF 0805
C99	60pF Folientrimmer
C100	100nF 0805
C101	2,2µF 10V Tantal G
C102	1800pF Styroflex 6
C103	10nF 0805
C104	100nF 0805
C105	22nF 0805
C106	47nF 0805
C107	4,7µF 6,3V Tantal
C108	1800pF Styroflex 6
C109	10nF 0805
C110	100nF 0805
C111	100nF 0805
C112	4,7µF 6,3V Tantal
C113	47nF 0805
C114	10µF 16V rad.
C115	100pF 0805
C116	220pF 0805
C117	47nF 0805
C118	100pF 0805
C119	100nF 0805
C120	47nF 0805
C121	100nF 0805
C122	100µF 16V rad.
C123	15nF Folie 5%
C124	15nF Folie 5%
C125	15nF Folie 5%

C126 15nF Folie 5%
C127 1µF 16V Tantal Gr.
C128 100µF 16V rad.
C129 2,2µF 10V Tantal G
C130 1µF 16V Tantal Gr.
C131 1µF 16V Tantal Gr.
C132 1µF 16V Tantal Gr.
C133 1µF 16V Tantal Gr.
C134 10µF 16V Tantal-Pe
C135 100nF 0805

Mainboard Quarze

Q1 4915,2KHz/32pF
Q2 dto.
Q3 dto.
Q4 dto.
Q5 4915,2KHz
Q6 5,3680MHz 30pF
Q7 Resonator CSB455

Mainboard potentometer

P1 100R/0,5Watt/Cerme
P2 10K Piher PT6 lieg
P3 100K PT6 liegend
P4 250R PT6 liegend
P5 2K Conrad 424390-2
P6 2,5K PT6-L
P7 2K Conrad 424390-2
P8 2K Conrad 424390-2
P9 5K Spindeltrimmer

Mainboard Inductivities

L6 coil kit 7.1S
L7 coil kit 7.1S
F1 fuse 2,5A mtr
L8 Neosid BV 00530700
R88A 2k7 1206
L9 Neosid BV 00530700

TR1 doublehole core QRP-PA
TR2 doubloe hole core BN43-2
TR3 double hole core QRP-PA
TR4 FT37-77
TR5 FT37-77
TR6 FT37-77
DR1 FT37-77 12 turns 0,5mm
DR2 47µH SMCC
DR3 47µH SMCC
DR4 100µH 1210
DR5 100µH 1210
DR6 100µH 1210
DR7 47µH 1210
DR8 470µH SMCC
L1 airwound coil
L2 airwound coil
L3 airwound coil
L4 coil kit7.1S
L5 coil kit 10

Mainboard misc.

RL1 Reed-Rel.12V 1XUm
BM1 connector 16hole
BM2 as above
BM3 as above
BM4 as above
BM5 as above
BM6 as above
BM7 as above
BM8 as above

partlist low pass filter kit(option)

C1 470pF COG 1206
C2 560pF COG 1206
C3 560pF COG 1206
C4 560pF COG 1206
C5 560pF COG 1206
C6 470pF COG 1206
C7 270pF COG 1206
C8 560pF COG 1206
C9 560pF COG 1206
C10 270pF COG 1206
C11 120pF COG 1206
C12 270pF COG 1206
C13 270pF COG 1206
C14 120pF COG 1206
C15-C19 22nF 0805
Rel1-Rel7 MEDER SIL1
D1-D11 LL4148 SOD80
Dr1 47µH 1210
Dr2 22µH 1210
Dr3 10µH 1210
Dr4 10µH 1210
L1=L3 25 turns T37-2
L2 27 turns T37-2
L4=L6 19 turns T37-6
L5 20 turns T37-6
L7=L9 13 turns T37-6
L8 15 turns T37-6

parts 10m Bandmodul

C1 33pF 0805
C2 33pF 0805
C3 33pF 0805
C4 1,5pF 0805
C5 1.5pF 0805
C6 10nF 0805
C7 10nF 0805
C8 10nF 0805
C9 film Trimcap 30pF 5mm rot
C10 47pF 0805
C11 150pF 0805
C12 100pF 0805
C13 1nF 0805
C14 10nF 0805
C15 10nF 0805
C16 10nF 0805
C17 10pF 0805
C18 15pF 0805
C19 3,3pF 0805
C20 4,7nF 0805
C21 10nF 0805
DR1 2,2uH 1210
DR2 entfällt
DR3 10µH 1210
DR4 10µH 1210
DR5 10µH 1210
L1 coil kit 7.1K
L2 coil kit 7.1K
L3 coil kit 7.1K
L4 coil kit 7.1K
Q1 29,0MHz 30pF crystall
R1 820R 0805
R2 820R 0805
R3 68K 0805
R4 27K 0805
R5 1,5K 0805
R6 10R 0805
R7 68R 0805
R8 68R 0805
R9 100K 0805
R10 56K 0805
R11 100K 0805
R12 150K 0805
D1 BA679S SOD80
D2 BA679S SOD80
D3 BA679S SOD80
D5 LL4148 SOD80
D6 BA679S SOD80
ST1 connector 16pin
T1 BFS20 SOT23
D4 BBY31 SOT23
T2 BF989 SOT143

Teile 12m Bandmodul

C1 39pF 0805
C2 39pF 0805
C3 39pF 0805
C4 1,5 pF 0805
C5 1,5 pF 0805
C6 10nF 0805
C7 10nF 0805
C8 10nF 0805
C9 film trimcap 30pF 5mm
C10 47pF 0805
C11 150pF 0805
C12 100pF 0805
C13 1nF 0805
C14 10nF 0805
C15 10nF 0805
C16 10nF 0805
C17 12pF 0805
C18 18pF 0805
C19 4,7pF 0805
C20 4,7nF 0805
C21 10nF 0805
R1 820R 0805
R2 820R 0805
R3 68K 0805
R4 27K 0805
R5 1,2K 0805
R6 10R 0805
R7 68R 0805
R8 68R 0805
R9 100K 0805
R10 56K 0805
R11 100K 0805
R12 150K 0805
D1 BA679S SOD80
D2 BA679S SOD80
D3 BA679S SOD80
D4 BBY31 SOT23
D5 LL4148 SOD80
D6 BA679S SOD80
L1 coil kit 7.1K
L2 coil kit 7.1K
L3 coil kit 7.1K
L4 coil kit 7.1K
Q1 25,890MHz 30pF
DR1 2,2uH 1210
DR2 unused
DR3 10µH 1210
DR4 10µH 1210
DR5 10µH 1210
T1 BFS20 SOT23
T2 BF989 SOT143
ST1 connector 16pin

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Teile 15m Bandmodul

C1 56pF 0805
C2 56pF 0805
C3 56pF 0805
C4 1,8pF 0805
C5 1,8pF 0805
C6 10nF 0805
C7 10nF 0805
C8 10nF 0805
C9 Fol.Trimm 30pF 5mm
C10 47pF 0805
C11 150pF 0805
C12 100pF 0805
C13 entfällt
C14 10nF 0805
C15 10nF 0805
C16 10nF 0805
C17 15pF 0805
C18 22pF 0805
C19 6,8pF 0805
C20 4,7nF 0805
R1 820R 0805
R2 820R 0805
R3 68K 0805
R4 27K 0805
R5 1,5K 0805
R6 10R 0805
R7 47R 0805
R8 68R 0805
R9 100K 0805
R10 56K 0805
R11 100K 0805
C21 10nF 0805
R12 150K 0805
Q1 22,000MHz 32pF
L1 coil kit 7.1K
L2 coil kit 7.1K
L3 coil kit 7.1K
L4 coil kit 7.1K
D1 BA679S SOD80
D2 BA679S SOD80
D3 BA679S SOD80
D4 BBY31 SOT23
D5 LL4148 SOD80
D6 BA679S SOD80
DR1 unused
DR2 unused
DR3 10µH 1210
DR4 10µH 1210
DR5 10µH 1210
ST1 connector 16pin
T1 BFS20 SOT23
T2 BF989 SOT143

Teile 17m Bandmodul

C1 68pF 0805
C2 68pF 0805
C3 68pF 0805
C4 2,2pF 0805
C5 2,2pF 0805
C6 10nF 0805
C7 10nF 0805
C8 10nF 0805
C9 film trimcap 30pF 5mm
C10 33pF 0805
C11 220pF 0805
C12 150pF 0805
C13 unused
C14 10nF 0805
C15 10nF 0805
C16 10nF 0805
C17 18pF 0805
C18 27pF 0805
C19 8,2pF 0805
C20 4,7nF 0805
C21 10nF 0805
R1 820R 0805
R2 820R 0805
R3 68K 0805
R4 27K 0805
R5 1,5K 0805
R6 10R 0805
R7 47R 0805
R8 68R 0805
R9 100K 0805
R10 56K 0805
R11 100K 0805
R12 150K 0805
D1 BA679S SOD80
D2 BA679S SOD80
D3 BA679S SOD80
D4 BBY31 SOT23
D5 LL4148 SOD80
D6 BA679S SOD80
L1 coil kit 7.1K
L2 coil kit 7.1K
L3 coil kit 7.1K
L4 coil kit 7.1K

Q1 19,068MHz 30pF
DR1 unused
DR2 unused
DR3 22µH 1210
DR4 22µH 1210
DR5 22µH 1210
T1 BFS20 SOT23
T2 BF989 SOT143
ST1 connector 16pin

parts 20m bandmodul

C1 82pF 0805
C2 82pF 0805
C3 82pF 0805
C4 2,7 pF 0805
C5 2,7 pF 0805
C6 10nF 0805
C7 10nF 0805
C8 10nF 0805
C9 Fol.Trimm 30pF 5mm
C10 33pF 0805
C11 220pF 0805
C12 150pF 0805
C13 unused
C14 10nF 0805
C15 10nF 0805
C16 10nF 0805
C17 22pF 0805
C18 39pF 0805
C19 8,2pF 0805
C20 4,7nF 0805
C21 10nF 0805
R1 820R 0805
R2 820R 0805
R3 68K 0805
R4 27K 0805
R5 1,5K 0805
R6 10R 0805
R7 47R 0805
R8 68R 0805
R9 100K 0805
R10 56K 0805
R11 100K 0805
R12 150K 0805
D1 BA679S SOD80
D2 BA679S SOD80
D3 BA679S SOD80
D4 BBY40 SOT23
D5 LL4148 SOD80
D6 BA679S SOD80
L1 coil kit 7.1K
L2 coil kit 7.1K
L3 coil kit 7.1K
L4 Filterbausatz 7.1K
Q1 15,000MHz 32pF
DR1 unused
DR2 unused
DR3 22µH 1210
DR4 22µH 1210
DR5 22µH 1210
T1 BFS20 SOT23
T2 BF989 SOT143
ST1 connector 16pin

parts 30m bandmodul

C1 120pF 0805
C2 120pF 0805
C3 120pF 0805
C4 3,9 pF 0805
C5 3,9 pF 0805
C6 22nF 0805
C7 22nF 0805
C8 22nF 0805
C9 filmtrimcap 30pF 5mm rot
C10 33pF 0805
C11 220pF 0805
C12 150pF 0805
C13 unused
C14 22nF 0805
C15 22nF 0805
C16 22nF 0805
C17 27pF 0805
C18 56pF 0805
C19 12pF 0805
C20 4,7nF 0805
C21 10nF 0805
R1 820R 0805
R2 820R 0805
R3 68K 0805
R4 27K 0805
R5 1,8K 0805
R6 10R 0805
R7 47R 0805
R8 68R 0805
R9 100K 0805
R10 56K 0805
R11 100K 0805
R12 150K 0805
D1 BA679S SOD80
D2 BA679S SOD80
D3 BA679S SOD80
D4 BBY40 SOT23
D5 LL4148 SOD80
D6 BA679S SOD80
L1 Filterbausatz 7.1K
L2 Filterbausatz 7.1K
L3 Filterbausatz 7.1K
L4 Filterbausatz 7.1K
Q1 11,1MHz 30pF
DR1 unused
DR2 unused
DR3 47uH 1210
DR4 47µH 1210
DR5 47uH 1210
T1 BFS20 SOT23
T2 BF989 SOT143
ST1 connector 16pin

parts 40m Bandmodul

C1 150pF 0805
C2 150pF 0805
C3 150pF 0805
C4 3,9pF 0805
C5 3,9 pF 0805
C6 22nF 0805
C7 22nF 0805
C8 22nF 0805
C9 film trimcap 30pF 5mm
C10 33pF 0805
C11 220pF 0805
C12 150pF 0805
C13 unused
C14 22nF 0805
C15 22nF 0805
C16 22nF 0805
C17 27pF 0805
C18 68pF 0805
Q1 8,000MHz 32pF
C19 15pF 0805
C20 4,7nF 0805
C21 10nF 0805
R1 820R 0805
R2 820R 0805
R3 68K 0805
R4 27K 0805
R5 1K 0805
R6 10R 0805
R7 47R 0805
R8 68R 0805
R9 100K 0805
R10 56K 0805
R11 100K 0805

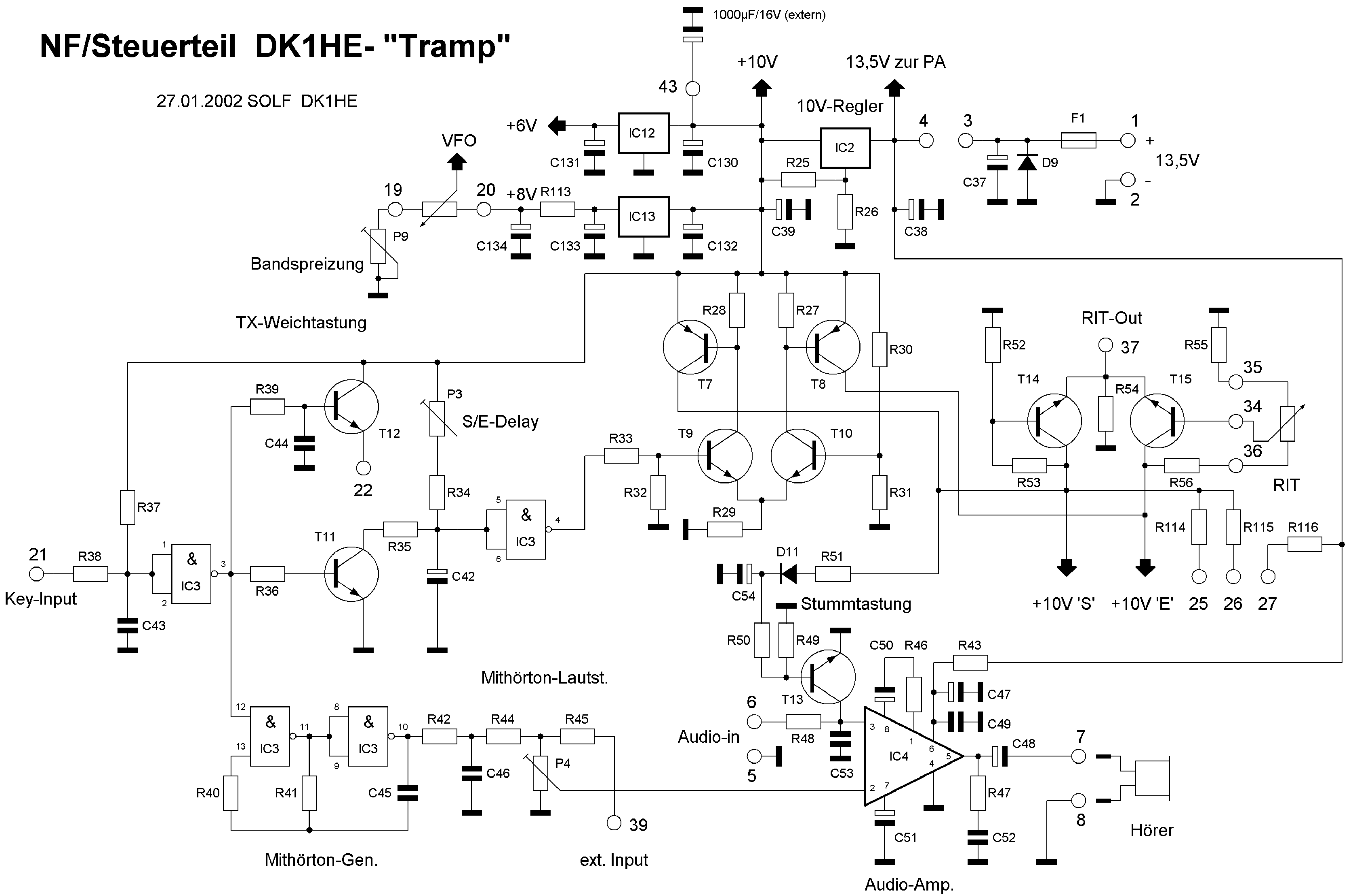
R12	150K 0805
DR1	unused
DR2	replaced by 1,5nF 1206
DR3	47µH 1210
DR4	47µH 1210
DR5	47µH 1210
L1	coil kit 7.1K
L2	coil kit 7.1K
L3	coil kit 7.1K
L4	coil kit 7.1K
D1	BA679S SOD80
D2	BA679S SOD80
D3	BA679S SOD80
D4	BBY40 SOT23
D5	LL4148 SOD80
D6	BA679S SOD80
T1	BFS20 SOT23
T2	BF989 SOT143
ST1	connector 16pin

parts 80m bandmodul

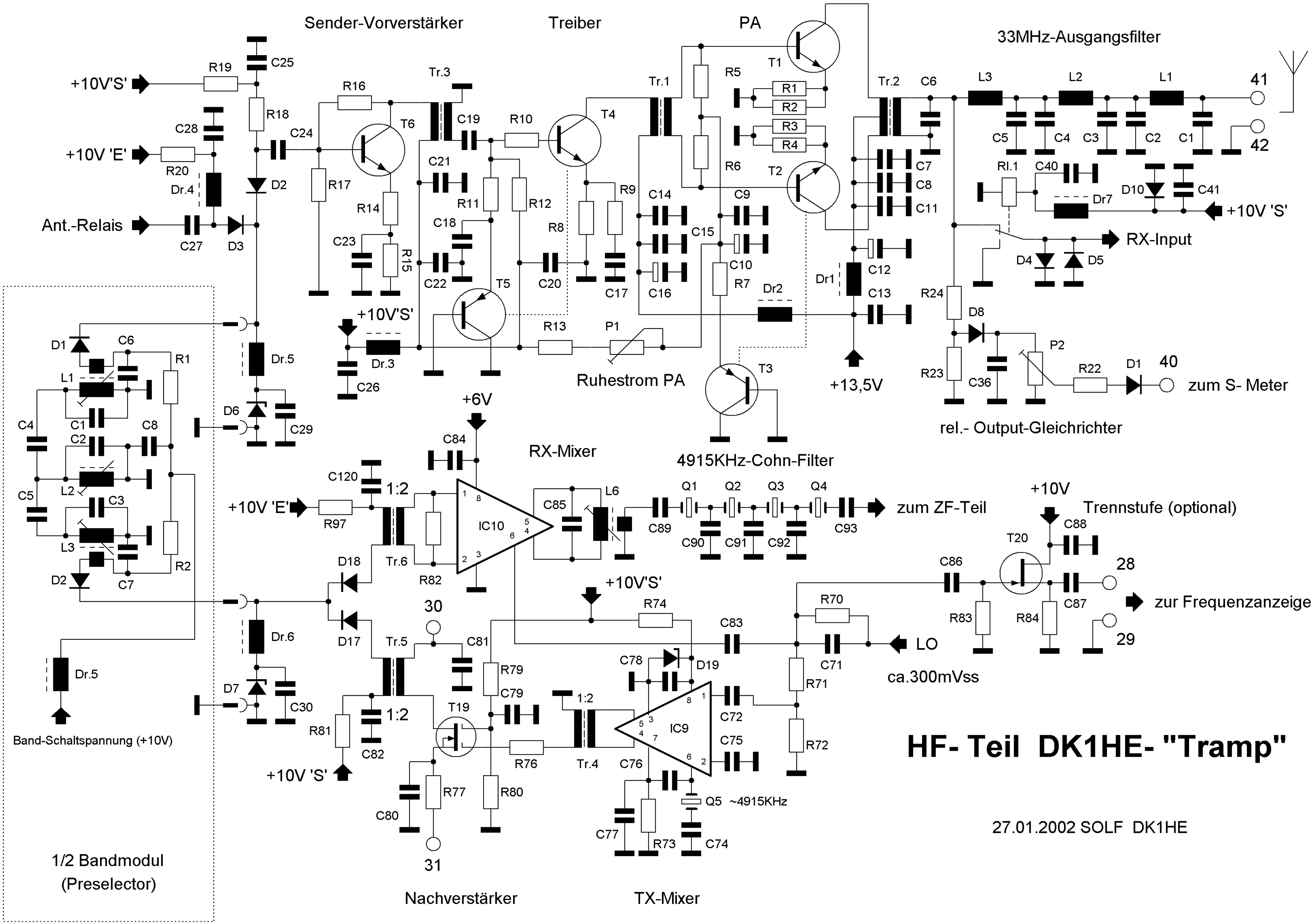
C1	330pF 0805
C2	330pF 0805
C3	330pF 0805
C4	10 pF 0805
C5	10 pF 0805
C6	47nF 0805
C7	47nF 0805
C8	47nF 0805
C9	film trimcao 30pF 5mm
C10	33pF 0805
C11	220pF 0805
C12	150pF 0805
C13	entfällt
C14	47nF 0805
C15	47nF 0805
C16	47nF 0805
C17	33pF 0805
C18	82pF 0805
C19	27pF 0805
C20	4,7nF 0805
C21	22nF 0805
R1	820R 0805
R2	820R 0805
R3	68K 0805
R4	27K 0805
R5	3,3K 0805
R6	10R 0805
R7	47R 0805
R8	68R 0805
R9	100K 0805
R10	56K 0805
R11	100K 0805
R12	150K 0805
Q1	4,50MHz 30pF
DR1	entfällt
DR2	entfällt
DR3	47µH 1210
DR4	47µH 1210
DR5	47µH 1210
L1	coil kit 7.1K
L2	coil kit 7.1K
L3	coil kit 7.1K
L4	coil kit 7.1K
D1	BA679S SOD80
D2	BA679S SOD80
D3	BA679S SOD80
D4	BBY40 SOT23
D5	LL4148 SOD80
D6	BA679S SOD80
T1	BFS20 SOT23
T2	BF989 SOT143
ST1	connector 16pin

NF/Steuerteil DK1HE- "Tramp"

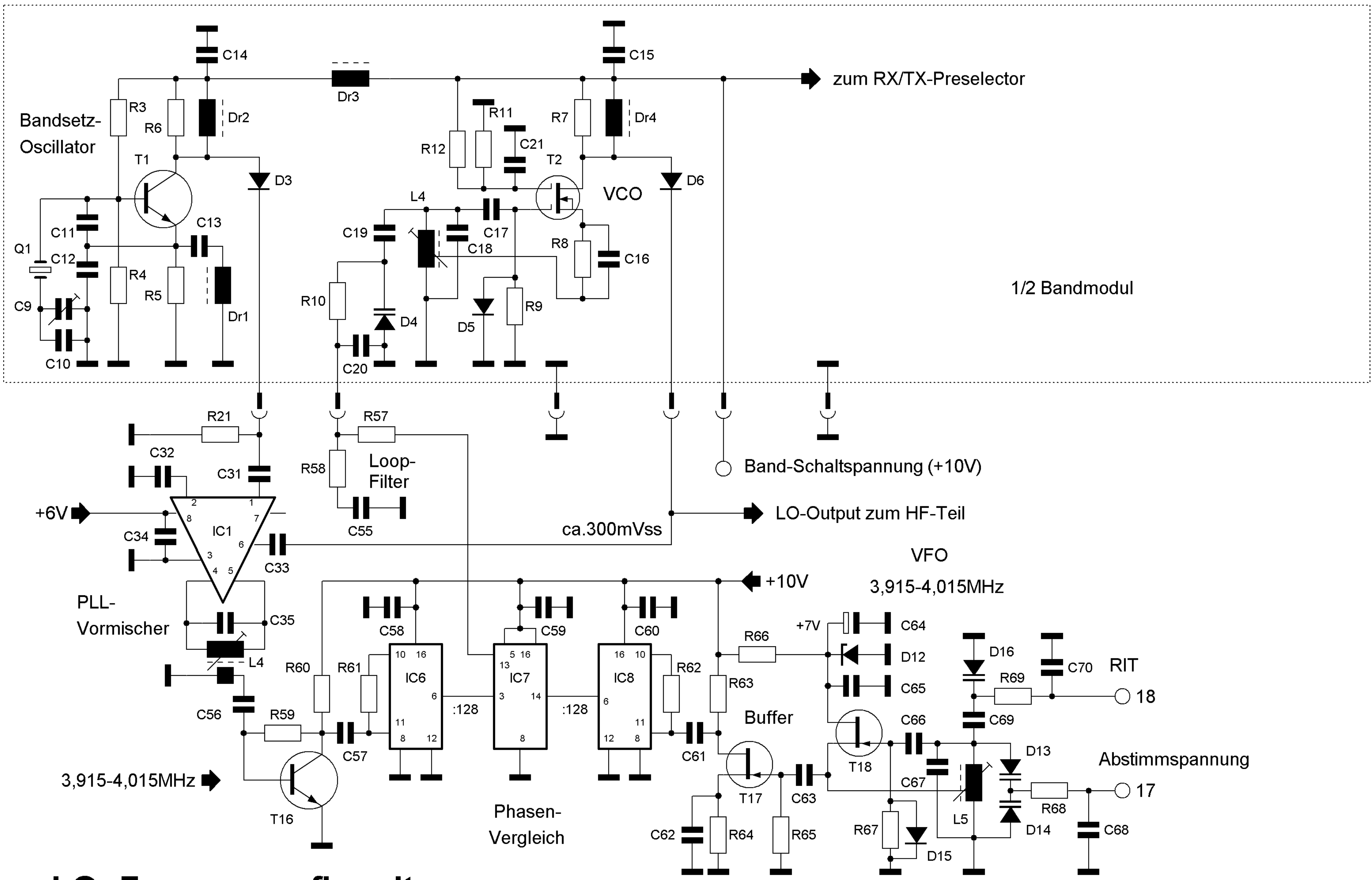
27.01.2002 SOLF DK1HE



Revision: 2.Mai 03



Revision: 2.Mai 03

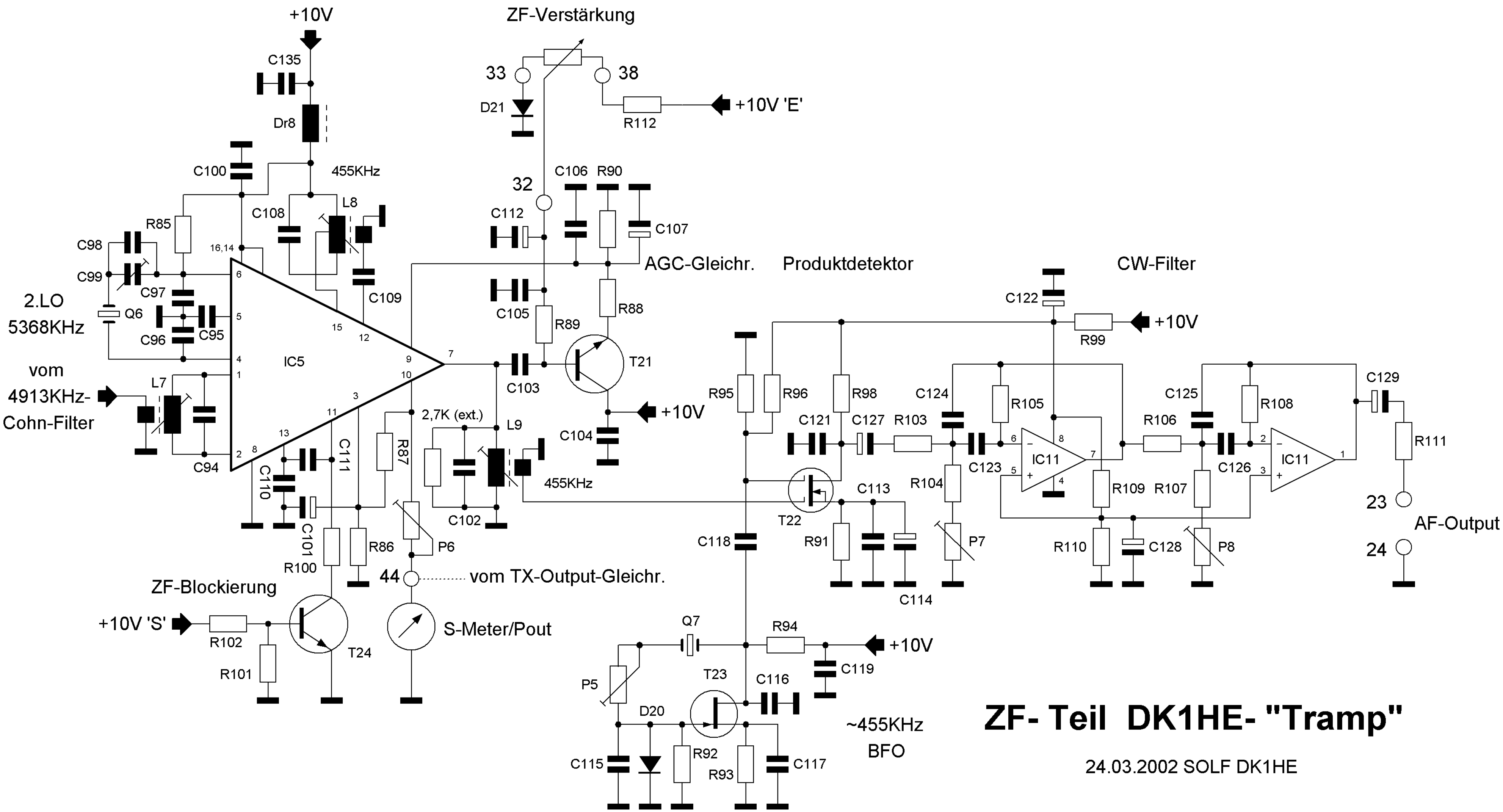


LO- Frequenzaufbereitung

DK1HE- "Tramp"

2.10.2001 SOLF DK1HE

Revision: 2.Mai 03

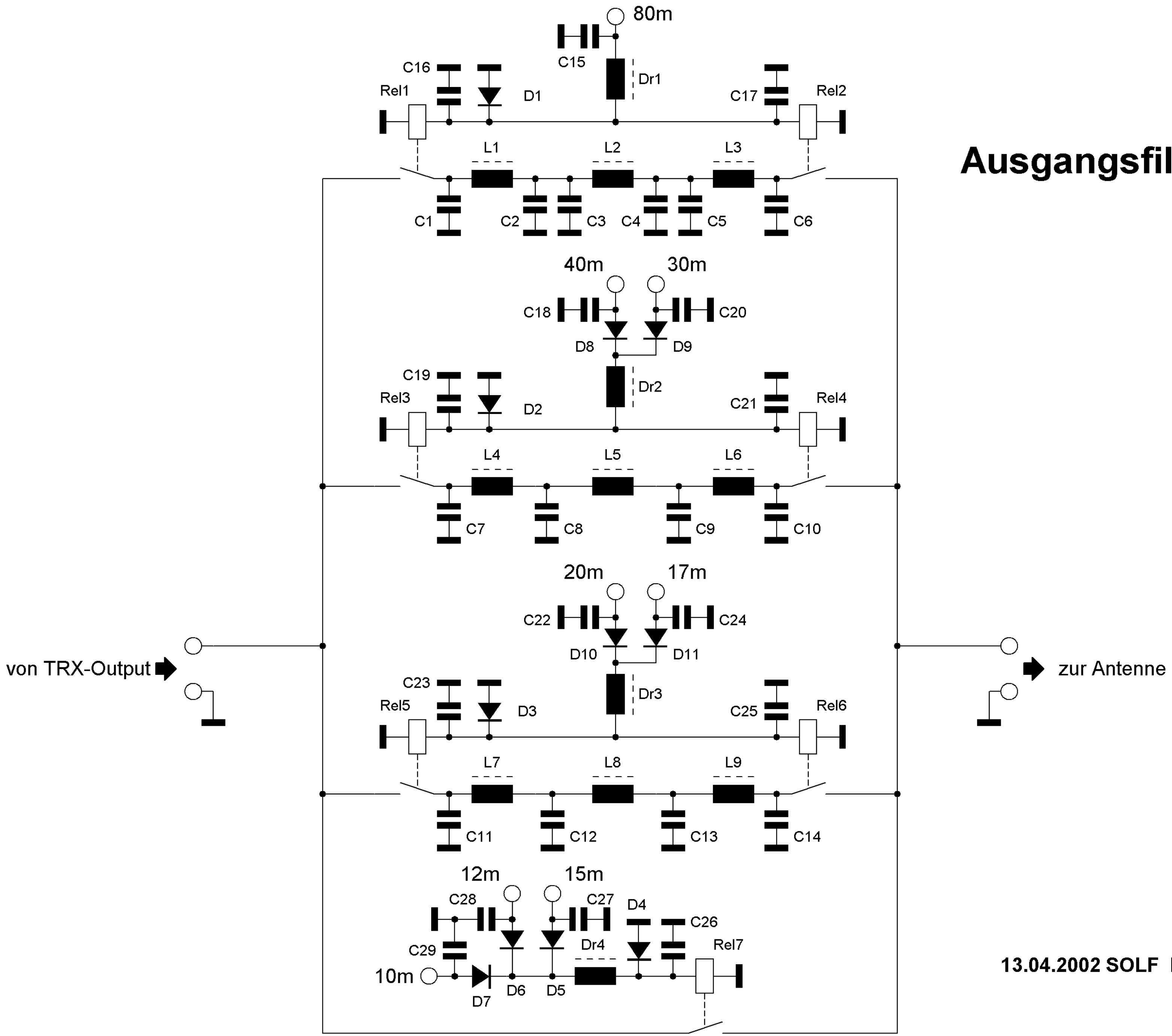


ZF- Teil DK1HE- "Tramp"

24.03.2002 SOLF DK1HE

Revision: 2.Mai 03

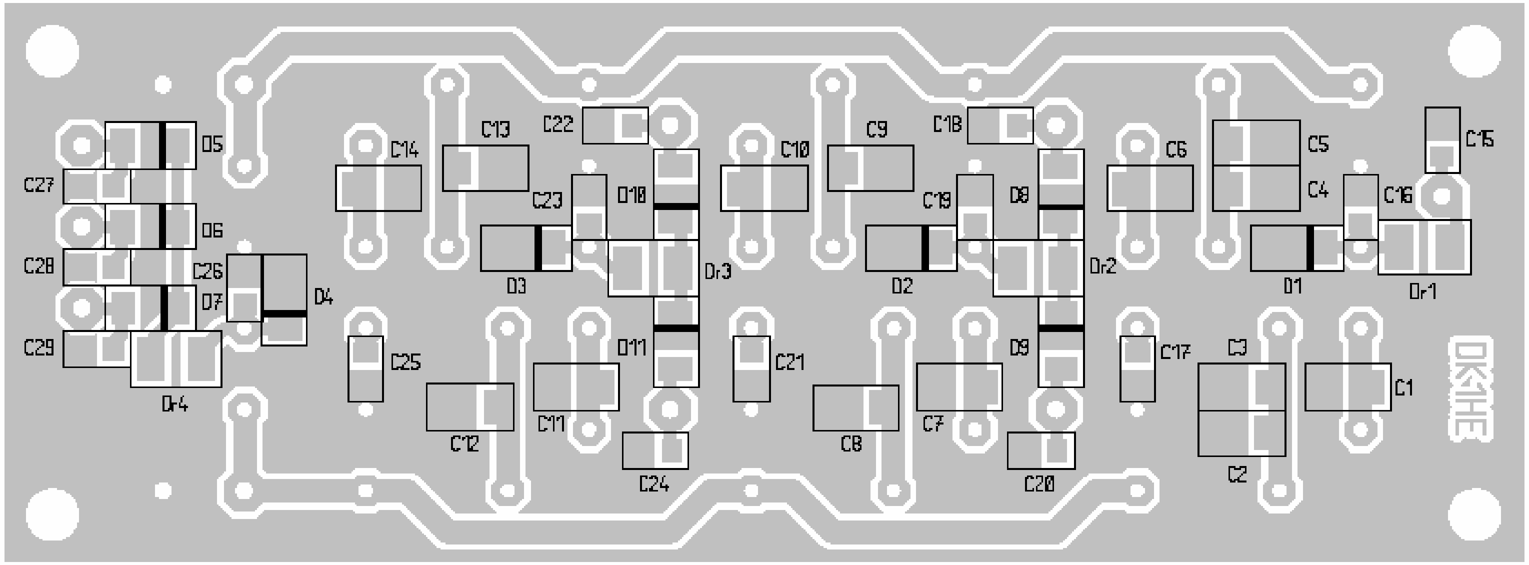
Ausgangsfilter-Tramp



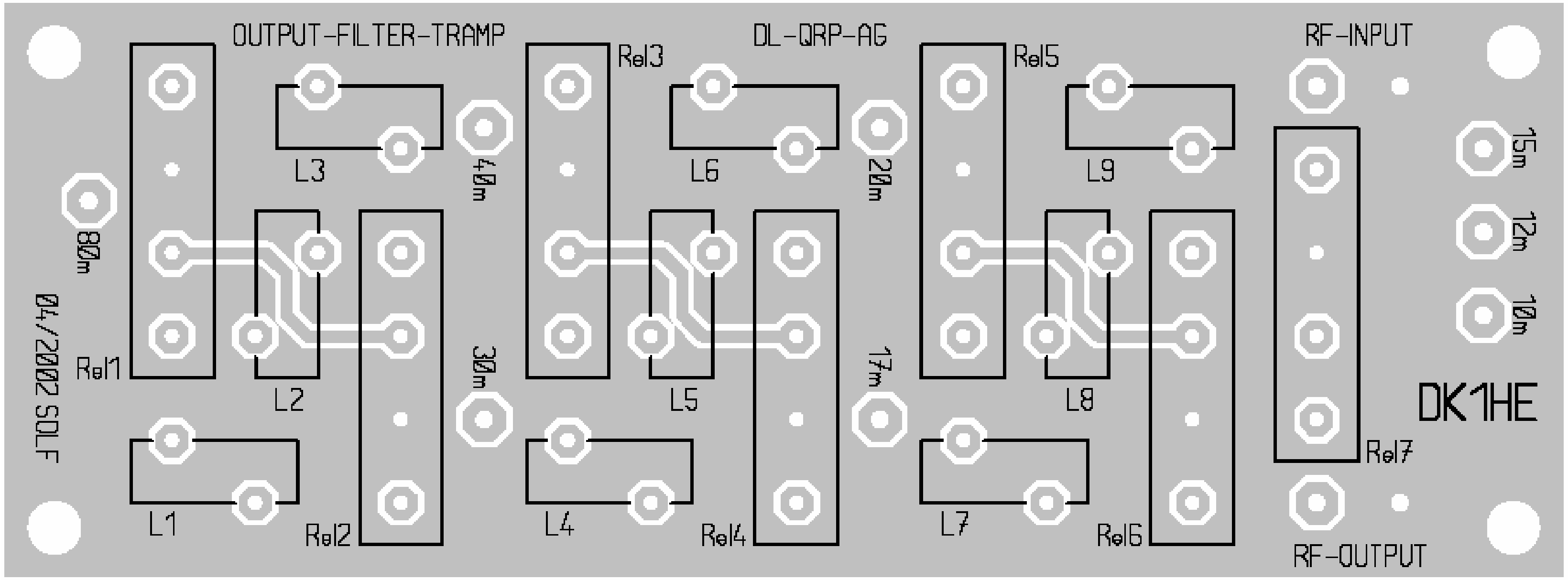
13.04.2002 SOLF DK1HE

Revision: 2.Mai 03

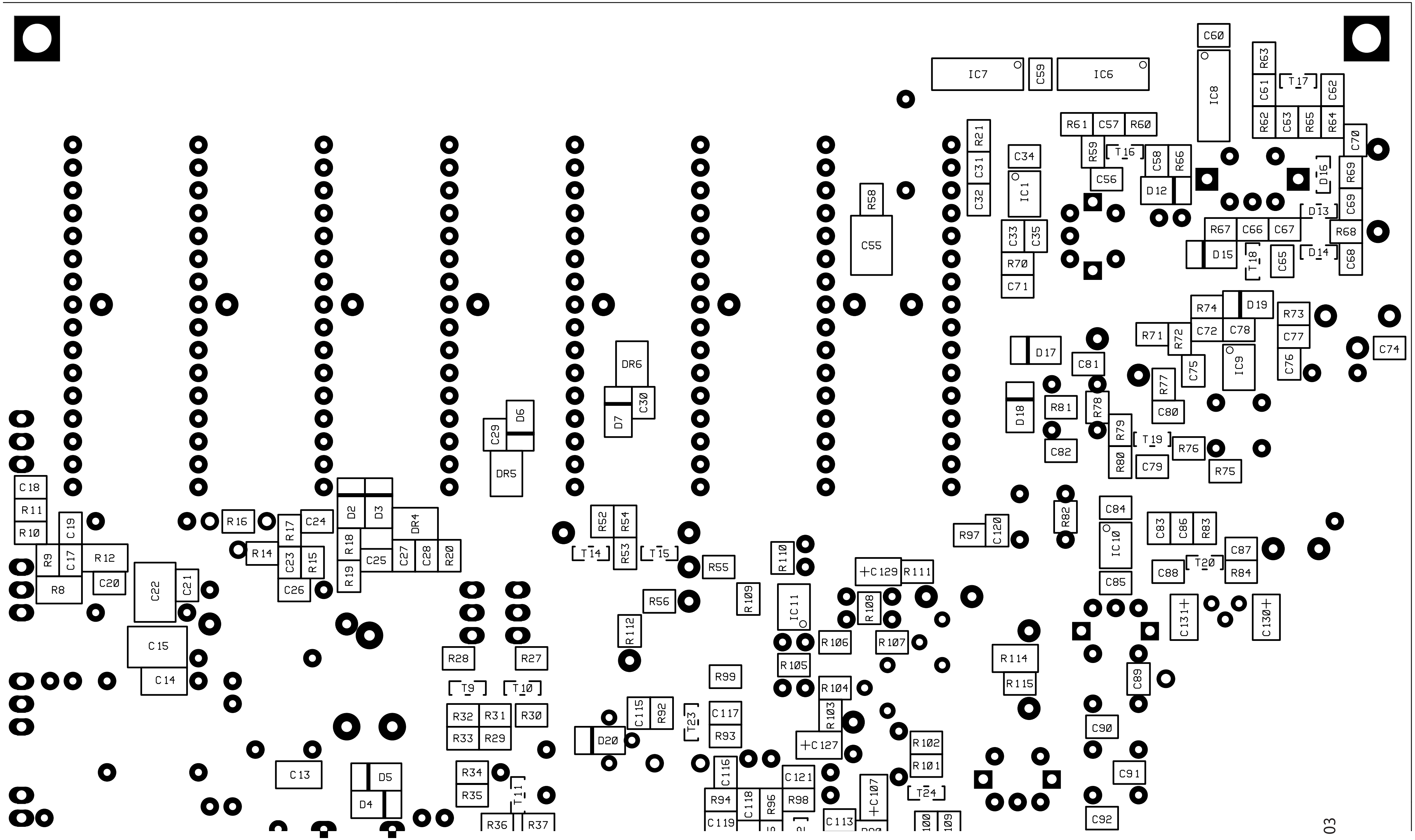
Tiefpassfilter Bestückungsplan Unterseite



Oberseite

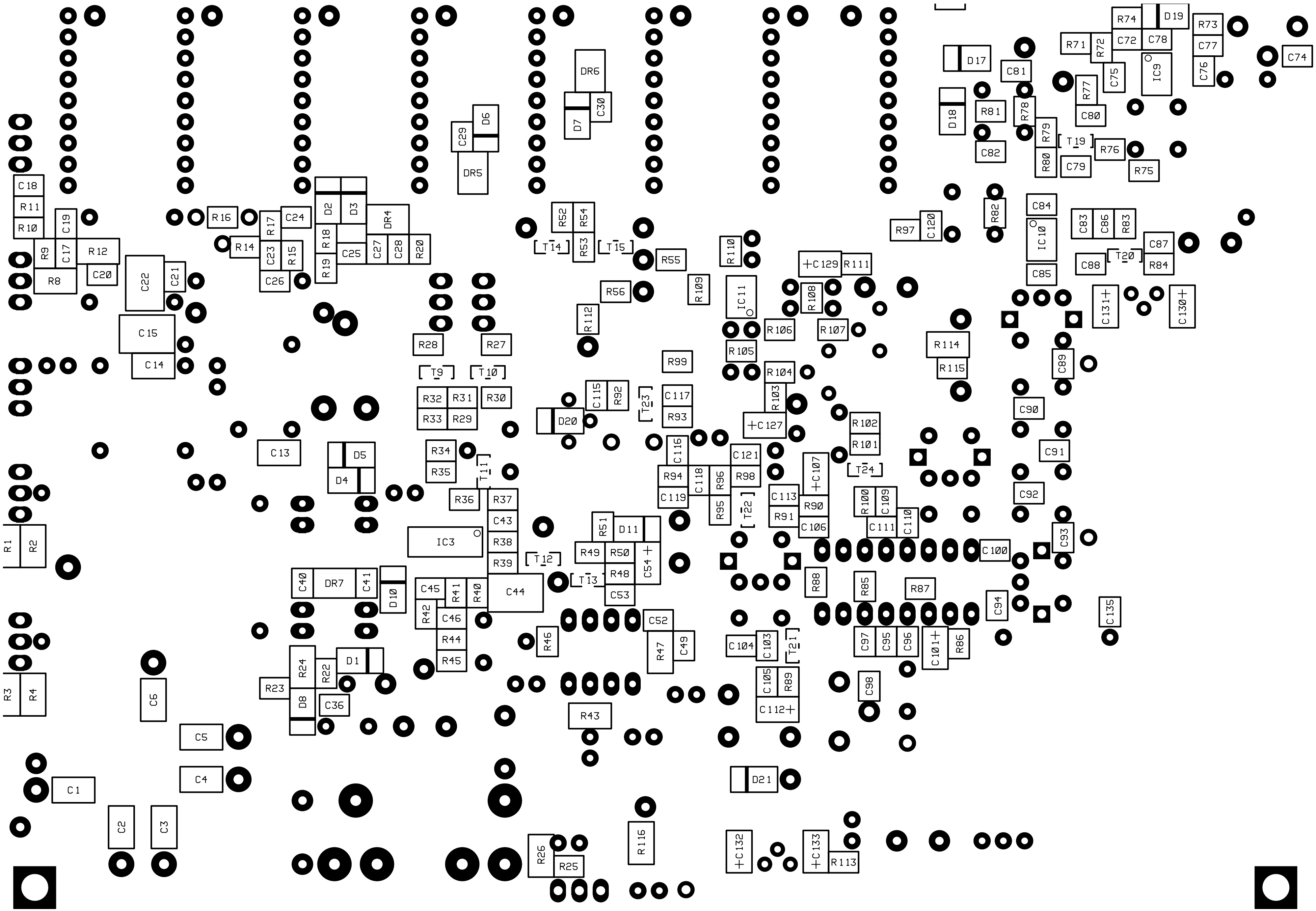


placement plan Low Pass Filter



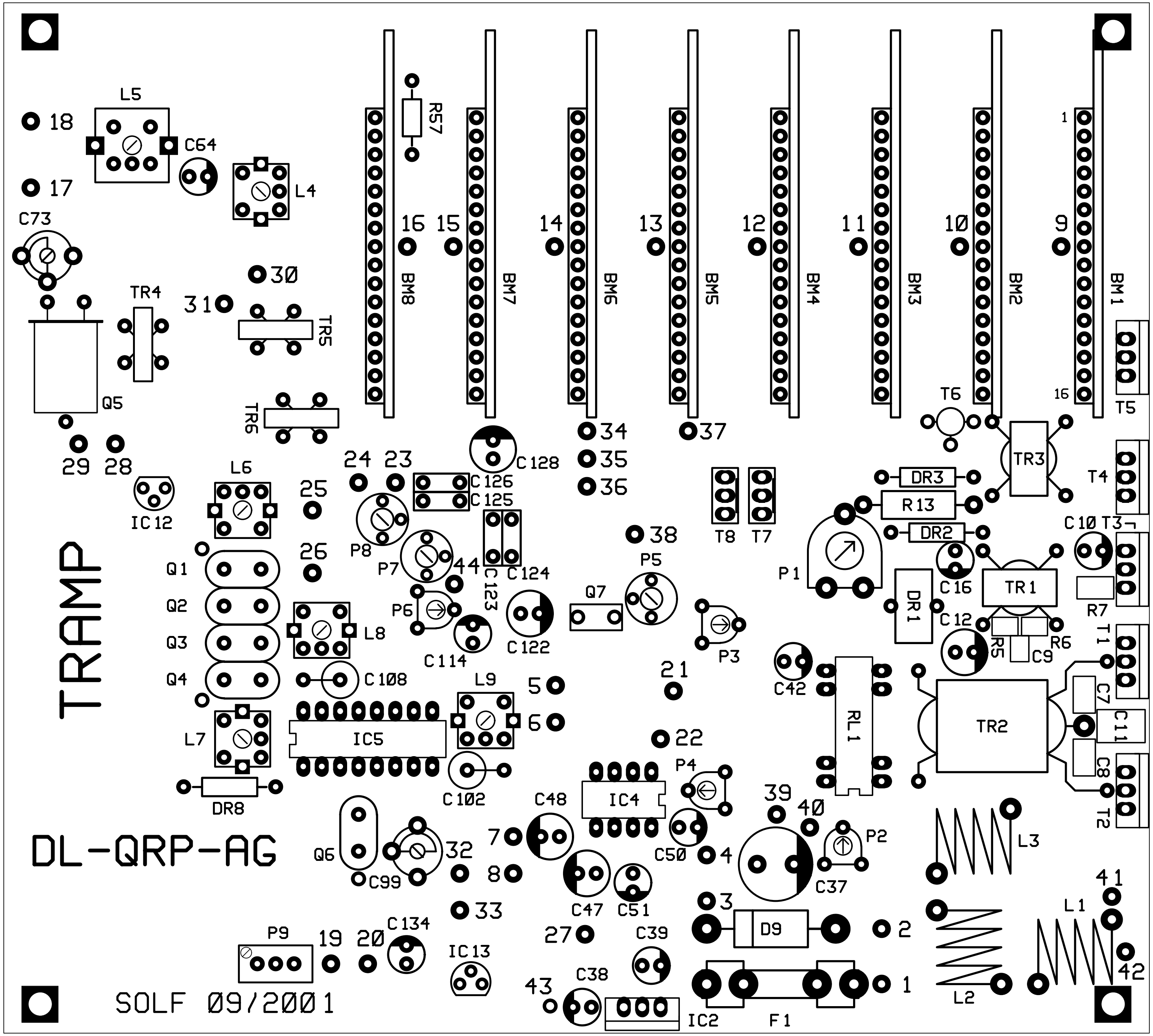
placement plan ainboard lower side part 2

Revision: 2.Mai 03



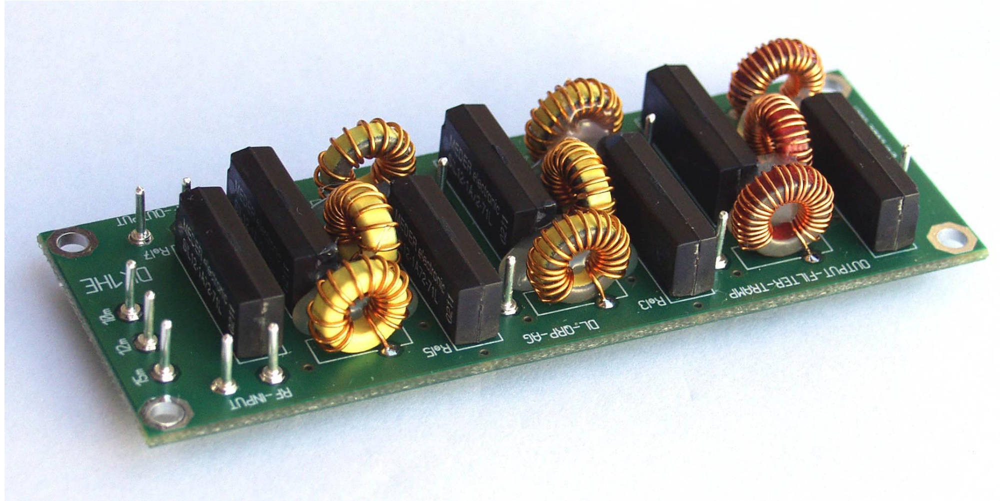
Revision: 2.Mai 03

placement plan Mainboard lowe side part 1

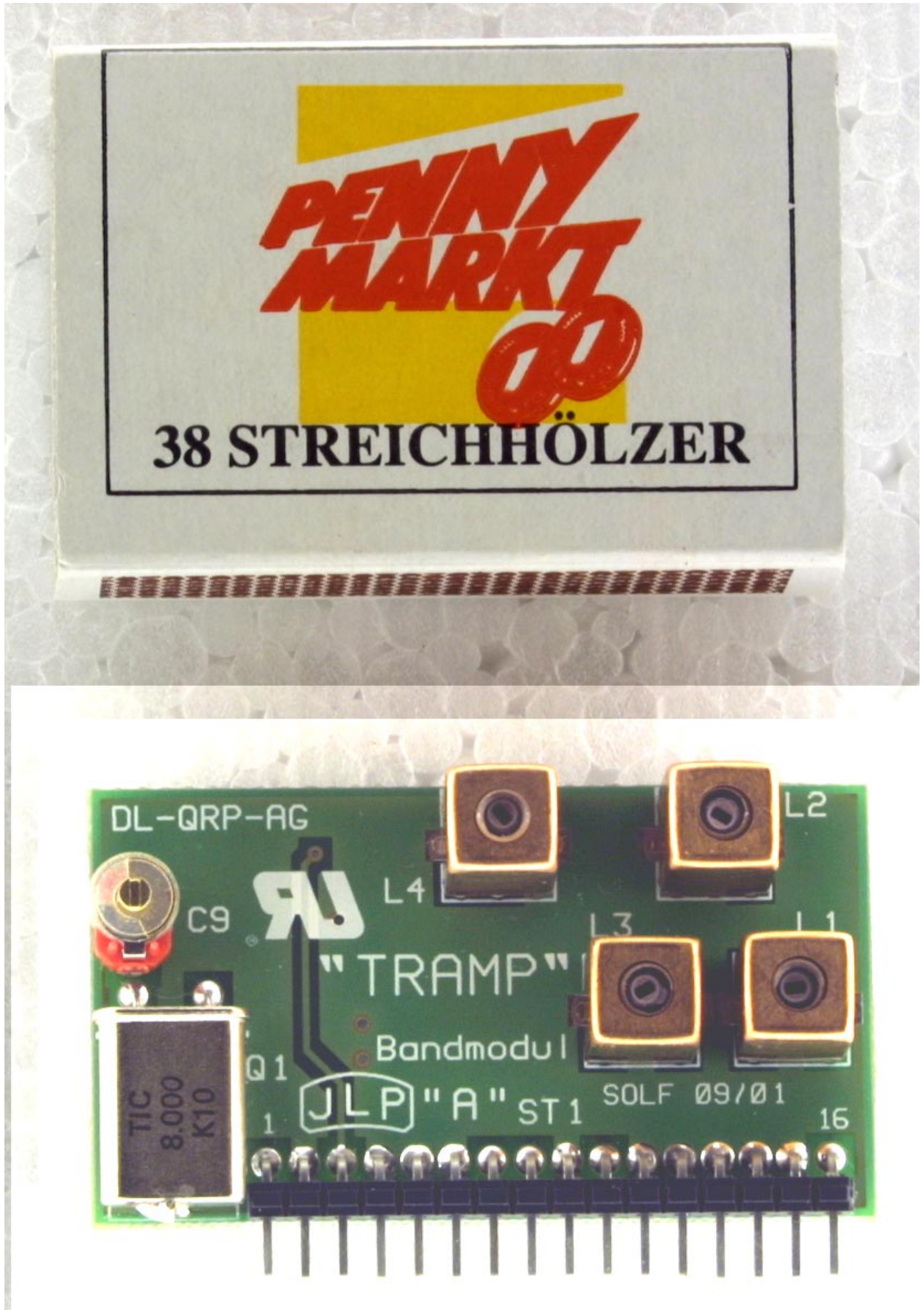


placement plan Mainboard upper side

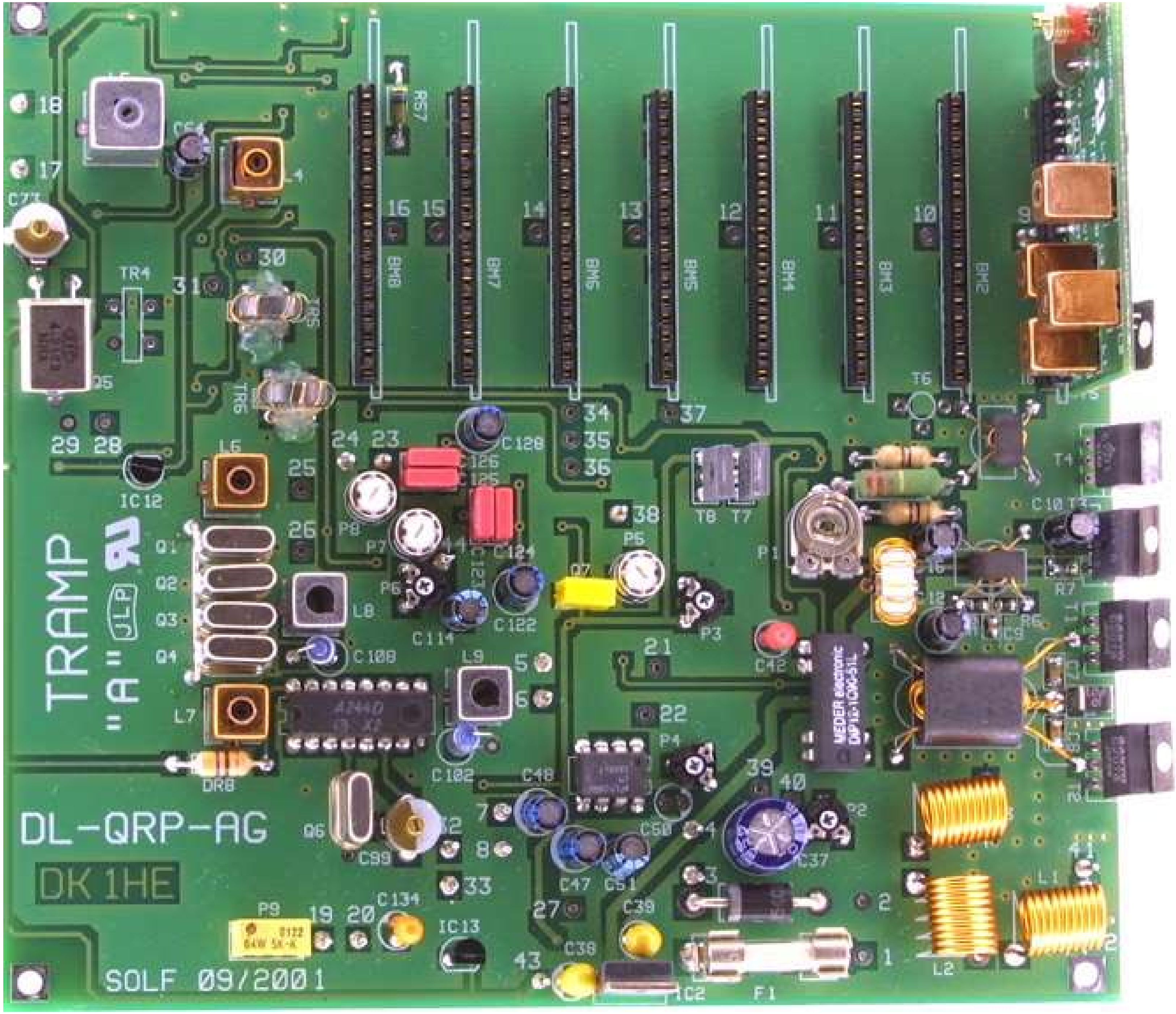
Revision: 2.Mai 03



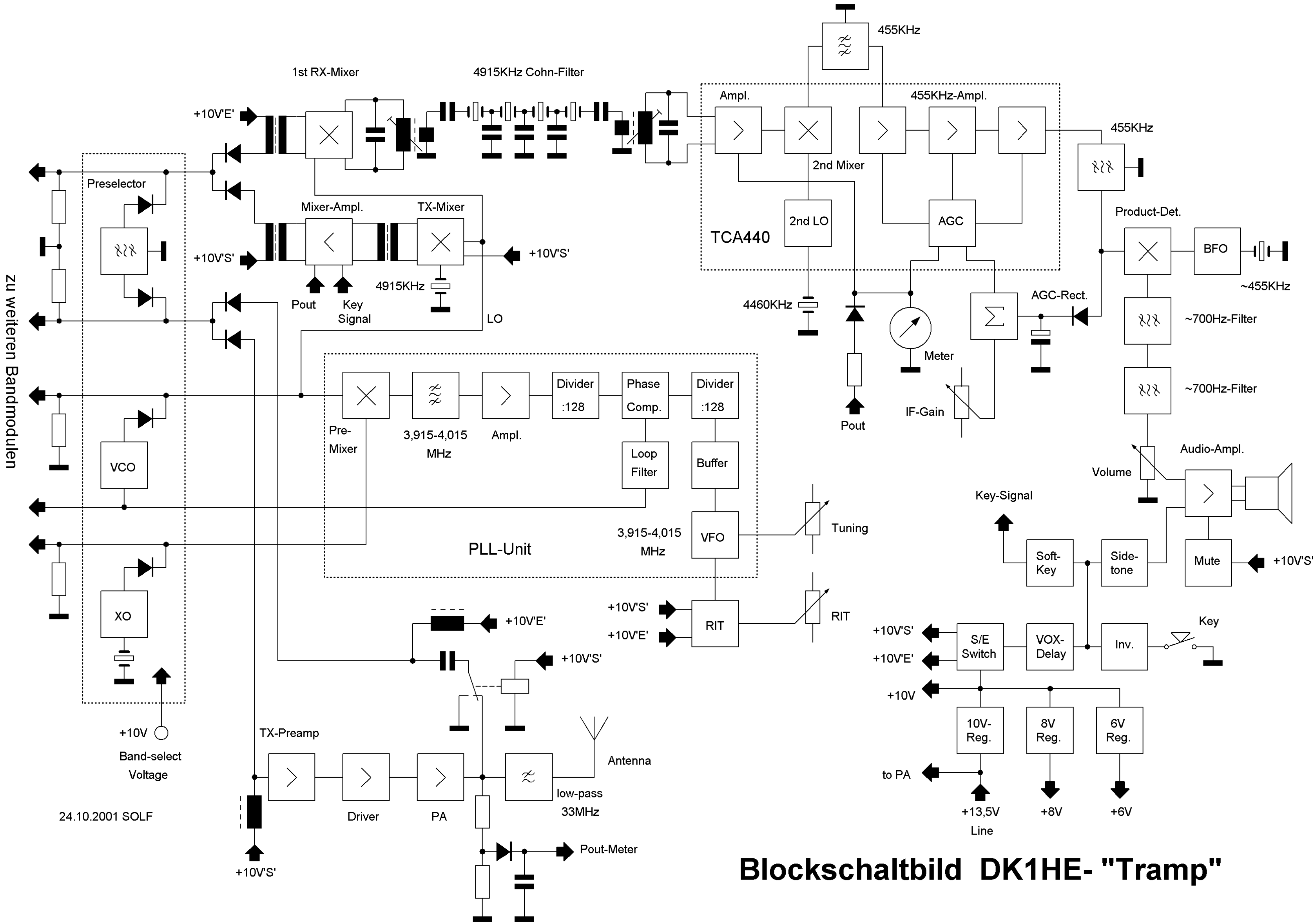
low pass filter Tramp



Bandmodulfoto



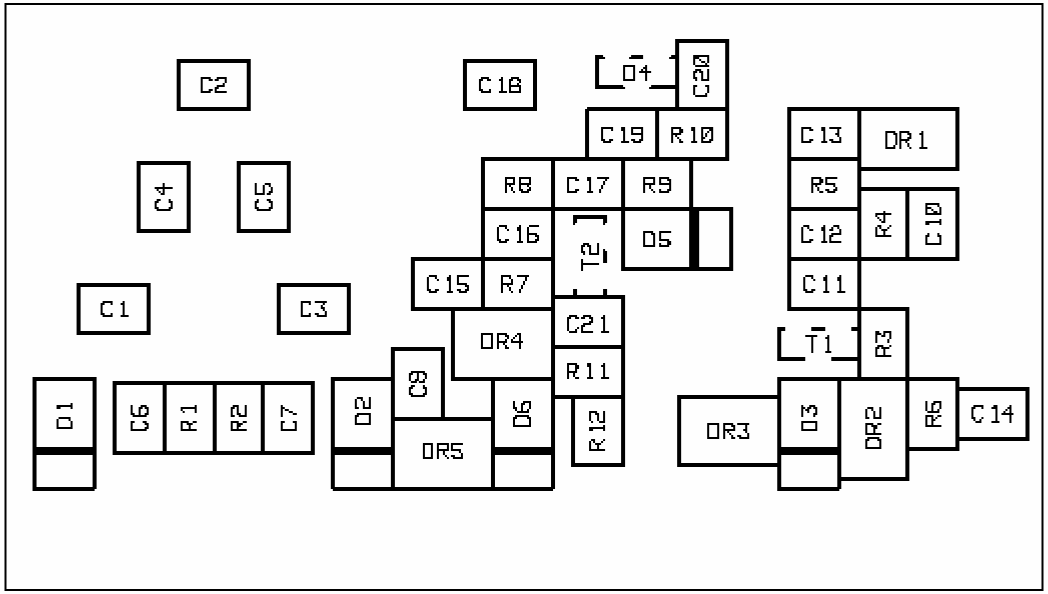
Tramp8 upper side



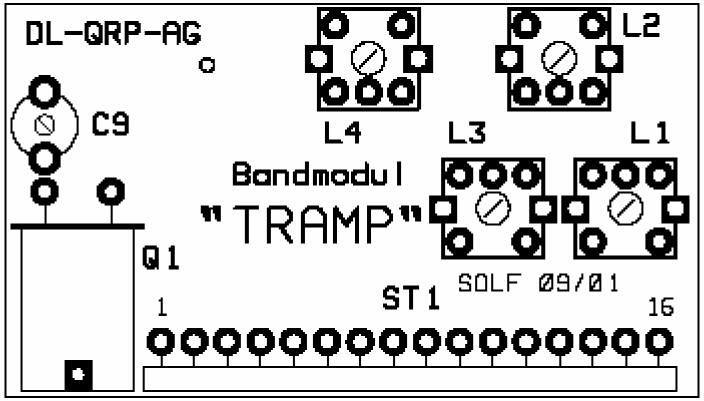
Blockschaltbild DK1HE- "Tramp"

Revision: 2.Mai 03

Bandmodul Unterseite



Bandmodul Oberseite



Placement plan Bandmodul