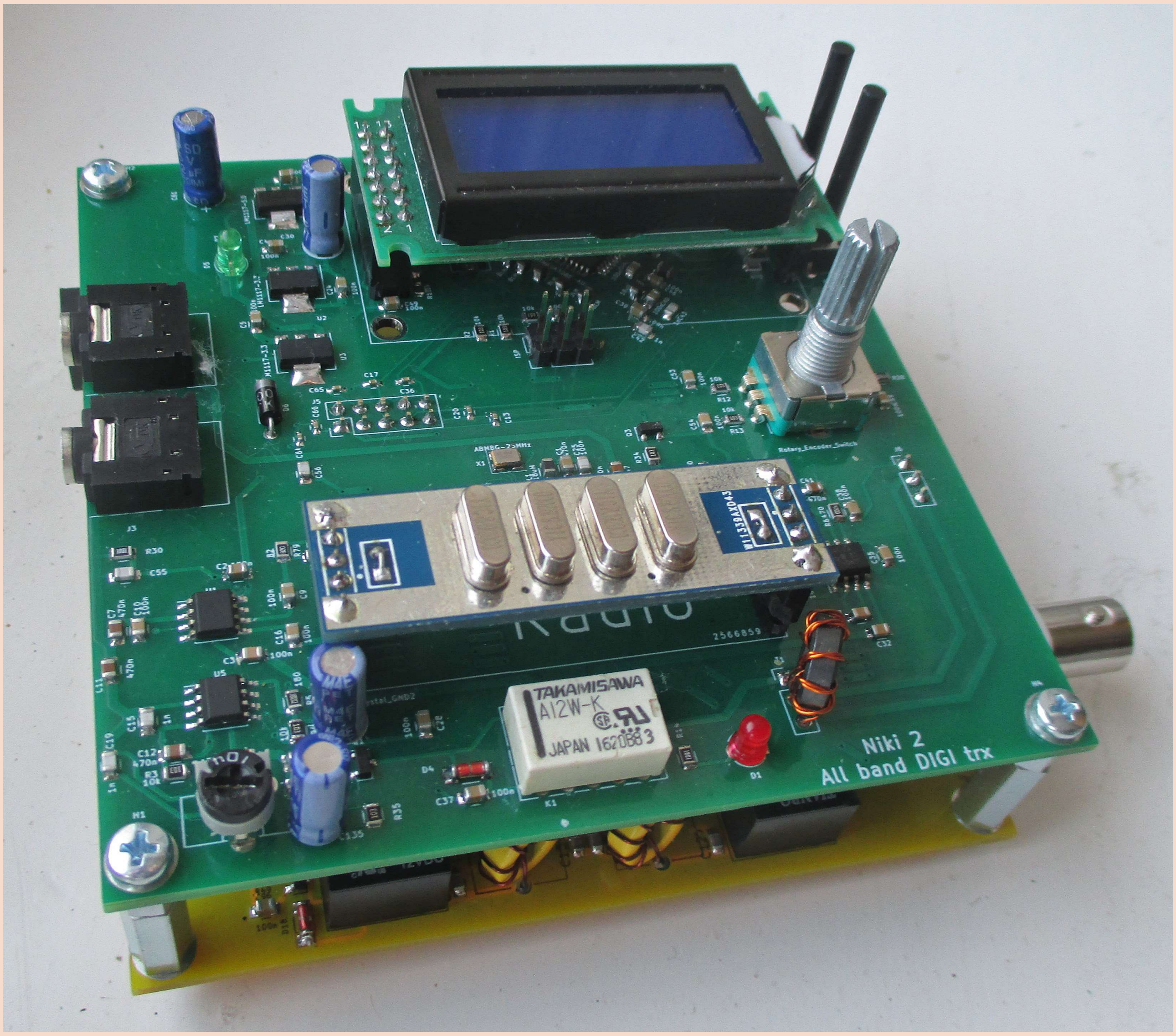
ALL BAND DIGI QRP
HF TRANSCEIVER

NIKI 2



INSTRUCTION MANUAL

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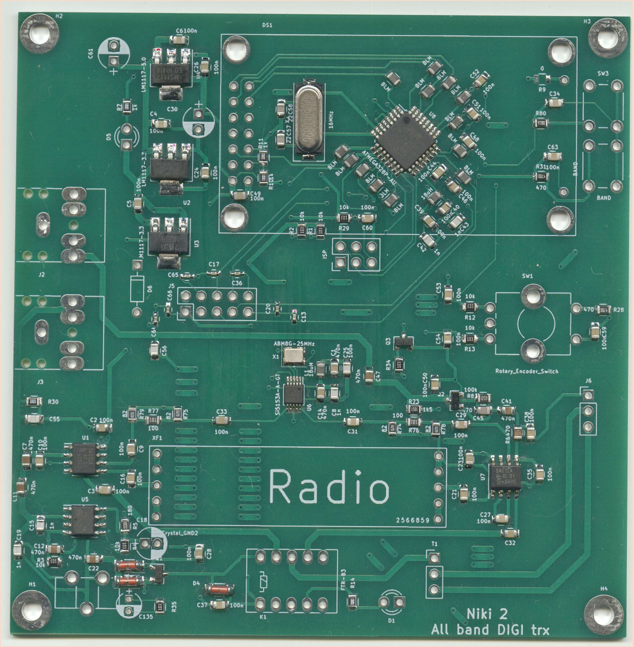
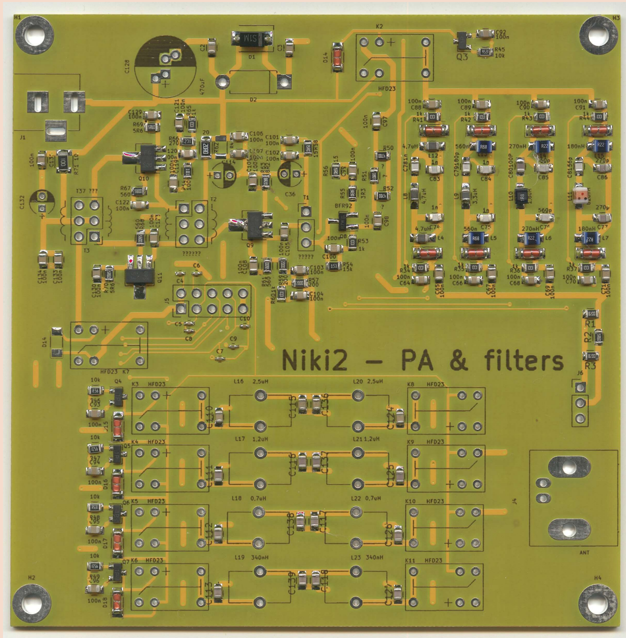
NIKI2 is a continuation of the popular mini transceiver psk NIKI80. The main difference is the use of frequency coversion, quartz filter and the ability to work with any digital emission, including sstv emission. Also new is the use of DDS instead of a quartz resonator, and the ability to work in the range of 1,8-30MHz bands.

THE TRANSCEIVER DESIGN

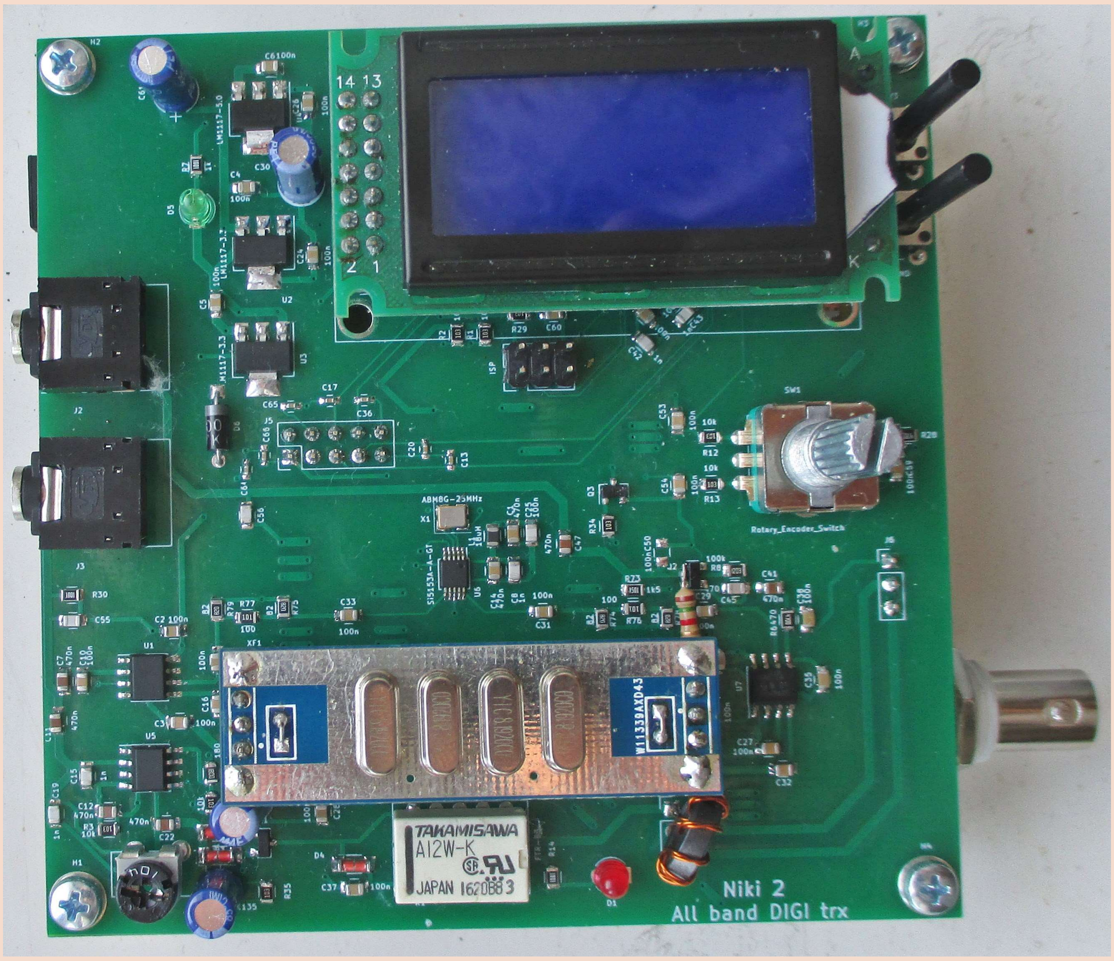
The kit for self-assembly includes a PCBs with smd components (already soldered), components for THT assembly and sockets.



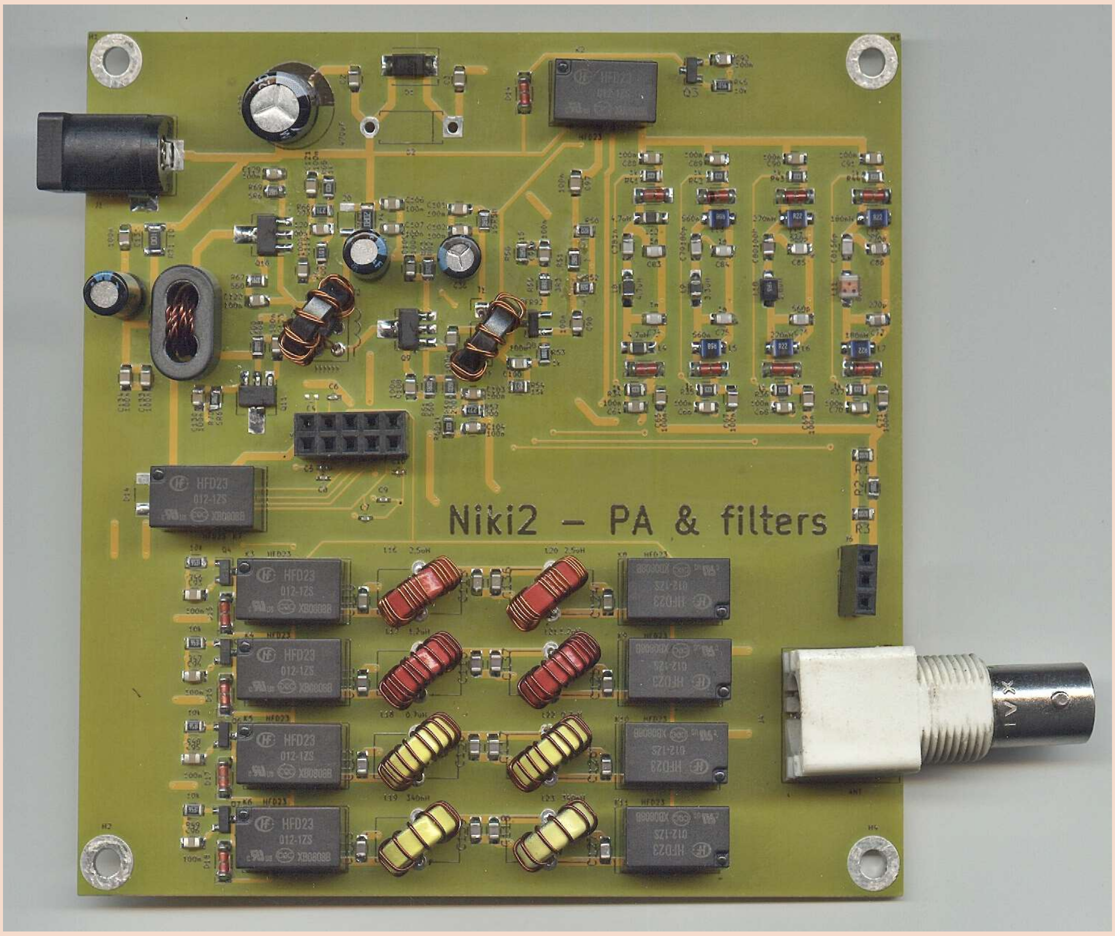


The transceiver circuit is a typical design with single frequency conversion. The signal from BPF (bandpass filter) is connected to the mixer module (SA612A), then to the quartz filter and finally to product detector, also based on SA612A. The quartz filter used in the device has a bandwidth of 3,0 kHz/-6dB and impedance of 1k ohm. The signal after detector is amplified by the low frequency amplifier (BC847C), then it is connected to the output jack socket for connection to the computer's sound card. The receiver has a sensivity of 0,18uV s/n -12dB. It is the sensivity determined by the stable visibility of the signal on the waterfall. The TX part of NIKI2 also uses a part of the receiver circuit. The receiver mixer is used as the modulator and the detector product is used as the transmitter mixer.
RF signal after the mixer is directed to BPF filters, that work both - in RX and TX mode.
The rx/tx band selectivity is guaranteed by the special combination of BPF and LPF.
RF signal selected from the bandpass filters is amplified in the pre-amplifier (BFR106 transistor), then through the transformer T2 to the transistor BFQ19 and through the matching transformer T2 to the push-pull amplifier (2 x BFQ19 transistors).
This is the best design for stable operation and low distortion.
The push-pull circuit is matched to the LPF output filters by the T3 transformer.
The quiescent currents of the BFQ19 transistors are about 30mA.
The output power of the amplifier is 1W in the range of 1,8 - 30MHz bands.

The VFO/BFO frequency generator is based on the Si5351 chip from Silicon Labs.
The VFO/BFO outputs are automatically switched during TX/RX. The control is provided by ATmega328 with 8x2 display. The transceiver does not require any additional computer control for the correct transmission/reception switching.
Switching is done by the vox circuit directly from the sound card. In the device, this is done using the LM358 amplification and separation system with an adjustable gain level. Switching to the transmission mode is indicated by the LED diode lighting.



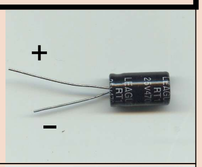
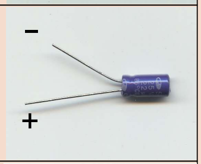
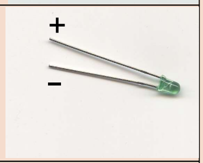
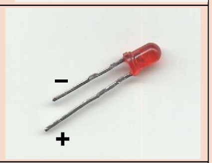
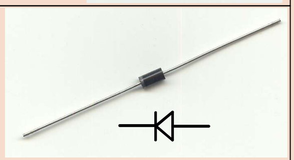
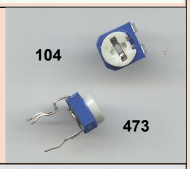
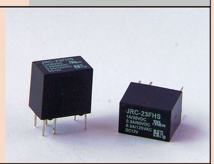
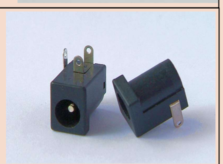
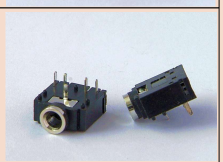
TAKAMISAWA
A12W-K
JAPAN
Niki 2
All band DIGI trx



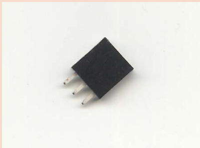
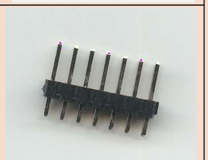
Niki2 – PA & filters

THE ASSEMBLY

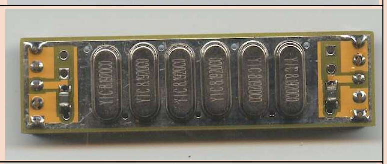
To start the minitransceiver, it is necessary to assembly THT components:

Electronic components	
Electrolytic capacitor C13, C128 470uF/16V (25V) or 220uF/16V(25V)	
Electrolytic capacitor C18, C30, C36, C114, C132, C135 22uF/16V	
LED DIODE D5	
LED DIODE D4	
Diode D2, D6 1N4007	
Mounting potentiometer RV1 100k (47k)	
Relays K2 - K11 (HFD23)	
Relay K1 A12W-K (FTR B3)	
Power DC socket 13,8V (2,5mm)	
Audio Jack stereo socket J2 , J3 3,5mm	
ANT BNC socket J4	

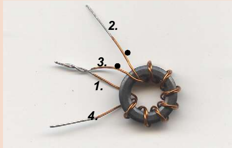
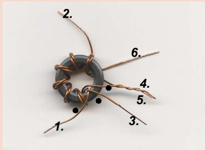
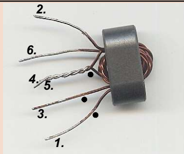
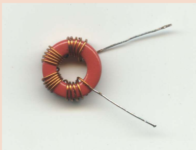
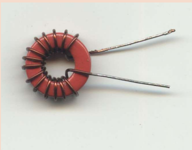
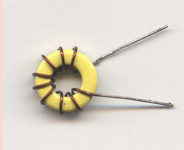
Mechanical elements

Rotary enkoder switch	
Sw2, SW3 Microswitch	
ISP 1 2x3 goldpin male connector	
J5 5x2 goldpin female connector	
J6 3x1 goldpin female connector	
J6 3x1 goldpin male connector	
J5 5x2 goldpin male connector	
J7 7x2 goldpin male connector	
LCD 8x2	

Quartz filter 3,0kHz/-6dB, Z=1000om

Quartz filter 4x	
Quartz filter 6x option	
Quartz filter 10x option	

Transformers and inductors

Transformer T1 Fig.1		A100-2	
Transformer T2 Fig.2		A100-2	
Transformer T3 Fig.3		A25-2	
L16, L20 Fig.4		T37-2	
L17, L21 Fig.5		T37-2	
L18, L22 Fig.6		T37-6	
L19, L23 Fig.7		T37-6	

T1

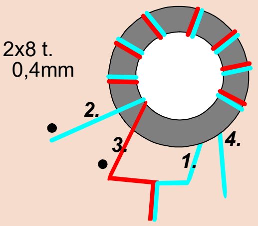


Fig.1

T2

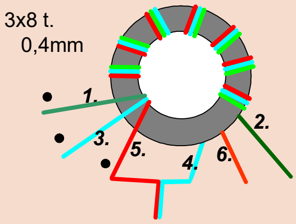
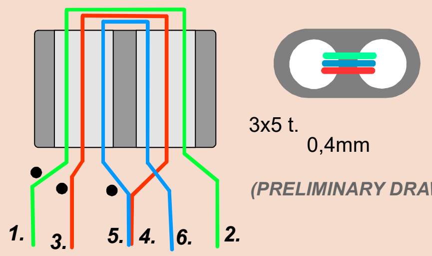


Fig.2

T3

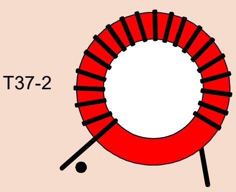


(PRELIMINARY DRAWING)

Fig.3

(● THE BEGINNING)

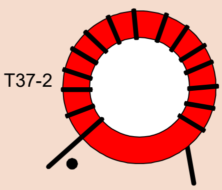
L16, L20



20t. 0,4mm

Fig.3

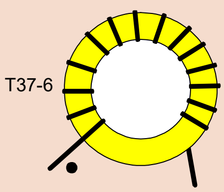
L17, L21



15t. 0,4mm

Fig.4

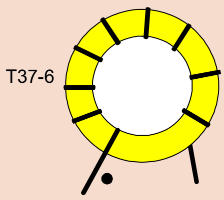
L18, L22



14t. 0,4mm

Fig.5

L19, L23



9t. 0,4mm

Fig.6

THE TRANSCEIVER DESIGN

To start assembly of the device you have to make the inductive elements.
All details are available in the figures and photos. The coil wire 0,3-0,4mm should be use. During the assembly of electrolytic capacitors and LEDs, pay attention to the correct polarity. After checking the correctness of assembly, connect the device to power supply (13,8V) and control the current consumption. The current consumption in RX mode should be approx. **100-110mA**.
Except the PA transistors, the rest of transceiver is protected against reverse power connection. Pay attention to the correct polarity when connecting the power supply.
First, we make and mount all inductive components according to the diagram and figures. Then we install: electrolytic capacitors, LEDs, relays, control buttons, gold pin control, connectors, rotary encoder, audio and BNC sockets and DC 13,8V power socket. The voltages should be the same as at the points indicated in the figures and photos (Figures 1,2,3). We measure voltages and currents after assembling the Radio and PA PCBs.
After checking voltages and currents, install the display and the quartz filter in the correct slots.

BFO PROGRAMMING AND START

Correctly assembled transceiver does not require any additional adjustments.
The only thing that needs to be done during first start is to program the BFO frequency.
Each XF filter has a special note with the frequency value of the USB freq. for digi mode operation.
Setting the BFO frequency (USB):

1. Turn off the radio
2. Press the lower button (BAND) - keep it pressed
3. Turn on the radio
4. Release the button when „Set BFO” appears
5. Set the correct frequency with the encoder
6. Press the upper button until the transceiver operating freqency appears

CONNECTIONS AND OPERATION

The transceiver is connected to the sound card using 3,5mm jack cables (not included). The cables should be of good quality (Fig.1).
It is recommended to use a galvanic separator to protect the computer from the efects of RF currents (Fig5.). The antenna with an impedance of 50 ohms should be connected to the antenna socket.
During operation, in TX mode, pay attention not to overload the transceiver with big signals from the sound card output. Too strong signal may cause distiortions and interference or any other communication problems.
Vox gain control potentiometer should be in the middle position during first start.
If necessary, final adjustments can be done while using the transceiver.
A mismatched antenna may results in problems of PA operation or its failure.

FIG.1

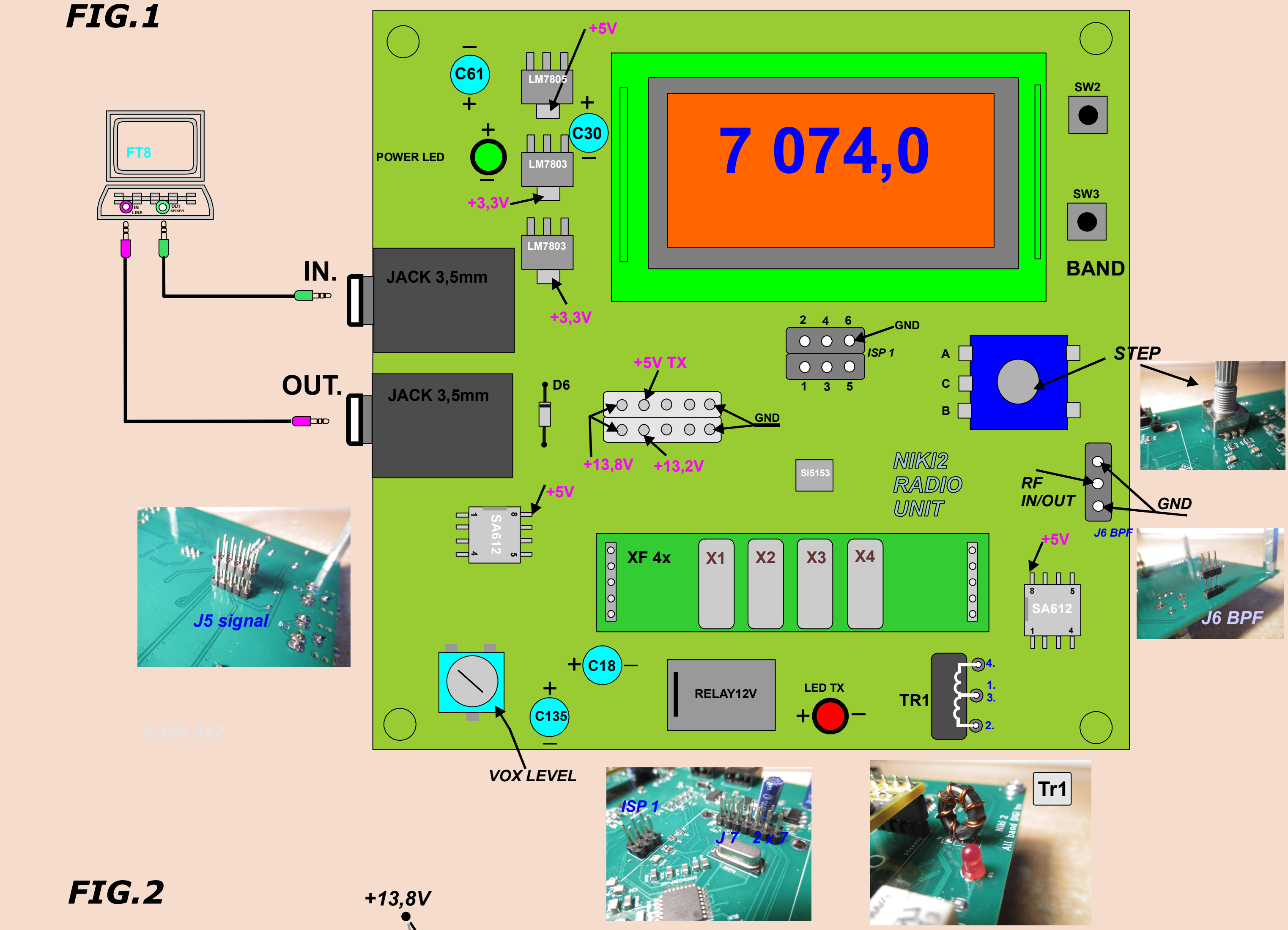

FT8
IN.
OUT.
JACK 3,5mm
JACK 3,5mm
POWER LED
C61
+5V
LM7805
C30
LM7803
+3,3V
LM7803
+3,3V
7 074,0
SW2
SW3
BAND
GND
ISP 1
2 4 6
1 3 5
A
C
B
STEP
+5V TX
D6
GND
+13,8V
+13,2V
Si5153
NIKI2
RADIO
UNIT
RF
IN/OUT
GND
J6 BPF
+5V
SA612
SA612
XF 4x
X1
X2
X3
X4
J5 signal
J6 BPF
C18
C135
RELAY12V
LED TX
TR1
VOX LEVEL
ISP 1
J 7 2 x 7
Tr1

FIG.2

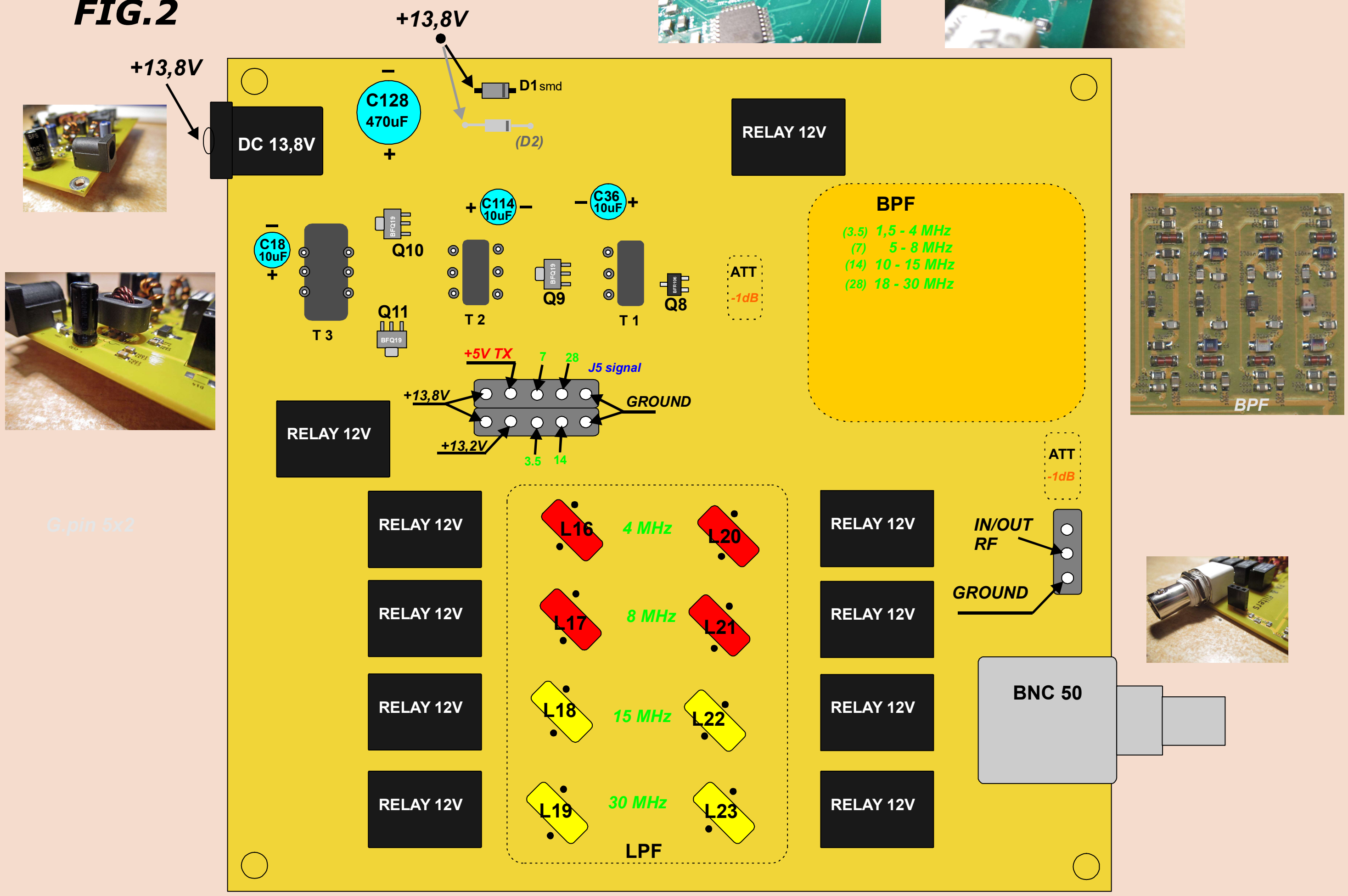
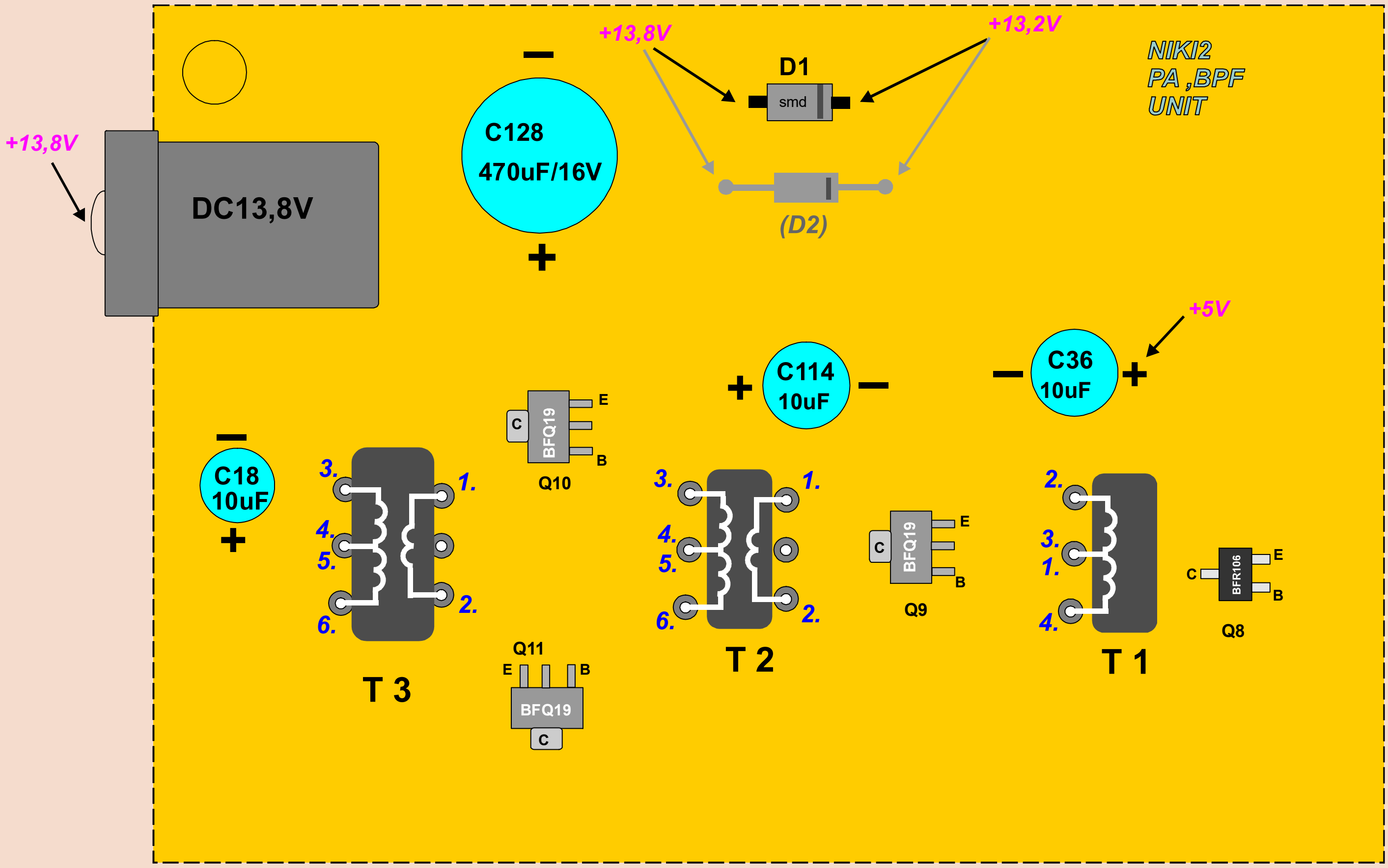
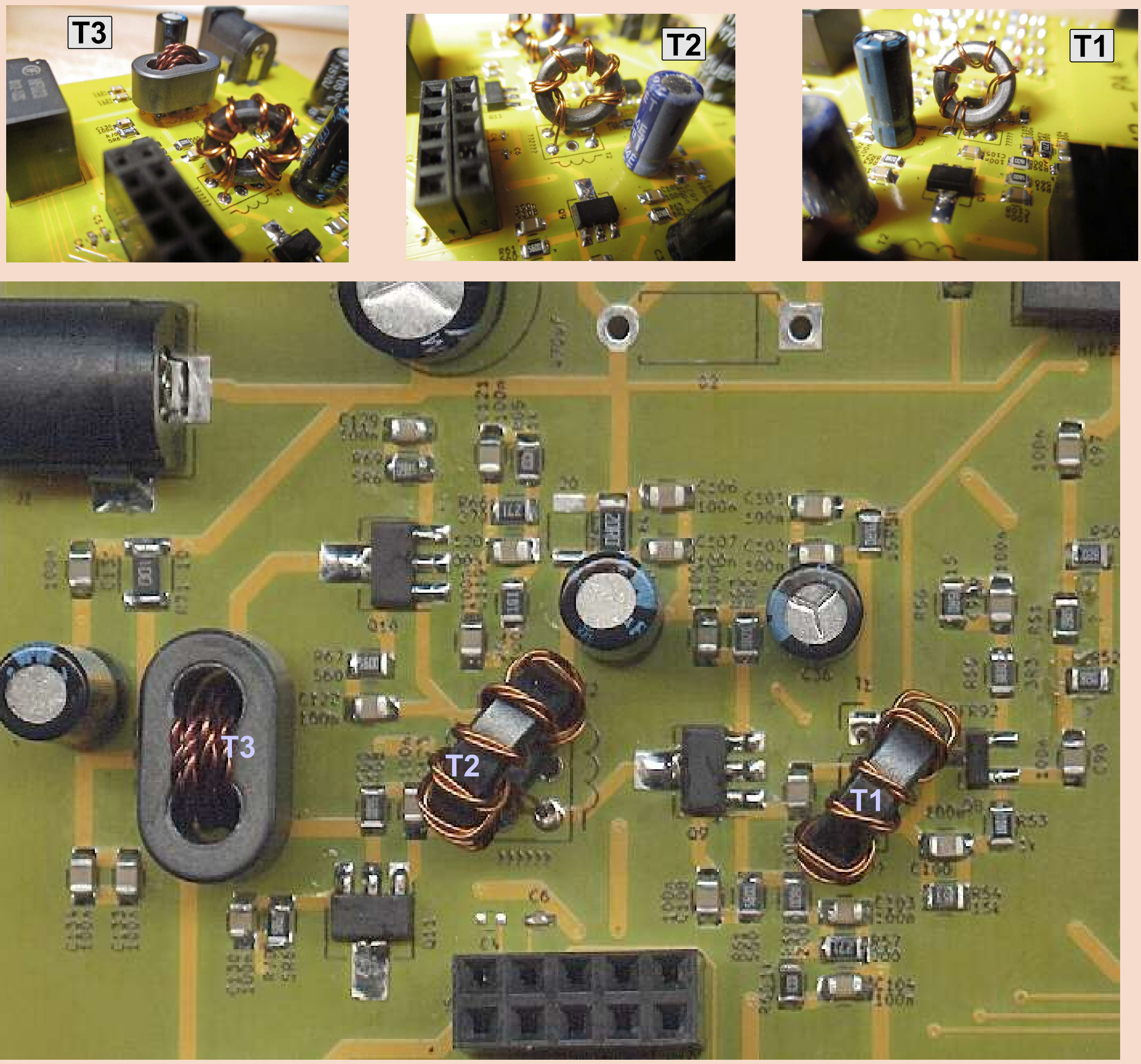

+13,8V
+13,8V
D1 smd
(D2)
DC 13,8V
C128
470uF
RELAY 12V
BPF
(3.5) 1,5 - 4 MHz
(7) 5 - 8 MHz
(14) 10 - 15 MHz
(28) 18 - 30 MHz
C114
10uF
C36
10uF
C18
10uF
Q10
T 3
T 2
Q9
T 1
Q8
ATT
-1dB
Q11
+5V TX
7
28
J5 signal
+13,8V
GROUND
+13,2V
3.5
14
RELAY 12V
ATT
-1dB
RELAY 12V
L16
4 MHz
L20
RELAY 12V
IN/OUT
RF
RELAY 12V
L17
8 MHz
L21
RELAY 12V
GROUND
RELAY 12V
L18
15 MHz
L22
RELAY 12V
BNC 50
RELAY 12V
L19
30 MHz
L23
RELAY 12V
LPF
BPF

FIG.3



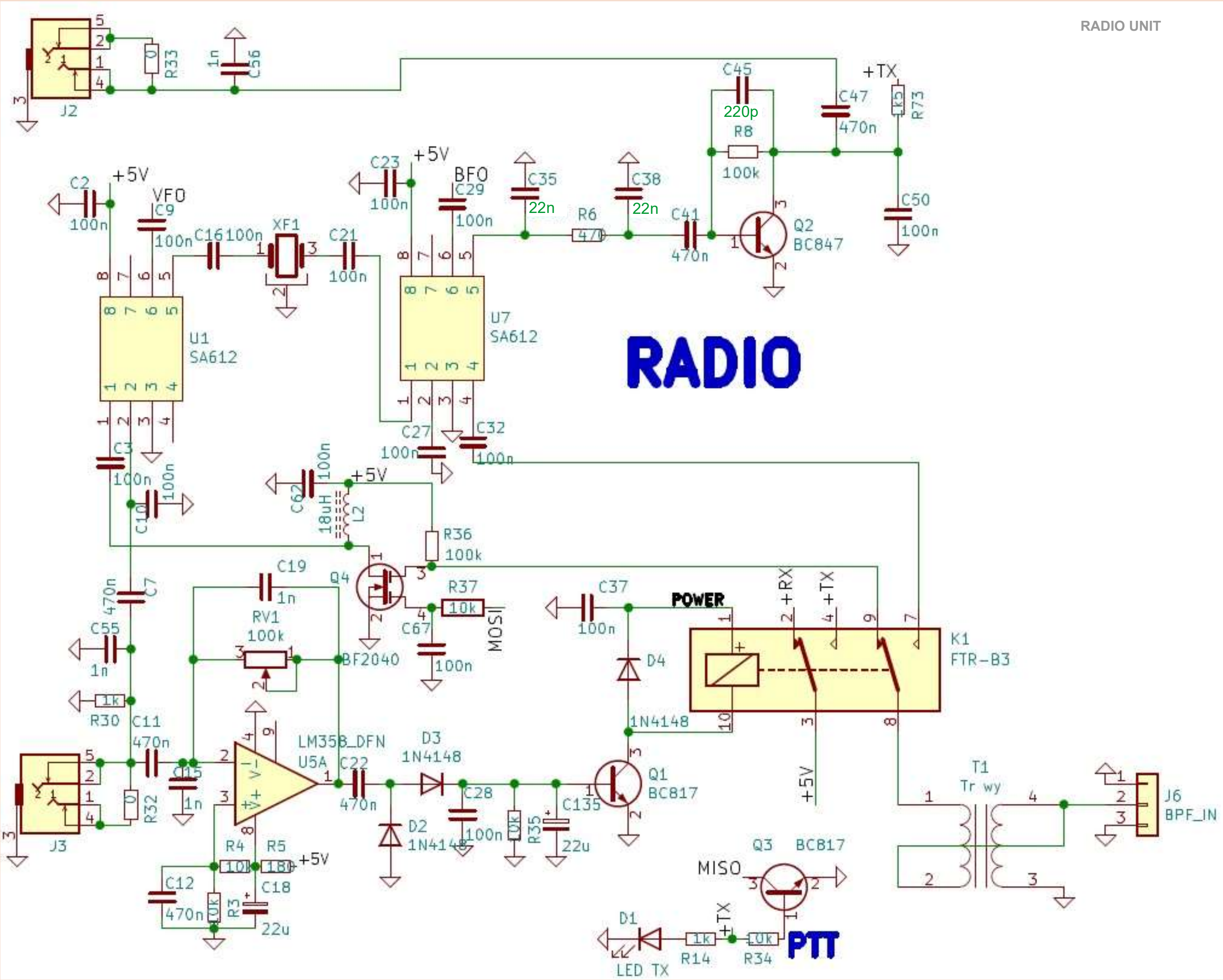
+13,8V
DC13,8V
C128
470uF/16V
+13,8V
+13,2V
D1
smd
(D2)
NIKI2
PA ,BPF
UNIT
+5V
C18
10uF
C114
10uF
C36
10uF
BFQ19
Q10
Q11
BFQ19
Q9
BFR106
Q8
T 3
T 2
T 1

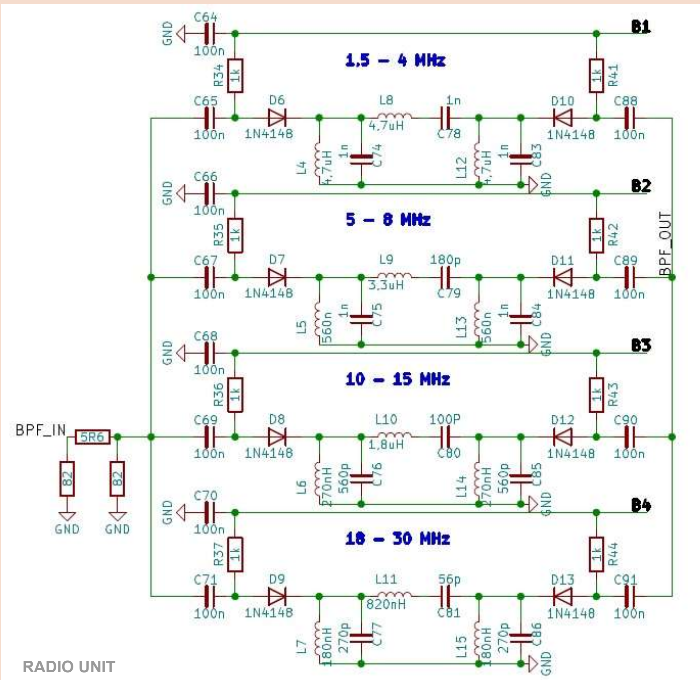
FIG.4

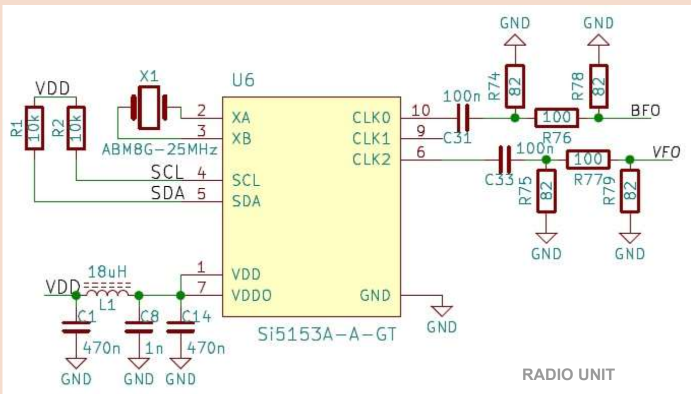


T3
T2
T1

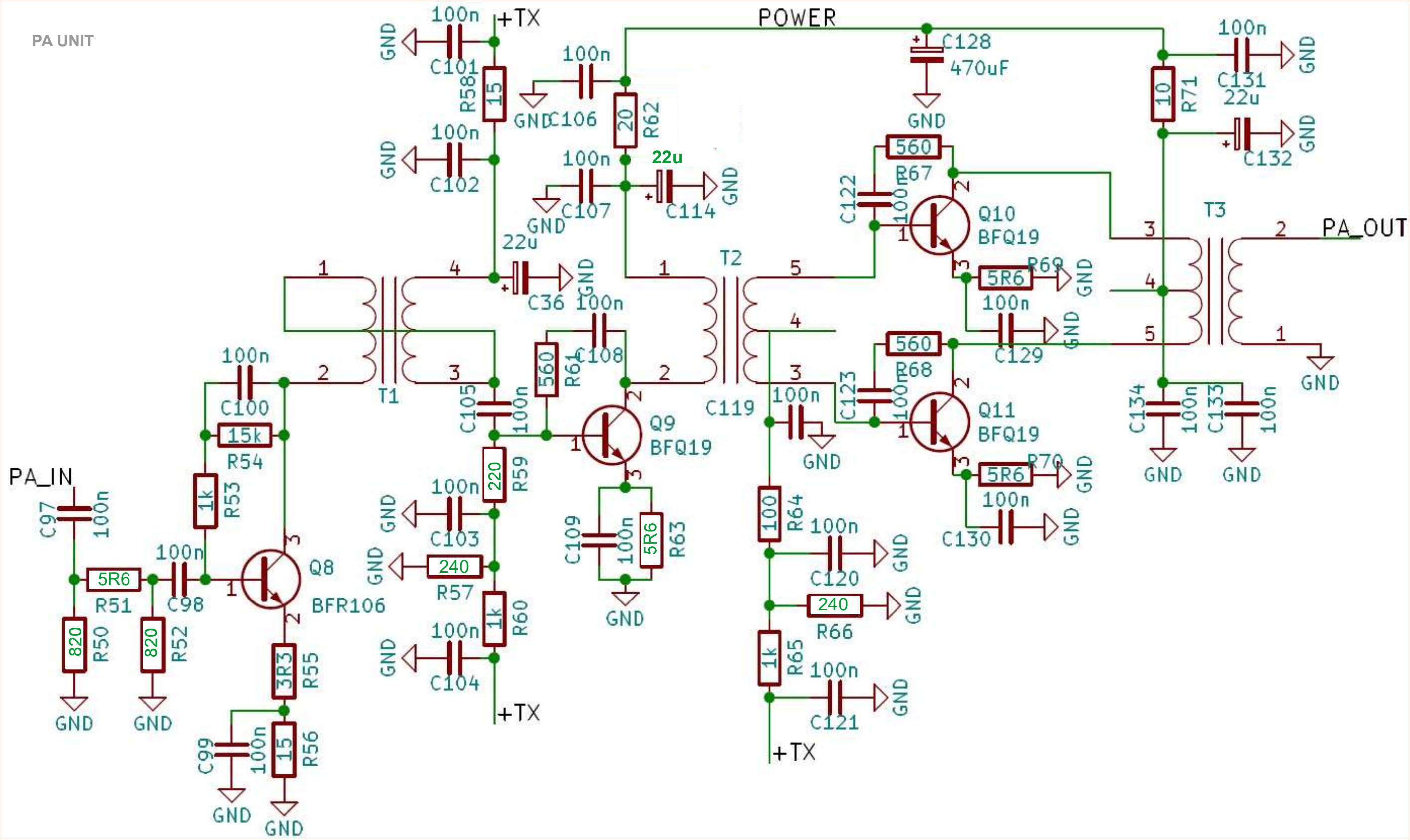
RADIO, BPF, PLL, SCHEMATIC DIAGRAM

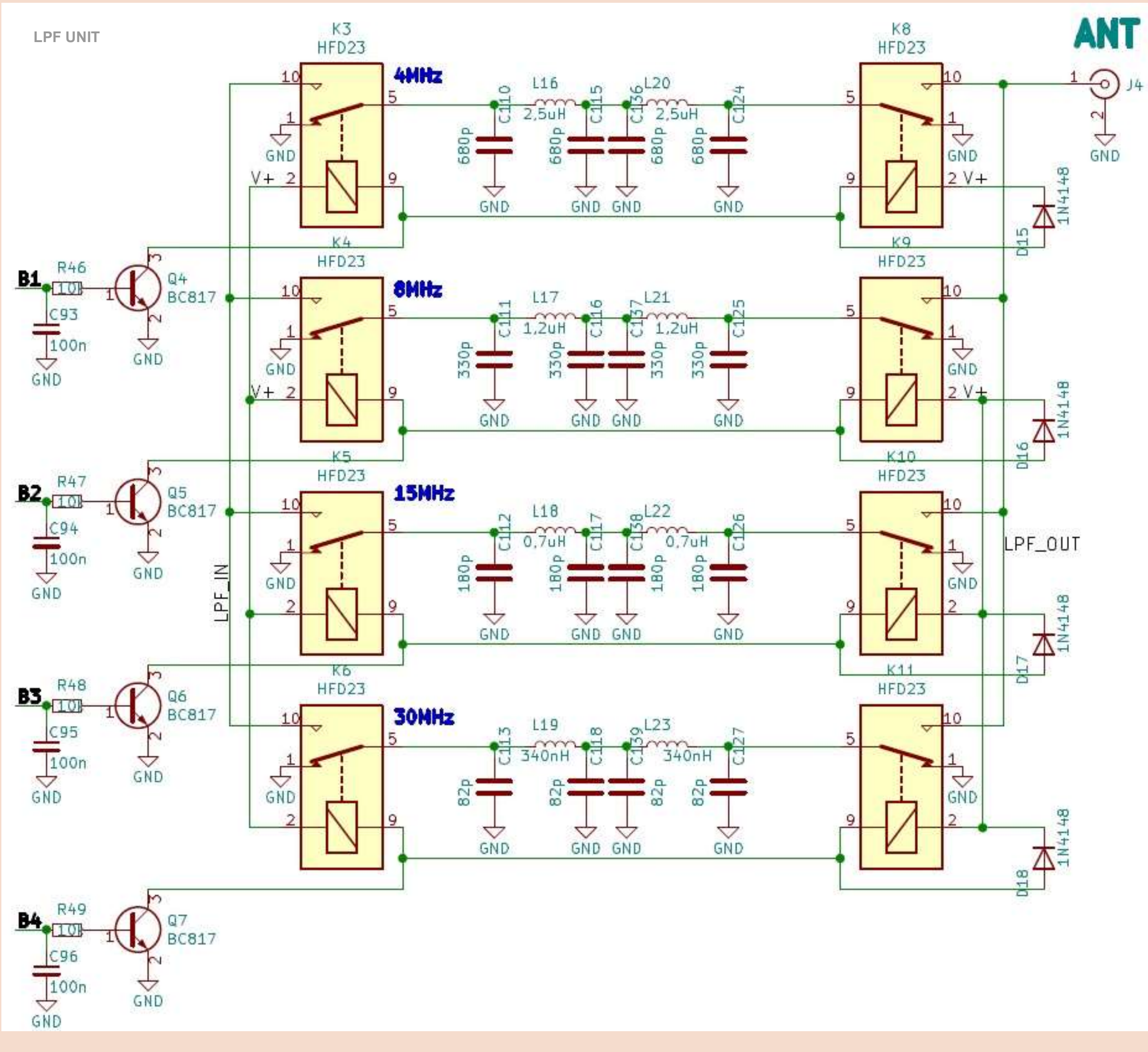




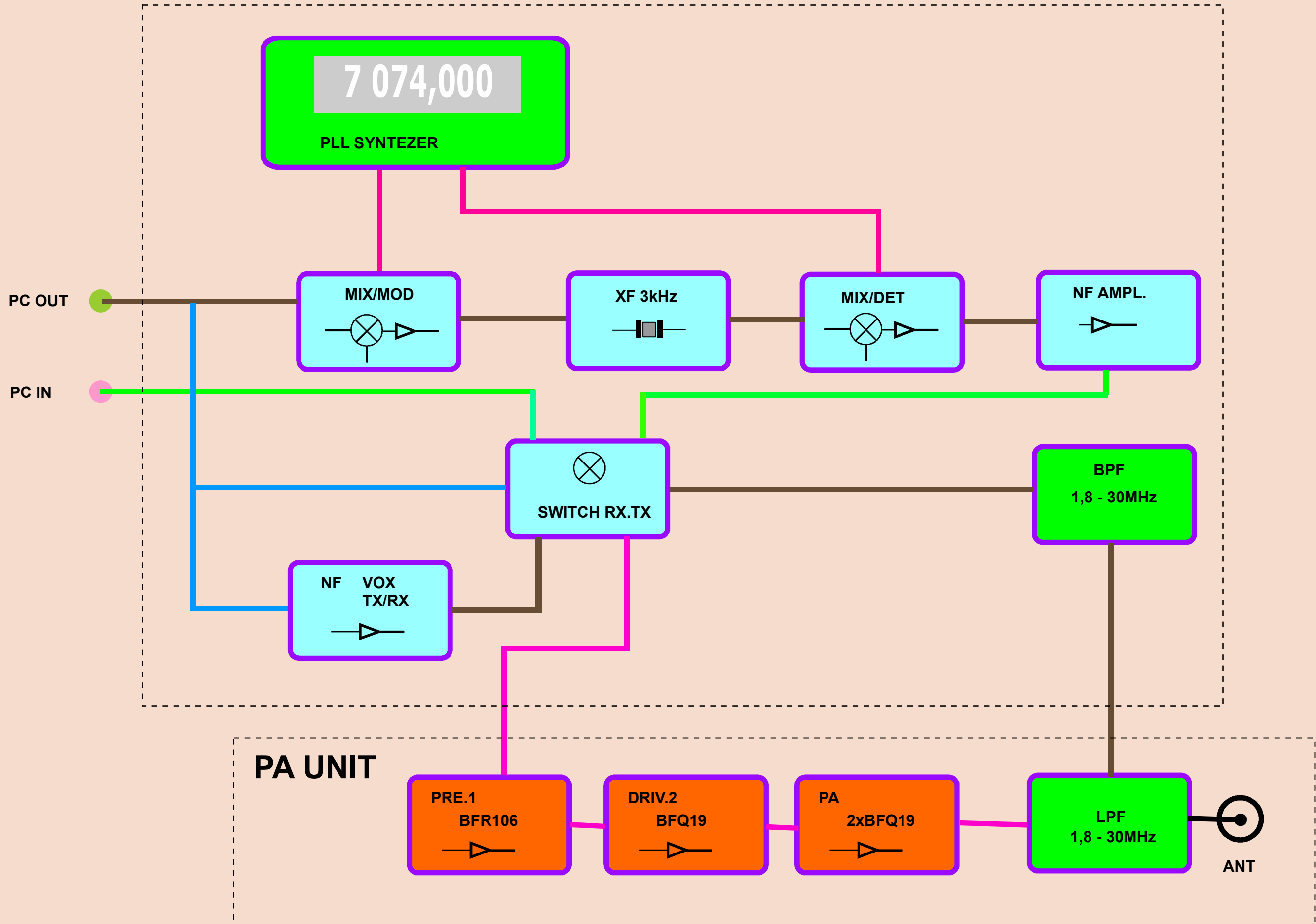


PA, LPF SCHEMATIC DIAGRAM



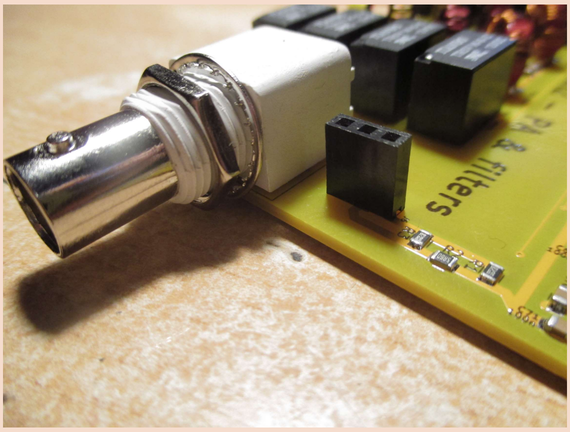
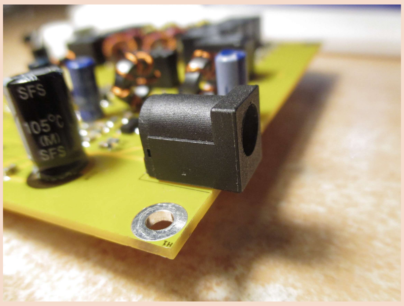
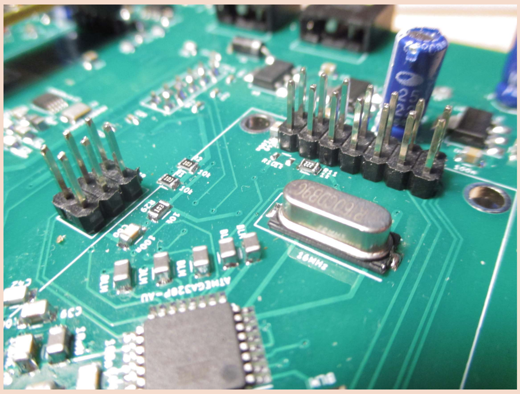
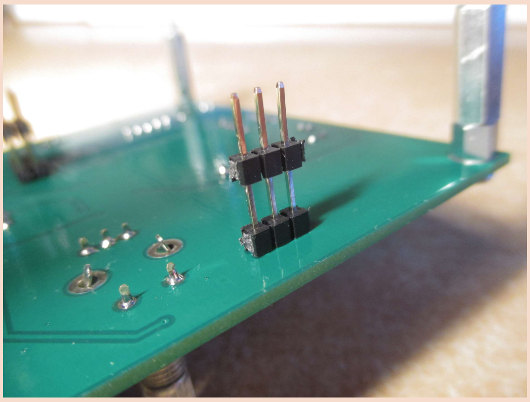
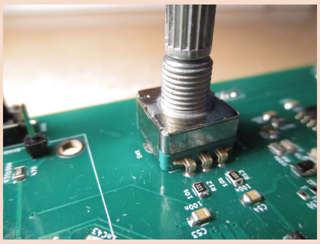
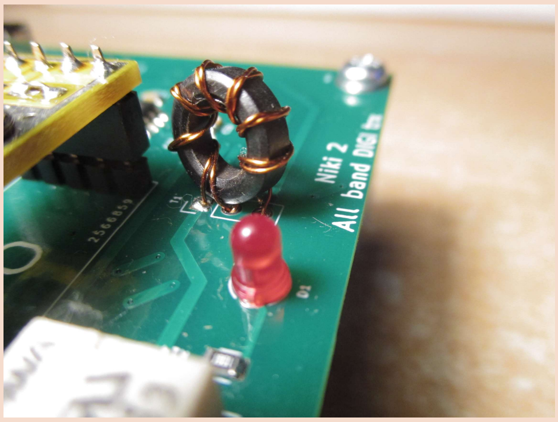


BLOCK DIAGRAM



PARAMETERS

RX FREQENCY RANGE	1800kHz - 30MHz
TX FREQENCY RANGE	1800kHz - 30MHz (Amateur band only)
EMISSION MODES	J3E (SSB), (All digi modes)
FREQUENCY STEP	100Hz , 1kHz , 10kHz, 100kHz
ANTENNA IMPEDANCE	50 Ohms, unbalanced
OPERATING TEMPERATURE RANGE	-10 C - + 50C (+14 F - + 122 F)
SUPPLY VOLTAGE	10,5V - 15V
POWER CONSUMPTION	RX (no signal) 120mA TX 350 - 380 mA
POWER OUTPUT	1,2 W (13,8V) (approx 1W)
SENSIVITY	0,18uV (1,8MHz - 30MHz) - 12dB S/N
HARMONIC RADIATON	-48 dB (1,8-30MHz)
BANDWIDTH	3,0 kHz DIGI MODE
CIRCUIT TYPE	Conversion heterodyne
SELECTIVITY 4 xtal filter	3,0 kHz - 6dB 5,5 kHz -60dB
SELECTIVITY 6 xtal filter (option)	3,0 kHz - 6dB 4,8 kHz -60dB
SELECTIVITY 10 xtal filter (option)	3,0 kHz - 6dB, 3,8 kHz -60dB
AUDIO INPUT IMPEDANCE	600 Ohms - 2k Ohms
AUDIO OUTPUT IMPEDANCE	600 Ohms - 2k Ohms
DIMENSIONS (PCB)	100 x 100 mm


PA & filters





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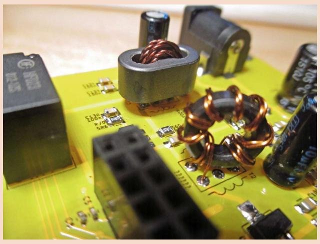
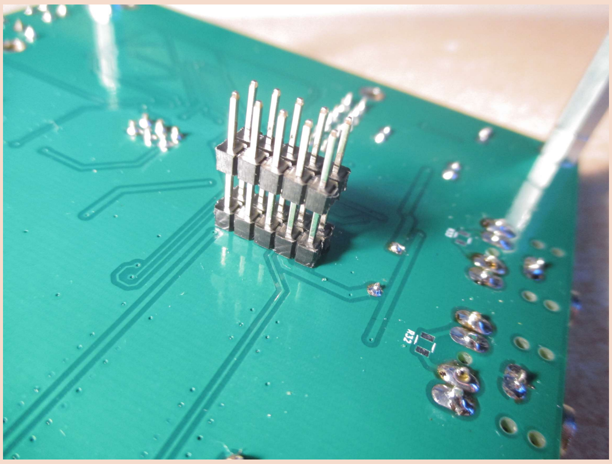
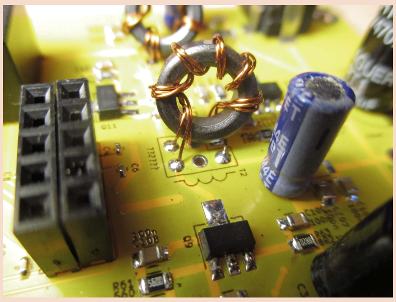
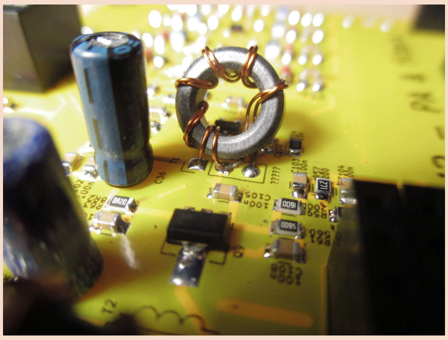
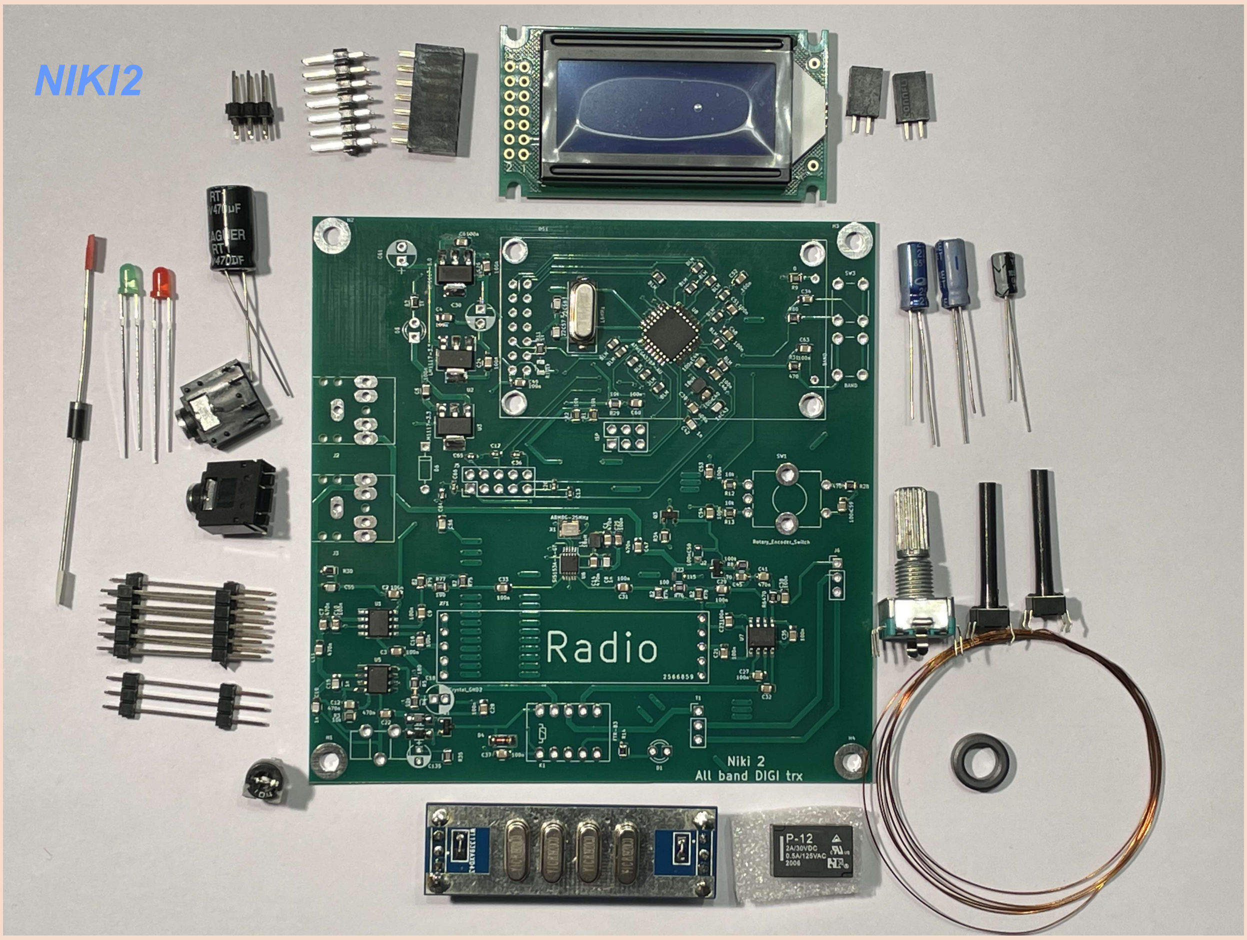
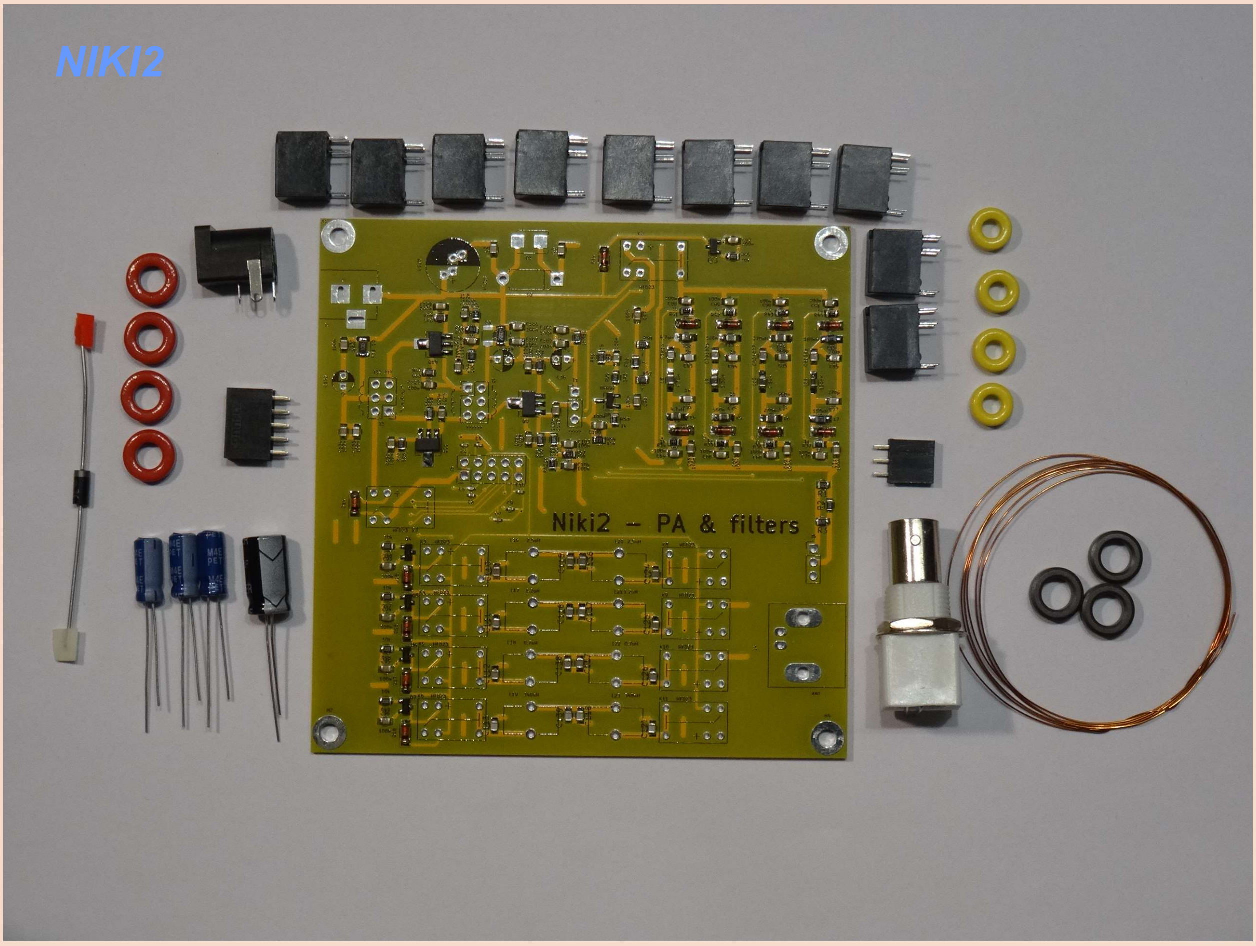



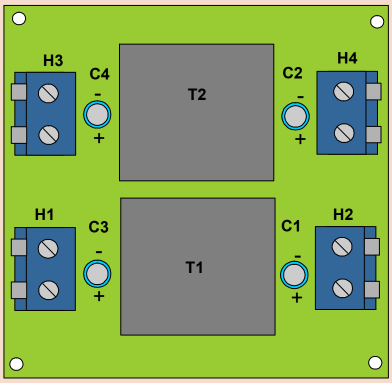
THT COMPONENTS

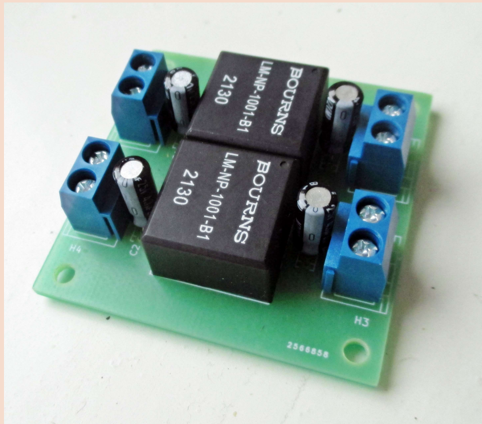




The galvanic isolator
(Option)

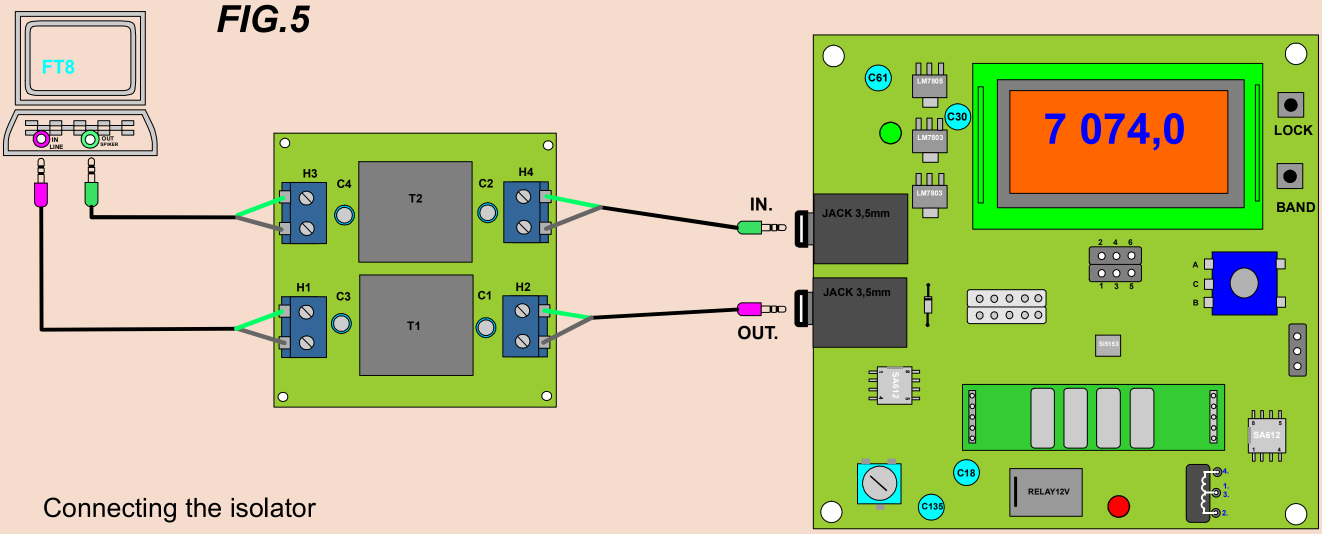
The galvanic isolator is used to protect the computer against overvoltage and RF currents. It is recommended when using an additional high power amplifier.



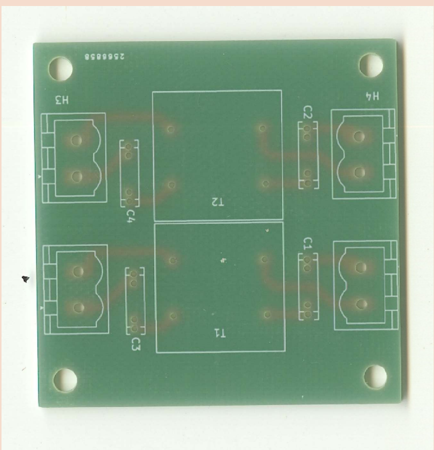


The THT components assembly

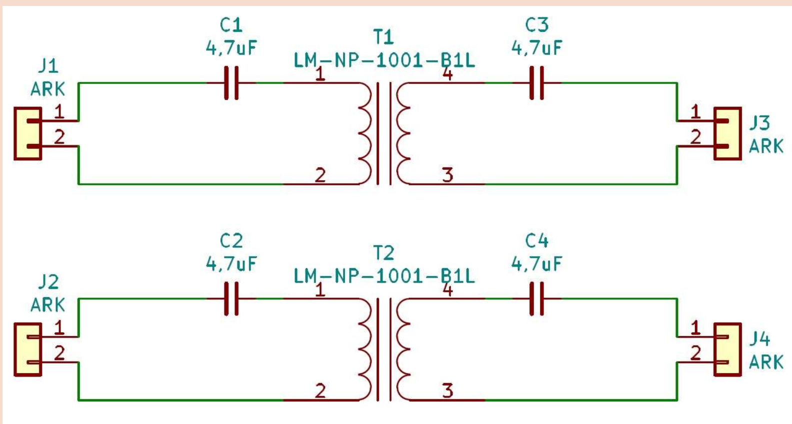
FIG.5



Connecting the isolator

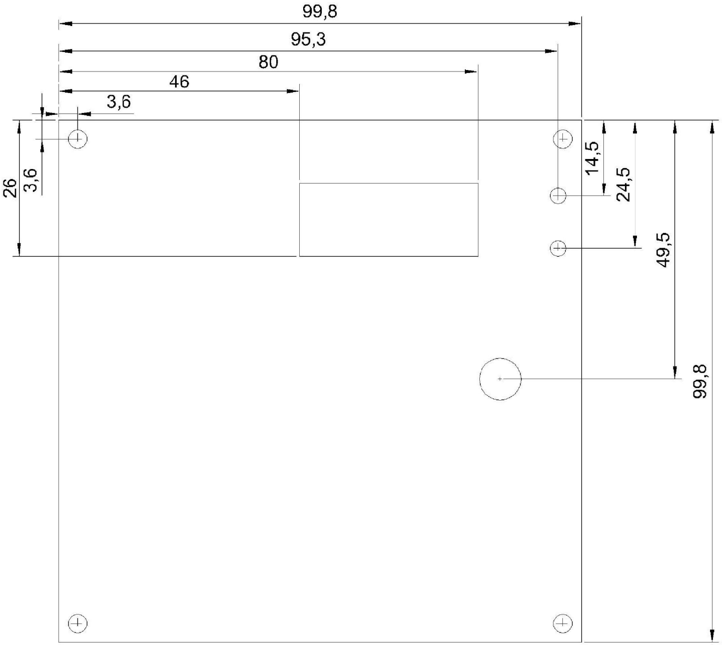


Isolator PCB - top view



SCHEMATIC DIAGRAM

DIMENSIONS



notes