

47 GHz Mixers for newbie - experiments on the tinkering bench by Wolfgang DD8BD

It was my intention to build a converter for 47 GHz, perhaps for future portable activities, but presently only for experimenting in the shack (20m high trees surround my location, so there is little chance for microwave activities from the home qth, but I was able to receive the 10GHz beacon from Hans, DK2MN, during the last year with my 60cm-dish on the roof). I plainly wanted to know, whether I could succeed with building a receiver for 47GHz

Besides those excellent publications about amateur microwave technique in the DUBUS Magazine by DB6NT, DC0DA, DL2AM and HB9MIN, I was very impressed by two articles in the net from K. Banke, N6IZW, („A Simple Harmonic Mixer/ Antenna Feed for 47 and 76 GHz Experiments) who achieved with quite simple means like semi rigid coax and diodes to construct mixers !

N6IZW's articles encouraged me to try my first own mixer design for a simple and cheap 24GHz-mixer (see DUBUS 2/2008) and further experiments on our microwave bands.

For the summer holidays in 2008 I had the plan to build a converter for 47GHz with the well known and fine DB6NT pcb's. Unfortunately I could not get the housing, what belongs to the DB6NT 47GHz transverter, may be my order by snail mail did not reach the address for such milled alu-boxes.

With help from John, PA7JB, I could beg Bert PE1RKI, to build some simple milled alu boxes for me and to form two conical horns for me on his lathe.
<http://members.chello.nl/b.modderman/index.html> With one of these boxes I built the first 47GHz mixer using a DB6NT pcb, the LO was fed via SMA and UT141 coax onto the pcb. As first IF.-amplifier I used a repaired and modified (now with ERA-1) Surplus amp from Picoseconds Pulse Lab and as second one a homebrew amp with MGA 86576 .

Then the idea came, to build a mixer from two aluminium blocks to be able to construct a 4 to 4,5mm round waveguide in the one and a thread for a 5mm adjusting screw in the other . And at last: Why not using the same principle for a 24GHz – mixer!

For these experiments I used two different DMC-oscillators, but a ready made DB6NT LO and a home brew 12-24GHz-doubler with waveguide high pass will also be used when the doubler is matched.

The present state of my experiments is simply to solder the anti parallel double diode BAT15-099 between the outer and the inner conductor of a piece of semi rigid (UT141) at the end of the coax, there is no capacitor in the LO line. The i.f. signal is fed via a thin wire to a SMD 47pF capacitor (47GHz) or a 100pF capacitor (24GHz). The inner conductor then is running into the little round waveguide.

The advantage of this type of homebrew mixer is , that you do not need a pcb ! And as long as you use bigger diode types like of the BAT14- or BAT15-series, you will not need a microscope to get on 47GHz! But as I can not compare this mixer type with those what are used for DX or for contests build along their original description, I can only say, that they are a starting point for newbie's like me on the tinkering bench.

As test beacons for 24 and 47GHz I used i n s i d e the shack ready made DB6NT-LO's , the beacon for 47GHz uses a 11,772225GHz - LO with a homebrew multiplier (again with BAT15-099) and a little homebrew Vivaldi antenna . When starting the 47GHz experiment I had to place the beacon antenna directly in front of the waveguide of the mixer.

Finally I tried to build a mixer for 24GHz with only one alu-block and a cover. The probe is located 3mm below the cover.

What you should have is a drilling machine for the work bench (perhaps additionally a milling machine but that is no must ! You can use milling cutters with your drilling machine although that is not recommended and can be dangerous!) And the little rest of the usual tools like screw-tabs.

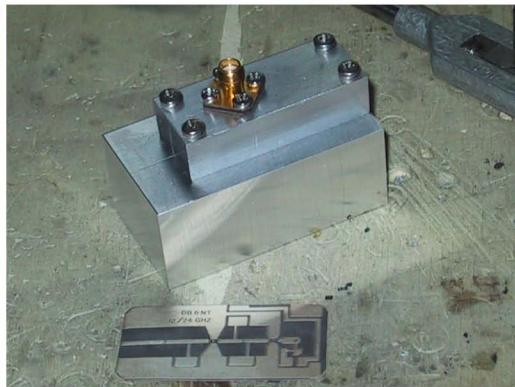
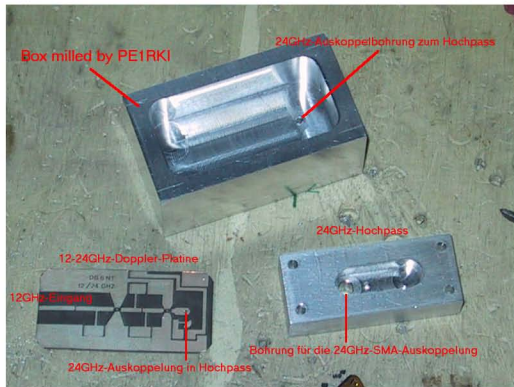
And to drill the 2,5mm threads for the sma-jacks is as easy as to drill the 3mm threads, as I finally found out this summer, hi! Surely you have some magnifier for your bench, so you will not have problems to solder the BAT15-099 or similar diodes! I glue a tooth-pick or a match-stick to the plastic or ceramic housing of semiconductors in order to place them. If you use a milling machine as newbie, be very careful and mill only step by step ½ or 1 mm of the aluminium. Take care; I just saw a milling cutter coming out of its chuck (Spannzangenfutter), because milling too much material.

At last; *Experimenting* with the basis-collector line, as diodes from two BFP420 transistors in a 47GHz-alu-block-mixer, the result was very poor and hardly any signal. Then I thought, why not trying these mixers just for some minutes on 24GHz, although equipped with a round waveguide of 4,5mm and my conical horn. The pocket calculator showed me where to look for the 24GHz IF, the 24GHz beacon was switched on in the shack and suddenly there was a loud beacon signal including my call sign from 24GHz appearing on the right intermediate frequency!!! I will try BFU725F transistors too!

This all is only for experimenting newbie's like me, not for DX, not for contests!

Enjoy your experiments!

73 Wolfgang, DD8BD



Mechanische Arbeiten am 12-24GHz-Doppler

Box for 12-24GHz Doubler

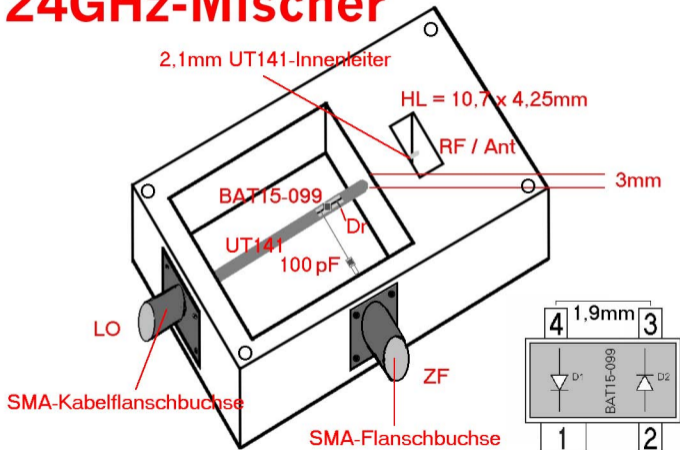
Probe

Hole for Probe

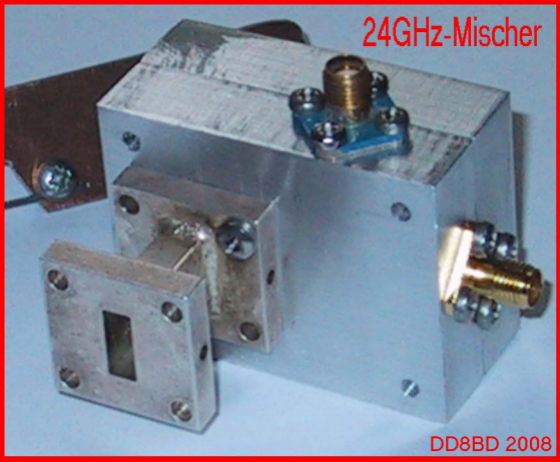
24GHz Highpass



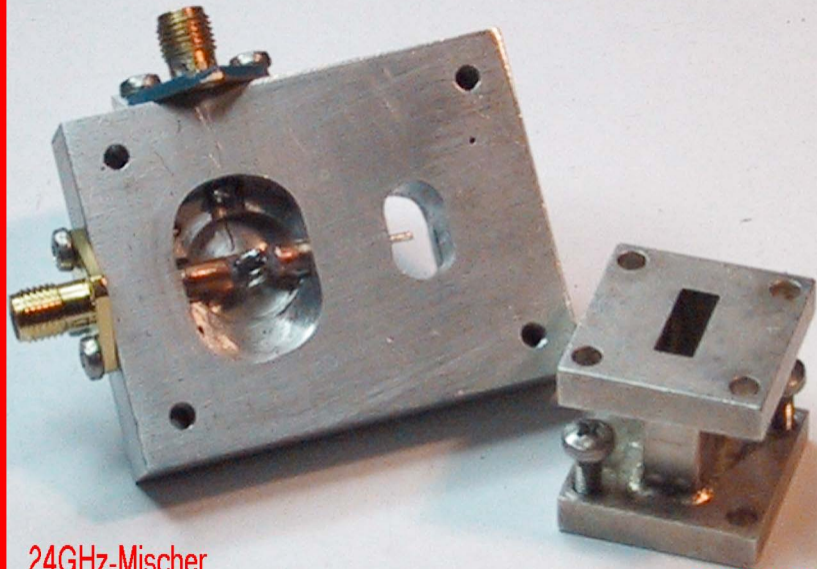
24GHz-Mischer



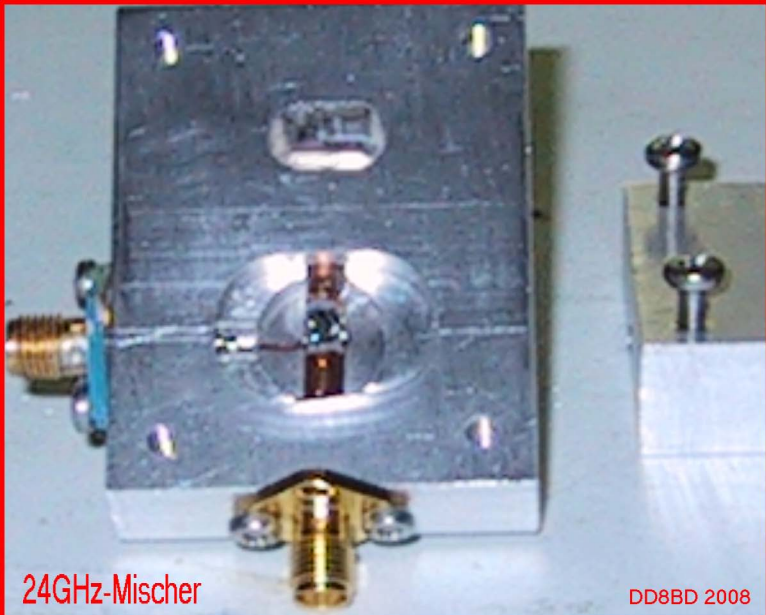
24GHz-Mischer



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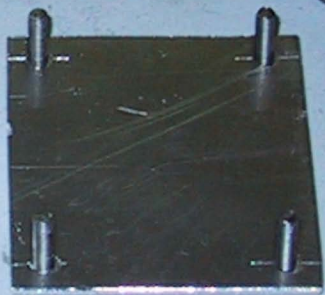
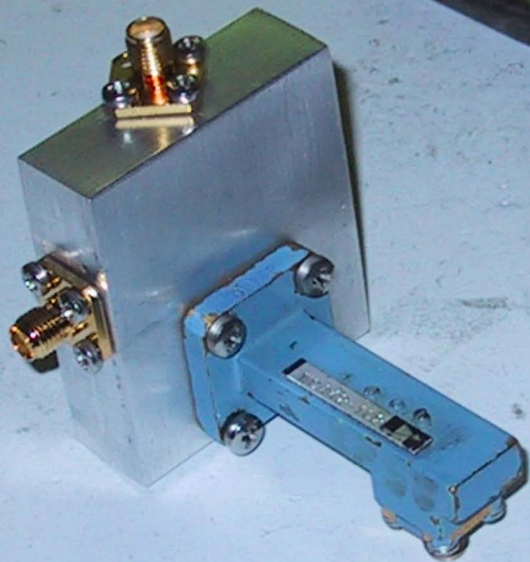


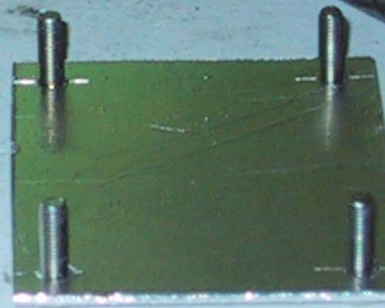
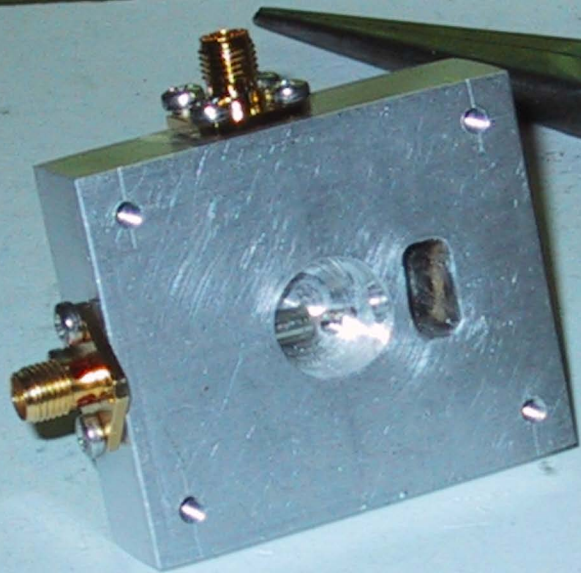
24GHz-Mischer

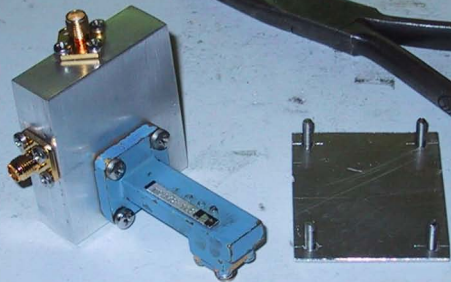


24GHz-Mischer

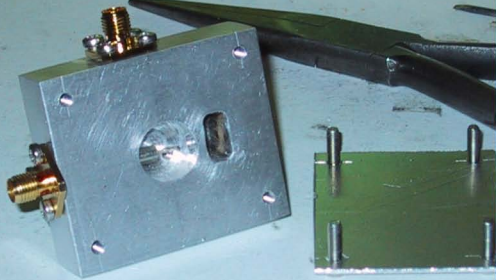
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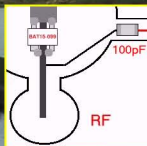
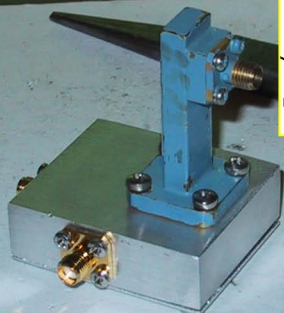




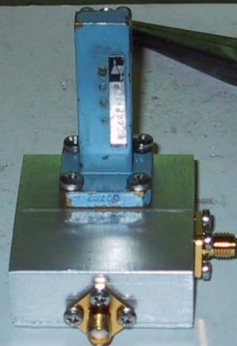
24GHz-Hohlleiter-Mixer



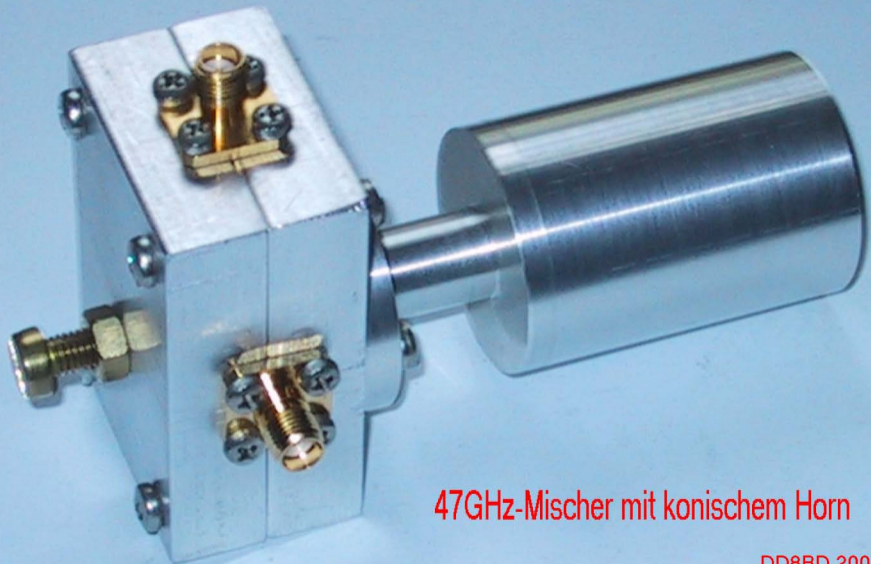
Mischer noch ohne Diode und Kondensator



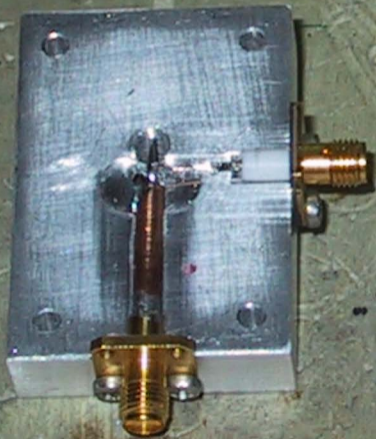
BAT15-099 SMD antiparallele Diode; 100pF SMD-C



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47GHz-Mischer mit konischem Horn





1,2 cm

1,2 cm

! Bol

→ oben + unten Schenkel - Gew.



Vorarbeiten für 47GHz-Mischer

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47GHz-Testaufbau

Bake

Vervielfacher mit BAT15-099

LO

DMC-NT [8.4V / -5V]

MSA86576-AMP

ERA-1-AMP

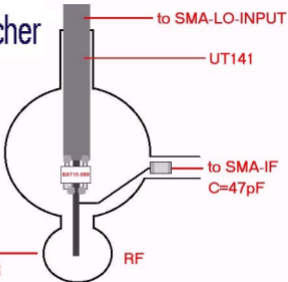
47GHz-Mixer mit BAT15-099

DMC-LO

20dB-conical horn



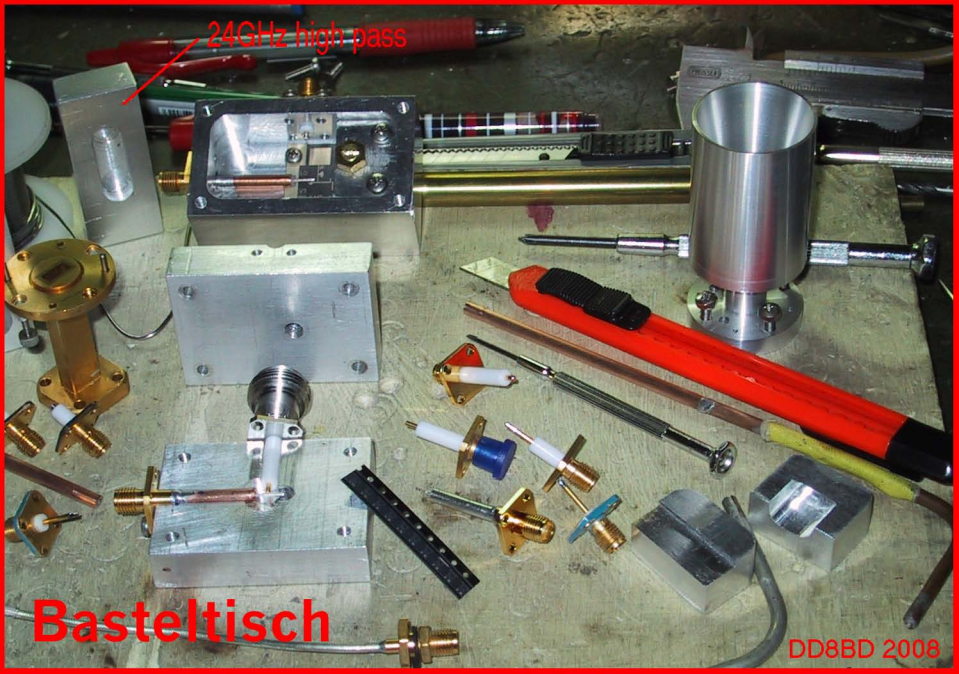
47GHz-Mischer



24GHz high pass

Basteltisch

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Mixer-Diode BAT15-099

47GHz-"First"

Erfolgreiche Signalübertragung auf 47GHz auf dem Basteltisch am 17.7.2008

12-24GHz

47GHz

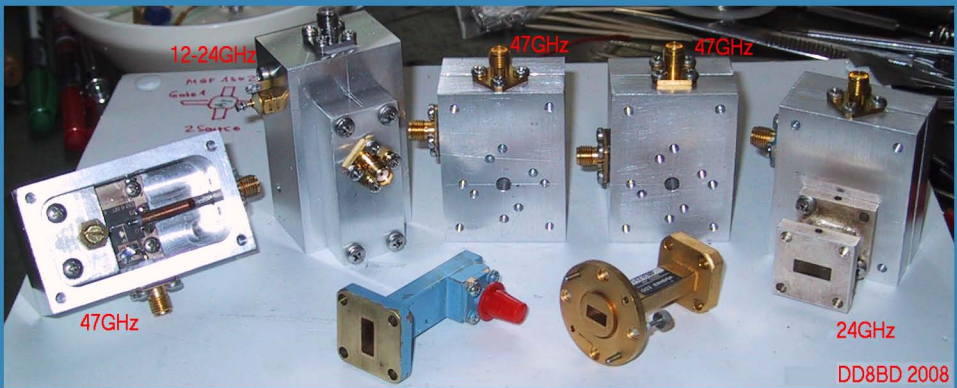
47GHz

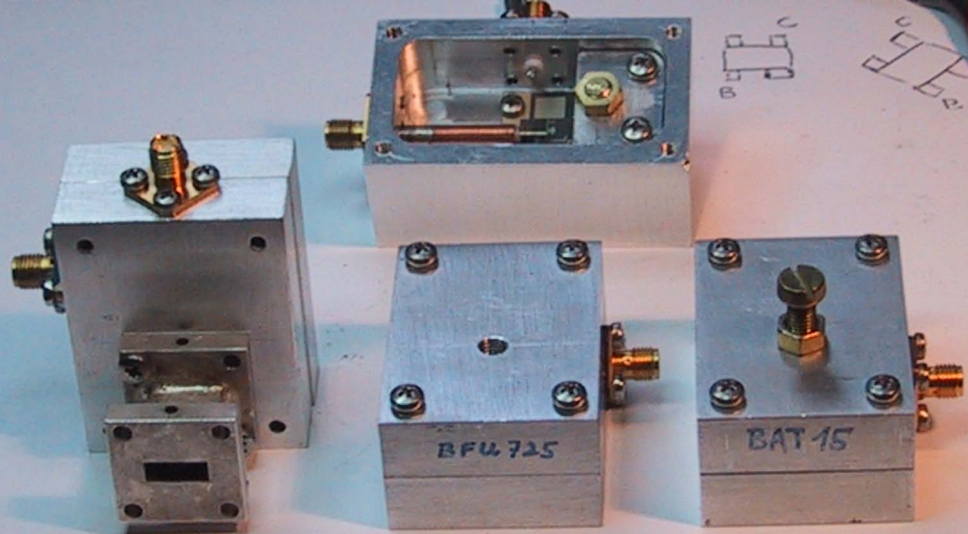
Mag 15W2
Gate 4
2 Source

47GHz

24GHz

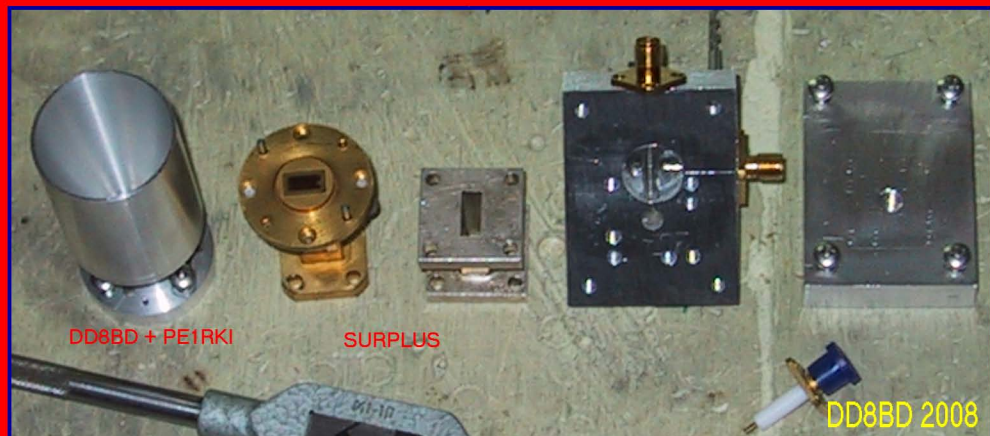
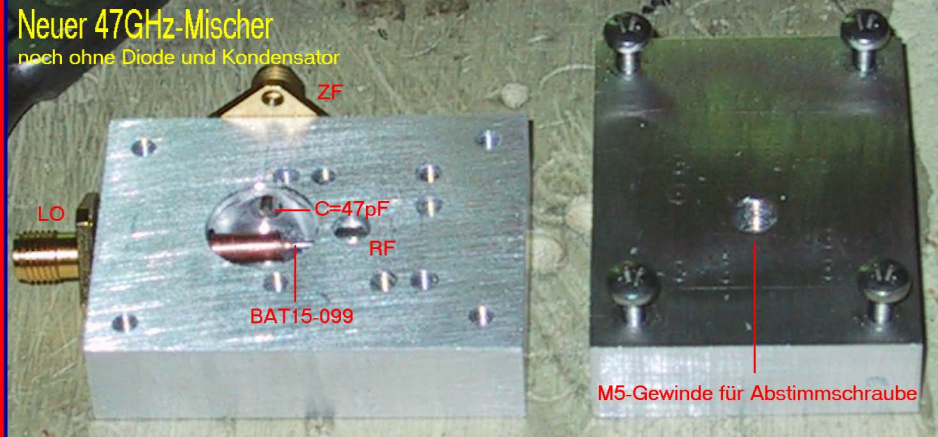
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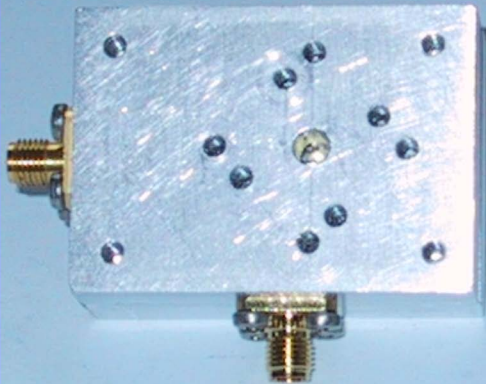


Neuer 47GHz-Mischer

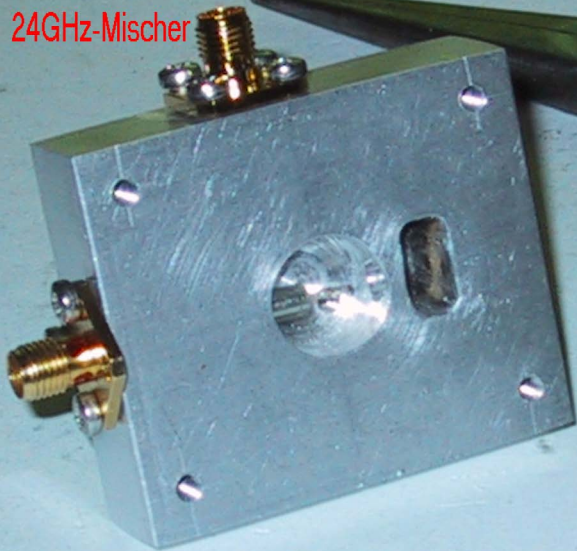
nach ohne Diode und Kondensator



47GHz-Mischer



24GHz-Mischer



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Homebrew vivaldi-antenna

DD88D 2008

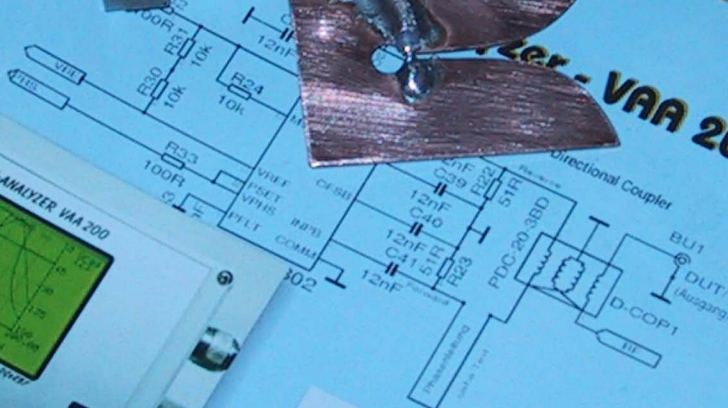
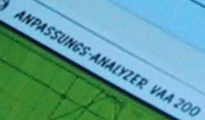
Bernd Koo, DG4RBF

Vektor-Anpassung

Messtechnik im Eigenbau



er - VAA 200 -



... Quartal
... DG4RBF
Elektro-Anpassung
Technik im Eigen
Analyzer - VAA 200

