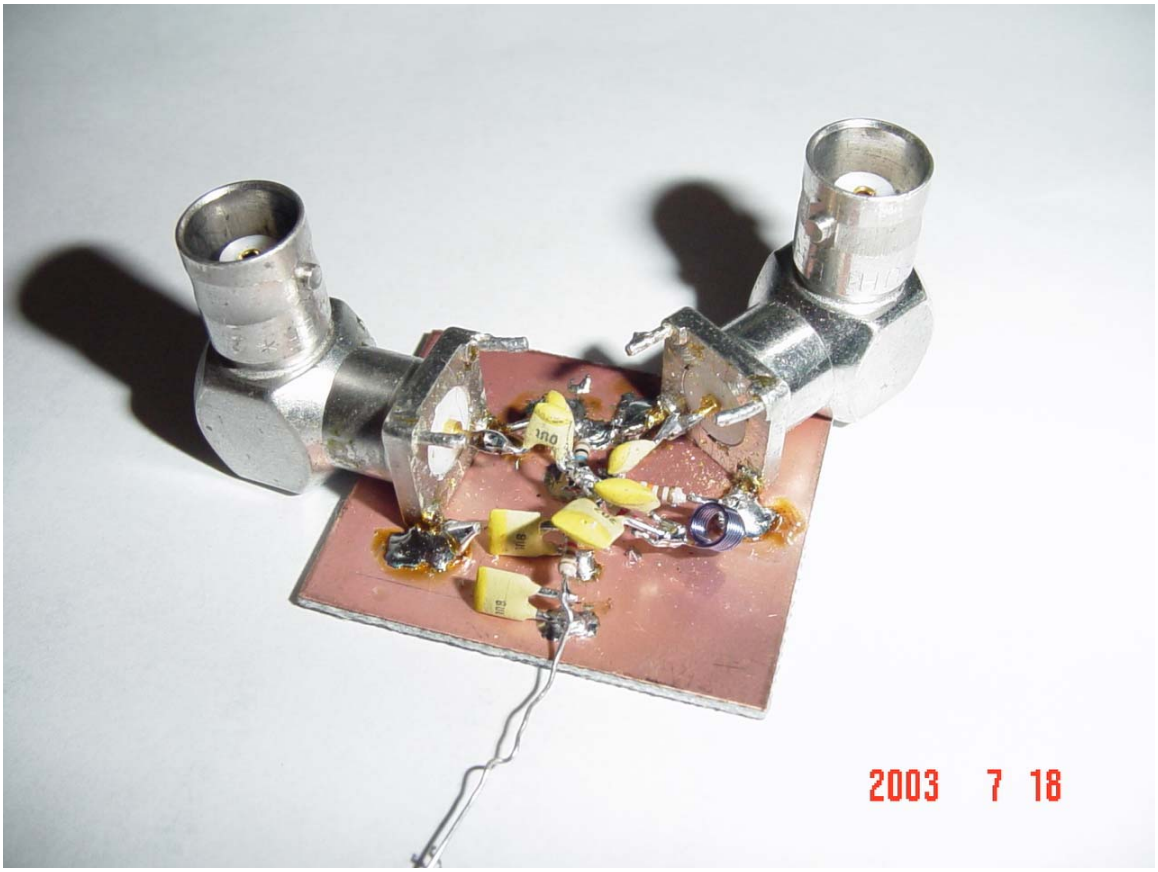
Wide band RF amplifier

10MHz – 500MHz



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Introduction

This paper describes an RF amplifier circuit which is suitable for the frequencies between 10MHz and 500MHz. These kind of amplifiers are called wide band amplifiers.

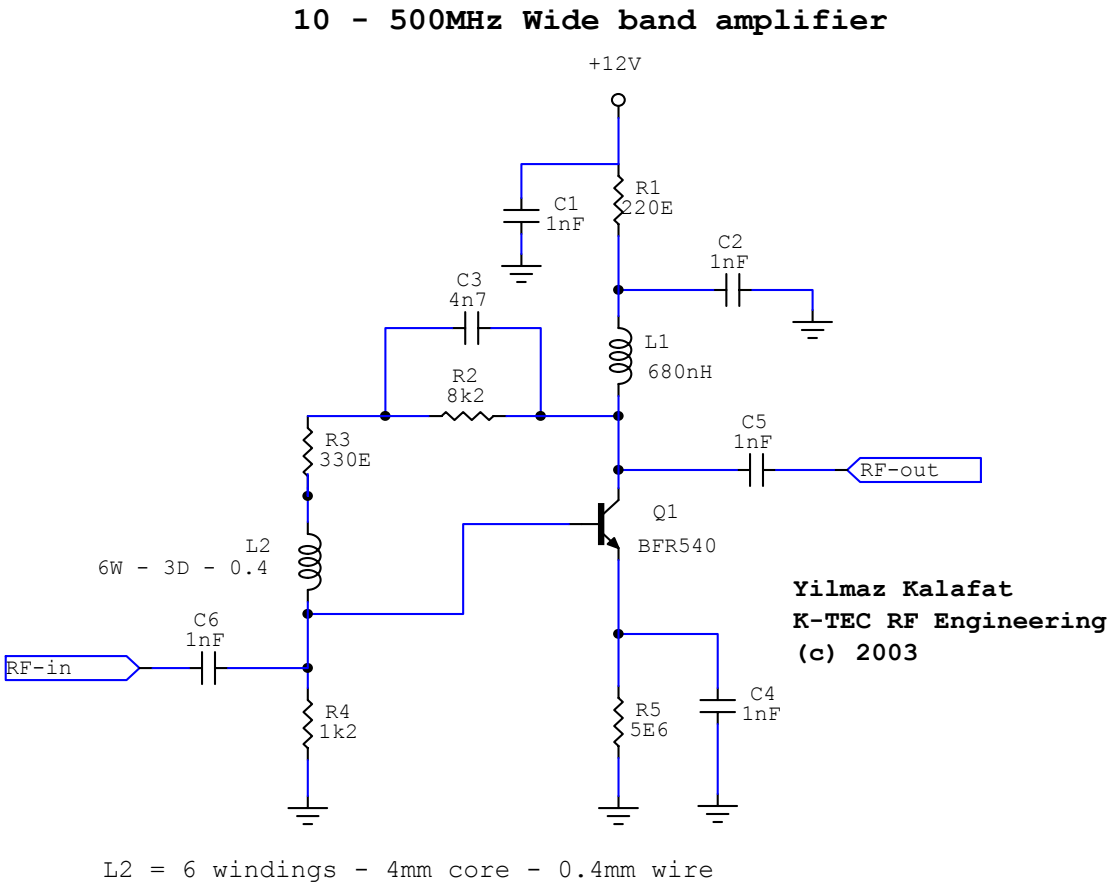
Wide band amplifiers are used in communication receivers, RF measuring equipment and tons of other devices. The circuit described here uses a state of the art transistor to get maximum performance at high frequencies. It can be used as a low noise pre-amplifier due to his low noise characteristics.

Amplifier specification

Supply voltage	: +12V
Current	: 10mA
Input / output impedance	: 50 Ohm
Frequency range	: 10MHz – 500MHz
Noise figure	: 3.5dB typical
IP2	: 110dBuV
IP3	: 105dBuV

All parameters are measured with professional equipment!

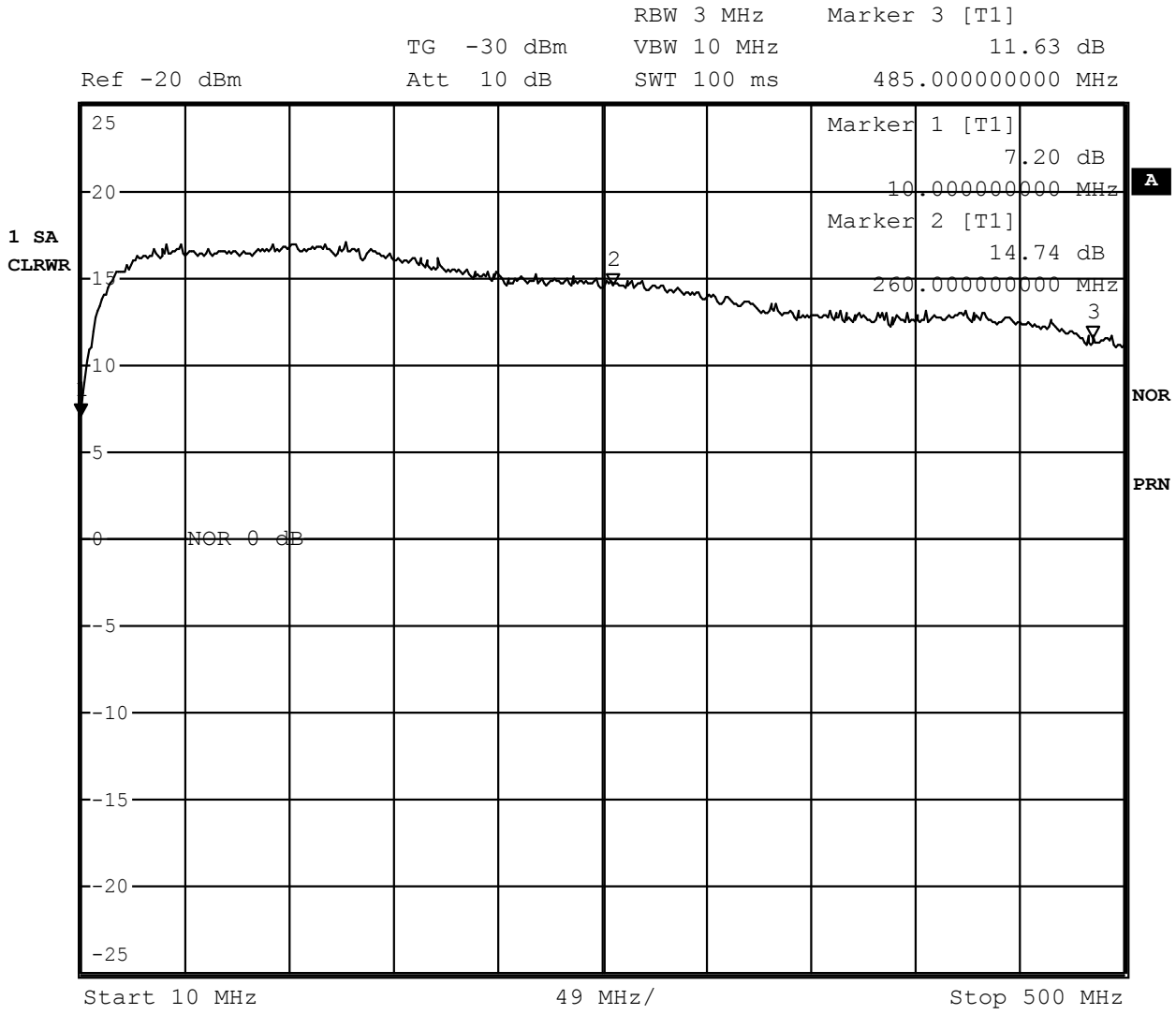
Circuit diagram



L2 = 6 windings - 4mm core - 0.4mm wire

This is a classical RF amplifier design. The feedback resistors R3 and R2 define the gain. By changing the values we can get a higher gain at low frequencies, but this will influence the overall gain taper of the amplifier. Coil L2 is used to get more gain at high frequencies. If the value is increased, instability will occur. Dimensions of L2 are: 6 windings, inner diameter is 3mm and wire thickness must be 0.4mm. In the proto type I used and SMD type for L1, make sure it's a high Q coil. The transistor, which is used here, is a wide band transistor with an Ft of 9 GHz. Like in all other RF circuits make sure that the connections are short as possible.

Measured parameters



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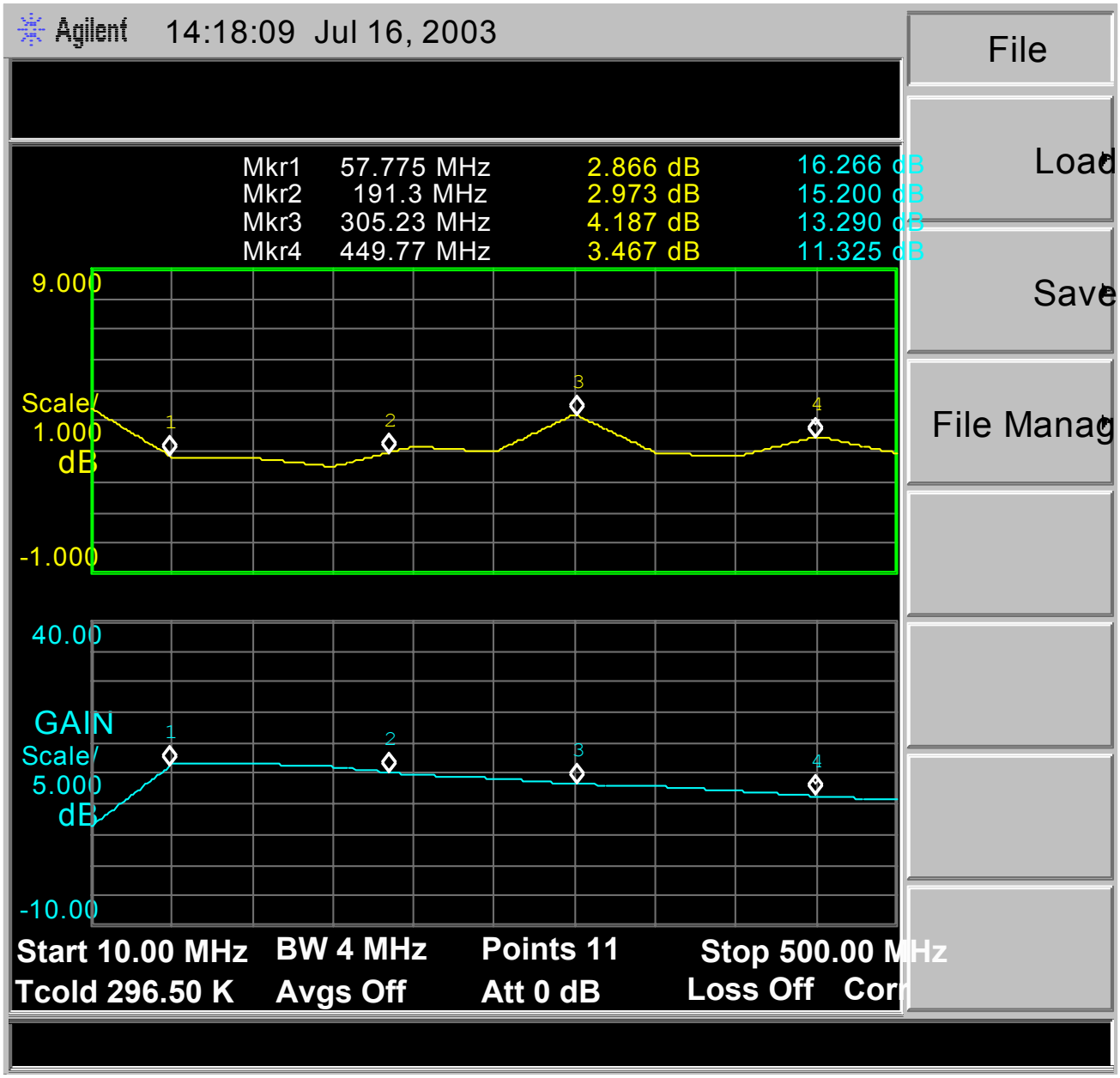
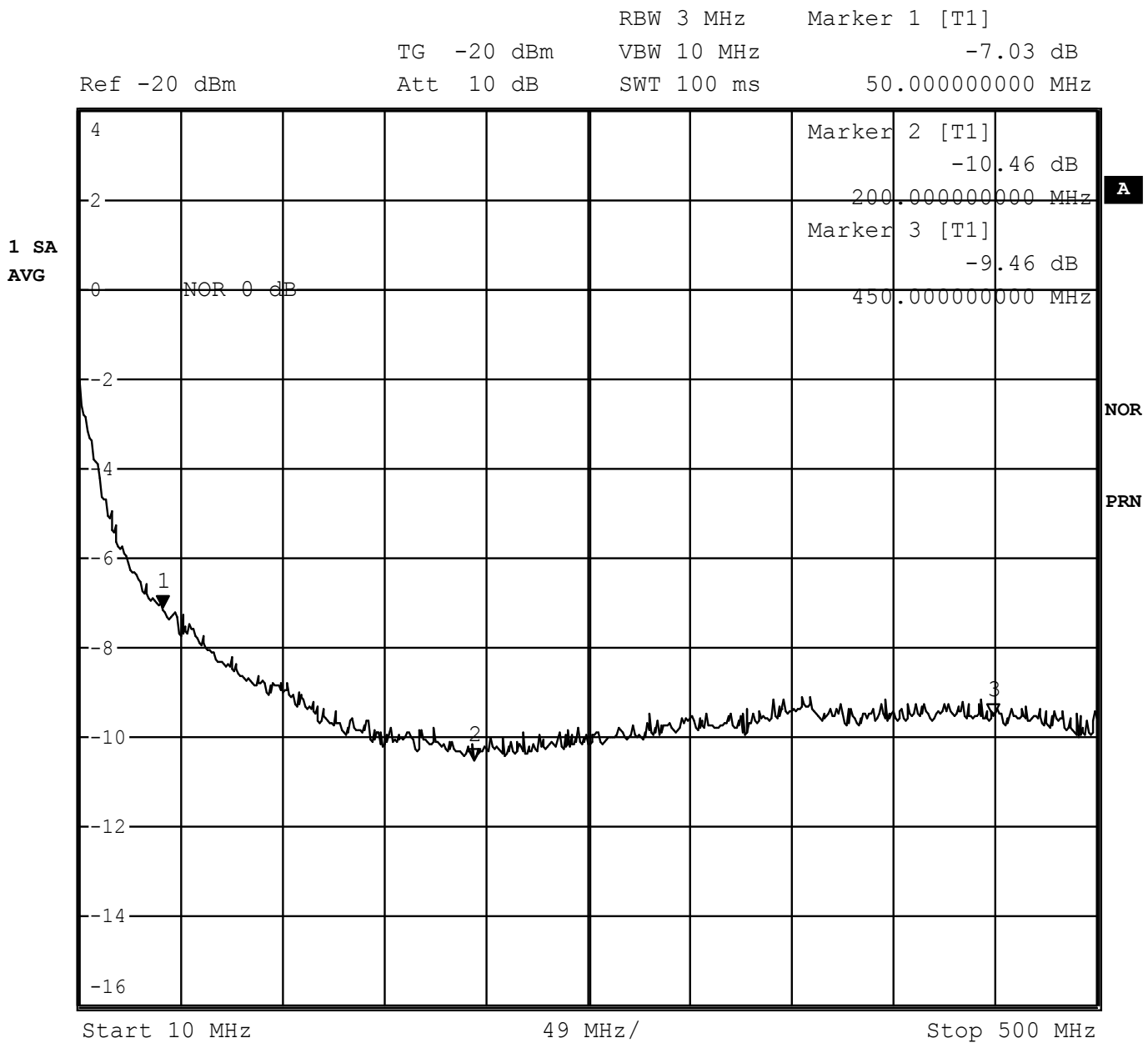
Amplifier gain is measured with a spectrum analyser, overall gain is >10dB, see picture above.



This pictures is a snap shot of an Agilent Noise Figure analyser, which I used to measure the noise figure. Typical noise figure is around 3.5dB. Marker-3 shows 4.1dB due to a disturbance in my lab, the amplifier was also not shielded. Lower graph shows the overall gain.



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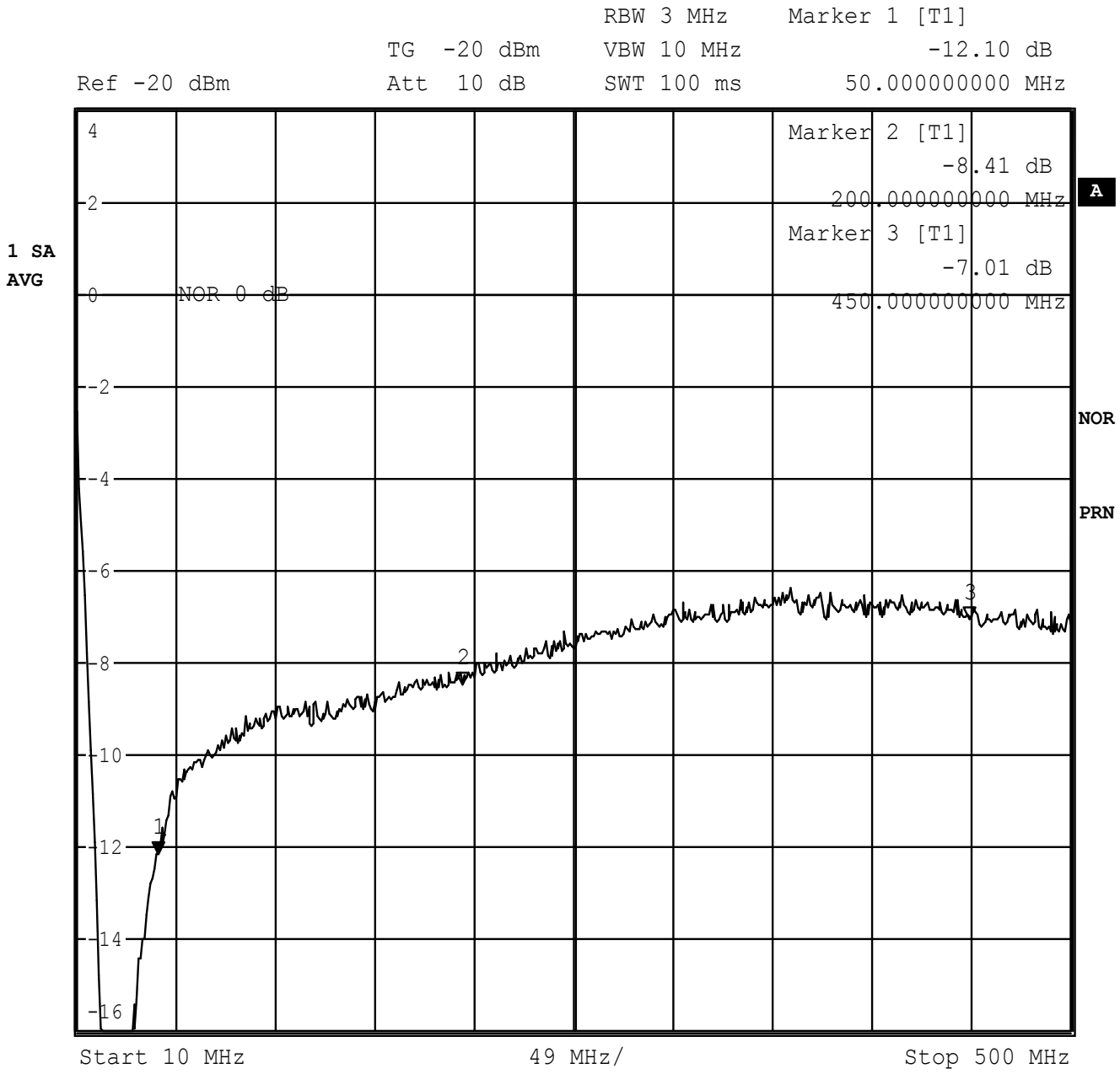
Picture above depicts the return loss of the amplifiers input. We can translate this value, which is >9dB, to a VSWR of 2 or lower. This is an acceptable value for a wide band amplifier.



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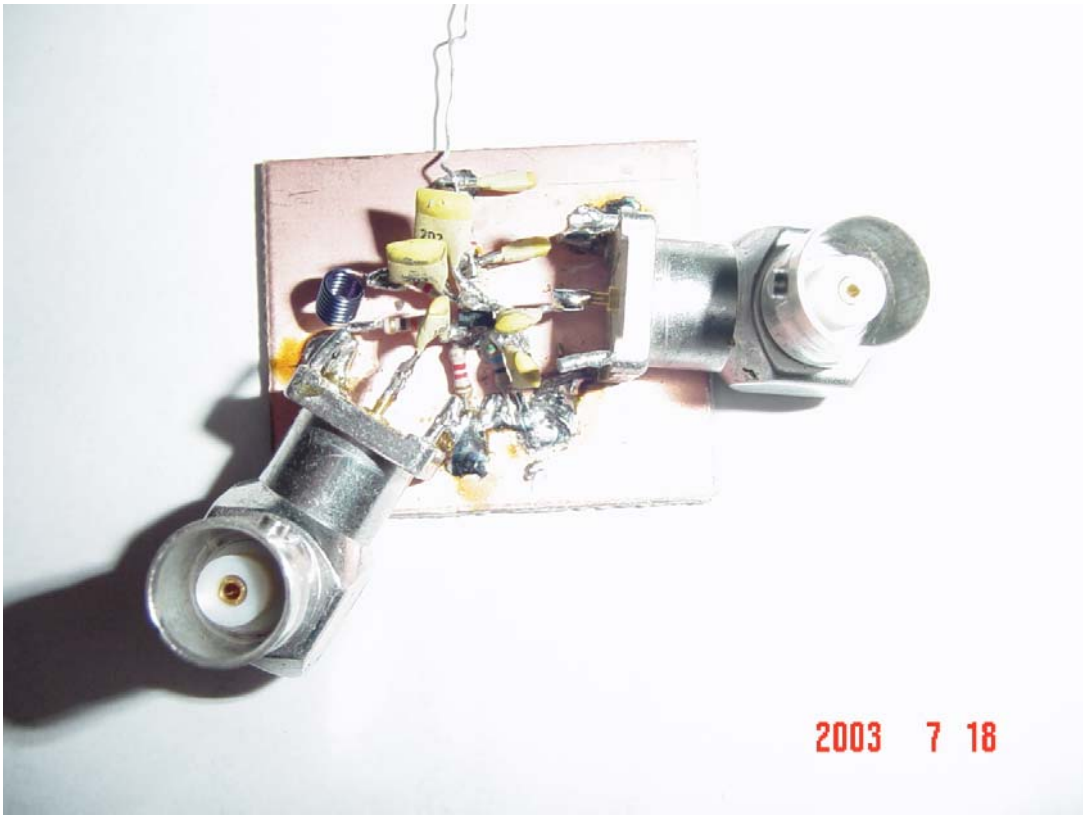
The same return loss measurement is also done for the output, VSWR is lower than 3.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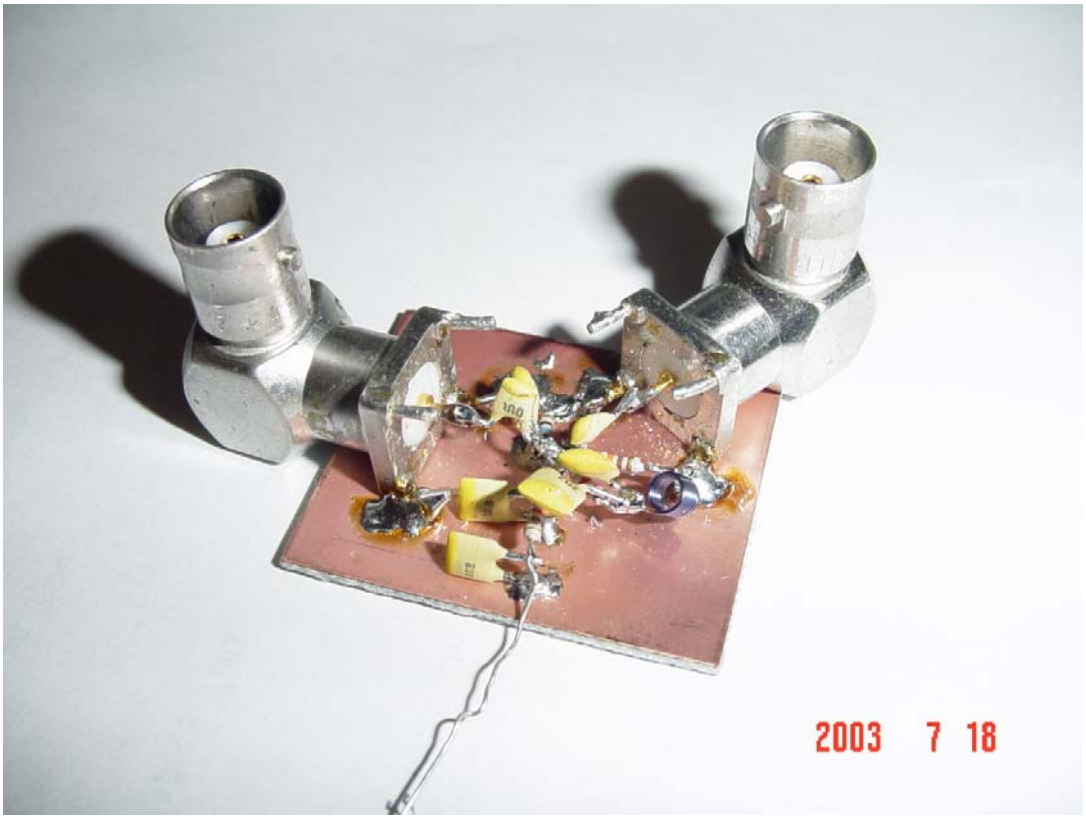
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