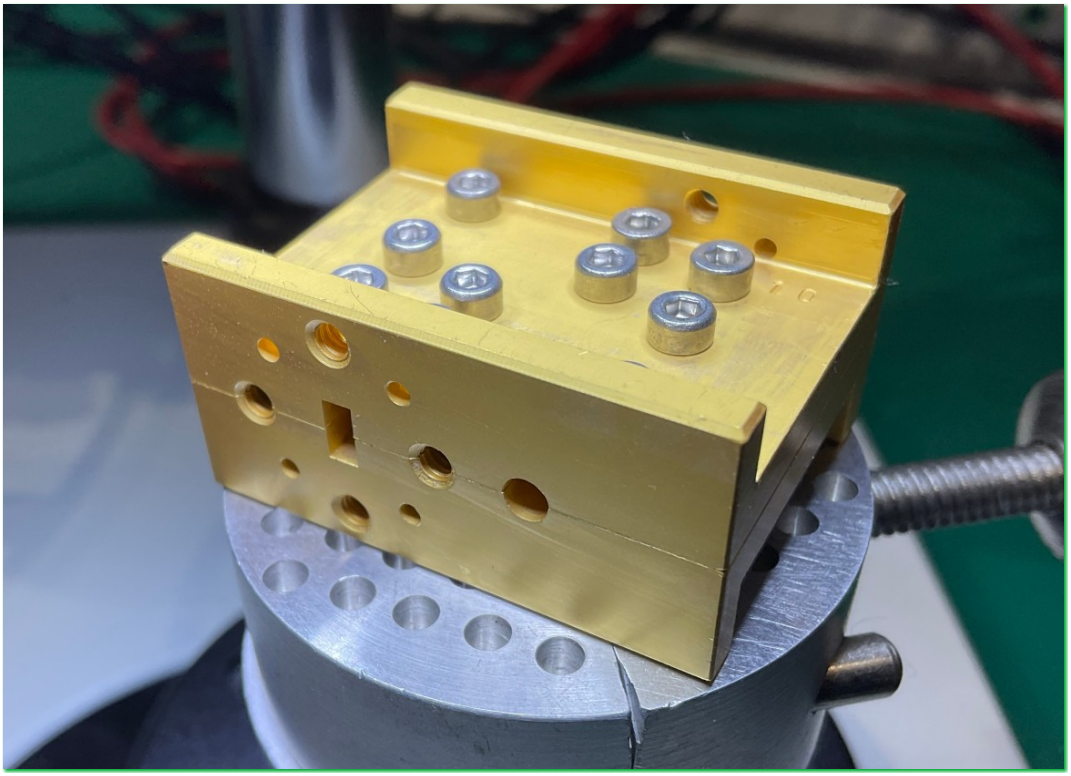
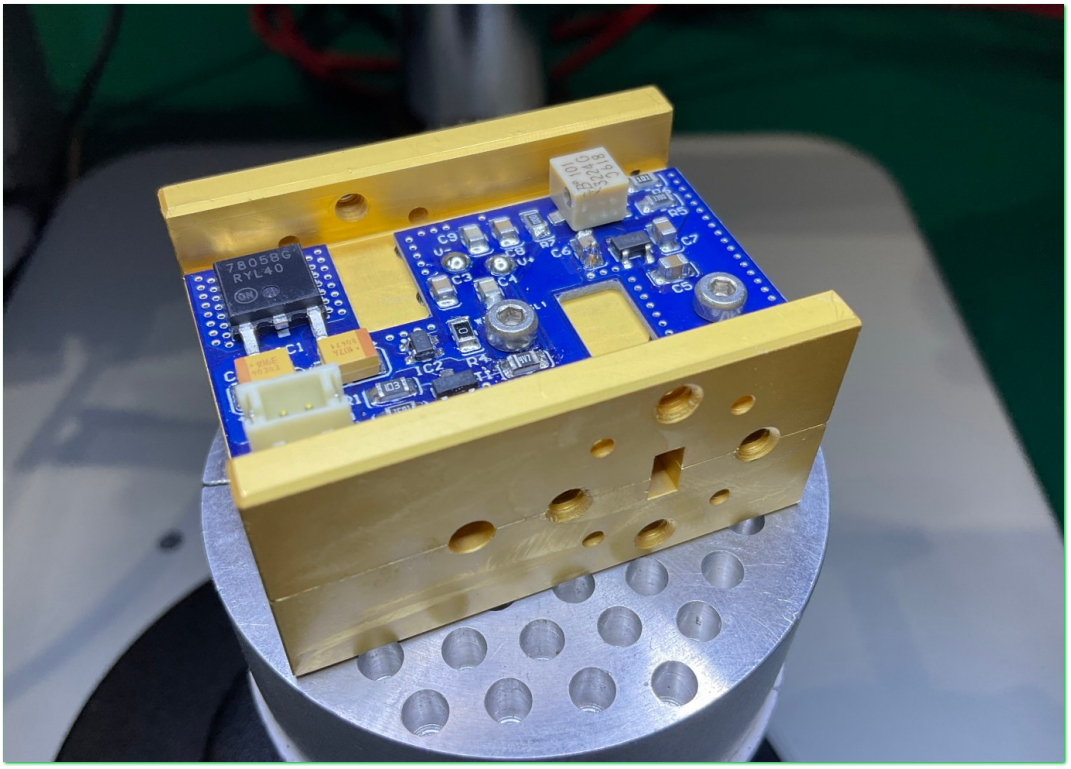


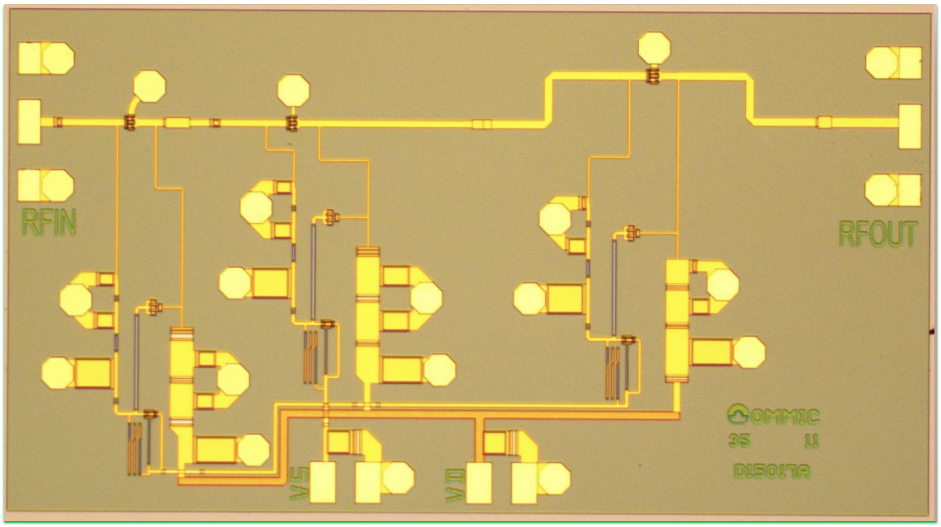


DFH47GHz LNA v1

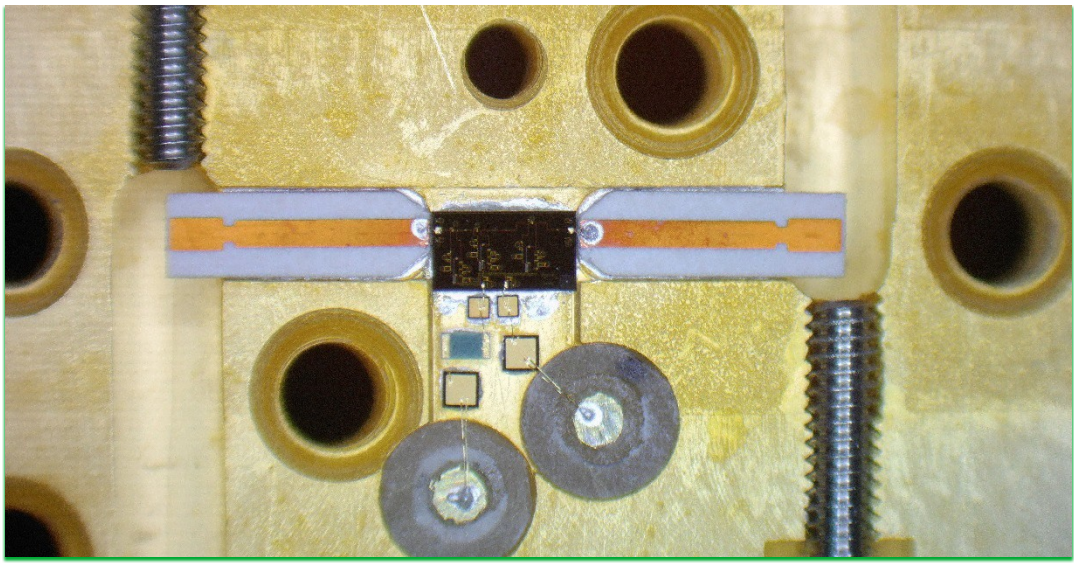
EA5DOM
EA3HMJ
EB3FRN

Intro

The DFH47GHz low noise amplifier is based in the MMIC CGY2260UH/C1 from OMMIC. It is a three stages GaAS with a size of 1.68 x 3.0 mm, covers from 25 to 43 GHz with a flat gain of 25 dB and a noise figure under 1.8dB.

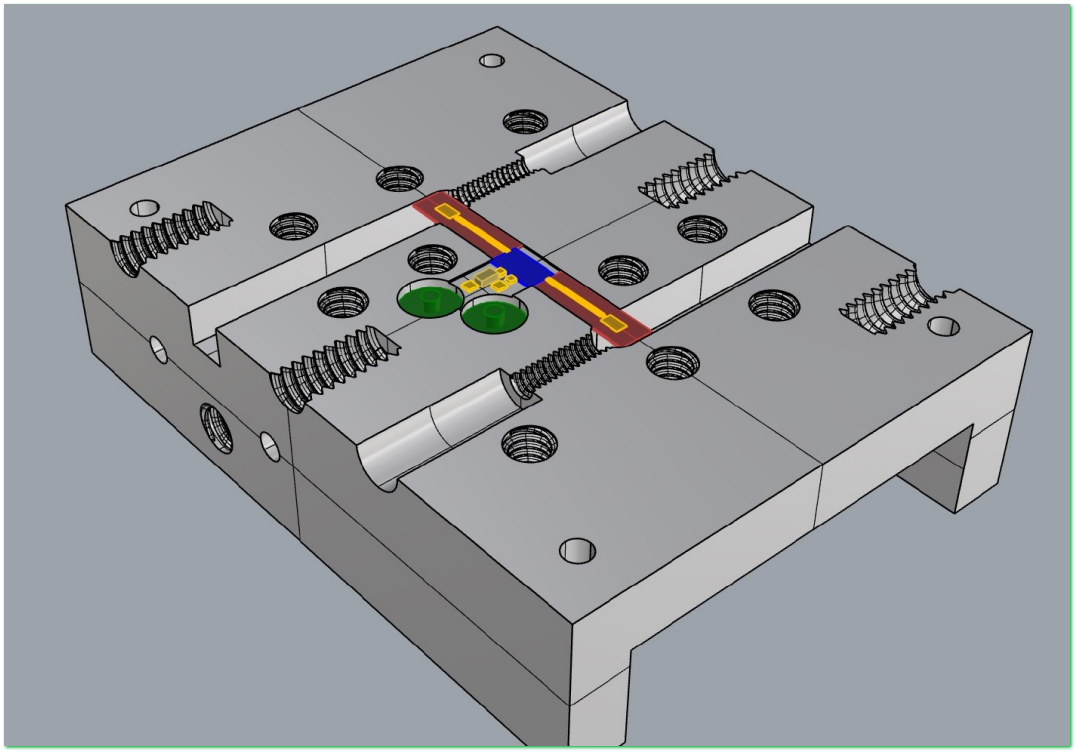


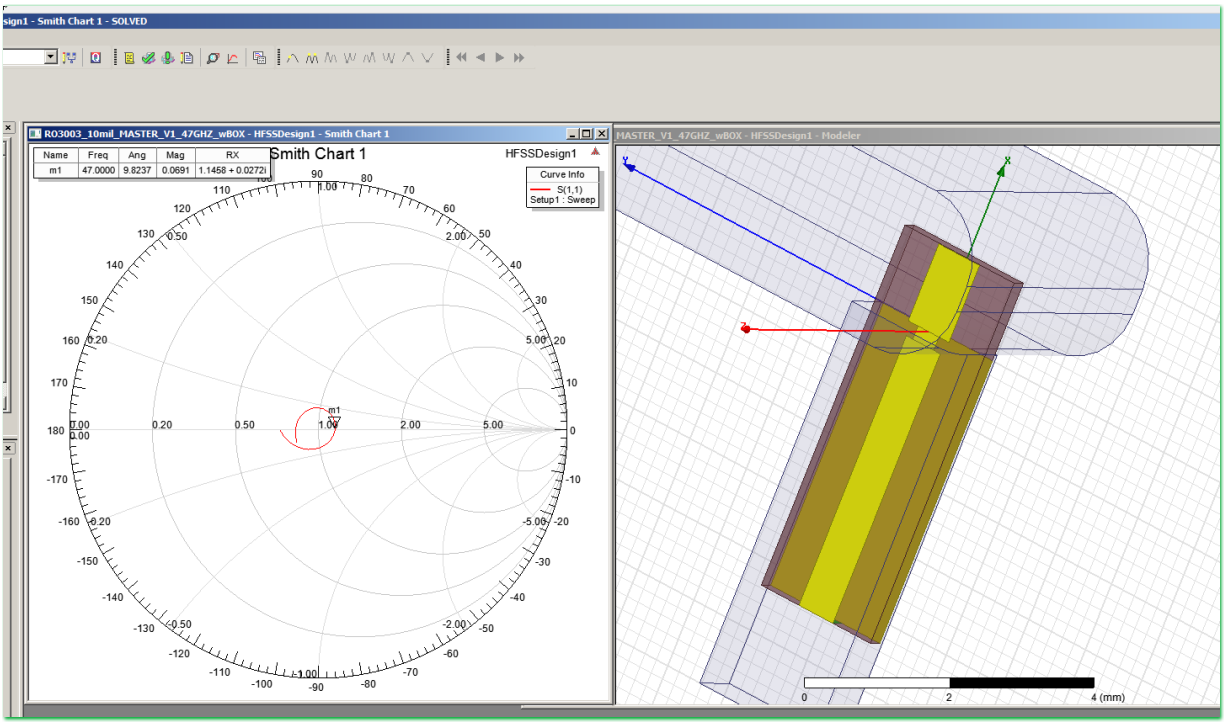
This MMIC chip is designed for K band but has very good performance up to 50 GHz. We have designed a LNA around it to get the best noise figure possible at 47,088 GHz.



Design

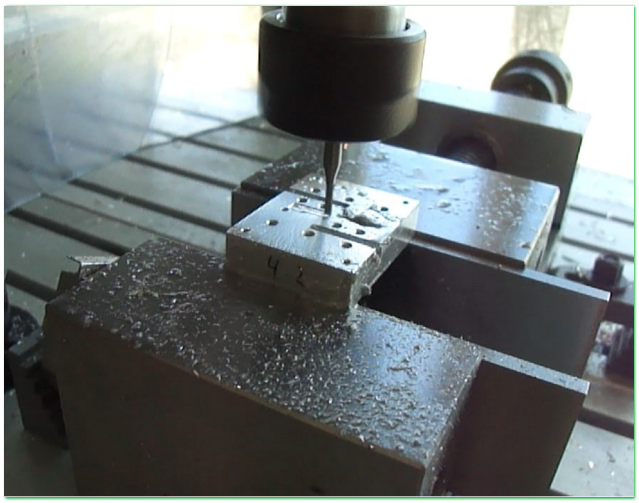
The amplifier has been designed using CAD/CAM and High Frequency Electromagnetic Simulation Software to simulate the waveguides, the microstrip and probes.

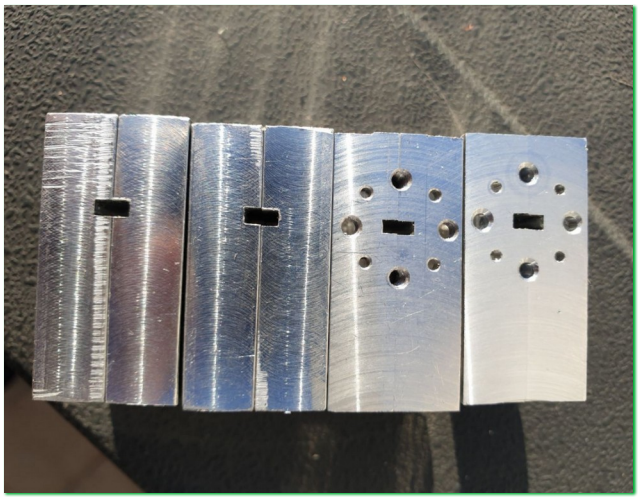


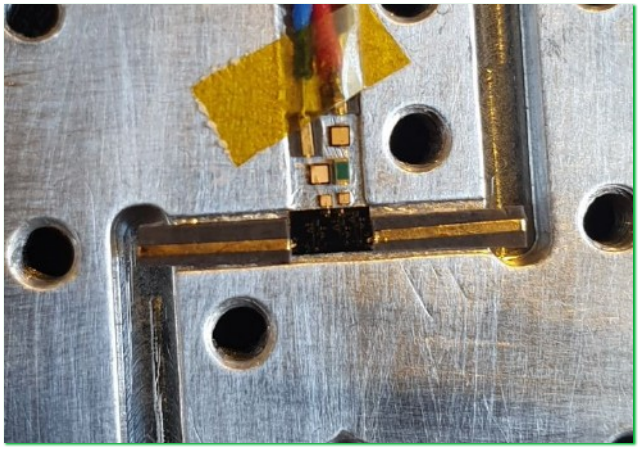


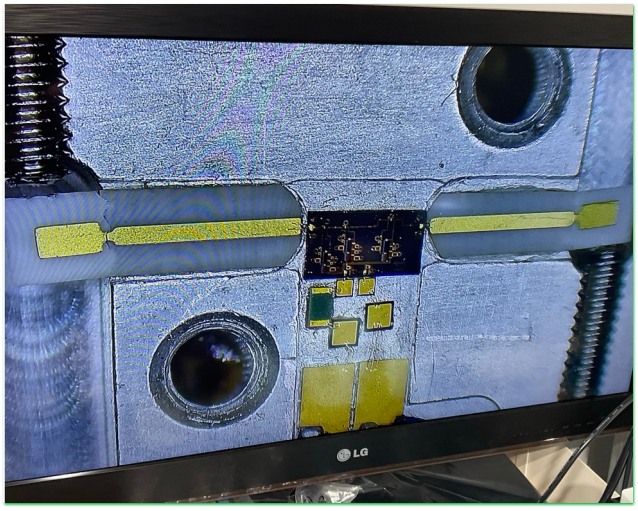
Prototyping

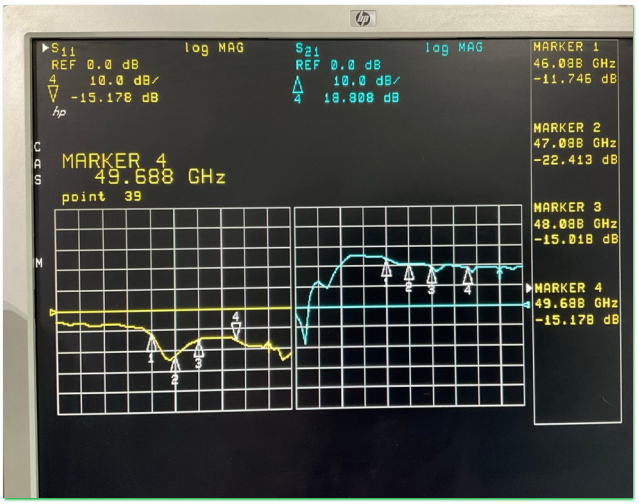
Three different versions have been built with a total of six evolutions to achieve the best performance and reliability.





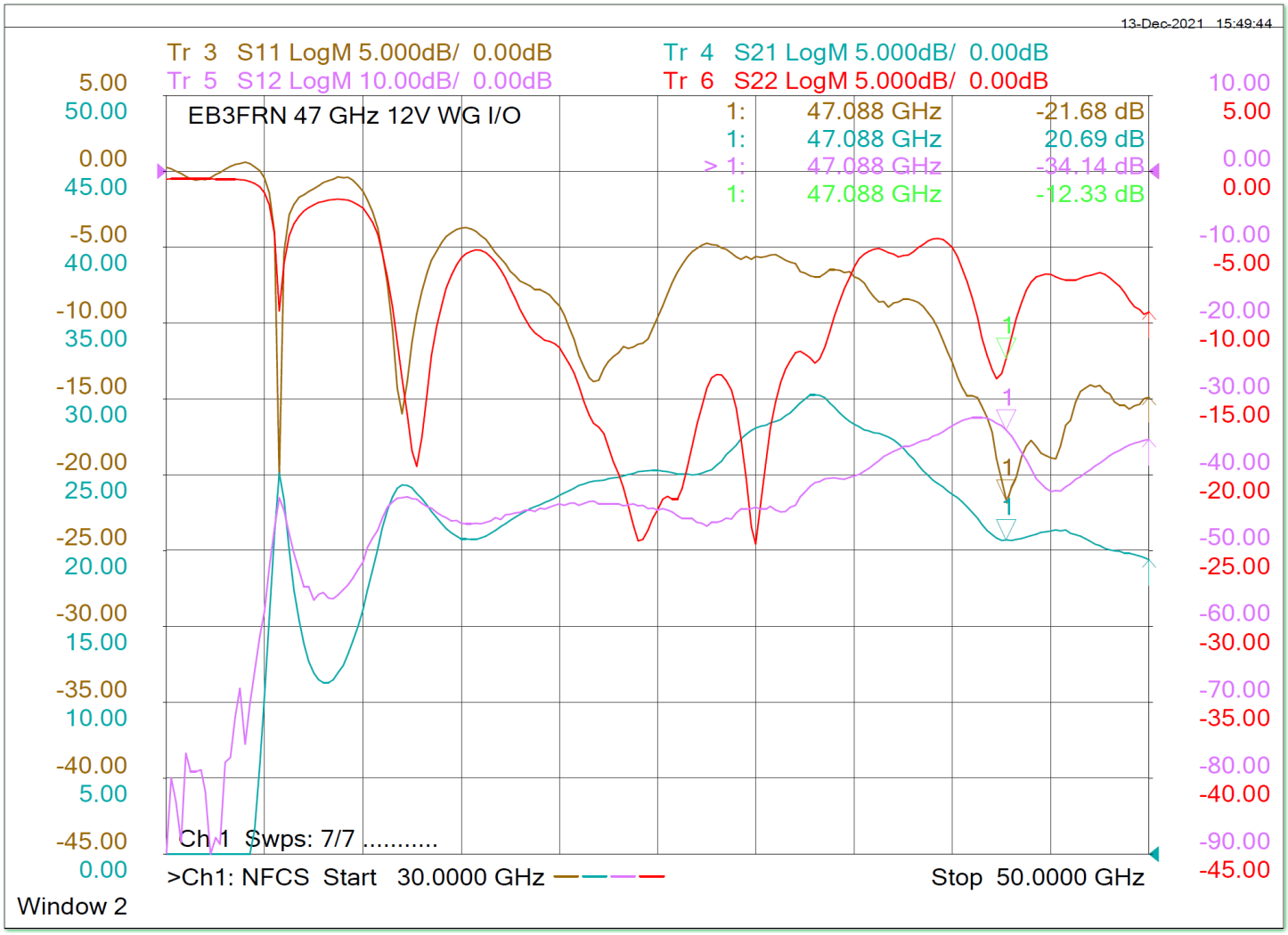






Preliminar S-parameters

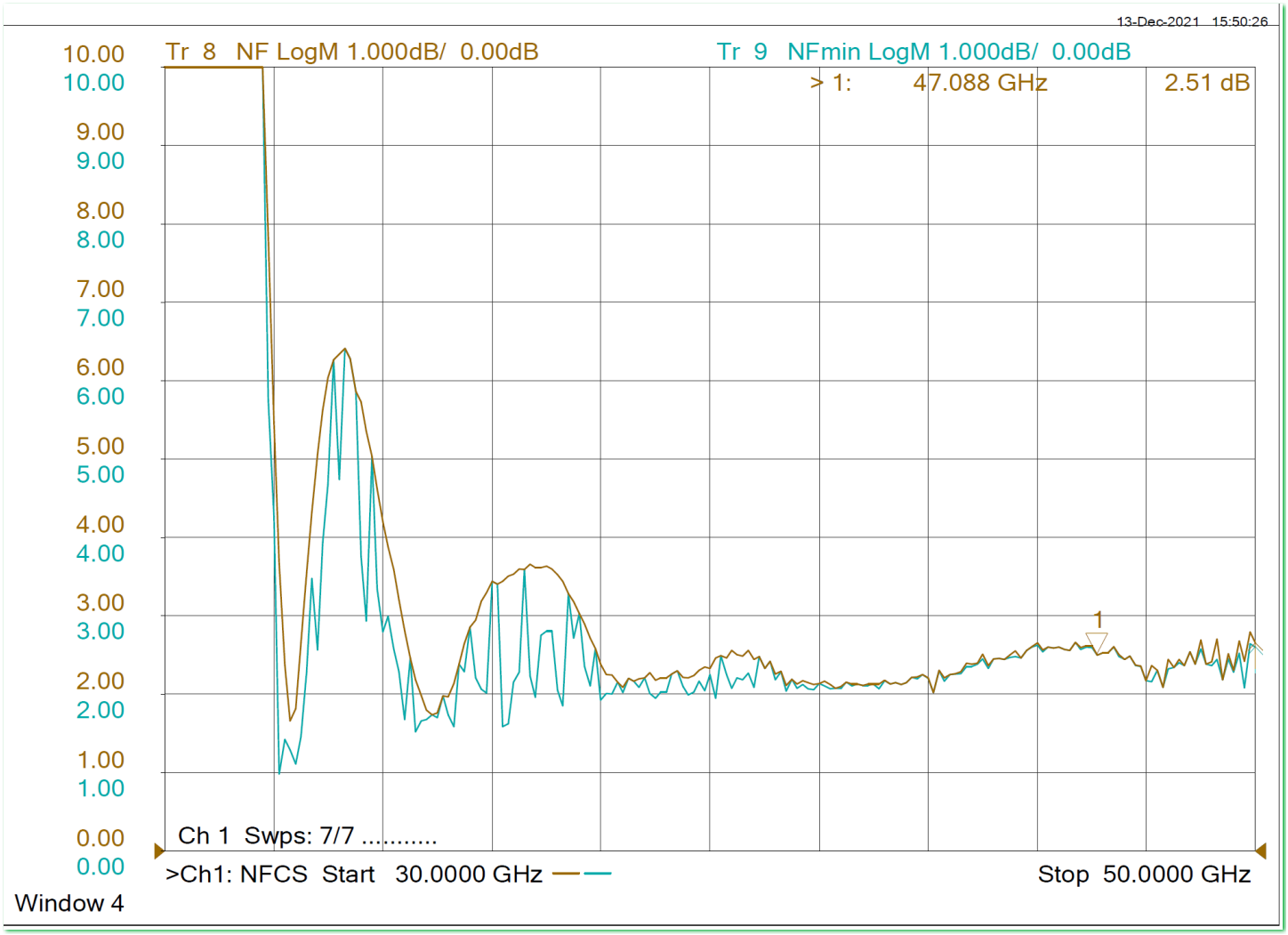
Independent measurements of the scattering parameters were made at the Yebes Astronomical Center (CAY). The DUT is the 1st preproduction unit used to evaluate the final design of the LNA and to verify the measurements in our laboratory.



Preliminar Noise Figure

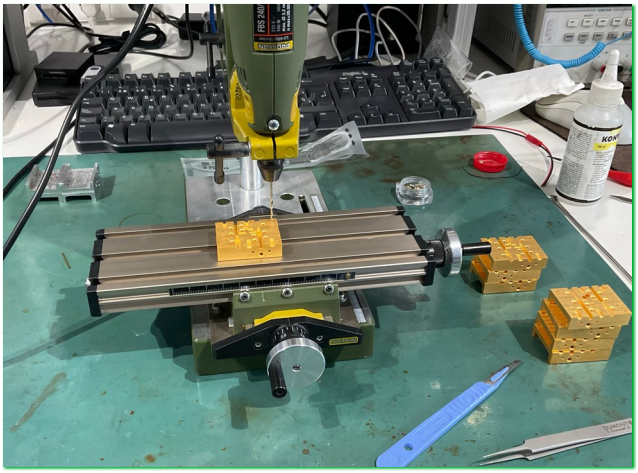
Independent measurements of the scattering parameters were made at the Yebes Astronomical Center (CAY). The DUT is the 1st preproduction unit used to evaluate the final design of the LNA and to verify our laboratory equipment including the noise source.

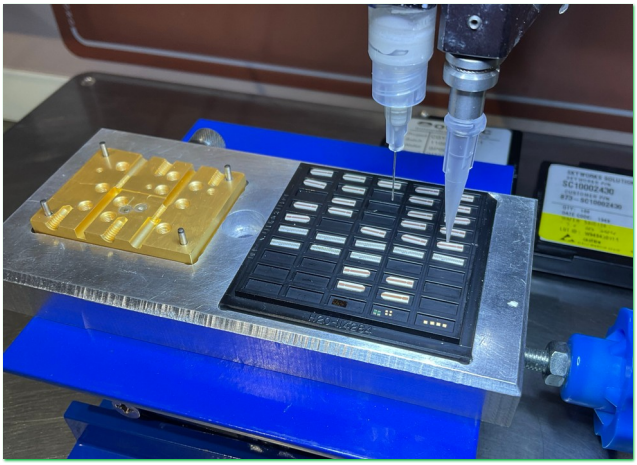
https://icts-yebes.oan.es/reports/doc/IT-CDT-2021-3.pdf

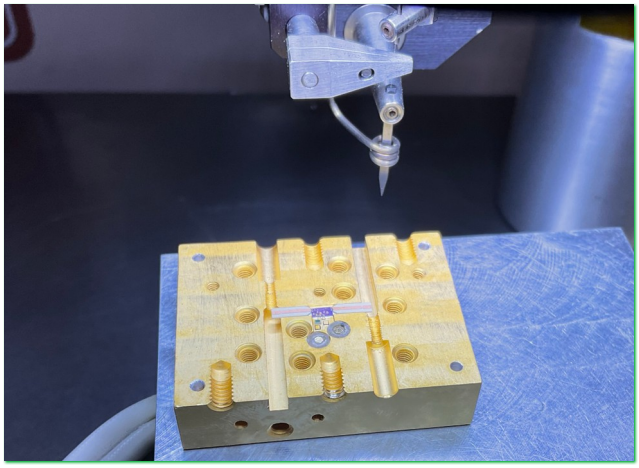


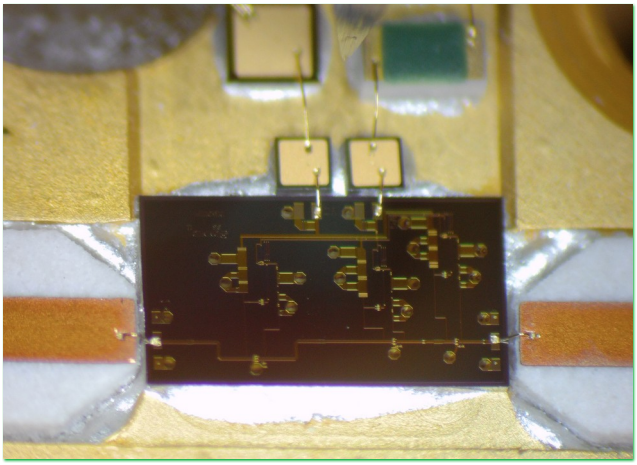
Production

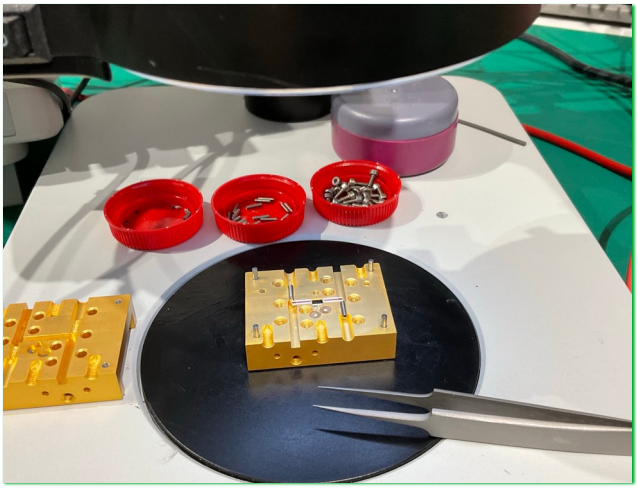
The chips are glued using EPO-TEK H20E epoxy and assembled using Westbond diebonding and wirebonding machines.
The bonding is performed using .8mil gold wire.

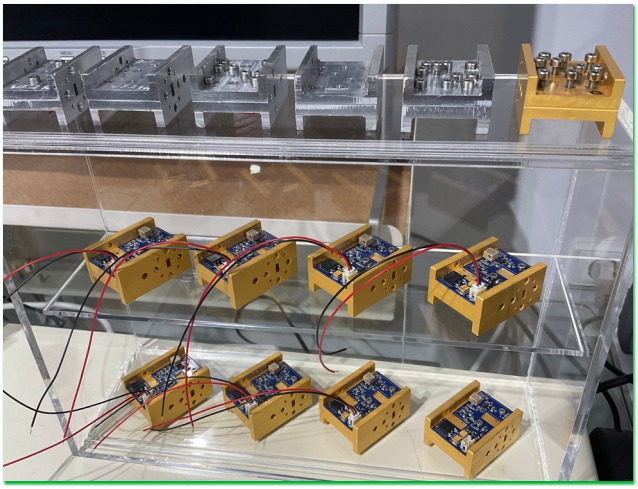






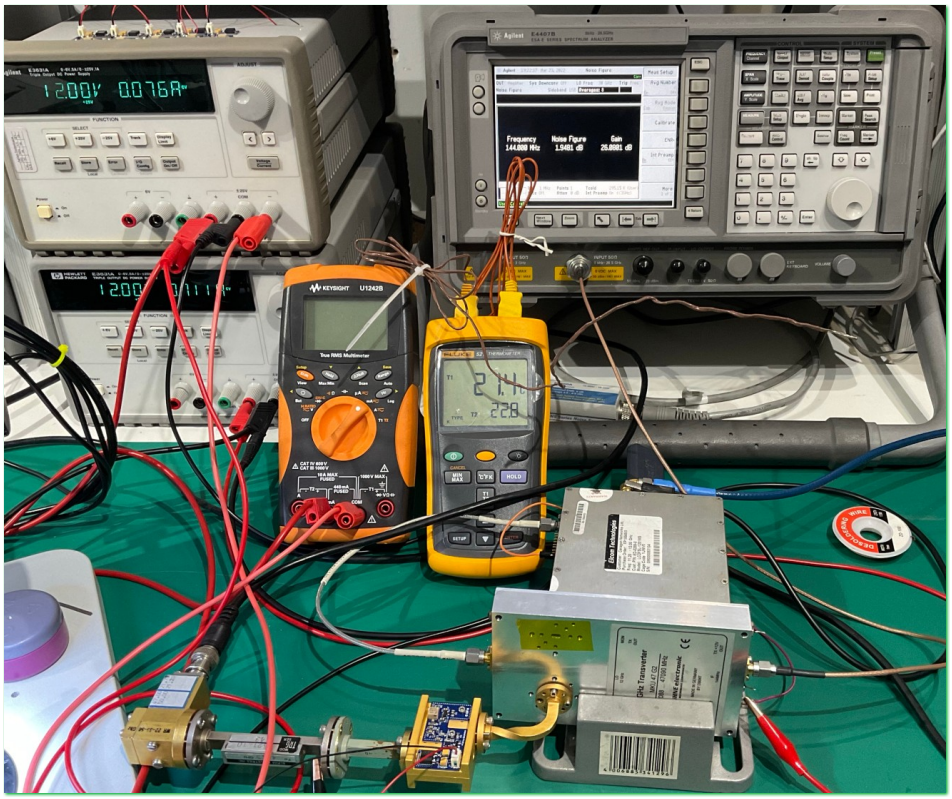


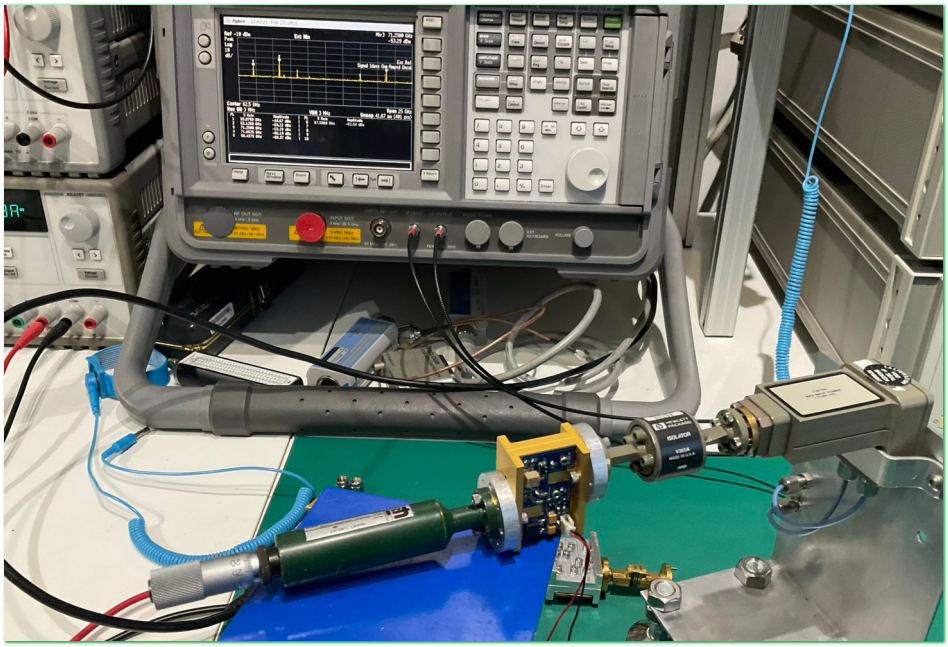




Testing

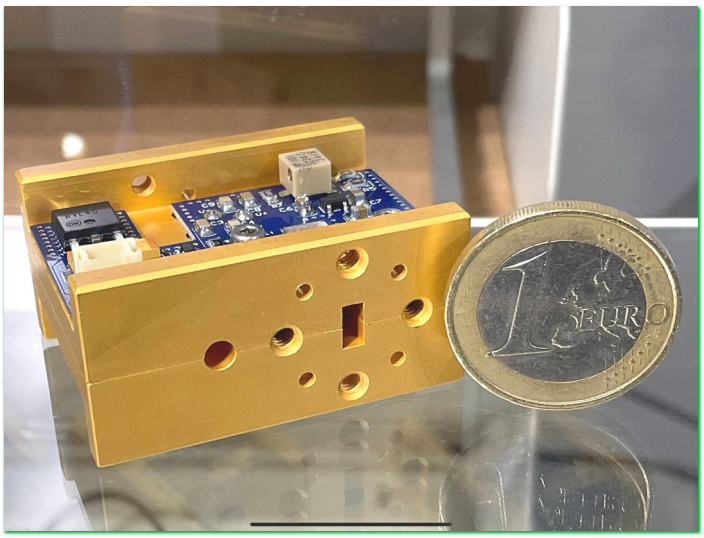
Every unit produced is fine tuned to get the best noise figure, adjusting drain and gate values individually. Stability tests are performed to see matching problems or self oscillations.



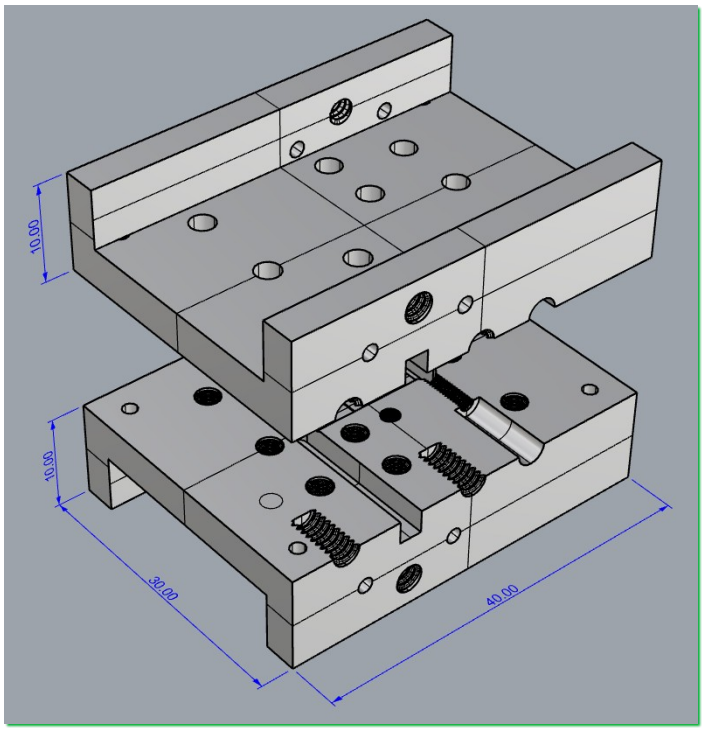


Specs

Typical specifications*	
Frequency	46 to 48GHz
Noise figure	2dB @25º 47088GHz
Gain	25dB
Max input power	-10dBm CW
Output power	5dBm OP1dB
Voltage	12v
Current	76mA
RF connector	WR19, UG387/U
DC connector	Micro JST 1.25mm
Case	Alumiunim with gold bath
Dimensions	30x40x20mm
Weight	42gr



Maximum Ratings (survival)	
DC voltage	20v
Current	90mA
Max input power	0dBm CW
Ambient temperature	-40 to 85 ºC
Storage temperature	-55 to 125 ºC

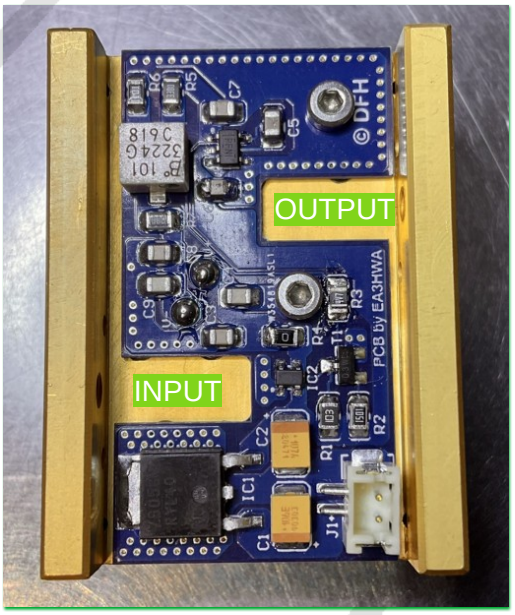


*Specs can change without notice

Calibration Certificate

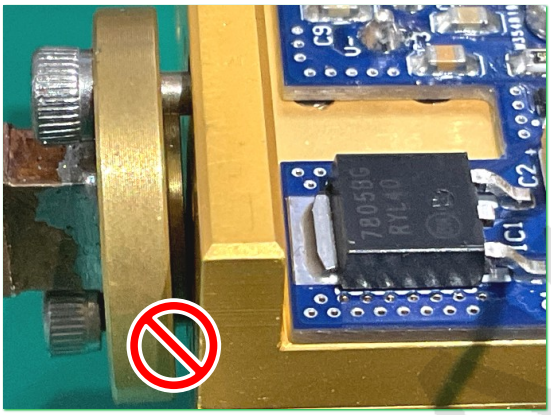
***Every amplifier is supplied with calibration certificate like this**

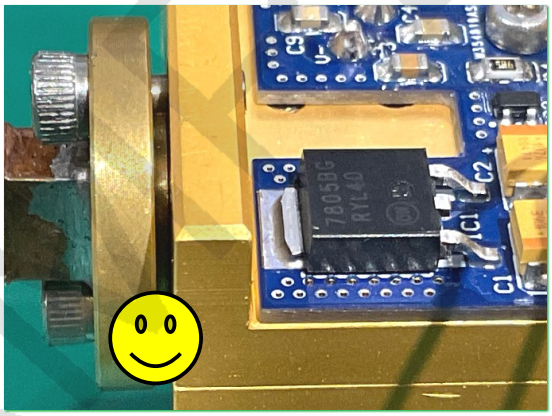
Device Under Test	
Serial number	Sample device
Measurement date	2022/03/20
Room temperature	25º
Gain	25dB
Noise figure	1.94dB @ 47,088GHz
Current at 12v	76mA



Measurement setup: Agilent E4407B-219, Kuhne MKU47G2, Micronetics NCI53350W
Noise source calibration: **https://icts-yebes.oan.es/reports/doc/IT-CDT-2021-3.pdf**

For best performance is very important keep the waveguide flange surface completely flat and smooth. For a perfect fit, tighten the bolts in clockwise, in multiple passes to achieve a uniform tightening. Visually check that the flange is seated correctly on the amplifier. Don't forget that it is 47GHz and every detail matters, it is easy to lose tenths of dB if the flanges don't have a good mating.





WARNING: This is a delicate and sensitive device, don't open the box and keep it dry. The amplifier chassis is the negative pole of the power supply, it is important to avoid any kind of electric shock or dischage. An improper use can cause a permanent damage.

This device may only be used for amateur or educational purposes. Under no circumstances may it be used for commercial, military or human health purposes.

About

The design of this LNA started in January 2020 and has finished with the production phase in March 2022.

We would like to thank the Yebes Astronomical Center (CAY) for their support and consultancy, which has helped us to accelerate the project.

This is a 100% amateur project funded by EA5DOM Luis, EA3HMJ Jose and EB3FRN Iban. The goal of this project is to make high performance devices available to the amateur community for the development and expansion of microwave and millimeter band activity, especially the moon reflection experiments and amateur radio astronomy.

To achieve it, a high precision machining center and a millimetric band laboratory for assembly and measurements have been built. We hope that these resources and the experience gained in this project will help us to address new challenges!

If you have comments or questions, feel free to write us to **icardona@gmail.com**