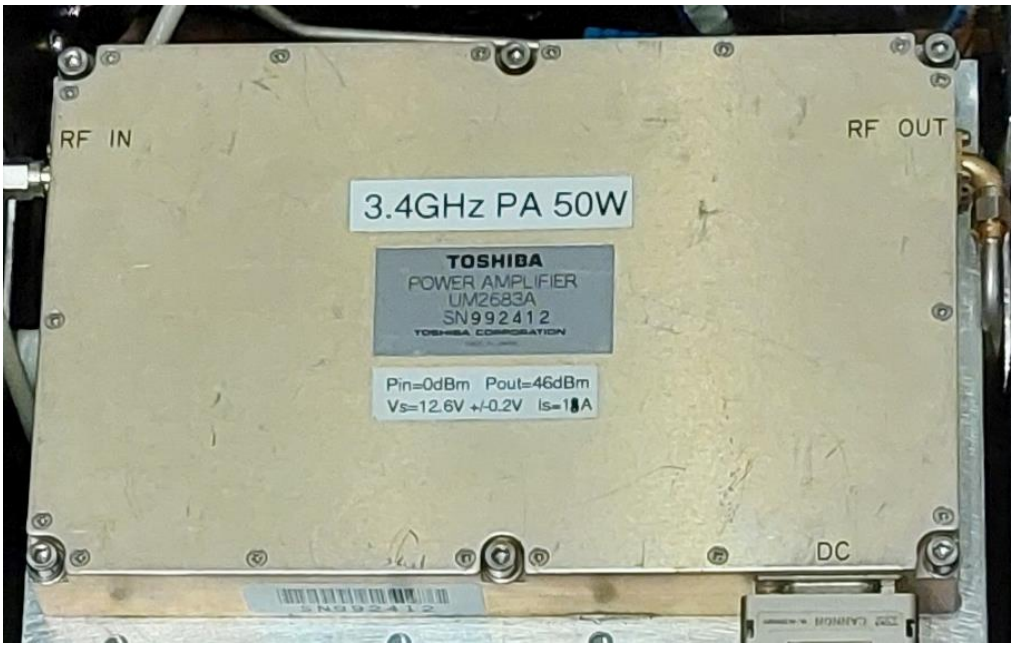
A 50W power amplifier for the 9cm band

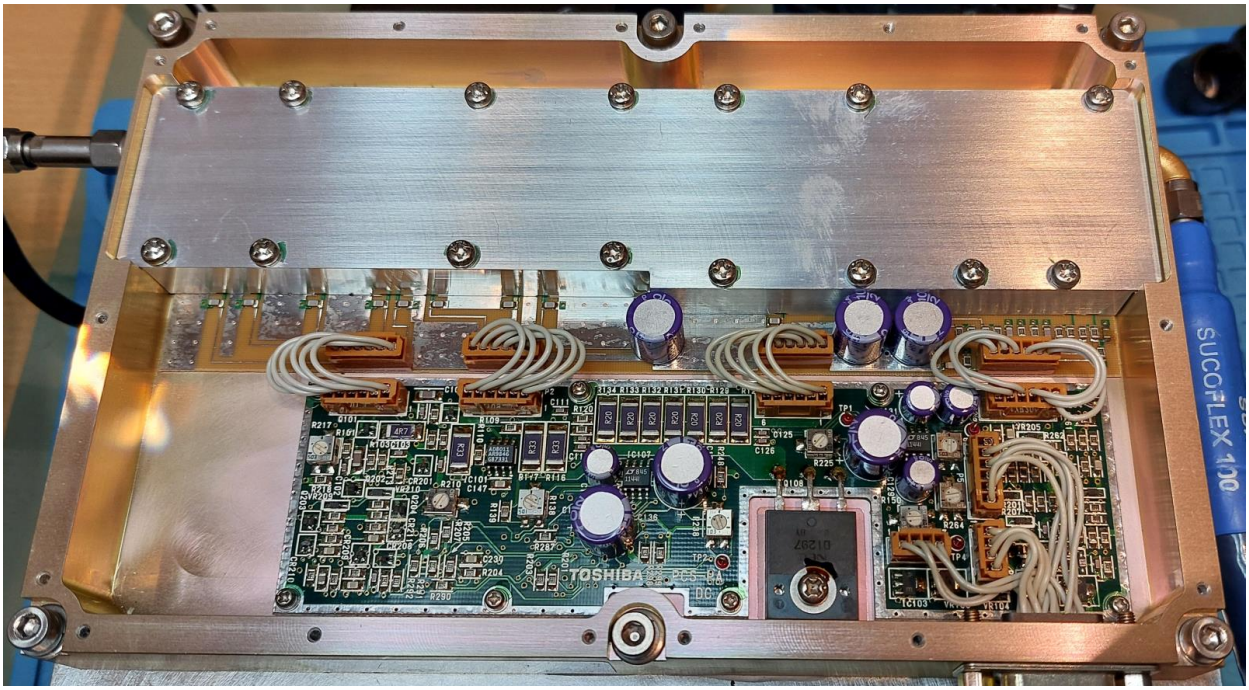
Matthias, DD1US, April 14th 2025, rev 1.1

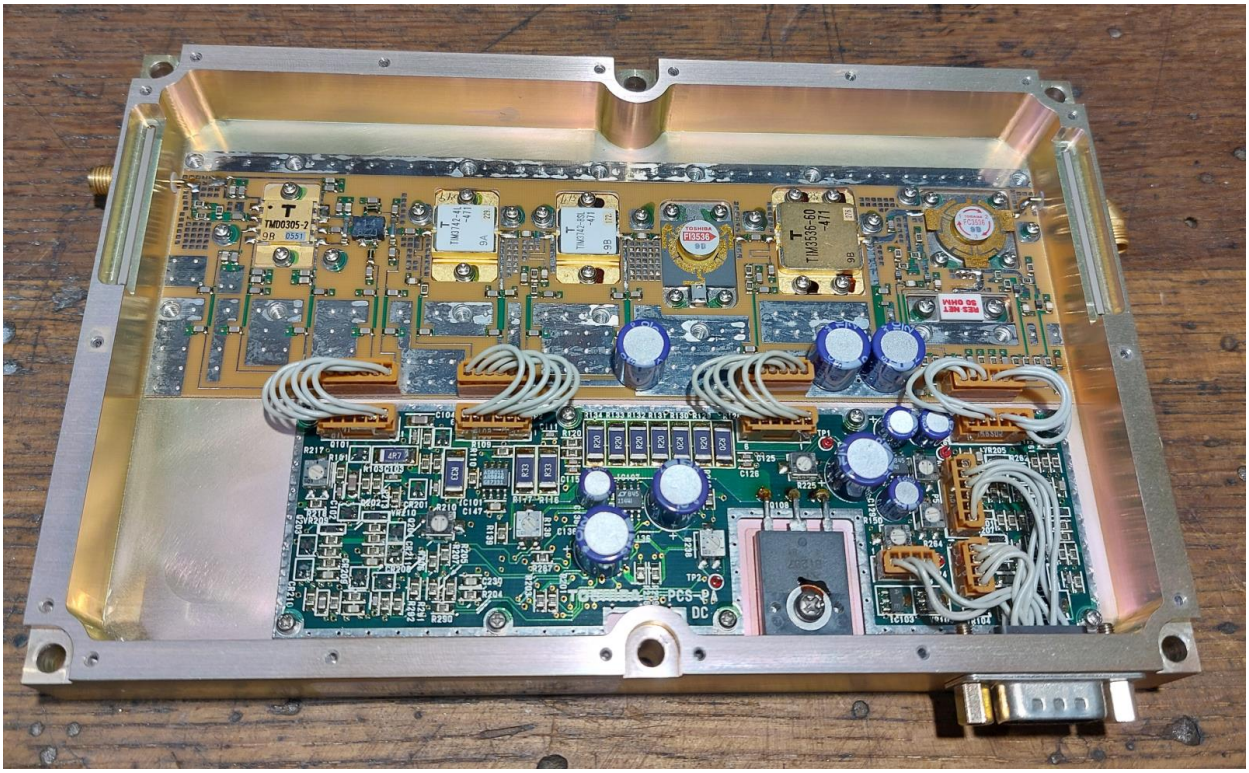
Last year at the Ham Radio Fair in Friedrichshafen I was able to acquire a power amplifier module from Toshiba for the 3.4GHz band. The part number is UM2683A. I had originally planned to combine two smaller Toshiba modules but skipped this plan and decided to build a PA based on one UM2683A module. Fortunately, there are several sources for information about this module on the Internet.

Here are some pictures of the module which features only 3 connectors: a female SMA-jack for RF IN, a female SMA-jack for RF OUT and a 15 pin Sub-D connector for DC and control purposes. As I was curious, I also opened the module and also removed the internal shielding of the RF amplifier chain.

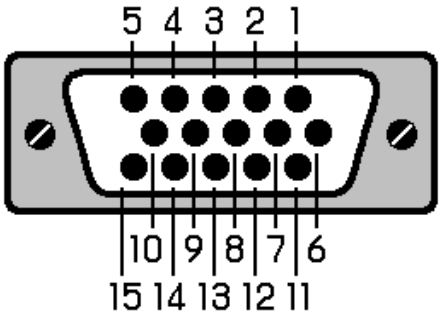


The module is specified to provide an output power of 40W with a DC supply voltage of 12.6V. This PA operates in class A and thus draws full DC power even without RF input drive power. The current consumption is approximately 18A.





Here is a description of the signals on the 15 pin SUB-D connector including the connections / colour coding of my wiring. This type of connector with 3 rows of 5 pins has been used to connect VGA monitors to a PC:



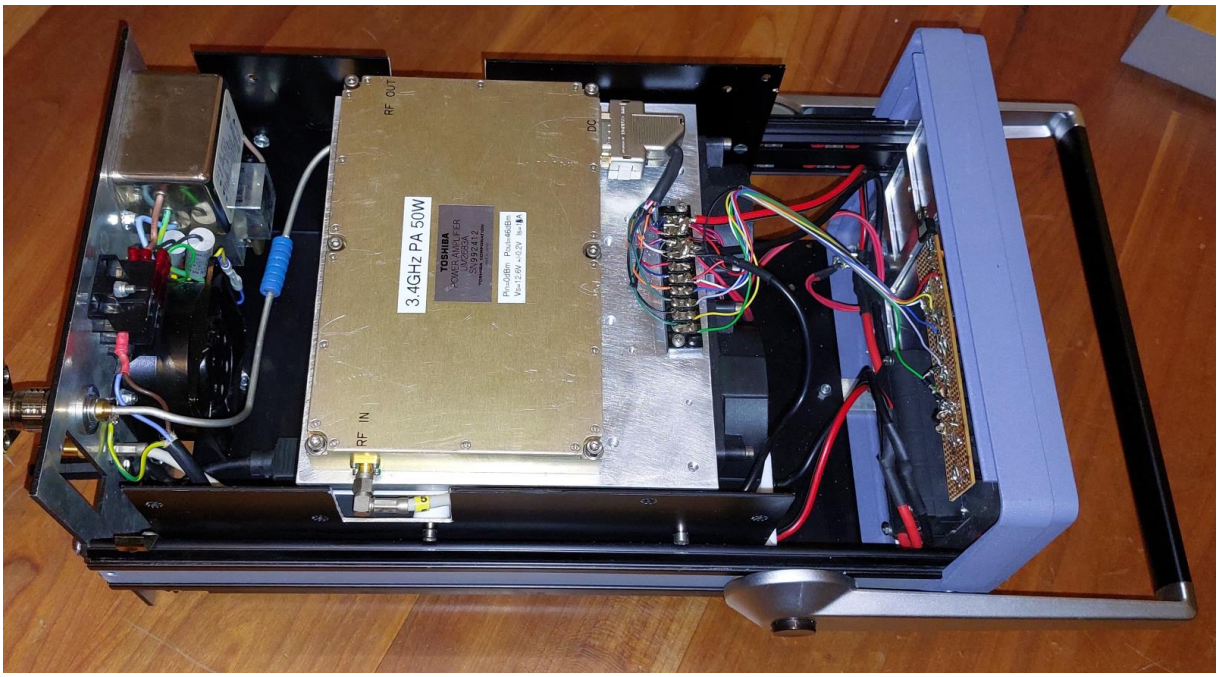
Pin # at connector	Colour of wire	Function	Connection block #
1	red/black	Vcc = +12.6V	B
2	white/black	Vcc = +12.6V	B
3	blue	Ground	C
4	orange	High Power Alarm (>42dBm = 0, <38dBm = 1)	G
5	green	SWR Alarm (0=high VSWR, 1=low SWR)	H
6	red	not connected	E
7	white	Ground	D
8	black	Temp-Alarm / Low Power Alarm (<6dBm = 0)	I
9	blue/white	PTT/PA-on (connect to ground to switch PA on)	F
10	green/white	Ground	D
11	red/white	Ground	C
12	Schwarz/weiss	Vcc = +12.6V	A
13	Blau/schwarz	Vcc = +12.6V	A
14	Orange/schwarz	n.c.	n.c.
15	Grün/schwarz	PA-Bias (+5V if bias nominal)	J

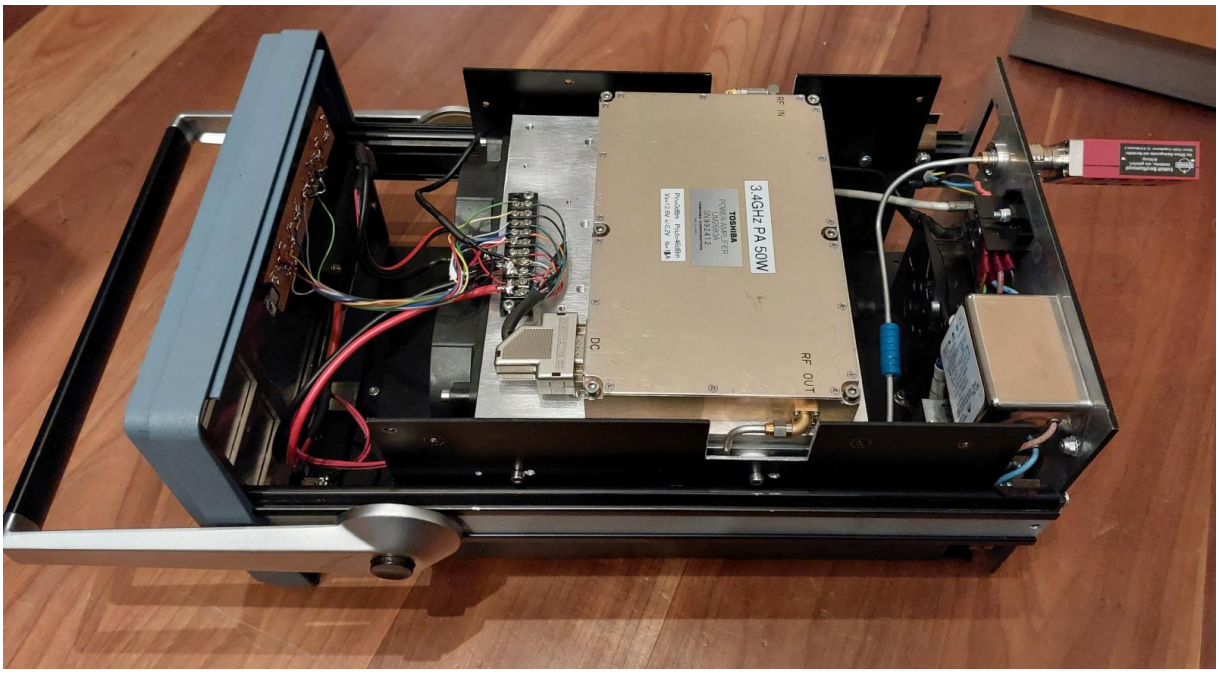
It is very important to use all four Vcc and ground connections as the wires are rather thin and the current quite high. As you will see in the pictures further down, I added a connection block next to the PA on its heat sink with the following connections:

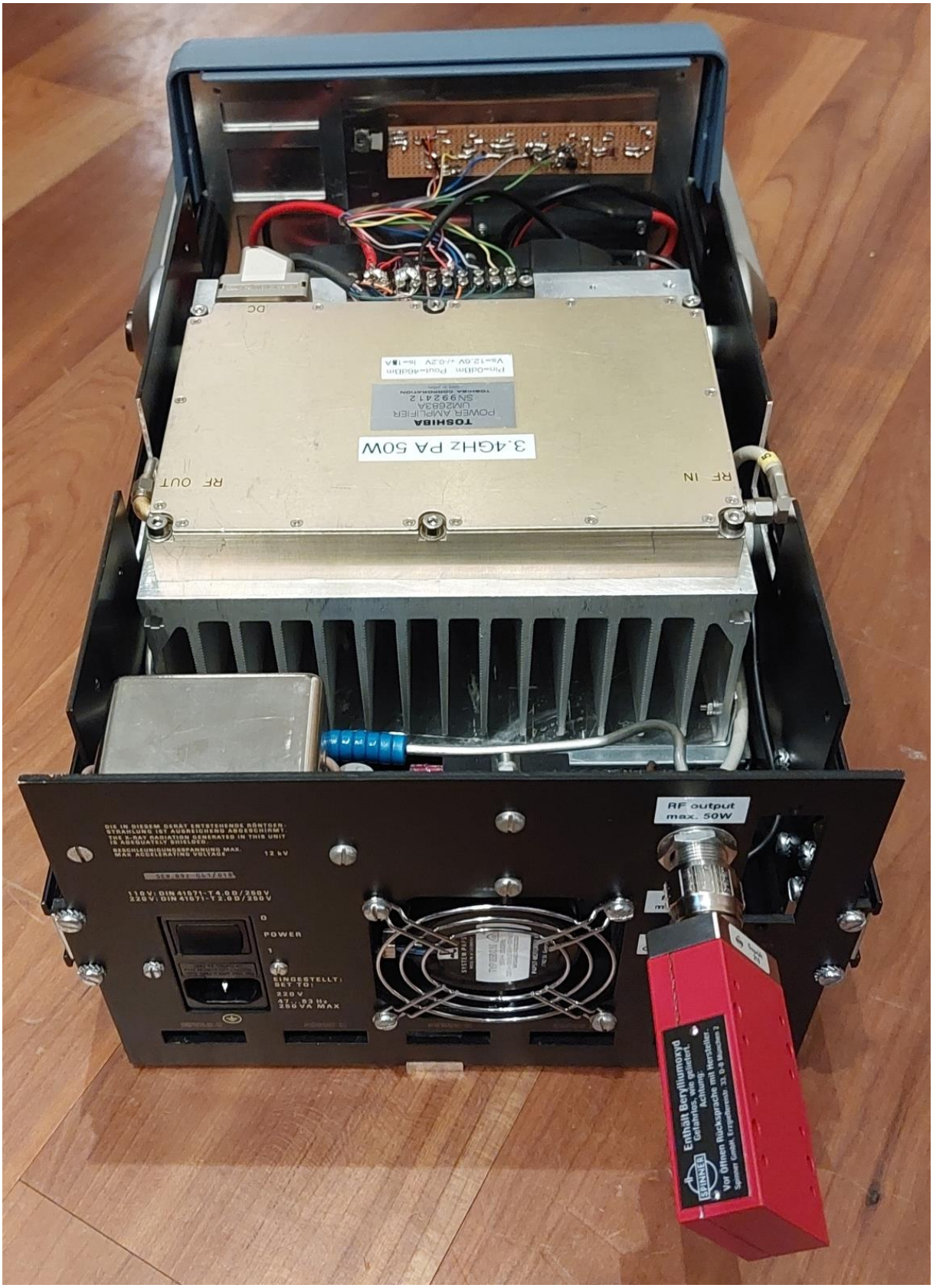
J	I	H	G	F	E	D	C	B	A
PA-Bias Alarm	Temp-Alarm	SWR-Alarm	High PWR-Alarm	PTT/PA-on	n.c.	Ground	Ground	+ Vcc	+Vcc
15	8	5	4	9	6	7&10	3&11	1&2	12&13
Green	Yellow	Grey	Blue	White			Black	Red	

I had an old encasing which I decided to use to integrate the PA including a 230V ac to 12.6V dc power supply.

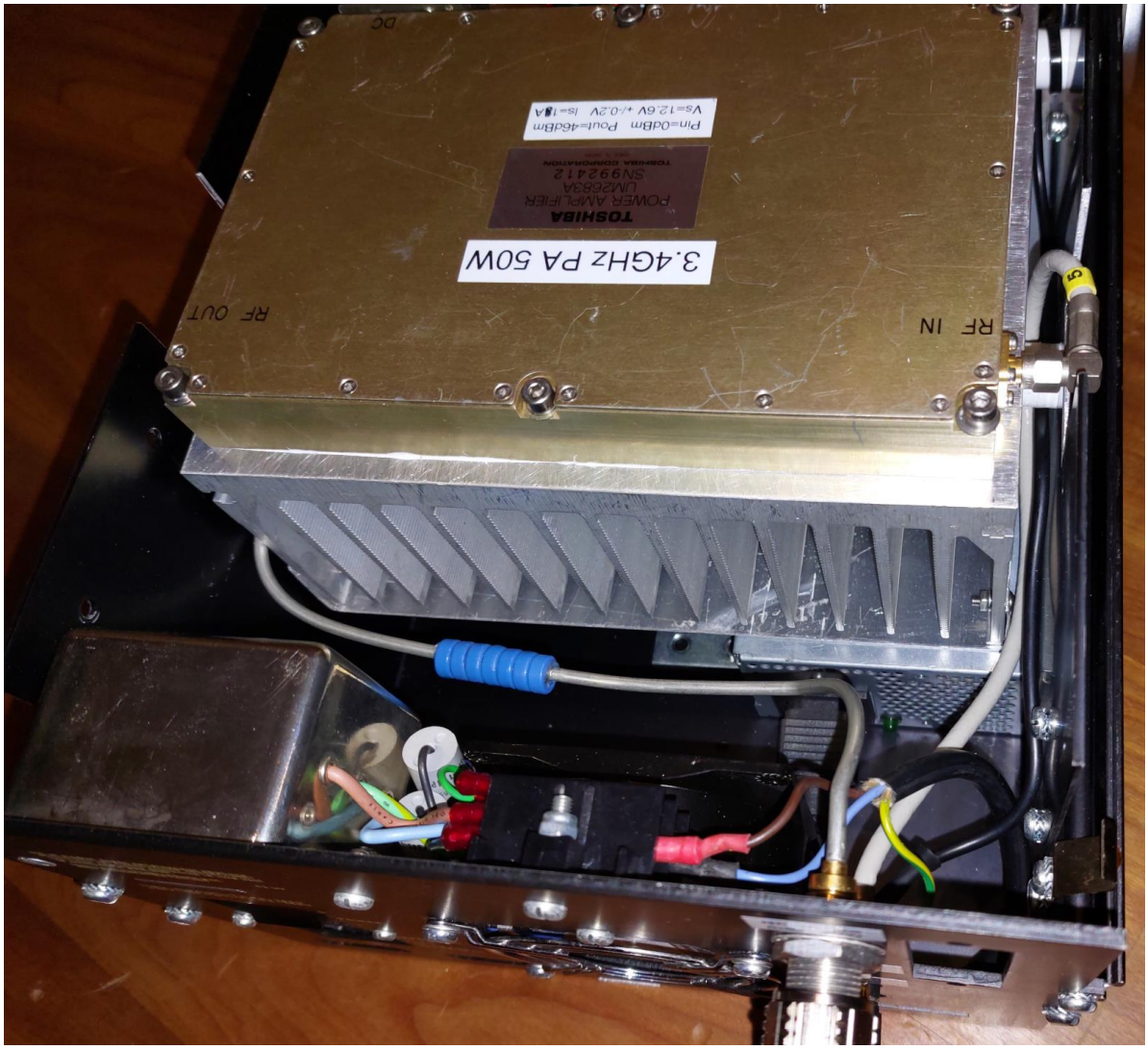
Here are some pictures of my setup:

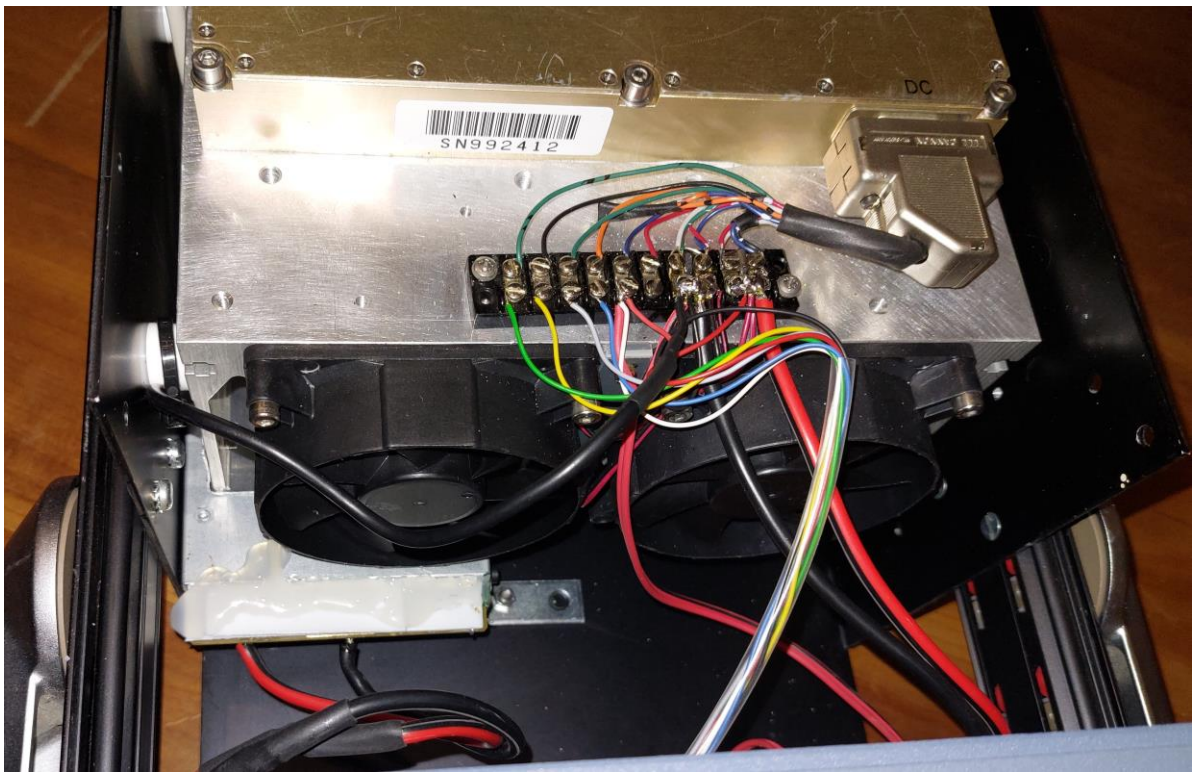


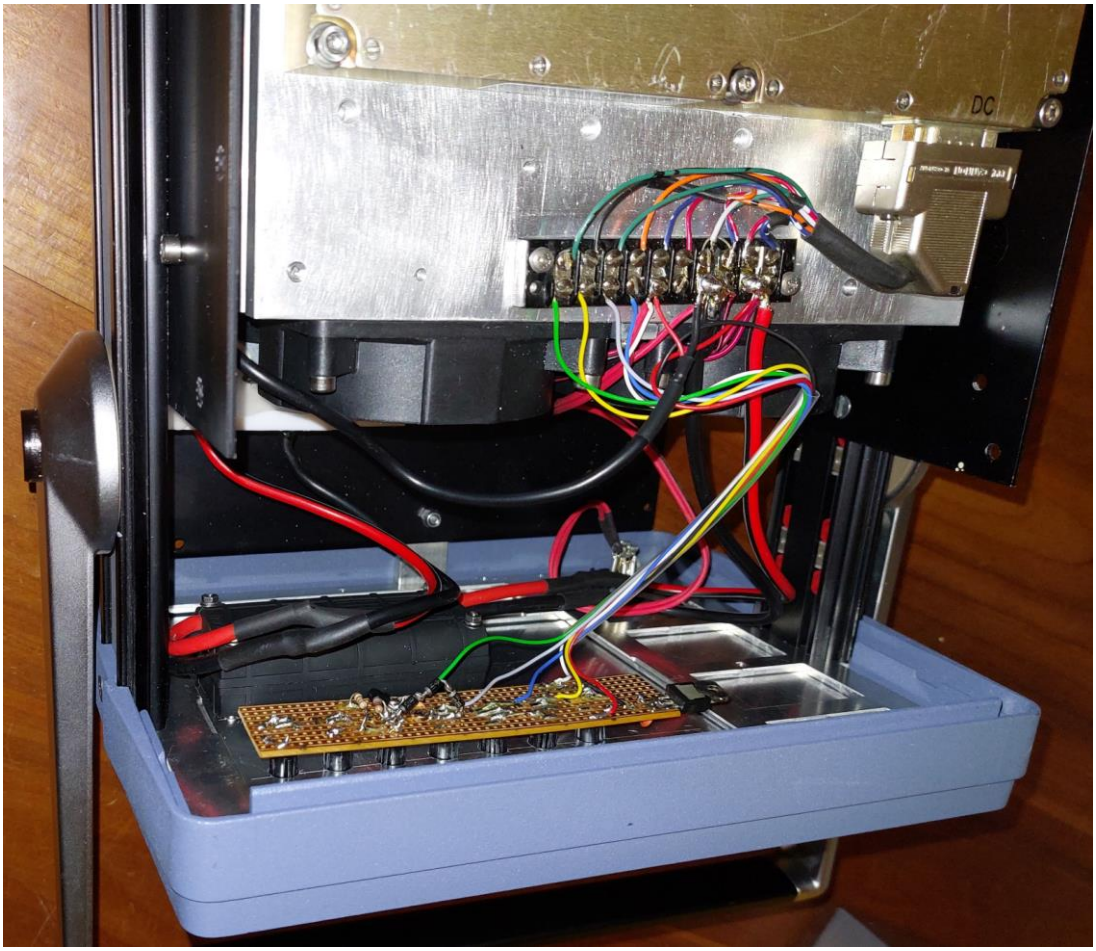




The PA module is mounted on a massive heatsink which is cooled by two fans blowing cold air through the fins of the heatsink where it is sucked out by another fan mounted on the backside of the encasing. The heatsink is mounted on top of a 12V/83A power supply which was originally used in a server rack. The power supply also features a built in fan blowing the warm air towards the end of the encasing.

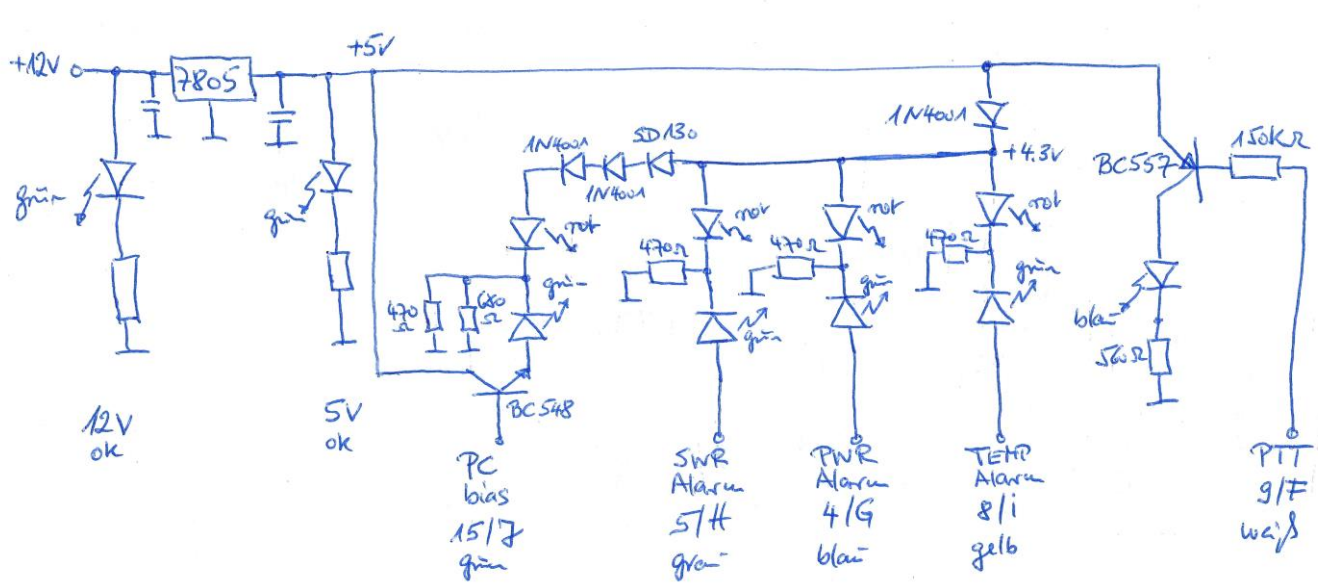

DC
RF OUT
RF IN
3.4GHz PA 50W
TOSHIBA
POWER AMPLIFIER
UM2683A
SN992412
TOSHIBA CORPORATION
Pin=0dBm Pout=46dBm
Vs=12.6V +/-0.2V Is=18A


DC
SN992412



In the front plate I integrated a DC voltage and current meter and 8 LEDs as indicators for the various voltages and alarm signals. The LEDs indicate: 12V supply (green = ok), +5V supply (green = ok), PA bias (green = ok, red = fault), SWR Alarm (green = ok, red = high), High Power Alarm (green = ok, red = too high), Temp / Low Power Alarm (green = ok, red = fault) and PTT (blue = PTT activated).

Here is a sketch of the simple schematic for the LED indicators.



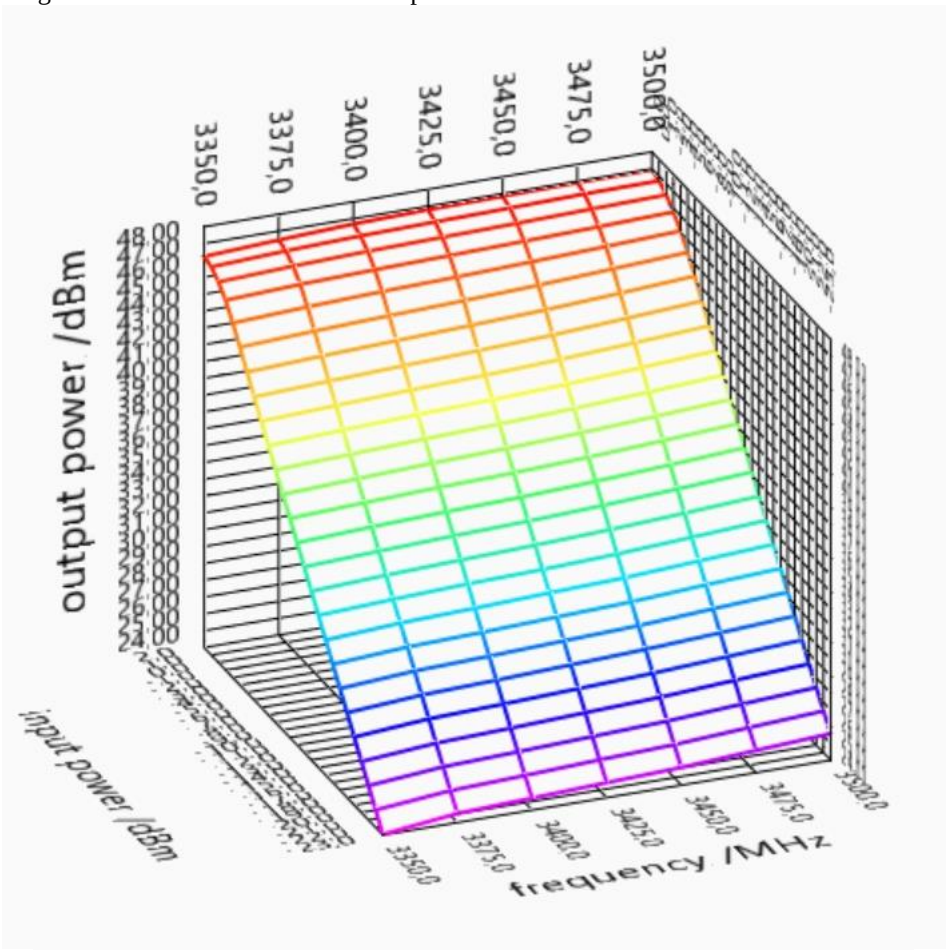
In addition, I added a push button switch to be able to activate the PTT / switch the PA module on for testing.

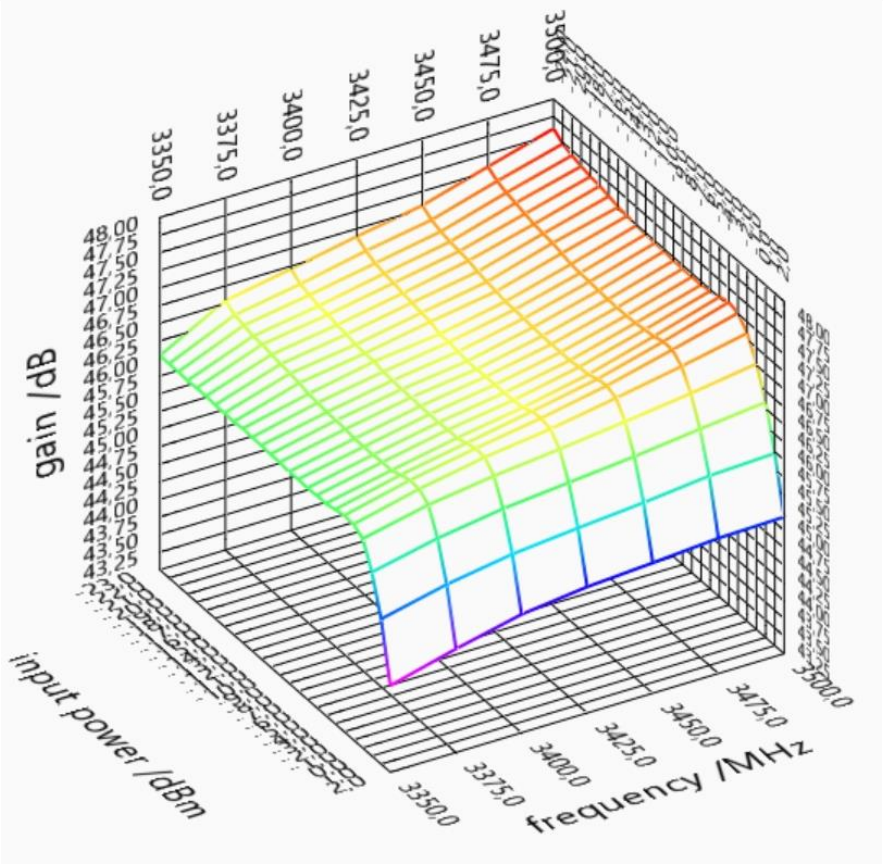

12V ok
5V ok
PA bias
SWR Alarm
PWR Alarm
Temp Alarm
PTT active
9cm PA 50W
1mW➡40W
Psat = 50W
12.5 V
00.3 A
12V Power Supply
Voltage & Current
DD1US
04/2025
PTT Test


12V ok
5V ok
PA bias
SWR Alarm
PWR Alarm
Temp Alarm
PTT active
9cm PA 50W
1mW➡40W
Psat = 50W
12.4 V
17.8 A
12V Power Supply
Voltage & Current
DD1US
04/2025
PTT Test

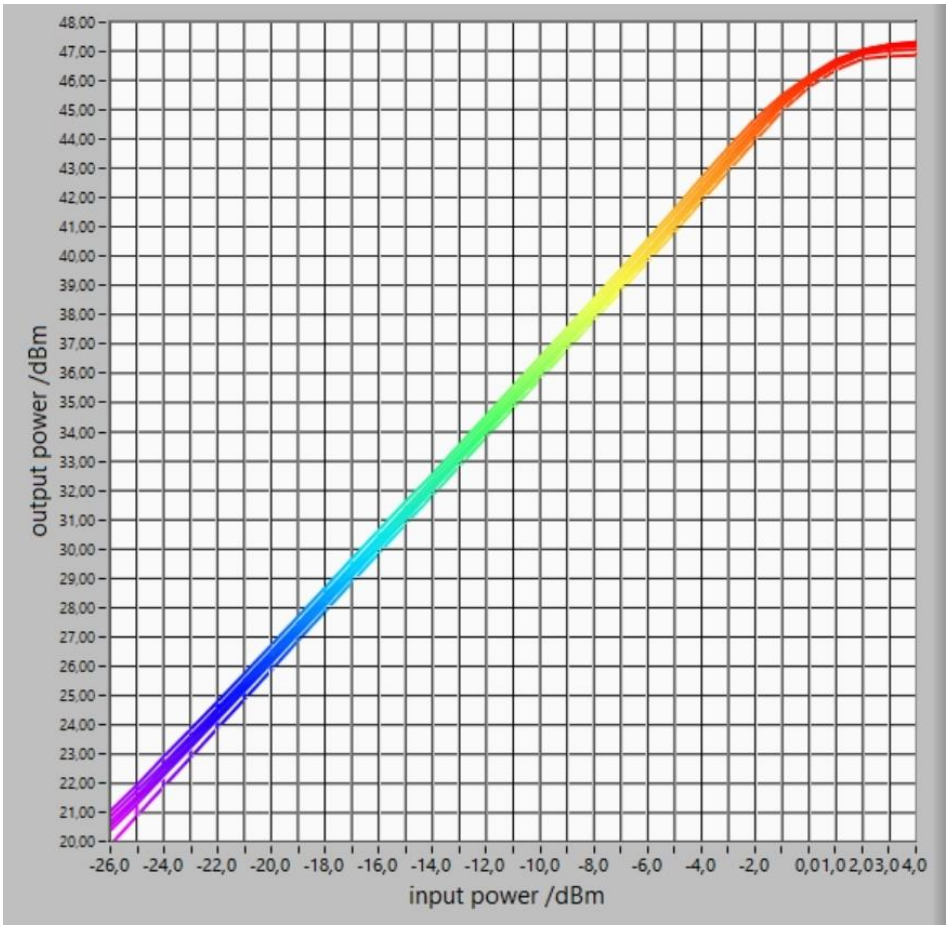
The back side features on the left an AC power jack, AC fuse and an AC power switch. The fan in the centre sucks the warm air out of the encasing. On the right you can see an N-jack for RF output, an SMA-jack for RF input and a 3.5mm jack for activating the PTT / switch the PA module on remotely.

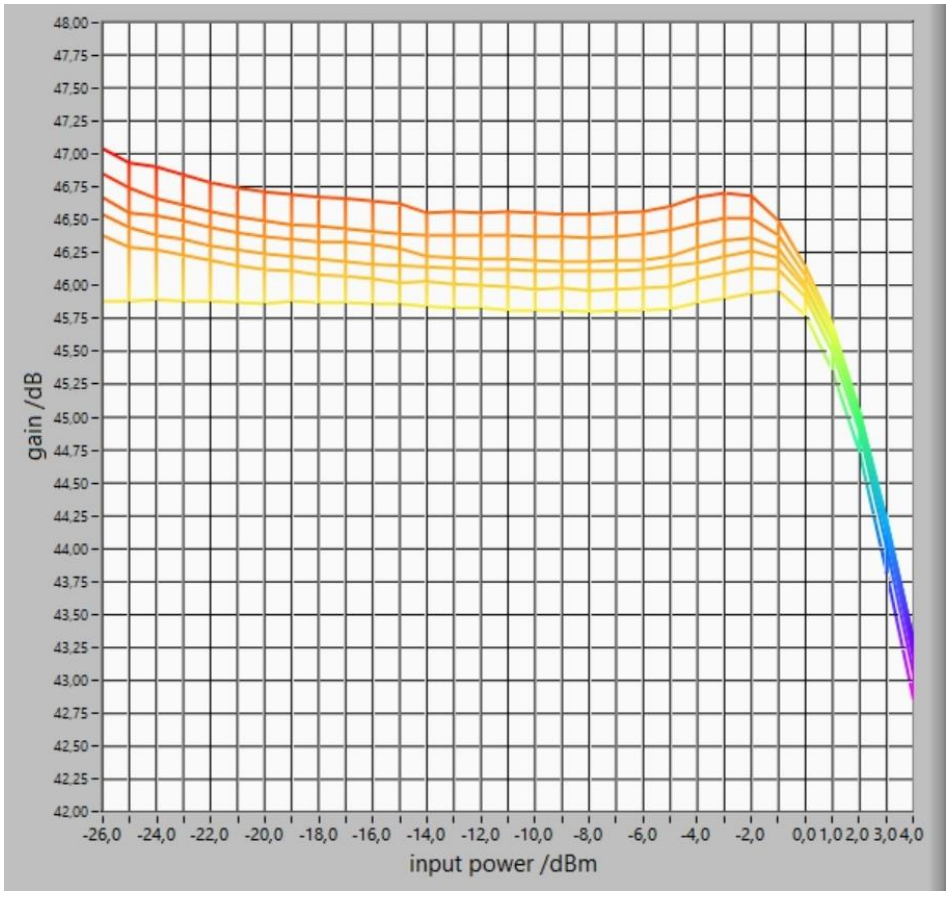
I characterized the PA using my automated measurement setup. Below find two graphs of gain and output power as a function of input power and frequency. The frequency range is 3350MHz to 3500MHz in 25MHz steps. The input power range is -23dBm to +2dBm in 1dB steps.





In the next two graphs you can see output power and gain plotted versus input power (from -26dBm to +4dBm).





The PA features a high gain of about 46.5dBm @3400MHz.

At an input power above -1dBm the gain decreases and the PA starts to the compress.

With an input power of 0dBm = 1mW, the PA delivers an output power of +46dBm = 40W.

When driving the PA in full compression the maximum output power is about 47dBm = 50W.

The amplifier is operated in Class A mode. The quiescent current consumption of the amplifier is about 18A and does not increase event at full RF output power. The maximum efficiency of the total amplifier is 22%.

I am always grateful to get feedback and will be happy to answer questions.

Please direct them to my Email address, which you find on my website.

Best regards

Matthias DD1US

Homepage: http://www.dd1us.de