Kjell Karlson's Comments:

[hpsdr] Munin revisited. ***Thu Aug 3 06:41:14 PDT 2017***

Some years ago I did a layout for a 100W PA using a pair of RD100HHF1 MOSFET transistors and called it Munin and an updated version, Munin II. As far as I know more than 250 of them were built around the world.

Munin was more or less a copy of the 100W PA´s used by ICOM, Kenwood and Yaesu. Apache Labs also have used a variant of this PA in all the 100W units sold until now. It is extremely robust and I have only managed to destroy 1 pair of them when I forgot to install the heat sink and used them for a long time at 100W out.

In the ANAN-7000, Apache Labs has removed the Push Pull Driver stage that uses 2 pcs. RD16HHF1 and drive the RD100HHF1 directly from the Orion MKII board that can deliver maximum 3W out.

I was very surprised when I saw this so I decided to test with one of my Munin boards. Using the same values as in the -7000 for the input circuit and a 1:1 transformer, I got 100W OUT with <3W IN on all bands except 6 meter. I measured the input Return Loss and found that by removing a 200 pF capacitor across the secondary of the transformer, the output on 6 meter could be reach with 2,5W IN.

Then I tried to reduce the feedback in the PA. The feedback resistors were 2 pc. 22 Ohm in parallel on each transistor and by increasing them to 39 OHM each, I can get 100W out with <1W drive on all bands! That means that the gain is >20 dB! And the linearity is not worse using less feedback.

According to the data from Mitsubishi, the gain on 30 MHz is 11,5 dB for one devise so for 2 in Push Pull the gain is 3 dB higher, 14,5 dB. So were does all this extra gain come from?

The gates are purely capacitive (Ciss=260 pF for each gate) so no power is lost in the input. So by just using a 1:1 transformer and load it with 50 Ohm on the secondary, the driving voltage is 20V P-P. There is a mismatch on the highest frequencies so one should expect that the gain should drop a lot of dB but still the gain is above 20 dB. It might be possible to optimize the input RL but I see no point in that as we have the Gain By Band adjustments in PSDR and PiHPSDR.

Another positive observation I did was that the efficiency is better when using this solution.

When using the original Munin, the current draw at 100W OUT was between 18 and 20A on all bands up to 10 meter and 22A on 6 meter. But now the current is <15A up to 10 meter and just a bit higher on 6 meter. I have no explanation for this!

May be it is time to do a new layout for a MUNIN III? It can be really small.

[hpsdr] Munin revisited. ***Fri Aug 4 01:15:04 PDT 2017***

Some more tests with the modified Munin board shows that if the feedback resistors are increased to 100 Ohm each, the gain is increased to >23 dB in the output stage. That means that it is possible to drive the PA to >100W by using Munin or Angelia on all bands except on 6 meter. But on 6 meter the output is >80W PEP.

I also tested without any feedback and the stage seems to be stable and the output on 50 MHz is >100W with a setting of 38.8. I can not see any increased IMD without feedback, it is at -30 dBc (ref PEP).

So from this, I conclude that it is possible to use the Push Pull PA with RD100HHF1 directly connected to Hermes, Angelia and Orion I to get 100W out.

I also find that the PA handles Pure Signal much better than the original Munin. The IM3 is >50 dBc on all bands. When using the original Munin it was difficult to get >40 dBc IM3.

[hpsdr] Munin III boards. ***Fri Jan 5 02:10:59 PST 2018***

"Some More tests …"

Today I tested again just to confirm my observations and except for 6 meter I measured the same. On 6 meter the PEP out was around 80W.

When using the Orion MK II board, it delivers >100W PEP on all bands.