

[Fitting an MMIC in place of the 2N3866 in PICASTAR \(Combo "C2"\)](#)

For some time I was thinking to add the option of an alternate device for the DDS amplifier. The 2N3866 is getting harder to find and also, the performance seems to taper off at the 10M end of the injection range for the local oscillator.

To cater for either amplifier though, the MMIC amplifier is an option you may wish to try? It is NOT endorsed by the PICASTAR official documents, modifications etc so is at your own risk. Having said that, I have fitted it to two Combo star builds so far.

Which MMIC Device:-

There are many MMIC's around made by various makers. The most common perhaps are probably the MINI-CIRCUITS™ devices. They make literally dozens of devices but the 'Spec.' needed here is fairly modest.

Gain of about 12dB down to DC (some devices do NOT go down to the frequency of interest here, ~13-42MHz)

Saturated output level of more than +10dBm (more is better !)

Suitable package.

The device I chose is the ERA-1SM. This has a gain of approx. 12dB and Sat output of +12dBm. An ERA-4SM might be usable too, but has slightly more gain. These are normally more expensive though.

Other devices are also suitable of course, from different makers. I also tried the RF Micro Devices™ RF2065 although I think it's now obsolete. It is apparently similar to the Mini-Circuits MAR-3 device, also obsolete, but still around if you look.

These devices though have a maximum output power (1dB Saturation) of +7-10dBm, slightly less than the ERA-1SM. When testing, you may appear to have FLAT gain from 12Mhz to 40MHz but it is being masked by the fact that the output is saturated. This will mean that harmonic content will be quite high! It is best to avoid this by putting an attenuator at the input to the amplifier if you use a higher gain part or one with relatively low 1dBm Sat. I.e. after the DDS output transformer or after the DDS filter. NB. There is no provision for this on the Combo C2 board. You could though, remove C330 and fit say, a 3dB attenuator in its place. (eg. Pi type: 270R,18R,270R) Best to use the ERA-1 if possible.

[How it's done in Combo:](#)

Do not fit any of the parts shown around the 2N3866 stage.

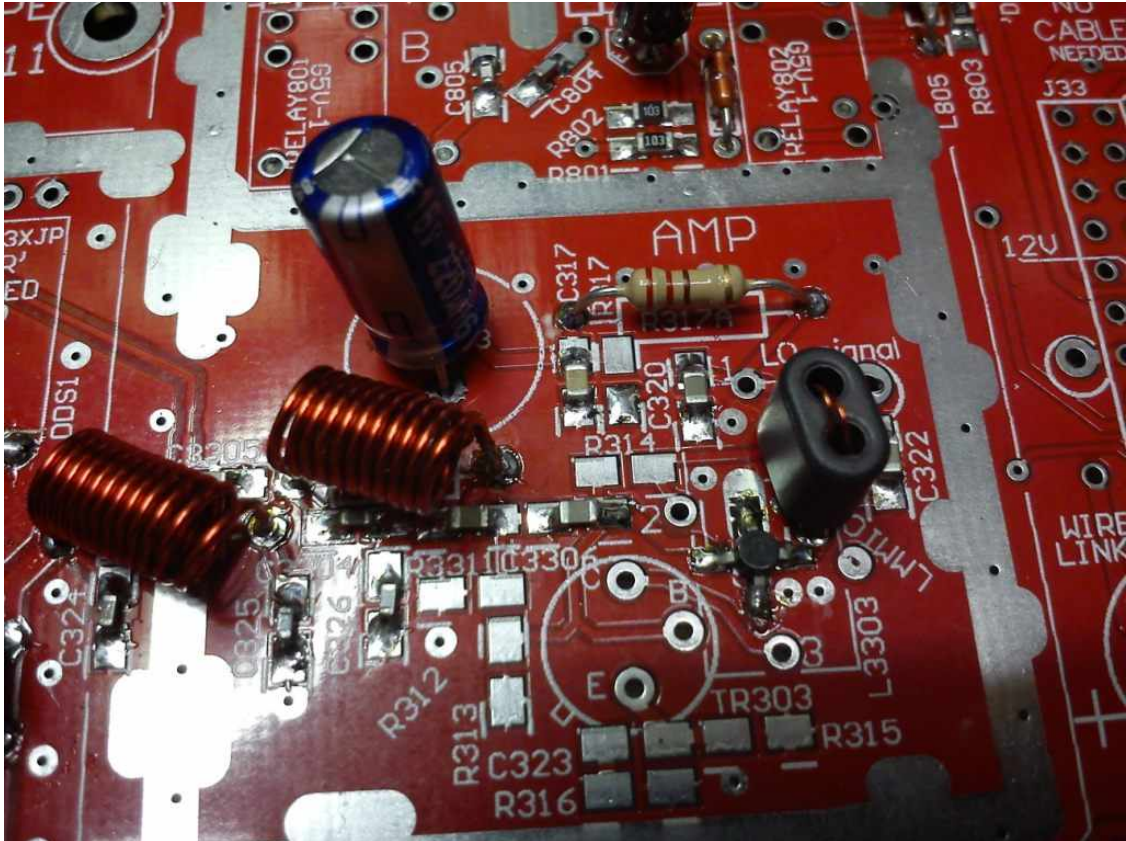
Fit these parts:-

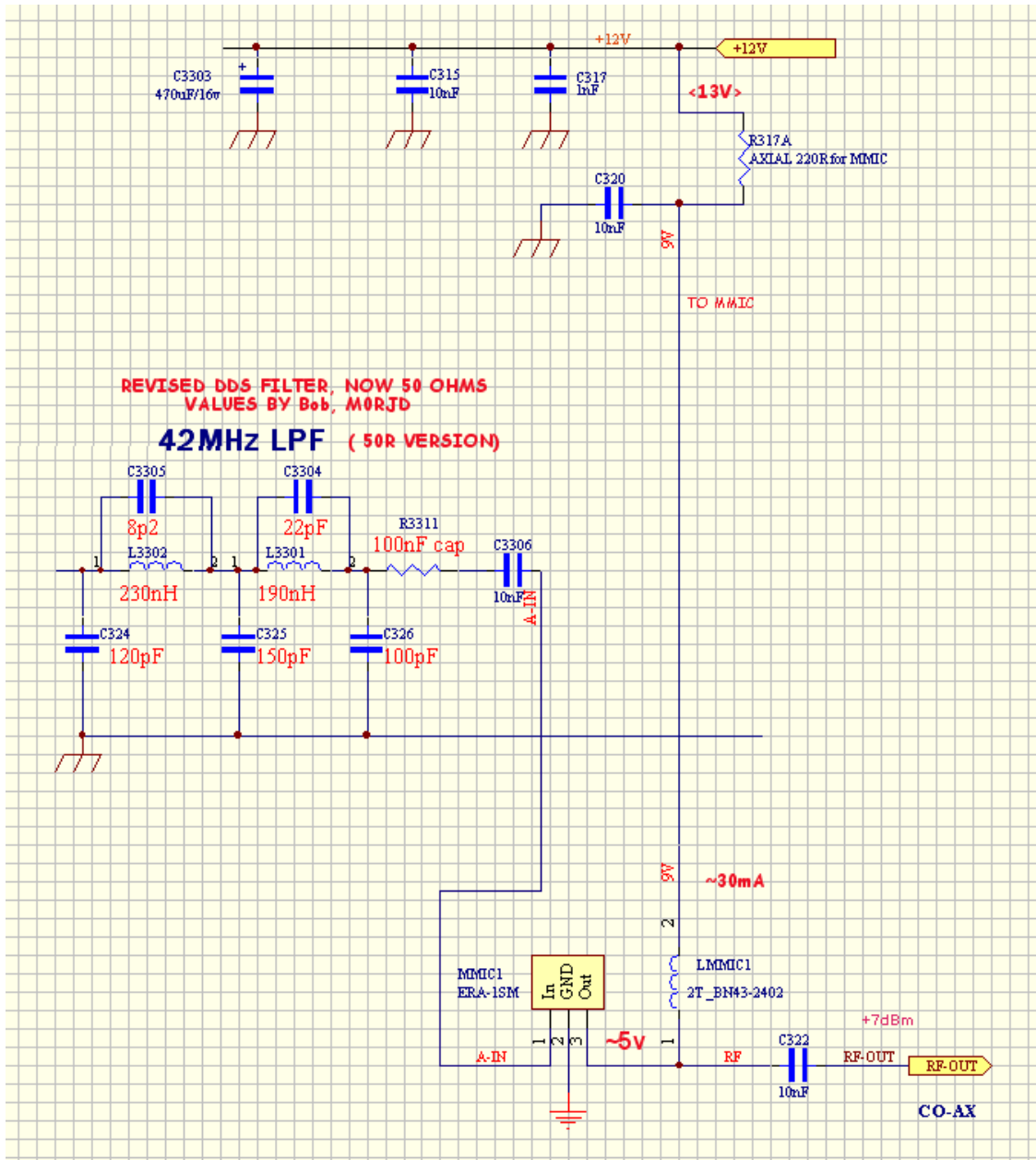
MMIC1 eg. ERA-1SM

R317A this needs to be calculated for the voltage and current of the MMIC. For the devices suggested, 220R is OK.

R3311 fit a 100nF cap
C3306,C322,C317,C320 10nF

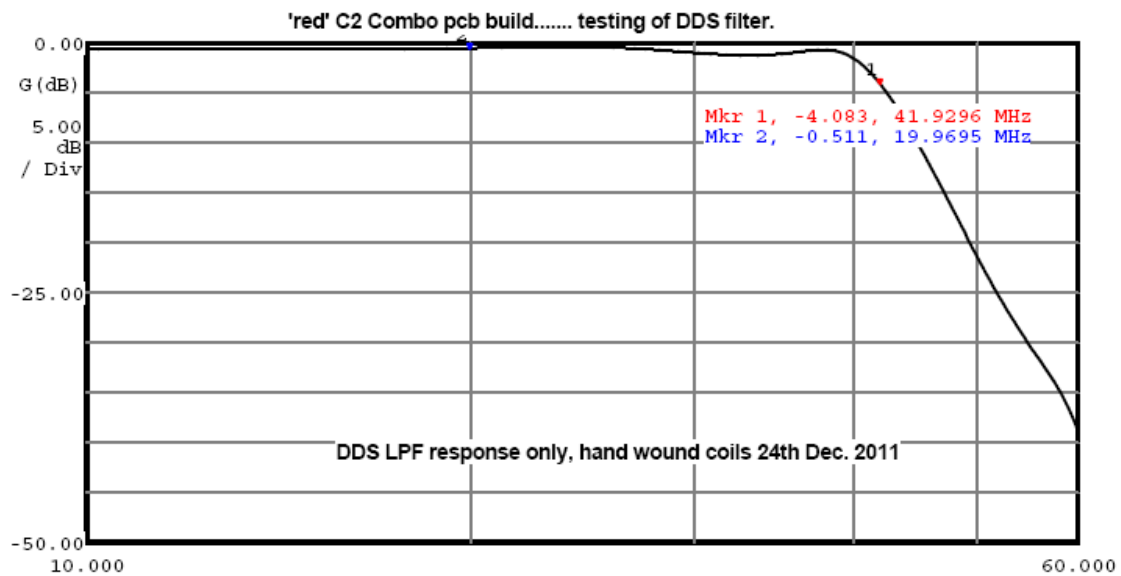
Picture below is how the MMIC amplifier stage will look. I used a BN43-2402 balun core but also tried a BN61-2402 core with similar results.



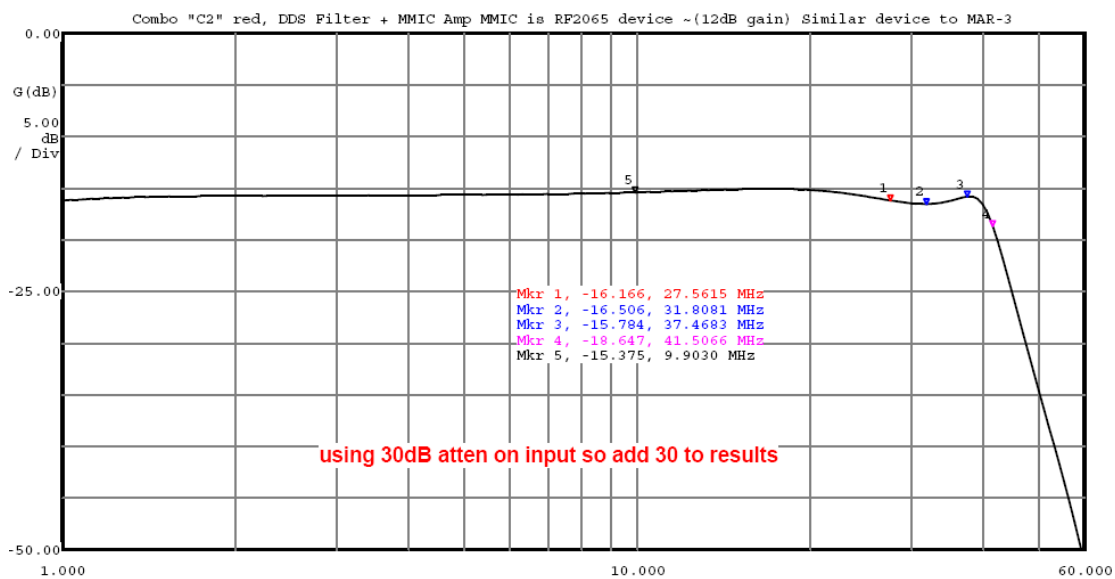


Fit the parts as per the Schematic, for the DDS output filter. NB: these must be the values for the 50R version of filter, as suggested by Bob, MORJD. See above.

You may have noticed air wound coils in this filter. As I didn't have Bob's specified toroids in stock, I used 0.5 or 0.6mm wire, close wound, 11T for L3302 and 10T for L3301 on a 4mm former. (drill bit) I then spread one end of L3302 very slightly. (see picture above)



After fitting the ERA-1 amp, here is a sweep of the DDS plus the ERA-1 amplifier stage. (Note; there was a 30dB attenuator on the input, to prevent overload of the N2PK VNA used for the sweep)



So, what is the end result of all of this? You should have no problems getting in excess of +7dBm output on all of the Bands up to 10M. It will drop slightly at 10M due to the fall of the DDS filter. (See plots above)

VK3PE

29th Dec, 2011

Testing done on Combo "C2" <red> PCB. Test gear, HP8560A S.A., N2PK VNA.