G8PZR's QUICK AND EASY LF MODIFICATION FOR THE TEN-TEC RX320

<u>These notes are for information only and it is your responsibility to decide whether or not to make use of them.</u>

<u>If you have any doubts whatsoever then please do not try this on your own receiver.</u>

<u>If you copy what I have done then please accept that you do so at your own risk.</u>

I have not seen any previous reference to this very quick and easy LF mod for the RX320 but, as it is so simple, would not be surprised if someone else thought of it first. If that is the case then I'm quite happy for them to take any credit, or all blame, for it.

This simple modification does not involve any changes to existing components or to the circuit board and it is not even necessary to remove the circuit board to fit it.
It can be easily tried and then removed without trace or damage if desired.

Analysis of the RX320 input filter shows a marked drop in sensitivity below 2 MHz with sensitivity at 100 KHz being as much as 40 dB down on that at 2 MHz.

Low frequency response is totally controlled by the first section of the input filter and is deliberately limited by design.
Later sections of the filter determine the response at higher frequencies and in particular set the notches above 30 MHz.

Bypassing the first section of the input filter with a 100 nF capacitor will flatten out the LF frequency response so that it is less than 1 dB down at 100 Khz.
The actual value isn't critical but shouldn't be very much lower and 100 nF is a reasonable compromise.
Using a wire link instead of the capacitor would, theoretically anyway, give a flat response down to DC but would also enable a DC path to the antenna socket via the filter inductors and is not recommended.

Above approximately 2 MHz the frequency response is unaffected.

I have analysed and tested both a direct link and a capacitor.
Both seem to work as predicted but I have not made any proper measurements……
just listened to signals that couldn't be heard before ☺

This modification ONLY changes the response of the input filter.

It is not offered as an alternative to the AMRAD input transformer modification and limitations imposed by the transformer will still restrict any improvement.
However, the improvement does seem to be significant.

Removing the LF restriction imposed by the input filter will not harm the RX320 but is quite likely to introduce the symptoms the restriction was intended to prevent in the first place.

There is no doubt that the Ten-Tec designers knew exactly what they were doing and they did not restrict the LF response just for the sake of it.
With the LF filtering removed the presence of strong medium wave broadcast band signals could adversely affect performance throughout the frequency range of the receiver.

A photograph included later shows the two points on top of the RF circuit board between which the capacitor may be soldered.
It could also be mounted below the circuit board.

Although there may not be any ill effects, this would depend on antenna and location, I would still not recommend leaving the capacitor in circuit for general use of the RX320.
A small switch could be conveniently mounted adjacent to the external antenna socket to allow the choice of improved LF response when required.

Listening tests were carried out during the day and at night using three different active antennas and at both LF and HF.

After modification no significant changes, other than the improved LF response were observed, but noticeable adverse effects might be expected with antennas producing stronger medium wave signals, such as an external long wire.

In the UK the BBC's Radio 5 Live on 909 KHz is a tough test for any radio and its strong signal can splatter several KHz either side of the centre frequency.
Using an HF active antenna with the unmodified RX320 produced noticeable effects up to 6 or 7 KHz either side during the day.
With the modified set this was not noticeably much worse, perhaps spreading up to 1 KHz further either side.

Using a tuned Palomar ferrite loop antenna the splatter on the unmodified set was reduced, again perhaps by about 1 KHz either side, and did not noticeably increase with the modified set.

Of the three antennas one was wide band, and specified only down to 500 KHz, one was a homebrew HF antenna based on a design published in Electronic Engineering many years ago, and the other was the tuned Palomar loop antenna.

Significant improvements were noticed with all three antennas right up to the top of the medium wave band with actual results varying depending on time of day.
At night several European stations were heard at the top of the medium wave band using the modified receiver that were not audible on the unmodified receiver.

At lower frequencies both the wide band and HF antennas pulled in signals after modification that could not be heard on the unmodified receiver.
The HF antenna gave good results on broadcast signals down to at least 180 KHz.

LF results were even better with the Palomar antenna, which was to be expected, and good signals on 60 KHz from MSF at Rugby were received day and night on the modified receiver whilst no signals were audible on the unmodified receiver.

Signals from MSF were also received during the day using the HF antenna with the modified receiver but these were much weaker.

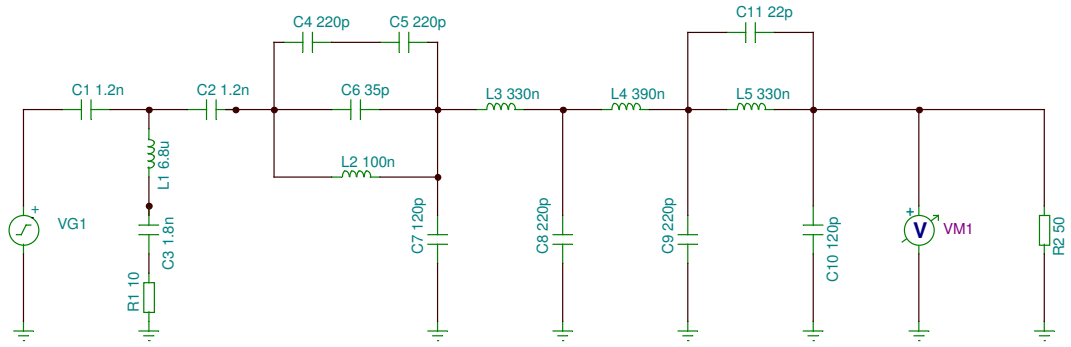
Listening tests at HF were carried out using the same antennas and no difference was noticed after modification on any signals, day or night, above approximately 2 MHz.
There was no obvious desensitisation or blocking but, again, this could be expected with different antennas or location.

I will repeat that I do NOT recommend leaving this modification in circuit for general use, especially with antenna systems more efficient than mine, but it does significantly improve the LF frequency response which can be beneficial under some circumstances.

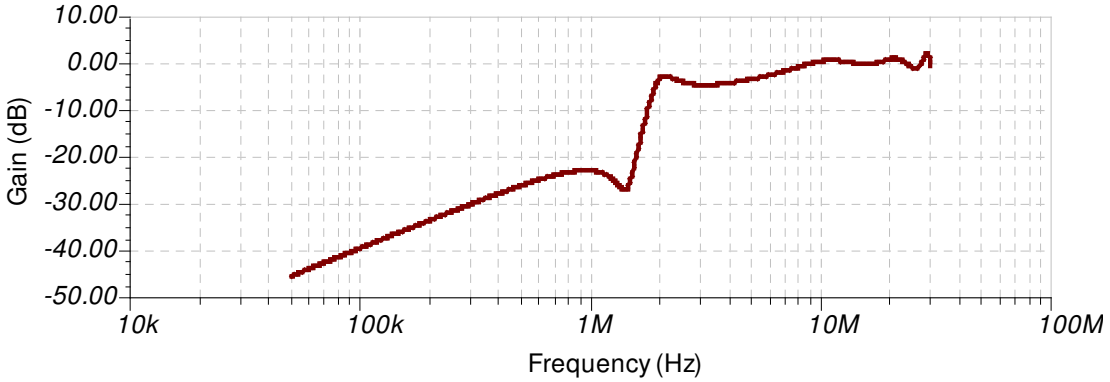
Initial evaluation was carried out with a Pspice emulator and I have included my findings just in case anyone is interested.

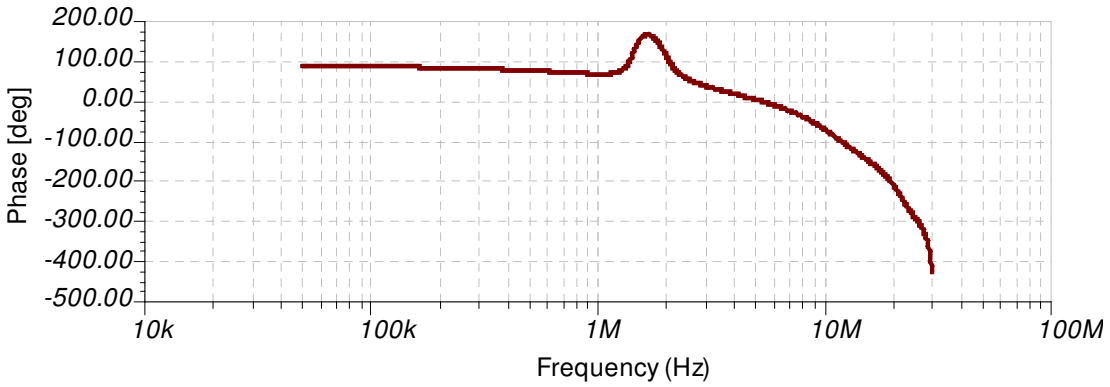
This first diagram is the unmodified input filter, as specified in the RX320 Schematic Diagrams and Material List that can be downloaded from the Ten-Tec web site.

Component identifiers do not match those on the schematic and the 50 ohm resistor to the right of the diagram is not part of the receiver but represents the load seen by the filter for analysis purposes.

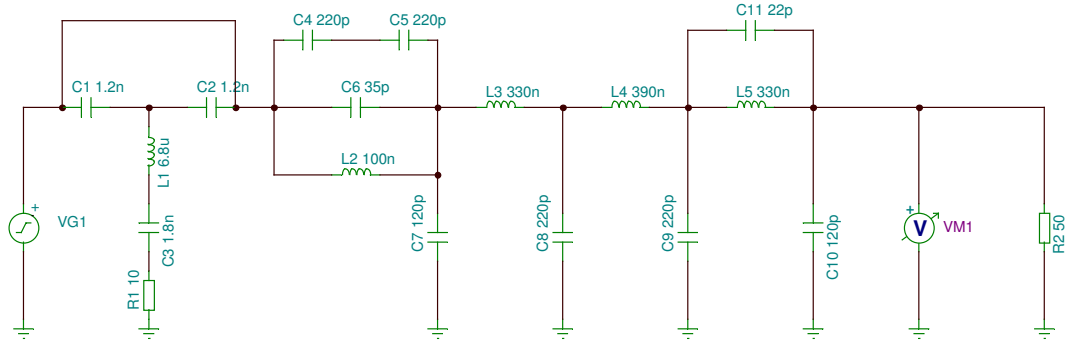


The analysed frequency response is as shown below……

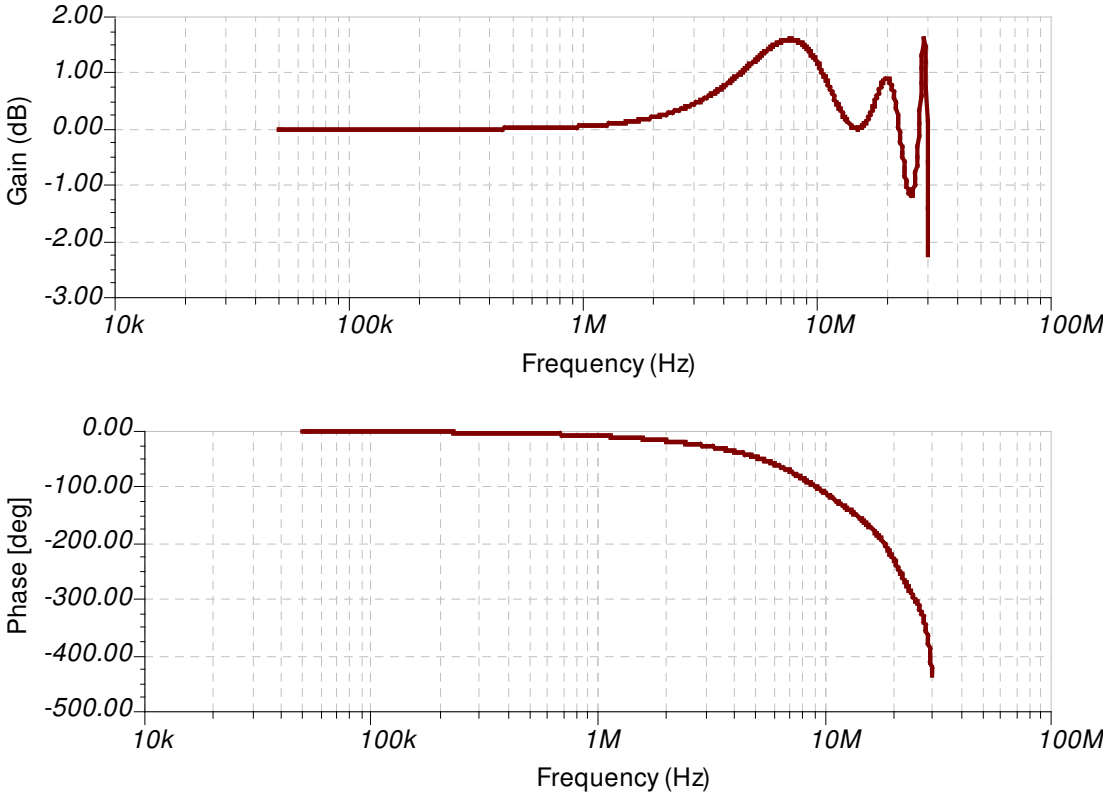




This diagram shows the placement of the link that bypasses the first filter section…….

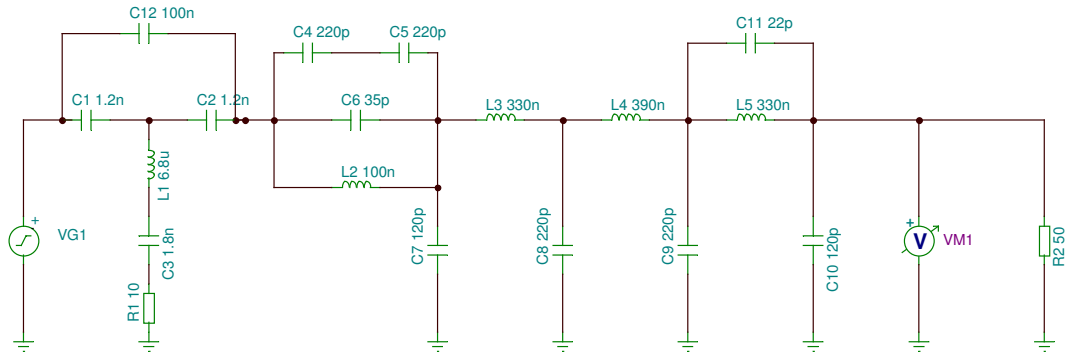


And this is the dramatic change to the frequency response……

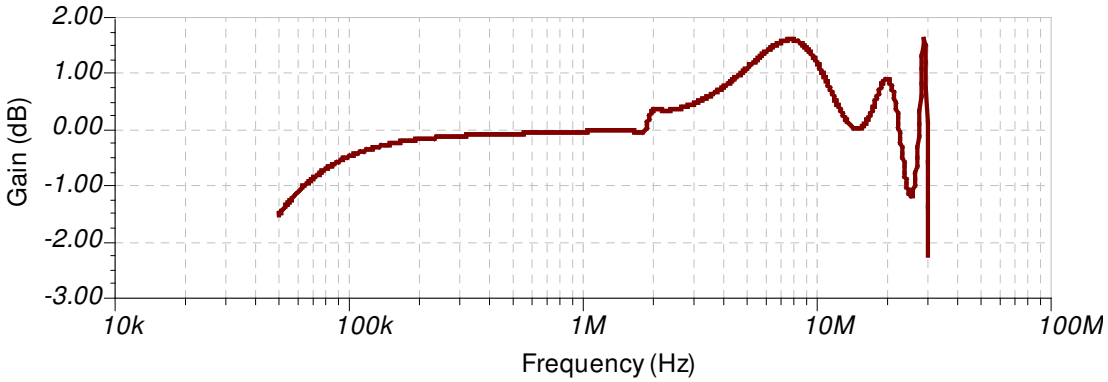


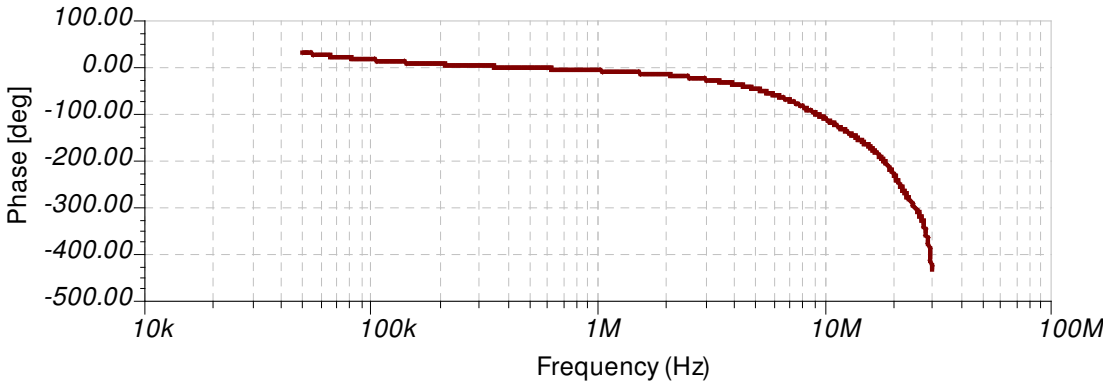
Please note that the plus and minus approximately 1 dB HF ripple is exactly the same for the unmodified set, it is only more noticeable here due to the significant change in scale.

This final diagram is the modification as proposed, with the link replaced by a 100 nF capacitor……



And, again, this is the frequency response……





Although not as smooth as when using the link that glitch at 2 MHz is less than 0.5 dB and a small price to pay for leaving the original components untouched.
The response at 100 KHz is still less than 0.5 dB down.
A larger value capacitor could be fitted, 1 uF for example gives a response that looks almost identical to that for the shorting link, but other factors will be limiting the frequency response and it's unlikely to make any noticeable difference.
100 nF is a good compromise and small enough to fit easily.

The first two photographs below show views of the RX320 RF section printed circuit board with arrows to indicate where the capacitor should be soldered.

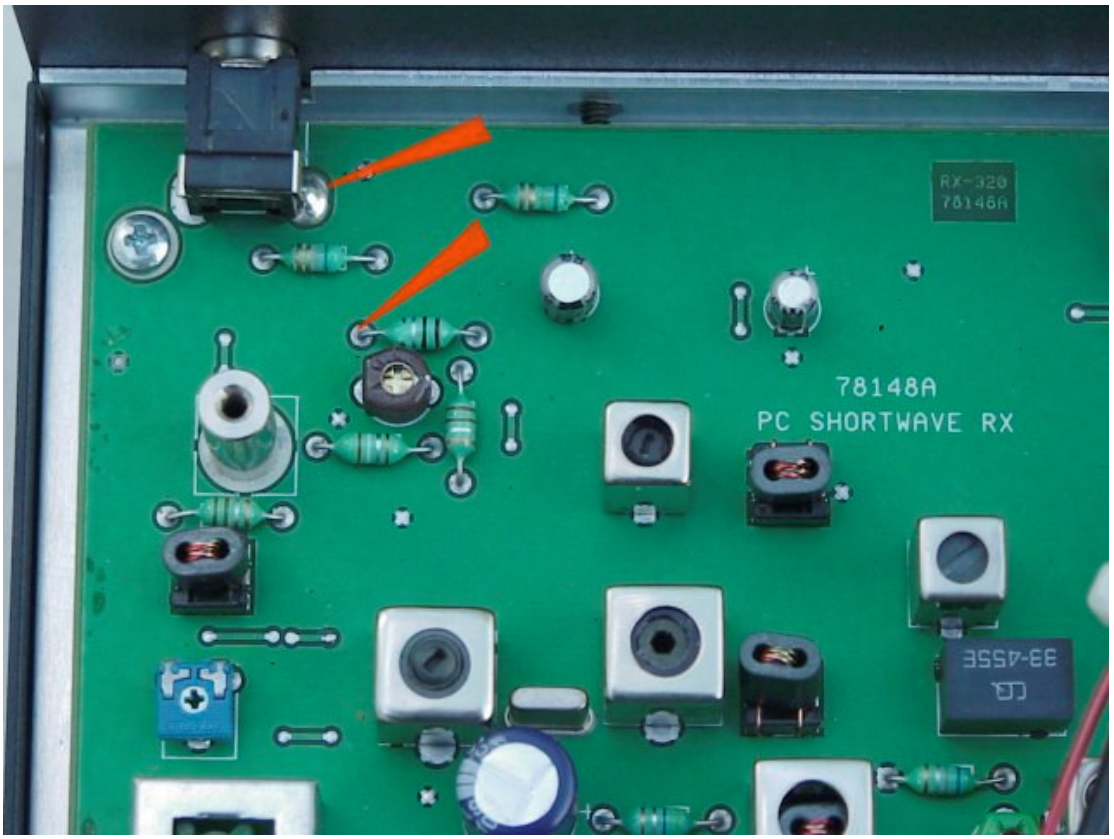
The third photograph shows the capacitor in place for test purposes.
The leads were deliberately left a bit long so that the photograph is clear.

The only caution is to make sure that no solder bridge is formed between either pad and the ground plane.

That's it.

A lot of explanation for a very simple modification ☺

Nigel Clarke
G8PZR


RX-320
78148A
78148A
PC SHORTWAVE RX