

# Receiving and Transmitting Band Pass Filters for Simultaneous Operation in the Air at 2, 3 and 4 Bands from the same Antenna System

by Dipl. Ing. Tasić Siniša –Tasa YU1LM/QRP

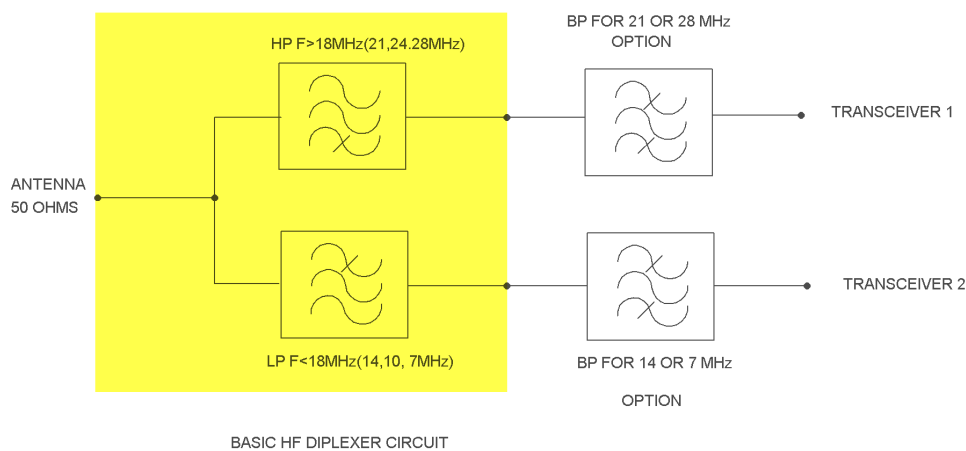
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I designed and realized a lot different type filters. Progress retired some very good communications solution from past. The professionally system at HF bands with LOG Periodic antennas from 4(7)-30MHz are now out of use in era modern satellite communications. Antenna fields with LOG antennas in different directions or rotary can be used with this my design simultaneous at different HAM bands. This solution is also attractive for expeditions which are not in position to have antenna farm but only one or two multiband antenna, RIGs are now small dimensions and this proposed solution will expanded number of QSOs for the sure There are many other possibilities such as SO2R or Multi OP single TX etc in Contesting. I wasn't in situation to test this design practically in operation I check predicted results at instruments and achieved very good agreement only. How to realize this inductors, capacitances will depend from used output power!! **Take care about quality Q factors, breaking voltages built in components to prevent damages RIGs. It is necessary unused port terminate with 50Ohms /10-50W if it is not used to enable correct work at other bands!**

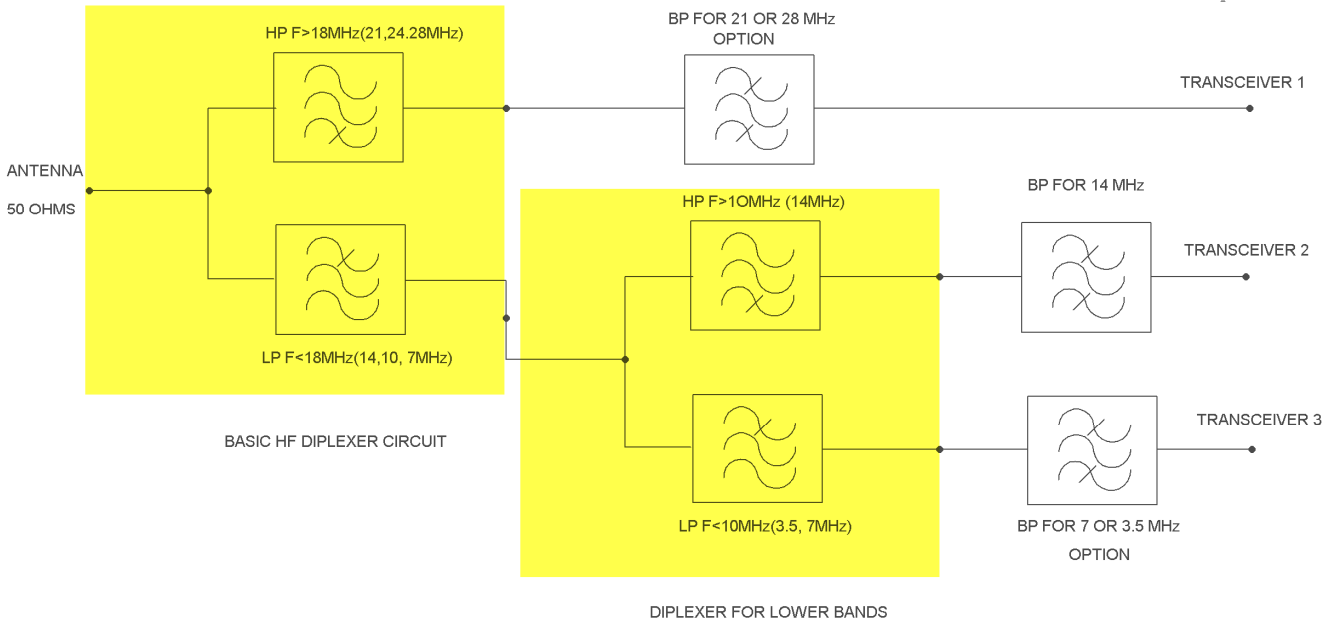
All components are taken in analyses with real losses. The designer's specifications target at the start ware:

1. Filters + additional BP have IL(insertion loss) less than 0.7dB (~14% power loss with inductors  $Q_0 \sim 200-300$ )
2. All filter components values have to be standard values for capacitors.
3. Coils are without taps!
4. Termination return loss at all ports have to be better than -20dB (VSWR=1.22).
5. Frequencies harmonically related to central diplexer frequency from lower and upper side are attenuated ~30dB or more.
6. No tune design and design with low sensitivity to component tolerances
7. Selectivity to all other band have to be min 70 dB this can be achieved adding additional BP from my site or some other designs to every output where it is necessary

These filters are realized as 3 port diplexers. See block diagrams for 2, 3 and 4 bands at pictures down!

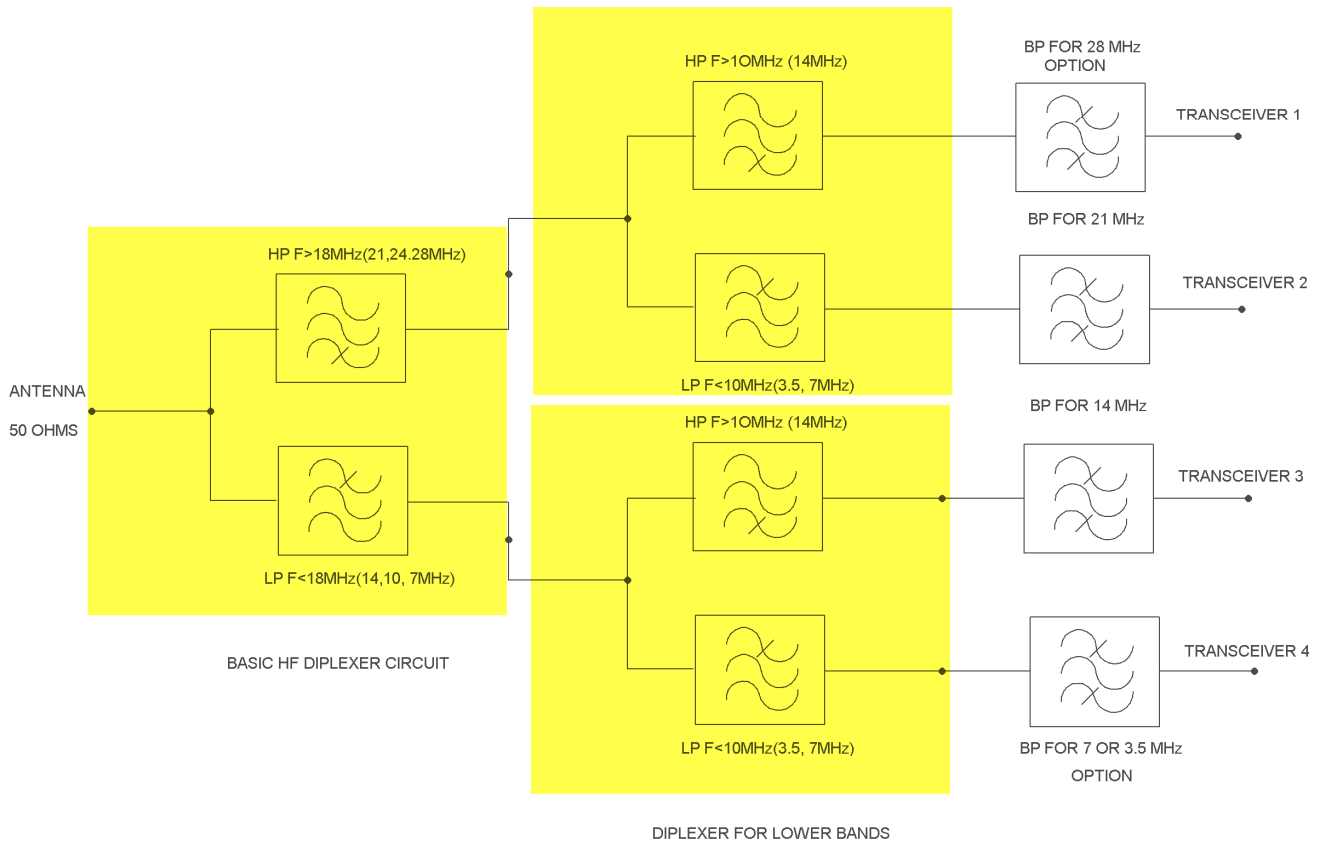


DIPLEXER FILTER SYSTEM FOR SIMULTANEOUS WORK ON 2 BANDS -YU1LM



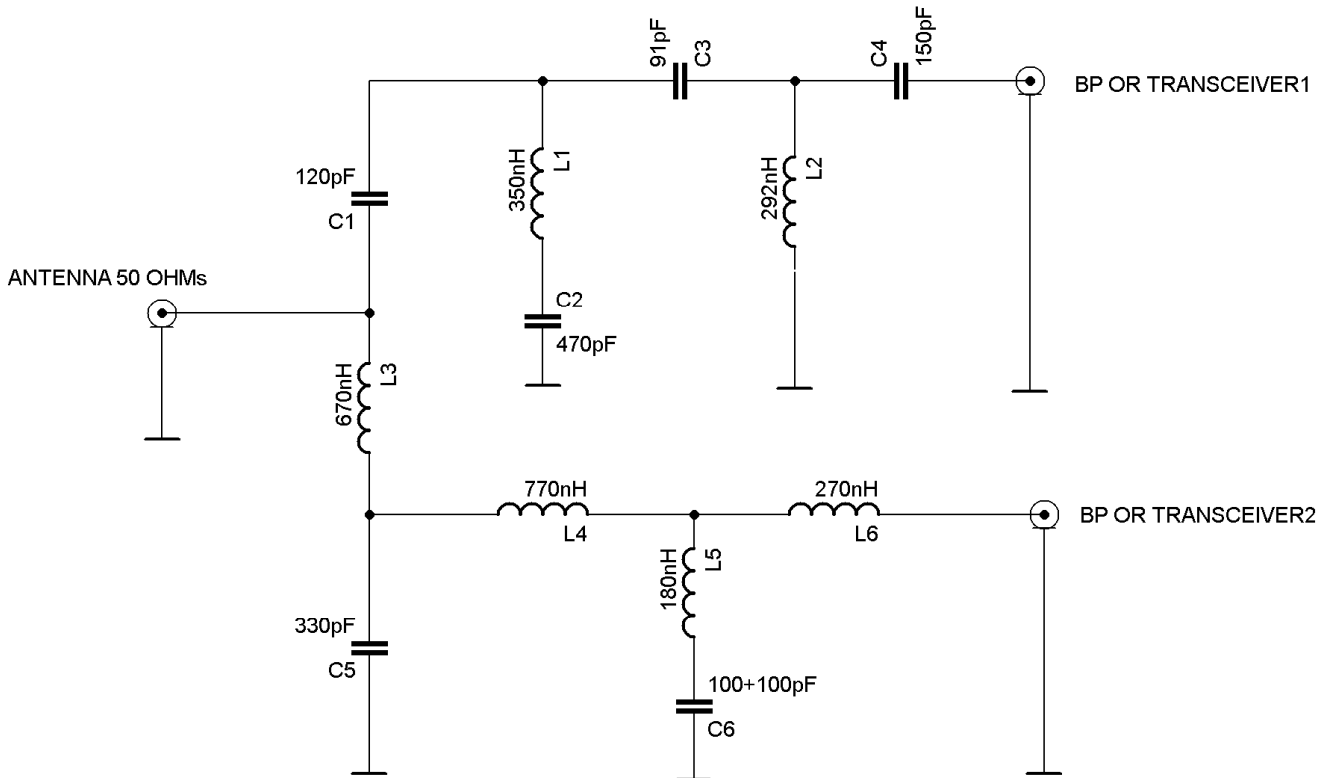
## DIPLEXER FILTER SISTEM FOR SIMULTANEOUS WORK ON 3 BANDS -YU1LM

DIPLEXER FOR HIGHER BANDS



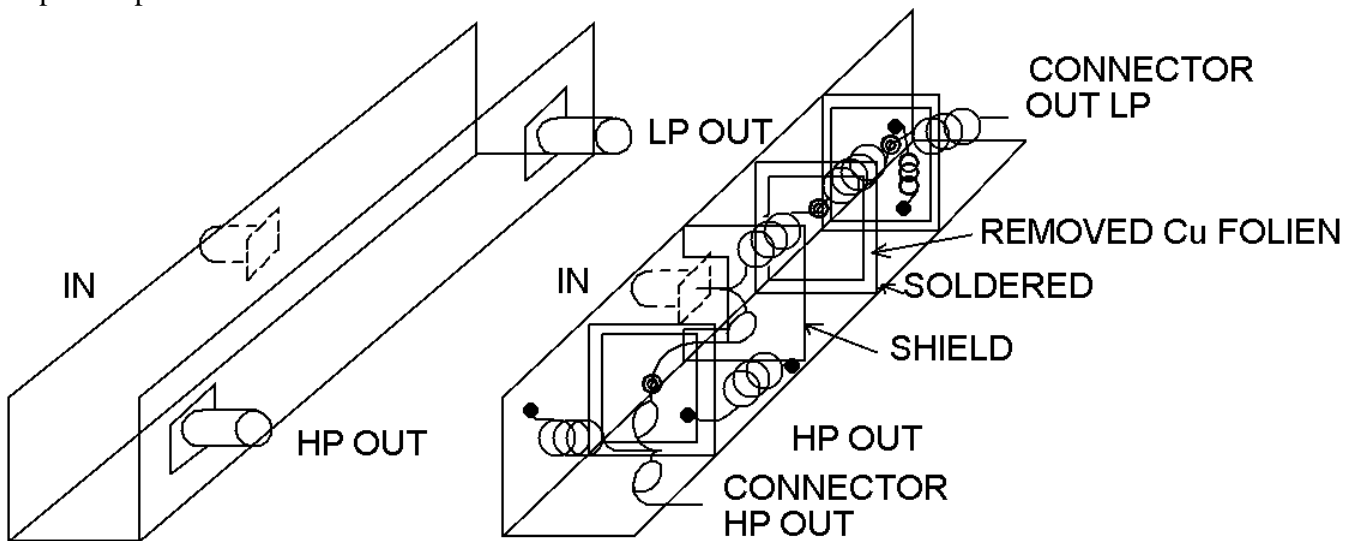
## DIPLEXER FILTER SISTEM FOR SIMULTANEOUS WORK ON 4 BANDS -YU1LM

The basic diplexer is designed for frequencies lower than 18MHz and higher than 18MHz according next schematics. Design is relatively simple only 6 capacitors and 6 inductors!

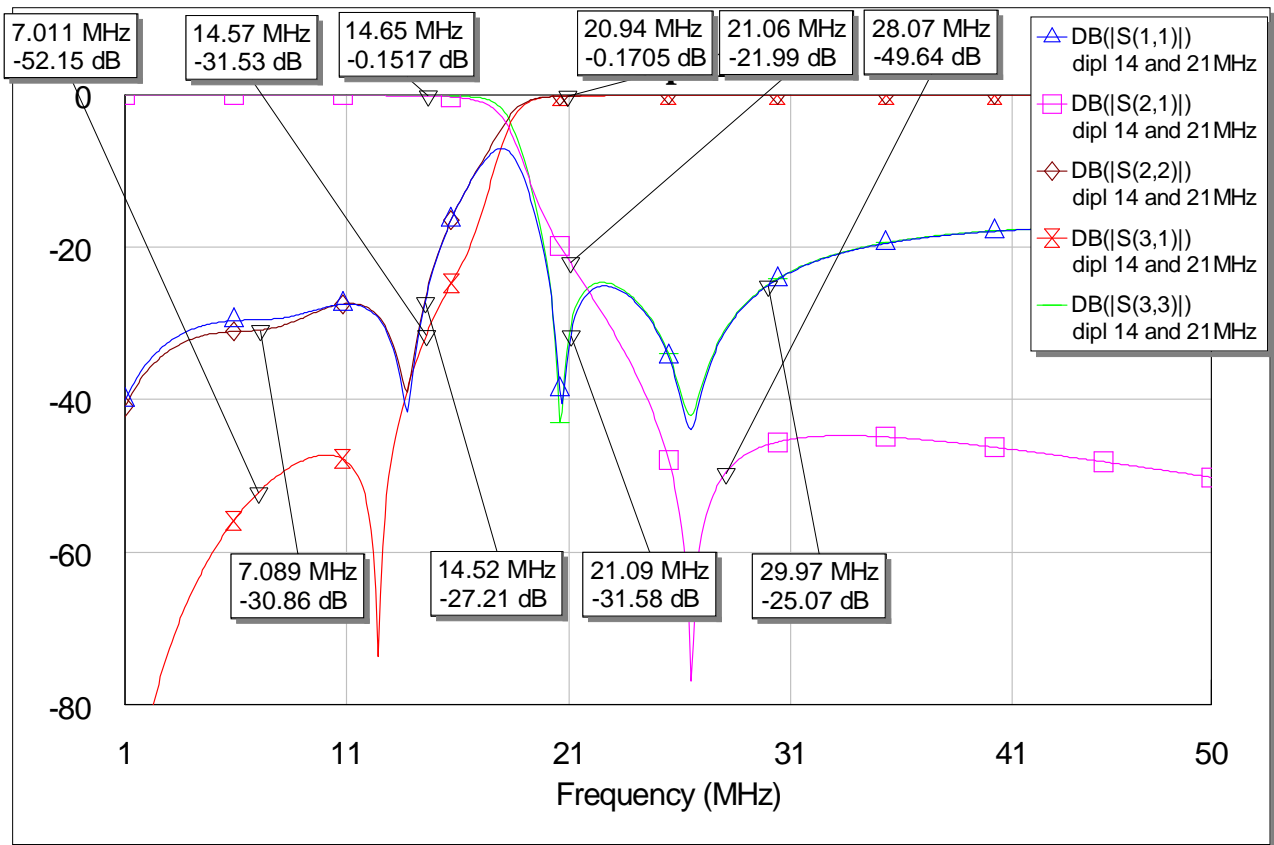


BASIC DIPLEXER 80,40,20 AND 15, 12, 10 m DESIGN -YU1LM

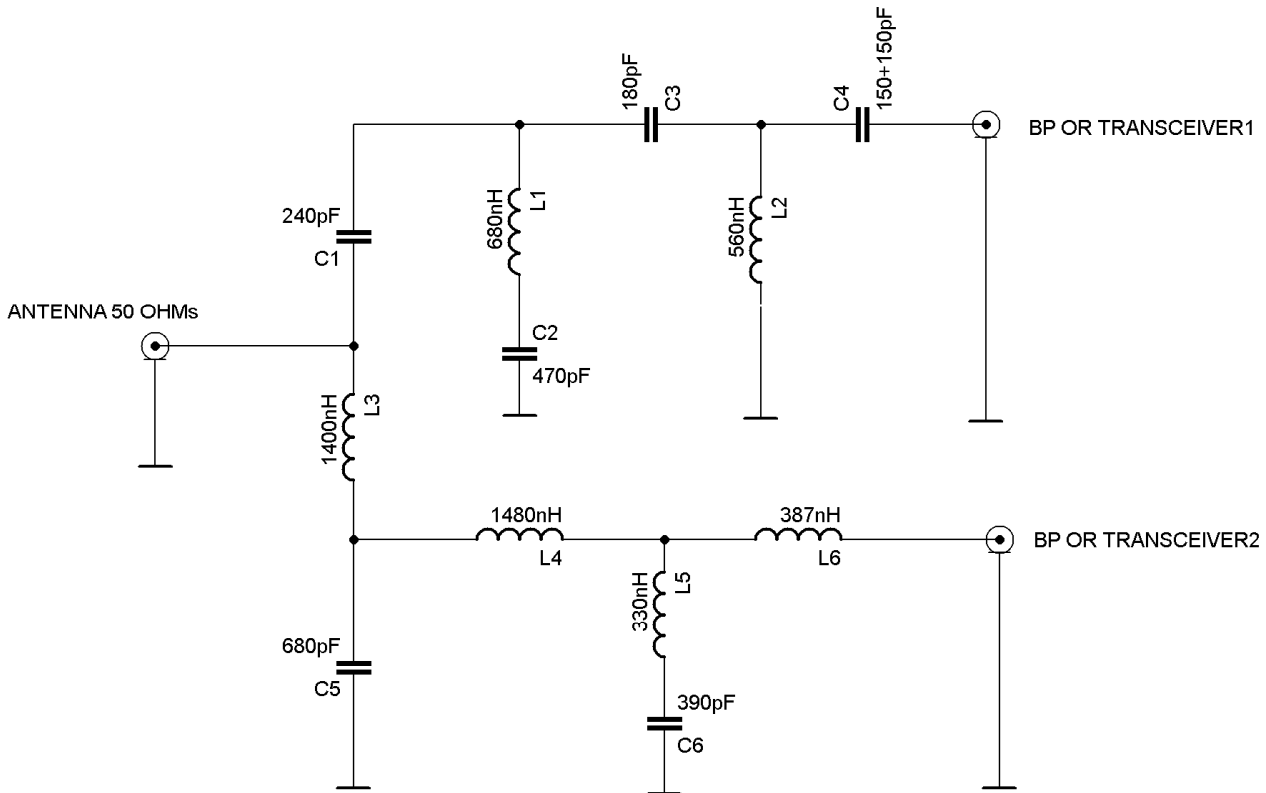
One of possible proposals for practical realization this filter is at picture down. Capacitors are possible realized as plate capacitors from FR4 PCB!



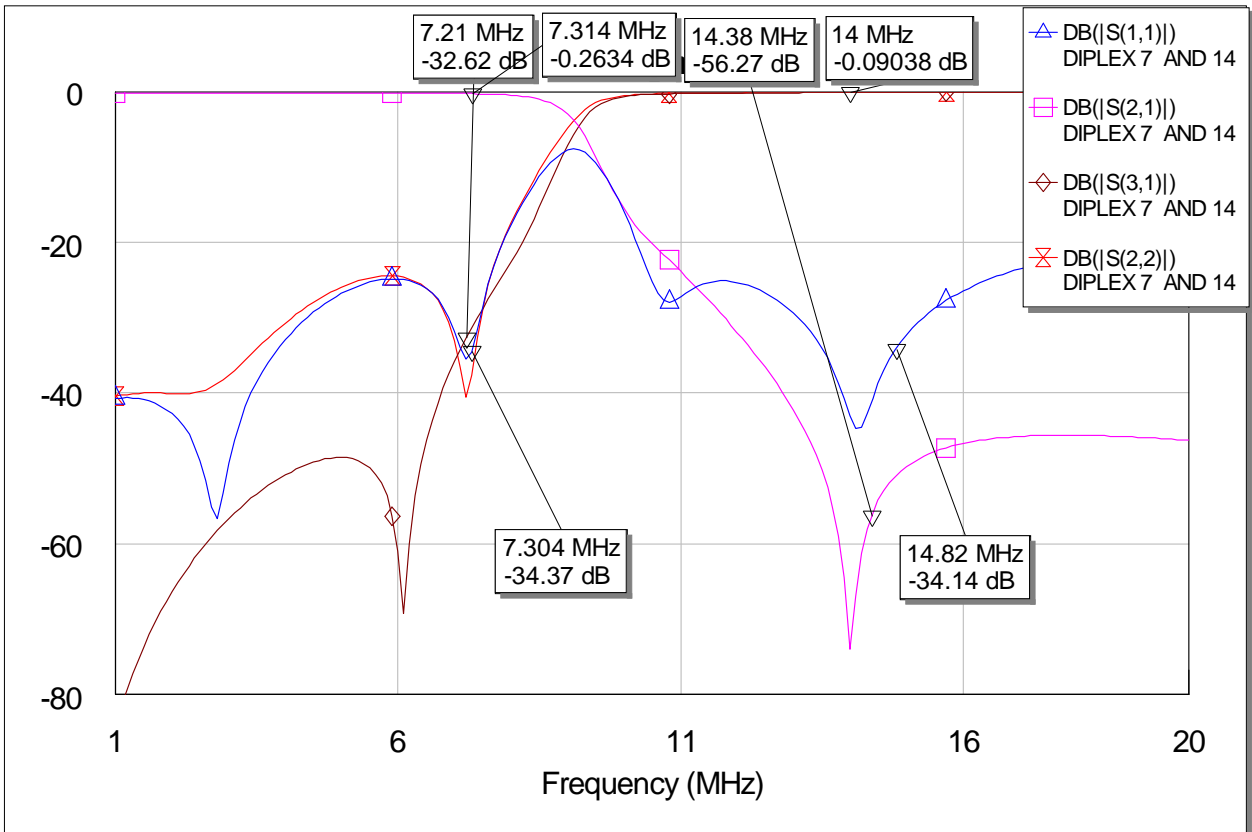
HF DIPLEXER MECHANICAL CONSTRUCTION - YU1LM



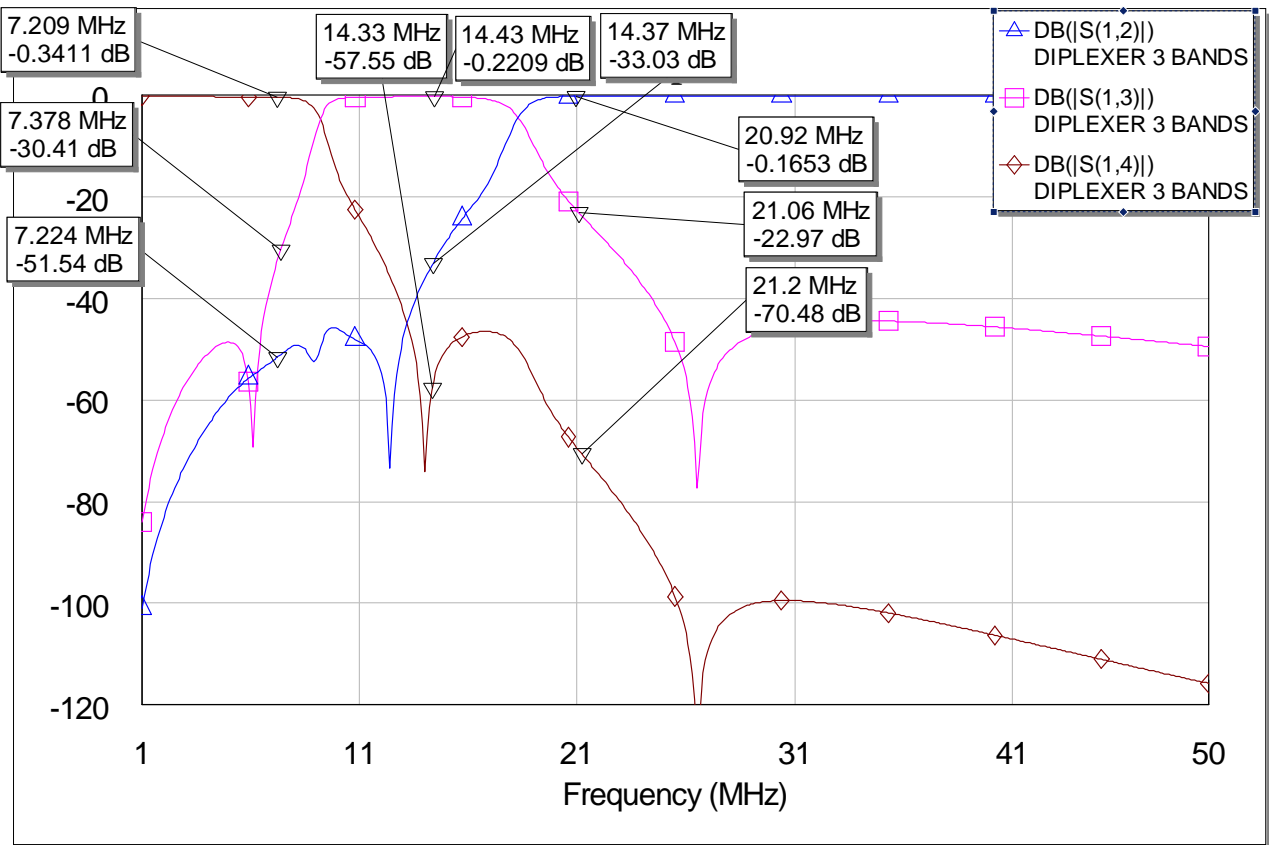
If we look at amplitude frequency response it is possible simultaneous work at 7 and 28MHz. The other combination (bands 40, 30, 20 and 15m) will require addition BP filters see some proposed realization at my WEB pages.



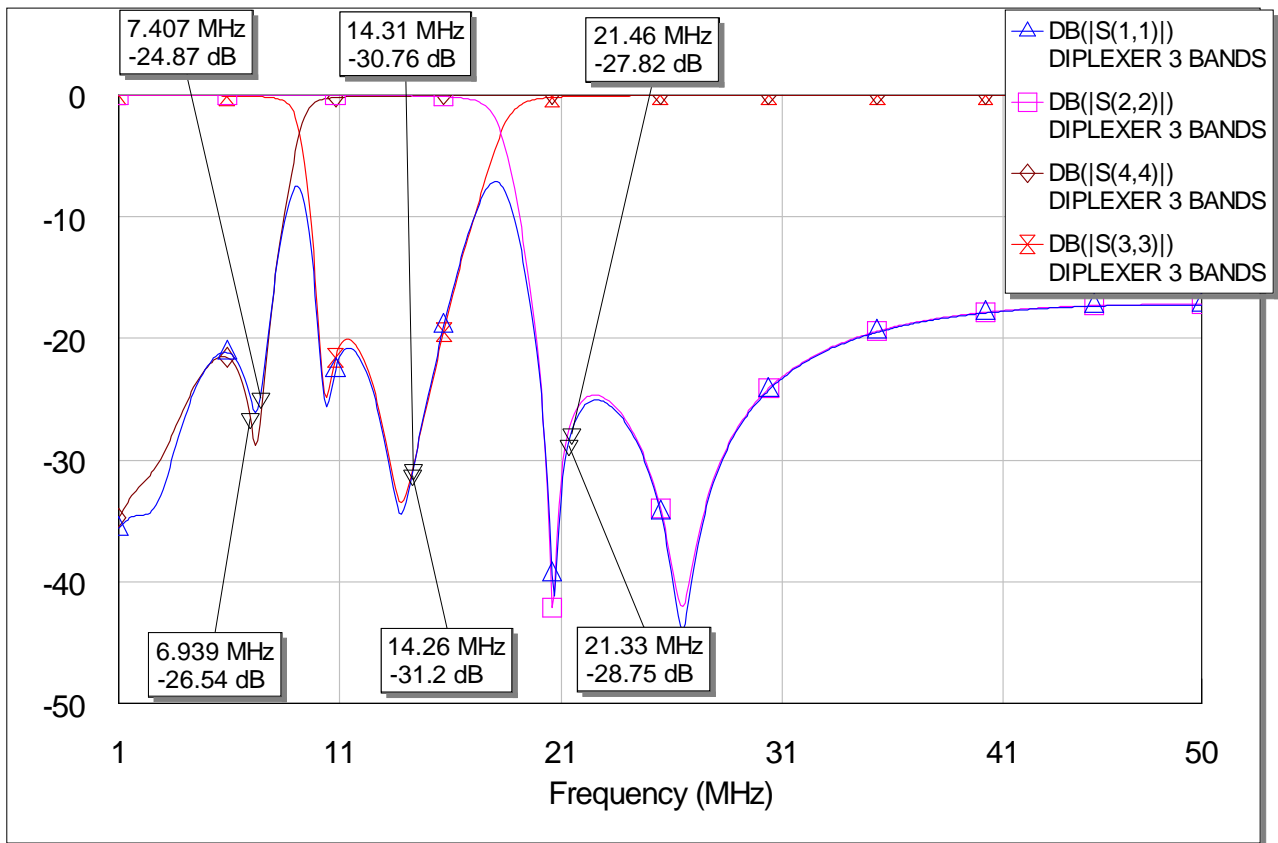
BASIC DIPLEXER 80,40 AND 20 m DESIGN -YU1LM



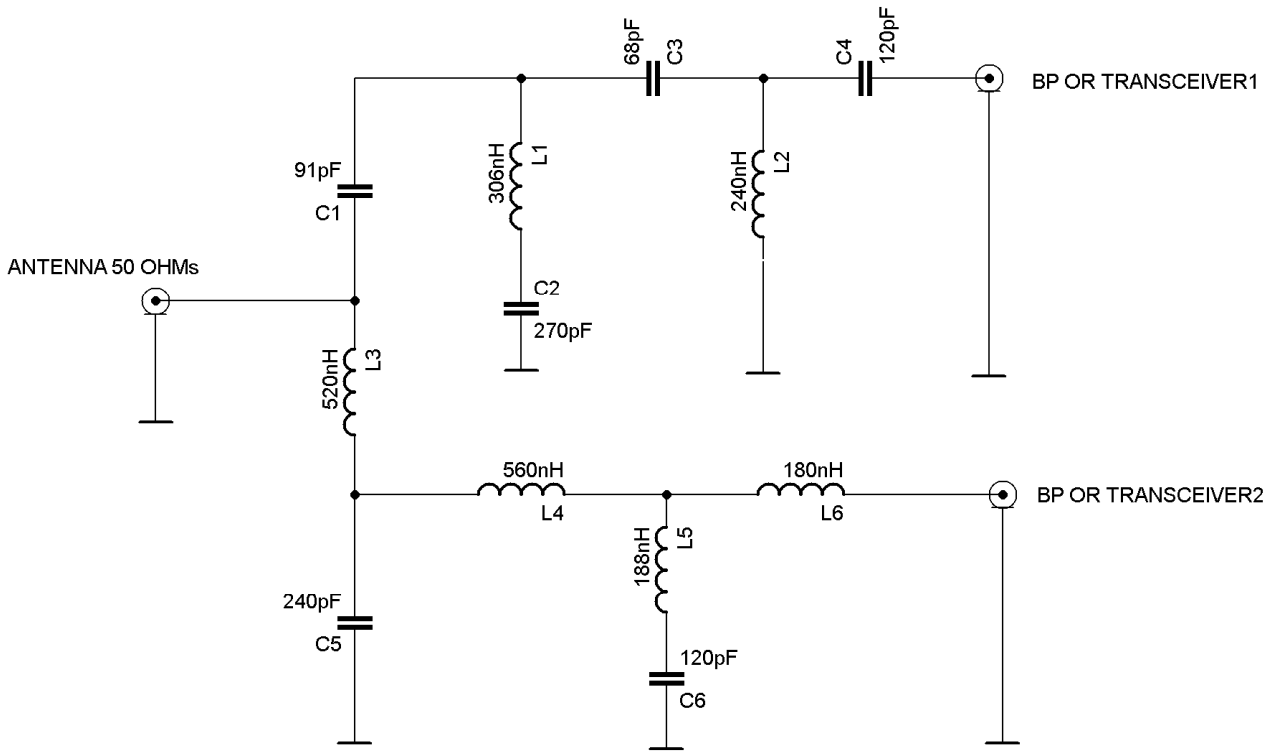
Amplitude frequency response diplexer 80,40 and 20m bands



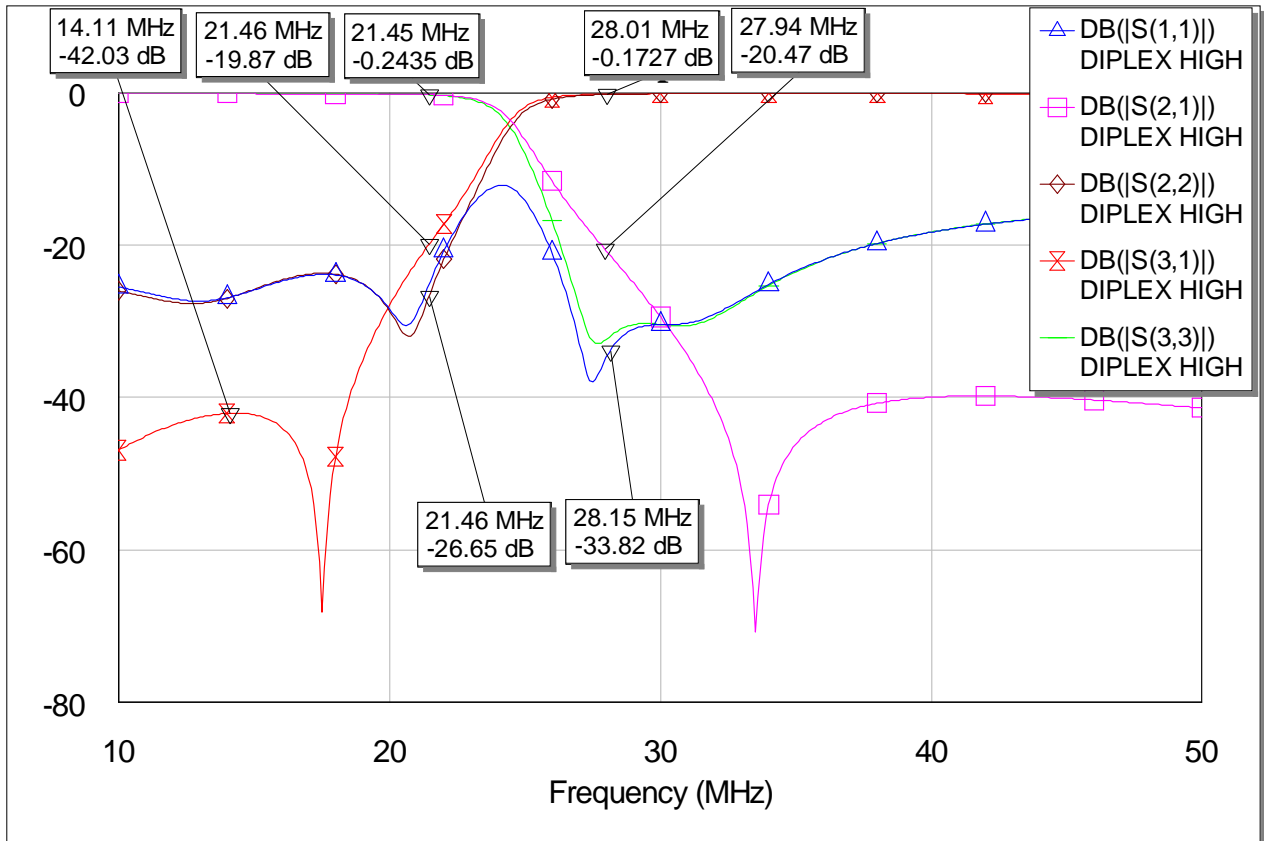
Amplitude frequency response basic diplexer 40, 20 and 15(10) bands



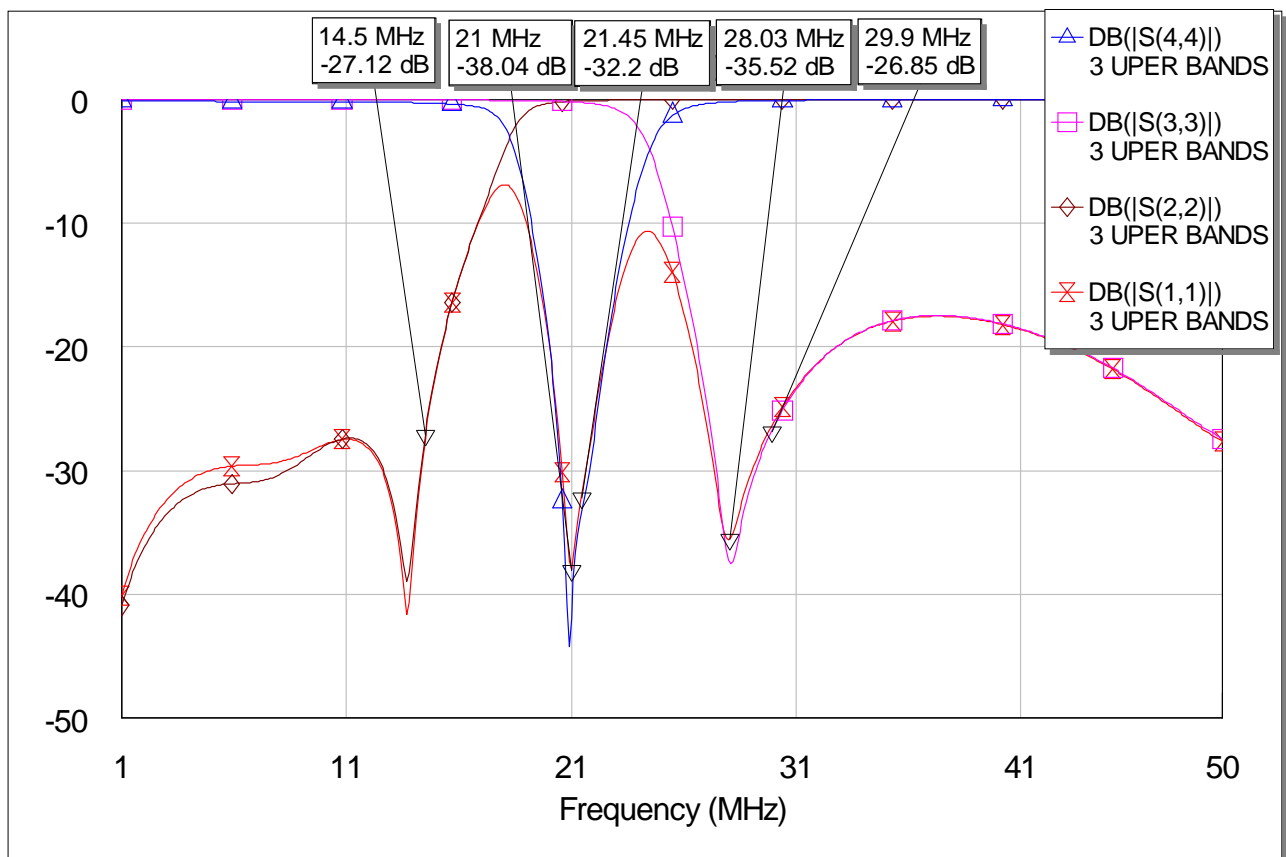
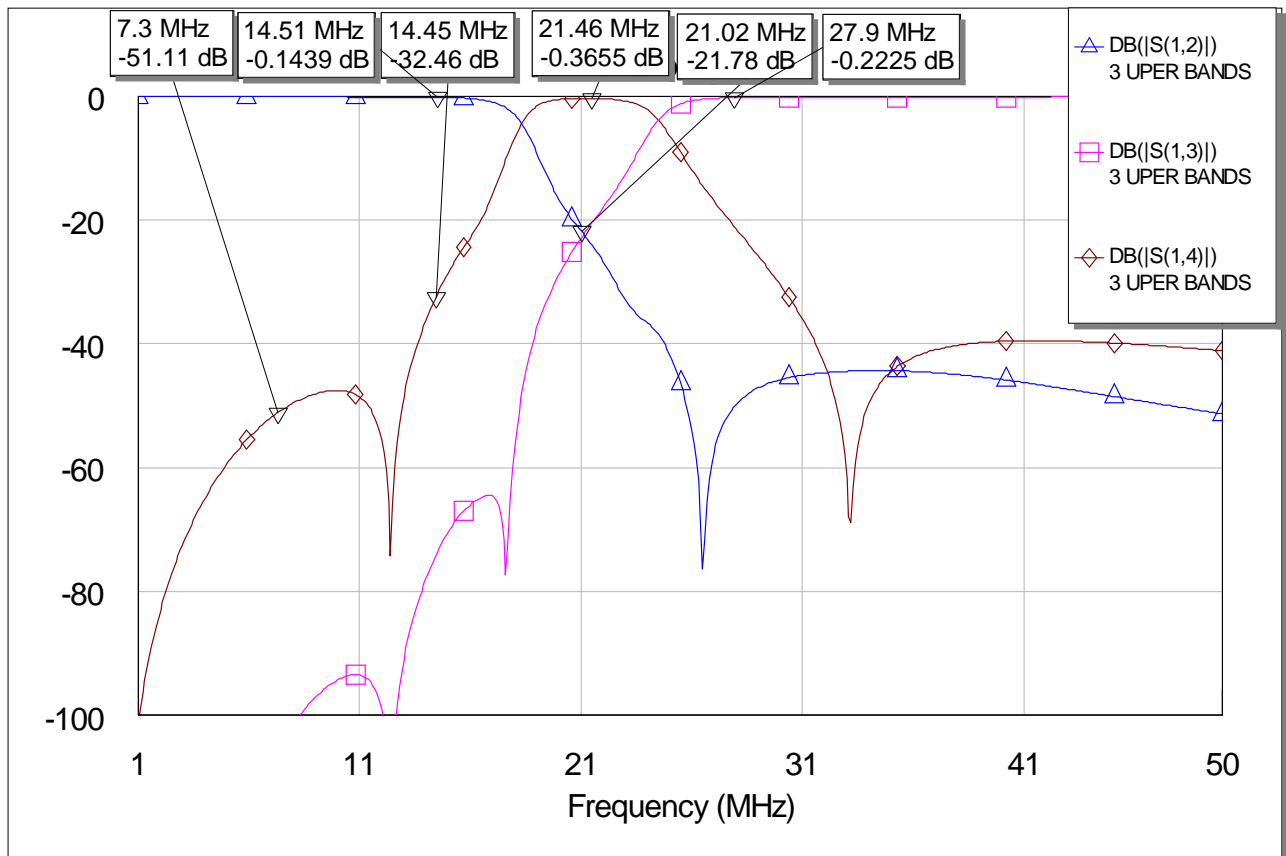
3 Band diplexer 40, 20, 15m SWR (S11, S22, S33 and S44 in dB) all results are better than -25dB (SWR<1.1)



BASIC DIPLEXER15 AND 10 m DESIGN -YU1LM

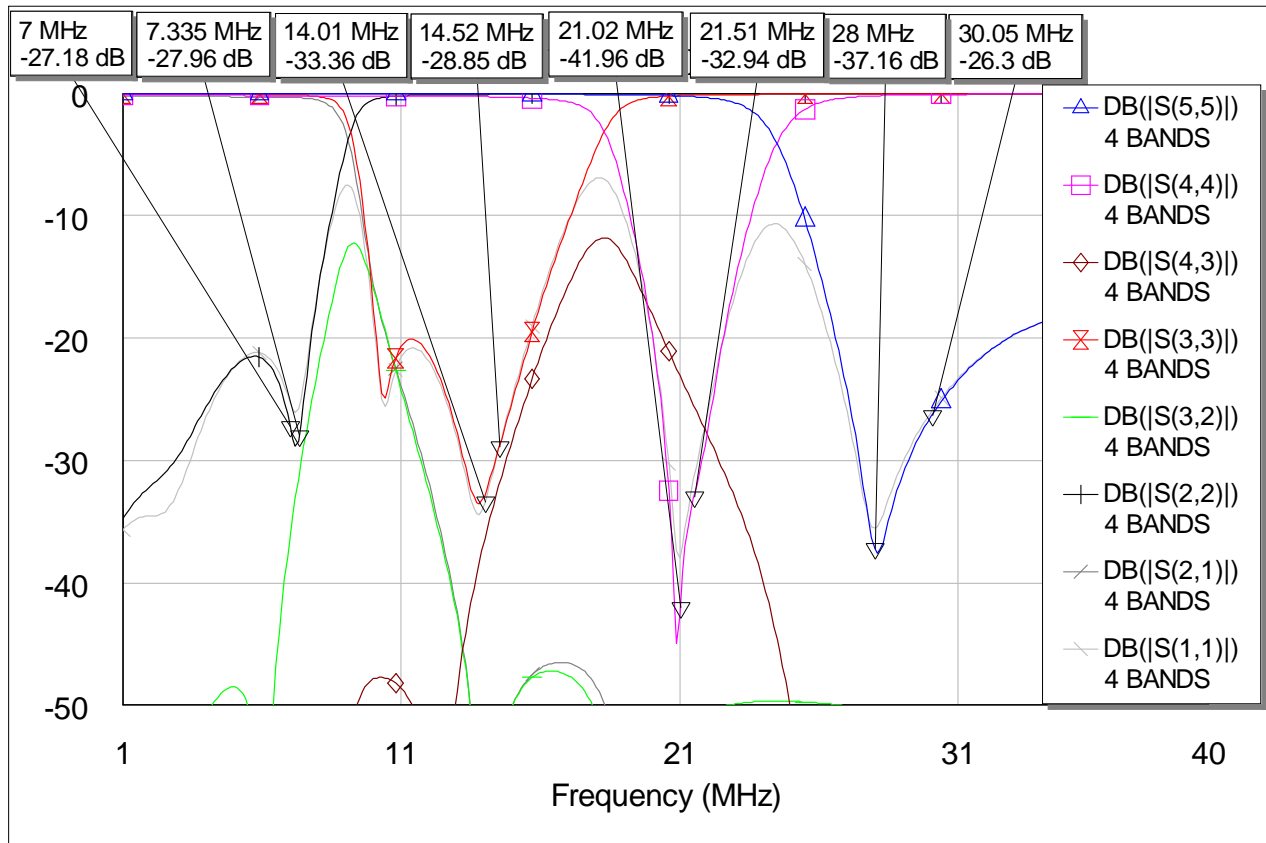
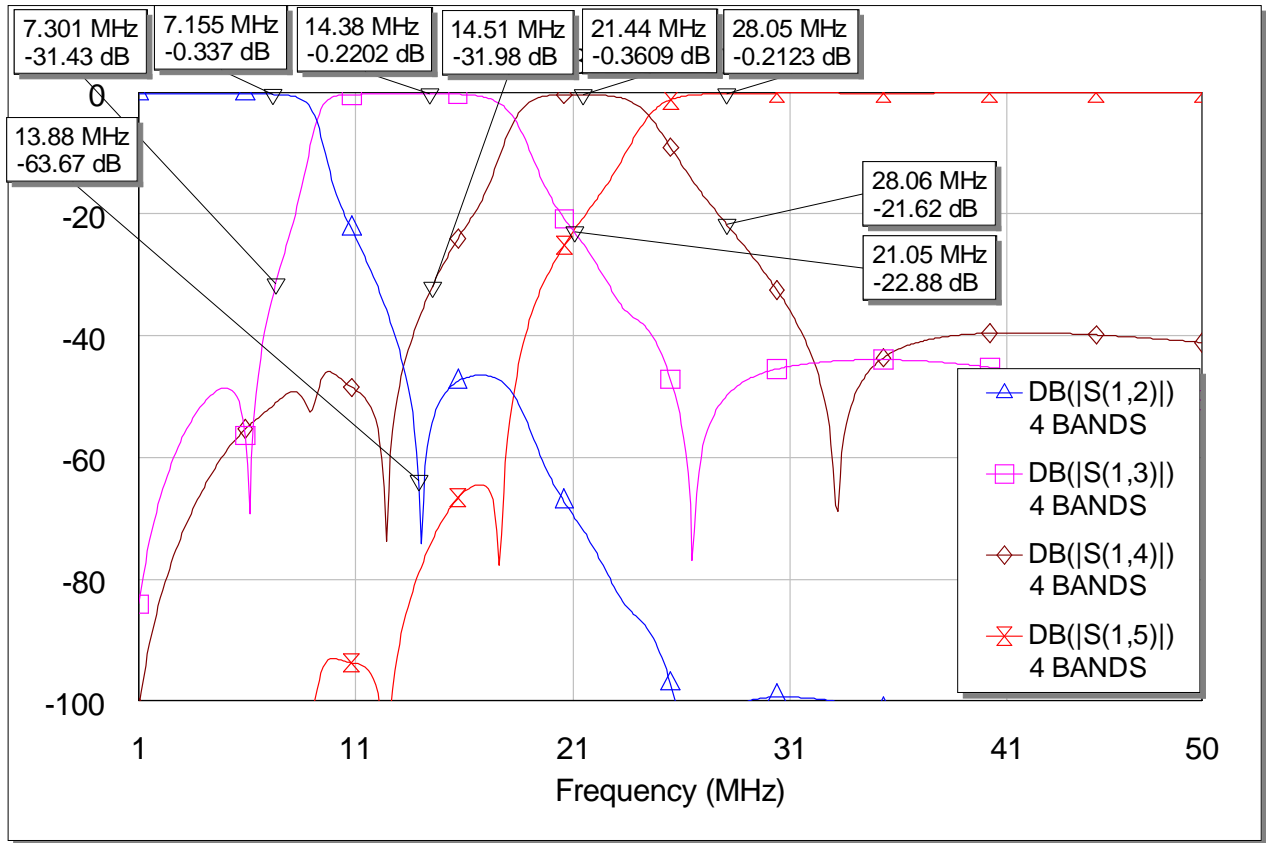


Amplitude frequency response basic diplexer 15 and 10 m bands

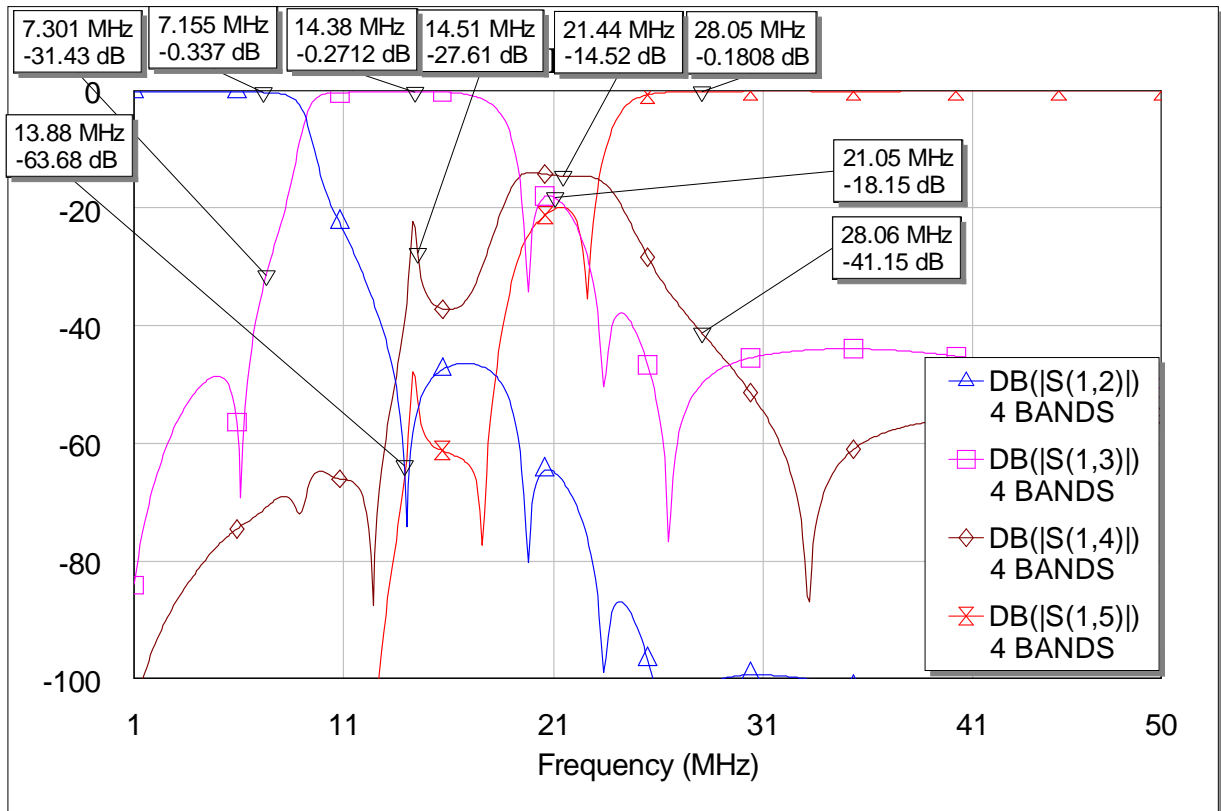
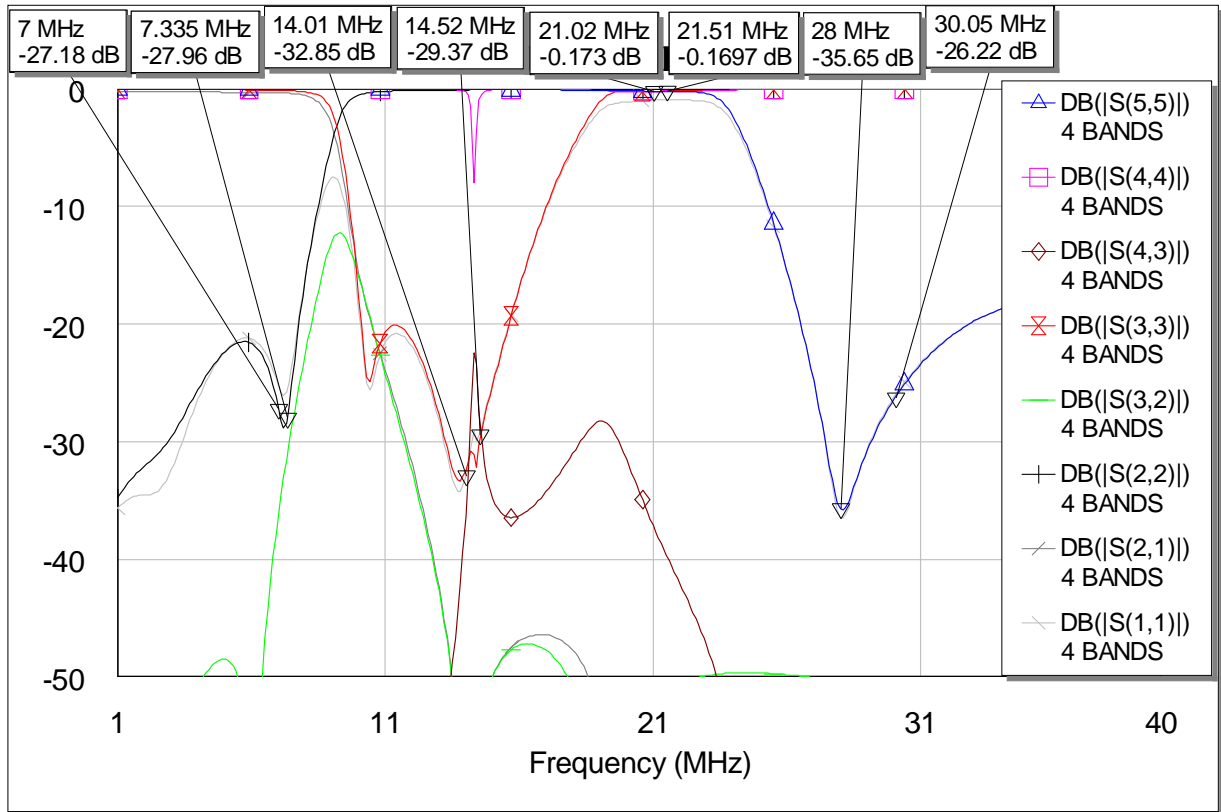


3 Band diplexer 20, 15, 10m SWR (S11, S22, S33 and S44 in dB) all results are better than -25dB (SWR<1.1)





4Band diplexer 40, 20, 15, 10m SWR (S11, S22, S33 and S44 in dB) all results are better than -25dB (SWR<1.1)



Two pictures up 4 band diplexer special case when 15m band is open (transceiver is not connected R~5000Ohms) you can see influence to diplexer port termination and transmission.

## **WARNING!**

**All built in components have to be adequate quality very high Q. This mean that capacitors have adequate breaking voltages, high current and that ring cores are from adequate RF materials for used frequency and square surface for used output power to avoid filter destruction or equipment damages. About selection component for high power RF BP filters please read article [4, 5] from well known filter designer expert Ed W3NQN.**

I am using very good freeware software from Wilfried DL5SWB for ring and air coils turns calculation [3]. Fine inductance adjustment for better SWR is possible with squeezing or unfolding wire turns on ring or air coils before fixing with small quantity of glue or silicon.

My advice is for air coils use copper or silver wire diameter min 2mm to minimize insertion losses!

My proposal for BP realization in case PCB realization is usage better SMD porcelain capacitors from ATC [7]. These capacitors if you want some kind of surface montage.

I wish you successful BP realization and I apologize for some possible mistakes. I made great effort to share my projects with all who are interesting for. Anyway, send me your comments positive or negative, results or photos of your realization are welcome.

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**VY 73/72 and GL in homebrew Tasa YU1LM/QRP**

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## **References:**

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2. <http://www.linear.com/designtools/software/>
3. [www.dl5swb.de](http://www.dl5swb.de)
4. *Ed Wetherhold W3NQN – Clean Your Signal with Band-Pass Filter –part1 ), QST May 1998(pages 44-48),*
5. *Ed Wetherhold W3NQN – Clean Your Signal with Band-Pass Filter –part1 ), QST June 1998(pages 30-42),*
6. <http://www.bavarian-contest-club.de/projects/bandpassfilter/100W-BP.pdf>
7. <http://www.atceramics.com/>