

Diplexer for Recycler Medium Level Electronics

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Abstract: A diplexer for the recycler medium level electronics is described in this paper. The diplexer operates by splitting the signal and sending the signals through a low pass filter and a high pass filter. The low pass filter and high pass filter are realized in microstrip form. The low pass section operates from 0.5 – 1.0 GHz, and the high pass section operates from 2.0 – 4.0 GHz.

Circuit description

The high pass filter, and the low pass filter are designed as two separate circuits. The filter will be connected using a signal splitter to realize a diplexer, as shown in fig.1. The filters are designed to have about 20 dB of insertion loss in the opposite bands, as shown in fig.2.

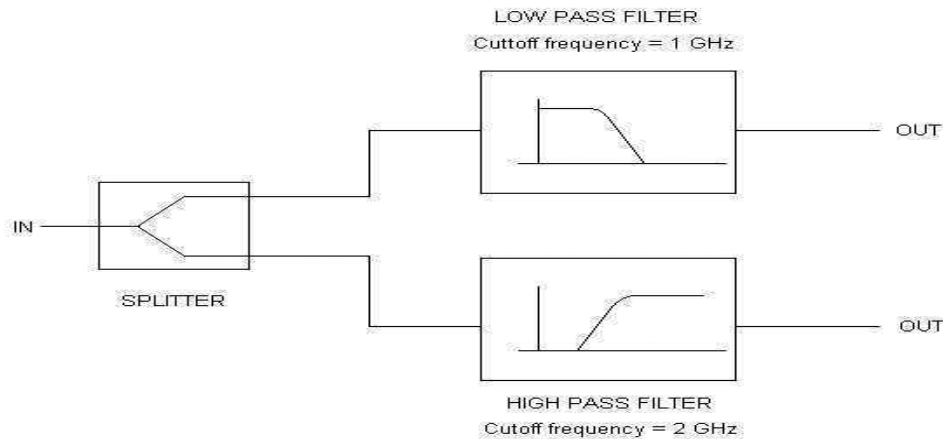


Fig. 1. Diplexer schematic

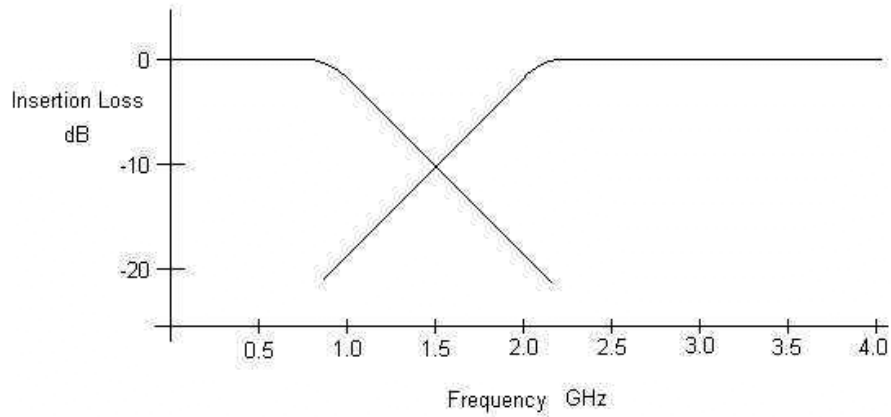


Fig. 2. Plot of the insertion loss vs. frequency of the diplexer

The low pass and high pass filters were designed using HP ADS. The ADS circuit schematic and the simulated results for the low pass filter is shown in fig. 3a and 3b. The high pass filter is shown in fig. 4a and 4b.

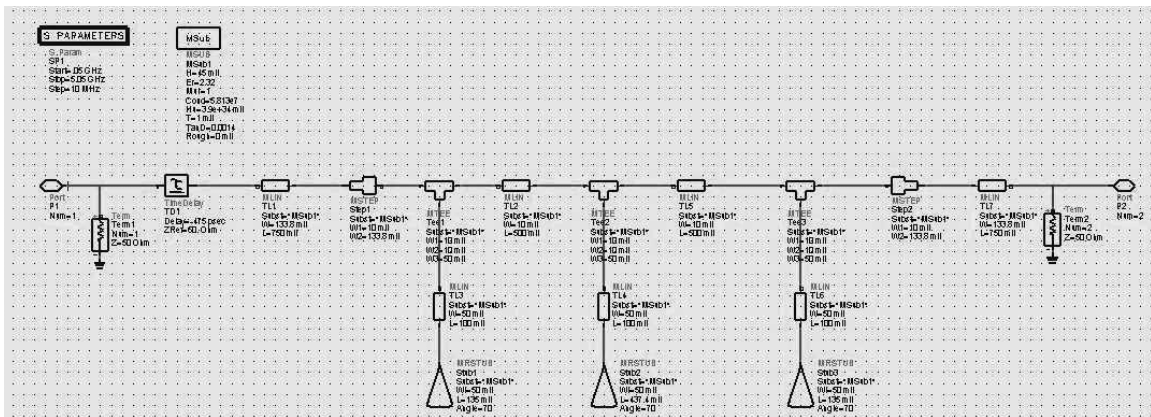


Fig. 3a. HP ADS circuit schematic of the low pass filter

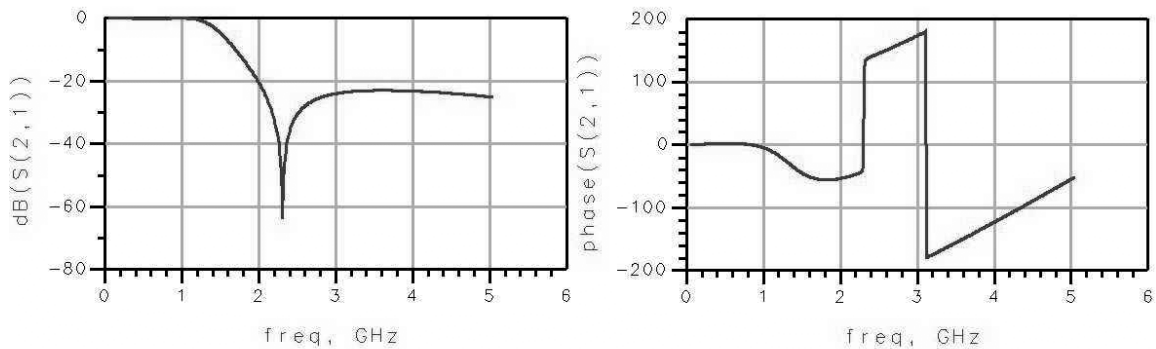


Fig. 3b. Simulated results of the low pass filter

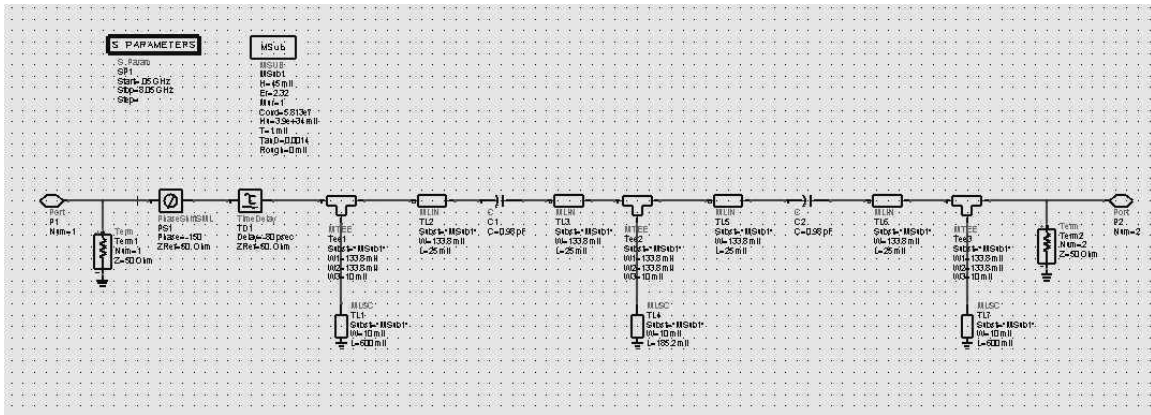


Fig. 4a. HP ADS circuit schematic of the high pass filter

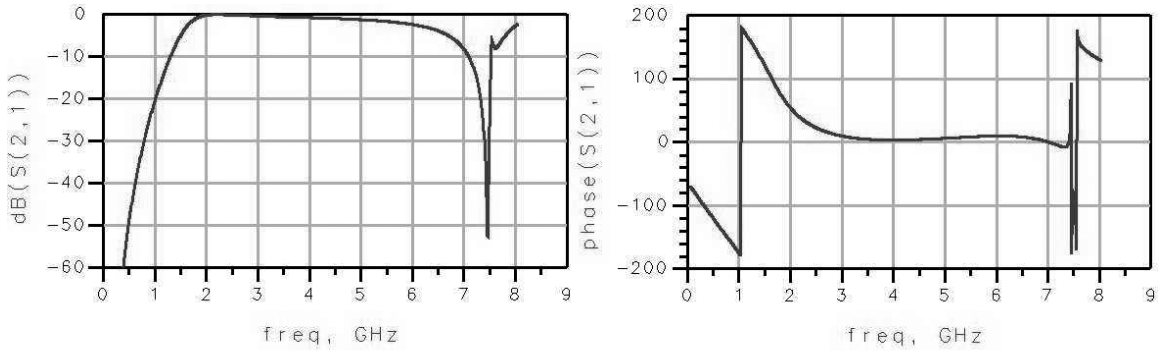


Fig. 4b. Simulated results of the high pass filter

Both the low pass circuit and the high pass circuit required tuning after fabrication. The center radial stub of the low pass circuit was increased in length from 437.5 mils, to 519 mils. The high pass filter required the addition of a thin strip of metal across the center high impedance shorted stub. A diagram of the modifications to the high pass filter is shown in fig. 5.

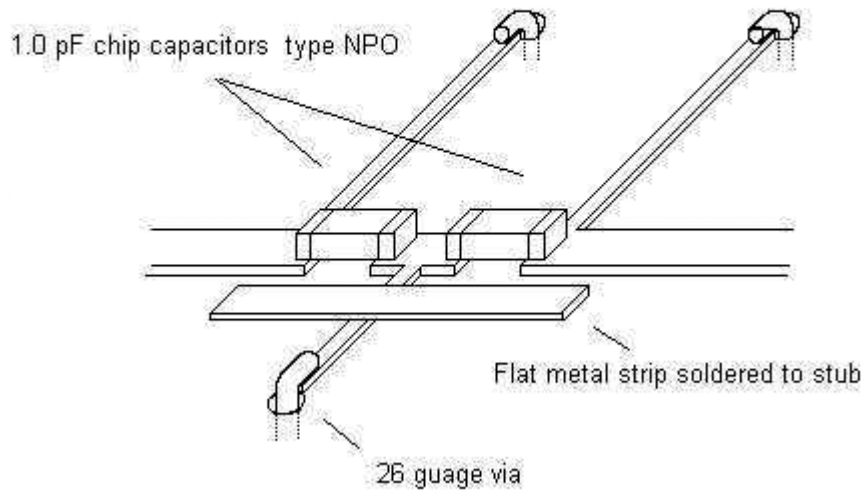


Fig. 5. Modification of high pass filter

The layout of the low pass circuit is shown in fig. 6a, and the layout of the high pass circuit is shown in fig. 6b. Photographs of the actual circuits are shown in figs 7a and 7b. The circuits were enclosed in a 3 inch by 3 inch aluminum box with type SMA connectors at the inputs and output of the circuit. An absorber material was used on the cover to prevent any changes in the circuit performance. The absorber is ARC technologies, type DD-10214.

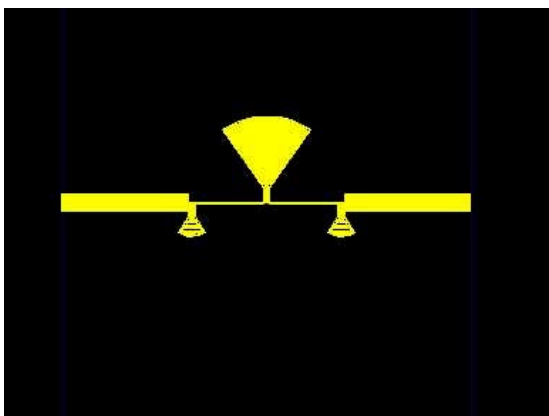


Fig. 6a. Low pass circuit layout

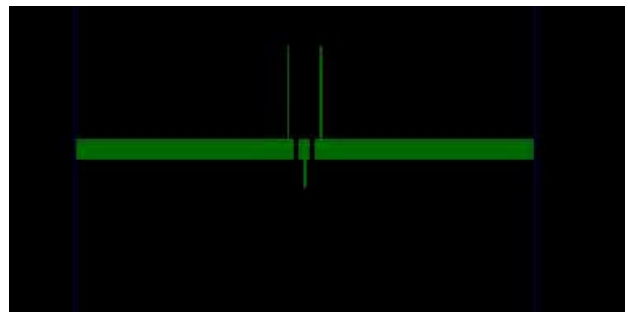


Fig. 6b. High pass circuit layout

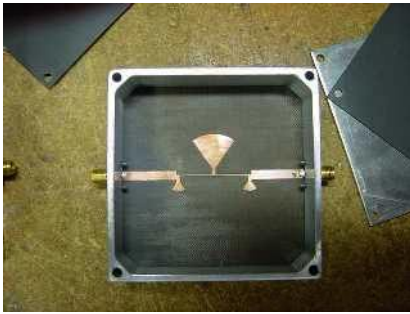


Fig. 7a. Low pass filter

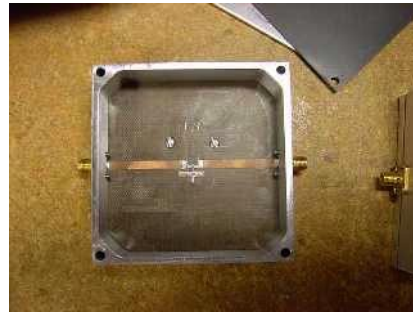


Fig. 7b. High pass filter

The measured results of the low pass filter is shown in fig.8, and the measured results of the high pass filter is shown in fig.9.

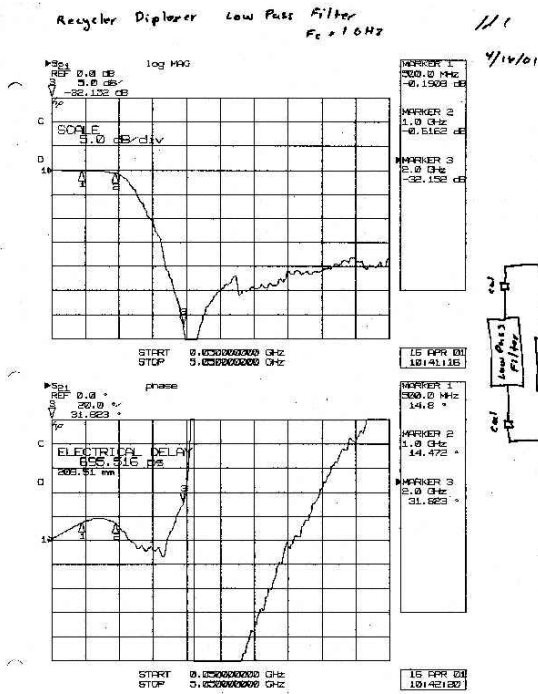


Fig. 8. Low pass filter measurements

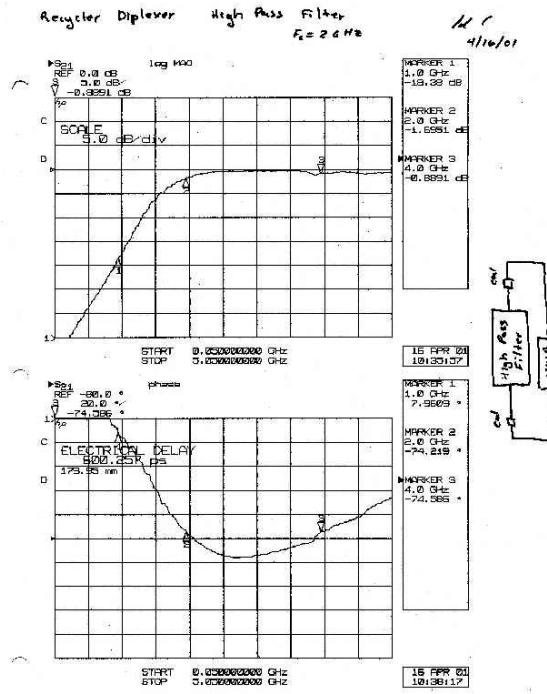


Fig. 9. High pass filter measurements

To complete the diplexer, a splitter is placed in front of the two filters. The KDI/Triangle QH45 90 hybrid was chosen to split the signal. A 3dB pad is placed between the splitter and the filters to improve isolation, as shown in photograph in fig.10. The measured results for the diplexer low pass section and high pass section is shown in figs. 11 and 12.

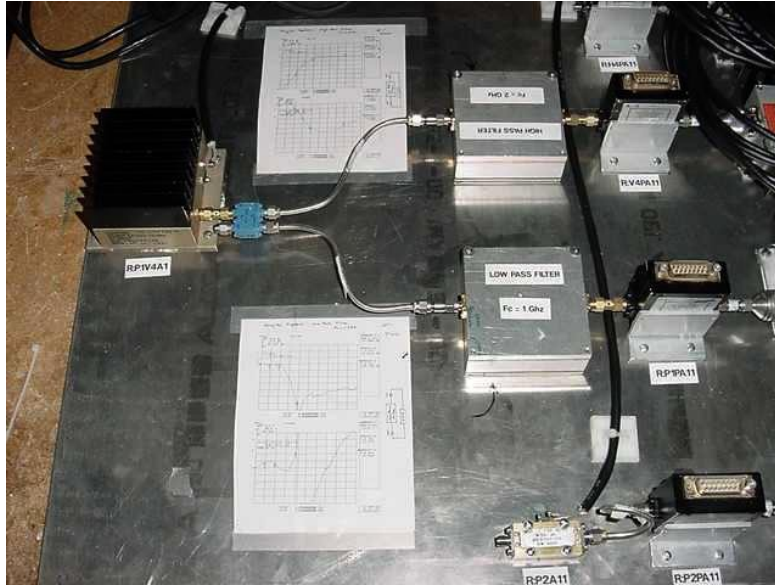


Fig. 10. Diplexer circuit shown in the system with the QH45 hybrid and the 3dB pads.

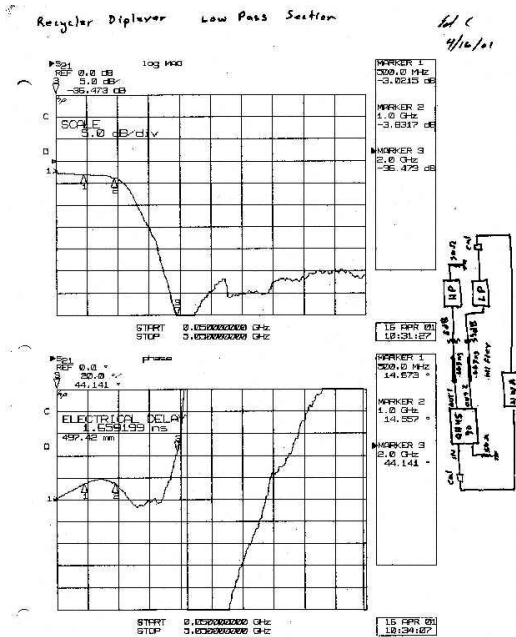


Fig. 11. Measured low pass section

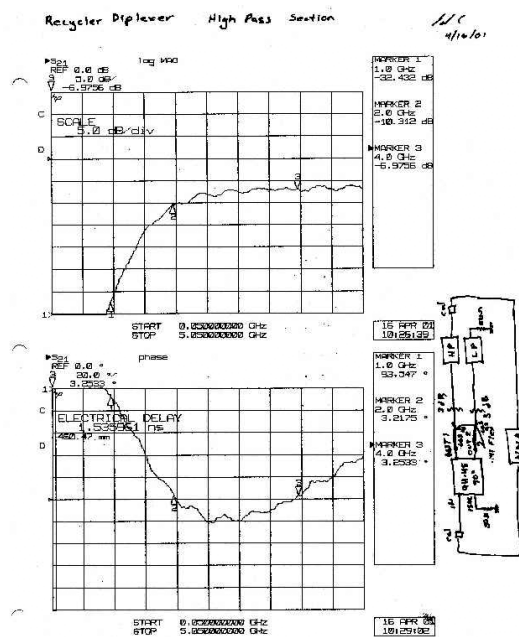


Fig. 12. Measured high pass section