

Matching filters of degree 2

David Martínez Martínez

Projet ANR-13-ASTR-14 COCORAM



Université
de Limoges



 CISTEME

Inria

May 11, 2016

4-ports model of the antenna

We consider a 4-ports model of the antenna where the S_{31} and S_{41} parameters represent the transmitted signal for each polarization (efficacy of the vertical and horizontal polarization).

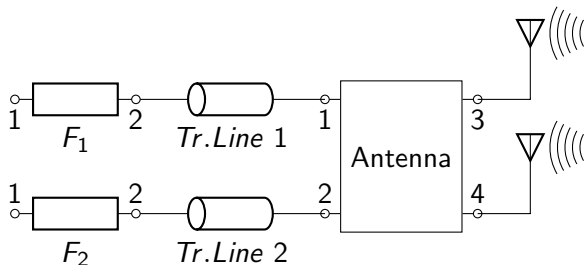


Figure 1: Complete transmission chain.

4-ports model of the antenna

Efficacy of the chain (filter+line+antenna).

From the system in Figure 1, the global efficacy if we consider the excitation of the first port of the antenna (parameters S_{31}) takes the form:

$$S_{31} = \frac{S_{21}^{F1} S_{31}^A (1 - S_{22}^{F2} S_{22}^A)}{(1 - F_{22}^{F2} S_{22}^A)(1 - S_{22}^{F1} S_{11}^A) - S_{12}^A S_{21}^A S_{22}^{F1} S_{22}^{F2}} \quad (1)$$

Optimization problem.

The problem that we solve is the maximization of the minimum of S_{31} :

$$\text{Max}_{S^{F1}, S^{F2}} \left(\text{Min}_{f \in I} |S_{31}| \right) \quad (2)$$

Considering a given constraint over the selectivity for each band.

Result for single band filters.

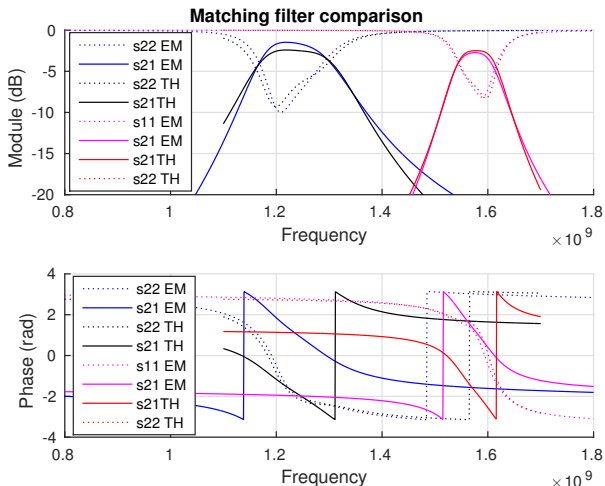


Figure 2: Comparison between the theoretical and the electromagnetic response of the dual-band filters.

Result for single band filters.

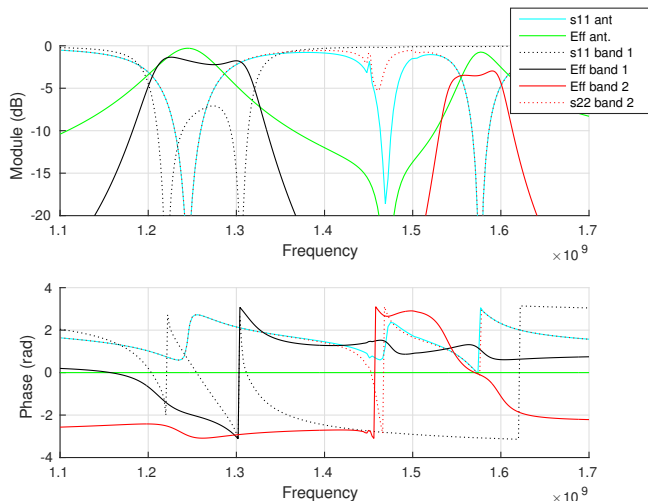


Figure 3: Result of the single-band filter connected to the antenna.

Dual-band filter. Diplexed solution

This filter is composed by an input diplexer, both single-band filters in parallel and an output diplexer.

- Avoid too large couplings (total fractional bandwidth about 30%).
- Allows the tuning of each filter independently.
- The input phase of each band is adjusted with the transmission lines *Trl.1* and *Trl.2*.

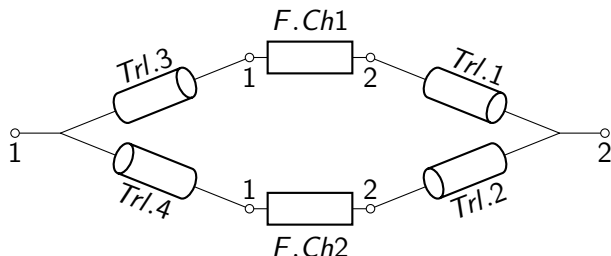


Figure 4: Dual-band filter structure.

Dual-band filter. Diplexed solution

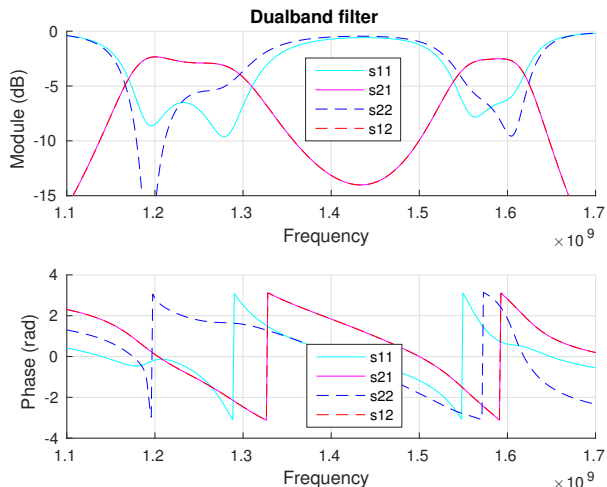


Figure 5: Response of the dual-band filter.

Dual-band filter. Diplexed solution

- Structure when the antenna is connected to the port 2 through the transmission line *Trl. Ant.*

Transmission line	Trl. Ant	Trl. 1	Trl. 2	Trl. 3	Trl. 4
Length (mm)	40	9.8	49.9	29.9	36.2

Table 1: Length of the transmission lines.

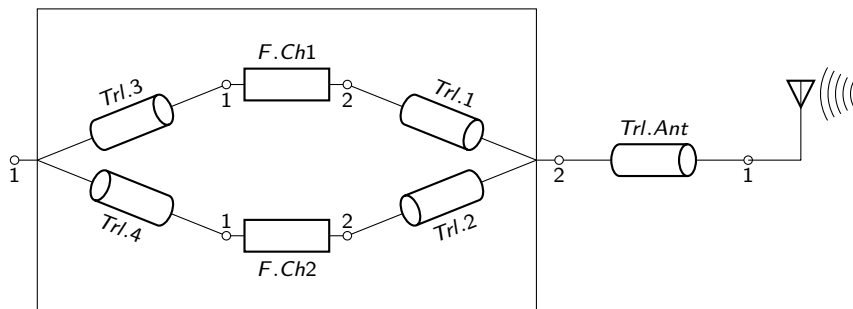


Figure 6: Dual-band filter with the antenna at the port 2.

Dual-band filter. Diplexed solution

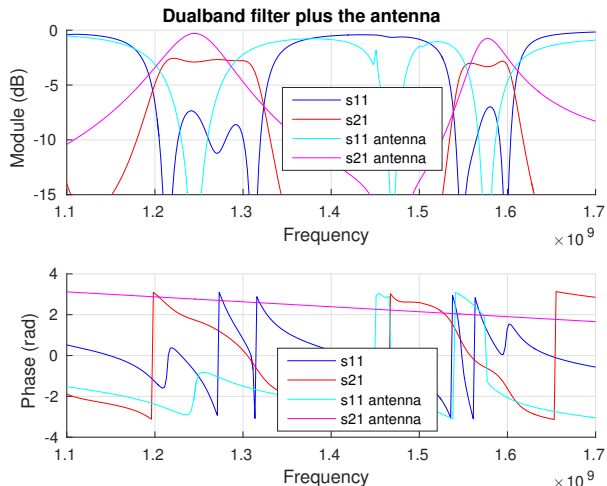


Figure 7: Global response of the dual-band filter connected to the antenna.