Compact Dual-Band Antenna Using an Anisotropic Metamaterial

Metamaterial Transmission Line Based Bandstop and Bandpass Filter Designs Using Broadband Phase Cancellation

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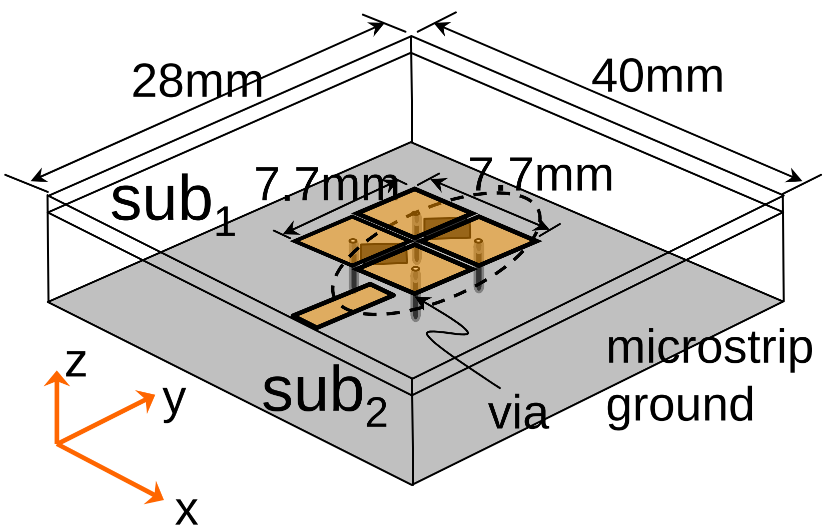
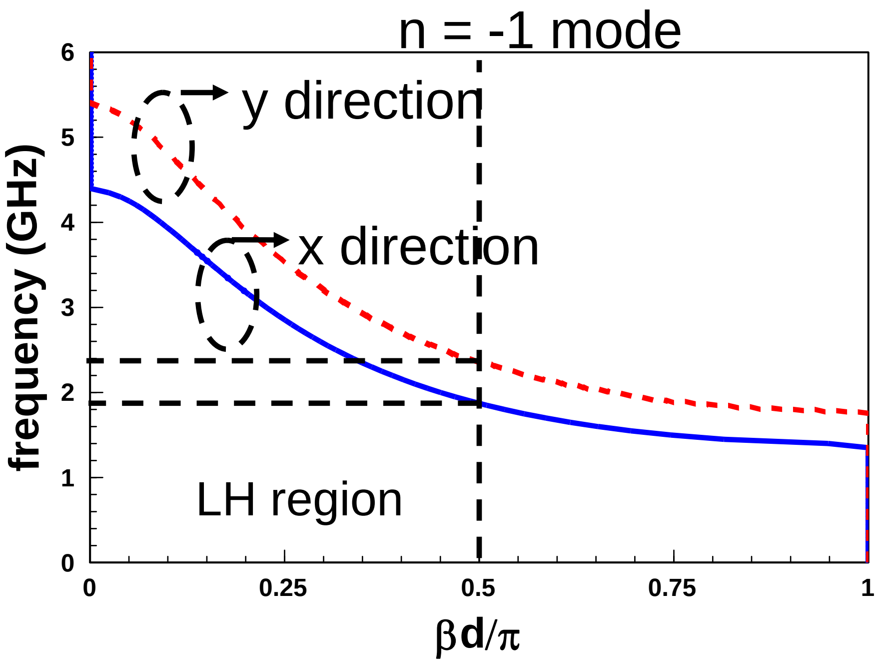
Dual-Band Antenna concept

- Conventional method uses same β with different resonant lengths to achieve dual-band operation. The proposed method uses same physical length but different β's to achieve the same goal.
- In x direction, MIM capacitances are used to increase the CL, and the provide an anisotropic medium in a single device.

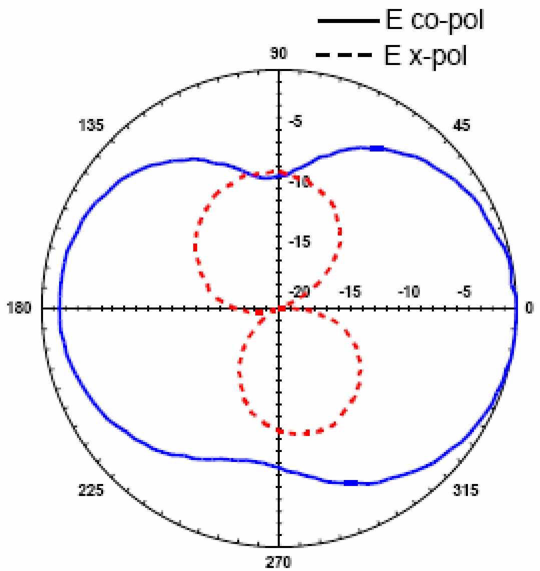
$1/17\lambda_0$ x $1/17\lambda_0$ x $1/19\lambda_0$



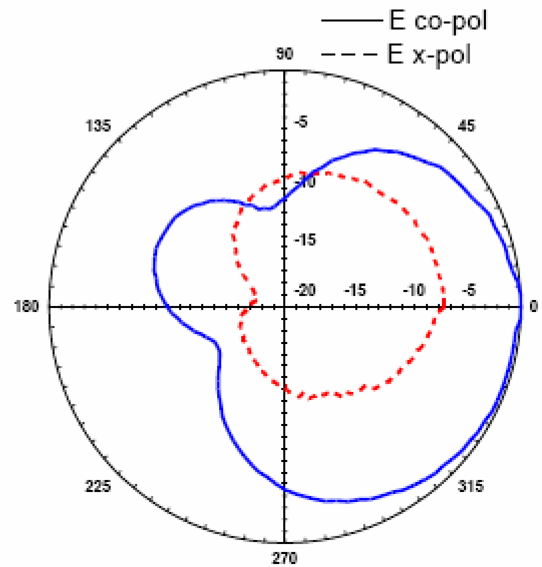
ε_{r1}=10.2 ε_{r2}=2.2



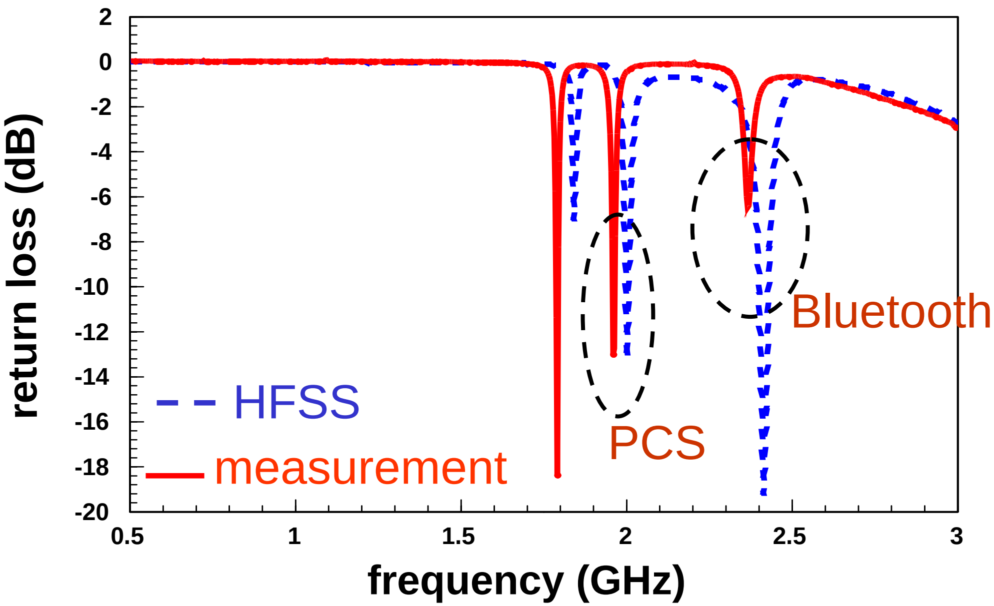
Dual-Band Antenna Measured Results



f_x=1.96GHz



f_y=2.37GHz



f_x= 1.96GHz

Gain = -3dBi

Efficiency = 25.4%

Cross-polarization for both plane >14dB

f_y= 2.37GHz

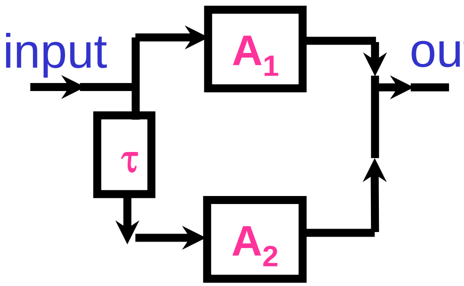
Gain = -2.3dBi

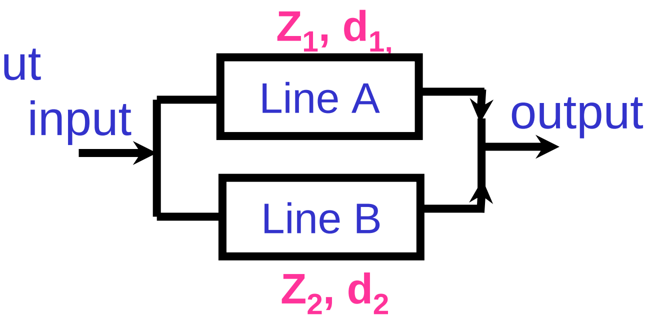
Efficiency = 28.9%

Cross-polarization for both plane ~7dB due to smaller ground plane

A 96% area size reduction compared to the patch antenna can be obtained.

Broadband Bandstop Filter Design Concept





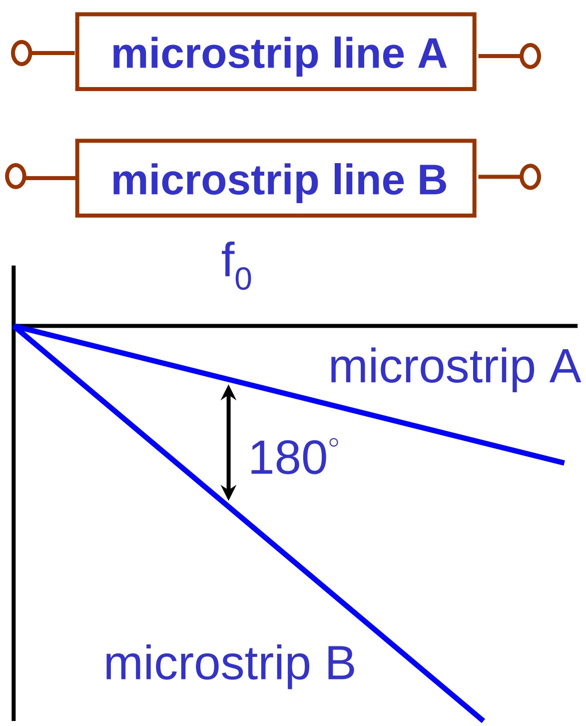
One section of transversal filter

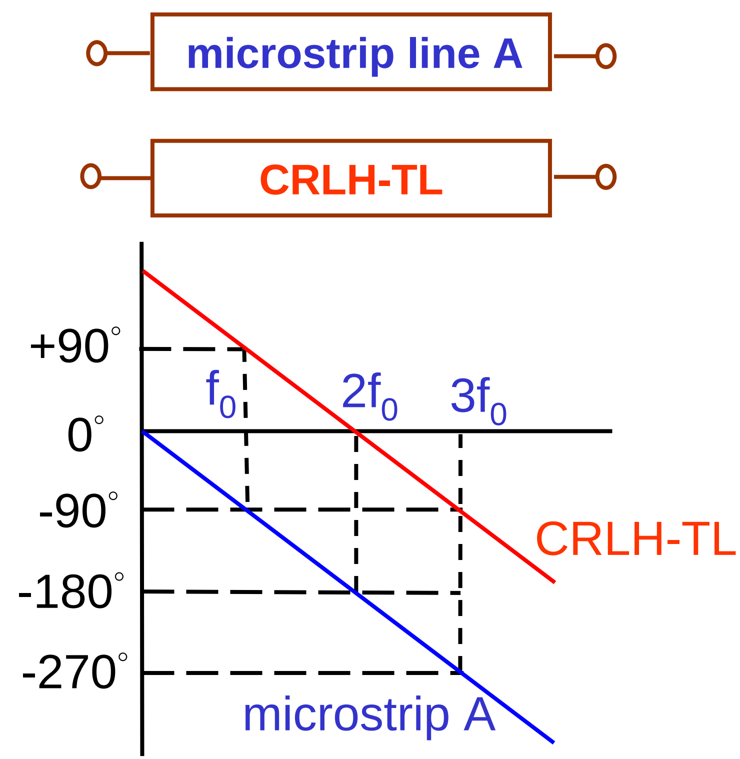
Signal cancellation:

A_1 = $-A_2$ in time domain

$Z_1 = Z_2$ and $d1-d2 = \pm(2n+1)\pi$

in frequency domain



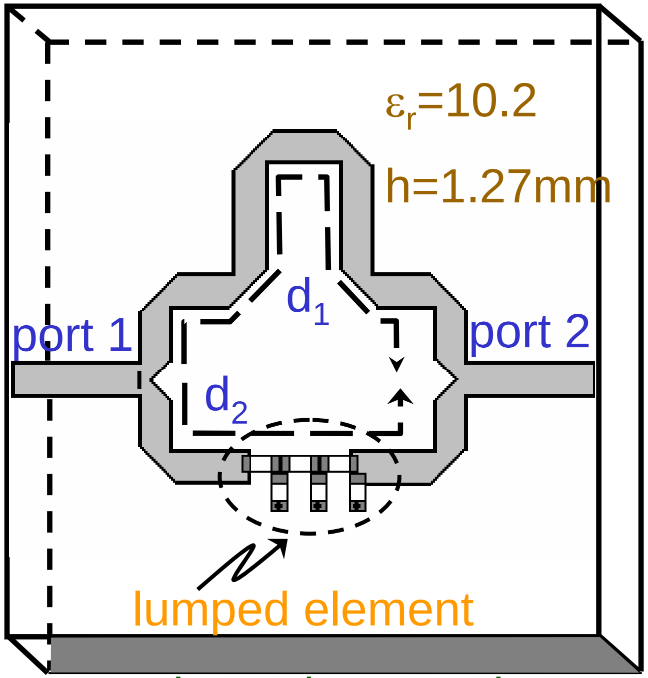


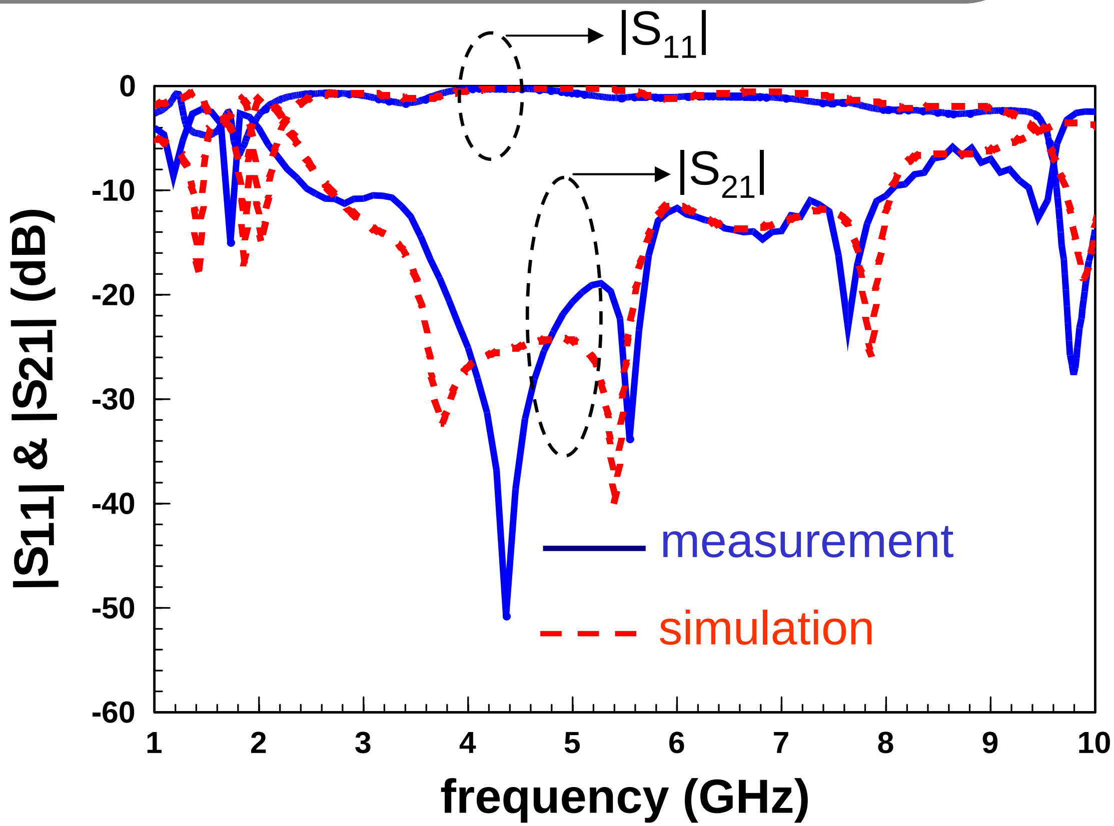
Broadband BSF Measured Results

3dB insertion loss BW : 130% (2GHz~9.6GHz)

10dB signal rejection BW : 78% (3GHz~8GHz)

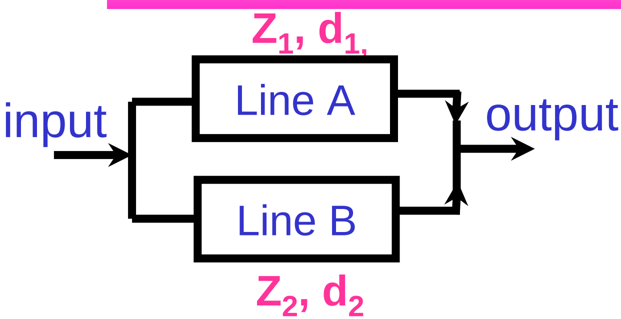
Next passband at higher frequency end with minimum insertion loss of -1.7dB @ 9.8GHz

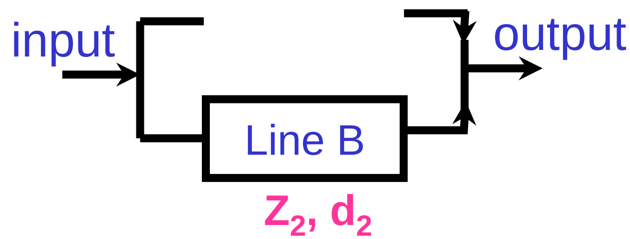


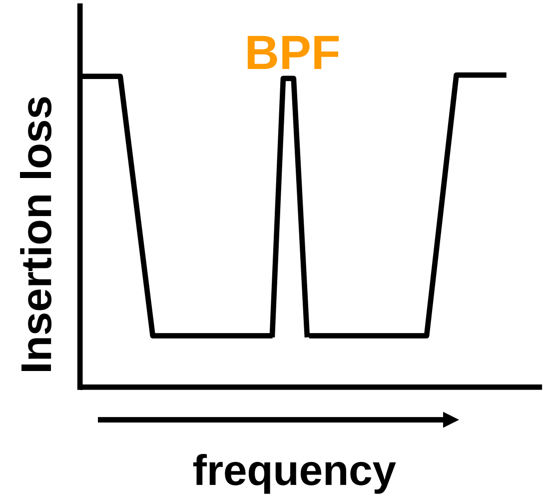


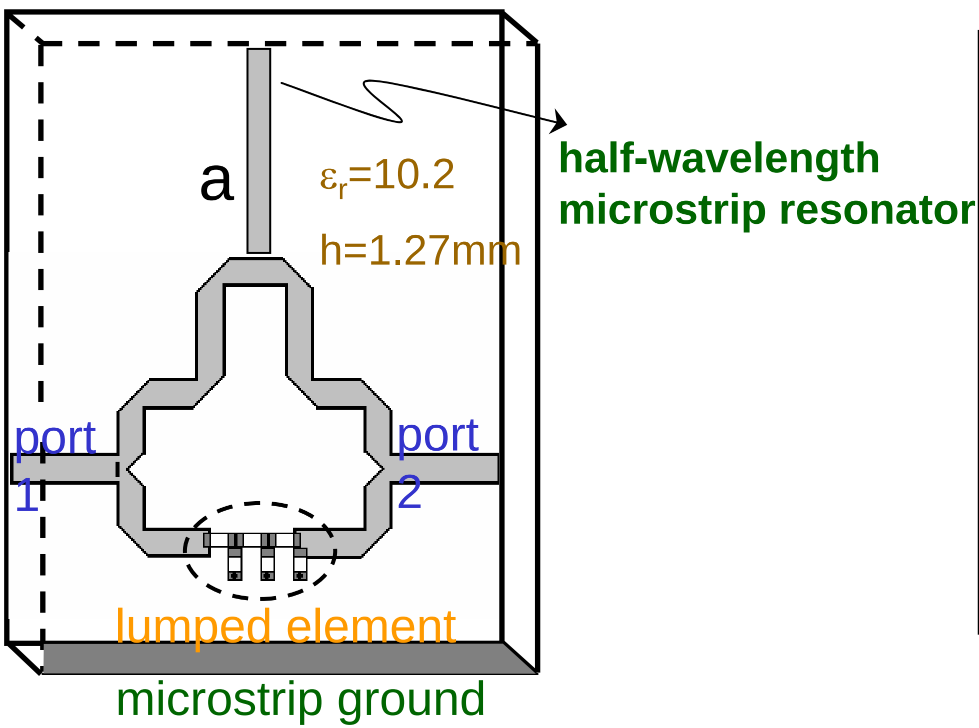
Narrow Band Bandpass Filter Designs

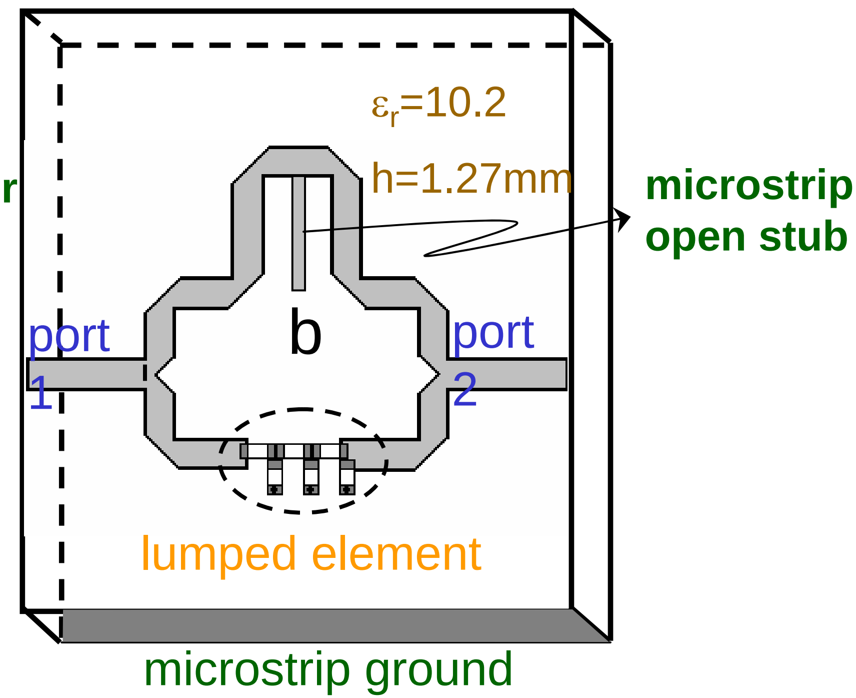
Use frequency dependent defeat to stop signal transmission in one path of the transversal filter











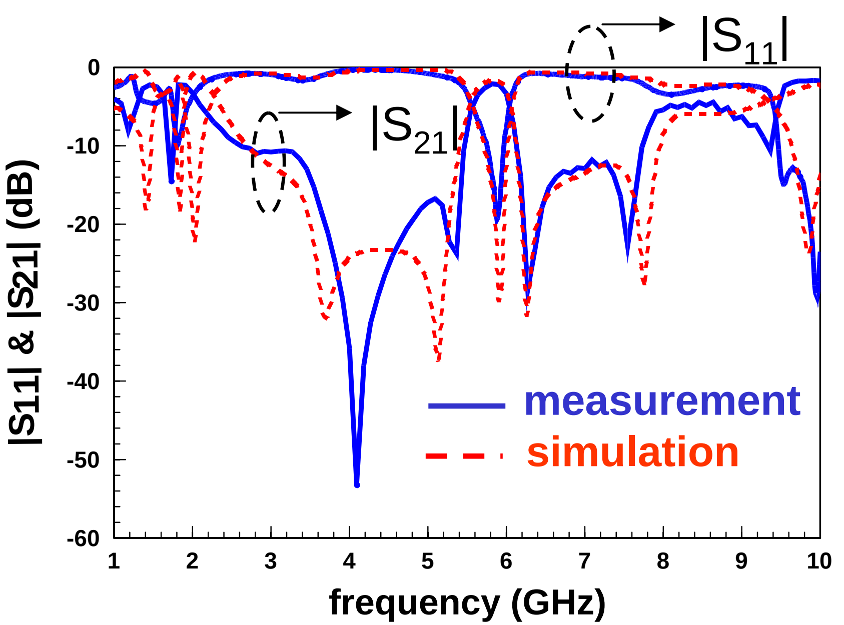
Narrow BPF Measured Results

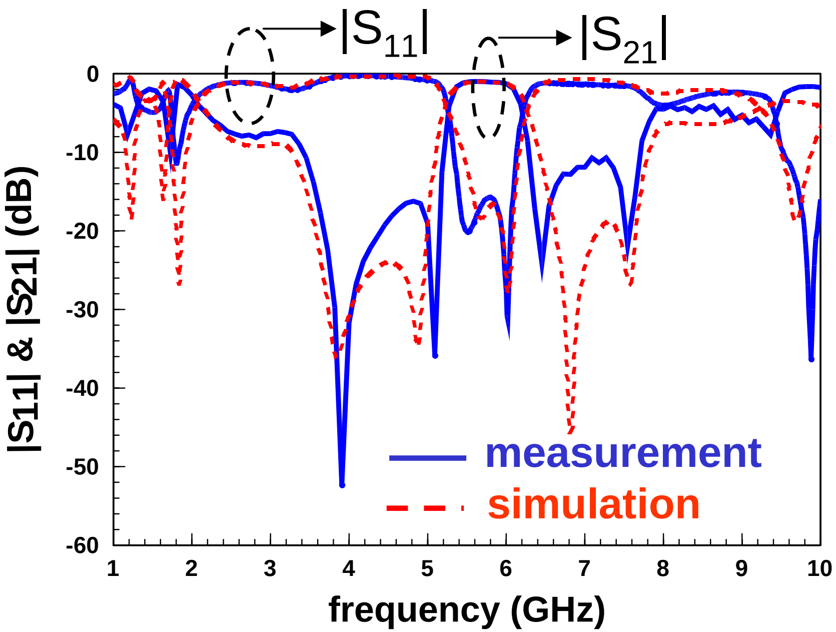
method a) use microstrip resonator : BW is determined by the loaded Q

3dB insertion loss bandwidth : 8% minimum insertion loss : -2dB@5.9GHz

method b) use microstrip open stub : BW is determined by the Z_0

3dB insertion loss bandwidth : 18% minimum insertion loss : -1.5dB@5.92GHz

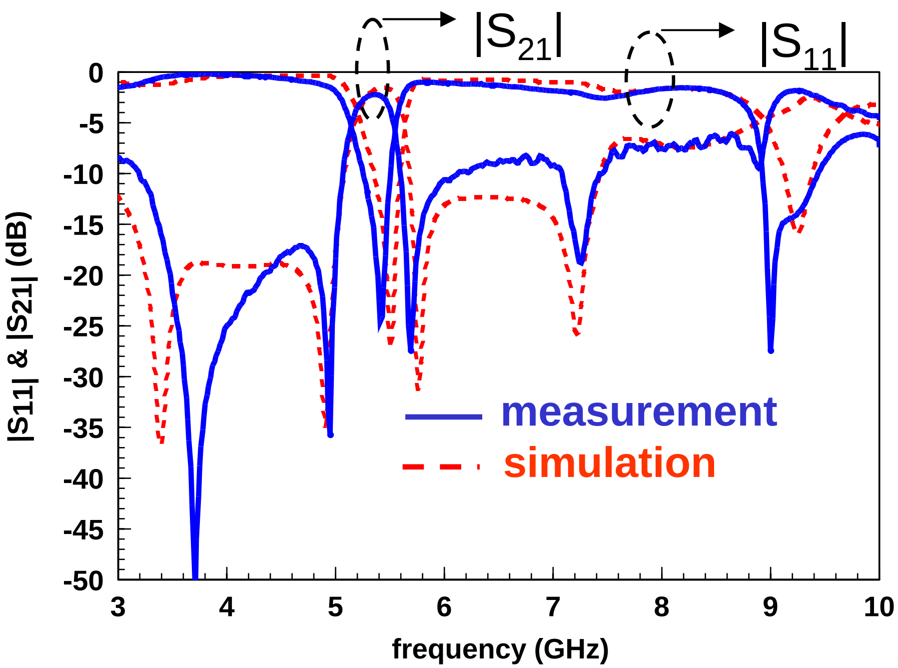




Selective Passband of BPF

- Passband of the BPF can be adjusted in the wide signal rejection range.
- The second harmonic of the passband can be eliminated by properly choosing the location where the defeat is attached.

Passband shifted to 5.5GHz with 8% 3dB insertion loss bandwidth



Passband @ 4GHz with 25% 3dB insertion loss bandwidth