



# Possible Designs of HOM Couplers for Superconducting 400 MHz RF Cavities



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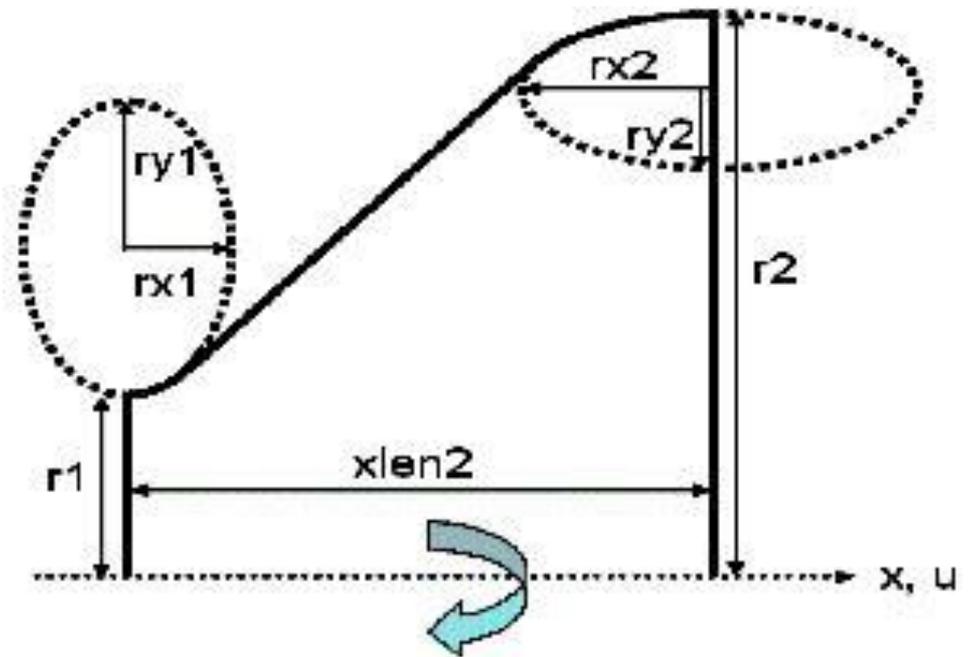
## Motivation

- **The field of protons excites different modes in the cavity, which leads to additional losses, which should be prevented**
- **Furthermore Disturbtions in electrical fields have a bad influence for beam dymnamics**



## Cavity parameters

Parameter	Value / mm
$rx2=ry2$	104
$rx1=ry1$	25
$r2$	343.6
$xlen2$	160
$r1$	150



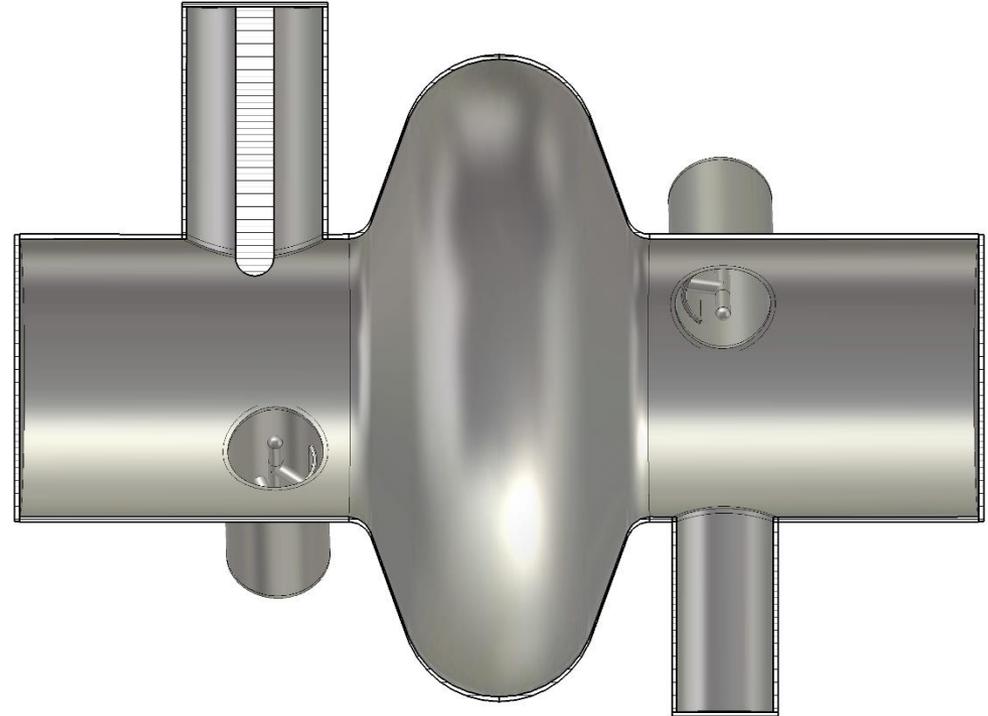
## Single cell cavities



## Simulated RF-parameters with established coupler design



**fundamental mode:**  
**Mode number 200:**



**401.8 MHz**  
**1.68 GHz**



## Established Coupler designs



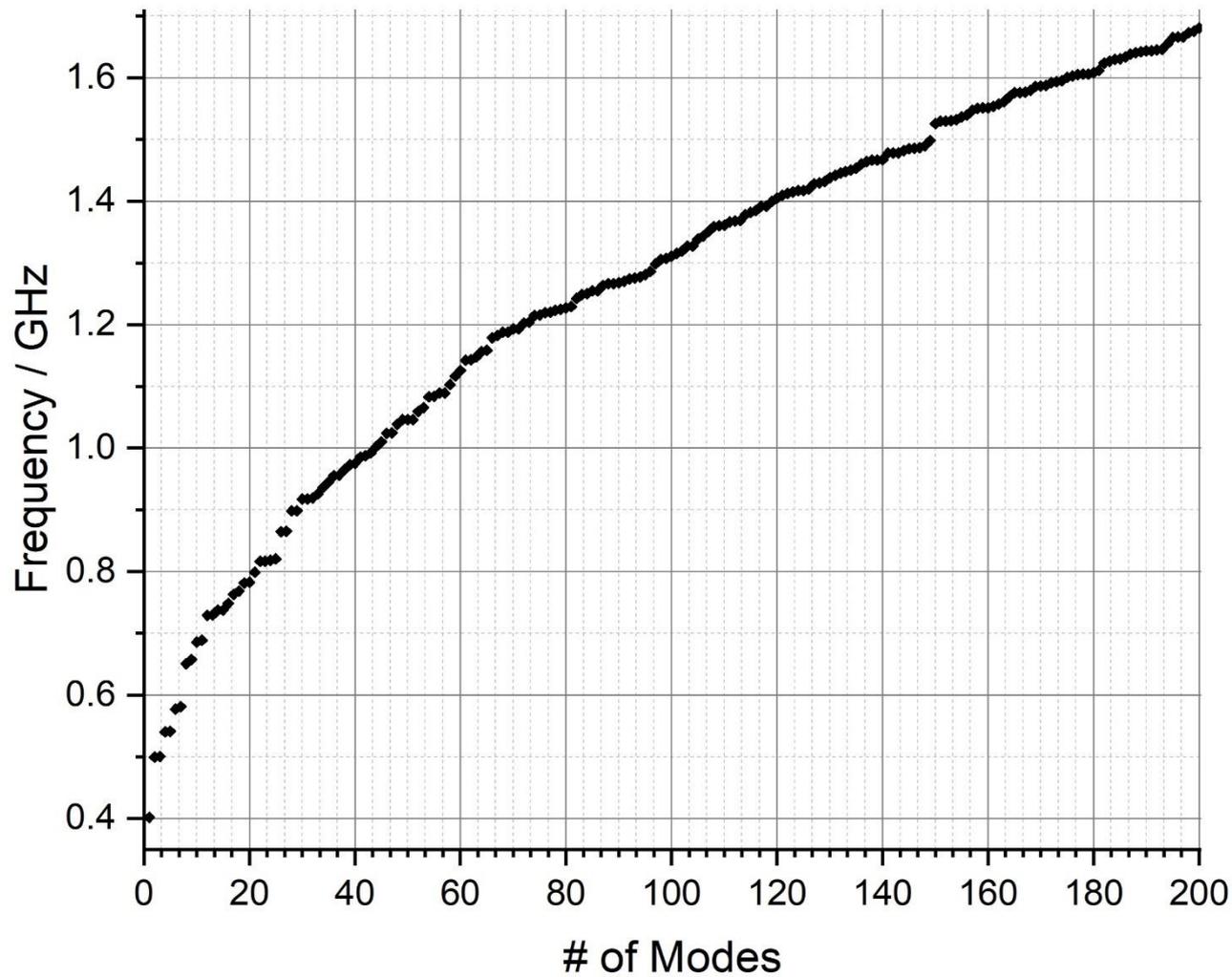
Probe-type



Hook-type

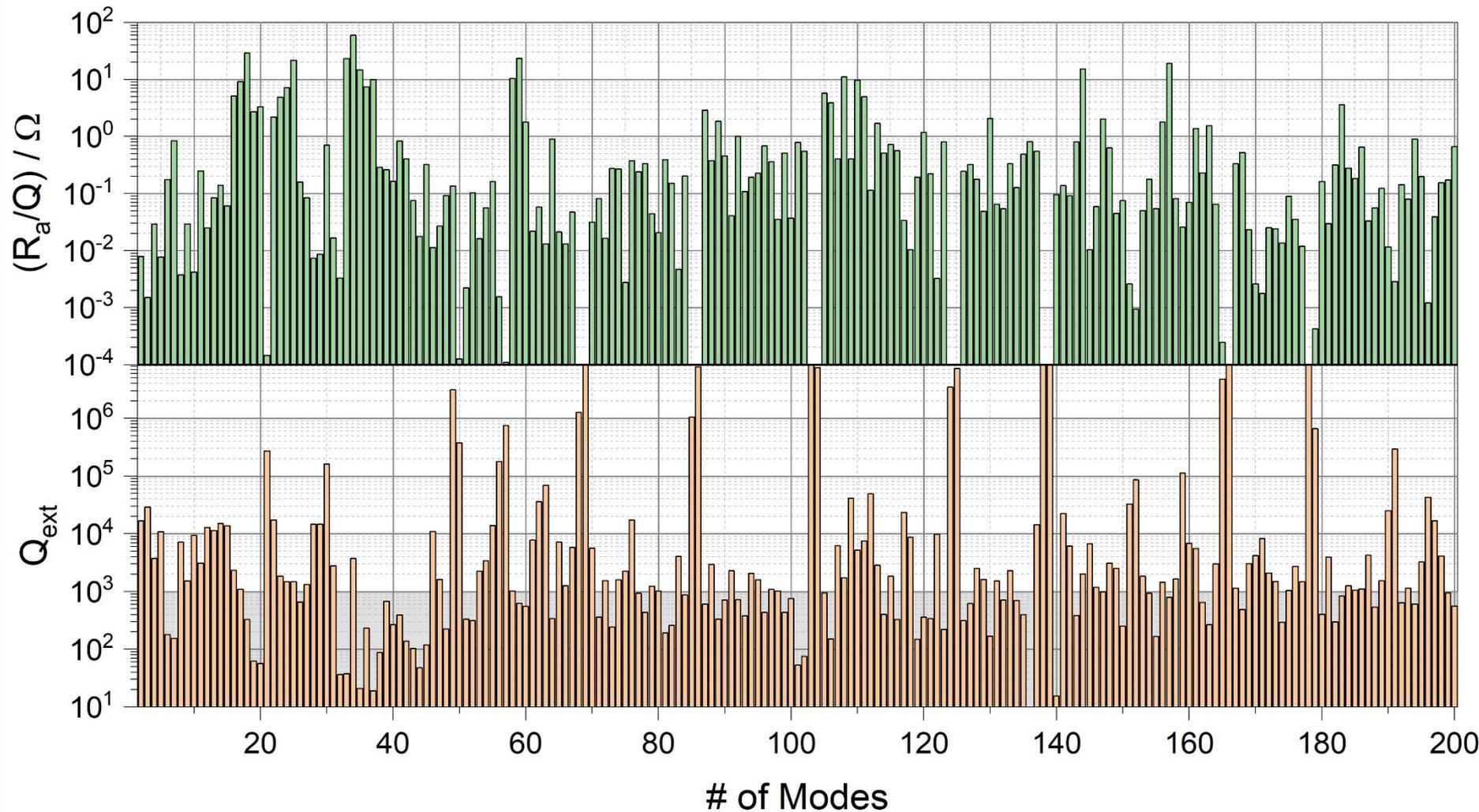


## Higher-order Mode Frequency



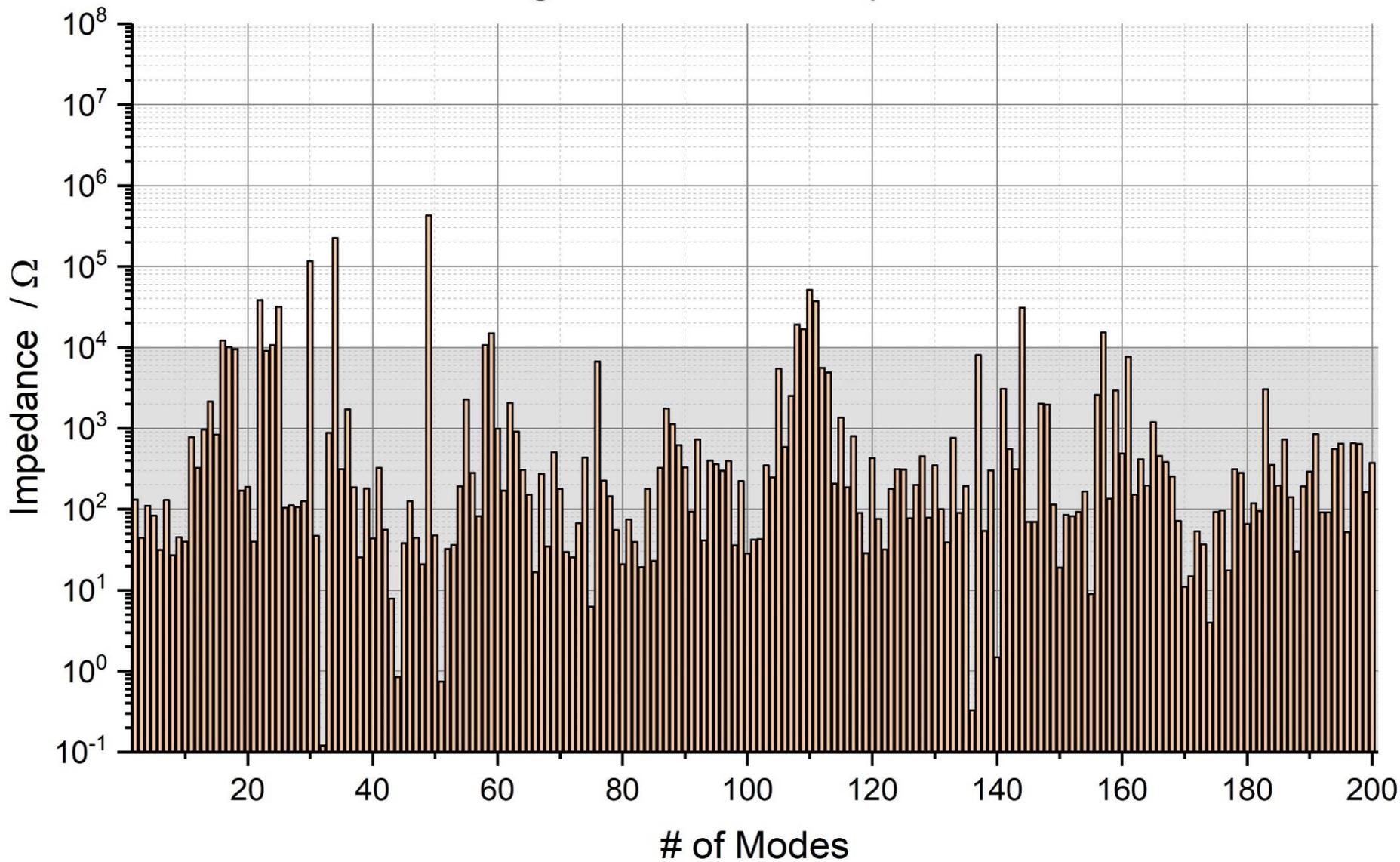


## Comparison of External Q values and $R_a/Q$ values



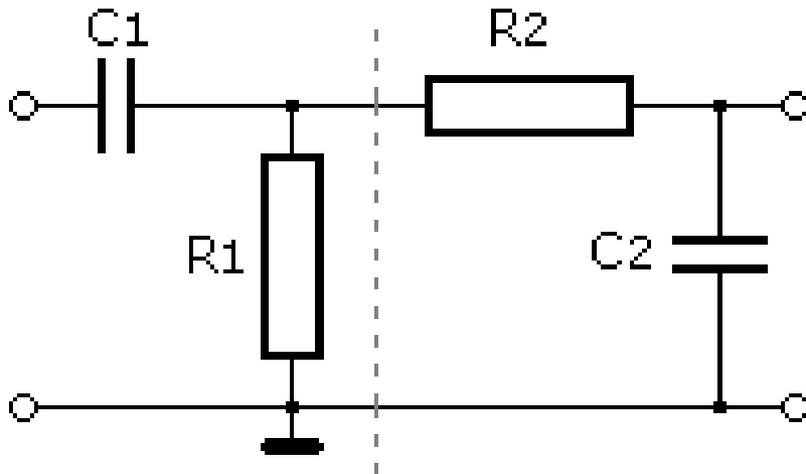


## Higher-order Mode Impedance

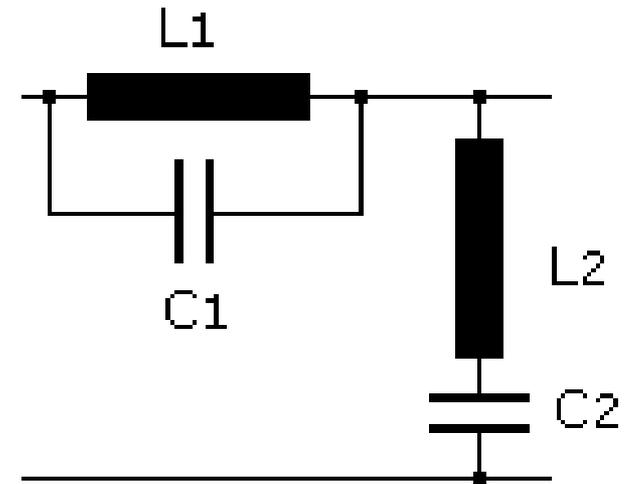




## Further ways for a possible coupler design



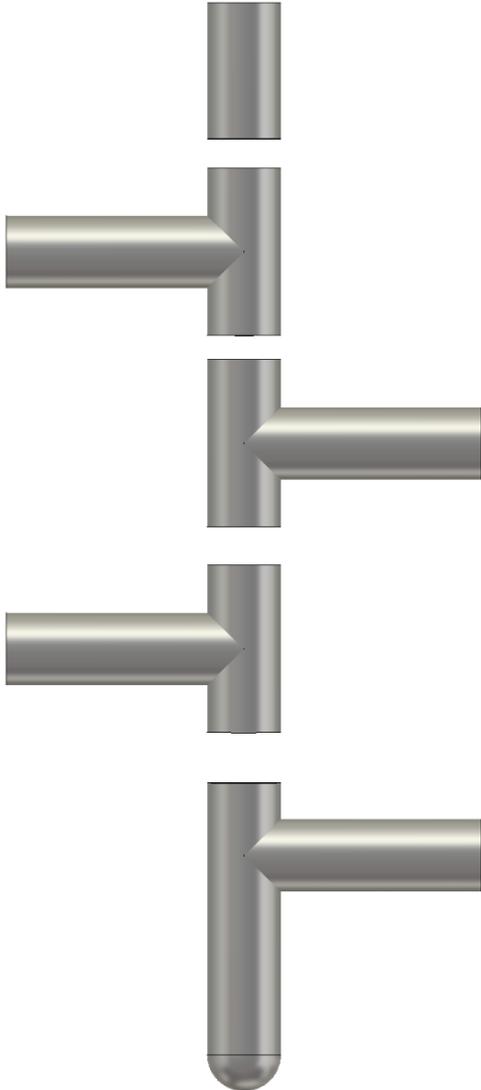
High-pass filter Low-pass filter



Band-stop filter



## High-pass filter coupler

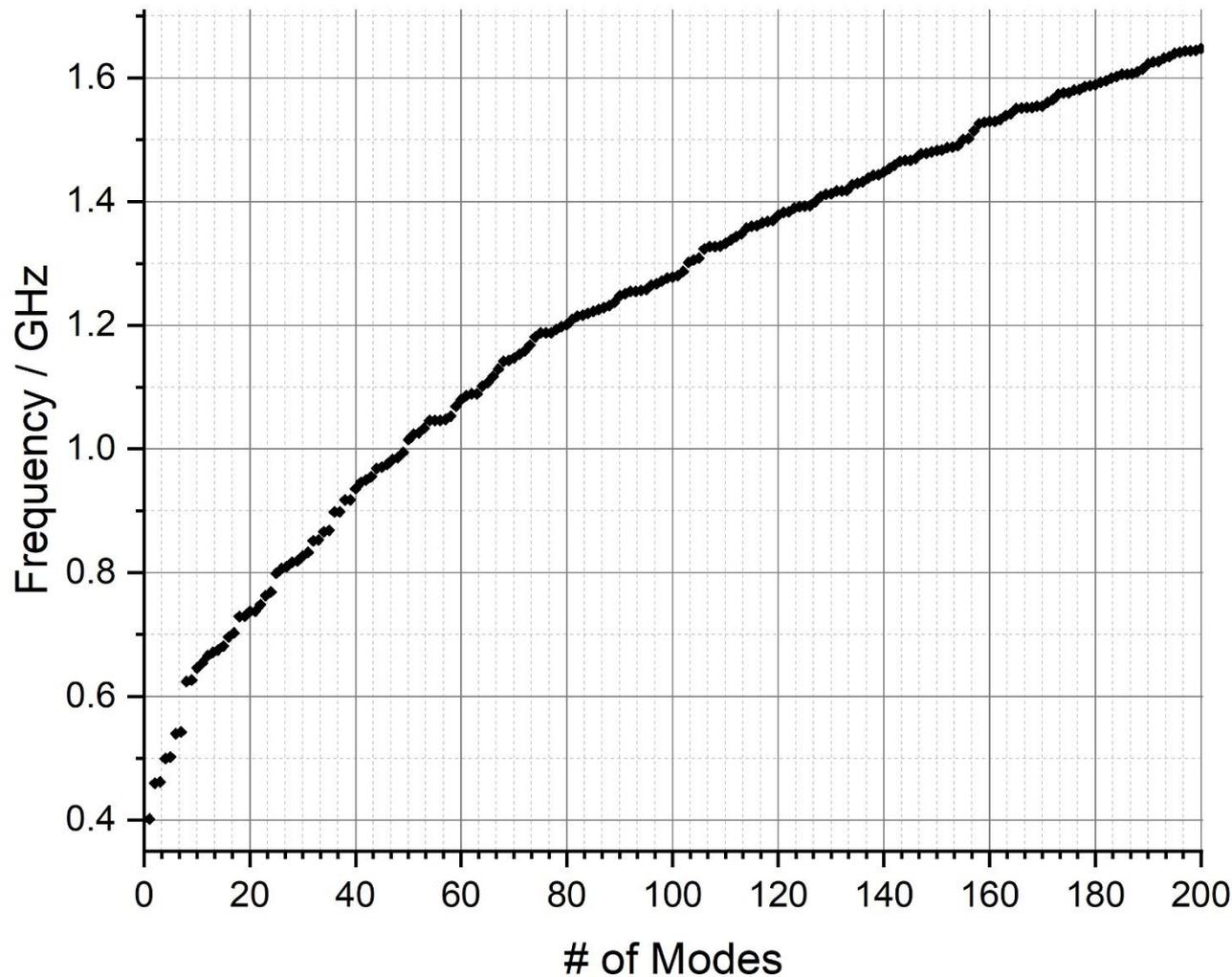


## Band-stop filter coupler



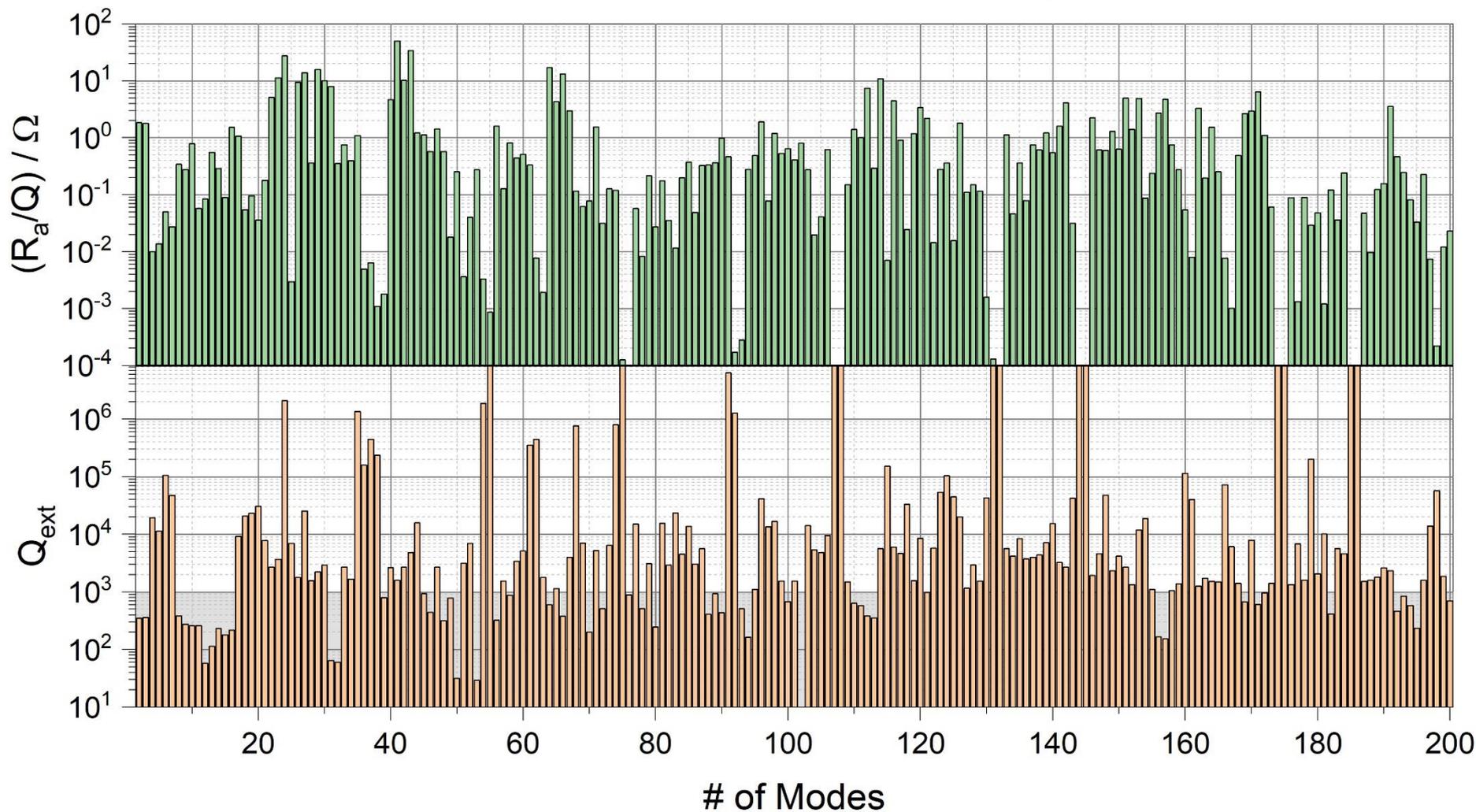


## Higher-order Mode Frequency



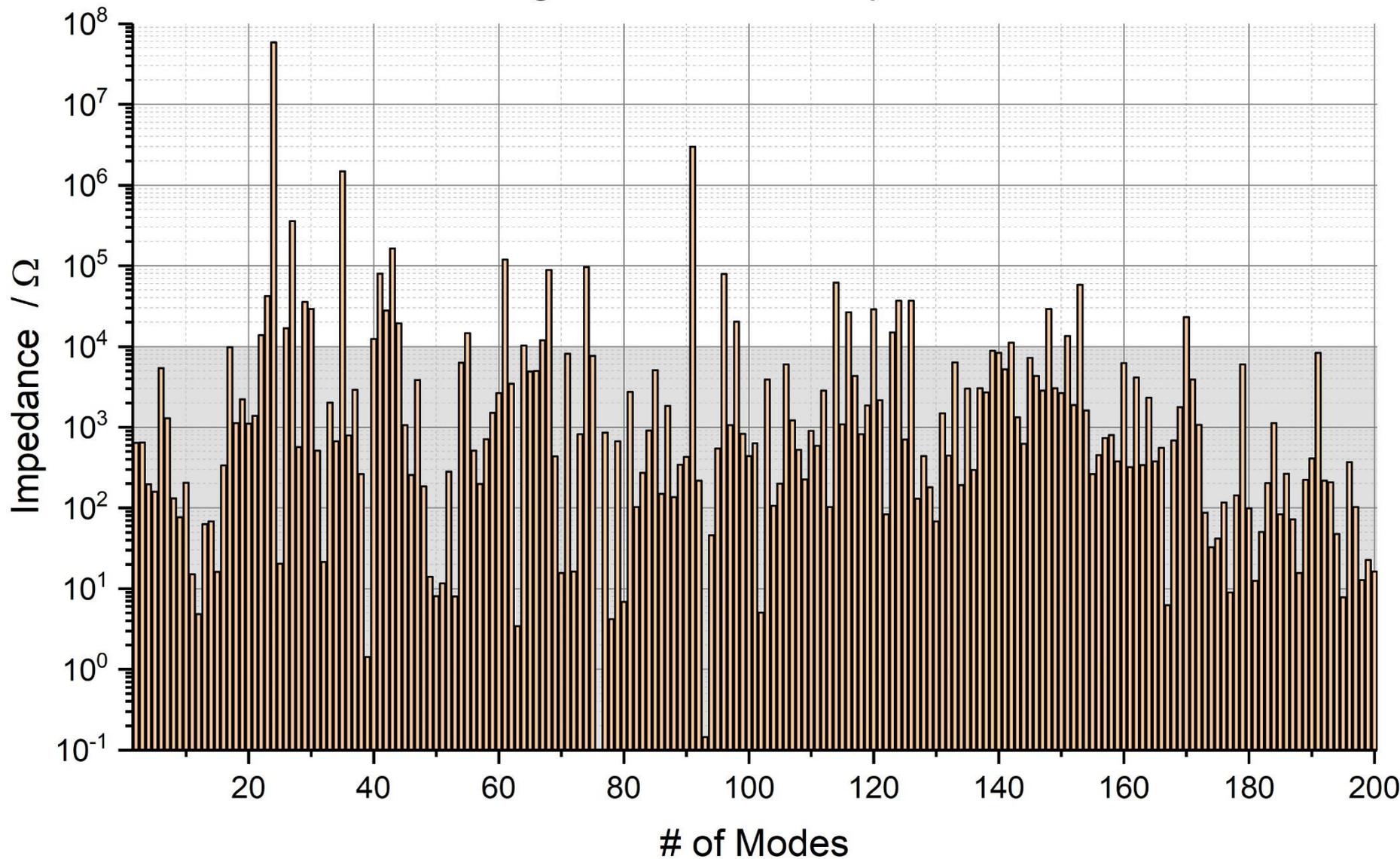


## Comparison of External Q values and $R_a/Q$ values



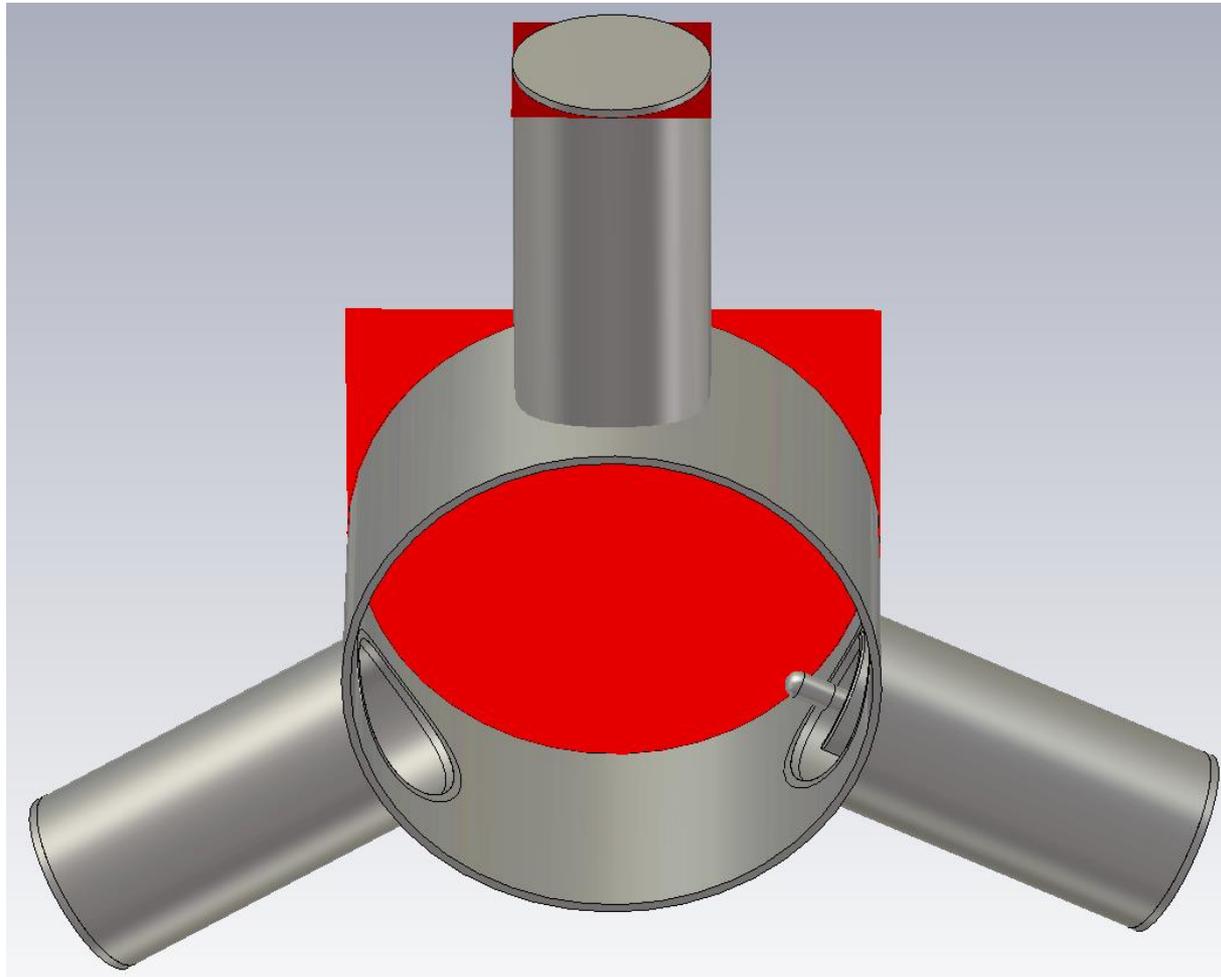


## Higher-order Mode Impedance



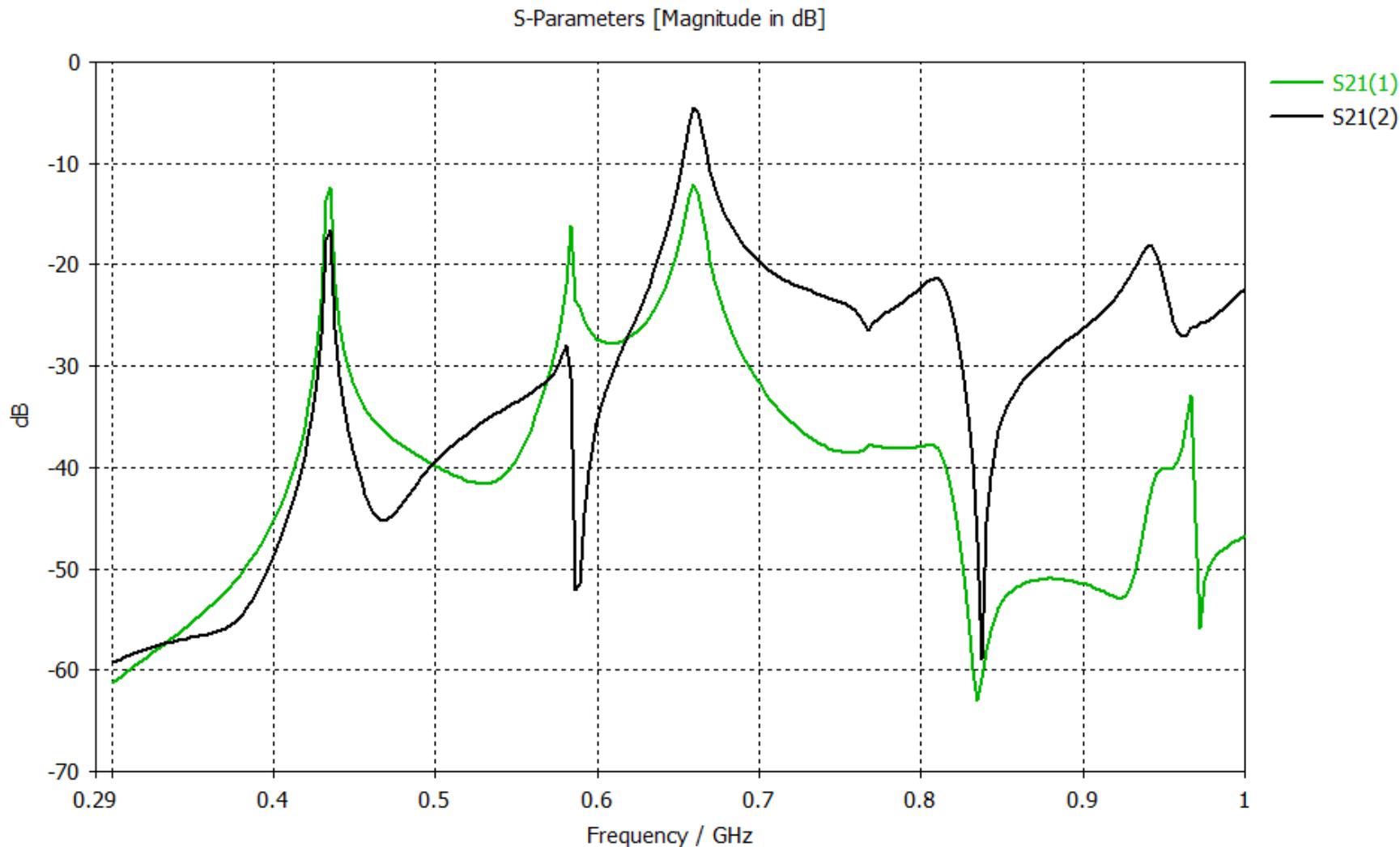


## Simulated S-parameters



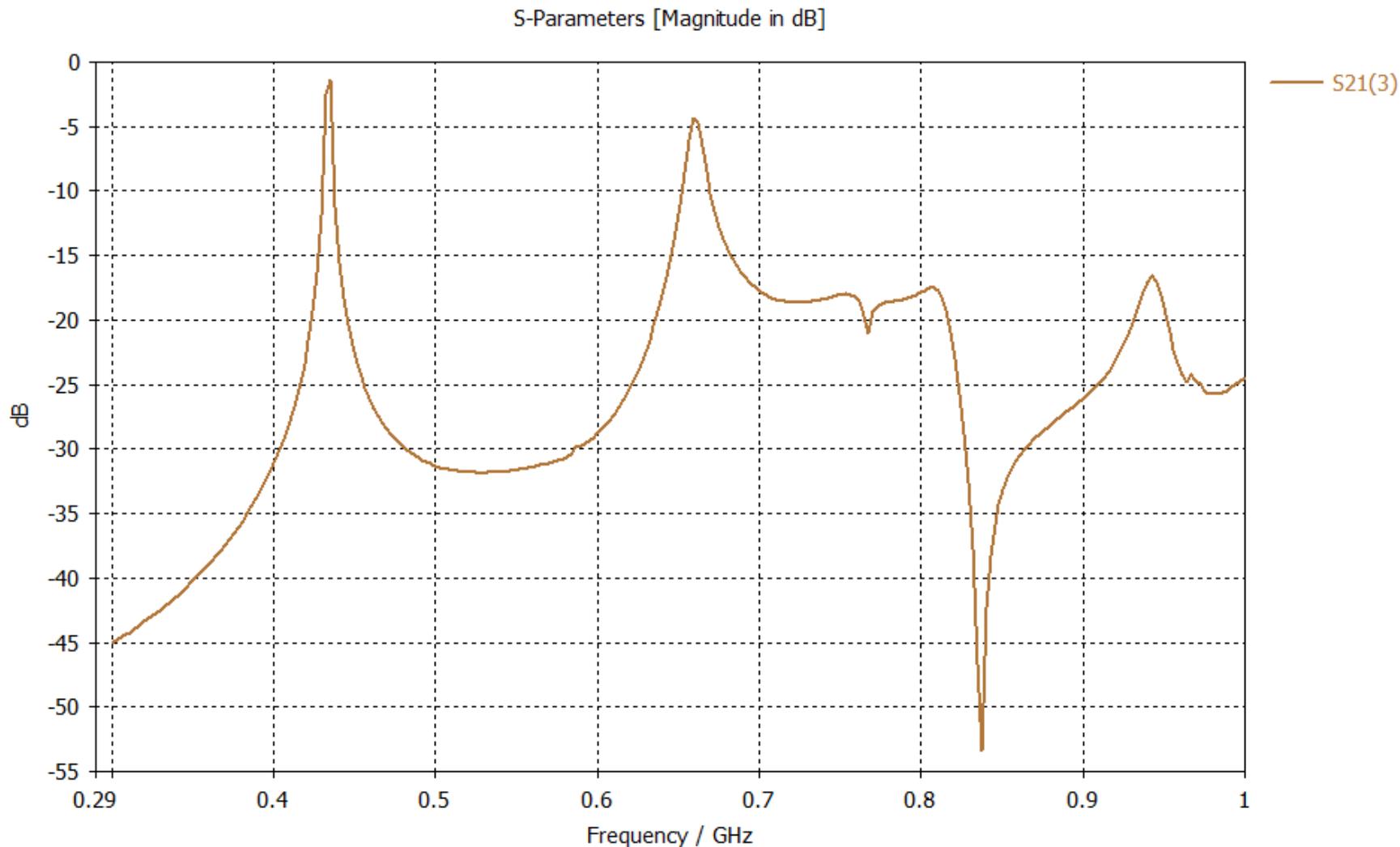


# Simulated S-parameters band stop dipole mode



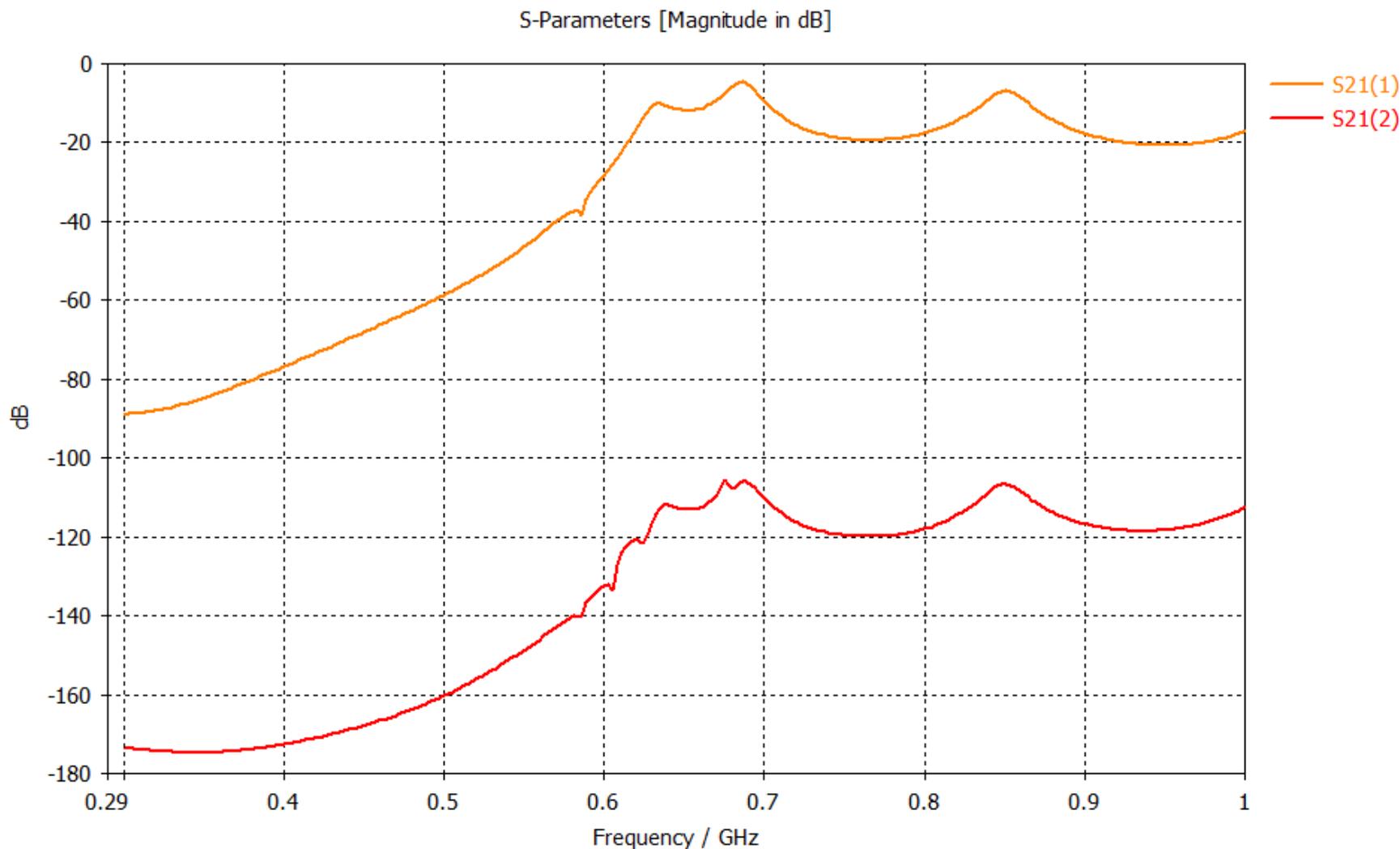


# Simulated S-parameters band stop monopole mode



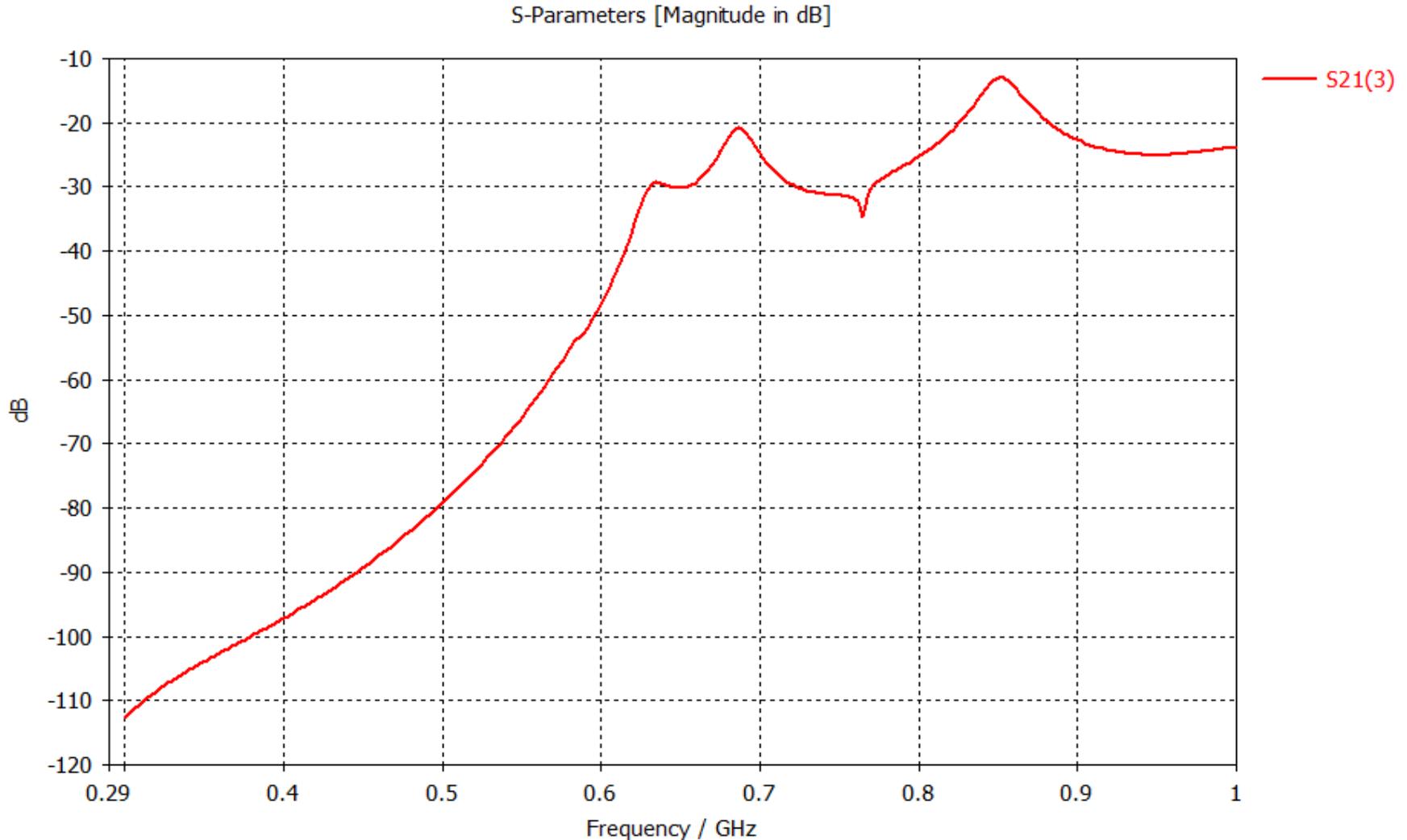


# Simulated S-parameters RC high pass dipole mode





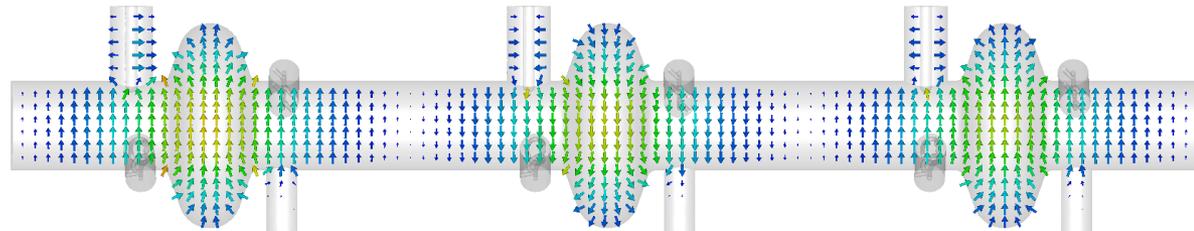
# Simulated S-parameters RC high pass monopole mode





## Summary & Outlook

- This is a worst case scenario in which there are only trapped modes. Furthermore some of those modes are unlikely to occur in the FCC.
- With the established coupler design only a few higher order modes have a impedance which is above 10 k $\Omega$
- The new coupler design is as of today not as efficient as the established design, investigations are ongoing
- Evaluation for an optimized configuration of the four coupler types
- Analysis of unlikely modes is foreseen

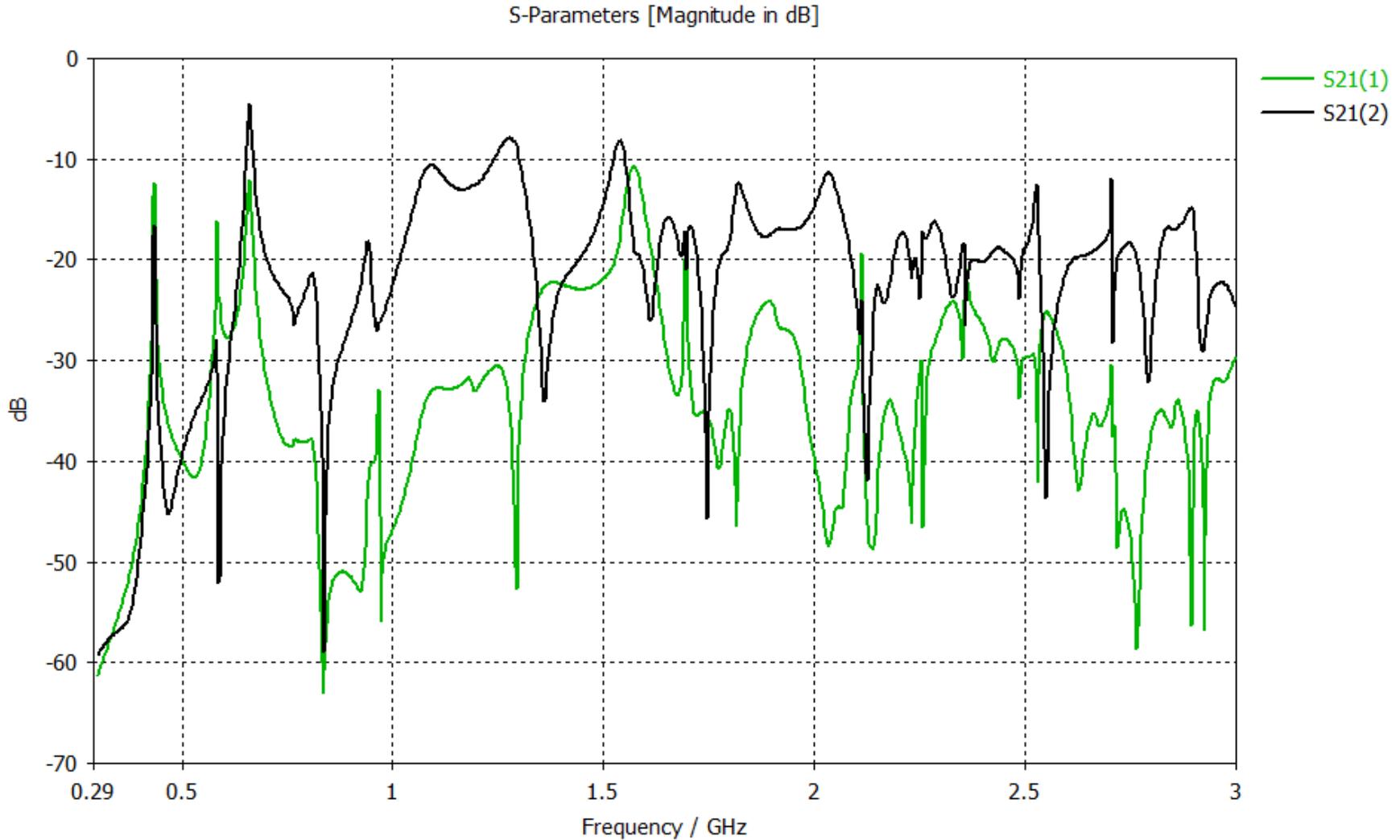




**Thank you for  
your attention!**

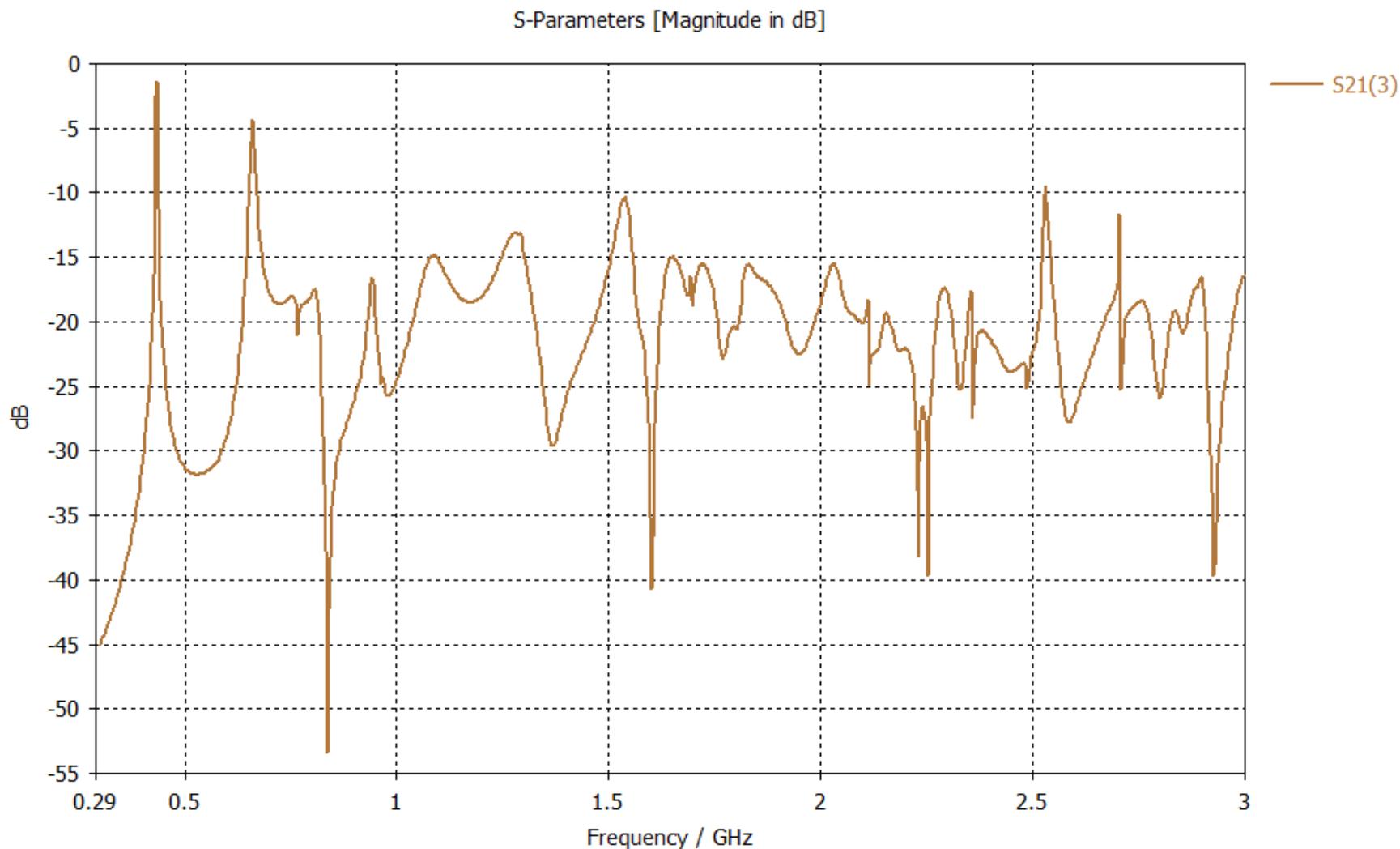


# Simulated S-parameters band stop dipole mode



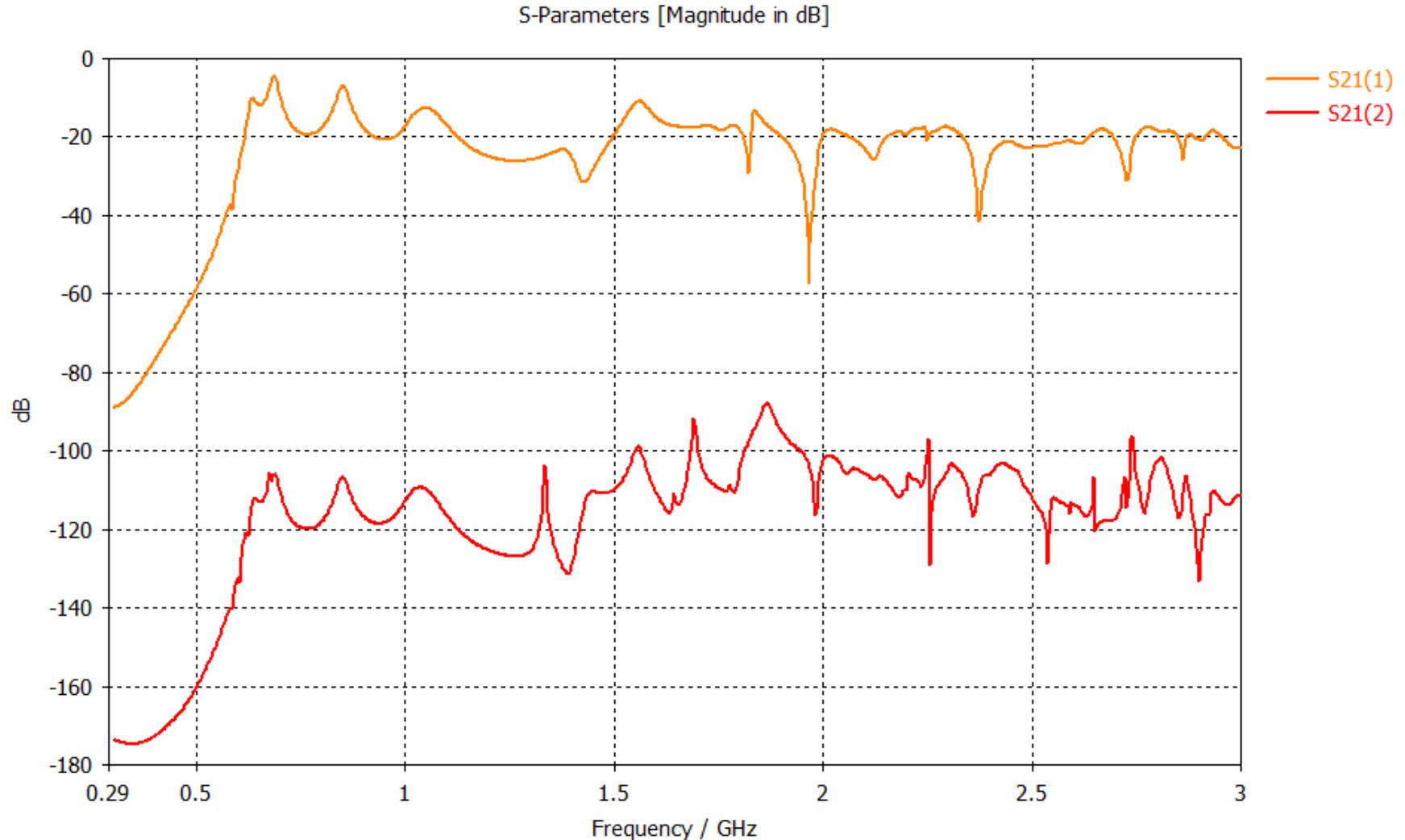


# Simulated S-parameters band stop monopole mode



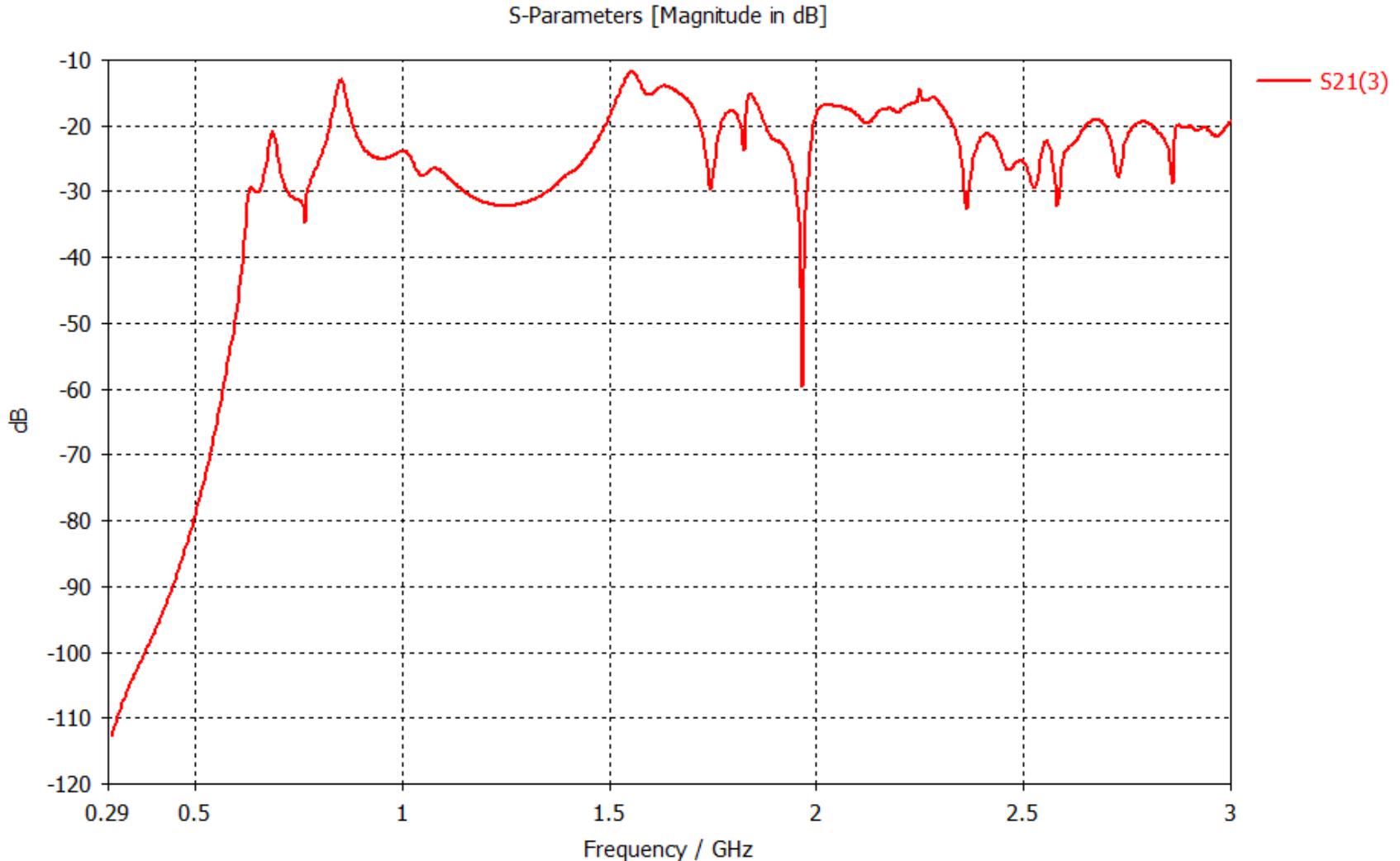


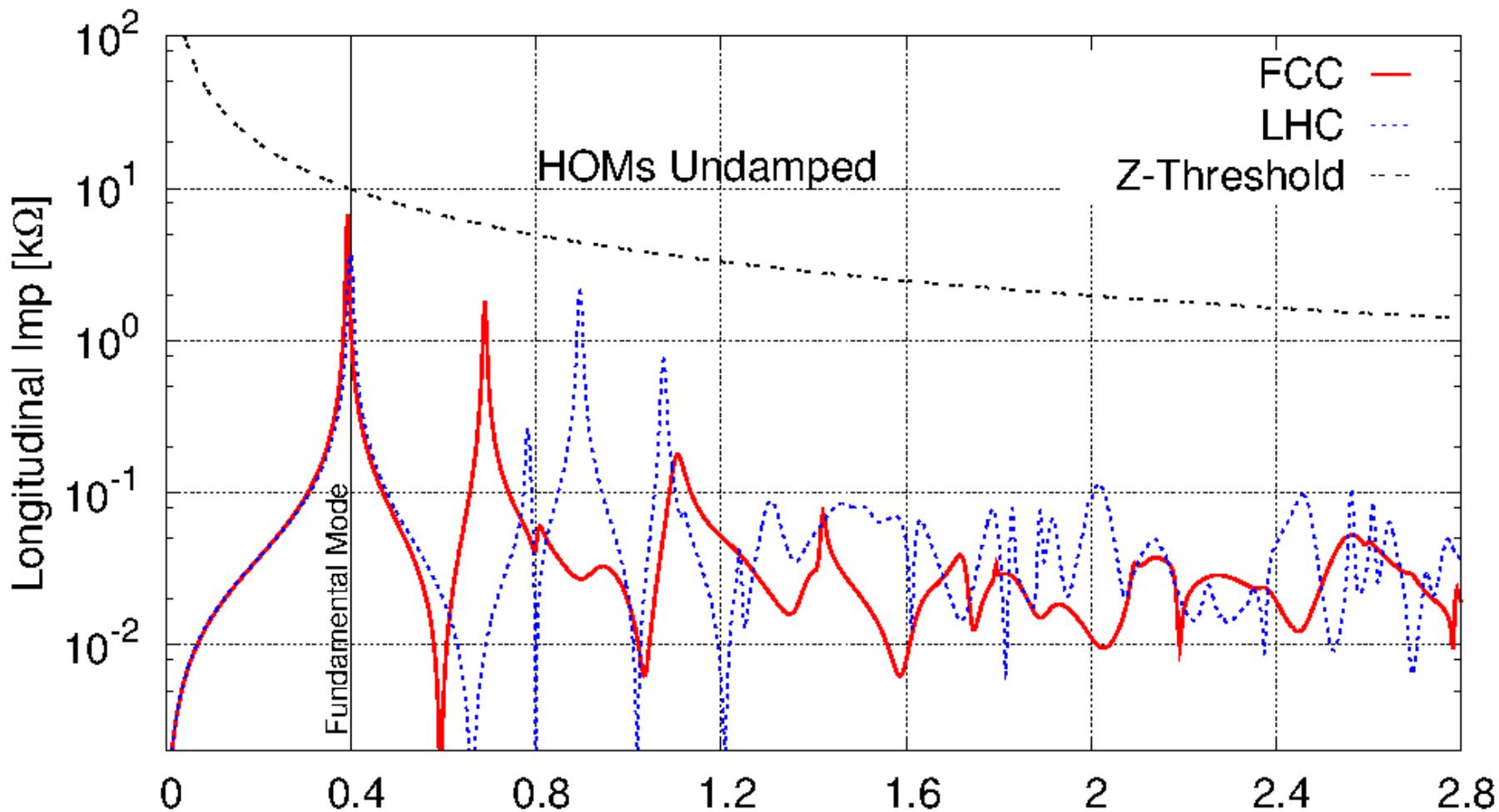
# Simulated S-parameters RC high pass dipole mode





# Simulated S-parameters RC high pass monopole mode





By R. Calaga