



Track D : Transmission line miniaturization challenge

Requirement for applicants: students; team entry is allowed

1. Design Target:

- Build an artificial passive transmission media (artificial transmission line, filter, metamaterial, or other types of transmission media) operating at 1 GHz.
- Absolute value of group delay (τ_g) at 1 GHz has to be higher than 1 ns.
- The measurement will be done on-site with a network analyzer.
- The winner is determined by the highest FOM

$$\begin{aligned} \text{FOM} &= (|\tau_g| / (-\text{dB}[S_{21}])) / (L+W+H) \\ &= (|\tau_g| / (-20 \log_{10}|S_{21}|)) / (L+W+H) \end{aligned}$$

2. Design Rules and Constraints:

- The artificial transmission media must be realized on a rectangular printed circuit board (PCB) with the relative dielectric constant less than 6 (the participants can select any board material and number of layers)
- The parameters ($L < 500$ mm and $W < 500$ mm) are related to the fabricated size (the entire rectangular printed circuit board), and H is determined by the maximum height of the entire circuit without SMA connectors.
- Surface mount device (SMD) RLC components could be used.
- The artificial transmission media must be connected with 50Ω female SMA connectors (ISO metric screw threads).
- SMA connectors have to be mounted on the edge of the PCB board.
- Length of the SMA connectors has to be shorter than 1.5 cm.
- To verify the dielectric constant of the PCB, a 36-mm, $50\text{-}\Omega$ reference line in microstrip or CPW form MUST be built at the same time, and will be tested on-site. The measured $\angle S_{21}$ of this reference line, including the phase shifts of adaptors, must be less than 120° at 1 GHz.

