How to Make A Coplanar Waveguide in FEKO

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This document describes how to design a grounded coplanar waveguide (GCPW) using FEKO. The work presented here is essentially "version 1.0", and further research into improving the canonical GCPW model is welcome. The model described here can be found in the following Snapdragon directory:

\\snapdragon\Common\William\FEKO\Coplanar Waveguide\2021\GCPW Canonical Model\version1

Feeding the GCPW

The main finding of this work is the implementation of the "ground wall", shown in Figure 1. The substrate (AlN here) is shown in orange and the copper is shown in blue.

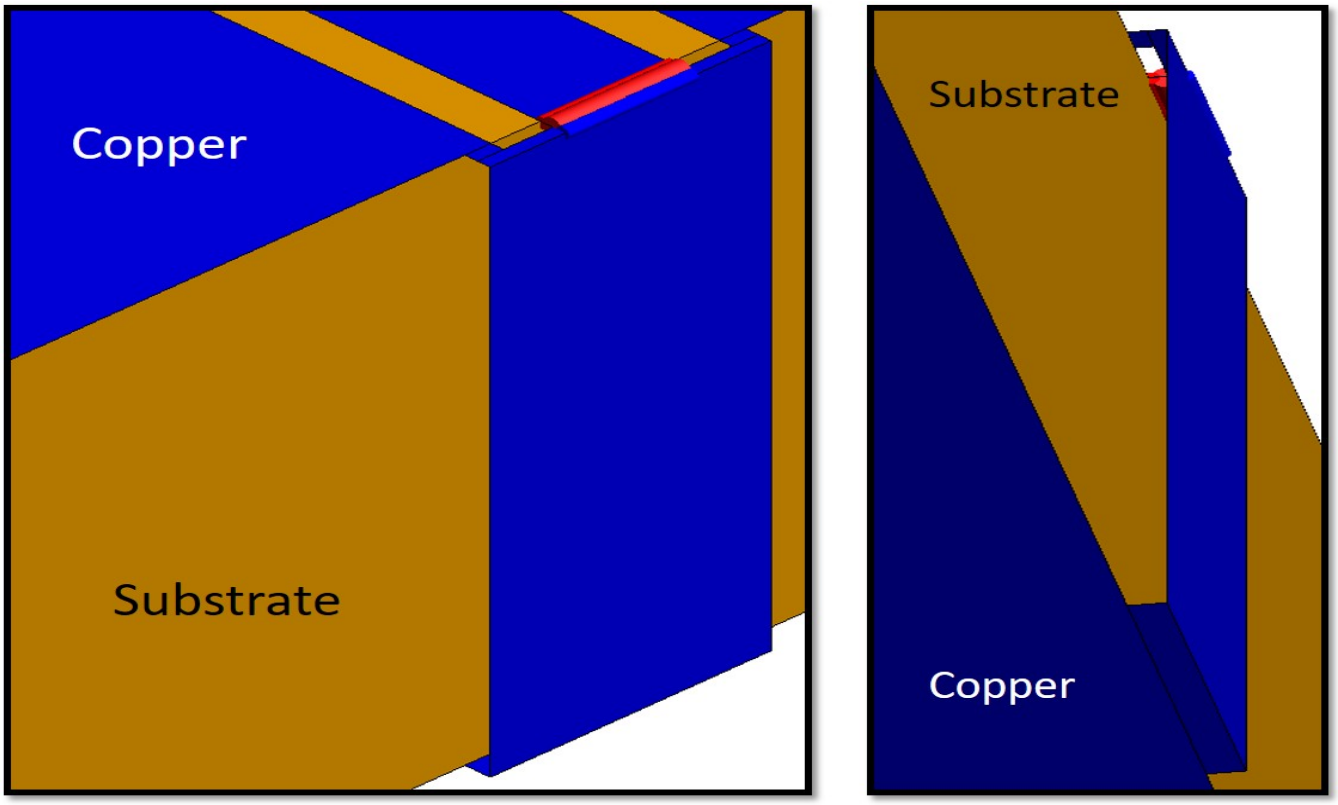

Figure 1: The ground wall design used to feed the GCPW.

A top view of the design with relevant dimensions is shown in Figure 2. The main take away here is that the negative side of the edgeport is connected directly to the top ground planes, resulting in a fork-like geometry. As Figure 2 shows, you will need to union together the faces that will be fed by the edgeport before assigning the positive and negative faces. Here it is done with two negative faces, but in principle one could combine them into a single rectangle.

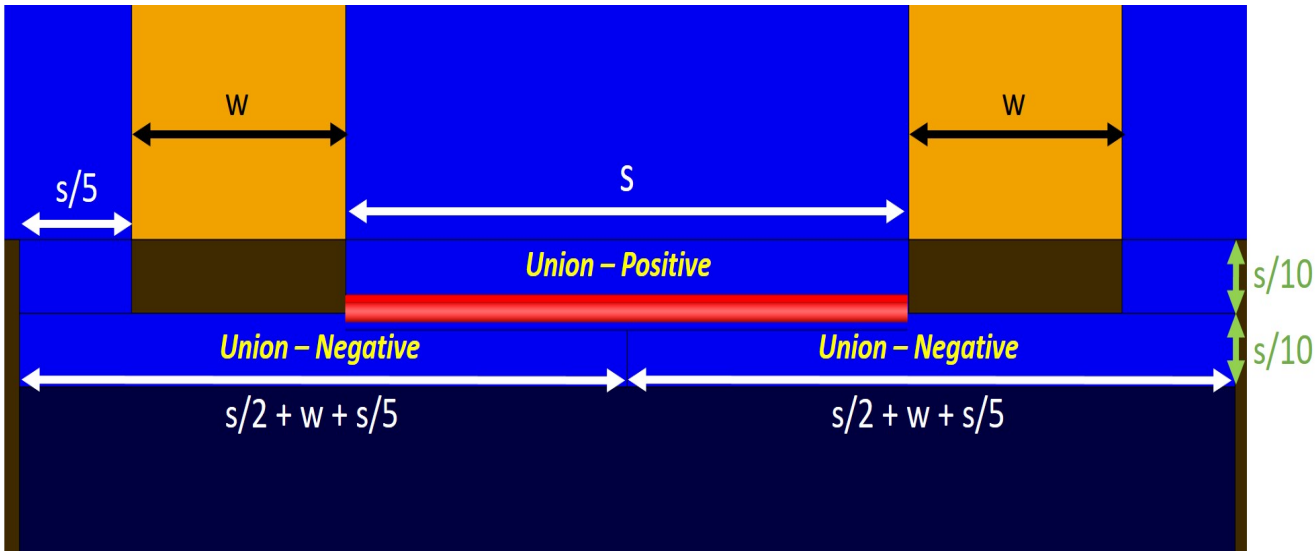

Figure 2: Top view of the ground wall design used to feed the GCPW with relevant dimensions. Also labeled are the three rectangular sections that are unioned together and the face of the edgeport they are connected to.

The connection to the bottom ground plane is similar to what is done in the microstrip model, and is shown in Figure 3 with relevant dimensions.

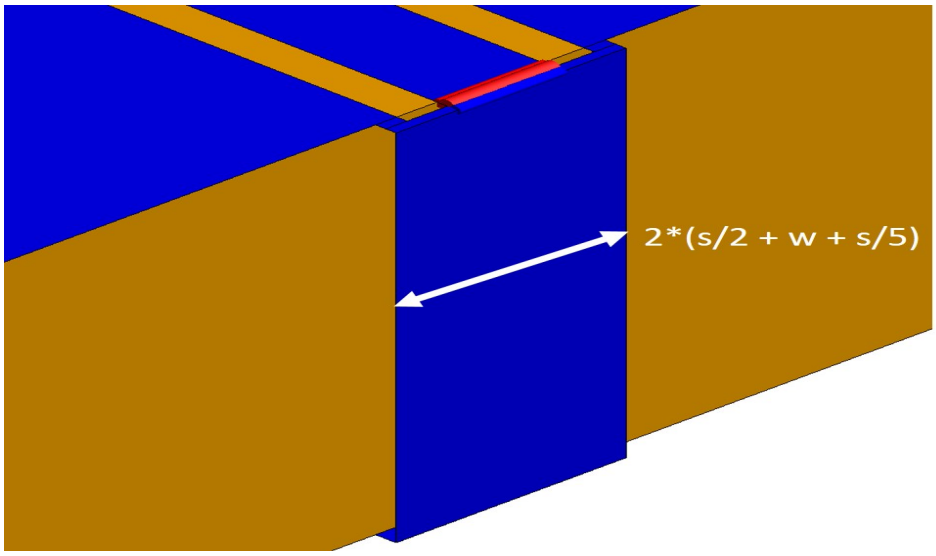

Figure 3: View of the ground wall design used to feed the GCPW with relevant dimensions.

Simulation Results

Here I present results of simulations for the above model for two different trace/gap width combinations on a 1 mm AlN substrate ($\epsilon_r = 8.9$). The relevant dimensions are given in the table below. The "calculator results" are the impedances obtained from the online GCPW calculator by Chemandy.

	s (mm)	w (mm)	substrate thickness (mm)	calculator result (Ohms)
Thin Trace	0.1	0.038	1	50
Thick Trace	0.5	0.227	1	50

The results are shown below in Figure 4:

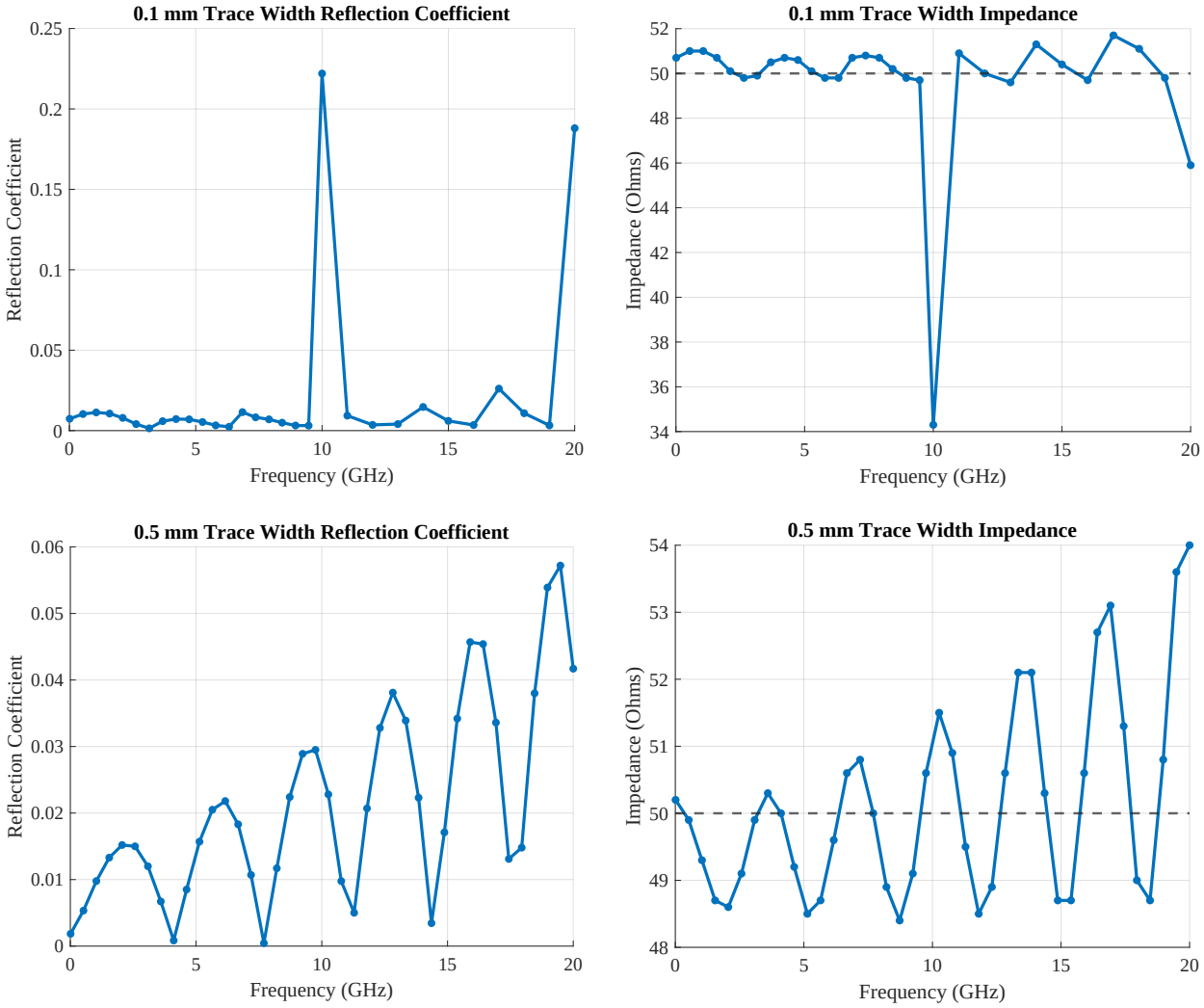

Figure 4: Results of the simulations using the parameters in the above table from 0.01 - 20 GHz.

The poor performance of the 0.1 mm trace width model at 10 and 20 GHz is a bit of a mystery at the moment. It might just be a result of the chosen geometry, but further research needs to be done to confirm this.