ESF Research Networking Programme NEWFOCUS

RF MEMS-Controlled Reconfigurable Partially Reflective Surfaces

Scientific report

This report describes the work carried out during the short visit to EPFL (LEMA) from June 25 to June 29. The purpose of the visit was to experimentally characterize the RF MEMS-controlled partially reflective surface (PRS) unit cells.

Main results

The fabricated cross-like PRS unit cell is shown in Fig. 1. The PRS unit cell is mounted on the PCB carrying the required bias circuitry. The PRS unit cells performance was measured using an orthomode transducer (OMT), since it was necessary the measure the PRS unit cell response for two incident orthogonal linear polarisations, and coupling between those polarisations. The size of the PCB shown in Fig. 1 corresponds to the orthomode transducer (OMT) aperture and flange size. OMT operating in X-band (central frequency $f_0 = 11.2$ GHz) is shown in Fig. 2, together with the rest of the equipment necessary for this measurement (VNA with waveguide TRL calibration kit; DC sources for the RF MEMS actuation).

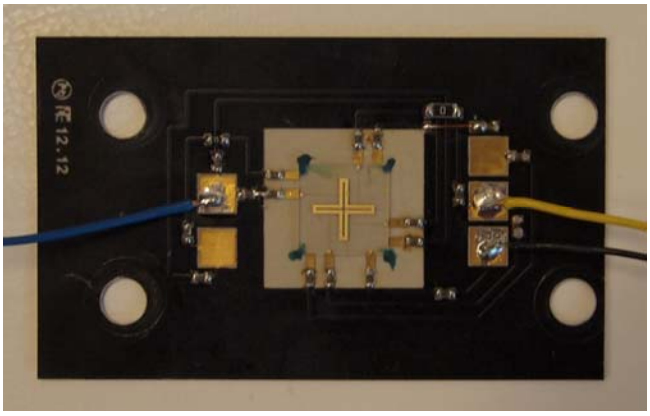

Fig. 1 Fabricated PRS unit cell mounted on the PCB with bias circuitry.

Fig. 2 Measurement setup.

The PRS reflectivity can be reconfigured independently in x- and y-polarisation by actuating RF MEMS switches Switch_x and Switch_y, respectively. This is confirmed in Fig. 3, which shows the simulated PRS reflection coefficient magnitudes.

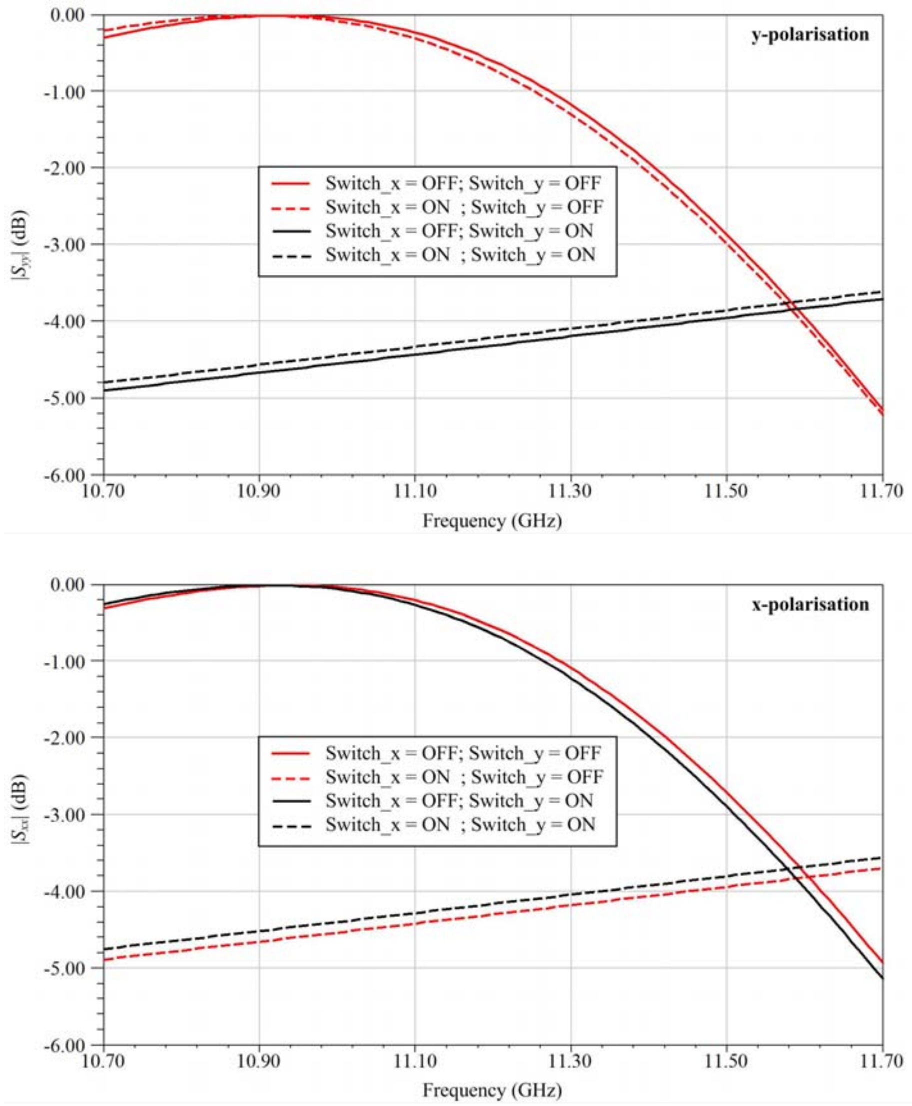

Fig. 3 PRS reflection coefficient magnitudes for y- and x-polarisation (simulated results).

Approximately 20 PRS unit cells with slight variations in geometry where fabricated by RF Microtech (Italy). Fig. 4 shows the simulated and measured response of the PRS unit cell mounted on the OMT, with good agreement of the results. It should be noticed that these results comprise the OMT influence. Therefore, they should not be directly compared to the simulation results shown in Fig. 3, which were obtained in the environment with periodic boundaries.

Finally, Fig. 5 shows that the coupling between orthogonally polarised signals is rather low, which confirms the possibility of using these PRSs in applications where dual-polarization operation is required.

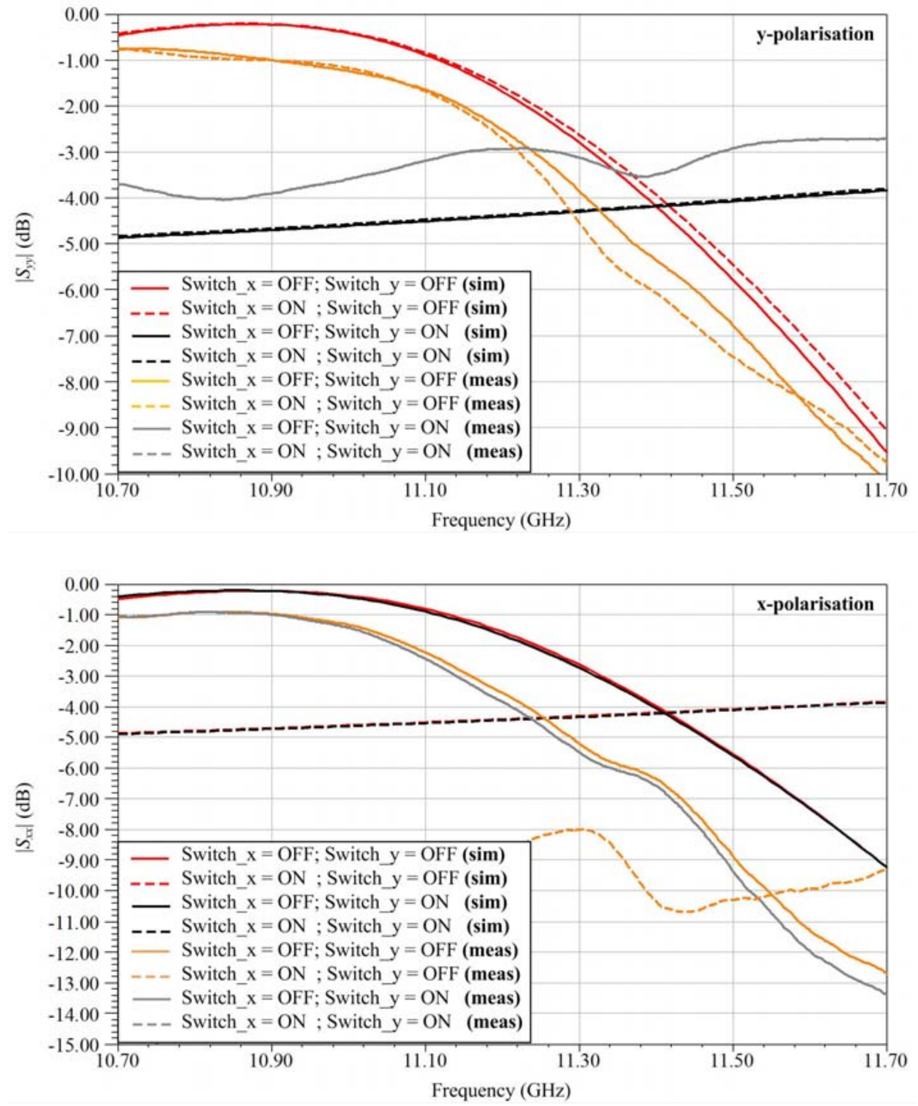

Fig. 4 PRS reflection coefficient magnitudes for y- and x-polarisation (measured and simulated results with OMT).

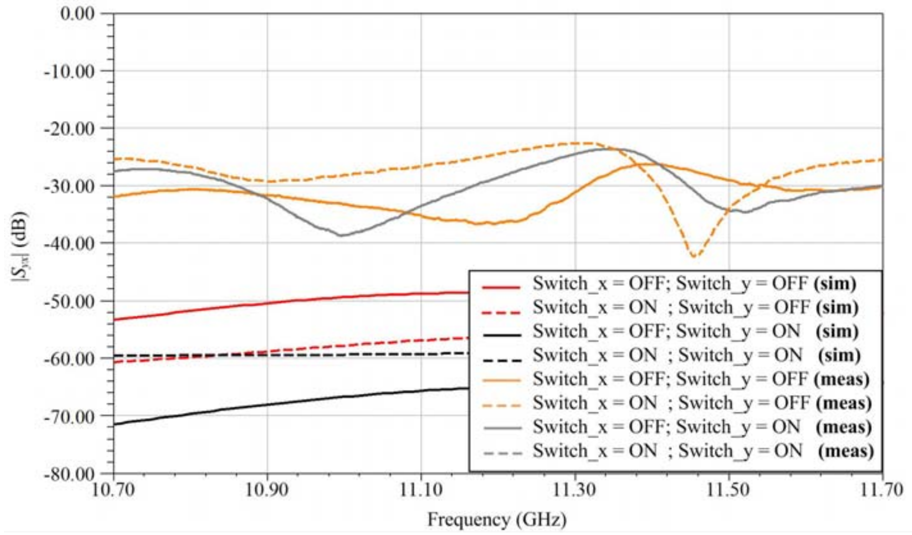

Fig. 5 Coupling between y- and x-polarisation (measured and simulated results with OMT).

Future collaboration and projected publications

The collaboration in the frame of the RF-MEMS-controlled PRSs will surely continue. During the visit, new ideas that could be realised using RF Microtech RF MEMS switches were brought up. Based on the results obtained in this short visit, two or three publications will be written on the RF MEMS-controlled PRS antennas.

July 5, 2012 Tomislav Debogović

Debogović