

Supplementary file for “Broadband Millimeter-Wave Textile-Based Flexible Rectenna for Wearable Energy Harvesting” in IEEE Transactions on Microwave Theory and Techniques

This supplementary section further elaborates on the test setup utilized in the wireless evaluation of the proposed mmWave rectenna. 3D full-wave simulation in CST Microwave Studio (MWS) is presented to demonstrate the suitability of the proposed test setup, and the accuracy of the assumptions with respect to the power available at the rectenna.

The test setup is formed of a Keysight 83020A Power Amplifier (PA) outputting 27 dBm, a 20 dBi horn, and the proposed AVA connected to a 50 Ohm power sensor. The AVA is positioned at 1 cm from the horn’s radiating aperture. The distance between the horn’s coax-to-waveguide interface is 12 cm and. The horn antenna has been modelled in CST MWS based, Fig. 1-supp. shows the simulated farfield gain of approximately 20 dBi of the horn antenna matching the specified gain of the practical horn.

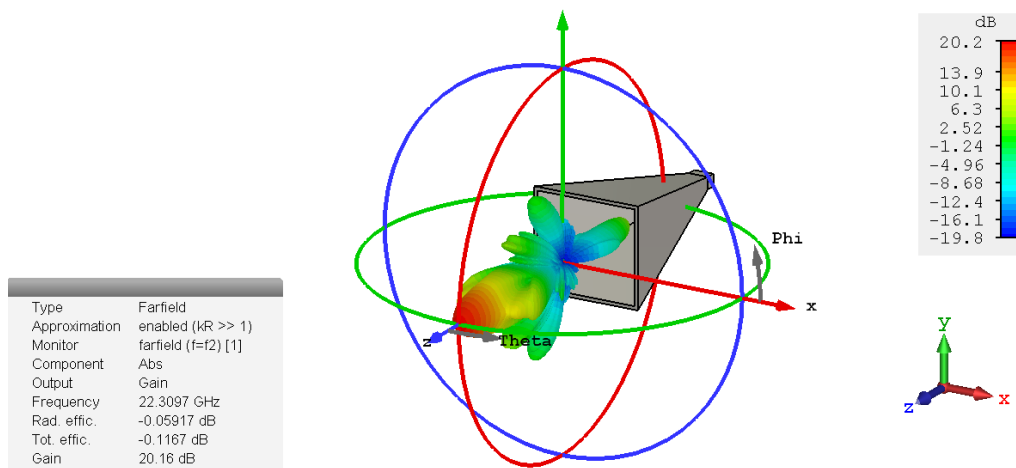


Fig. supp-1. The simulated gain of the horn antenna of similar dimensions to the experimental horn showing 20 dBi gain the horn used in the experiment.

The AVA is then included in the simulation model as shown in Fig. 2-supp. and the forward transmission between the horn and the AVA is simulated. Open boundaries are used in all directions and the materials are modelled based on the measured properties. Waveguide ports are used to excite the horn and the AVA.

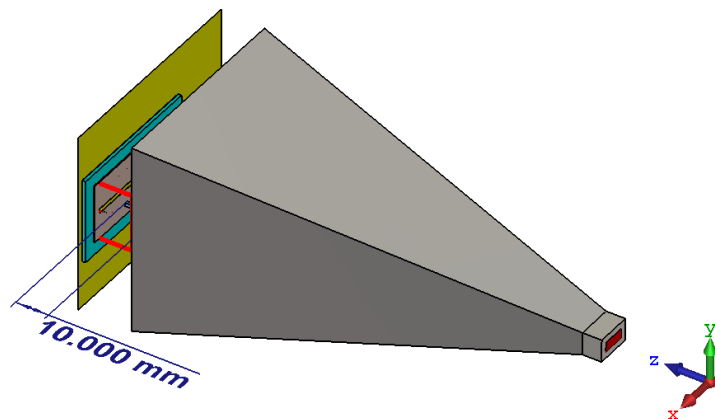


Fig. supp-2. The horn to AVA CST Microwave Studio 3D model

The simulated forward transmission is shown in Fig. supp-3 showing -15.8 dB transmission between the horn and the AVA. When comparing the simulated forward transmission to the measured 12 dBm power at the AVA's input, the simulated value ($PA - S(2,1) = 27 - 15.8 = 11.2$ dBm) agrees within 1 dB with the practical measurements. When varying the frequency of the CW generator while performing the measurements, the power input has been varied to account for the variations in the forward transmission at different frequencies. The PA's output however cannot be accurately quantified due to the PA's gain compression at higher input power levels. As a result, the 12 dBm input power is verified by the power sensor connected to the AVA's port.

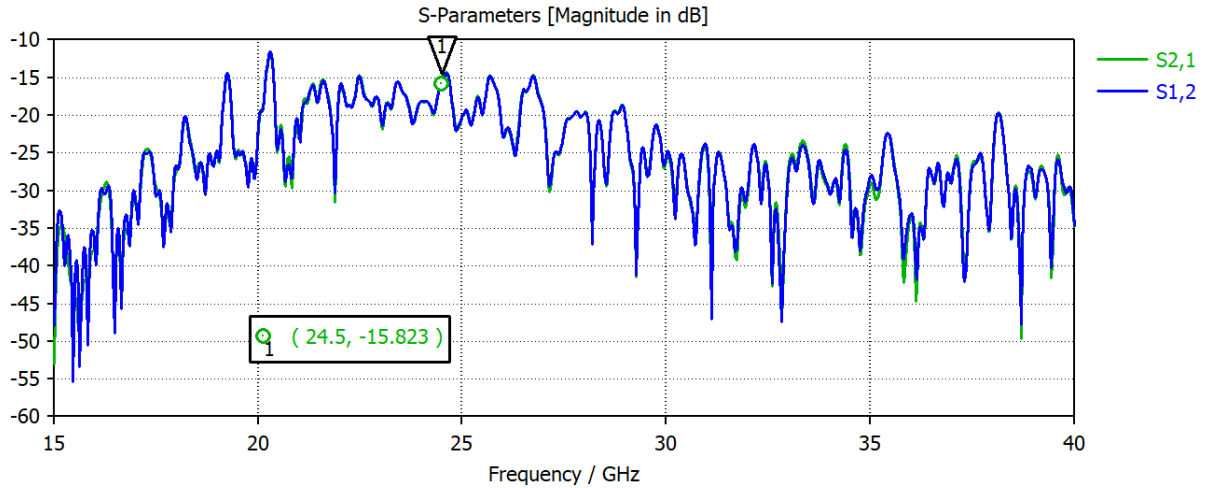


Fig. supp-3. The simulated forward transmission between the horn and the AVA at 1 cm.