

# Scattering Parameter Model of Low Level Electrical Contacts in Electro-mechanical Microwave Switches – A Switch Manufacturer Approach

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*Abstract*— A model that predicts the variation of the scattering parameters with contact resistance for RF microwave switches is presented. The studies encompass analyses and measurements of electro-mechanical coaxial microwave switches as well as RF MEMS switches. The model accounts for the effects of the contact geometry, contact force and surface texture on the discontinuity in the transmission line generated by the contacts of microwave switches. The model demonstrates the influence of high frequency signals on constriction resistance and insulation resistance of the contacts. An experimental setup is presented for the validation of the model. The experimental data correlates very closely with the performance predicted by analyses for all three studied frequencies covering L-band through C-band to Ku-band. The same model is relevant for standard electro-mechanical switches as well as for RF MEMS switches. The usefulness of the model is evident in the manufacturing environment for electro-mechanical RF switches. The model establishes a method for monitoring RF characteristics by performing a DC contact resistance test that is easier to implement especially over temperature extremes and over a large number of switching operations. The model also defines an acceptable limit criterion of the DC contact resistance values. In case of RF MEMS switches the model aids in developing a better understanding of possible failure modes and their impact on RF and mechanical switch performance.