# Tunable Defected Ground Structure and Its Applications to Simultaneous Reconfigurable Communication and Partial Discharge Detection

by

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# ABSTRACT

This thesis work is about the research of reconfigurable microstrip antenna for the partial discharge (PD) detection application. Detection of PD via UHF emission characterization at 500 MHz is an effective diagnostic tool for monitoring high voltage systems so as to predict the failure. Therefore, dual-band antenna with tunable 2nd operating band for simultaneous PD's UHF emission detection and multi-band communications is needed. To accomplish this objective, frequency tuning techniques of antennas are reviewed with the emphasis on the use of defected grounded structure (DGS) and active elements on microstrip monopole antenna. An active dual-band micorstrip monopole antenna is presented using varactor loaded DGS with Islands (DGSI) on feedline. This antenna's 2nd operating frequency is tuned from 2.156 GHz to 2.78 GHz when varactor is biased with 5 V to 29 V DC respectively. Moreover, 10-dB matching bandwidth of 62 MHz (28.6%) and 64 MHz (23.0%) are recorded under the above bias conditions. For the sake of completeness of tuning element study, this thesis investigates on DGS stub-loaded structure which offers flexibility in frequency tuning while overall good impedance matching performance is kept. To this end, a novel microstrip monopole antenna using above DGS stub-loaded structure is implemented. Frequency tuning is achieved through the uses of MEMS switches so as to control the slot length of DGS. The prototype MEMS switched antenna reports 27% frequency tuning range from 0.91 GHz to 1.19 GHz for the 2nd operating frequency while the 1st operating frequency is kept unchanged at 0.49 GHz and -18.5 dB matching. Moreover, the bandwidth of 2nd operating band is changed from 382 MHz to 120 MHz for the same MEMS switches control status. The antenna's measurement results agree with the simulations and fulfill the needs of the prototype PD detection.

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