ABSTRACT

The object of this thesis is to study the superconductors that are uniquely conveying electricity without producing any loss in energy, according to its nearly zero resistance; moreover, it excludes any nearby magnetic fields by acting as a magnetic mirror. In addition, pair of remarkable and important superconductivity theories are studied; the phenomenological Ginzburg-Landau and the microscopic BCS theories.

Superconductors are of two types: conventional low-temperature superconductors (LTS) which require temperatures no higher than a few degrees above absolute zero to convey electricity, and high-temperature superconductors (HTS) which are considered to demonstrate superconductivity at or above the temperature of liquid nitrogen, making the HTS the forefront of today's filter technology and is changing the way of designing the communication systems, electronic systems, medical instrumentation, and the military microwave systems.

In this thesis, the high temperature superconductors (HTS) are studied with details about on its characteristics and applications. In addition, studying surface impedance, this is described in terms of the relevant two-fluid model that is closely related to the electron conduction mechanism of the superconductors. Moreover, an outlined comparison between conventional (CTF) versus empirical (ETF) two fluid models is presented.

The Microstrip technology is studied, where the HTS material is used in a structure of thin film on a compatible and low loss substrate material, such as $LaAO_3$ and MgO. This offers a possibility of reducing markedly in the weight and volume of the microwave equipment. The Effective Dielectric constant ε_{eff}, Permeability μ_{eff}, Wavelength λ_{eff}, and characteristic impedance are discussed.

According to the importance of the HTS ability in exhibiting spontaneous polarization under the influence of an electric field, a study of ferroelectricity and nature of ferroelectric material shifting its dipole moment orientation from state to another by applying an electric field, is taken into consideration. This polarization switching is evidenced by Polarization-Electric field loop (The Hysteresis Loop). Moreover, Ferroelectrics Perovskite Structure, materials, and

application are presented. In addition, illustrating the dielectric properties is detailed to elucidate the terms of tunability and the quality factor.

Finally, a study of the microwave characteristic of the HTS microstrip transmission Line (YBCO/STO) is presented numerically in this thesis, simulated, and verified by an algorithm using matlab language. This algorithm is developed to compare the simulation results with the recently published results, to enable enhancing the quality factor of the tunable resonator by varying the size of the microstrip, and enable to study the dielectric response of depositing STO on NGO, and Compare between Changing the Q with Frequency in STO and STO/NGO to obtain the best of quality factor Q.