University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

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BEng (Universidad de Blumenau, 2015)

"Substrate Integrated Waveguide Variable PIN-diode Attenuator"

Department of Electrical and Computer Engineering

Thursday, October 18th, 2018
10:00 A.M.
Engineering Office Wing
Room 430

Supervisory Committee:
Dr. Jens Bornemann, Department of Electrical and Computer Engineering, University of Victoria (Supervisor)
Dr. Poman So, Department of Electrical and Computer Engineering, UVic (Member)

External Examiner:
Dr. Andrew Rowe, Department of Mechanical Engineering, UVic

Chair of Oral Examination:
Dr. Helen Kurki, Department of Anthropology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Due to the increase in the broadband networks and the demand for data rate and operating frequency, such as mobile broadband, automotive radar, and communication systems, the development of new devices that can offer different applications and still provide good integration is highly necessary for communication systems. These devices need to have a low-cost profile, compact sizes, and high efficiency. Moreover, circuits which can control the signal strength are wanted in these communication systems. For manipulating large signals, attenuators are good candidates since they offer a lower power consumption. As the control element in variable attenuators, PIN diodes have been used due to their functionality as a variable resistance when used at high frequencies. There has been an effort in the development SIW technology since it has demonstrated a good compromise between RWG and MS besides presenting a low cost, light component and easy fabrication profile. The transition of the SIW structure allows many applications when combined with MS/CPW-based devices. Also, due to the block size of SIW, that sometimes can be too large for some practical circuits, a novel guided wave structure derived from SIW components, HMSIW, also need to be investigated. In order to explore some of the applications of SIW and HMSIW transitions and to demonstrate the integration of SMT components, in this work, a proposed HMSIW variable attenuator to operate in the X-band (considering the frequency range between 6GHz and 10GHz), an HMSIW variable attenuator to operate in the K-band, (between 18GHz and 28GHz) and an SIW-CPW variable attenuator to operate in the K-band, (between 18GHz and 28GHz) were developed to explore some of the applications of SIW and HMSIW transitions and to demonstrate the integration of these technologies with SMT components. The integration with SMT components was accomplished and the attenuation goal of each structure, of about 5 dB, was achieved by adjusting the level of the DC bias applied in the PINdiodes. A verification of the design procedure was accomplished by the experimental characterization of the HMSIW Variable Attenuator in X-band. The simulation and measured results present a good agreement and the initial goal of 5dB attenuation was achieved and verified by the measurements.