



University  
of Victoria

Graduate Studies

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

of

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BSc (Sir Syed University Karachi, 2010)

**“Performance Analysis of P2MP Hybrid FSO/RF Network”**

Department of Electrical and Computer Engineering

Friday, December 15, 2017

10:00 A.M.

Engineering Office Wing

Room 430

Supervisory Committee:

Dr. Fayez Gebali, Department of Electrical and Computer Engineering, University of Victoria  
(Supervisor)

Dr. M. Watheq El-Kharashi, Department of Electrical and Computer Engineering, UVic (Member)

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Dr. Brad Buckham, Department of Mechanical Engineering, UVic

Chair of Oral Examination:

Dr. Ralph Huenemann, School of Business, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

## **Abstract**

Free space optics (FSO) technology is proving to be an exceptionally beneficial supplement to conventional Fiber Optics and radio frequency (RF) links. FSO and RF links are greatly affected by atmospheric conditions. Hybrid FSO/RF systems have emerged as a promising solution for high data rate wireless communication. FSO technology can be used effectively in multi-user scenarios to support Point-to-Multi-Point (P2MP) networks. In this work we present and analyse a P2MP Hybrid FSO/RF network that uses a number of FSO links for data transmission from the central node to different remote nodes of the network. A common backup RF link is used by the central node to transmit data to any of the remote nodes in case of failure of any FSO links. Each remote node is assigned a transmit buffer at the central node for the downlink transmission. We deploy a non-equal priority protocol and p-persistent strategy for nodes accessing the RF link and will consider the back up RF transmission link with lower frame transmission rates as compared to the FSO link. Under different atmospheric conditions, we also study various performance metrics of the network. We study the throughput from the central node to the remote nodes individually as well as the following: the average transmit buffer size, the frame queuing delay in the transmit buffers, the efficiency of the queuing systems and the frame loss probability.