MODELING OF MULTIMODE FIBER SYSTEMS

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DECLARATION

I do hereby declare that the work reported in this research project was exclusively carried out by me under the supervision of Dr. R. P. Thilakumara. The work included in the thesis has not been submitted for any other academic qualification at any institution.

Signature: *UOM Verified Signature* Date: 24.05.2008

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This is dedicated to my father,

Late. Mr. S. Murugesapillai

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ABSTRACT

The optical communication is of great interest in developing extensive, high-speed networking infrastructures. Optical fibers provide many advantages over traditional copper cables and wireless links. Among these advantages are high security, low electromagnetic interference, extremely low loss, very high bandwidths, and highly manageable cabling. However, the very small wavelengths associated with optical radiation require very small waveguide dimensions. Waveguide dimension of single mode fiber (SMF) are < 10μm, resulting in relatively poor yield in device manufacturing. For most of the last-mile networks topologies, cost constraints limit the appeal of SMF. Large core fibers allow for less restrictive manufacturing tolerances; however, they also results in multimode propagation that exhibit distortion from the dispersion in propagation among the many modes. The distortion can be prohibitively large for data rates approaching and exceeding 1 Gb/s.

Improvement of the deployability of these multimode fibers depends on the proper design of the multimode fiber link parameters for the reduction of the over estimation. Conventional multimode fiber model ignores all the effects of the different laser mode profiles in the link simulation and over estimates the penalty. Proposed modified model for vertical cavity surface emitting laser (VCSEL) based multimode fiber (MMF) links considers all effects of different laser mode profiles and compare the transmitted eye diagrams and Q-Factors with the conventional model.

Significant differences observed in the eye diagrams and the Q-factors of the modified model compared to the conventional model with various kinds of graded index multimode fibers and VCSEL. 29 % of Q-factor improvement observed in laser optimized MMF link with rate of 10 Gb/s and distance of 300 m.