

Transporting RF Signals over Free-Space Optical Links

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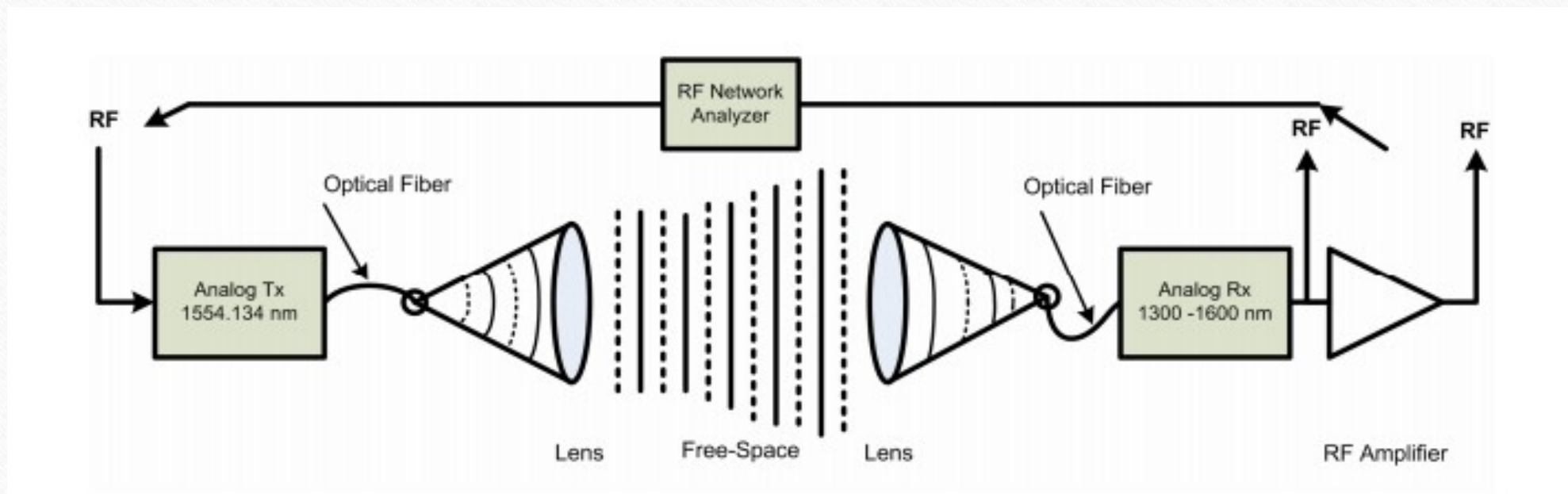
introduction

- Free space optics (FSO) is a technology that uses modulated optical beams, typically generated by light emitting diodes (LEDs) and lasers, to transmit information line-of-sight through the atmosphere.
- The desire to extend high-speed Internet access has fueled much of this growth and as a result, the primary focus of most FSO research and development has been toward the transmission of digital signaling formats. This paper investigates the use of FSO technology to transport modulated radio frequency (RF) analog signals.

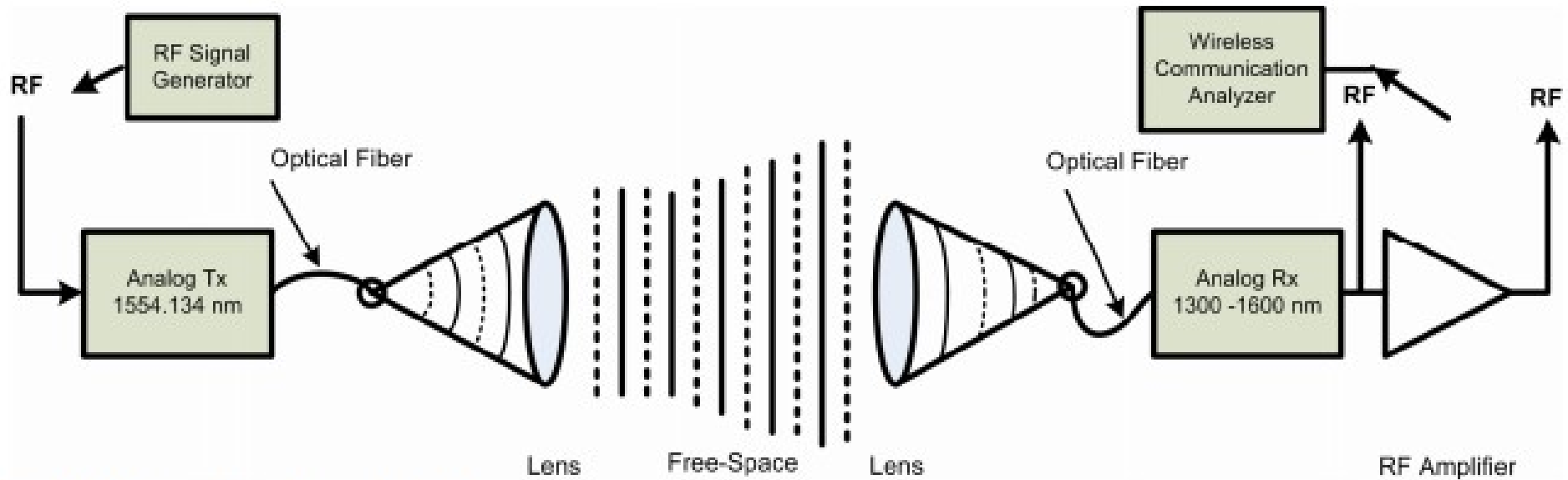
The advantages of FSO links for transmission of modulated RF signals are as follows:

- FSO transmission links can be deployed faster, and in some instances more cheaply, than optical fiber links.
- When compared with wireless RF links, FSO requires no licensing, provides better link security and much higher immunity from EMI.
- FSO is highly immune to interference from other sources of optical radiation.
- FSO provides a viable transport medium for transporting IS-95 CDMA signals to base stations from macro- and microcell sites and can reduce the setup costs of temporary microcells deployed for special events, e.g., a football game, by eliminating the need for a directional microwave link or connecting cable.

FSO experimental setup for transmission response, reflection response, and group delay measurements.

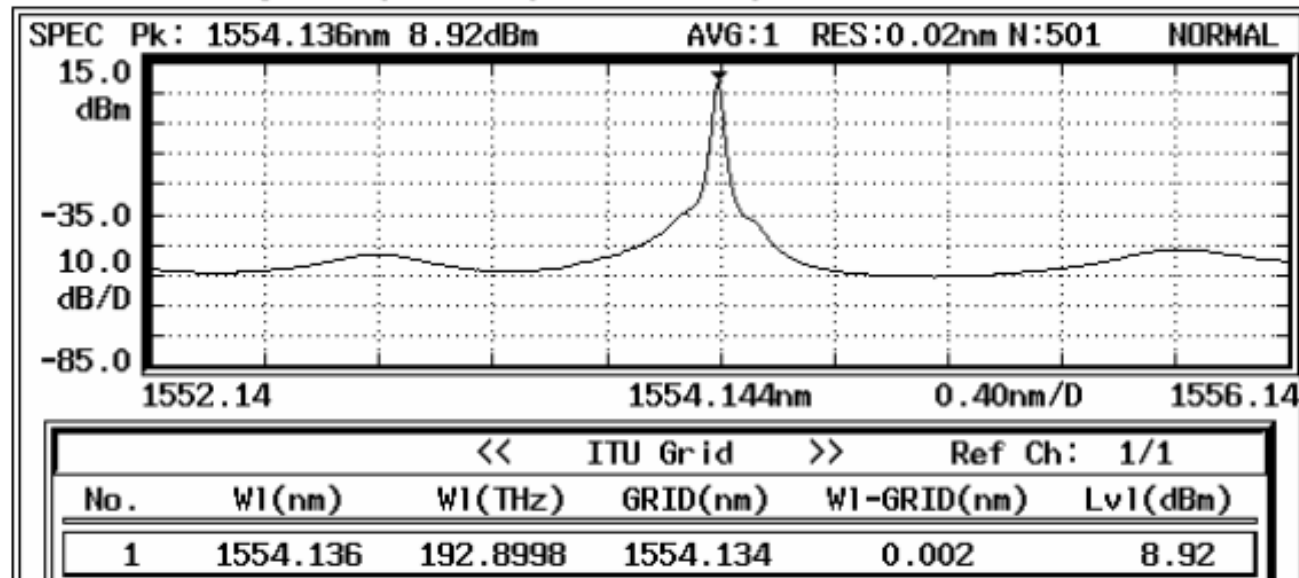


FSO experimental setup for SNR measurements.



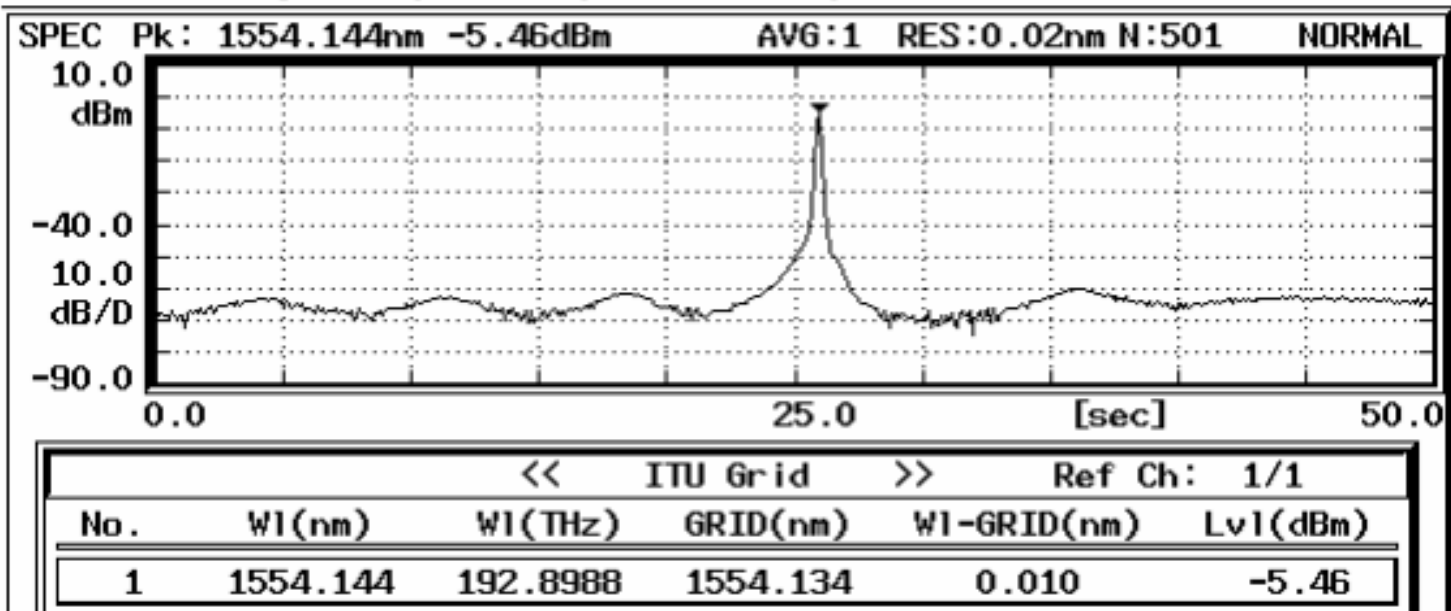
Optical Power Measurements and Analysis

** ADVANTEST Q8384 Optical Spectrum Analyzer **

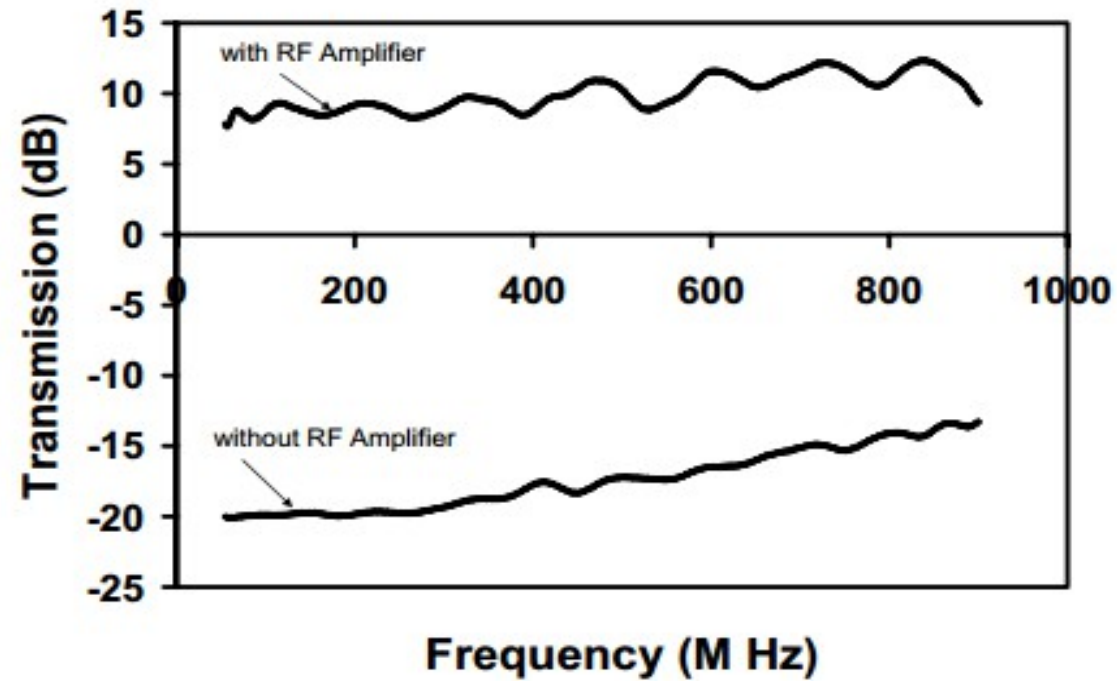


Optical Power Measurements and Analysis

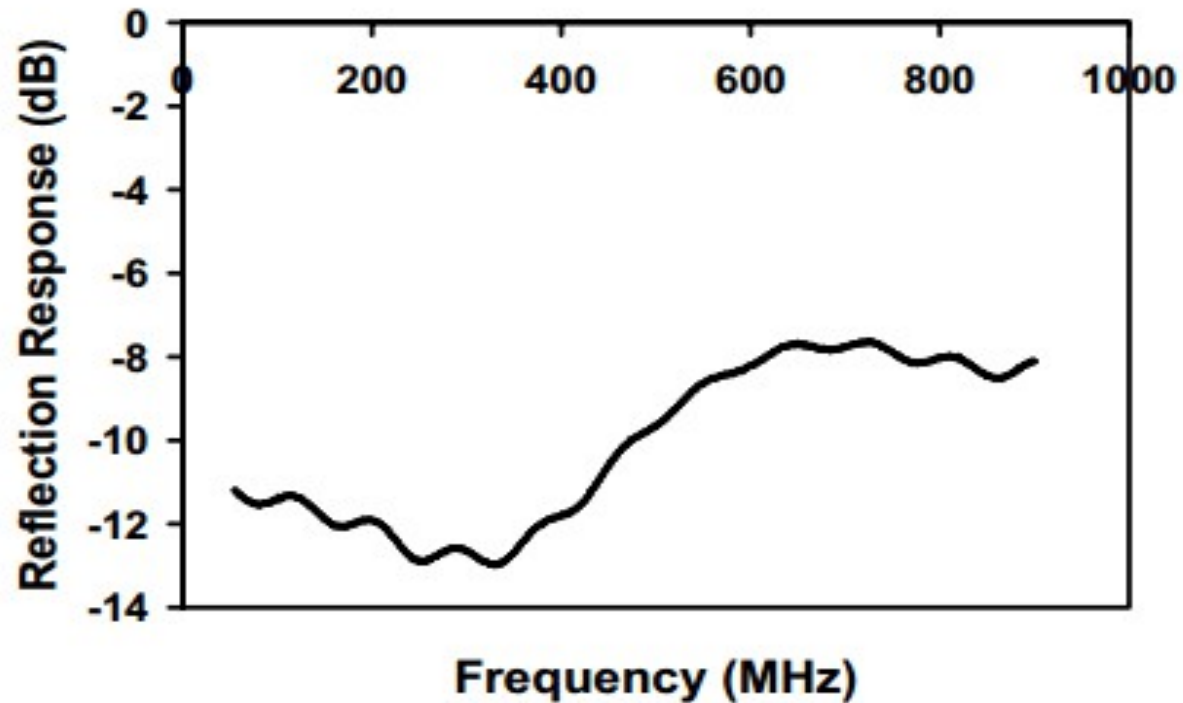
** ADVANTEST Q8384 Optical Spectrum Analyzer **



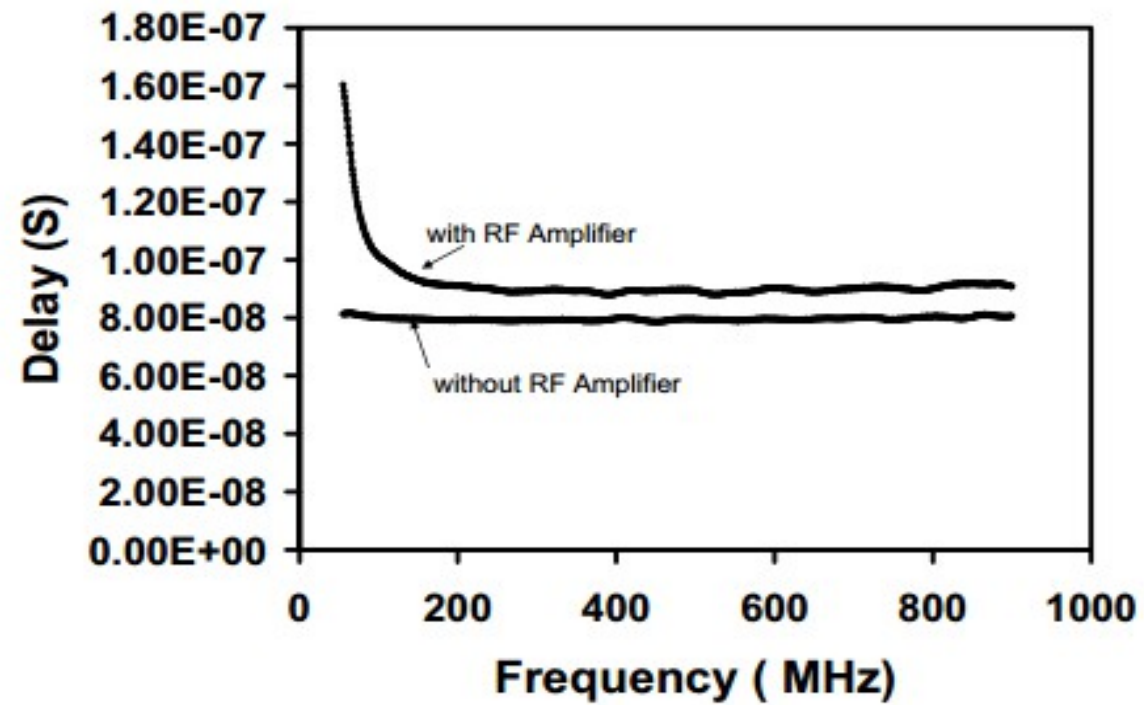
Transmission Response Measurements



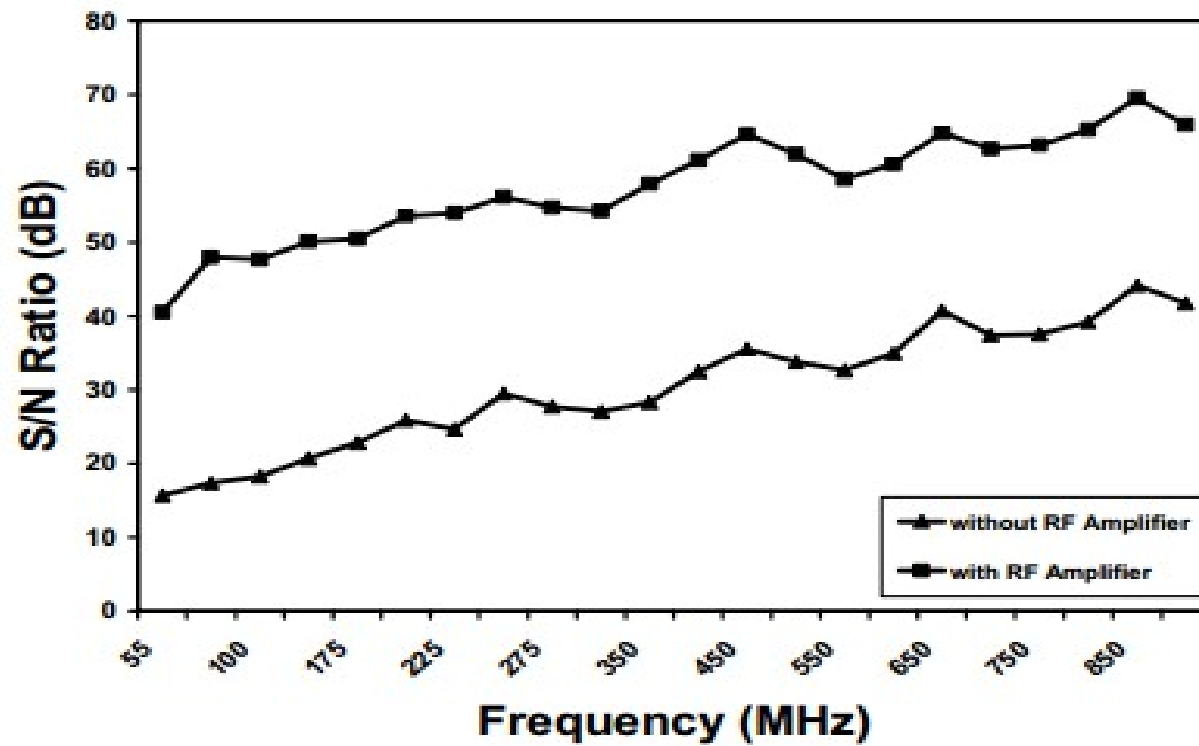
Results of reflection response measurements.



Group Delay Measurements



SNR Measurements



CONCLUSION

- The results of transmission response, reflection response, group delay, and SNR measurements are very promising, and indicate that FSO is suitable for this application and performs comparably with similar fiber optic links. The motivation for this investigation has been to take advantage of the increased security and insusceptibility to electromagnetic interference (EMI) afforded by FSO, and to stimulate farther research in this emerging area of optical communications. When direct line-of-sight can be established, FSO can provide an attractive replacement for fiber optic links to transport modulated RF analog signals over short distances.