

Link Budget Analysis for 350 GHz Communication Link

Shubhendu Bhardwaj*, Niru Nahar, and John L. Volakis
Electroscience Laboratory, the Ohio State University,
1330 Kinnear Road, Columbus, OH-43212, USA

Communication systems in the free band beyond 300 GHz are of interest for short distance communication. To assess the feasibility of such a communication system, a realistic link budget analysis is needed. Such link budget analyses have been conducted before based on TDS (optical) measurements and theoretical loss models. For this work, we present a more realistic link budget analysis based on the measurement of transmission losses using all electronic Tx-Rx system, operating from 325 to 500 GHz.

It is well known that most losses in a THz communication are in free-space propagation channel between the transmitter and receiver. It is therefore essential to more accurately characterize these losses. To do so, we used a VDI Tx/Rx frequency extender system operating at 325 – 500 GHz generated from vector network analyzer. Using such a system, we characterized total link losses including combined effect of absorption losses, free-space losses, antennas losses and misalignment losses. A log linear model for the propagation was then constructed using linear regression analysis.

Using the link characterization from these measurements, a communication link using commercially available WR-2.8 mixer and WR-5.1 frequency tripler devices (VDI) was simulated at 350 GHz in AWR-VSS/MATLAB. We conclude that, achievable data-rate of 20 Mbps is possible at a transmission distance of 8.5 m. However, data-rates upto 1 Gbps are possible using the dielectric lenses with the Tx and Rx antennas.

Our estimates demonstrated that previously predicted link budgets are optimistic for an all-electronic system (using currently available components). Also, to maintain multi-Gbit link, high gain antenna structures would likely be required. At the conference, we will present the required antenna gains for longer link distances. This study will also explore various possible antenna choices to enhance antenna gains for such applications.