

Terabit Wireless Communication Challenges

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Abstract

This presentation briefly discusses a research effort on Terabit Wireless communication systems for possible space applications. Recently, terahertz (THz) technology (300-3000 GHz frequency) has attracted a great deal of interest from academia and industry. This is due to a number of interesting features of THz waves, including the nearly unlimited bandwidths available, and the non-ionizing radiation nature which does not damage human tissues and DNA with minimum health threat. Also, as millimeter-wave communication systems mature, the focus of research is, naturally, moving to the THz range.

Many scientists regard THz as the last great frontier of the electromagnetic spectrum, but finding new applications outside the traditional niches of radio astronomy, Earth and planetary remote sensing, and molecular spectroscopy—particularly in biomedical imaging and wireless communications — has been relatively slow. Radiologists find this area of study so attractive because t-rays are non-ionizing, which suggests no harm is done to tissue or DNA. They also offer the possibility of performing spectroscopic measurements over a very wide frequency range, and can even capture signatures from liquids and solids.

According to Shannon theory, the broad bandwidth of the THz frequency bands can be used for terabit-per-second (Tb/s) wireless communication systems. This enables several new applications, such as cell phones with 360° autostereoscopic displays, optic-fiber replacement, and wireless Tb/s file transferring. Although THz technology could satisfy the demand for an extremely high data rate, a number of technical challenges need to be overcome before its development. This presentation provides an overview the state-of-the-art in THz wireless communication and the technical challenges for an emerging application in Terabit wireless systems. The main issue for THz wave propagation is the high atmospheric attenuation, which is dominated by water vapor absorption in the THz frequency band. The technical challenges in design such a system and the techniques to overcome the challenges will be discussed in this presentation.