

# Prospects of Terahertz Frequencies Application in Space Systems

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**Abstract.** The article considers the possible concept of space systems capable of operating in the terahertz frequency range (0,1–10 THz). The design and selection of antennas, sensors and emitters are revealed for applications in space communications at terahertz frequencies. An array (a square of 1 m side) of horn antennas with an output diameter of 1 cm and a fast solid-state detector was considered as the receiving antenna, and a parabolic antenna with a diameter of 10 cm was taken as the transmitting antenna. The required transmitter power for the communication ranges of 1000, 4000, 20 000 and 40 000 km has been calculated. An atmospheric attenuation of the signal due to the moisture, which is the main source of absorption of the terahertz radiation, is evaluated. This attenuation is about 20 dB. However, the selected design of the terahertz frequency range antennas can compensate for strong attenuation both in the atmosphere and in empty space. Moreover, one of the benefits of the terahertz frequency range is an ability to create a narrow radiation pattern that increases the efficiency of spectrum application. The article shows that the power of modern sources of terahertz is enough for spacecraft-to-spacecraft communication. Earth-to-spacecraft communication is possible with low-orbit spacecraft; for high-orbit spacecraft, the pulse mode of data transmission can be used.

**Keywords:** terahertz frequency, space communication, receiver, transmitter, antenna