



300-GHz CMOS Transceivers and Future of Sub-Terahertz Communication

Minoru Fujishima

Hiroshima University, Higashi-hiroshima, Japan; e-mail: fuji@hiroshima-u.ac.jp

In the sixth generation (6G), sub-terahertz, including the 300 GHz band, is finally going to be used for wireless communications. 300 GHz band allows continuous use of the 44 GHz frequency band identified for wireless communications. By using such a wide bandwidth, ultrahigh-speed communications exceeding 100 Gb/s can be expected. On the other hand, it has been believed that higher frequencies shorten the communication distance and limit it to short-distance communications. However, free-space optical communications with frequencies much higher than terahertz have enabled long-distance communications between satellites over distances of several thousand kilometers. This fact contradicts predictions that communication distances will shorten as frequencies increase.

In this talk, it will be shown that increasing the frequency bandwidth to achieve higher data rates requires increasing the receiving power to ensure the required signal-to-noise ratio. This fact is a major factor in shortening the communication distance. On the other hand, it is also clarified that theoretically the carrier frequency does not affect the communication distance if the equivalent isotropic radiated power (EIRP) of the transmitter and the antenna size of the receiver are the same. This eliminates the above contradiction.

As a result, if ultrahigh-speed communication is to be achieved using an ultrawide bandwidth, a focused beam is essential to increase the received power using limited transmit power. On the other hand, if wireless transmission with a focused beam can be realized, the energy consumption of the entire system can be reduced because the power efficiency during transmission is improved. In this talk, I would like to discuss theoretically how the world would change if terahertz communication could be realized.

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References

- [1] M. Fujishima, “Will Terahertz Communication Change the World?” The 2022 Asia-Pacific Microwave Conference (APMC 2022).