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# Section
# Microwave and Wireless Communications

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# Section Information

It has already been over more than a hundred years since Maxwell's predictions of the electromagnetic wave presence and experiments by Hertz. Needless to say, contemporary information and communication technology (ICT), especially microwave wireless communication technology, has a direct and indirect impact on our lives at present. In other words, this technology area consists of many fields, element and system technologies and has many applications.

In the section of "microwave, wireless communication", we would like to invite advanced theories and technologies across a wide spectrum. These can be related to microwave and millimeter wave communication, including radar sensor, etc., which may be fundament or application, element or system, hardware or software, methodology theory or measurement. We hope to present the state-of-the-art technologies in this section.

**Section Editor-in-Chief**
Prof. Dr. Giovanni Crupi

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# Selected Papers

## Hybrid FSO/RF Communications in Space–Air–Ground Integrated Networks: A Reduced Overhead Link Selection Policy

**Authors:** Petros S. Bithas, Hector E. Nistazakis, Athanassios Katsis and Liang Yang

**Abstract:** Space–air–ground integrated network (SAGIN) is considered an enabler for sixth-generation (6G) networks. By integrating terrestrial and non-terrestrial (satellite, aerial) networks, SAGIN seems to be a quite promising solution to provide reliable connectivity everywhere and all the time. Its availability can be further enhanced if hybrid free space optical (FSO)/radio frequency (RF) links are adopted. In this paper, the performance of a hybrid FSO/RF communication system operating in SAGIN has been analytically evaluated. In the considered system, a high-altitude platform station (HAPS) is used to forward the satellite signal to the ground station. Moreover, the FSO channel model assumed takes into account the turbulence, pointing errors, and path losses, while for the RF links, a relatively new composite fading model has been considered. In this context, a new link selection scheme has been proposed that is designed to reduced the signaling overhead required for the switching operations between the RF and FSO links. The analytical framework that has been developed is based on the Markov chain theory. Capitalizing on this framework, the performance of the system has been investigated using the criteria of outage probability and the average number of link estimations. The numerical results presented reveal that the new selection scheme offers a good compromise between performance and complexity.

https://doi.org/10.3390/electronics13040806

## Advancing into Millimeter Wavelengths for IoT: Multibeam Modified Planar Luneburg Lens Antenna with Porous Plastic Material

**Authors:** Javad Pourahmadazar, Bal S. Virdee and Tayeb A. Denidni

**Abstract:** This paper introduces an innovative antenna design utilizing a cylindrical dielectric Luneburg lens tailored for 60 GHz Internet of Things (IoT) applications. To optimize V-band communications, the permittivity of the dielectric medium is strategically adjusted by precisely manipulating the physical porosity. In IoT scenarios, employing a microstrip dipole antenna with an emission pattern resembling cos10 enhances beam illumination within the waveguide, thereby improving communication and sensing capabilities. The refractive index gradient of the Luneburg lens is modified by manipulating the material's porosity using air holes, prioritizing signal accuracy and reliability. Fabricated with polyimide using 3D printing, the proposed antenna features a slim profile ideal for IoT applications with space constraints, such as smart homes and unmanned aerial vehicles. Its innovative design is underscored by selective laser sintering (SLS), offering scalable and cost-effective production. Measured results demonstrate the antenna's exceptional performance, surpassing IoT deployment standards. This pioneering approach to designing multibeam Luneburg lens antennas, leveraging 3D printing's porosity control for millimeter-wave applications, represents a significant advancement in antenna technology with scanning ability between −67 and 67 degrees. It paves the way for enhanced IoT infrastructure characterized by advanced sensing capabilities and improved connectivity.

https://doi.org/10.3390/electronics13091605

# A Federated Learning-Based Resource Allocation Scheme for Relaying-Assisted Communications in Multicellular Next Generation Network Topologies

**Authors:** Ioannis A. Bartsiokas, Panagiotis K. Gkonis, Dimitra I. Kaklamani and Iakovos S. Venieris

**Abstract:** Growing and diverse user needs, along with the need for continuous access with minimal delay in densely populated machine-type networks, have led to a significant overhaul of modern mobile communication systems. Within this realm, the integration of advanced physical layer techniques such as relaying-assisted transmission in beyond fifth-generation (B5G) networks aims to not only enhance network performance but also extend coverage across multicellular orientations. However, in cellular environments, the increased interference levels and the complex channel representations introduce a notable rise in the computational complexity associated with radio resource management (RRM) tasks. Machine and deep learning (ML/DL) have been proposed as an efficient way to support the enhanced user demands in densely populated environments since ML/DL models can relax the traffic load that is associated with RRM tasks. There is, however, in these solutions the need for distributed execution of training tasks to accelerate the decision-making process in RRM tasks. For this purpose, federated learning (FL) schemes are considered a promising field of research for next-generation (NG) networks' RRM. This paper proposes an FL approach to tackle the joint relay node (RN) selection and resource allocation problem subject to power management constraints when in B5G networks. The optimization objective of this approach is to jointly elevate energy (EE) and spectral efficiency (SE) levels. The performance of the proposed approach is evaluated for various relaying-assisted transmission topologies and through comparison with other state-of-the-art ones (both ML and non-ML). In particular, the total system energy efficiency (EE) and spectral efficiency (SE) can be improved by up to approximately 10–20% compared to a state-of-the-art centralized ML scheme. Moreover, achieved accuracy can be improved by up to 10% compared to state-of-the-art non-ML solutions, while training time is reduced by approximately 50%.

https://doi.org/10.3390/electronics13020390

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Deadline: 15 October 2024

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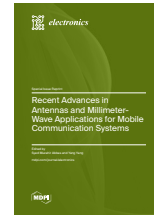


Application of Computational Electromagnetics Techniques and Artificial Intelligence in the Engineering

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