

Phased array fed reflector antenna systems for mm-Wave base stations

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Credit: AI-generated image ([disclaimer](#))

The exponential growth in mobile applications, the number of connected devices to the mobile network, as well as the emergence of the internet-of-things all demonstrate that a significant upgrade to the current mobile network infrastructure is critical.

As a result, many industrial and research groups are developing new technologies, architectures, systems, and algorithms for mobile fifth-generation (5G) and beyond (6G) networks. For his Ph.D. research, Amr Elsakka developed a novel [base station antenna](#) solution for the next generation of mobile communications.

The thesis of Amr Elsakka focuses on developing a novel base station antenna (BSA) solution for the next generation of mobile communications. Specifically, the use of reflector antenna systems that are fed by a phased-array feed (PAF) is investigated.

Such antenna systems promise reduced [power consumption](#) in comparison to conventional antenna architectures while directing the radiated power to the active users only. This leads to low interference between users and results in a higher system capacity.

Advantage over conventional systems

In his research, Elsakka addressed a number of key challenges. First, the use of PAF systems for the radio access [network](#) base stations (the part of the network that includes the connection between the user equipment and the base station) is motivated and its potential use instead of conventional antenna systems is explored. Then, the antenna system requirements were determined for a practical use case; namely a 60° sector of the cell assumed to be in urban areas.

Furthermore, a design framework is provided for the reflector geometry and for the feed array layout to provide the desired coverage to the 60° cell sector. A complete prototype system was also fabricated, and its performance verified through radiation pattern measurements.

Additionally, a performance studies were conducted in various user scenarios and using different radiation beam generation algorithms.

Elsakka's study demonstrates that the PAF system concept has a major

advantage over conventional antenna systems to reduce [energy consumption](#) and produce highly directive radiated beams to minimize interference between users.

Point-to-multipoint

Secondly, Elsakka proposes the use of a designed reflector for point-to-multipoint (P2MP) fronthaul systems. The fronthaul/backhaul is the part of the network that connects the radio access network to the mobile core network. The antenna system is required to provide a highly directive radiated beams to compensate for the huge pathloss at millimeter-wavelengths (mm-Waves). Furthermore, a wide scan range is necessary to produce multiple scanned beams that enable communication with multiple base stations that are at different locations. Moreover, the antenna system is required to provide limited beam steering to compensate for the mast twist and sway due to wind. The antenna system was simulated and demonstrated for practical scenarios. The results showed compliance of the antenna system with the requirements.

In summary, Elsakka's research explores the advantages and limitations of PAF systems for future mm-Wave base stations. Based on his research, Elsakka and his collaborators conclude that such systems have the potential to be used in future [base stations](#) in mobile communications.

More information: PhD Thesis: [Phased Array Fed Reflector Antenna Systems for mm-Wave Base Stations](#)

Provided by Eindhoven University of Technology

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