URSI AP-RASC, Sydney, Australia, 17-22 August 2025

L-Band Array Antenna Design for Satellite-Based ADS-B Surveillance

Miguel Ferrando-Bataller*, Gorka Casasus-Goyeneche, Miguel Ferrando-Rocher and Javier Vera-Sánchez
(1) Antennas and Propagation Lab, Universitat Politècnica de València, Spain, e-mail: mferrand@dcom.upv.es

The SATERA project, funded under the Horizon Europe framework, aims to enhance aerial surveillance through satellite-based technologies. This initiative tackles key challenges in global air traffic management [1], particularly in remote and oceanic regions where traditional ground-based systems lack coverage. The project is aligned with the SESAR (Single European Sky ATM Research) initiative [2] , which seeks to modernize and harmonize European air traffic management systems.

A crucial component of the SATERA project is the development of innovative antennas tailored for satellite-based applications. This paper presents a design of a phased-array antenna as a proof-of-concept for Automatic Dependent Surveillance-Broadcast (ADS-B) reception in Low Earth Orbit (LEO) satellites. The proposed antenna operates at 1090 MHz and is designed to optimize signal reception while maintaining high gain and minimizing interference. The antenna features a unit cell microstrip patch structure with T-shaped elements to enhance electromagnetic performance and reduce overall dimensions, making it suitable for compact satellite platforms

The unit-cell design consists of a circular metallic patch bonded to a foam layer using Roger's adhesive, avoiding conventional dielectric substrates to minimize losses and simplify fabrication. The sub-array prototype was developed at the Antennas and Propagation Lab of the Universitat Politècnica de València, with simulations and measurements confirming a bandwidth of approximately 13 MHz, low coupling between feeding ports, and a circular polarization suitable for ADS-B applications. Future work will focus on scaling this design into larger arrays to enhance gain and beam resolution while maintaining a compact footprint. Several configurations of 2D arrays with phase control have been simulated, trying to cover a 2000 km radius area with a minimum of 20 spot beams.

This research is part of the SATERA project, supported by the SESAR 3 Joint Undertaking (JU) under grant agreement No. 101164313, with additional funding from Spain's Ministerio de Ciencia e Innovación under research projects PID2022-136869NB-C33 and PID2022-141055NB-C21. The proposed array antenna represents a foundational step in developing reliable satellite-based ADS-B surveillance solutions

[1] T. Bolik and P. Ravenhill, "SESAR: The past, present, and future of European air traffic management research," Engineering, vol. 7, no. 4, pp. 448–451, 2021

[2] SESAR 3 Joint Undertaking. (2024) Space-based composite ADS-B and multilaTeration systEm validation thRough scalable simulAtions [Online]. Available: https://www.satera-sesar.eu/Informazioni/. [Accessed: 09 January 2025].