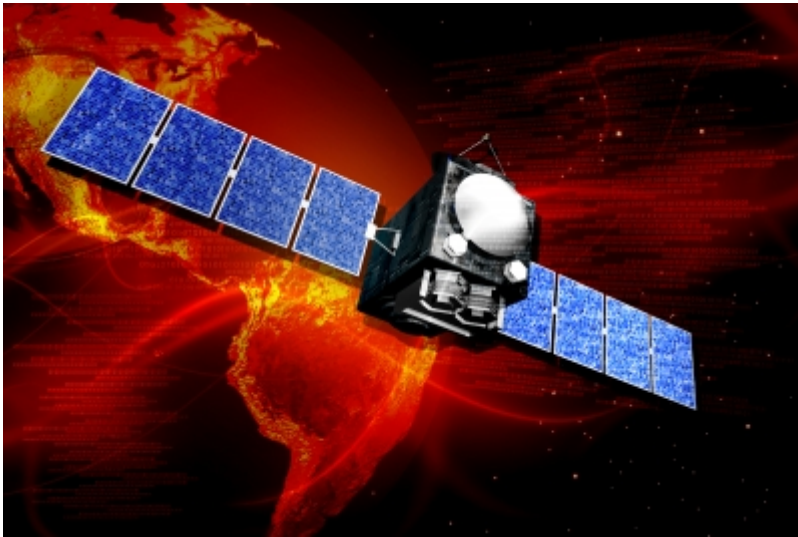


# ESCAM. An alternative to mechanical scanning.

A low-cost reflectarray antenna based on liquid-crystal cells that provides beam scanning at millimeter-waves with improved reliability



## Contact information

**Address:** ETSI de Telecomunicación - UPM, Avenida Complutense, 30, Ciudad Universitaria, 28040, Madrid

**Phone number:** 910671900

**Website:** [etsit.upm.es](http://etsit.upm.es)

**Email:** [jose.encinar@upm.es](mailto:jose.encinar@upm.es)

## Technological Offers type

Technological solutions

## Research and innovation areas

- Digital Technologies, Artificial Intelligence, Cybersecurity, 5G, Robotics
- Security, Defense and Disaster-Resilience
- Space and Earth Observation

## ODS



**Available from:** 2020

## Where?

Applied Electromagnetism Group Information Processing and Telecommunications Center

Keywords: | [antenna](#) | [security](#) | [space](#)

## Brief description of the technology solution and the added value it provides

ESCAM (Electronic Scanning Antenna for Millimeter-wave applications) is a low-cost solution for electronic beam scanning at frequencies above 100 GHz is desirable, as an alternative to mechanical scanning, for certain applications in communications, radar, image reconstruction for security and scientific missions in space.

This invention provides a technological solution for low-cost and reliable antennas based on liquid crystals to provide electronic beam scanning in mm-wave and Terahertz ranges. The invention improves the antenna performance by using multi-resonant cells in one or two layers of liquid crystal. At present, there is not any available technology that provides electronic beam scanning at frequencies around 100 GHz and above. The main advantages of the new technology with respect to mechanical scanning using motors are: low-cost, higher reliability and low power consumption.

## Description of the technological base

Electronic beam scanning would be desirable at frequencies above 100 GHz for certain applications. Prior demonstrators of beam scanning antennas based on liquid crystals used a single resonant patch above a layer of liquid crystal (LC) as phasing cells. This configuration showed significant limitations in bandwidth, range of phase and losses, which made them unsuitable for practical applications.

ESCAM solves the problems mentioned above, by using multi-resonant cells, which provide an improvement in range of phase, bandwidth and losses. The multiple resonances can be implemented in each phasing cell by using 3 parallel dipoles, where the dipole lengths are optimized to improve the bandwidth and phase range. Another alternative is to use two layers of LC for a further improvement of the scanning performance

*“Development of low-cost antennas based on liquid crystals to provide electronic beam scanning in mm-wave and Terahertz ranges”*

## Market demands

### Space

- Reliable beam scanning at mm-wave and Terahertz for instruments to study the atmosphere, as an alternative to mechanical systems using motors, which require a special lubrication and should be on operation during several years.
- Space industry needs technologies that allows research in different parameters and range of frequencies.
- Due to high cost to orbital a satellite, low weight technologies are crucial.

### Security

- After 11-S, the security agencies and market are looking for new technologies that improve weapon and explosive detection.
- In recent years, a wide range of privacy laws have emerge in development countries. Technologies such as radars in the range of sub-millimeter frequency bands, that allows security screening without personal intrusion, are an important step to obey this new legal imperative.

### ICT, embedded systems for communications

- Ultra wide-band communications is an incipient market that allow high-data-rate and well-suited for radio-frequency-sensitive environments, indoor and out-door.

## Competitive advantages

- The proposed technology provides a low-cost and reliable solution for electronic beam scanning at frequencies in the range of mm-waves and Terahertz, as an alternative to mechanical scanning using motors.
- The cost of ESCAM is much lower (at least one fourth) of the cost of complex mechanical scanning systems.
- At present, there is not any available technology that provides electronic beam scanning at frequencies around 100 GHz and above.
- The power consumption is very low for the proposed electronic beam scanning, at least one tenth of the consumption in mechanical systems using motors.
- Low-cost imaging in real time for weapon and explosive detection.

*“The Global Satellite Industry Revenues has increase 7 % in 2012, with 189,5 billion dollars, outpacing both worldwide economic growth rate (2,3%) and U.S. growth (2,2%)”*

## Development stage

- Concept
- Research
- **Lab prototype**

- Industrial prototype
- Production

## **Contact**

### **Contacto ESCAM**

J.A. Encinar, G. Pérez-Palomino, M. Barba, X. Quintana, M. Andreas, J.M. Oton, A. Broquetas, J. Abril, E. Novae {jose.encinar@upm.es, xabi@tfo.upm.es, broquetas@tsc.upc.edu}

### **Contacto UPM**

Área de Innovación, Comercialización y Creación de Empresas

Centro de Apoyo a la Innovación Tecnológica – UPM

e: [innovacion.tecnologica@upm.es](mailto:innovacion.tecnologica@upm.es)