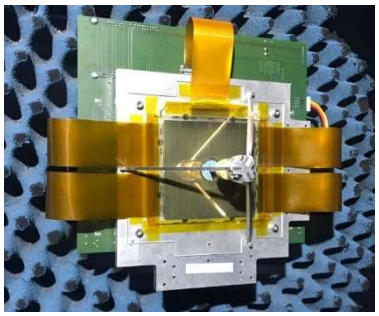
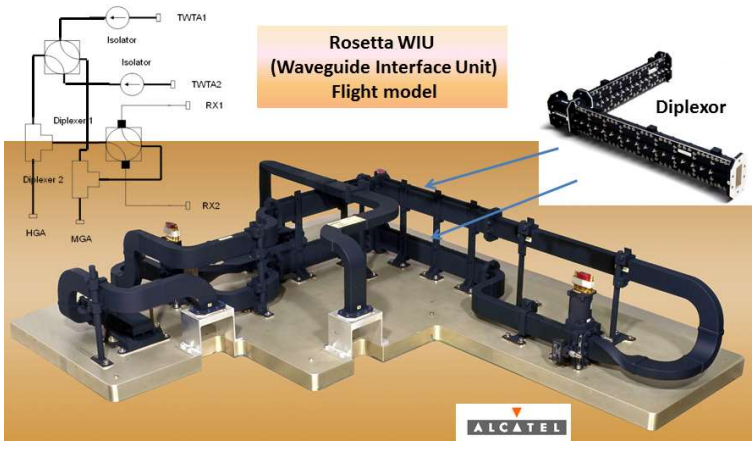
Applied Electromagnetism Group

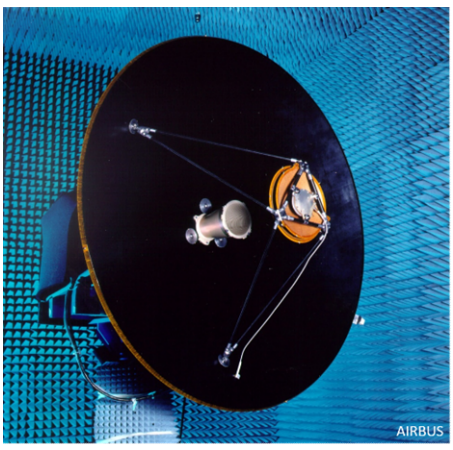
The Applied Electromagnetism Group (GEA) has more than twenty years' experience in developing software tools for the analysis and design of passive devices, periodical structures and antennas for space applications. The group has implemented efficient numerical methods in computational electromagnetics, such as MoM, FEM, Modal Analysis and Domain Decomposition. Different waveguide components (polarizers, filters, diplexers/triplexers, OMTs, power-combiners, Beam-Forming-Networks) and dichroic sub-reflectors have been designed, built and tested. Some of them have flight in Telecom satellites (Hispasat-1A-B-C-E, Artemis, Sesat, Astra-1K-3B-1M, Europe*Star, Newbird, Sky-Bridge, Eutelsat-W2A, Amazonas-2-5, among others) and scientific missions (Mars Express, Venus Express, Rosetta, Herschel-Planck, Bepi-Colombo).

Facilities and infrastructures

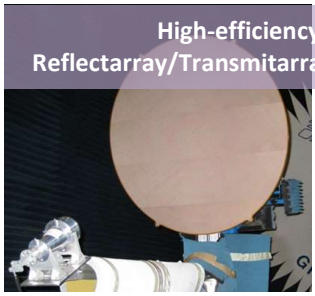


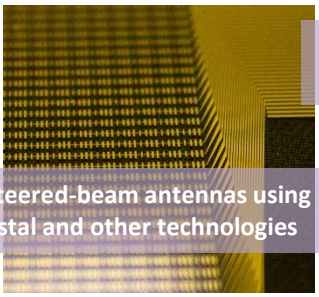
- Technological development of high-performance passive reflectarray antennas for space and 5G communications, as well as frequency selective surfaces (Mars Express dichroic subreflector).
- Design, manufacture and measurement of low cost antennas and liquid crystal sensors in millimeter and sub-millimeter waves, as well as using other technologies (diodes, MEMS, graphene).
- Design and development of passive microwave and millimeter wave components (filters, multiplexers, orthomode transducers, power combiners) based in waveguide technology for satellite applications (Hispasat 1B, Eutelsat W2A, Astra 3B, Rosetta).
- Development of efficient CAD tools for the design of passive microwave and millimeter wave components.

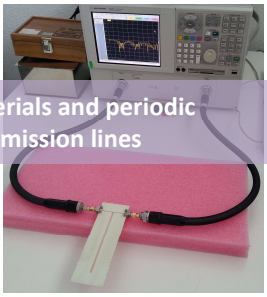


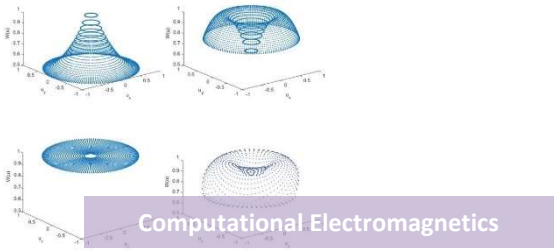


Research areas associated with Big Science









Main projects in Big Science

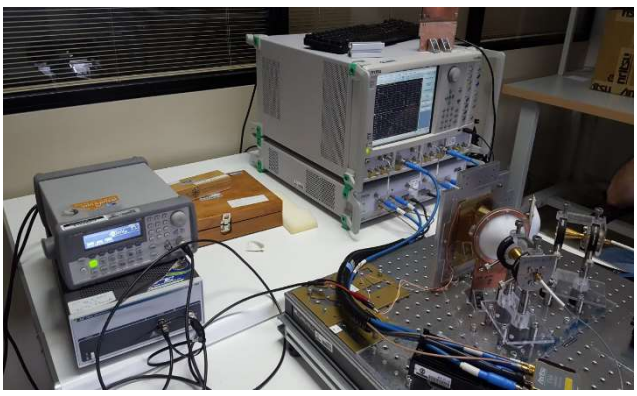
- ***ARIADNE*** *(Artificial Intelligence Aided D-band Network for 5G Long Term Evolution), H2020 5G PPP, European Commission: different technologies are developed and integrated (Artificial Intelligence, Machine Learning, Radiofrequency above 100 GHz) for wideband wireless communication systems, beyond 5G.*
- ***MARTA*** *(Multiple Beam Antennas based on Reflectarrays and Transmitarrays), ESA: it was demonstrated that the number of antennas in satellites to provide a multi-spot coverage for wideband Internet access (using 2 frequencies and 2 polarizations), can be reduced from 4 reflectors to 2 multi-beam reflectarrays, each one generating all the beams for RHCP and LHCP.*
- *Compact K/Ka band antenna feed for multi-beam satellite communications, ESA: the main objective is the development of dual-band (K/Ka) antenna feeders for communication satellites.*
- ***RAIPAD*** *(Reflectarray Antennas with Improved Performances and Design Techniques), ESA: a final antenna breadboard (BB) of 1.1-m diameter has been designed , manufactured and tested to provide the "South Pan–American mission (PAN–S)" on the Amazonas satellite operating in Tx (11.7–12.2 GHz) and Rx (13.75–14.25 GHz).*

Collaboration with Large European Scientific Facilities

- ***ESA****, Fraunhofer Institute, French National Centre for Scientific Research (CNRS), Airbus Defense & Space, Thales Alenia Space.*

Software, tools or licenses to be applied to Big Science

- *GEA has developed specific software tools for the design of reflectarray antennas for two space applications: a) contoured beams in Ku-band for DBS and b) multi-spot beam in Ka-band.*



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