



Pole for Doctoral Studies
Center for Doctoral Studies
Sciences and Technology and Medical Sciences

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

Mrs Oumaima NAYAT ALI

Will present his research work with the aim of earning a
Doctorate

Doctoral program: **Mathematical and Physical Sciences and New
Technologies**

Discipline: Physics

Specialty: Electronics and Telecommunications

On 13/09/2025 at 11H00 at the Defense room of the Faculty of
Sciences of Tetouan

Under the theme

**Deisgn of Low Cost Circularly Polarized Antennas with
Beamsteering Capability.**



Front of the jury composed of:

First Name & Last Name	Establishment	Designation
Pr. Mohammed ESSAAIDI	ENSIAS Rabat, Mohamed V University	President
Pr. AMAR TOUHAMI Naima	FS Tetouan, Abdelmalek Essaadi University	Reviewer
Pr. Mohssin AOUTOUL	FS El Jadida, Chouaib Doukkali University	Reviewer
Pr. Alia ZAKRITI	ENSA Tetouan, Abdelmalek Essaadi University	Reviewer
Pr. Mohsine KHALLADI	FS Tetouan, Abdelmalek Essaadi University	Examiner
Pr. Asmaa ZUGARI	FS Tetouan, Abdelmalek Essaadi University	Examiner
Pr. Mariem AZNABET	FS Tetouan, Abdelmalek Essaadi University	Co-Adviser
Pr. Otman EL MRABET	FS Tetouan, Abdelmalek Essaadi University	Supervisor

Research Laboratory: Intelligent System Design

Abstract



Antennas with beam steering capability have gained a lot of interest during the last decade and are being widely used in satellite communications, weather surveillance radars, and military radar systems owing to their ability to tackle many problems that wireless communications can suffer nowadays. In this thesis, a novel circularly polarized antenna with four ports and loaded with complementary split ring resonator (CSRR) for beam steering applications without phase shifters or PIN diodes is presented. The single antenna loaded with CSRR is arranged in a rotational manner forming a 4-port structure. The separation distance among the four antennas is optimized for achieving a steering angle of 28° with an isolation level greater than 25-dB over the whole bandwidth. When one of the four antennas is excited, the others either open-circuited or terminated to a $50\text{-}\Omega$ impedance, the antenna has a resonant frequency of 5.8 GHz and produces a left-hand circularly polarized (LHCP) tilted beam in the elevation plane. The introduction of the CSRR leads to achieving a small design and also to get circular polarization characteristics. The beam steering capability is originated from the mutual coupling with other antennas. The proposed structure has been fabricated and characterized experimentally. The measured results show a radiation efficiency of 90% and a gain of 6 dBi over the whole bandwidth. This characteristic can be tuned which makes the proposed design suitable for many modern communication systems.

Keywords: Circularly Polarized Antenna, Beamsteering, Metamaterials, CSRRS.