

# IMS2025 Student Design Competition

## IEEE IMS 2025 San Francisco, CA

### Miniaturized Magnetoceramic Composite Antenna

TC13 – Microwave Control Techniques Committee

#### Detailed description and rules

##### Introduction

Miniaturized antennas for VHF (30-300 MHz) and UHF (300 MHz-3 GHz) are increasingly important due to the growing demand for compact, portable communication devices, particularly in defense, aerospace, and consumer electronics. Reducing antenna size without sacrificing performance allows devices to be more versatile, lightweight, and easier to integrate into systems like UAVs, handheld radios, and IoT devices. As a result, engineers are required to rethink the designs of antennas with novel (off-the-shelf) components such as Rogers MAGTREX 555. The competition will consist of a Rogers' provided sample of (12" x 18") MAGTREX 555 material to develop a 400 MHz antenna with the goal of reaching a miniaturization factor of five times less than that of the wavelength at 400 MHz.

##### Design specifications and rules

Participants must simulate and design a 400 MHz antenna with the goal of reaching a miniaturization factor of five times less than that of the wavelength at 400 MHz. The antenna must use the MAGTREX 555 materials, however additional multiple materials may be used to meet the metrics. Participants must be able to connect the antenna using an SMA connector to a VNA to measure performance (S11) during the competition (SMA adapter will be available during the competition).

Request of MAGTREX555 substrate: Participants can request for MAGTREX555 substrates to build up an antenna prototype but must submit simulations of the antenna designed to [yajie.chen@rogerscorporation.com](mailto:yajie.chen@rogerscorporation.com). The offered MAGTREX555 substrates are either 1.5mm or 2.5 mm in thickness with double sided copper cladding.

##### Evaluation process

The simulations and designs will be evaluated by a commission at IMS 2025 based on measurements taken on site. For the evaluation, only small signal parameters and the antenna design will be considered. In case of equal or very close results, the jury may consider additional criteria such as practicability and quality of workmanship. The performance will be evaluated based on the following:

Measurement	Metric
Resonant Frequency	400 MHz
Return Loss	< -15 dB
Voltage Standing Wave Ratio	<2:1
Impedance	50 Ohms
Size	<14 cm a side (assuming a square patch)

##### Scoring

Scoring will be done based on the following weights.

Measurement	Metric	Score Weight %
Resonant Frequency	400 MHz	25%
Return Loss (BW)	< -15 dB	20%

Voltage Standing Wave Ratio	<2:1	10%
Impedance	50 Ohms	10%
Size	<14 cm a side (assuming a square patch)	10%
Efficiency	Simulated	5%
Gain	Simulated	5%
CP or LP	Simulated	5%
FOM (BW*Effi)/Vol	Simulated (average efficiency)	10%

## Name and number of supporting MTT-S Technical Committee

MTT TC-13 Microwave Control Techniques Committee

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