

IMS2025 Student Design Competition

IEEE IMS 2024 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 MAGTRES 555. The competition will consist of a Rogers' provided sample of (12" x 18") MAGTRES 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 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 be manufactured as a single body using only the MAGTRES 555 materials. 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).

Evaluation process

The 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	< -15 dB	12.5%
Voltage Standing Wave Ratio	<2:1	12.5%
Impedance	50 Ohms	25%
Size	<14 cm a side (assuming a square patch)	25%

Name and number of supporting MTT-S Technical Committee

MTT TC-13 Microwave Control Techniques Committee

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Contact information

MTT-13 TC

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Participation estimate

New Competition:

Amir Mortazawi, University of Michigan, USA

Yuanxun Ethan Wang, University of California, Los Angeles, USA

Jonathan Chisum, University of Notre Dame, USA

Dimitra Psychogiou, University College Cork, Ireland, USA

Bartlomiej Salski, Warsaw University of Technology, Poland

Grzegorz Fotyga, Gdansk University of Technology, Poland

Xun Gong, University of Central Florida, USA

Piotr Kulik, University of Central Florida, USA

Guoan Wang, University of South Carolina, USA

Equipment information

- **A VNA up to a minimum of 2 GHz (Keysight IMS model is acceptable or NanoVNA)**
- **A variety of SMA/RP-SMA connectors adapters kit.**
- **A MAGTREX 555 Antenna provided by Rogers that meets all the specs.**
- **A 400 MHz Antenna using a classical substrate that meets all performance (Except Size Requirement) Will be used to compare size reduction of participant antenna.**