



## 2024 IEEE AP-S Student Design Contest

# Use of nanoVNA to demonstrate robust on-body antennas for communications, energy harvesting, and other applications

Travel to the 2024 IEEE AP-S and win up to US \$1,500!

Join the 15<sup>th</sup> IEEE Antennas and Propagation Society (AP-S) Student Design Contest! Build and design a system that utilizes a nanoVNA to demonstrate flexible robust on-body antennas for communications, energy harvesting, and other applications. The top 6 teams will receive travel funds to attend the IEEE Antennas and Propagation Symposium in Florence, Italy, July 14–19, 2024 to demonstrate their working systems. 1st, 2nd, and 3rd place winners will be announced at the 2024 IEEE AP-S Awards Presentation at the conference and will receive cash awards of US \$1,500, \$750, and \$250, respectively.

Important deadlines (see next page) are **December 31, 2023, and May 20, 2024.**

**Goal: Propose a setup using nanoVNA that demonstrates live impedance measurements and stability, miniaturization, and radiation efficiency of flexible on-body antennas in a practical application and provide educational material to explain it.**

### Specifications

- The setup must be able to visualize/demonstrate a practical application of the on-body antennas for communications and energy harvesting of your choice using nanoVNA.
- You can choose the maximum frequency allowed by the nanoVNA in any ISM band.
- The results must be displayed in real time, with easy visualization (e.g., on a computer, a tablet, or a mobile phone.)
- The setup and procedure must be easy to understand for non-specialists.
- The setup must be easy to reproduce in a classroom.
- The teams must explain the theory behind their demonstration setup in a simple way, so that it can be understood by non-engineers.
- Provide step-by-step instructions to allow reproducing the system for anyone who wants to use it for teaching purposes.
- Merit will be assigned to designs based on the following criteria, equally weighted:
  - Creativity and justification of the design and its application.
  - Capability of the system to show practical energy harvesting or communication of on-body antennas application.
  - Quality of the experimental setup and results of using nanoVNA as power source and measurement.
  - Educational value and clarity of the DIY/demonstration instructions.
- Existing licensed software at the university (e.g., electromagnetic simulation software) or free software may be used. Any other commercial software used for the project should be included in the budget. The total production cost for the entire system must be less than US\$1,500.

## Eligibility

The team should consist of 2 to 5 students, with at least 50% being undergraduate students. For a 5-year Bachelor-cum-Master degree program, students in years 1 to 3 are considered undergraduates. Each team should be advised by one professional mentor who is a member of the IEEE AP-S, but the work needs to be done primarily by the students. No student or mentor should be involved in more than one team.

## Application and Review Process

1. All applicants must submit a preliminary design by **December 31, 2023**. It must include:
  - a. A proposal limited to **four pages** and in 12-pt Times New Roman font that includes:
    - i) A detailed description of the setup and the properties to be measured.
    - ii) A detailed description of the system to be built.
    - iii) A bill of materials (up to US \$1,500).
  - b. A letter from a professional mentor, such as a professor or engineer in industry, indicating agreement to supervise the project (the students being mainly responsible for doing the work). The mentor must be an AP-S member (please provide IEEE membership number) and must verify that all team members are graduate or undergraduate students at a university, college, or technical school. The proposal and letter must be integrated into a single PDF file named **TeamName.pdf**.
2. The team of reviewers will assess each preliminary design based on the likelihood of achieving the design goal and the specifications, as well as the creativity of the project and the quality of the written materials. Six semi-finalist teams will be selected by **January 20, 2024** and will receive US\$1,500 each to build and test their designs.
3. The six finalist teams will receive stipends of up to US\$5,000 per team to travel to and attend the IEEE AP-S Symposium. The stipend is intended to cover equipment shipping costs and all expenses for one team representative; however, it may be divided among multiple team members. Additional funds may be available to support teams with large travel distances. Please contact the Student Design Contest Coordinator for details.
4. Each of the six semi-finalist teams must submit their final design by **May 20, 2024** in the form of a video demonstration of the working system ( $\leq 10$  minutes), step-by-step instructions to replicate the system ( $\leq 5$  pages) in PDF format ( $\leq 5$  MB file size), and a final report ( $\leq 5$  pages) in PDF format ( $\leq 5$  MB file size). Submission instructions for the video demonstration will be provided later (some videos from previous contests are available on YouTube – in the IEEE AP-S Student Design Contest Channel. The report should follow the two-column format of the IEEE Transactions on Antennas and Propagation and include:
  - i) A detailed description of the system's measurement capabilities
  - ii) An easy-to-understand explanation of the theory behind the measurement system
  - iii) A list of parts and materials required, including where to obtain them and costs.
  - iv) Photos of the final system.
  - v) Measurement results obtained using the system.
  - vi) Biographies (100 words or less each) and photos of all design team members.
5. The finalists will be expected to demonstrate their working systems during the Symposium and attend the Awards Banquet. Two celebratory dinner tickets will be reimbursed per team, for one team member and the team mentor. Each team should bring all necessary equipment for the demonstration.
6. Several Design Contest Judges will be appointed to assess each design based on achieved performance, creativity, completeness of the description, functionality of the system as determined by the video, and quality of written materials. The Design Contest Judges will assess the final demonstrations and take into account the final reports to select the 1st, 2nd, and 3rd prize winners, who will receive certificates and cash prizes of US \$1,500, \$750, and \$250, respectively. The prize winners will be announced at the Awards Presentation during the symposium.

## How to Submit Materials

Send all questions and materials to **designcontest2024@ieeeaps.org** with the subject line "2024 IEEE AP-S Design Contest." **Messages without this subject line may not be received.** All submitted materials must be in PDF format according to the guidelines above.