2027 IEEE AP-S Student Design Contest

Reconfigurable Receiving Antennas for Integrated Sensing and Communications (ISAC)

Travel to the 2027 IEEE AP-S and win up to US $1,500!

Join the 18th IEEE Antennas and Propagation Society (AP-S) Student Design Contest! Design a dual-mode, reconfigurable receiving antenna system for ISAC that utilizes unmodified, commercial off-the-shelf (COTS) transmitters, such as Wi-Fi routers or Bluetooth beacons, as ambient signal sources, propose a setup to demonstrate its utility, and provide educational material to explain it. To ensure compliance with local regulations, the student-designed hardware must operate as a receiver. The antenna system must dynamically switch between sensing and communication modes. The top 6 teams will receive travel funds to attend the IEEE AP-S Symposium in Kyoto, Japan (June 20–25, 2027) to demonstrate their working systems. 1st, 2nd, and 3rd place winners will be announced at the 2027 IEEE AP-S Awards Presentation during the conference and will receive cash awards of US$1,500, $750, and $250, respectively.

Important deadlines (see next page) are **December 31, 2026** and **May 24, 2027**.

Specifications

- The demonstration setup must showcase the two operational modes of your reconfigurable receiving antenna system, utilizing unmodified COTS transmitters (TXs) of your choice (such as Wi-Fi routers or Bluetooth beacons; single or multiple TXs) as ambient signal sources. In Sensing mode, the antenna system treats existing ambient EM signals as “illuminators of opportunity.” Working in tandem with a basic signal-processing backend, the antenna must optimize its characteristics to detect or track environmental changes, such as human movement or object positioning. In Communication mode, the antenna focuses on establishing a robust data link with a specified COTS TX. The system must dynamically direct its main beam toward the desired TX while simultaneously placing pattern nulls or utilizing polarization mismatch to suppress strong, direct-path interference from other ambient communication sources.
- Students can also consider demonstrating the communications and sensing aspects simultaneously.
- To comply with local radio regulations, the student-designed hardware must operate strictly as a receiver. Any RF transmitter used during the final on-site demonstration must comply with applicable Japanese radio laws. Examples of acceptable ambient signal sources include commercially available Wi-Fi routers or Bluetooth beacons certified for use in Japan, as well as smartphones operating in standard mobile hotspot (tethering) mode.
- Many low-cost RF circuits, modules, and even nano-VNAs are now commercially available. Teams can consider cleverly using these off-the-shelf components to build their system.
- Performance metrics/results must be displayed in real time, with easy visualization.
- The setup and procedure must be easy to understand for non-specialists and easy to reproduce in a classroom.
- The teams must explain the theory behind their demonstration setup in simple terms for non-engineers.
- Provide step-by-step instructions so others can replicate the system 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 demonstrate its reconfigurability and the two operational modes
  - Quality of the experimental setup and results
  - Educational value and clarity of the DIY/demonstration instructions
- Existing licensed software at the university or free software may be used. Any other commercial software used should be included in the budget. The total production cost for the entire system must be less than US$1,500.

Eligibility

The team must consist of 2 to 5 students, and at least 50% of the team members must be undergraduate students by the end of May 2027. 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, 2026 (GMT-10)**. It must include:
   a. A proposal in pdf limited to **FOUR pages** and in 12-pt Times New Roman font that includes:
      i) A detailed description of the demonstration setup and quantities to be measured and/or postprocessed.
      ii) A detailed description of the antenna 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) and to advance any initial system-building costs, if necessary. The mentor should regularly monitor the team's progress to ensure the project is completed on time. 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.
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 22, 2027**, and will receive US$1,500 each to build and test their designs.
3. The six semi-finalist teams will receive stipends of up to US$10,000 per team to attend the IEEE AP-S Symposium. These funds will be provided upon the submission of their final materials and visa application confirmation letters. The stipend is intended to cover equipment shipping costs and all expenses for two team representatives (at least one of them must be an undergraduate student). This amount can be divided among multiple team members.
4. Each of the six semi-finalist teams must submit their final design by **May 24, 2027,** in the form of a video demonstration of the working system (≤ 10 minutes), step-by-step instructions to replicate the system (≤ 5 pages) in PDF format (≤ 5 MB file size), and a final report (≤ 5 pages) in PDF format (≤ 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) Detailed description of the antenna system's capabilities for ISAC.
   ii) An easy-to-understand explanation of the theory behind the antenna system and the demonstration setup.
   iii) A list of parts and materials required, including where to obtain them and costs.
   iv) Photo(s) of the final system and demonstration setup.
   v) Simulation and measurement results of the antenna system.
   vi) Biographies (100 words or fewer each) and photos of all team members.
5. Semi-finalist teams must commit to completing their projects, submitting all required materials, and attending the Symposium to demonstrate their working systems and participate in the Awards Ceremony. Each team should bring all necessary equipment required for their demonstration.
6. Several judges will be appointed to evaluate each design based on achieved performance, creativity, system functionality, educational value, and quality of final materials and on-site demonstration. Based on these results, the judges will select the 1st, 2nd, and 3rd place 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

Proposals must be submitted by a student member of your team through the provided link https://ieeeaps.wizehive.app/program/ieee-aps-sdc/info. All submitted materials should be in PDF format, following the guidelines above.

For all inquiries, please contact **designcontest@2027.apsursi.org**, using '*2027 IEEE AP-S Design Contest TeamName*' as the subject line. **Messages without this subject line may not be received**.