Rev. 2016-10-26

IMS2017 Student Design Competition Rules

As part of the technical program, the Student Design Competition (SDC) is one of the most energetic parts of IMS. The SDCs have proven to be very successful events in the past 12 years, as evidenced by the ever increasing student participation and the support it has enjoyed from the organizers, both logistically and financially. The IMS2017 in Honolulu will continue the legendary tradition of enthusiasm with a very strong SDC program.

TC number and name:

MTT-26 WIRELESS ENERGY TRANSFER AND CONVERSION

The title of Student Design Competition:

Wireless Power Transmission (WPT) Design Competition

Submission Deadline: Friday, 31 March 2017

Sponsors:

MTT-26 Wireless Energy Transfer and Conversion
MTT-10 Biological Effects and Medical Applications
MTT-20 Wireless Communication

Competition Coordination:

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A short abstract or summary describing the competition:

Competitors are required to design, construct, measure, and demonstrate a wireless power transmission link between two resonant coils. This project will introduce students to the concept and implementation of LC resonators, Q factor and mutual coupling toward efficient energy transfer. Power transfer efficiency (as defined in rules) and novelty of the design will be the leading criteria in selecting the winning design. Testing and judging of the prototypes will be performed at the International Microwave Symposium. A member of the design group must be present at the testing to assist with the evaluation. The winners of the competition will be recognized at the Student Awards Luncheon at the 2017 International Microwave Symposium. Faculty members are encouraged to introduce this as a project for their students in order to acquaint them to electromagnetic & lumped element component design. This competition is sponsored by the technical committee on Wireless Energy Transfer and Conversion (MTT-26), Biological Effects and Medical Applications (MTT-10) and Wireless Communication (MTT-20).

Design Specification/Rules:

1. Any technology may be used for the design, but must be the result of student effort.
2. Use of commercially available components is allowed.
3. The demonstrator shall allow for internal inspection by the judges.
4. Three coils are to be fabricated with the highest Q factor at 6.78MHz. Coils must be fabricated with resonant capacitors and be presented ready to test as 6.78 MHz resonators.
    a. Coil A: 80 mm x 50 mm x 5 mm (size of a smartphone)
    b. Coil B: 80 mm x 50 mm x 5 mm (same as coil A)
    c. Coil C: 10 mm x 5 mm x 2 mm (size of a swallow device)
5. The fabricated resonant coils will be tested on two setups:
    a. Biomedical application: transmission efficiency from coil B and to coil C will be measured, while the distance between the two coils will be fixed at 50mm. Coil C will be encased in a phantom that mimics the body tissues. This setup aims at simulating a WPT receiver coil implanted at about 5cm into the body. You do not need to encapsulate your coils because the phantom will consist of separate bags of saline water which will be placed around your coils. The phantom is comprised of 0.4% NaCl + 99.6% DI water (the percentage is by weight) resulting in a dielectric constant of around 81 (Tolerance in NaCl concentration on the day of the competition will affect the effective dielectric constant. Be ready to re-tune your coil on the D-Day).
    b. Consumer electronics application: while transmission efficiency from coil A to coil B will be kept at 50%, the distance between the two coils will be measured.

6. It is expected that entrants will measure their wireless links using a 50 Ohm VNA by measuring the magnitude of $|S_{21}|^2$ at 6.78 MHz. This will not necessarily load the link optimally and so, whilst it is not expected that students have access in their home laboratories to more sophisticated measurement equipment, at IMS, a Keysight ENA network analyzer with 006 WPT option will be available to fully analyze the link at both 50 Ohms and with an optimal load and/or source impedances.
7. All the coils shall have a SMA connector (not considered for the volume limit)
8. Testing and judging of the harvesters will be performed at the 2017 International Microwave Symposium. A member of the design group must be present at the testing to assist with the evaluation. Only one set of coil A, B and C per participating group is allowed.
9. Contestants should prepare a small poster (A3 size) describing the specificities of their prototype and their designing experience: the tradeoff they have been facing and justifying their choices. They should be able to answer the judge's questions regarding the design.
10. A judge cannot assign a grade to a design originating fully or partly from its university.
11. Few tuning minutes are given to each team prior the measurement perform by the judges. Each official measurement will be done once. No tuning is allowed after the official measurement is conducted. The decision of the judges shall be final.

Evaluation Criteria:

1. Distance/transfer efficiency will be used as the first judging criteria
2. Additionally the judges will assign the coils a grade based on their designing process presented in their poster
3. Distance/transfer efficiency and the grade will be summed up to provide the final mark that will be used to designate the winning design

Prizes:

This will be a two-level contest with graduate and undergraduate students competing for distinctive prices:

1. Best undergraduate design for consumer electronics application: $500
2. Best design for consumer electronics application: $750
3. Best design for biomedical application: $750
4. The teams that will demonstrate the best performances will be given the opportunity to publish a common paper describing their designs in microwave magazine.

Any further questions regarding this competition can be addressed to the competition organizers.