IMS2018 Student Design Competition Rules

TC number and name:

MTT-5 MICROWAVE HIGH-POWER TECHNIQUES

Title of Student Design Competition:

14th High Efficiency Power Amplifier Student Design Competition
(IMS2018 – 14th HEPA-SDC)

Submission Deadline:

Sunday, 1 April 2018

Sponsors:

MTT-5 Microwave High-Power Techniques

Primary contact name(s), email address, and phone number of host or competition leader(s)

James Komiak	HEPA-SDC Coordinator 603-885-6910, james.j.komiak@baesystems.com
Kamal Samanta	HEPA-SDC Judge kmlsamanta@googlemail.com

A short abstract or summary describing the competition:

MTT-5 (High Power Amplifier Components and Techniques Committee) is pleased to announce the fourteenth High Efficiency Power Amplifier (HEPA) Student Design Competition (SDC) will take place at the 2018 IEEE MTT-S International Microwave Symposium (IMS) in Philadelphia, Pennsylvania on Tuesday, 12 June 2018. This competition is open to all students, both undergraduate and graduate, registered at a recognized educational establishment. This year's contest will focus on PAs having both high efficiency and linearity. The competitors are required to design, construct, and measure a highly efficient, linear PA at a

frequency of their choice between **1 GHz** and **10 GHz**. To qualify for the linearity test, the PA must produce an output power of at least 4 watts, but no more than 40 watts, when excited by a single carrier at the frequency of test. All linearity testing will be conducted using two equal amplitude carriers spaced 5 MHz apart. To qualify for the linearity measurement, with 0 dBm per tone input, carrier-to-intermodulation ratio (C/I) must be greater than 30 dB*.

The winner will be the PA that demonstrates the highest power added efficiency (PAE) when producing a two-tone carrier-to-intermodulation ratio (C/I) of 30 dB*.

A representative of the design group must be present at the testing to assist with the evaluation. Each team is limited to a maximum of two entries.

* C/I is based on the ratio expressed in dB between the amplitude of either carrier and the highest intermodulation product. PAE will be measured at the first output power with increasing Pin from 0 dBm where this ratio falls below 30 dB.

Design Specification/Rules

1. The power amplifier (PA) design may use any type of technology, but must be the result of new effort, both in the amplifier design and fabrication.
2. The PA mechanical design should allow for internal inspection of all relevant components and circuit elements. The RF ports should be SMA female connectors. Bias connections should be banana plugs.
3. The PA should require a maximum of two dc supply voltages for operation.
4. The PA must operate at a frequency in the range of 1 GHz to 10 GHz, and have an output power level when excited by a single carrier of at least 4 watts, but no more than 40 watts at the frequency of test.
5. All PAs should require less than 24 dBm of input power to reach the minimum 4 watt output power when excited with a single carrier.
6. Measurements will be made by the judges only. A team representative must be present at testing to provide information on connections, design frequency, and expected output power level.
7. All linearity measurements will be performed under CW two-tone operation with two equal amplitude carriers spaced 5 MHz apart at room ambient

conditions into a 50 ohm load. Only the power at the two fundamental carrier frequencies will be included in the measurement of output power.

8. Linearity measurements will be conducted with a maximum of 21 dBm input power per tone. The tone power will be swept from 0 dBm to 21 dBm and the C/I ratio measured.
9. The winner will be based on the amplifier's PAE measured during official testing at the lowest power level for which the C/I ratio* equals 30 dB. If the C/I ratio is better than 30 dB over the entire testing range, the measurement at 21 dBm input power per tone will be used. The figure of merit for scoring will be the PAE multiplied by a frequency weighting factor having the form (GHz)^0.25.
10. A student group may enter a maximum of 2 PAs, but can receive an award for only one PA.
11. Team size will be up to 4 students.
12. The decision of the judges will be final. Awards from IMS and industry will be presented at the Student Awards Luncheon.
13. Student contestants must notify the MTT-S committee by e-mailing Jim Komiak < james.j.komiak@baesystems.com> of their intention to compete in the contest before Sunday, 1 April, 2018. This notification must include information on the University or educational affiliation of the entry, the name and contact information of the group's adviser, and the PA's approximate output power level, dc voltage requirements and frequency of operation.

* C/I is based on the ratio expressed in dB between the amplitude of either carrier and the highest intermodulation product. PAE will be measured at the first output power with increasing Pin from 0 dBm where this ratio falls below 30 dB.

Prizes:

The team with the winning PA design, as measured at IMS and determined by the judges, will receive a prize of $2,000, and will be invited to submit a paper describing the design for the MTT-S Microwave Magazine.

Modelithics will award their high precision PA model software awards to the top three (3) PA teams.

National Instruments (formerly AWR Corporation) will award 1-year complimentary licenses of its NI AWR Design Environment software to the top three (3) placing teams.

Modelithics, *Agilent* and *National Instruments* offer design software assistance to all competitors.

EMC Technology / Florida RF Labs offers a high frequency passive component kit consisting of couplers, terminations, resistors, and attenuators to each student team.

RFMW offers discounts for PAs and components to the student competitors.