High-Performance Optoelectronic Oscillator

Sponsoring MTT-S Technical Committee

MTT-3 (Microwave Photonics)

Coordinator(s)

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Competition Description and Rules

In this competition, each contestant team is required to design an optoelectronic oscillator (OEO) loop with no laser source. An external laser source will be provided at the competition site. If the designed OEO loop is connected to the external laser source, it should be able to oscillate in the frequency range of 9-11 GHz. The generated microwave signals should have the minimized phase noise and frequency drift and maximized side-mode suppression. The contestants are encouraged to design their own solutions for the specified OEO loop.

The optoelectronic oscillator must be securely mounted in a package. It should have one optical FC/APC connector for optical input, an SMA connector for RF output, and up to three banana plugs for DC power supply voltage input. The contestants should choose the most suitable DC power supply voltages within ±12 volts. An external laser source and 4 sets of DC power supplies will be provided at the competition site. The committee will use a signal source analyzer to evaluate the output microwave signal.

An optical delay line or a phase shifter can be inserted in the designed OEO, allowing the adjustment of the relative phase conditions. Electronic amplifiers can be used in the loop to boost the power of the microwave signal.

The design specifications for the OEO are:

- Oscillation frequency: 9 to 11 GHz (select one)
- Time for self-starting procedure: <10 min
- Peak RF power output: >0 dBm
- Phase noise performance: <-100 dBc/Hz@ 1 kHz; <-120 dBc/Hz@10 kHz
- Frequency stability: $<10^{-8}$@1min
- Side mode suppression: >50 dB

Evaluation Criteria

1. Has the OEO met specifications? Yes=40%; No =0 %

2. Phase noise performance (20%): The phase noise is measured by the signal source analyzer when the supplies of the OEO have been powered on for 10 min. The optical input power from the external laser source is fixed at 80 mW (or other value depending on the parameters of the laser source at the competition site). The worst phase noise at the 10-kHz frequency offset will be recorded for comparison. (For example, if the phase noise varies between -130 dBc/Hz to -145 dBc/Hz @ 10 kHz, then the worst-case phase noise -130 dBc/Hz will be used for comparison between the submitted designs.)
3. Frequency stability (20%): The frequency stability is defined as the capability of the OEO to maintain its designed frequency, and expressed as the maximum percent deviation from the designed frequency value. The frequency stability should be maintained under a temperature fluctuation of over 20 °C in 5 min (a hair dryer will be used to change the temperature).
4. Side mode suppression (20%): The side mode suppression is measured by the electrical spectrum analyzer or the signal source analyzer when the proposed OEO is working in the steady state. The side mode suppression is defined as the power ratio between the oscillation frequency and its side modes. In the event of a tie, the fiber length used in the OEO, which could be evaluated by the free spectrum range through the phase noise spectrum, will be the tie-breaker and the decision of the MTT-3 committee is final and cannot be challenged.

How to Participate

The objective of the contest is to demonstrate new and effective optoelectronic oscillator scheme for microwave signal generation. Teams of up to 4 students are allowed to participate in this contest. The students must submit a signed statement from their academic advisor that the work is principally the effort of the students. At least one student member from the team must register for and attend the conference to demonstrate their design and the OEO at the IMS2019. The designs will be judged by members of MTT-3 using pre-defined criteria including phase noise, frequency stability, and side mode suppression. The students must submit entry materials by **March 15, 2019,** using the instructions posted on the IMS2019 Student Design Competition website. Please also send a copy of the form to the organizers of this competition using their contact information listed at the beginning of this document. The students should use the email address issued by their respective institutions for all communication regarding the competitions rather than their personal emails.

Student Eligibility Criteria

This contest is open to all who are enrolled as full-time students at a university during the time the work was performed. Students may enter as individuals or as a team of no more than four students.

Awards

The first and second place winning teams will receive a prize of $1500 and $500 (US), respectively.