



RF Power Amplifier Design and Integration for 4G/5G Applications

(December 17-21, 2017)

Venue: Indian Institute of Technology Roorkee, Roorkee-247667, Uttarakhand, India

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Overview

With the advent of upcoming wireless communication standards, the spectral, as well as energy efficiency both, are inevitable requirements. The exponential increase in data rate is presenting great challenges for radio frequency (RF) power amplifier designer to enhance efficiency over wide bandwidth. Moreover, spectral efficient modulation scheme such as quadrature amplitude modulation (QAM) and Orthogonal frequency-division multiplexing (OFDM) has high peak to average power ratio. These results into envelope varying signals driving the power amplifier inefficiently at average power backed-off from its saturation. Therefore, proper efficiency enhancement technique must be deployed to handle such signals over wider bandwidth. Moreover, due to unavailability of wide bandwidth at existing communication bands, it is expected that 5G will exploit mm-wave bands to achieve gigabit experience. This makes the scenario quite challenging for RF power amplifier designer due to several technological challenges in designing RF circuits at mm-wave frequencies.

This course will focus on design challenges related to various classes of RF power amplifier including high efficiency switch mode amplifiers. The latest schemes for extending bandwidth in such power amplifiers will also be discussed along with dynamic range as well as bandwidth extension of Doherty Power amplifiers. This course will also cover expert talk from Industry on the latest state-of-the-art developments in microwave to sub-mm-wave technologies including multilayer miniaturized passives, and cost-effective multichip and system-on-package (SoP) modules.

This course is very useful for academicians as well industry designers since it involves basic background theory as well as hands-on training on design simulation using CAD tools. This course will also familiarize participants with various RF measurement techniques using hand-on training in RF instruments.

Objective:

The primary objectives of the course are as follows:

- i) Practical design approach for various RF power amplifiers.
- ii) Providing exposure to mm-wave and sub-mm wave technologies along with circuits and systems.
- iii) Enhancing the capability of the participants to understand the challenges faced by power amplifier designers for applications such as 4G/5G communication.

Course Information	Duration: Dec. 17 - Dec. 21, 2017
Modules	<p>Module 1: Introduction to RF active circuit design and RF network analysis Module 2: Nonlinear analysis of RF power amplifier and Transmit/Receive module design Module 3: Microwave and mm-wave circuit integration and packaging Module 4: High efficiency switched mode power amplifiers Module 5: Efficiency enhancement techniques in power amplifiers Number of participants for the course will be limited to fifty.</p>
You Should Attend If...	<ul style="list-style-type: none"> ▪ you are an electronics engineer or research scientist interested in designing RF active circuits such as RF power amplifier. ▪ you are RF design engineer or research scientist interested in advance power amplifier design such as switch mode power amplifiers, Doherty Power Amplifier, Chirex outphasing power amplifiers etc. for defence and wireless industry. ▪ you are a student or faculty member from academic institution interested in learning how to design RF active circuits with hands-on training in CAD simulation of power amplifier design. ▪ you are RF design engineer or research scientist interested in hands-on training in RF characterization and measurements of RF power amplifier useful for wireless communication.
Fees	<p>The participation fees for attending the course is as follows:</p> <ul style="list-style-type: none"> • Participants from abroad: US \$500 • Industry/ Research Organizations: Rs. 15000.00 • Academic Institutions (Faculty): Rs. 7000.00 • Academic Institutions (Students): Rs. 5000.00 <p>➤ Students have to show the proof of their full time student enrollment in academic institute.</p> <p>The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility.</p> <p>Fee does not include accommodation and food. On request basis, participants may be provided with accommodation on payment basis.</p> <p>Note: Accommodation: 1. The registration fee should be sent in advance through bank draft drawn in favor of "Dean SRIC, IIT Roorkee" and payable at Roorkee latest by Dec. 7, 2017. 2. The Complete form along with payment may please be sent to: Dr. Karun Rawat, Department of Electronics and Communication Engineering, IIT Roorkee, Roorkee-247667, Uttarakhand, e-mail: karunfec@iitr.ac.in, karun.rawat.in@ieee.org</p>

The Faculty



Dr. Kamal K Samanta graduated in Science (Phy Hons) and Engineering (ECE) before his double Masters in Management (R&D) and Technology (ECE) from the University of Calcutta, which followed his PhD degree in Microwave Eng. from the University of Leeds, England. For more than two decades, he has been extensively involved in a wide range of industrial R&D activities on advanced microwave and mm-wave fabrication processes, devices, circuits and systems, covering frequency MHz to 200 GHz and power from μW (MMICs) to Megawatts (SSPAs). His roles have included that of Senior Principal/Lead R&D - Engineer, -Scientist and -Consultant. The organisations he has worked for include Thales Aerospace, UK; European Aeronautics Defence and Space (EADS) Astrium (Airbus), UK; Indian Space Research Organization; IPR, Dept. of Atomic Energy, India; RFMD and Filtronics Compound Semiconductor, UK, and Milmega UK (GaN PA MMICs). Presently he is working for Sony Europe as a Chief Engineer and Technology Leader- mmW R&D, for next generation wireless communication.



Dr. Karun Rawat has received his PhD. degree in electrical engineering from University of Calgary, Canada in 2012, where he worked as a student research assistant and later Post-doctoral research fellow under the research grant of iCORE and CRC chair, Alberta, Canada. He is currently Assistant Professor in department of Electronics and Communication at Indian Institute of Technology Roorkee, India. Prior to this, he was Assistant Professor in Centre for Applied Research in Electronics, Indian Institute of Technology Delhi from 2013-2014 and scientist in the Space Applications Center, Indian Space Research Organization Ahmedabad, from 2003–2007. His research has resulted in more than 50 publications in journals and conferences and one published book. He has given several IEEE talks in India as well as abroad including workshops in power amplifiers at IEEE IMaRC 2014-2015 and IEEE APMC 2015, ARFTG 2016. Dr. Rawat is reviewer of several IEEE transactions. Dr. Rawat has received research production award for three consecutive years from 2009-2011 during his PhD. He also received best design prize in 3rd Annual Smart Radio Challenge in 2010. He is also member of the editorial board of Wiley journal in RF and Microwave Computer Aided Engineering (RFMiCAE).



Dr Pathak is currently working as Associate Professor in the Department of Electronics & Communication Engineering, Indian Institute of Technology Roorkee, Uttarakhand, India. He has received B. Tech. in Electronics & Telecommunication Engineering and M. Tech. in Electronics Engineering from University of Allahabad in 1998 and 1996 respectively. He completed his Ph.D. degree in the area of Millimeter-wave Integrated Circuits from Indian Institute of Technology Delhi in 2005. He has also held the position of post doctoral research fellow at 'NRD Super Broadband Research Centre, Tohoku Institute of Technology, Sendai, Japan', as well as Centre for Applied Research in Electronics (CARE), IIT Delhi. He is recipient of DST Fast Track Research Grant for Young Scientists (2007), IETE India National Research Fellowship in the area of 'Microwave and Radar Engineering' (2004, 2005) and DRDO, Government of India, 'Junior Research Fellowship' in the area of 'Integrated Optics' in the year of 1999. Dr Pathak has served as Vice Chairman of IEEE Microwave Theory and Techniques Society MTT-S Uttar Pradesh Chapter (2014-16), Faculty advisor, IEEE MTT-S IIT Roorkee student branch (2011-Till date), Coordinator student activities and member executive committee of IEEE Uttar Pradesh section (2015-16). He has acted as reviewer of several reputed journals including IEEE transactions and letters. Dr Pathak has guided 6 PhD theses and supervised 38 MTech dissertations in the area of RF -to- THz Integrated Circuits, Systems & Sensors. He has published more than 110 papers in reputed international journals and conferences and has one US patent to his credit.

Course Co-ordinator

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<http://www.gian.iitkgp.ac.in/GREGN>

Indian Institute of Technology Roorkee

Registration Form

RF Power Amplifier Design and Integration for 4G/5G Applications

(MHRD Scheme on Global Initiative on Academic Network (GIAN))

December 17 - 21, 2017

- Name
- Designation
- Affiliation
- Address for Correspondence
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- Email:
- Phone No:
- Accommodation required: **Yes / No**
- Type: Hotel/Hostel/Guest House (accommodation shared basis may be available @Rs. 500/
per day)
- Cheque/DD No.
- Dated for Rs.

Date

Signature of the participant

Note:

1. The registration fee should be sent in advance through bank draft drawn in favor of "Dean SRIC, IIT Roorkee" and payable at Roorkee latest by Dec 7, 2017.

2. The Complete form along with payment may please be sent to:

Dr. Karun Rawat, Department of Electronics and Communication Engineering, IIT Roorkee, Roorkee-247667, Uttarakhand, India, Ph.No.: (+91)- (0)1332-284830, e-mail: karunfec@iitr.ac.in, karun.rawat.in@ieee.org