



Radio Frequency (RF) Design for Wireless Telecommunication Products

30 Nov., 1, 7 & 8 Dec. 2007

An application has been submitted to the New Technology Training Scheme for this course to get endorsed. If successful, eligible participants may obtain up to 50% of course fee refund from NTTS

One of the most important applications of RF is in wireless telecommunication. Radio and TV broadcasting, cellular phones, cordless phones, pagers, wireless PDAs, Wi-Fi enabled computers, Bluetooth headsets, etc. are everyday examples of this.

In today's flourishing, yet highly competitive wireless products market the demand is strong for competent RF professionals who possess the knowledge and experience required for designing products in increasingly compressed timeframes. To remain competent these professionals have to continuously refresh their skills through training and other appropriate means.

Jointly organized by Hong Kong Productivity Council, Lexiwave Technology (Hong Kong) Ltd., and Hong Kong Science and Technology Parks Corporation, this 4-part modular course aims to provide participants with an insightful training on RF design from a practical, industrial perspective.

In addition to being led through a systematic, theoretical presentation with case studies on commercial products, participants will also take part in measurement demonstrations on the use of state-of-the-art RF equipment.

Who Should Attend

RF Designers, IC Designers, Wireless Product Designers, Field Application Engineers, Design Managers, Business Development Engineers and Managers, and related professionals.

Organizers:



Co-organizer:



Please circulate this leaflet to those who are interested.

Advanced & Manufacturing Technology



Course Structure

The course will be conducted by RF experts with rich local and overseas industrial experience. It comprises the following 4 independent parts and participants may choose to enroll in any or a combination of them.

PART I : RF SYSTEM DESIGN - 30 November 2007

Part I provides participants with a comprehensive account of the various functional blocks in a RF system, the associated design considerations, and other fundamental knowledge RF designers need to know.

RF System Design – VHF and UHF Low Power RF Transceiver

- Transmitter
 - ✧ Circuit Blocks (Oscillator; Modulator; Buffer Amplifier; Frequency Multiplier; Power Amplifier; Output Filter)
 - ✧ Major Design Issues (C/N; Modulation Depth; Voltage Gain; Power Gain; Power Efficiency; Harmonic Prevention and Suppression)
- Receiver
 - ✧ Circuit Blocks (Low Noise Amplifier; Local Oscillator; Mixer; IF Amplifier; Demodulator; Bassband Amplifier; Comander)
 - ✧ Major Design Issues (Gain / Intermodulation Balance; Bandwidth and Noise; Mixer Gain; Mixer Efficiency; IF Gain and Bandwidth; Baseband Bandwidth; S/N Optimization; Current Consumption)
- Frequency Synthesizer
 - ✧ Circuit Blocks (RF Oscillator; Buffer Amplifier; PLL Chip; Loop Filter; Quartz Crystal Oscillator)
 - ✧ Major Design Issues (Phase Noise; Channel Acquisition; Programming Technique; Frequency Stability; Temperature; Supply Voltage; Load Pulling)
- Antenna
 - ✧ External Antenna (Dimension; Connector Quality)
 - ✧ Internal Antenna (Dimension; Location; Spacing; Material; Matching)

PART II : RFIC DESIGN - 1 December 2007

Participants will first be given an overview of RFIC design, including design flow and relevant process technology; followed by a detailed presentation on various practical design issues and tips for critical RF building blocks such as LNA, Mixer and Biasing Circuits, and the use of CAD tools for simulation and layout.

RFIC Design – Basics and Building Block Design

- Basics of RFIC Design
 - ✧ Methodology and Considerations
 - ✧ Process Technology (Bipolar; CMOS; BiCMOS; SiGe BiCMOS)
- RFIC Building Block Design
 - ✧ LNA (Topology and Design Considerations)
 - ✧ Mixer (Topology and Design Considerations)
 - ✧ Voltage and Current Biasing (Bandgap; PTAT; Startup Circuitry)
- RFIC Design Flow and CAD Tools
 - ✧ RF and Analog Design Flows
 - ✧ Simulation and Layout Tools (Cadence; ADS; TopSpice; Tanner)

PART III : RF PCB DESIGN - 7 December 2007

The quality of Printed Circuit Board (PCB) layout has a determinant effect on the performance, stability and reliability of wireless products. Participants will learn in this part the various principles and techniques used in RF PCB Design.

RF PCB Design Techniques

- PCB for RF Circuits (SS / DS Component Placement; Best Utilization of Board Area; Arrangement of Layers; Trace Routing; Board Material / Characteristic De-sensitization; Grounding Plane; Power Line Routing and Power Plane; Decoupling; Via Holes; Shielding)
- PCB Design for Analog and Digital Circuits
 - ✧ Analog Circuits (Isolation of Weak and Strong Signals and Noise; Differential Pair; Linear / Switching Power Supply)
 - ✧ Digital Circuits (Digital Noise; Trace Length Equalization; Decoupling)
- Electromagnetic Compatibility Issues
 - ✧ EM Interference (Prevention and Suppression)
 - ✧ EM Susceptibility (Anti-jamming Improvement)
 - ✧ Electrostatic Discharge (Component Location; Grounding and Trace Routing)
- Mechanical Design (Chassis Design for Maximum Board Area; Placement of Antenna, I/O Connectors and other Components; Ventilation, Heat Transfer and Thermo Relief)
- PCB Design for Mass Production (DS / SS Surface Mounted Components Placement for Wave Soldering / Reflow Soldering; Penalization / Breakaway / Fiducial Marks; Test Points and Test Pins)

PART IV : RF INSTRUMENTATION and MEASUREMENT - 8 December 2007

Measurement is a cornerstone of engineering - it is therefore important that RF engineers know what to measure and test for, and what instruments are best suited for the job. In this part of the course participants will be introduced to different RF instrumentation and measurement techniques. In-class measurement demonstrations will also be performed.

RF Instrumentation and Measurement

- Instrumentation for RF Testing and Measurement
- Receiver (Sensitivity Test; Outband Rejection Test; Channel Acquisition)
- Transmitter (Output Measurement; Modulation Measurement; Phase Noise & Residual FM)
- Laboratory Testing (Sub-circuit Test; Product Test; RFIC Application Circuit Test and Measurement)

About the Instructors

Dr C.M. Yuen received his B.Eng. and Ph.D degrees in Electronic Engineering from the City University of Hong Kong. His research interest is mainly in the design of RF and Microwave circuits for low voltage and low power consumption wireless systems. He has twenty years of experience in RF product design and manufacturing in Hong Kong and Mainland China. Dr Yuen is currently an advisory engineer in the field of HDTV and IPTV.

Mr Henry Lau received his M.Sc. and MBA degrees from UK and USA respectively. He has more than 20 years of experience in designing RF systems, products and RFICs in both Hong Kong and US. He has worked for Motorola and Conexant in US as Principal Engineer on developing RFICs for cellular phone and silicon tuner applications. Mr Lau holds four US patents and has two patents pending. He is currently running Lexiwave Technology Ltd., a fabless semiconductor company in Hong Kong and US designing and selling RFICs.

Medium of Instruction

Cantonese (with English terminology)

Award of Certificate

A Certificate of Completion will be awarded to participants who enroll in the full course and have attended at least 6 half-day training sessions.

Date

30 November, 1, 7, and 8 December 2007

Time

9:30 – 12:30 (a.m. sessions) & 14:00 – 17:00 (p.m. sessions)

Venue

1/F., HKPC Building, 78 Tat Chee Avenue, Kowloon

Course Fee

Normal: HK\$1,100 (Per Part) / HK\$4,000 (Full Course)

Early Bird: HK\$990 (Per Part) / HK\$3,600 (Full Course) (For participants who enroll and pay on or before 3 Nov 2007)

An application has been submitted to the New Technology Training Scheme for this course to get endorsed. If successful, eligible participants may obtain up to 50% of course fee refund from NTTS.

Application

To enroll, please complete the attached enrolment form and send it together with the appropriate fee to Ms Catherine Lam

PTI, Hong Kong Productivity Council

3/F., HKPC Building, 78 Tat Chee Avenue, Kowloon

(All cheques should be crossed and made payable to 'Hong Kong Productivity Council')

Enquiries

Tel: 2788 5563 or 2788 5716

Fax: 2788 5567

Email: brian@hkpc.org

Enrolment Form 報名表

1. Course 課程 Radio Frequency (RF) Design for Wireless Telecommunication Products

Part	Subject	Course Fee	Early Enrolment on or before 3 Nov 2007
<input type="checkbox"/> 1	RF SYSTEM DESIGN	HK\$1,100	HK\$990
<input type="checkbox"/> 2	RFIC DESIGN	HK\$1,100	HK\$990
<input type="checkbox"/> 3	RF PCB DESIGN	HK\$1,100	HK\$990
<input type="checkbox"/> 4	RF INSTRUMENTATION and MEASUREMENT	HK\$1,100	HK\$990
<input type="checkbox"/>	Full Course (Part 1 – 4)	HK\$4,000	HK\$3,600
Total:			

Duration 日期 30 November, 1, 7 and 8 December 2007 Course Code 課程編號 _____

2. Name (English) (Mr/Mrs/Ms*) 姓名 (中文) (先生/女士/小姐*)

Mobile / Pager 手提 / 傳呼機 _____ E-mail Address 電郵地址 _____

3. Organization (English) _____ 公司名稱 (中文) _____

Position 職位 _____

Mailing Address 通訊地址 _____

Tel 電話 (Day 日間) _____ (Night 晚間) _____ Fax 傳真 _____

4. Payment Method 付款方法

<p>(A) By Credit Card (No.): _____ — _____ — _____ — _____</p> <p>Please debit my credit card A/C for HK\$ _____</p> <p style="text-align: right;">Name of Cardholder _____</p> <p style="text-align: right;"><input type="checkbox"/> VISA <input type="checkbox"/> MASTER</p> <p>Signature _____ Date _____</p>	<p>Expiry Date 有效日期 _____ (yy) _____ (mm)</p>
<p>(B) Enclosed is my cheque of HK\$ _____ Cheque No. _____ (The cheque has to be crossed and made payable to the "Hong Kong Productivity Council.")</p>	

** For cheque payment, please send the cheque for the appropriate fee with this completed form to Productivity Training Institute, 3/F., Hong Kong Productivity Council, HKPC Building, 78 Tat Chee Avenue, Kowloon Tong, Kowloon (Attn: Ms. Catherine Lam)

** For reservation (if applicable), please fax the completed form to (852) 2788 5567.

IMPORTANT NOTE 注意:

21.9.07

1. Course fee must accompany this form (or its photocopy), otherwise enrolment may be rejected.
報名表(可用影印本)必須連同學費一併繳交, 否則報名可能無效。
2. HKPC has adopted a Personal Data (Privacy) Policy. Information about the policy is available at HKPC enrolment counters for collection. You may also contact our Personal Data Controlling Officer for further details.
本局已實施個人資料(私隱)政策, 有關資料單張可於報名處索閱, 或閣下可與本局個人資料管理主任查詢。
3. Applicants are encouraged to pay by credit cards, EPS or cheques, if possible. Amount received will be imprinted. Cheques are subject to bank clearance.
本局建議申請者以信用卡、易辦事或支票繳交學費。學費收據以本局機印方為有效, 支票收妥作實。
4. Enrolment fee is **not refundable** unless HKPC is notified in writing of your withdrawal **at least 5 working days** before the course commences. A handling charge of HK\$200 will also be levied.
除非本局於課程開始前最少五個工作日收到申請者書面通知退學, 否則已繳學費概不退還。申請者申請退還學費需繳交手續費二百元正。
5. An applicant may, subject to approval from HKPC, nominate a person to attend the course on his/her behalf.
申請者可提名他人代替其本人出席課程, 惟事先須得本局同意。
6. HKPC reserves the right to reject any application in any circumstances and for whatever reasons. Payment of fees should only be construed as conditional acceptance of application.
香港生產力促進局保留在任何情況下及以任何原因拒絕任何人學申請的權利。申請者繳付學費後, 仍須符合入學的所有條件, 其申請方可獲得接納。
7. HKPC reserves the right to change the contents, venue and / or time as necessary.
香港生產力促進局保留在任何情況下更改課程內容、授課地點、日期及時間的權利。
8. Classes in the morning, afternoon or evening will be cancelled if typhoon signal No. 8 or above OR black rainstorm warning is still hoisted after (or is announced by the Hong Kong Observatory to be hoisted at/after) 6:00 a.m., 11:00 a.m. and 4:00 p.m. respectively. Participants will be notified when the class will be made up as soon as possible.
颱風及黑雨警告: 如課堂時間是在早上(9:00-12:00)、下午(2:00-5:00)或晚間(6:30-9:00), 將在下列情況下取消: (一)八號或以上颱風訊號或黑色暴雨警告訊號在早上 6:00、11:00 或下午 4:00 仍然懸掛; 或(二)香港天文台在早上 6:00、11:00 或下午 4:00 或之後, 宣佈將懸掛八號或以上颱風訊號或黑色暴雨警告訊號。本局將盡早通知學員補課的日期及時間。