

1. Course Detail

COURSE TITLE: RF Communication and Planning

FACILITATOR(S):

NAMES: Prof Stanley Henry Mneney

Department: Electrical, Electronics and Communication Engineering

College: Engineering and Technology

Duration: 2 weeks / 20 hours

Planned Start Date: 1st August, 2022

Venue: DSP Lab, Pengo Building

2. Introduction (*Provide brief introduction to the short course*)

The course aims at providing candidates with an understanding of the basic principles of Radio Frequency (RF) Communication and advanced technologies in the planning, designing and network optimization for wireless networks. Candidates will be introduced to the evaluation of the performance of different RF wireless systems and in particular the 3G (UMTS) and the 4G(LTE) networks.

3. About the Program

The course will review RF fundamentals in RF communication using the basic building blocks. It will review RF propagations in terms of RF Path Loss and empirical RF Path Loss Models.

The alternative transmission media are transmission lines. This part will review issues related to bandwidth and channels, analogue modulation, and digital modulation, and antennas.

The evolution of wireless communications will be highlighted. In system design, RF Regulatory Considerations of. Radio Network Planning Aspects including coverage, capacity, traffic and quality, and Radio Network Planning Procedures will be discussed. Radio Frequency Planning and Designing Tools, Radio Network Optimization, Radio Network Troubleshooting will be discussed in detail. The Air interfaces and Spectrum allocations for 3G and 4G, UMTS services and Applications, Main Parameters in WCDMA, UMTS/HSPA Radio Network Planning, UMTS/HSPA Radio Link Budget, UMTS/HSPA Radio Resource Management, UMTS/HSPA Optimization Aspects, UMTS/HSPA Major KPIs will be discussed.

The lectures will cover products and services that are offered by LTE. The performance in terms of peak data rates, latency and average throughputs of loaded cells will be introduced; LTE frequency bands and operators deployment strategies will be highlighted. The link budgets and coverage footprints for LTE sites will be defined.

In LTE networks the following will be covered: Principles of LTE radio planning and optimization including the LTE cell search and network access and attachment procedure; LTE all-IP core network architecture and signaling; Mobility management in LTE and the connected mode states; Security procedures and algorithms used in LTE networks; Radio resource management and interference

management through the X2 interface; Femtocell and Home Node B standardization and architecture; Future network deployments.

4. **Course Contents:** The course shall include but not limited to: *(specify contents to be covered)*
 - 3.1 RF Characteristics and Systems.
 - 3.2 Wireless Networks Planning and System Design.
 - 3.3 UMTS RF Planning, Design and Optimizations.
 - 3.4 LTE Introduction and System Planning.
 - 3.5 Practical assignment.

5. **Learning Outcomes:** After completion of the short course, the participant should be able to: *(Specify the learning outcomes)*
 - RF fundamentals
 - RF propagation planning and Modulation Techniques.
 - Antenna principles and types
 - Calculation of propagation losses and link budgets.
 - Engineering tools for Radio Frequency Planning and optimization
 - RF system design considerations
 - Evaluation of the performance of different RF wireless systems.

6. **Who Should Attend:** This short course is suited to a wide range of professionals, including *(Specify the Professionals who should attend) for example*
 - 5.1. Researchers in mobile communication and wireless radio networks.
 - 5.2. Engineers and technicians working in Design and Developments of mobile and wireless networks.
 - 5.3. Managers and radio network service providers.
 - 5.4 Candidates involved in Structured Engineers Internship Program (SEIP)

7. **Course Fees** *(Specify fees to be paid by participants)*
 - I. Registration Fee: Tsh 20 000
 - II. Course Fees: Tsh 180 000
 - Total Fee = TSh 200 000

8. **Requirements** *(Specify the minimum number of attendees, equipment, space requirements, etc)*

Minimum Number of Attendees: 10

Equipment: Computer with internet, Smart Board Projector.

Space Requirement: class room with computer which has internet etc.

COURSE TITLE: RF COMMUNICATION AND PLANNING**Facilitator(s): PROF S H MNENEY****COLLEGE: ENGINEERING AND TECHNOLOGY****ELECTRICAL ELECTRONICS AND COMMUNICATION ENGINEERING**

№	Date	Total no of Hours	Topic
Unit – I: RF Characteristics and Systems			
1		4	RF fundamentals and basic building blocks, RF Propagations, RF Path Loss and Shadowing, Empirical RF Path Loss Models, Bandwidth and Channels. Analogue Modulation, Digital Modulation, Antennas Characteristics, Antenna types, Antenna for Wireless systems and the decibel scale
Unit – II: Wireless Networks Planning and System Design.			
2		6	Wireless Communications History, Current Wireless Systems, Radio System design, RF Regulatory Considerations, Radio Network Planning Aspects, Coverage, Capacity, Traffic and Quality, Radio Network Planning Procedures Major Radio Frequency Planning and Designing Tools, Radio Network Optimization, Traffic Engineering, Introducing KPIs.
Unit– III: UMTS RF Planning, Design and Optimizations			
3		4	Air interfaces and Spectrum allocations for 3G and 4G, UMTS services and Applications, Main Parameters in WCDMA, UMTS/HSPA Radio Network Planning, UMTS/HSPA Radio Link Budget, UMTS/HSPA Radio Resource Management, UMTS/HSPA Optimization Aspects, UMTS/HSPA Major KPIs.
Unit– IV: LTE Introduction and System Planning			
4		6	Products and services that offered by LTE; Peak data rates, latency and average throughputs of loaded cells; LTE frequency bands and operators deployment strategies; Defining link budgets and coverage footprints for LTE sites; Principles of LTE radio planning and optimization; The LTE cell search and network access and attachment procedure; LTE all-IP core network architecture and signaling; Mobility management in LTE and the connected mode states; Security procedures and algorithms used in LTE networks; Radio resource management and interference management through the X2 interface; Femtocell and Home Node B standardization and architecture.
Total no of contact hours		20 hrs	

References

- 1) Jaana Laiho, Achim Wacker , Tom š Novosad, (2006), —Radio Network Planning and Optimization for UMTS|. ISBN: 0470015756
- 2) Z. Han, K.J.R. Liu, "Resource Allocation for Wireless Networks", Cambridge University Press, 2008
- 3) Vijay K. Garg,—Wireless Communications and Networking||, Elsevier, 2007.