



African Advanced Level Telecommunications Institute (AFRALTI)

**Online Training Course on
Spectrum Management Training Programme**

EM2.4 - Opportunistic Spectrum Access and Cognitive Radio

15 November – 10 December 2021

TRAINING COURSE OUTLINE

COURSE DESCRIPTION

Title	EM2.4 Opportunistic Spectrum Access and Cognitive Radio
Objectives	The aim of this course is to introduce learners to the concepts of opportunistic spectrum access in its different variants (overlay and underlay) and identify spectrum sensing techniques and different approaches used to exploit White spaces, as well as to learn the current regulations about Cognitive Radio and White Spaces
Dates	15 November – 10 December 2021
Duration	4 weeks
Registration deadline	14 November 2021
Training fees	USD 200
Course code	21OI27749MUL-E

DESCRIPTION OF THE TRAINING COURSE

This course covers the concepts of opportunistic spectrum access in its different variants (overlay and underlay) and identify spectrum sensing techniques and different approaches used to exploit White spaces, as well as to learn the current regulations about Cognitive Radio and White Spaces.

LEARNING OUTCOMES

After completion of the course, the learners will be expected to have gained knowledge on:

- Basic principles of the cognitive radio
- Spectrum sensing techniques

- White spaces concepts and regulation

The learners will also be expected to have an understanding of:

- The concept of cognitive radio systems
- The mechanisms that support Dynamic spectrum access.

The learners will be expected to gain special skills on:

- The ability to define interference limits for secondary usage
- The ability to estimate the probability of detection in a simulated scenario
- The ability to apply the knowledge and special skills acquired from the d course

TARGET POPULATION

This training is targeted those who are entering the regulatory environment or those interacting with technologies as operators, developers or managers. It is targeted at those aiming to understand the evolution of Spectrum management, and the various emerging technologies that will assist in improving efficiencies with a view to developing a general overview of trends.

This may include professionals working in the telecommunications industry like technical engineers/technicians, lawyers and regulatory staff across all departments.

Other institutions and individuals that are dedicated to building their capacity related to new technologies are also advised to participate.

ENTRY REQUIREMENTS

Resources working in the fields mentioned above are eligible for the training irrespective of their experience.

TUTORS/INSTRUCTORS

NAME OF TUTOR(S)/INSTRUCTOR(S)	CONTACT DETAILS
Martin Mwaura	Email: martinmwaura@live.com Tel: +254733879673
Jonathan Mwakijele	Email: Jmwakijele@afraiti.org Tel: +254718860897

TRAINING COURSE CONTENTS

<i>Sn</i>	<i>Topic</i>
1	Introduction
2	Software Defined Radio
3	Dynamic Spectrum Access
4	Spectrum Sensing and Interference Temperature

5	Dynamic Spectrum Access Models
6	Spectrum Overlay and Underlay and Commons model
7	Game Theory
8	White Spaces and regulation
9	Spectrum Trading and economics models
10	Examples of technologies using White Spaces (IEEE 802.22 and 802.11)

TRAINING COURSE SCHEDULE

Week / Session	Topic	Topic coverage	Exercises and interactions
Week 1	EM2-4 Sub Module-1: Introduction - Radio Spectrum Utilization	Spectrum Scarcity, Spectrum management models, Approaches to share spectrum, Spectrum occupancy and measurement, Introduction to cognitive radio	Live Lecture through ZOOM: Monday and Wednesday from 1500 Hours to 1700 Hours EAT. Quiz 1- Friday
	EM2-4 Sub Module-2: Introduction to the Software defined radio	Introduction to Software defined radio (SDR), levels & tiers of SDR, SDR models and examples	
	Forum discussion 1: What factors influence the efficiency of Spectrum usage?		
Week 2	EM2-4 Sub Module-3: Dynamic Spectrum Access and Cognitive radio	Shared Access, Dynamic Access, Refarming, Cognitive Radio-Components and functions, Regulatory issues for cognitive access	Live Lecture through ZOOM: Monday and Wednesday from 1500 Hours to 1700 Hours EAT. Quiz 2- Friday
	EM2-4 Submodule 4: Spectrum Sensing and Interference Temperature	Signal detection, Cooperative & Non-Cooperative sensing, Interference based testing, Interference temperature	
	Forum discussion 2: Technology changes (advancement) and Regulation. How are they inter-related?		
Week 3	EM2-4 submodule 5: Dynamic Spectrum Access Models	Shared Spectrum use & management Models, The secondary Market, Dynamic Spectrum Access Architecture,	Live Lecture through ZOOM: Monday and Wednesday from 1500 Hours to 1700 Hours EAT. Quiz 3- Friday
	EM 2-4 submodule 6: Spectrum Overlay, Underlay and Commons model	Spectrum Overlay, Underlay and Commons model	
	EM 2-4 submodule 7- Game Theory	Game Theory, The Nash Equilibrium	
	Forum discussion 3: To what extent does consumer behaviour affect the evolution of technology?		
Week 4	EM 2-4 submodule 8- White Spaces and regulation	Identification and detection of WS, Occupation Database-its structure & administration, regulation of WS, WS devices	Live Lecture through ZOOM: Monday and

EM 2-4 submodule 9- Regulatory approaches to Dynamic Spectrum Allocation	Regulatory Issues for Cognitive Access, Geographic databases, ASA & LSA, Spectrum allocation recommendations	Wednesday from 1500 Hours to 1700 Hours EAT.
EM 2-4 submodule 10- Technologies using White Spaces	Examples of technologies using white spaces	Quiz 4- Friday
Assignment		
Forum discussion 4: Spectrum sharing- should all public use spectrum be available for sharing?		

METHODOLOGY (Didactic approach)

- Instructor-Led online learning, training material will be shared every week. Learners can reach out to the instructors on the training portal.
- The participants will be expected to go through the study material and the provided references.
- Optional live lectures and discussions through will be held on ZOOM every Monday and Wednesday from 1500 Hours to 1700 Hours EAT.

EVALUATION AND GRADING

The evaluation will be based on:

- Participation in all 4 Forums (10%)
- Quiz 1 (10%)
- Quiz 2 (10%)
- Quiz 3 (10%)
- Quiz 4 (10%)
- Assignment (50%)

Participants should score an overall mark of 60% to receive ITU Certificate.

TRAINING COURSE COORDINATION

AFRALTI coordinator: Jonathan Mwakijele Head of Management, Policy and Regulatory Unit Nairobi, Kenya. Tel: +254 718 860 897 Email: Jmwakijele@afralti.org	ITU coordinator: Emmanuel Niyikora Programme Officer ITU Area Office for West Africa, Dakar, Senegal Tel : +250 788312939 Email: emmanuel.niyikora@itu.int
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REGISTRATION AND PAYMENT

ITU Academy portal account

Registration and payment should be made online at the ITU Academy portal.

To be able to register for the course you **MUST** first create an account in the ITU Academy portal at the following address:

<https://academy.itu.int/user/register>

Training course registration

When you have an existing account or created a new account, you can register for the course online at the following link: <https://academy.itu.int/training-courses/full-catalogue/sntp-em24-opportunistic-spectrum-access-and-cognitive-radio-0>

You can also register by finding your desired course in our training catalogue <https://academy.itu.int/training-courses/full-catalogue>

Payment

1. On-line payment

A training fee of USD 200 per participant is applied for this training. Payment should be made via the online system using the link mentioned above for training registration.

2. Payment by bank transfer

Where it is not possible to make payment via the online system, select the option for offline payment to generate an invoice using the same link as above. Download the invoice to make a bank transfer to the ITU bank account shown below. Then send the proof of payment/copy of bank transfer slip and the invoice copy to Hcbmail@itu.int and copy the course coordinator. **All bank transaction fees must be borne by the payer.**

Failure to submit the above documents may result in the applicant not being registered for the training.

3. Group payment

Should you wish to pay for more than one participant using bank transfer and need one invoice for all of them, create an account as **Institutional Contact**. **Institutional Contacts** are users that represent an organization. Any student can request to be an institutional contact or to belong to any existing organization.

To do this, head to your profile page by clicking on the **“My account”** button in the user menu. At the bottom of this page you should see two buttons:

- a. If you want to **become an institutional contact**, click on the **“Apply to be an Institutional Contact”** button. This will redirect you to a small form that will ask for the organization name. After you fill the name of the organization you want to represent, click on **“continue”** and a request will be created. An ITU Academy manager will manually review this request and accept or deny it accordingly.
- b. If you want to **belong to an existing organization**, click on the **“Request to belong to an Institutional Contact”** button. This will redirect you to a small form that will ask you to select the organization you want to join from an organization list. After you select the correct organization, click on **“continue”**, a request will then be created. The Institutional Contact that represents that organization will manually accept or deny your request to join the organization.

ITU BANK ACCOUNT DETAILS:

Name and Address of Bank:	UBS Switzerland AG Case postale 2600 CH 1211 Geneva 2 Switzerland
Beneficiary:	Union Internationale des Télécommunications
Account number:	240-C8108252.2 (USD)
Swift:	UBSWCHZH80A
IBAN	CH54 0024 0240 C810 8252 2
Amount:	USD 200
Payment Reference:	21OI27749MUL-E - P.40635.1.01

4. Other method of payment

If due to national regulations, there are restrictions that do not allow for payment to be made using options 1 & 2 above, please contact the ITU coordinator for further assistance.