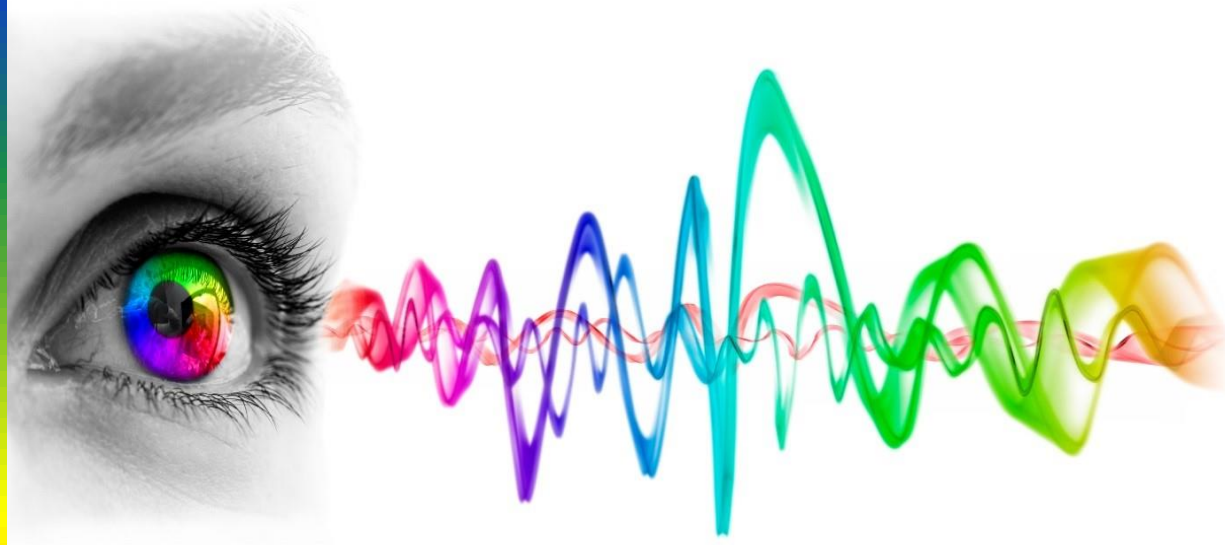
LS telcom

LS Multi Copter Projects and Services (Pty) Ltd

LS of South Africa Training Academy

PROSPECTUS OF

TRAINING COURSES



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LS Multi Copter Projects and Services (Pty) Ltd

Dear Client,

The LS of South Africa Training Academy has developed several training courses in the radio engineering, telecommunication and spectrum management industry as very few courses in this field of industry are available in South Africa and SADC.

The training calendar shown on Page 63, reflects the training dates for the following courses on offer:

BROADCAST

- DVB-T2 Technology
- Broadcast Planning for FM/TV & DTT (using CHIRplus_BC)
- Fundamentals to Broadcast Engineering
- RF Electromagnetic (EMF) Radiation Exposure Measurements
- FM Broadcast Engineering
- FM Radio 101
- Digital Radio Fundamentals
- Digital Video Broadcasting Head-ends
- Theory of Satellite and Digital Television Decoders
- Repair and Replace Broadcast Equipment

SPECTRUM MANAGEMENT

- Spectrum Management
- Spectrum Monitoring
- Spectrum Management, Planning and Spectrum Monitoring
- Spectrum Management, Planning and Foundation of Telecoms Regulations
- Spectrum Analysis Refresher

DIGITAL MOBILE AND MICROWAVE

- Microwave Link Planning
- Introduction to 5G

RADIO NETWORK PLANNING

- Radio Network Planning

REGULATORY AND OTHER

- Foundation of Telecommunication Regulation
- Fundamentals of Networking

The Training Academy is a MICTSETA (Media, Information and Communication Technologies Sector Education and Training Authority) accredited training provider for the following SAQA registered unit standards within the Broadcast Engineering Certificate (SAQA #48792):

- Calculate Interferences for Broadcast Frequencies (#115028)
- Predict Broadcast Signal Coverage (#115032)
- Modify an International Telecommunication Union Assignment Plan (#115034)
- Add New Services to Conditional Access Systems (# 115042)
- Implement Fault-finding techniques in electronic systems (# 115054)
- Operational Principles and Circuit Theory of Satellite and Digital Television Decoders (#115027)
- Repair and Replace Broadcast Equipment (#115041)

The enclosed document provides a short synopsis of the training courses as indicated above. Course fees are available on request. Prices vary from individual to groups.

We wish to offer training courses that responds to our client's needs and trust that the training courses would meet your expectations. If you have any questions, please do not hesitate to contact us.

Yours sincerely,

Dorothea Schutte

LS of South Africa Training Academy

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1 LS OF SOUTH AFRICA TRAINING COURSES

1.1 DVB-T2 Technology

1.1.1 Training Focus

This four-day course offers classroom training to delegates interested in understanding the underlying principles that make up the DVB-T2 terrestrial television broadcast system.

Attention is given, but not limited to, COFDM modulation, network topologies (SFNs/MFNs), capacity considerations, a case study and monitoring approaches.

1.1.2 Course Outcomes

- Introductory principles of DVB-T2 with specific comparison to its predecessor DVB-T.
- Basic elements of DVB-T2.
- Technical overview of DVB-T2 technology and aims to provide delegates with knowledge of the inner workings of the system, how data is structured and also how to calculate the system payload capacity.
- Practical aspects of DVB-T2 network roll-out through a case study (South Africa) and network monitoring approaches.
- Visit operational sites in order to experience examples of installed DVB-T2 network infrastructure.
- Delegates will have an opportunity to evaluate the knowledge they gained through short daily written tests.

1.1.3 Prerequisites

- Basic understanding of broadcast principles is advisable.

1.1.4 Audience

- Delegates with a desire to understand the DVB-T2 technology.
- Delegates who are involved with broadcast network deployment, regulation or operations.

1.1.5 Course Structure

Day	Course Contents
Day 1	▪ Introduction to DVB-T2 ▪ DVB-T1 background ▪ DVB-T2 Parameter Overview and System Block Diagram ▪ Input Processing (modes, formats, T2-MI) ▪ Bit Interleaved Coding and Modulation (BICM)
Day 2	▪ DVB-T2 Frame Structure (Superframe, Frame, OFDM Symbol, FEC Block) ▪ OFDM Generation (Pilot Carriers, Carrier Modes, Guard Interval, FFT Modes) ▪ Anatomy of the DVB-T2 signal and Capacity Example (Bit Rate Calculation)
Day 3	▪ Case Study: South Africa (network topology, head end, distribution, transmission network, monitoring) ▪ Measurement and monitoring principles ▪ Overview of DVB-SIS (Single Illumination System)
Day 4	▪ Visit to DTT Site

Example:

On-site Installation and Testing

2 x 5kW Liquid Cooled Transmitters

1.2 FM Broadcast Engineering

1.2.1 Training Focus

This eight-day course (covering theoretical and practical elements) offers classroom training to delegates with limited knowledge and experience of FM Broadcasting Transmission principles and operation of equipment as well as broadcast networks. Alternatively, delegates can opt for a 5-day theory course.

Attention is given to broadcasting basics such as Electromagnetic waves, transmission principles and modulation. The course also covers hardware such as transmitters, combiners, feeder cables and antennas.

The core elements of operating a broadcast network such as preventative maintenance, fault-finding, FM measurement techniques, monitoring and operational issues are also covered as well as visits to operating stations.

1.2.2 Course Outcomes

- Introductory principles of FM Broadcasting theory
- Workable knowledge of FM Transmitters, combiners and antennas
- Able to do basic FM measurement techniques
- Knowledge of Linking of sites and studios as well as monitoring and remote control
- Workable knowledge of Preventative maintenance and fault-finding
- Understand Operational issues
- Visit operational sites
- Delegates will have an opportunity to evaluate the knowledge they gained through short daily written tests.

1.2.3 Prerequisites

- Basic understanding of broadcast principles is advisable
- Workable knowledge of Mathematics

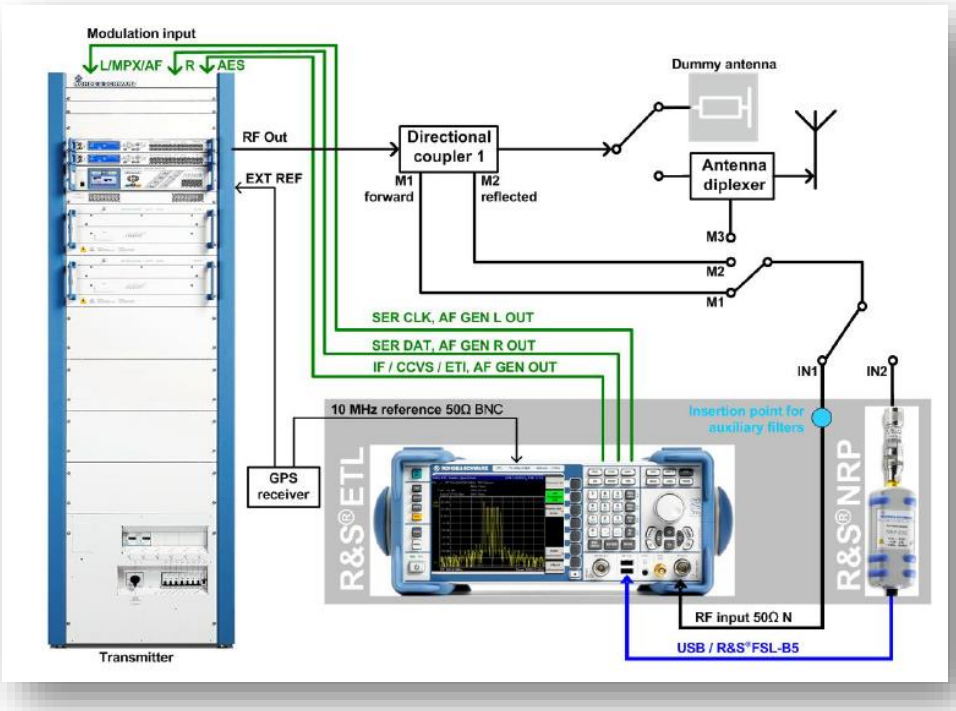
1.2.4 Audience

- Delegates with a desire to understand FM transmission and to operate FM transmitters as well as FM broadcast networks.

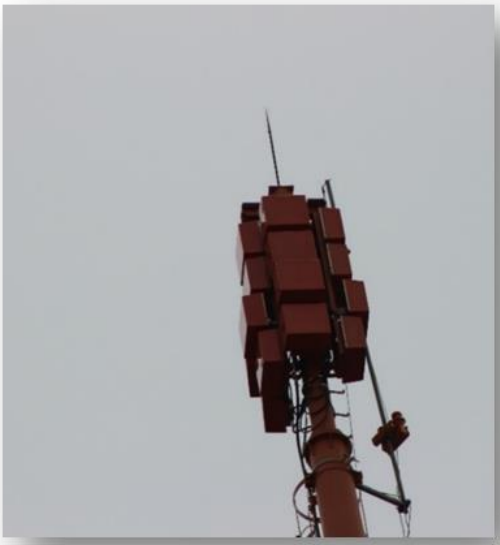
1.2.5 Course Structure

Day	Course Contents
Day 1	Electromagnetic waves, Wave transmission and RF Principles
Day 2	RF Planning, Coverage
Day 3	Preventative Maintenance, Modulation and Stereophonic Broadcasting, FM Transmitters
Day 4	Filters/Combiners, Dummy Loads, RF Switches, U-Link Panels, Antennas
Day 5	Linking of sites and studios , Telemetry and Audio Processing Fault-finding and Operational issues
Day 6	Introduction to Measurement and Practical Measurements
Day 7	Practical Measurements
Day 8	Site Visit

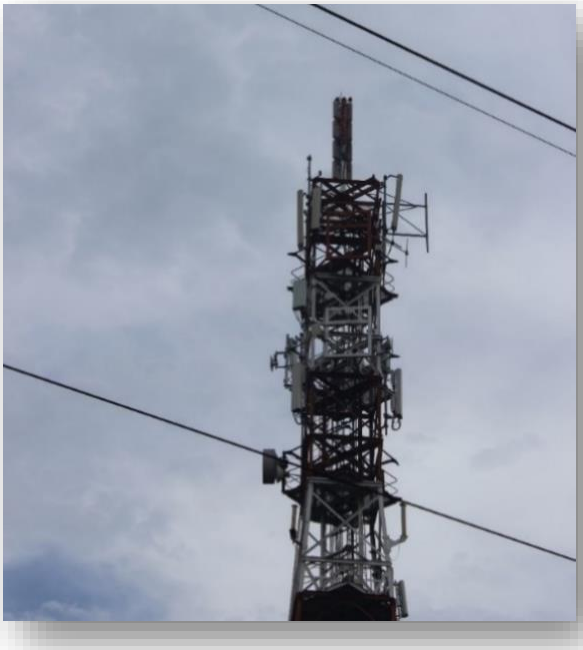
Example: Typical Transmitter Test set-up



Example: Antenna – Empangeni, Durban - Horisontal Antennas



Example: Antenna – New Castle, Durban



Example: A typical FM dipole antenna

1.3 FM Radio 101

1.3.1 Training Focus

This one-day course offers classroom training to delegates interested in understanding the underlying principles of FM sound broadcasting.

Attention is given but not limited to the basics of FM modulation, analogue and digital audio, basic transmission infrastructure and the Nautel VS Series FM transmitters.

The training is presented at the offices of LS of SA, Johannesburg.

1.3.2 Course Outcomes

- Delegates will have a solid understanding of the fundamentals of FM sound broadcasting
- Delegates will gain confidence to set up and operate the Nautel VS Series FM transmitters

1.3.3 Prerequisites

- The delegate/s should preferably work at an existing radio station – preferably within a technical and/or production capacity.
- Some basic knowledge of the technical workings of a radio station are required, along with an understanding of terminologies applicable to studio and/or transmission working environments
- Whilst not essential, some basic electronics knowledge could be helpful.

1.3.4 Audience

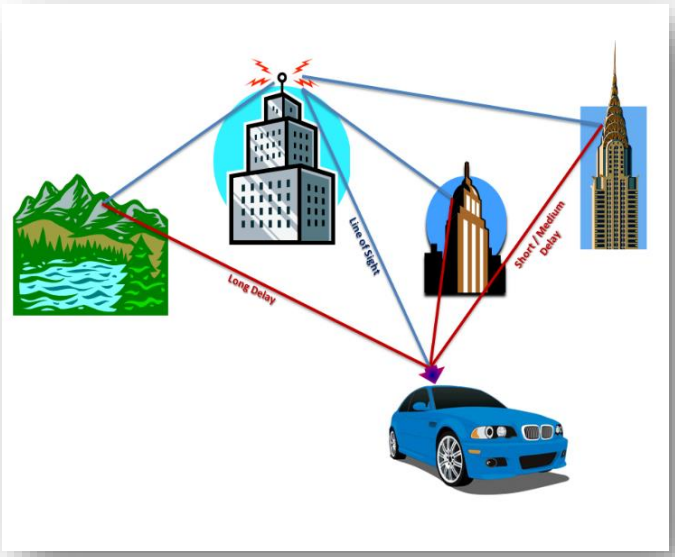
- Delegates with a basic understanding of broadcast principles.
- Delegates with a desire to further their understanding of FM Sound Broadcasting
- Delegates who are involved with broadcast network deployment and day-to-day operations at a radio station.

1.3.5 Course Structure

Day	Course Contents
Day 1	▪ Some FM and audio basics ▪ The architecture of a modern FM transmitter broadcast chain ▪ Overview of the typical components at a transmitting station ▪ Set up of the transmitter for normal operation ▪ Content generation (with practical exercises) ▪ Working with the user interface(s) – (with practical exercises) ▪ Practical transmission demonstrations into a low power test (dummy) load ▪ Maintenance and Troubleshooting guidelines

Example: Feeder and Antenna Systems

Example: Radio Reception



1.4 Digital Radio Fundamentals

1.4.1 Training Focus

This one-day course offers classroom training to delegates interested in understanding the underlying principles of digital sound broadcasting (DSB).

Attention is given but not limited to DSB (encompassing DAB+ and DRM) fundamentals, advantages/disadvantages, basic infrastructure, requirements for frequency bands and planning of networks.

1.4.2 Course Outcomes

- Delegates will have a solid understanding of the fundamentals of DSB.

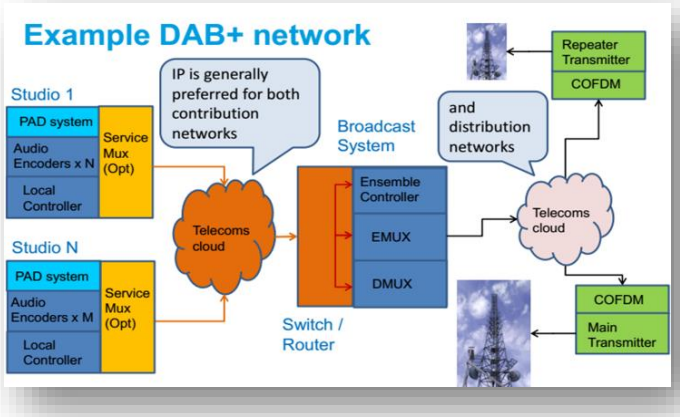
1.4.3 Prerequisites

- The delegate/s should preferably work at an existing radio station – preferably within a technical and/or production capacity.
- Some basic knowledge of the technical workings of a radio station are required, along with an understanding of terminologies applicable to studio and/or transmission working environments.
- Whilst not essential, some basic electronics knowledge could be helpful.

1.4.4 Audience

- Delegates with a basic understanding of broadcast principles.
- Delegates with a desire to further their understanding of DSB.
- Delegates who are involved with broadcast network deployment and day-to-day operations at a radio station.

1.4.5 Course Structure



One day course

- Overview of DAB+ and DRM technologies
- Advantages/disadvantages of DSB
- International status quo
- Current difficulties with implementation of DSB
- Frequency bands for deployment of DSB
- Planning of DSB networks
- Requirements for the frequency plan for DAB+ and DRM deployment
- Transmission Infrastructure requirements

1.5 Spectrum Management

1.5.1 Training Focus

The spectrum management function is a task normally undertaken by the national communication regulator of a country. This function includes amongst others the licensing of spectrum, spectrum allocations, development of channel plans and the frequency coordination within the country and with its neighbouring countries. This three-day training program covers various aspects of spectrum management. It includes information on the history, important international organisations that play important roles all around the world including the ITU. There will be an overview on the spectrum usage and applications throughout the available frequency spectrum. The latest hot topics around the world related to spectrum management will be discussed. The course also include information on frequency occupation and spectrum efficiency of certain technologies.

1.5.2 Course Outcomes

- The course will empower the participants to visualise the spectrum usage and application over the complete frequency spectrum.
- After the course is completed the participants will have a much clearer understanding of the regulatory function and the difficulty of the engineering and administrative tasks that the regulator need to undertake daily.
- The course will also clearly indicate all the role players that need to be consulted during the different regulatory tasks and functions.

1.5.3 Prerequisites

No formal prerequisites are required but keen interest in the functions of the regulator is required. People with an engineering background will appreciate certain technology aspect more while people with other backgrounds might appreciate the negotiation skills that are required more.

1.5.4 Audience

The target audience include spectrum managers, regulators and policy makers. It includes information for non-engineering persons and people with a key interest in spectrum management.

1.5.5 Course Structure

Day	Course Contents
Day 1	**Introduction to Spectrum Management** ▪ Definitions of Spectrum Management ▪ Why was Spectrum Management introduced? ▪ What are the main components of Spectrum Management? **Radio Communication Systems** ▪ Principle of Radio Communication ▪ Classification of Systems ▪ Common Parameter of Radio Communication Systems **Historical Overview of Spectrum and Propagation** ▪ The History of the Radio Spectrum ▪ Characteristics of Radio Spectrum, how is it classified ▪ Propagation effects **Modulation Schemes** ▪ Analogue Modulation ▪ Digital Modulation ▪ Analogue vs. Digital Modulation ▪ Error correction and coding ▪ Spread Spectrum
Day 2	**ITU and International Spectrum Management Organisations** ▪ The role of the ITU in Spectrum Management ▪ The Radio Regulations ▪ Table of Frequency Allocations ▪ International Spectrum Management Organizations **Spectrum Licensing** ▪ Spectrum Management and Frequency Planning ▪ Reasons for Spectrum Licensing ▪ Licenses types ▪ Methods to select the Licensee **Frequency coordination ITU notification** ▪ Frequency Assignment Options ▪ Reasons for frequency Coordination? ▪ Harmonized Coordination Methods

	▪ Best or Preferred Frequencies **The Spectrum Resource: Overview of Frequency Bands** ▪ Frequency Bands (ELF to EHF) ▪ Applications, Characteristics and allocations
Day 3	**Spectrum Efficiency** ▪ What contributes to Engineering efficiency? ▪ What contributes to Economic efficiency? ▪ Which factors influencing spectrum efficiency ▪ Example efficiencies of different technologies ▪ What are the characteristics of an efficient frequency plan **Latest Developments in Radio Technology** ▪ Dealing with the spectrum “capacity crunch” ▪ Mesh networks. ▪ Multi Technology planning ▪ Machine to machine (M2M) communications ▪ Sensor networks ▪ Power line telecommunications (PLT) and its use of the radio spectrum ▪ Multiple and distributed antenna networks ▪ Can we use micrometer and nanometer wavelengths? ▪ What might future wireless networks look like ▪ Low capacity data networks – Sigfox and LoRa ▪ Overview of new generation networks: LTE-M, NB-IoT, 5G **Regulatory and White Space** ▪ Status of white space in Africa ▪ What is white space in general radio spectrum terms? ▪ Why is white space becoming increasingly relevant? ▪ White space and cognitive radio interlinked? ▪ What does a white space database look like? ▪ What services might be offered in white space? ▪ What are the policy options for regulators? **The digital Dividend** ▪ The problems of analogue television and the benefits of DTT ▪ The 'double whammy' digital dividend ▪ How much spectrum can be released? ▪ 700 and 800 MHz and international harmonization

Section IV – Table of Frequency Allocations
(See No. **2.1**)

9-110 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
Below 9	(Not allocated) 5.53 5.54	
9-14	RADIONAVIGATION	
14-19.95	FIXED MARITIME MOBILE 5.57 5.55 5.56	
19.95-20.05	STANDARD FREQUENCY AND TIME SIGNAL (20 kHz)	
20.05-70	FIXED MARITIME MOBILE 5.57 5.56 5.58	
70-72 RADIONAVIGATION 5.60	**70-90** FIXED MARITIME MOBILE 5.57 MARITIME RADIO-NAVIGATION 5.60 Radiolocation	**70-72** RADIONAVIGATION 5.60 Fixed Maritime mobile 5.57 5.59

Region

Band

Service
Primary
Secondary
Permitted

Footnotes

1.6 Microwave Link Planning

1.6.1 Training Focus

This training course is presented as a three-day (theory) or a four-day (theory and practical) course. The three-day theoretical training course provides trainees with a strong background in microwave transmission and link planning for modern point to point Digital Microwave Radio

The course also covers in detail all important aspects of radio propagation, such as multi-path fading, free space loss, reflection and refraction

Microwave links are required to perform as the backhaul of the network of all the mobile technologies today, with an ever increasing demand for capacity. If designed appropriately the links can deliver this performance. The course offers knowledge of planning microwave links. Topics covered are microwave devises, typical antennas, feeder cable, path profiles, line of sight, antenna diversity, modulation schemes and frequency bands.

The four-day course offers an additional day to provide practical knowledge of planning microwave links. The trainees will perform an installation of a microwave link for which they have done the planning. Measurements of the incoming signal will be performed on the link once installed. The measured results will be compared with the results obtained from the planning. This can also involve fault finding if the figure of the planned link does not reflect the measured signal level of the installed link.

1.6.2 Course Outcome

After completion of this course, participants will:

- Understand essentials of microwave transmission and link design for point to point systems
- Become familiar with equipment used and understand different network topologies
- Be able to improve and optimize network performance and quality
- Understand how to use a microwave link planning tool (CHIRplus_TC)

1.6.3 Prerequisites

Microwave link planning experience

1.6.4 Audience

Entry to mid-level Microwave link planners

1.6.5 Course Structure

Day	Course Contents
Day 1	**Introduction** ▪ Standardization institutes ▪ Basics and definitions ▪ Point-to-Point microwave link description, frequency bands **Wave Propagation and related Microwave Link Parameters** ▪ Free spaces calculation ▪ Atmospheric attenuation, rain attenuation (influence of polarization), diffraction, tropospheric scatter, multipath fading **Path Profile Planning** ▪ Terrain data (DTM and DEM layer, Morpho Maps) ▪ LOS and Fresnel Zone (Near and far field predictions) ▪ Map and field survey **Antennas** ▪ Antenna technique ▪ Antenna parameters (Patters and gain, beam width, Cross polarization discrimination) ▪ Passive repeaters/reflectors
Day 2	**Power Budget** ▪ Free space loss ▪ Link budget over the entire radio link ▪ Fade margin and availability (Link outage and unavailability) ▪ Adaptive modulation ▪ Diversity types (Space and Frequency diversity) **Frequency Planning** ▪ Ranges for radio links (Frequency, antenna depending on link distances) ▪ Frequency plans (creation, evaluation, national and international plans) ▪ Upper and lower band planning **Interference** ▪ General description (definition, passive and active) ▪ Determination of interference criteria (C/I, T/I) ▪ Particular scenarios (Onsite interference, High Low Clash) ▪ Interference analysis for FWA networks

Day 3	**Link Planning in CHIRplus_TC (Practical Exercises)** ▪ Create sites ▪ Define a frequency planning from ITU-R F.385-10 Annex 1 (band, channel spacing) ▪ Create link (determine availability, capacity, modulation rate) ▪ Link calculations and analysis (availability, interference, channel assignment)
Day 4	Practical Training

Example: Trainees perform an installation of a microwave link for which they have done the planning. (Photo's courtesy of LS Multi Copter Projects and Services' RPAS section).

1.7 Broadcast Planning using CHIRplus_BC

1.7.1 Training Focus

This four-day course teaches delegates the basic broadcast planning parameters and equip them with the necessary knowledge to perform the necessary tasks of a terrestrial broadcaster, signal distributor or regulator.

1.7.2 Course Outcomes

- Delegates will be able to use CHIRplusBC on day-to-day tasks
- Delegates will have a clear understanding of RF planning principles and interference theory on FM networks, Analogue and Digital Television networks.

1.7.3 Prerequisites

- A basic understanding of RF will be beneficial.

1.7.4 Audience

- Any regulatory delegate in the broadcasting department.
- Any delegate in the field of broadcasting terrestrially
- Any signal distributor in the broadcasting field
- Any person interested in the broadcasting field

1.7.5 Course Structure

Day	Course Contents
Day 1	▪ Introduction to LS telcom and LS of South Africa ▪ Broadcast Software technologies ▪ Basic Broadcast planning ▪ Broadcast Antennas ▪ Wave propagation phenomena ▪ Wave propagation models ▪ Examples and Exercises on CHIRplus_BC

Day 2	▪ System setup and system administration ▪ Database handling ▪ Database parameters ▪ Transmit parameters ▪ Broadcast planning & field strength calculations ▪ Interference Theory ▪ FM network analyses
Day 3	▪ Frequency identification ▪ Steps to follow during frequency identification ▪ FM frequency identification ▪ Analogue TV and DTT frequency identification ▪ FM interference analysis ▪ Analogue TV interference analysis ▪ Examples and Exercises on CHIRplus_BC
Day 4	▪ DTT interference analyses (Self interference) ▪ MFN / SFN networks ▪ Inter service interference analyses (DTT to Analogue) ▪ Compatibility DTT vs. other services (e.g. LTE) ▪ Practical DTT planning session

1.8 Radio Network Planning

1.8.1 Training Focus

The training course will give the participant a good understanding of radio network planning as addressed detailed in the “Course Outcomes” section.

1.8.2 Course Outcomes

The three-day course will address the following topics:

- Introduction Radio Network Planning
- Coverage Planning
- Cell Structure Planning
- Traffic Planning
- Frequency Planning

1.8.3 Prerequisites

Basic engineering understanding of radio network planning is advisable.

1.8.4 Audience

Delegates with a desire to understand radio network planning.

1.8.5 Course Structure

Day	Course Contents
Day 1	**Introduction Radio Network Planning** ▪ Cellular Networks ▪ Targets for Radio Network Planning ▪ Planning Sequence
Day 2	**Coverage Planning** ▪ Coverage ▪ Link Budgets ▪ Basics of Wave Propagation ▪ Statistics of the Radio Channel

	▪ Field Strength Predictions ▪ Measurement Techniques **Cell Structure Planning** ▪ Cell Layouts ▪ Omni Cells ▪ Sector Cells ▪ Macro, Micro, Pico Cells ▪ Site Configuration
Day 3	**Traffic Planning** ▪ Basics of Traffic Theory ▪ Capacity of Carrier Frequency ▪ Traffic Density ▪ Traffic Forecast ▪ Traffic Measurements **Frequency Planning** ▪ Interference ▪ Regular reuse pattern ▪ Frequency assignment with planning tools

1.9 Introduction to Digital Video Broadcasting Head-ends

1.9.1 Training Focus

The training course will provide training to delegates interested in understanding the various systems and sub-systems that constitute a modern Digital Television Broadcasting Head-End.

The subject matter covers, but is not limited to: Digitizing video and audio, digital compression, transport streams and the analysis thereof.

1.9.2 Course Outcomes

Delegates will have a good understanding of a Digital Television Broadcasting Head-End and its various sub-systems.

1.9.3 Prerequisites

Basic understanding of broadcast principles is advisable.

1.9.4 Audience

- Delegates with a basic understanding of broadcast principles.
- Delegates with a desire to understand the principles behind modern Digital Television Broadcasting Head-Ends.
- Delegates who are involved with broadcast network deployment, regulation or operations.

1.9.5 Course Structure

Day	Course Contents
Day 1	▪ Digital Video [starting from PAL analogue] ▪ Digital Video Compression [MPEG, RLC, GoP] ▪ Transport Stream Structure [PIDs, SI & PSI Tables] ▪ Conditional Access Basics [Scrambling, Encryption] ▪ Functions of Head-End Systems [Ingest, Multiplexing, Gateway] ▪ ETSI TR 101-290 monitoring [Priority 1, 2 and 3 errors]

1.10 Foundation of Telecommunications Regulation

1.10.1 Training Focus

This two-day course, closely based on the ITU ICT Regulation Toolkit and the ITU Telecommunications Regulation Handbook, looks at the basic concepts related to telecommunications regulation.

1.10.2 Course Outcomes

To better understand the concept of telecommunications regulation, what its functions and ultimate goals and objectives are.

1.10.3 Prerequisites

Basic knowledge of spectrum management and telecoms regulation policy.

1.10.4 Audience

Newcomers to the telecommunications industry, seeking to learn more about the basic concepts of telecommunications regulation and spectrum management.

1.10.5 Course Structure

Day	Course Contents
Day 1	▪ Introduction ▪ Technology in Context ▪ Why Regulate?? ▪ Regulatory Organisations ▪ International Frameworks ▪ Looking Ahead

Day 2	Universal Access & Universal Service ▪ Trends & Approaches ▪ Policy Rationale ▪ Types of Universal Access and Service ▪ Universal Access Reform ▪ Strategies for Developing Economies Regulatory Challenges ▪ Intellectual property (IP) issues ▪ Content regulation ▪ Green ICT

1.11 Introduction to 5G

1.11.1 Training Focus

The one-day course provides the participant with a clear overview of the main drivers and strategy behind the development of 5G with its benefits, performances, markets and the management of the 5G spectrum. This course might be extended to a 2 or 3-day course as more information becomes available on 5G.

1.11.2 Course Outcomes

After completing the course, participants will have a clearer view of how the evolution towards a 5G standard is leading the chase to identify new spectrum, which spectrum bands are under consideration, and whether 5G might mark the end to the hunger of mobile operators for more mobile spectrum.

1.11.3 Prerequisites

Basic knowledge of spectrum management and mobile network concepts and technologies.

1.11.4 Audience

Those who need to better understand the spectrum implications of 5G technologies, whether from a regulatory, commercial or technical perspective.

1.11.5 Course Structure

Day	Course Contents
Day 1	▪ What is 5G ▪ Vertical markets enabled by 5G ▪ Strategies and Standardisation for 5G ▪ 5G Trials ▪ 5G Infrastructure and its Challenges ▪ 5G Spectrum ▪ Duplexing, Modulation, Antenna Techniques ▪ Narrowband IoT (NB-IoT)

1.12 Fundamentals of Broadcast Engineering

1.12.1 Training Focus

This one-day course offers classroom training to delegates interested in understanding the underlying principles of Broadcast Engineering. It is also a preferred prerequisite for the MictSeta course “Implement fault finding Techniques in Electronic systems”.

Attention is given but not limited to an introduction to electromagnetic waves and FM antennas, introduction to modulation and transmitters as well as principles of combiners.

The training is presented at the offices of LS of SA, Johannesburg.

1.12.2 Course Outcomes

- Delegates will have a solid understanding of the fundamentals of broadcast engineering, including electromagnetic waves, wave transmission as well as radiation of radio waves and the propagation of these waves through space.
- Delegates will also be able to describe the principle of operation of the various types of combiners used in broadcasting.
- Delegates will gain confidence for the course in fault finding techniques

1.12.3 Prerequisites

You must have the following entry level requirements before you can enrol for this module:

- Grade 12 or an equivalent qualification/B.Tech Diploma in Radio and Television Engineering
- Already competent in:
  The use of hand and power tools
  Basic soldering and wiring
  Using test equipment
- Some basic knowledge of the technical workings of a radio station are required, along with an understanding of terminologies applicable to studio and/or transmission working environments
- Basic electronics knowledge.

1.12.4 Audience

- Delegates with a basic understanding of broadcast principles.
- Delegates with a desire to further their understanding of Broadcasting Transmission

1.12.5 Course Structure

Day	Course Contents
Day 1	▪ Introduction to Electromagnetic Waves ▪ Introduction to FM antennas ▪ Introduction to modulation and transmitters ▪ Principles of combiners

1.13 Spectrum Analysis Refresher Course

1.13.1 Training Focus

This two-day course offers classroom training to delegates who are interested in both expanding and/or supplementing the fundamental techniques of spectrum analysis and use of a spectrum analyser.

1.13.2 Course Outcomes

- Delegates will have a solid understanding of the fundamentals of spectrum analysis, e.g. super-heterodyne receiver as the basis of understanding, filters, mixers, detection methods, etc.
- Delegates will also be able to identify with all terminologies used within the ambit of spectrum analysis, and
- Delegates will gain confidence for the course in doing measurements

1.13.3 Prerequisites

You should have the following entry level requirements before you can enrol for this module:

- National Diploma (T3/S4) or higher - preferably with a specialty in the field of Electronic Communication Systems (Radio Engineering/Electronic Measurements)

1.13.4 Audience

- Delegates with a basic understanding in the use of a spectrum analyser.
- Delegates from an Electronic Communications Systems background (e.g. broadcast/military/telecommunications)

1.13.5 Course Structure

Day	Course Contents
Day 1	▪ Introduction ▪ Spectrum Analyser Fundamentals ▪ Digital IF Overview ▪ Amplitude and Frequency Accuracy
Day 2	▪ Sensitivity and Noise ▪ Dynamic Range ▪ Extension of frequency ranges ▪ Modern Spectrum Analysers/practical demos

1.14 RF Electromagnetic (EMF) Radiation Exposure Measurements

1.14.1 Training Focus

The training course will allow the participant to gain competencies in the theory and practical measurements of analogue/digital broadcast and mobile telephony electronic communication systems.

1.14.2 Course Outcomes

The three-day course will aim to provide the following outcomes

- Delegates will gain further insight into the non-ionising effects of electromagnetic radiation (EMF) exposure
- Understand the principles of determining the maximal levels of EMF exposure
- Overview of measurement techniques as can be applied for analogue (e.g. FM) and digital (DAB/DVB-T2) transmission standards
- Overview of measurement techniques used for mobile telephony (e.g. UMTS/GSM) communications
- Overview of measurement techniques used for LTE and TETRA communication systems
- Providing the basis and appropriate strategies for EMF measurement and reporting

1.14.3 Prerequisites

Delegates will be required to demonstrate an advanced understanding of both analogue (AM/FM)/digital (DAB/DVB-T2) broadcast standards, as well as those used for mobile telephony (GSM-E900/UMTS/LTE) and TETRA communication standards. Delegates would therefore need to be in possession of a suitable Engineering Degree and/or National/NH Diploma/B.Tech in the appropriate field.

1.14.4 Audience

This course is primarily aimed at technical personnel at Communication Regulatory Authorities and Service Providers who are required to perform EMF safety measurements within public spaces and/or transmission facilities for compliance purposes. The Narda SRM-3006 narrow-band analyser forms the basis of the practical measurements and access to such an instrument is strongly recommended.

1.14.5 Course Structure

Day	Course Contents
Day 1	**Standards I – Exposure Limits and Present Status of Bio-Electromagnetic Research** ▪ Introduction to ICNIRP ▪ Current biological research on non-thermal effects ▪ Revision of ICNIRP guidelines ▪ Field strength variations in space and time ▪ Consequences for exposure measurements ▪ Basic measurement principles
Day 2	**Standards II – Measurement standards** ▪ Correct measurements for – FM/DAB/DVB-T2 ▪ Correct measurements for- GSM E900/UMTS/TETRA/LTE ▪ Outlook and introduction to 5G measurements.
Day 3	**Measurement standards III (continued…)** ▪ Introduction to radar ▪ Reporting methodologies ▪ Measurement strategies ▪ Practical demonstration/s ▪ Final discussions/closure

1.15 Fundamentals of Networking

1.15.1 Training Focus

Participants attending this course will learn the fundamentals of networking. They will be able to identify network architectures, topologies, devices, and physical media.

Attendees will be able to install and configure routers and wireless access points as well as correctly cable the devices. Attendees will troubleshoot network problems and identify security holes. This will also explain the history of the Internet, IPv4, and IPv6.

1.15.2 Course Outcomes

- Network cabling
- Network subnetting
- Router setup
    - Routing protocols
    - DHCP
    - DNS
    - Port Forwarding
- Wireless access point setup
- Ability to identify network security holes
- Ability to identify network components
- Ability to troubleshoot a network

1.15.3 Prerequisites

Basic knowledge of computers and components

1.15.4 Audience

- Delegates with a basic understanding of computers and computer systems and components
- Delegates interested in learning about network fundamentals
- Delegates needing to troubleshoot and solve common networking problems
- Delegates with network maintenance responsibilities

1.15.5 Course Structure

Day	Course Contents
Day 1	▪ Introduction to a network? ▪ Network architectures ▪ client/server, peer-to-peer ▪ Recognizing common network components ▪ Network topologies ▪ Backbones and segments ▪ How is data transmitted? o Packet switching and circuit switching o Encapsulation ▪ Introduction to the ISO OSI model o Comparison to Department of Defence model/IP stack (TCP/IP model) o Explanation of: TCP, IP, ports o Explanation of each layer, protocols, addressing, data flow ▪ Physical Media o NIC and MAC addressing o Cable and connection types ▪ Network Components o Explanation of broadcast and collision domains o Devices: hub, switch, router, bridge, firewall, WAP, NAS ▪ Network Connection Types o Dial-up Modem, DSL, FTTH/FTTP (PON, AON) o Wireless WAN Technologies ▪ Cellular, WiMAX, LTE ▪ IP Addressing o Binary conversions o Hexadecimal o IPv4 and IPv6 o Reserved/special addresses o Subnetting ▪ DHCP, DNS, and NAT
Day 2	▪ What is a protocol? o Protocol definition o three-way handbrake o Practical examples ▪ History of the Internet o Covers important milestones: ARPA/DARPA net, Ethernet, ... ▪ Routing Protocols o Routing and Forwarding

	○ Autonomous Systems ○ Routing algorithms ▪ link state ▪ distance vector ▪ hierarchical ▪ Wireless Networking ○ 802.11 specification ○ 802.11 comparison ○ Wireless components ○ Frequencies, interference, and antennas ▪ Network Threats ○ Types of threats ○ Mitigation and prevention ▪ Network Troubleshooting ○ Problem scope refining ▪ Networking Tools ○ Protocol Analyzers ○ Throughput testers ○ Windows Command-line functions ▪ Practical session on networking

1.16 Spectrum Monitoring

1.16.1 Training Focus

This course is based on the latest ITU-R recommendations, reports and handbooks and provides an introduction into the most common spectrum monitoring and measurements techniques. It is also presented theoretical background and practical examples that help in understanding specifics of administrative spectrum monitoring. The training concludes with number of practical examples.

1.16.2 Course Outcomes

After the training, the participants will be able to understand standards, the procedures and methods of the most common monitoring measurements, to distinguish between different measurements technologies, to respect technical limitations of measurement equipment, to present results to different user groups on a simple way.

1.16.3 Prerequisites

Basic understanding of radio communication is advisable.

1.16.4 Audience

Delegates with a basic understanding of radio communication and electromagnetic wave propagation.

Delegates interested in spectrum monitoring measurement and techniques.

Delegates who are employed in regulatory authorities, that are supposed to execute spectrum monitoring measurements, reporting and providing early warnings to policy makers.

1.16.5 Course Structure

Day	Course Contents
Day 1	▪ General expectations of spectrum monitoring ▪ Utilization of spectrum monitoring results ▪ Manual monitoring (ITU/ECC references, proposed procedure) ▪ Channel & band occupancy (ITU R1, ERO/ECC) ▪ Monitoring of broadcast ▪ Interference description, detection, reporting

	▪ Analysis of results and reporting ▪ Automated monitoring ▪ Detection of regulatory unauthorized utilizations ▪ Inspection / certification / technical acceptance ▪ Monitoring of digitally modulated signals ▪ Real time radio occupancy monitoring (for utilizing of white space) ▪ General license compatibility monitoring (like SRD/ISM/WiFi) ▪ Monitoring of assignments (like cellular access systems or MMDS) ▪ Areal monitoring (geolocation of low power sources) ▪ Interpretation of results and publishing (what, why and when to publish)

1.17 Spectrum Management, Planning and Spectrum Monitoring

1.17.1 Training Focus

This training course offers the participants with a high level understanding of the main topics of Spectrum Management, Radio Network Planning and Spectrum Monitoring over a 5-day period.

For course outcomes, prerequisites and audience, refer to the individual courses under points 1.5, 1.8 and 1.15 above.

The high level breakdown of the topics that will be covered during the course is as follows:

Day	Course Contents
Day 1 and Day 2	Spectrum Management
Day 3 and Day 4	Radio Network Planning
Day 5	Spectrum Monitoring

1.17.2 Course Structure

The detailed breakdown of the topics that will be covered in this training course is as follows:

Day	Course Contents
Day 1	**Introduction to Spectrum Management** ▪ Definitions of Spectrum Management ▪ Why was Spectrum Management introduced? ▪ What are the main components of Spectrum Management? **Radio Communication Systems** ▪ Principle of Radio Communication ▪ Classification of Systems ▪ Common Parameter of Radio Communication Systems **Historical Overview of Spectrum and Propagation** ▪ The History of the Radio Spectrum ▪ Characteristics of Radio Spectrum, how is it classified ▪ Propagation effects

	Modulation Schemes ▪ Analogue Modulation ▪ Digital Modulation ▪ Analogue vs. Digital Modulation ▪ Error correction and coding ▪ Spread Spectrum
Day 2	**ITU and International Spectrum Management Organisations** ▪ The role of the ITU in Spectrum Management ▪ The Radio Regulations ▪ Table of Frequency Allocations ▪ International Spectrum Management Organizations **Spectrum Licensing** ▪ Spectrum Management and Frequency Planning ▪ Reasons for Spectrum Licensing ▪ Licenses types ▪ Methods to select the Licensee **Frequency coordination ITU notification** ▪ Frequency Assignment Options ▪ Reasons for frequency Coordination? **Spectrum Efficiency** ▪ What contributes to Engineering efficiency? ▪ What contributes to Economic efficiency? ▪ Which factors influencing spectrum efficiency **Latest Developments in Radio Technology** ▪ Dealing with the spectrum “capacity crunch” ▪ Mesh networks. **Regulatory and White Space** ▪ Status of white space in Africa ▪ What is white space in general radio spectrum terms? ▪ Why is white space becoming increasingly relevant? **The digital Dividend** ▪ The problems of analogue television and the benefits of DTT ▪ The 'double whammy' digital dividend

Day 3	**Introduction Radio Network Planning** ▪ Cellular Networks ▪ Targets for Radio Network Planning ▪ Planning Sequence **Coverage Planning** ▪ Coverage ▪ Link Budgets ▪ Basics of Wave Propagation ▪ Statistics of the Radio Channel ▪ Field Strength Predictions ▪ Measurement Techniques
Day 4	**Cell Structure Planning** ▪ Cell Layouts ▪ Omni Cells ▪ Sector Cells ▪ Macro, Micro, Pico Cells ▪ Site Configuration **Traffic Planning** ▪ Basics of Traffic Theory ▪ Capacity of Carrier Frequency ▪ Traffic Density ▪ Traffic Forecast ▪ Traffic Measurements **Frequency Planning** ▪ Interference ▪ Regular reuse pattern ▪ Frequency assignment with planning tools
Day 5	**Spectrum Monitoring** ▪ General expectations of spectrum monitoring ▪ Utilization of spectrum monitoring results ▪ Manual monitoring (ITU/ECC references, proposed procedure) ▪ Channel & band occupancy (ITU R1, ERO/ECC) ▪ Broadcast monitoring ▪ Interference description, detection, reporting ▪ Analysis of results and reporting

	▪ Automated monitoring ▪ Detection of regulatory unauthorized utilizations ▪ Inspection / certification / technical acceptance ▪ Monitoring of digitally modulated signals ▪ Real time radio occupancy monitoring (for utilizing of white space) ▪ General license compatibility monitoring (like SRD/ISM/WiFi) ▪ Monitoring of assignments (like cellular access systems or MMDS) ▪ Areal monitoring (geolocation of low power sources) ▪ Interpretation of results and publishing (what, why and when to publish)

1.18 Spectrum Management, Planning and Foundation of Telecommunications Regulation

1.18.1 Training Focus

The training course offers the participants with a high level understanding of the main topics of Spectrum Management, Radio Network Planning and Foundation of Telecommunication Regulations. The course is offered over a 5-day period.

For course outcomes, prerequisites and audience, refer to the individual courses under points 1.5, 1.8 and 1.10 above.

The high level breakdown of the topics that will be covered during the course is as follows:

Day	Course Contents
Day 1 and Day 2	Spectrum Management
Day 3 and Day 4	Radio Network Planning
Day 5	Foundation of Telecoms Regulation

1.18.2 Course Structure

Day	Course Contents
Day 1	**Introduction to Spectrum Management** ▪ Definitions of Spectrum Management ▪ Why was Spectrum Management introduced? ▪ What are the main components of Spectrum Management? **Radio Communication Systems** ▪ Principle of Radio Communication ▪ Classification of Systems ▪ Common Parameter of Radio Communication Systems **Historical Overview of Spectrum and Propagation** ▪ The History of the Radio Spectrum ▪ Characteristics of Radio Spectrum, how is it classified ▪ Propagation effects

	Modulation Schemes ▪ Analogue Modulation ▪ Digital Modulation ▪ Analogue vs. Digital Modulation ▪ Error correction and coding ▪ Spread Spectrum
Day 2	**ITU and International Spectrum Management Organisations** ▪ The role of the ITU in Spectrum Management ▪ The Radio Regulations ▪ Table of Frequency Allocations ▪ International Spectrum Management Organizations **Spectrum Licensing** ▪ Spectrum Management and Frequency Planning ▪ Reasons for Spectrum Licensing ▪ Licenses types ▪ Methods to select the Licensee **Frequency coordination ITU notification** ▪ Frequency Assignment Options ▪ Reasons for frequency Coordination? **Spectrum Efficiency** ▪ What contributes to Engineering efficiency? ▪ What contributes to Economic efficiency? ▪ Which factors influencing spectrum efficiency **Latest Developments in Radio Technology** ▪ Dealing with the spectrum “capacity crunch” ▪ Mesh networks. **Regulatory and White Space** ▪ Status of white space in Africa ▪ What is white space in general radio spectrum terms? ▪ Why is white space becoming increasingly relevant? **The digital Dividend** ▪ The problems of analogue television and the benefits of DTT ▪ The ‘double whammy’ digital dividend

Day 3	**Introduction Radio Network Planning** ▪ Cellular Networks ▪ Targets for Radio Network Planning ▪ Planning Sequence **Coverage Planning** ▪ Coverage ▪ Link Budgets ▪ Basics of Wave Propagation ▪ Statistics of the Radio Channel ▪ Field Strength Predictions ▪ Measurement Techniques
Day 4	**Cell Structure Planning** ▪ Cell Layouts ▪ Omni Cells ▪ Sector Cells ▪ Macro, Micro, Pico Cells ▪ Site Configuration **Traffic Planning** ▪ Basics of Traffic Theory ▪ Capacity of Carrier Frequency ▪ Traffic Density ▪ Traffic Forecast ▪ Traffic Measurements **Frequency Planning** ▪ Interference ▪ Regular reuse pattern Frequency assignment with planning tools
Day 5	**Foundation of Telecommunication Regulations** ▪ Introduction to Telecommunications regulations ▪ Technology in Context ▪ Why Regulate?? ▪ Regulatory Organisations ▪ International Frameworks ▪ Looking Ahead

	Universal Access & Universal Service ▪ Trends & Approaches ▪ Policy Rationale ▪ Types of Universal Access and Service ▪ Universal Access Reform ▪ Strategies for Developing Economies

2 MICTSETA ACCREDITED UNIT STANDARDS

mictseta

Accreditation no: ACC/2017/07/0027

Media, Information and Communication Technologies
Sector Education and Training Authority

Accelerating quality skills towards an information savvy society

The LS of South Africa Training Academy is an accredited training provider for the Broadcast Engineering Certificate (#48792) which is a registered qualification of the South African Qualifications Authority (SAQA).

The prospectus provides information on the following SAQA registered unit standards:

2.1 Calculate Interferences for Broadcast Frequencies (SAQA #115028, NQF Level 5, 10 Credits)

2.1.1 Training Focus

Delegates who attend this course will learn how to predict interference between radio services on a wanted service between other transmissions of the same broadcast technology.

2.1.2 Course Outcomes

The course will address the following topics:

- Determine parameters for wanted and unwanted sites and interference potential for different broadcast services.
- Perform and Analyse interference calculations
- Determine interferences for service areas and make recommendations on how to mitigate interference.

2.1.3 Prerequisites

- Grade 12 or an equivalent qualification/B.Tech/S4 Electronic Engineering Diploma
- Successfully completed the unit standard: Predict Broadcast Signal Coverage #115032

2.1.4 Audience

- Delegates with an understanding of the fundamentals of FM;LF/MFand DVB-T2 broadcasting parameters
- Delegates who is already competent in using radio network planning software
- Delegates with an understanding of coverage and coverage overlap
- Delegates experienced with wave propagation models

2.1.5 Course Structure

Day	Course Contents
Day 1	**Determine parameters for wanted and unwanted sites** ▪ Geneva Agreements governing frequency assignments/allotments ▪ Planning guidelines and procedures for frequency additions and amendments ▪ Field strength calculations for the applicable broadcast technologies. ▪ Radio network planning and applicable transmission parameters. ▪ Signal to noise and signal to interference ratios. ▪ Radio network planning software. **Perform interference calculations** ▪ Determination of Channel frequencies/field strengths by multiplication methods ▪ Propagation data for VHF broadcasting services ▪ Analogue and digital signals and difference in minimum usable field strengths. ▪ Interferences in a MFN and SFN
Day 2	**Analyse interference calculations** ▪ Propagation models to calculate interferences accurately ▪ Co and adjacent channel protection ratio factors contributing to interferences ▪ Antenna patterns/Antenna polarization discriminations **Determine interferences for service areas and make recommendations** ▪ Use of broadcast planning software tool (CHIRplus-BC) for area interference calculations ▪ Analyses of interference calculations ▪ Adjustment of transmission and modulation parameters to overcome interferences

2.2 Predict Broadcast Signal Coverage (SAQA #115032, NQF Level 5, 15 Credits)

2.2.1 Training Focus

The focus of this course is for the learner to be able to predict broadcast signal coverage for LF/MF, FM and DTT transmissions using the applicable transmission parameters in a manual and automated environment.

2.2.2 Course Outcomes

The course will focus on the following specific outcomes:

- Determine parameters for wanted sites that will influence coverage for different broadcast services
- Perform coverage calculations
- Analyse coverage calculations
- Calculate signal coverage and prepare reports

2.2.3 Prerequisites

- Grade 12 or an equivalent qualification/B.Tech/S4 Electronic Engineering Diploma
- Successfully completed the unit standard: Measure, analyse and report on broadcast field strength #115029

2.2.4 Audience

- Delegates with an understanding of the fundamentals of components that affect signal coverage; options for coverage calculations; coverage contours; familiar with HF/FM and DVB_T2 coverage planning,
- Delegates who is already competent in:
  - Specific broadcast technology under investigation
  - Know the different components of a broadcast transmission system
  - Understand antenna patterns and polarisation
  - Understand frequency plans and assignments
  - Has some idea on wave propagation.

2.2.5 Course Structure

Day	Course Contents
Day 1	**Determine parameters for wanted sites** ▪ ICASA Frequency plan ▪ Broadcaster's service area requirements ▪ Optimum antenna heights/site heights for best coverage results **Perform coverage calculations** ▪ Coverage Using Propagation Prediction Curves ▪ Propagation prediction method ▪ Propagation curves ▪ Calculation of coverage areas using CHIRplus_BC planning software tool
Day 2	**Analyse coverage calculations** ▪ Coverage thresholds for signal coverage predictions ▪ Propagation models ▪ LF/MF Coverage predictions ▪ Calculation results ▪ FM & DTT & DAB Coverage predictions ▪ Field strength calculations **Predict signal coverage and prepare reports** ▪ Perform coverage predictions for LF/MF & FM broadcast stations & DVB-T2 television stations ▪ Prepare reports within prescribed procedures ▪ Predict interference zone for LF/MF broadcast station

2.3 Modify an International Telecommunication Union Assignment Plan (SAQA #115034, NQF Level 5, 4 Credits)

2.3.1 Training Focus

The focus of this course is for the learner to be able to understand an assignment plan is and how a specific Broadcast assignment plan can be modified.

2.3.2 Course Outcomes

The course will focus on the following specific outcomes:

- Determine requirement for frequency additions for applicable regional agreement and identify appropriate frequencies for coordination and plan modification
- Determine co-ordination process with neighbouring countries
- Determine notification process with ITU for specific Agreement for plan modification

2.3.3 Prerequisites

- B.Tech/S4 Electronic Engineering Diploma
- Successfully completed the unit standard:
  - Calculate Interferences For Broadcast Frequencies Unit Standard #115028
  - Measure, Analyse And Report On Broadcast Field Strenghts Unit Standard #115029
  - Predict Broadcast Signal Coverage Unit Standard #115032

2.3.4 Audience

- Delegates with an understanding of the fundamentals of Spectrum management; Frequency Planning concepts; Coverage and Interference analysis;
- Delegates who is already competent in wave propagation; ITU and its role in spectrum management; familiar with broadcast radio planning software packages.

2.3.5 Course Structure

Day	Course Contents
Day 1	**Determine regulatory provisions of applicable regional agreement** ▪ Geneva 75, Geneva 84 and Geneva 2006 agreements ▪ Procedure for modification to plans ▪ Procedure for coordination of other terrestrial services ▪ Notification of frequency assignments

	Determine co-ordination with neighbouring countries ▪ GE 75 agreement – Coordination requirements per country ▪ GE 84 agreement – Coordination calculation ▪ GE 2006 agreement - ▪ Limits and methodology for determining agreement with other administrations ▪ Examination of conformity with the digital plan **Notify the ITU of frequency agreements** ▪ Geneva 75, Geneva 84 and Geneva 2006 agreements - Notification of frequency assignments ▪ Article 9 and 11 of Radio Regulations

2.4 Add New Services to Conditional Access Systems (SAQA #115042, NQF Level 5, 20 Credits)

2.4.1 Training Focus

The five day training course will equip the learner with the necessary basic understanding of the conditional access system within the digital television head-end ecosystem as well as to explain the typical processes and procedures to be followed when adding or removing services from the channel line-up.

2.4.2 Course Outcomes

Delegates who attended this course will be able to:

- Explain conditional access installation and configuration
- Plan new services
- Add new services to Conditional Access Systems
- Solve problems when adding new services
- Comply with workplace health and safety requirements during the adding of new services

2.4.3 Prerequisites

- B.Tech or S4 Electronic Engineering Diploma with television as a subject
- Completed the course: Introduction to Digital Video Broadcasting Head-ends

2.4.4 Audience

- Delegates with an understanding of the fundamentals of television broadcasting
- Delegates who is already competent in Digital Video Broadcasting (DVB) Basics and DVB Service Information (SI) Basics

2.4.5 Course Structure

Day	Course Contents
Day 1	**Explain Conditional Access Installation And Configuration** ▪ The installation and configuration of Conditional Access, Stand Alone Scramblers and Conditional Access Encrypter. ▪ The Conditional Access Code Download tool configuration for Code Download services ▪ Decoder qualification in terms of conditional access message handling and service information handling ▪ Individual activity (#1)

	Plan New Services ▪ The assessment of business requirements for new services ▪ Procedures pertaining to: Electronic Programme Guide Information Approval of additional services Approval for processes and back-out plans Materials, test equipment, broadcast equipment and tools needed for the addition of new service activities Special equipment required for new services ▪ Planning of new service activities ▪ MPEG-2 related to digital video, digital audio, private data and modulation and transmission theory ▪ Service Information (SI) specifications and Program Specific Information (PSI) ▪ DVB Transport Stream Analyser equipment used for analysing DVB information ▪ Individual activity (#2)
Day 2	**Add New Services To Conditional Access Systems** ▪ New services added correctly in the system and transport streams ▪ Testing of systems/equipment for performance ▪ The settings and adjustments to components Group activity (#3) **Solve Problems When Adding New Services** ▪ Identification, evaluation and solutions to potential new service problems ▪ Reporting of unresolved problems ▪ Status reports on the outcome of new additions ▪ Group activity (#4)
Day 3	**Comply With Workplace Health And Safety Requirements During The Adding of New Services** ▪ Adherence to health and safety practices ▪ Precautions to avoid damage to components, tools and equipment ▪ Removal of waste and debris in accordance with environmental requirements ▪ Storage of tools and equipment ▪ Identification and handling of potential health hazards ▪ Individual activity (#5)

Day 4	**Practical Exercises** ▪ Exposure to the basic building blocks of a DVB head end ▪ Viewing of typical CA configuration screens ▪ Use of Transport Stream Analyzer for basic analysis
Day 5	**Practical Exercises (site visit)**

2.5 Implement Fault-Finding Techniques in Electronic Systems (SAQA #115054, NQF Level 5, 8 Credits)

2.5.1 Training Focus

This training course will equip the learner with the necessary basic knowledge and skill to use logical methods and equipment to fault-find/troubleshoot professional broadcast transmission equipment.

2.5.2 Course Outcomes

Delegates who attended this course will be able to:

- Read and interpret schematic diagrams.
- Compile block diagrams of operations and functions of equipment.
- Relate information of the block diagrams to circuit boards.
- Test electronic systems (using instrumentation).
- Select electronic system fault location strategies.
- Locate faults in electronic systems.

2.5.3 Prerequisites

- Grade 12 or an equivalent qualification/B.Tech Diploma in Radio and Television Engineering
- Completed the course: Fundamentals of Broadcast Engineering

2.5.4 Audience

- Delegates with an understanding of the fundamentals of electronics, radio frequencies and wave transmission.
- Delegates who is already competent in the use of hand and power tools, basic soldering and wiring and familiar with test equipment

2.5.5 Course Structure

Day	Course Contents
Day 1	**Read and Interpret schematic programs** ▪ Identification of component symbols ▪ Function of components
Day 2	**Compile block diagrams of operations and functions of equipment.** ▪ Block symbols and the function thereof in compiled block diagrams ▪ Identification of block inputs and outputs signal points ▪ Indication of waveform/levels on schematic diagrams **Relate information of the block diagrams to circuit boards** ▪ Identification and function of components associated with blocks Identification and indications of block inputs and outputs test points on printed circuit boards. **Test electronic systems (using instrumentation)** ▪ Functions of common test instrumentation ▪ Selection of test instrumentation for a given type of circuit. ▪ Identification of test points on hardware Evaluation of the operation/function of the circuit (Analogue/Digital)
Day 3	**Select electronic system fault location strategies** ▪ Selection of fault location methods for system types (Sequential/Non-Sequential) ▪ Selection of Individual tests Recording/procedural documentation **Locate faults in electronic systems** ▪ Execution of fault location strategy ▪ Effective use of selected test equipment to locate faults Accurate use of system documentation for board-level fault location
Day 4	**Practical Fault-finding**

2.6 Operational Principles and Circuit Theory of Satellite and Digital Television Decoders (SAQA #115027, NQF Level 5, 4 Credits)

2.6.1 Training Focus

The purpose of this skills programme is to equip the learner with the necessary basic understanding of the satellite and digital television decoder (also known as Set Top Box – STB) operation and its role within the digital television signal delivery chain.

The course will consist of 2-day's theoretical/practical training.

2.6.2 Course Outcomes

The specific outcomes to be achieved with this skills programme is to:

- Understand the fundamental principles of satellite television signal transmission and reception;
- Be able to identify and explain the signal processing performed in a satellite television decoder;
- Understand the fundamental principles of digital television signal transmission and reception;
- Be able to identify and explain the signal processing performed in a digital television decoder.

2.6.3 Prerequisites

Delegates should have a basic understanding of:

- video and television systems
- television receiver circuits

2.6.4 Audience

Technically skilled people who work in the broadcasting environment and need to use sophisticated methods and equipment to install, set-up, operate and fault find domestic and semi-professional digital satellite and terrestrial television receiving installations.

2.6.5 Course Structure

Day	Course Contents
Day 1	**The Fundamental Principles Of The Processes Required In The Transmission Of Satellite Television Sound And Vision Signals** ▪ Principles behind the transmission of satellite television sound and vision signals ▪ Frequency bands and channel bandwidths relating to the satellites and terrestrial digital television ▪ Principles of the processes required in the reception of satellite television sound and vision signals ▪ Principles of the processes required in the transmission of digital terrestrial television sound and vision signals
Day 2	**Identify And Explain The Signal Processing Performed In Satellite And Digital Television Decoders** ▪ The signal processing stages in a satellite analogue decoder on board level ▪ The functions of signal processing stages in a satellite decoder on component level ▪ The functions of the signal processing stages in a digital terrestrial decoder on board level ▪ The functions of the signal processing stages in a digital terrestrial decoder on component level ▪ Practical exercises

Example: Course participants performing a DTT TV decoder installation

2.7 Repair or Replace Broadcast Equipment (SAQA #115041, NQF Level 5, 10 Credits)

2.7.1 Training Focus

The purpose of this course is to equip the learner with the necessary knowledge and skill to use sophisticated methods, functional and circuit diagrams, and diagnostic tools and other test equipment to locate and repair faults on broadcast equipment.

2.7.2 Course Outcomes

The course will focus on the following specific outcomes:

- Planning fault finding activities
- Diagnosing faults in broadcast equipment and systems
- Repairing or replacing broadcast equipment
- Comply with workplace health and safety requirements when repairing or replacing broadcast equipment
- Reporting and feedback on repair or replacement activities
- Solve problems related to repairing and replacing equipment

2.7.3 Prerequisites

Grade 12 or an equivalent qualification/B.Tech Diploma

2.7.4 Audience

- Delegates that understand the fundamentals of Audio, video, and data principles; electronic principles and component identification
- Delegates who is already competent in the use of hand and power tools; basic soldering and wiring; using test equipment and able to read and interpret electronic circuit diagrams

2.7.5 Course Structure

Day	Course Contents
Day 1	**Plan fault finding activities** ▪ Performance criteria ▪ Diagnostic Tools and Aids ▪ Digital IC Troubleshooters ▪ Workshop Tools and Aids for Servicing and Maintenance

	Diagnose faults in broadcast equipment ▪ Trouble-shooting Techniques ▪ Digital troubleshooting methods **Diagnose faults in broadcast system** ▪ Fault Diagnosing ▪ Quick Fixes ▪ Trouble-shooting with Flowcharts ▪ Trouble-shooting process ▪ Isolation of fault causes ▪ Trouble-shooting methods
Day 2	**Repair or replace broadcast equipment** ▪ Repair and/or Replacement of Faulty Equipment Items ▪ Conditions for repair ▪ Specific items for repair **Health & safety requirements** ▪ Housekeeping ▪ Ventilation ▪ Fire prevention ▪ First Aid ▪ Administrative controls ▪ Electrical Safety **Report and feedback on repair or replacement activities** ▪ Maintenance reporting ▪ Central maintenance and repair records. ▪ Maintenance Schedule **Solve problems related to repairing and replacing equipment** ▪ Human factors affecting repairs of broadcast equipment ▪ Protection against power surges and lightning ▪ Planning and Budgeting for maintenance and repairs

3 2025 Training Calendar

The training courses will be provided on the dates indicated below unless otherwise agreed.

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LS of SOUTH AFRICA TRAINING ACADEMY

2025 TRAINING CALENDAR

BROADCAST		
TRAINING COURSE	**DURATION**	**DATE**
DVB-T2 Technology (Theory and Practical)	4 days	09.- 12.06.2025
DVB-T2 Technology (Theory and Practical)	4 days	01.- 04.09.2025
DVB-T2 Technology (Theory and Practical)	4 days	03.- 06.11.2025
Broadcast Planning using CHIRplus_ BC	4 days	03.- 06.03.2025
Broadcast Planning using CHIRplus_ BC	4 days	01- 04.07.2025
Broadcast Planning using CHIRplus_ BC	4 days	10.- 13.11.2025
Fundamentals to Broadcast Engineering	1 day	31.03.2025
Fundamentals to Broadcast Engineering	1 day	22.09.2025
RF Electromagnetic Radiation Exposure Measurements	3 days	25.- 27.03.2025
RF Electromagnetic Radiation Exposure Measurements	3 days	17.- 19.06.2025
RF Electromagnetic Radiation Exposure Measurements	3 days	18.- 20.11.2025
FM Broadcast Engineering (Theory and Practical)	8 days	17.- 26.02.2025
FM Broadcast Engineering (Theory and Practical)	8 days	12.- 21.05.2025
FM Broadcast Engineering (Theory and Practical)	8 days	13.- 22.10.2025
FM Radio 101	1 day	30.04.2025
FM Radio 101	1 day	21.08.2025
Digital Radio Fundamentals	1 day	29.05.2025
Digital Radio Fundamentals	1 day	15.09.2025
Digital Video Broadcasting Head-ends	1 day	30.06.2025
Digital Video Broadcasting Head-ends	1 day	22.08.2025
Theory of Satellite and Digital Television Decoders	2 days	10.- 11.03.2025
Theory of Satellite and Digital Television Decoders	2 days	25.- 26.08.2025
Repair and Replace Broadcast Equipment	2 days	29.- 30.07.2025
Repair and Replace Broadcast Equipment	2 days	29.- 30.09.2025

RADIO NETWORK PLANNING		
TRAINING COURSE	**DURATION**	**DATE**
Radio Network Planning	3 days	01.-03.04.2025
Radio Network Planning	3 days	24.- 26.06.2025
Radio Network Planning	3 days	18.- 20.08.2025
Radio Network Planning	3 days	01.- 03.10.2025

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2025 TRAINING CALENDAR

SPECTRUM MANAGEMENT		
TRAINING COURSE	**DURATION**	**DATE**
Spectrum Management	3 days	17.- 19.03.2025
Spectrum Management	3 days	26.- 28.05.2025
Spectrum Management	3 days	14.- 16.07.2025
Spectrum Management	3 days	27.- 29.10.2025
Spectrum Monitoring	1 day	13.03.2025
Spectrum Monitoring	1 day	17.07.2025
Spectrum Management, Radio Network Planning and Spectrum Monitoring	5 days	07.- 11.04.2025
Spectrum Management, Radio Network Planning and Spectrum Monitoring	5 days	08.- 12.09.2025
Spectrum Management, Radio Network Planning and Foundation of Telecoms Regulation	5 days	07.- 11.07.2025
Spectrum Management, Radio Network Planning and Foundation of Telecoms Regulation	5 days	06.- 10.10.2025
Spectrum Analysis refresher course	2 day	07.- 08.05.2025
Spectrum Analysis refresher course	2 day	05.- 06.08.2025

DIGITAL MOBILE AND MICROWAVE		
TRAINING COURSE	**DURATION**	**DATE**
Microwave Link Planning	3 days	04.- 06.02.2025
Microwave Link Planning	3 days	14.- 16.04.2025
Microwave Link Planning	3 days	12.- 14.08.2025
Microwave Link Planning	3 days	16.- 18.09.2025
Microwave Link Planning (Theory and Practical)	4 days	04.- 07.02.2025
Microwave Link Planning (Theory and Practical)	4 days	14.- 17.04.2025
Microwave Link Planning (Theory and Practical)	4 days	12.- 15.08.2025
Microwave Link Planning (Theory and Practical)	4 days	16.- 19.09.2025
Introduction to 5G	1 day	22.05.2025
Introduction to 5G	1 day	07.08.2025

REGULATORY AND OTHER		
TRAINING COURSE	**DURATION**	**DATE**
Foundation of Telecommunication Regulation	2 days	03.- 05.06.2025
Foundation of Telecommunication Regulation	2 days	27.- 29.08.2025
Fundamentals of Networking	2 days	11.- 12.02.2025
Fundamentals of Networking	2 days	22.- 23.07.2025

4 Terms and Conditions

Scheduled Training Course

The LS of South Africa Training Academy provides scheduled training courses as indicated in the Training Calendar. Dates can be rescheduled to accommodate the client's needs.

Customised Training Courses

Training courses can be customised to the client's needs. Full flexibility on course content, duration of course and scheduling of course dates. Customised training can be held at the premises of the Training Academy or at the clients preferred choice of site or venue.

Our classroom training method has also been extended to on-line learning platforms for groups upon request. Learning is therefore no longer limited by distance and travel restrictions.

Training Time Schedule

If not marked differently the training starts at 9:00 am and ends at 5:00 pm.

Course Fee

1. Course fees are available on request. Prices vary from individual to groups.
2. Register 5 or more delegates for one training course and receive discount.
3. Each price is quoted in South African Rand and exclude Value Added Tax (VAT) for South African customers.
4. The course fee must paid in full (unless expressly agreed otherwise) latest 10 working days prior to the course start date in order to guarantee a seat.
5. Delegates are not allowed to attend courses if payment has not been made.
6. The course fee includes course material, refreshing beverages, snacks and a **light lunch** during training courses.
7. Travelling costs, accommodation and living expenses for the delegates are not included.
8. Prices are exclusive of all taxes, fees, levies, customs duties raised outside South Africa.
9. All additional costs for training at locations other than at the LS of South Africa Training Academy will be borne by die client.

Banking Detail:

Supplied on Tax Invoice.

Application

1. A Learner Admission Application form must be completed and returned to the LS of South Africa Training Academy latest 21 working days prior to the training course start date.
2. Once delegate is notified of his/her acceptance to enrol, the delegate must complete the registration form and return it by e-mail to the LS of South Africa Training Academy latest 15 working days prior to start date of the course.

Minimum number of attendees

LS of South Africa Training Academy reserves the right to change the course date or cancel the course if the number of delegates is insufficient.

Language

The courses will be held in English unless stated otherwise. The course documentation is in English.

Certificates

Certificates of participation will be awarded to all those who complete a course.

Location

The scheduled courses are held at the LS of South Africa Training Academy in Ruimsig, Johannesburg, South Africa, unless stated otherwise. Training courses are offered on-site by special arrangement.

Data protection

As an attendee you agree that we keep and process your personal data to manage and administer the training course and to keep you informed of future training courses on offer.

COVID-19 policy

All COVID-19 health and safety protocols and measurements are applied at the training academy.

Withdrawal policy

1. Cancellations may be made free of charge up to 13 working days prior to the start of the training course.
2. After this time, a cancellation charge of 80% of the course fee applies. Withdrawals must be confirmed in writing prior to the course start date, otherwise the full amount will be due.
3. Substitutions may be applied for in writing 5 working days prior to the course starting date.

Disclaimer

1. The LS of South Africa Training Academy reserves the right to change or cancel any part of its published programme due to unforeseen circumstances.
2. Your registration alone does not constitute a binding agreement and requires our written approval which regularly can be assumed by our invoice.

5 Our Clients