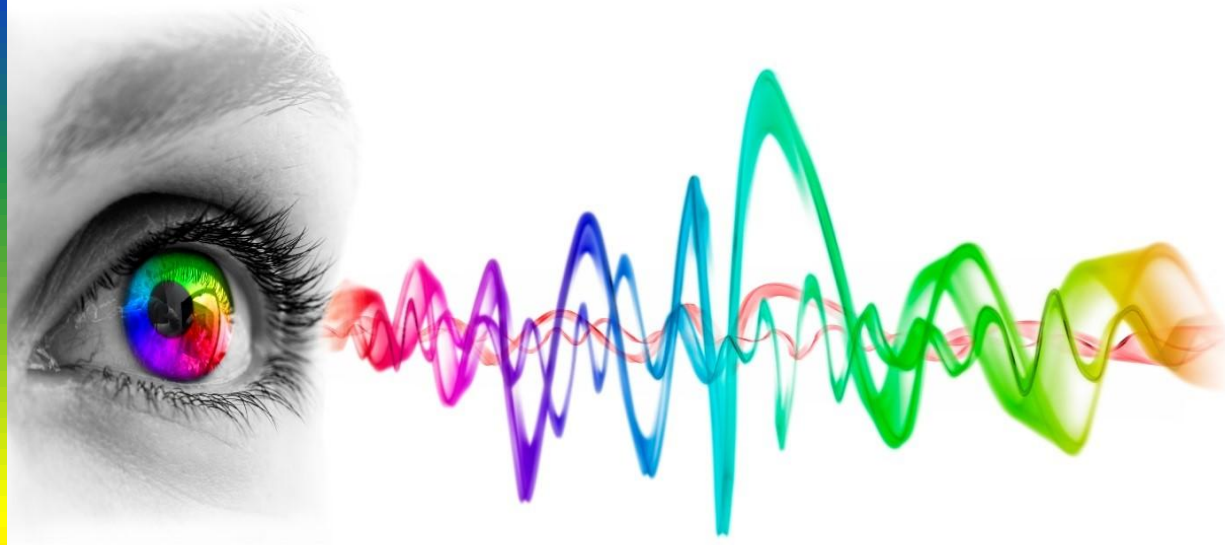
LS telcom

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 51, 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
- Operational Principles and Circuit Theory of Satellite and Digital Television Decoders

SPECTRUM MANAGEMENT

- Spectrum Management
- Spectrum Monitoring
- Spectrum Management, Planning and Spectrum Monitoring
- Spectrum Management, Planning and Foundation of Telecoms Regulations
- Spectrum Analysis
- Spectrum Matters for 5G

DIGITAL MOBILE AND MICROWAVE

- Microwave Link Planning
- Introduction to 5G

RADIO NETWORK PLANNING

- Radio Network Planning

REGULATORY

- Foundation of Telecommunication Regulation

OTHER

- Fundamentals of Networking
- Wireless Connectivity for IoT
- Wireless Systems for Industrial Applications
- EMC Testing and Measurements

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 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

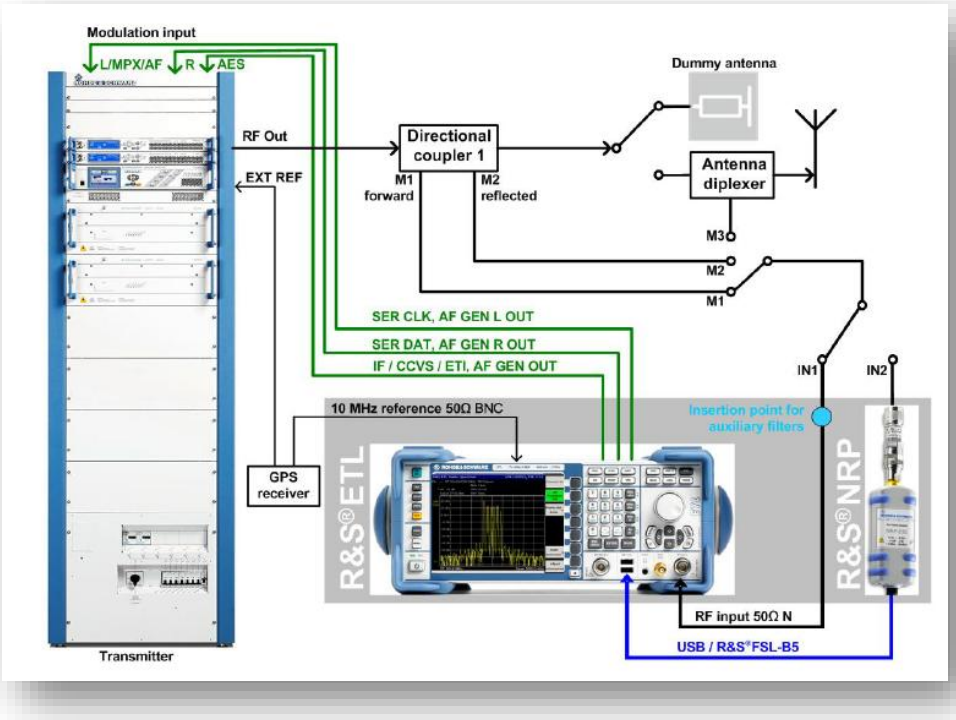
- Introductory principles of FM Broadcasting theory
- Workable knowledge of FM Transmitters, combiners and antennas
- Able to do basic FM measurement techniques
- Knowledge of Linking of sites and studios as well as monitoring and remote control
- Workable knowledge of Preventative maintenance and fault-finding
- 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 Course Structure

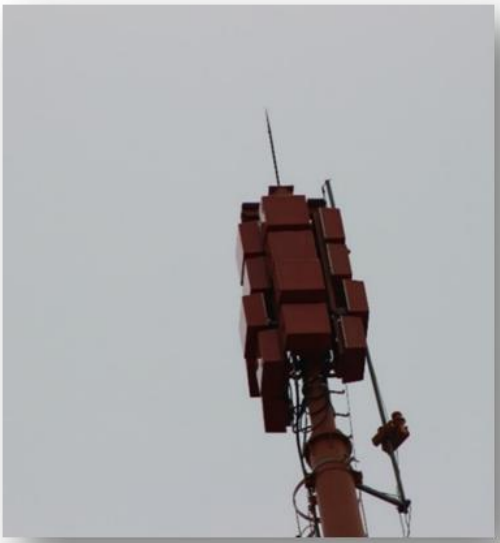
Day	Course Contents
Day 1	Electromagnetic waves, Wave transmission and RF Principles
Day 2	RF Planning, Coverage
Day 3	Preventative Maintenance, Modulation and Stereophonic Broadcasting, FM Transmitters
Day 4	Filters/Combiners, Dummy Loads, RF Switches, U-Link Panels, Antennas

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

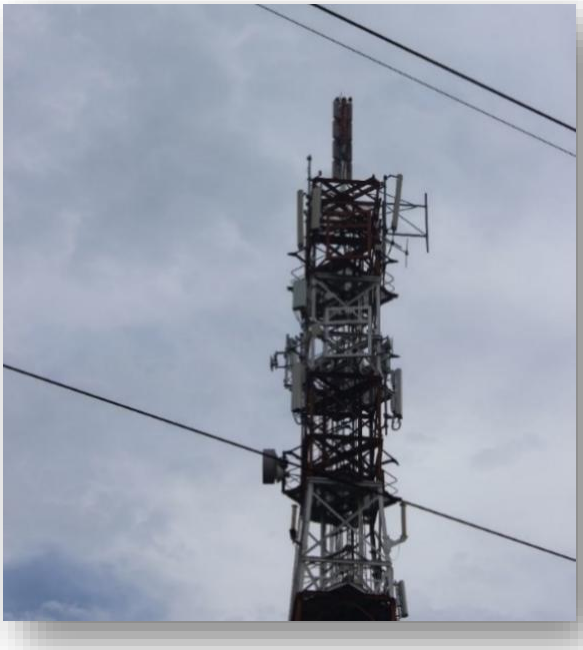
Example: Typical Transmitter Test set-up



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

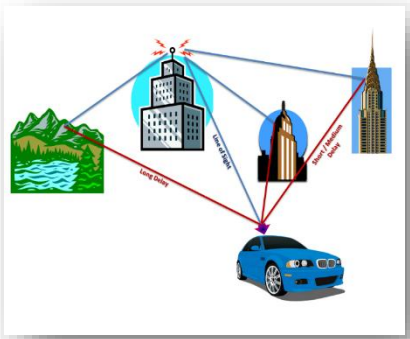
- Delegates will have a solid understanding of the fundamentals of FM sound broadcasting
- Delegates will gain confidence to set up and operate the Nautel VS Series FM transmitters

1.3.3 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).

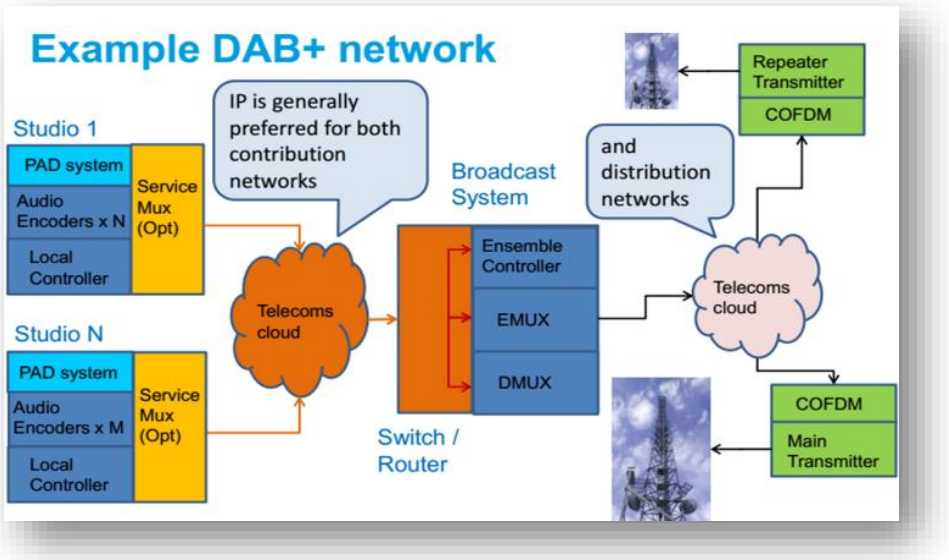
Attention is given but not limited to DSB (encompassing DAB+ and DRM) fundamentals, advantages/disadvantages, basic infrastructure, requirements for frequency bands and planning of networks.

1.4.2 Course Outcomes

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

1.4.3 Course Structure

Day	Course Contents
Day 1	▪ 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 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 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 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 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 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 Course Structure

Day	Course Contents
Day 1	▪ Introduction ▪ Technology in Context ▪ Why Regulate?? ▪ Regulatory Organisations ▪ International Frameworks ▪ Looking Ahead ▪ Regulating for effective competition ▪ Spectrum Management
Day 2	▪ Spectrum Monitoring ▪ Spectrum Pricing ▪ Network Access and Interconnection ▪ Universal Access and Service ▪ Regulatory challenges going forward ▪ Cyber security ▪ 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 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 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

1.13.1 Training Focus

The Spectrum Analyzer is a very necessary test instrument in the hands of the RF engineer and technician. It is used to investigate and analyze modulated RF signals, measure RF signals, monitor RF components while adjustments and/or repairs are made on RF transmission equipment.

It may be used for finding unwanted and/or illegal RF signals in a frequency band.

It is a sensitive and expensive instrument and therefore the necessary precautions should be taken into account while operating the Spectrum Analyzer.

Spectrum Analyses knowledge serves as the foundation for Network Analyzers and complex RF Signal analyzers.

1.13.2 Course Outcome

After completing the three-day training course, delegates will be able to:

- Know all the functions of the Spectrum Analyzer
- Resolve a RF signal and measure the amplitude of a single carrier
- Measure the channel power and frequency of a digital signal
- Measure the frequency of a Carrier signal
- Forward and reflected powers measurements using a directional coupler
- Do signal to noise measurements
- Measure the characteristics of a RF filter
- Tune a simple RF filter

1.13.3 Course Structure

Day	Course Contents
Day 1	• Fundamentals of the Spectrum Analyzer • Precautions • Reference level and reference level offset • Use of Attenuators, internal and external • Various detectors • Purpose of the preamplifier

	• RBW, VBW and Sweep • Traces • Noise Floor/Sensitivity, phase/sideband noise • Averaging
Day 2	• Noise floor • Carrier power measurement • Accurate measurement of channel power • Adjacent channel power measurement • Signal to noise measurement • Use of detectors • Trace displays • Markers
Day 3	**Practical measurements and adjustments:** • Measurement of a single carrier frequency and power • Measurement of a digital Signal frequency and channel power • Forward and reflected power measurements using directional coupler • RF Filter measurement and tuning • Basic direction finding using an antenna

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 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 Exercises
	  o Measuring EMF levels with an analyzer
	  o Calculating EMF levels and using LS emulation software
	▪ 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 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?
	  ○ Packet switching and circuit switching
	  ○ Encapsulation
	▪ Introduction to the ISO OSI model
	  ○ Comparison to Department of Defence model/IP stack (TCP/IP model)

	○ Explanation of: TCP, IP, ports ○ Explanation of each layer, protocols, addressing, data flow ▪ Physical Media ○ NIC and MAC addressing ○ Cable and connection types ▪ Network Components ○ Explanation of broadcast and collision domains ○ Devices: hub, switch, router, bridge, firewall, WAP, NAS ▪ Network Connection Types ○ Dial-up Modem, DSL, FTTH/FTTP (PON, AON) ○ Wireless WAN Technologies ▪ Cellular, WiMAX, LTE ▪ IP Addressing ○ Binary conversions ○ Hexadecimal ○ IPv4 and IPv6 ○ Reserved/special addresses ○ Subnetting ▪ DHCP, DNS, and NAT
Day 2	▪ What is a protocol? ○ Protocol definition ○ Three-way handbrake ○ Practical examples ▪ History of the Internet ○ Covers important milestones: ARPA/DARPA net, Ethernet, ... ▪ Routing Protocols ○ 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 sessions on networking ○ Network cable making and testing ○ Router setup and configurations

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 also present 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 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 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 refer to the individual courses under points 1.5, 1.8 and 1.16 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 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 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

1.19 Wireless Connectivity for IoT

1.19.1 Training Focus

The Internet of Things (IoT) covers a huge range of use cases and applications and scales from single devices to massive systems with various elements connecting in real time. Wireless connectivity is an integral part of IoT. Depending on the application, factors such as range, data requirements, security, power requirements and battery life will dictate the choice of one or some form of combination of wireless technologies.

Traditional cellular mobile networks based on 2G/3G/4G have almost ubiquitous coverage and high data rates but at cost of high power requirements at end user devices. Low Power Wide Area Networks (LPWAN) based on standards like LoRaWAN, Ultra Narrow Band (UNB) or NB-IoT, are expected to complement traditional connectivity solutions for long range communication. Short range technologies such as Bluetooth, BLE, ZigBee, WiFi or RFID will provide connectivity over short distances. And, of course, 5G presents another set of opportunities for IoT connectivity.

This course explores radio technologies for IoT applications; discusses the underlying concepts and the resulting advantages and limitations. An analysis of spectrum requirements and availability complements the training.

1.19.2 Course Outcome

After completing the one-day training, participants will be familiar with most recent radio technologies available to power IoT applications. They will understand the differences between the technologies, and the benefits and compromises of each.

1.19.3 Course Structure

Day	Course Contents
Day 1	▪ IoT applications and communication requirements ▪ Overview on wireless technologies and approaches for IoT applications ▪ Spectrum requirements and availability ▪ Radio systems for Low Power Wide Area Networks ▪ Radio systems for Low Power Personal Area Networks ▪ 3GPP systems and the role of 5G for IoT
Day 2	▪ LoRa network planning with CHIRPlus_TC

1.20 Spectrum Matters for 5G

1.20.1 Training Focus

5G is driven both by the need for mobile operators to quench the growing, insatiable and unquestionable thirst for mobile data, and to support new use cases and services. Numerous institutional, academic, commercial and regulatory organizations continue to work towards the commercialization of 5G services but fundamental questions remain such as what can 5G really deliver, what will 5G networks look like, and how will this impact spectrum demand, authorization and usage?

There is also the question of technology evolution: To what extent have 5G enhancements contributed towards characteristics such as the air interface, massive MIMO and network slicing, or will it be 6G that really delivers against the original vision set out by proponents of 5G?

When it comes to the question of spectrum however, there are many different views about how growth in data traffic impacts upon demand for radio spectrum. It is also evident that below 6 GHz there is very little spectrum remaining that can be re-farmed for mobile services and much of the focus for new spectrum for future mobile (5G and 6G) services is concentrated above 6 GHz. New spectrum being proposed for 6G will be in the THz range which means the signal propagation will be limited but offers extremely wide bandwidths. How feasible is it to deliver mobile services at such high frequencies? Are there ways to use existing spectrum more efficiently, or are current mobile technologies such as LTE Advanced and 5G already very close to the limit of what is achievable?

1.20.2 Course Outcome

After completing the two-day training course, participants will have an understanding of how the evolution towards a 5G standard is leading the chase to identify new spectrum, which spectrum bands are under consideration for 5G and 6G, and whether 5G or possibly 6G might mark the end to the hunger of mobile operators for more spectrum.

1.20.3 Course Structure

Day	Course Contents
Day 1	▪ Forecasts of demand for data services ▪ Realistically forecasting spectrum demand ▪ Bands capabilities and issues with existing IMT bands ▪ New bands being considered for 5G and 6G services
Day 2	▪ Propagation and coverage of bands above 6 GHz

	▪ The spectrum efficiency of existing IMT technologies ▪ The 5G ecosystem ▪ A roadmap for the introduction of 5G services ▪ Authorization of 5G spectrum

1.21 Wireless Systems for Industrial Applications – Industry 4.0

1.21.1 Training Focus

In nearly every factory floor and industrial setting, communication links are used to carry vital information between machinery and to control and monitor devices. From periodic updates to ongoing process and manufacturing management, timely delivery without failure is critical to operations. Cabled systems can be very expensive and tether equipment to fixed locations, reducing flexibility in equipment placement and reorganization. Turning to wireless technology addresses the cabling drawbacks but requires careful examination of transmission, operational and propagation characteristics to achieve the required performance.

A solid understanding of the possibilities and limitations of current radio technologies (including 5G), deployment scenarios and spectrum availability is therefore essential for the successful introduction of wireless systems for automation. This course describes technologies and concepts for wireless communication for industrial applications. It considers operational requirements, specific RF propagation characteristics, available frequency bands, compatibility issues and develops appropriate design strategies. An overview and comparison of appropriate wireless technologies for industrial applications will complete the training.

1.21.2 Course Outcome

After completing the one-day training course, delegates will understand the requirements and limitations of radio systems for industrial applications. They will know the physical and regulatory constraints of the radio environment and understand the procedures for system planning.

1.21.3 Course Structure

Day	Course Contents
Day 1	▪ Introduction: the wireless landscape ▪ Industrial requirements ▪ Spectrum for wireless automation ▪ Radio propagation in industrial environment ▪ Wireless network system design criteria and system selection ▪ Radio systems for wireless automation ▪ Compatibility issues

1.22 Spectrum Monitoring/Measurements

1.22.1 Training Focus

This training is based on the Spectrum Monitoring Measurements and Techniques, giving an introduction into the practical aspects of spectrum monitoring measurements. You will carry out practical exercises to the limitations of spectrum monitoring measurements. The training ends with some real-life measurements.

1.22.2 Course Outcome

After the training, you will be able to perform practical spectrum monitoring measurements under real conditions and limitations in the RF field. You will be able to make estimations on expected measurement results, judging the quality of the performed measurements, and planning measurement campaigns. These skills can be transferred directly to daily work.

- Monitoring vs Measurement
- Understand most common measurements
- How to apply methods and procedures
- Measurement technologies
- Technical limitations of equipment

1.22.3 Course Structure

Day	Course Contents
Day 1	• LS OBSERVER • General • Utilization • Manual and automated radio monitoring • Interference
Day 2	• Automated monitoring • Detection of regulatory unauthorized utilizations • Inspection • Monitoring of digitally modulated signals • Real time radio occupancy monitoring • Monitoring of assignments

Day 3	• Overview of spectrum monitoring tasks
	• Selecting equipment according to the actual task
	• Distinguishing between real signals and intermodulation products
	• Limitations due to real-life environment
	• Basic measurements
	• Practical measurements on FM broadcast / DVB-T transmitters
	• Different usage of homing and direction finding
	• Locating transmitters using various methods
	• Alternative spectrum measurement techniques (UAV/Mobile Measurements)
	• Practical demonstrations
	  ○ UAV based spectrum measurement demonstrations
	  ○ Cellphone based mobile measurements - QoS

1.23 Introduction to EMC Testing and Measurements (Anechoic Chamber)

1.23.1 Training Focus

All electronic components including cellphones, computers and vehicles consist of Radio Frequency transmissions which will need to be tested and checked for electromagnetic compliance.

1.23.2 Course Outcome

This course will provide the basic knowledge to do Electromagnetic Compliance testing of any products in a Full Anechoic chamber. This course will also cover different anechoic chamber designs, principles and use cases. The candidate will also be taught the skills to extract and analyze radiation patterns and gain curves of antennas or any radiating element in a system.

1.23.3 Course Structure

Day	Course Contents
Day 1	• EMC/EMI Standards • Chamber Pattern Measurements • Chamber Spectrum Measurements • Pre-measurement Calibrations • EMC measurements • EMI measurements • Basics of Anechoic Chamber Design • Anechoic Chamber Control room
Day 2	**Practical demonstrations:** • Chamber Overview • Pattern Measurements • Gain Measurements • EMC testing • EMI testing

1.24 Operational Principles and Circuit Theory of Satellite and Digital Television Decoders

1.24.1 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.

1.24.2 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.

1.24.3 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 2026 Training Calendar

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

LS Multi Copter Projects and Services (Pty) Ltd

LS of SOUTH AFRICA TRAINING ACADEMY

2026 TRAINING CALENDAR

BROADCAST		
TRAINING COURSE	**DURATION**	**DATE**
DVB-T2 Technology (Theory and Practical)	4 days	09.- 12.06.2026
DVB-T2 Technology (Theory and Practical)	4 days	03.- 06.11.2026
Broadcast Planning using CHIRplus_ BC	4 days	03.- 06.03.2026
Broadcast Planning using CHIRplus_ BC	4 days	07- 10.07.2026
Fundamentals to Broadcast Engineering	1 day	31.03.2026
Fundamentals to Broadcast Engineering	1 day	22.09.2026
RF Electromagnetic Radiation Exposure Measurements	3 days	24.- 26.03.2026
RF Electromagnetic Radiation Exposure Measurements	3 days	02.- 04.06.2026
FM Broadcast Engineering (Theory and Practical)	8 days	18.- 27.05.2026
FM Broadcast Engineering (Theory and Practical)	8 days	12.- 21.10.2026
FM Radio 101	1 day	21.08.2026
Digital Radio Fundamentals	1 day	29.05.2026
Digital Video Broadcasting Head-ends	1 day	30.06.2026
Theory of Satellite and Digital Television Decoders	2 days	14.- 15.05.2026
SPECTRUM MANAGEMENT		
TRAINING COURSE	**DURATION**	**DATE**
Spectrum Management	3 days	17.- 19.03.2026
Spectrum Management	3 days	14.- 16.07.2026
Spectrum Management	3 days	27.- 29.10.2026
Spectrum Monitoring	1 day	09.03.2026
Spectrum Monitoring	1 day	21.07.2026
Spectrum Matters for 5G	2 days	18.-19.06.2026
Spectrum Matters for 5G	2 days	15.-16.09.2026
Spectrum Monitoring/Measurements	3-days	28.- 30.04.2026
Spectrum Monitoring/Measurements	3-days	17.- 19.08.2026
Spectrum Management, Radio Network Planning and Spectrum Monitoring	5 days	23.- 27.02.2026
Spectrum Management, Radio Network Planning and Spectrum Monitoring	5 days	24.- 28.08.2026
Spectrum Management, Radio Network Planning and Foundation of Telecoms Regulation	5 days	13.- 17.04.2026
Spectrum Management, Radio Network Planning and Foundation of Telecoms Regulation	5 days	03.- 07.08.2026
Spectrum Analysis course	3 days	10.- 12.03.2026
Spectrum Analysis course	3 days	11.- 13.08.2026

LS telcom
LS Multi Copter Projects and Services (Pty) Ltd

LS of SOUTH AFRICA TRAINING ACADEMY

2026 TRAINING CALENDAR

DIGITAL MOBILE AND MICROWAVE		
TRAINING COURSE	**DURATION**	**DATE**
Microwave Link Planning	3 days	10.- 12.02.2026
Microwave Link Planning	3 days	21.- 23.04.2026
Microwave Link Planning	3 days	08.- 10.09.2026
Microwave Link Planning (Theory and Practical)	4 days	10.- 13.02.2026
Microwave Link Planning (Theory and Practical)	4 days	21.- 24.04.2026
Microwave Link Planning (Theory and Practical)	4 days	08.- 11.09.2026
Introduction to 5G	1 day	08.05.2026
Introduction to 5G	1 day	20.08.2026

RADIO NETWORK PLANNING		
TRAINING COURSE	**DURATION**	**DATE**
Radio Network Planning	3 days	17.-19.02.2026
Radio Network Planning	3 days	23.- 25.06.2026
Radio Network Planning	3 days	06.- 08.10.2026

REGULATORY AND OTHER		
TRAINING COURSE	**DURATION**	**DATE**
Foundation of Telecommunication Regulation	2 days	22.- 23.07.2026
Foundation of Telecommunication Regulation	2 days	29.- 30.09.2026
Fundamentals of Networking	2 days	07.- 08.04.2026
Fundamentals of Networking	2 days	01.- 02.09.2026
Wireless Connectivity for IoT	2 days	05.- 06.05.2026
Wireless Connectivity for IoT	2 days	28.- 29.07.2026
Wireless Systems for Industrial Applications	1 day	07.05.2026
Wireless Systems for Industrial Applications	1 day	30.07.2026
Introduction to EMC Testing and Measurements	2 days	12.- 13.05.2026
Introduction to EMC Testing and Measurements	2 days	01.- 02.10.2026

3 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.

4 Our Clients