



LS telcom Training Academy

Training Calendar 2024

Online Training
Classroom Training
Live Web-Seminars
E-Learning Sessions



Course Overview

	Training Course	Page	Duration (days)	Price (€)	Date
	Radio Communications				
NEW	Spectrum Matters for 5G/6G	5	2	1,495	11. - 12.11.2024
	Wireless Connectivity for the Internet of Things (IoT)	6	1	795	13.11.2024
	5G Readiness and Network Deployment	6	1	795	14.11.2024
NEW	From the 4G/LTE to the 5G-NR Air Interface	7	3	2,495	26. - 28.11.2024
	Digital Terrain Data – Requirements, Production and Usage	8	1	on request	on demand
	In-Building Wireless Network Design	8	2	on request	on demand
	Radio Networks for Critical Communications	9	2	1,495	08. - 09.04.2024
	Radio Network Planning for Critical Communications Networks	9	2.5	1,850	10. - 12.04.2024
	Planning and Coordination of Microwave Links (PtP/PtMP)	10	2	1,495	03. - 04.06.2024
	Radio Link Calculation and Coordination Tool – CHIRplus_TC	10	3	2,150	05. - 07.06.2024
	Wireless Systems for Industrial Applications – Industry 4.0	11	1	795	15.11.2024
	Wireless Networks Calculation Tool – CHIRplus_TC incl. Net Module	11	2	1,495	17. - 18.09.2024
	Spectrum Management				
	Managing and Regulating the Radio Spectrum: A Practical Guide	12	4.5	2,995	09. - 13.09.2024
	Sharing and Dynamic Spectrum Access – Hidden Spectrum Resources?	13	2	1,495	16. - 17.04.2024
	Dealing with the Capacity Crunch	13	2	1,495	18. - 19.04.2024
	Technical Issues in Radio Spectrum Management	14	4.5	2,995	14. - 18.10.2024
NEW	Spectrum Matters for 5G/6G	14	2	1,495	11. - 12.11.2024
	5G and Satellite Compatibility	15	2	1,495	20. - 21.03.2024
NEW	Outcome of WRC 2023	15	1	795	20.02.2024 (online)
	SPECTRAplan S	16	3-5	on request	on demand
	SPECTRAemc Workflow Wizards Configuration	16	3	on request	on demand
	SPECTRAemc Framework Functionalities	17	3	on request	on demand
	SPECTRAemc Radio Calculation Functionalities	17	5	on request	on demand
	SPECTRAemc Coordination AddOns	18	3	on request	on demand
	IT Architecture, Implementation & Maintenance for mySPECTRA Solutions	18	3-5	on request	on demand
NEW	mySPECTRAcloud Report Management	19	3	on request	on demand
NEW	mySPECTRAcloud Configuration Management	19	3-5	on request	on demand
NEW	(Telephone) Number Management	20	3	on request	on demand
NEW	Special Event Management	20	3	on request	on demand

Course Overview

	Training Course	Page	Duration (days)	Price (€)	Date
	Monitoring & Measurements				
	LS OBSERVER – Sensor-based Monitoring and Direction Finding	21	3	2,150	08 - 10.10.2024
	Spectrum Monitoring - Measurements and Techniques	22	2	1,495	13. - 14.05.2024 / 18. - 19.11.2024
	Practical Spectrum Monitoring Measurements	22	3	2,550	15. - 17.05.2024 / 20. - 22.11.2024
	Measurements of Human Exposure to RF Electromagnetic Fields	23	3	2,750	23. - 25.09.2024
	Measurements of Human Exposure to RF Electromagnetic Fields at 5G NR Base Stations	23	1	950	29.02.2024 (online) / 26.09.2024
	Broadcast				
	FM, DAB, TV and 5G Broadcast Antennas	24	1	795	04.11.2024
	DVB-T2 – 2 nd Generation Digital Video Broadcast	25	2.5	1,850	05. - 07.11.2024
	DVB-T2 – Measurement Technology in Theory and Practice	25	1.5	1,495	07. - 08.11.2024
NEW	FeMBMS – 4G/5G-based Broadcast	26	2	1,795	03. - 04.07.2024
	Broadcast Planning Tool CHIRplus_BC (LF/MF)	26	2	on request	on demand
	Broadcast Planning Tool CHIRplus_BC (Radio/TV, Analog/Digital)	27	3	2,150	22. - 24.04.2024
	Broadcast Planning Exercises using CHIRplus_BC	27	2	1,495	25. - 26.04.2024



Welcome to the LS telcom Training Academy!

Since 2003, the LS telcom Training Academy offers a vast selection of training courses covering a variety of topics in broadcast, telecommunications, spectrum management and monitoring. This includes training on latest radio technologies and regulations, radio network planning, spectrum management as well as basic and advanced training on LS telcom's software tools.

In our courses we pay special attention to the following success factors:

- First-class lecturers and trainers with relevant experience
- Current, relevant topics and contents
- Limited attendance
- Pleasant atmosphere in modern rooms incl. lunch, drinks, coffee breaks and WiFi

Customized Training

Besides choosing our regular courses listed in this training calendar, feel free to ask for your individual training according to your specific needs. Build your own training program by picking any suitable course module from our portfolio. You determine the date and the number of people attending.

In the future we would like to support you - professionals at all skill levels and seniorities, whether engineering, technical, managerial or administrative - in your further training and will take up gladly your desires and suggestions.

Take advantage of our seminars to exchange ideas with our lecturers and other experts at eye level.

You will be awarded

After the training, each participant takes home not only sound knowledge but also an award from the LS telcom Training Academy. The certificate confirms that the delegate has successfully participated in the training.



A stylized, handwritten signature in black ink, appearing to read 'Roland Götz'.

Roland Götz
Chief Operating Officer



Radio Communications - Overview

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Spectrum Matters for 5G/6G

2 Days

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?

Course Objectives

After completing the 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.

Intended for

those who need to better understand the spectrum implications of 5G technologies with an appreciation of new frequencies being proposed for 6G, whether from a regulatory, commercial or technical perspective.

Contents

- 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
- 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

Date

11. - 12.11.2024

Course Fee

1,495 € (excluding VAT)

Wireless Connectivity for the Internet of Things (IoT) | 1 Day

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.

Course Objectives

After completing the 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.

Intended for

This course is intended for those who have basic knowledge in radio communication systems, who are interested in wireless systems for IoT applications and who may be responsible for implementing radio systems in industry.

Contents

- 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

Date

13.11.2024

Course Fee

795 € (excluding VAT)

5G Readiness and Network Deployment

1 Day

Training Focus

5G has been designed to support a wide range of use cases, requiring many new considerations when implementing networks. From the network densification expected for enhanced mobile broadband, to dedicated networks for applications such as industrial automation, the challenges in rolling-out 5G are varied and different from previous generations of wireless broadband technology. This course examines the regulatory, operational and commercial, challenges of rolling-out 5G networks. It provides a detailed view of network deployment using new 5G technology and the practicalities of roll-out. It provides examples and exercises which untangle the complexities of 5G network deployment for all the parties involved, and it will enable informed business decisions, and help those involved in 5G to establish future use and roll-out strategies.

Course Objectives

After completing the course, participants will have a solid grounding in the challenges facing 5G network roll-out and deployment across a range of different scenarios, and will understand the challenges and benefits compared to historical wireless technologies.

Intended for

those who wish to strengthen their knowledge of 5G technology, or will be involved in deployment, roll-out or use, and who need to understand the challenges and implications of 5G roll-out on their businesses or organizations. This includes governments, local authorities, vertical industries (e.g. energy, transport, education, healthcare, manufacturing or utilities), operators and vendors.

Contents

- Understand the status of 5G and the road-map to its initial and longer-term deployment
- Identify the key challenges in deploying 5G infrastructure and accessing new and existing spectrum bands
- Demonstrate the benefits and features of 5G technology and how it will support a wide range of different users
- Examine the likely costs of a typical 5G deployment
- Discover how to achieve positive benefits from 5G technology deployment

Date

14.11.2024

Course Fee

795 € (excluding VAT)



From the 4G/LTE to the 5G-NR Air Interface

3 Days

Training Focus

This training course is aimed at those people working within the wireless communication business or broadcast business. Participants will get an overview on the 4G/LTE and 5G-NR physical layer. First of all wireless communication basics like OFDMA, DFTs-OFDMA, Forward Error Correction and MIMO will be discussed followed by an in-depth overview of 4G and 5G technology and standards. The training is presented in cooperation with Rohde & Schwarz.

Course Objectives

After completing this course, delegates will understand the technology behind 4G and 5G. Focus is on the physical layer not on the protocol level. Several practical demonstrations will solidify the theoretical knowledge.

Intended for

This course is intended for those who have a basic knowledge in information technology, who may be employed in network operators or regulators.

Contents

a) Wireless Communication Basics

- Introduction and overview, physical layers mobile communication standards (2G to 5G)
- From single-carrier to multicarrier (OFDM)
- OFDM, OFDMA, SC-FDMA, DFTs-OFDMA basics
- Forward Error Correction (FEC) in mobile communication (2G, 3G, 4G, 5G)
- Shannon, SISO/MISO/MIMO/Alamouti principle, multi-antenna systems

b) 4G/LTE Standard

- Introduction to 4G/LTE
- 4G/LTE air interface
- LTE spectrum, 4G bandwidths, LTE OFDM parameter
- LTE radio frame structure
- LTE downlink and uplink – physical layer overview
- PDSCH, PDCCH, PUSCH, etc.
- MCS, modulation pattern, FEC
- Reference signals
- FDD and TDD
- LTE performance

c) 5G Standard

- Introduction to 5G-NR
- FR1 and FR2
- 5G usage scenarios
- 5G-NR air interface
- 5G spectrum, 5G OFDM parameter, BWP, CA
- FDD and TDD
- 5G architecture options (NSA; SA)
- 5G radio frame structure, slot, subframe, radio frame, SSB
- 5G downlink and uplink – physical layer overview
- PDSCH, PDCCH, PUSCH, etc.
- MCS, modulation pattern, FEC
- Reference signals
- 5G multi-antenna systems, massive MIMO, massive beam forming
- 5G performance (data rates, spectral efficiency, ...)
- 4G MBSFN and 5G, DSS
- Examples for current spectral occupation in mobile communication (2G, 3G, 4G and 5G)
- Practical 5G demonstrations using a signal generator and a spectrum analyzer with vector signal analysis

Date

26. - 28.11.2024

Course Fee

2,495 € (excluding VAT)

Digital Terrain Data – Requirements, Production and Usage | 1 Day

Training Focus

This course will give an introduction into the world of digital terrain data as used in radio planning tools. Lessons inform about basic map production, coordinate systems and storing of information in vector or raster format. The different terrain data types used in radio planning tools will be explained, further, the most common data sources, production processes, and quality criteria will be discussed. Finally, recommendations regarding the suitability of using terrain data for different radio communication services will be given.

Course Objectives

After completing the course, participants will be able to compare terrain data by data type, file format, resolution, coordinate system, accuracy, and source in order to specify the optimum data set for their tasks.

Intended for

This course is intended for those who have basic knowledge in GIS software, who are interested in digital terrain data and who may be employed as radio planners or system administrators for radio network planning and spectrum management tools.

Contents

- Overview of terrain data types
- Coordinate system, projection and data
- Comparison vector versus raster data
- Elevation and land use data
- Maps for visualization
- Population data
- Conductivity data

Date

on demand

Course Fee

on request

In-Building Wireless Network Design

2 Days

Training Focus

Users of wireless networks expect ubiquitous coverage that includes indoor areas such as subway stations and tunnels, shopping malls and high rise buildings. These environments require specific in-building distribution networks as signals from outdoor base stations are often unavailable due to the shadowing effects of metallic surfaces and solidly constructed buildings.

The planning of in-building networks requires fundamental understanding of the relevant issues and approaches to extend coverage into buildings.

This course discusses the relevant questions in relation to design and dimensioning of such systems. The training introduces different concepts to achieve indoor coverage and discusses pros and cons of available technologies like leaky feeder cable, distributed antenna systems (DAS), use of base stations or optical repeater systems. Delegates will learn about in-building wave propagation, network architecture, and the typical technologies for in-building wireless networks deployed today. The classroom training is complemented with practical demonstrations of scenarios with a specific tool for in-building wireless network design.

Course Objectives

After completing the course, delegates will understand the approaches, procedures and requirements for in-building wireless network design and will be familiar with the technical and economic constraints of indoor networks.

Intended for

This course is intended for those who have a general knowledge in radio network planning and who are interested in technical and practical aspects of in-building wireless network design and who may be employed in telecoms regulators, telecoms operators, and utility and transportation companies.

Contents

- Introduction to in-building wireless network design
- Requirements on indoor network design
- Elements of wireless indoor networks
- Radio wave propagation in indoor environments
- Planning of in-building wireless networks
 - Leaky feeder cabling
 - Passive distribution components
 - Antennas
 - Optical distribution systems
- 2G/3G/4G/5G/TETRA/WiFi
- Practical demonstration of in-building wireless network design with indoor planning tool

Date

on demand

Course Fee

on request

Radio Networks for Critical Communications | 2 Days

Training Focus

Professional users in public safety, PPDR, transportation, utilities and industry must rely on efficient radio systems to provide wireless communication for support of their daily operation. Implemented radio technology, network design and user requirements must be carefully matched against each other. A solid understanding of users' requirements and the possibilities and limitations of technologies is therefore essential.

This course discusses issues which need to be considered when a radio system for critical communications shall be introduced or existing systems shall be replaced: Is it better to use services from an existing operator or to build and operate a dedicated network? Which deployment concept should be selected? How to define coverage and capacity? Which technology can provide the required services? These and other questions related to the design and introduction of RF networks for critical communications will be discussed. Starting with specific requirements, the course introduces services specific to critical communications, explains typical planning approaches and highlights possible implementation scenarios. A comparison of recent and upcoming radio technologies like TETRA, DMR, LTE as well as 5G for broadband applications completes the training.

Course Objectives

After completing the course, delegates will understand users' requirements and limitations of current radio technologies like TETRA, DMR, LTE, 5G etc. They will know the technical and economic constraints of radio systems for critical communications and will be able to realistically assess the promises of system vendors and service providers.

Intended for

This course is intended for those who have basic knowledge in radio communication systems, who are interested in technical aspects for critical communications networks and who may be employed in telecoms regulators, organizations for public security and utility and transportation companies.

Contents

- Introduction to radio networks for critical communications
- Requirements on communication services and applications
- Mobile broadband for PPDR
- Elements of a radio network for critical communications
- Planning and operation of a radio network
- Radio systems for critical communications (DMR, TETRA, LTE, 5G)

Date

08. - 09.04.2024

Course Fee

1,495 € (excluding VAT)

Radio Network Planning for Critical Communications Networks | 2.5 Days

Training Focus

Radio networks for professional use in public safety, transportation, utilities, and industry must provide reliable communication for mission critical applications. The use of appropriate design parameter and planning procedures is crucial to achieve the required network performance.

This course provides a solid understanding of how to design and plan networks for critical communications using digital radio technologies like TETRA, DMR or LTE/5G.

The course follows the typical steps of radio network planning from definition of coverage thresholds, over first network design and coverage planning to the development and analysis of frequency plans. Practical considerations and tasks including site selection and antenna configurations are discussed by means of photos and documents originating from real-life networks. Live calculations with a planning tool are used to illustrate effects of site selection and site and network configuration. Supporting the practical exercises, theoretical elements of the course include the principles of radio propagation, link budgets, the determination of coverage thresholds and capacity considerations. The course will be presented as classroom training with slides, interactive tool calculations and exercises to be done by the participants.

Course Objectives

After completing the course, delegates will be familiar with the typical procedures for RF network planning for radio technologies like TETRA, DMR and LTE/5G. They know how to define planning criteria for RF networks and understand the underlying technical and theoretical approaches.

Intended for

This course is intended for those who have basic knowledge in radio network planning, who are interested in radio network planning for critical communications networks and who may be employed in telecoms regulators, telecoms operators, and utility and transportation companies.

Contents

- Targets and procedures for radio network planning
- System parameter and architecture of critical communication networks
- Definition of coverage and capacity targets
- Antenna configurations, site selection and coverage planning
- Capacity considerations
- Frequency planning

Date

10. - 12.04.2024

Course Fee

1,850 € (excluding VAT)

Planning and Coordination of Microwave Links (PtP/PtMP) | 2 Days

Training Focus

Modern transmission networks require communication links with high link capacity and availability. Microwave Point-to-Point (PtP) and Point-to-Multipoint (PtMP) systems can provide the required performance if the links are designed appropriately. Theoretical know-how combined with best practice for link engineering and design ensures that the possibilities of modern link technology will be fully available after implementation.

The course introduces both theoretical and practical knowledge in planning of microwave links. Topics touched cover wave propagation, link budget and availability calculations as well as technical parameters of antennas and microwave devices. Best practice for the analysis of path profiles including line of sight aspects, selection of antenna, modulations scheme and frequency band is provided. Availability engineering of links is discussed as well as frequency and capacity planning for complex transmission networks. This includes the effective use of frequency raster and the analysis of network interference to achieve low interference and high frequency reuse.

Course Objectives

After completing the course, delegates will be familiar with the principles of microwave radio link planning and will be in the position to design individual microwave links as well as complete PtP and PtMP networks.

Intended for

This course is intended for those who have basic knowledge in radio communications and microwave link technology, who are interested in microwave link planning and who may be employed in regulators, telecoms operators and utility or transportation companies.

Contents

- Spectrum regulation and licensing aspects
- Relevant ITU recommendations
- Wave propagation and effects
- ITU propagation models
- Path profile analysis
- Microwave devices and antennas
- Availability and error performance
- Link budget calculation
- Frequency planning and channel assignment
- Interference analysis and network optimization

Date

03. - 04.06.2024

Course Fee

1,495 € (excluding VAT)

Radio Link Calculation and Coordination Tool – CHIRplus_TC | 3 Days

Training Focus

The design of microwave links requires complex calculations to dimension link capacity and availability or to assign frequencies. The planning tool CHIRplus_TC provides the required functionality in a user-friendly way and is essential for proper link design. The seminar introduces essential features to perform link engineering and planning tasks for Point-to-Point and Point-to-Multipoint systems. The first day is dedicated to the general tool handling. The different database functions and configurations are presented and discussed with the delegates. The following days will cover the necessary steps to perform typical link calculations - from data input over the setting of required parameters to the calculations analyses. Finally, reports and data export options will be presented. The entire workflow that is required to execute microwave radio link planning tasks as well as the Point-to-Multipoint network planning process is covered. Additionally, an overview of further network technologies included in the Net Module will be introduced.

Course Objectives

After the training the delegates will be able to efficiently solve link planning and coordination tasks using CHIRplus_TC and to interpret the calculation results for microwave links and Point-to-Multipoint networks.

Intended for

This course is intended for those who have basic knowledge in radio communication and microwave link design and who are interested in the functionality provided by CHIRplus_TC.

Contents

- Setup and configuration of CHIRplus_TC
- Interaction with the Graphical User Interface (GUI)
- Usage of databases and spreadsheets (especially filtering)
- Point-to-Point microwave link design
- Path profile and link budget
- Reliability/availability analyses
- Frequency planning and network optimization
- Interference calculation and complete network analyses
- Point-to-Multipoint network planning
- Net Module: Overview of network technologies
- Data import and export, reports and documentation

Date

05. - 07.06.2024

Course Fee

2,150 € (excluding VAT)

Wireless Systems for Industrial Applications – Industry 4.0 | 1 Day

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 the 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.

Course Objectives

After completing the 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.

Intended for

This course is intended for those who have basic knowledge in radio communication systems, who are interested in wireless systems for industrial applications and who may be responsible for radio systems in industry.

Contents

- 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

Date

15.11.2024

Course Fee

795 € (excluding VAT)

Wireless Networks Calculation Tool – CHIRplus_TC incl. Net Module | 2 Days

Training Focus

The design of wireless networks considering mobile technologies such as mobile, TETRA, DMR, PMR or wireless IoT (Internet of Things) technologies (e.g. LoRa™) requires complex calculations to dimension link capacity and link availability and to perform frequency assignment. Planning software like LS telcom's CHIRplus_TC provides the required functionality in a user-friendly way and are essential for proper network design.

A thorough knowledge of the available functionality and understanding of calculation results considerably shortens planning time and results in optimized network performance.

The seminar introduces essential features to perform planning tasks for wireless networks systems. The first day is dedicated to the general tool handling. The different database functions and configurations are presented and discussed with the delegates. The following day will cover the necessary steps to perform typical wireless network calculations - from data input over the setting of required parameters to the calculations analyses. Finally, reports and data export options will be presented. An overview of the network technologies included in the Net Module will be introduced.

The course is presented as classroom training with tool based exercises to be done by the delegates. After a very short introduction with a few theory slides, the seminar will mostly focus on the topics by corresponding examples shown by the trainer and following dedicated exercises that are carried out by the delegates.

Course Objectives

After the training the delegates will be able to efficiently perform advanced network design and planning tasks using CHIRplus_TC. They will learn how to get best use on well-established engineering procedures and algorithms for wireless networks.

Intended for

This course is intended for those who have a basic knowledge in radio communication, who are interested in the functionality provided by CHIRplus_TC and who may be employed in telecoms regulators, telecoms operators, and utility and transportation companies.

Contents

- Setup and configuration of CHIRplus_TC
- Interaction with the Graphical User Interface (GUI)
- Usage of databases and spreadsheets (especially filtering)
- Path profile and line of sight
- Net Module: Overview of network technologies
- Standardized data import and export
- Reports and documentation

Date

17. - 18.09.2024

Course Fee

1,495 € (excluding VAT)

Spectrum Management - Overview

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Managing and Regulating the Radio Spectrum: A Practical Guide | 4.5 Days

Training Focus

The radio spectrum is a limited resource that has to be shared between different services, technologies, users and countries. It is the task of regulatory authorities to manage the resource and to optimize its use. International frameworks provide the basis for spectrum management, however knowledge of the characteristics of the radio spectrum and technologies that use it are necessary for these frameworks to be translated into realizable policies and practices at a national and regional level.

This course begins by providing an overview of the goals of spectrum management as well as delivering an understanding of the specific characteristics of different parts of the radio spectrum and how this impacts its utility and value. The use of different spectrum bands is discussed, together with a consideration of the way in which historic and new radio technologies use spectrum and the techniques being considered to maximize efficiency and sharing. Different facets of spectrum management and regulation are explained. The course explores assignment and planning methods from the classical command and control techniques to developments in economic techniques such as pricing, trading and auctions. It takes a look at emerging techniques such as dynamic spectrum access and licensed shared access to help understand what failings of existing techniques they are seeking to redress.

Course Objectives

After completion of the course, participants will understand how the radio spectrum is used, and approaches to its management and regulation. They will have extended their knowledge of spectrum management and will have been updated on the latest techniques and processes being employed.

Intended for

This course is ideal for those working in a practical position within a spectrum regulator or regulatory body. It is useful for those who wish to deepen their knowledge of the toolkit for spectrum regulation and management including consultants, investors, manufacturers, major spectrum users and those for whom managing the spectrum is a part of their daily job.

Contents

- Fundamentals of spectrum management
- Characteristics of radio spectrum and radio technologies
- Historic and new radio communication systems
- The international framework and processes for spectrum management
- Methods for licensing spectrum and service planning
- Spectrum demand and efficiency
- New techniques (dynamic spectrum access, license shared access)

Date

09. - 13.09.2024

Course Fee

2,995 € (excluding VAT)

Sharing and Dynamic Spectrum Access – Hidden Spectrum Resources? | 2 Days

Training Focus

The planning rules for radio services often leave small gaps which cannot be used or the scattered use of spectrum by a primary user leaves larger opportunities. Such spectrum might be accessible for different or additional radio services, typically ones with very low power which will not cause undue interference to the primary users. These opportunities are often termed 'whitespaces' and their use is being considered through methods such as dynamic spectrum assignment. In addition, regulatory techniques are trying to find ways to make sharing spectrum more attractive. This course examines the background to whitespaces, considering how and where they arise and looks at sharing opportunities. It then focuses on how spectrum might be made available to additional parties, and what kind of communications it might support. Finally, the various regulatory methods and technologies (including DSA/LSA and the role of databases) being considered will be examined.

Course Objectives

After completing the course, delegates will understand the history of whitespaces, and the opportunities for sharing together with methods to regulate usage. Current developments and case studies will also be provided.

Intended for

those who need to understand the regulation and practical application of whitespaces and advanced sharing techniques, whether from a regulatory or commercial perspective.

Contents

- What are whitespaces?
- The possible applications of whitespace spectrum
- Technologies being developed for the exploitation of whitespaces
- Where are there opportunities for more sharing?
- How is interference dealt with
- The regulatory processes and procedures being applied
- Geographic databases and dynamic spectrum access
- Licensed shared access and similar regulatory tools

Date

16. - 17.04.2024

Course Fee

1,495 € (excluding VAT)

Dealing with the Capacity Crunch | 2 Days

Training Focus

The amount of data traffic being carried over mobile networks is ever increasing, yet the amount of spectrum used to deliver that data is limited. This is leading, many believe, to a situation where there will be insufficient spectrum to deliver the capacity necessary to handle the traffic, often termed the 'capacity crunch'. This course examines the various forecasts for mobile data traffic and considers whether and where growth might finally stop. It also explores various models used to turn the traffic levels into spectrum requirements to try to determine how much spectrum might be needed. The various methods for delivering data capacity will be discussed, together with an examination of the efficiency and effectiveness of the various mobile technologies (2G, 3G, 4G and 5G) and strategies such as network densification, off-loading and wholesale networks. The impact of the growth of Machine-to-Machine (M2M) and the Internet of Things (IoT), and the role of ultra-reliable, low latency communications will be discussed. Other issues, such as the cost per bit delivered, and the energy required to power networks will also be considered to examine whether there are financial and environment constraints on data capacity growth and consumption.

Course Objectives

After completing the course, participants will be aware of various forecasts for mobile data, and methods used to predict mobile spectrum demand. They will have an understanding of types and performance of techniques used to deliver mobile data, and will understand the commercial and economic issues that affect the delivery of mobile capacity.

Intended for

people working as regulators, as well as for organizations such as government departments, transport operators, satellite companies, and military establishments who use the radio spectrum and who wish to understand the sources of the pressure to find more spectrum for mobile data.

Contents

- How much spectrum is there?
- Forecasting the growth of mobile data traffic
- A historical viewpoint on the accuracy of predictions
- Calculating mobile spectrum demand
- Is there a limit on eventual demand?
- Country case studies on data growth
- The impact M2M and IoT and URLLC
- Methods for handling mobile data
 - Mobile technologies (e.g. 2G, 3G, 4G, 5G)
 - Offloading
 - Network densification
 - Wholesale and shared network model
- The cost and energy implications of the various techniques

Date

18. - 19.04.2024

Course Fee

1,495 € (excluding VAT)

Technical Issues in Radio Spectrum Management | 4.5 Days

Training Focus

At its heart, radio spectrum management is essentially a technical discipline, overlaid by strategic and economic considerations. One of the main technical goals of spectrum management is to control interference between radio users so as to optimize the use of the spectrum. Controlling interference is not straightforward and requires the balancing of many factors and undertaking this balancing act requires expert skills. This course describes the necessary theoretical, practical and physical qualities of the radio spectrum including the specifics of wave propagation. Following a review of technical fundamentals such as modulation, antennas and propagation modeling, the course considers the characteristics of different parts of the radio spectrum, and examines in detail the different uses to which it is put. The course then discusses why specific uses are often associated with particular radio frequencies and reviews the technical capabilities and limitations of today's RF technologies. Interference mechanisms and coordination procedures are explored, together with an understanding of how the performance of radio equipment affects interference and coverage. Finally, detailed explanations of the specifics of the most common radio communication services including broadcast, land mobile, fixed and satellite services are given.

Course Objectives

After completing the course, participants will have a full understanding of the technical and physical issues which impact spectrum management. In addition, they will have deepened their technical knowledge of different radio services and will understand the principles behind controlling interference and the coordination procedures.

Intended for

This course is intended for those interested in the technical aspects of spectrum management. This includes those working in a technical function at regulators as well as in telecommunications and broadcasting companies and in organizations with a need for strong technical knowledge.

Contents

- Communication principles, modulation techniques and antennas
- Radio wave propagation, terrain data and propagation calculations
- Characteristics and use of the radio spectrum from ELF to EHF
- Detailed exploration of a range of radio communication services:
 - Technical characteristics, service planning
 - Frequency assignment, coordination procedures

Date

14. - 18.10.2024

Course Fee

2,995 € (excluding VAT)



Spectrum Matters for 5G/6G

2 Days

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?

Course Objectives

After completing the 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.

Intended for

those who need to better understand the spectrum implications of 5G technologies with an appreciation of new frequencies being proposed for 6G, whether from a regulatory, commercial or technical perspective.

Contents

- 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
- 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

Date

11. - 12.11.2024

Course Fee

1,495 € (excluding VAT)

5G and Satellite Compatibility

2 Days

Training Focus

Many countries are looking at introducing 5G mobile services into the C-band frequency range (3300 – 4200 MHz). These frequencies are currently used by, amongst other services, satellites which deliver a range of uses from television broadcasting to weather information to, in some cases, mission-critical aspects such as telemetry, tracking and command (TT&C). This course will look in detail at the technical and operational issues surrounding the use of the band for 5G, the potential impact on satellite services, and the value and usefulness of mitigations that can be used to improve compatibility. Whilst the course focuses on the situation in C-band, the methods and techniques apply equally in other shared bands.

Course Objectives

After completing the course, participants will be aware of the technical and operational complexities of sharing the C-band between satellite and terrestrial 5G services. The impact on both services will be considered, together with an examination of the potential mitigation techniques, and their effectiveness. At the end of the course, delegates will understand the technical and operational practicalities of sharing the band.

Intended for

people working as regulators and within mobile or fixed wireless operators, as well as for organizations such as government departments and satellite companies who use the radio spectrum and who wish to understand the potential for using the C-band for 5G services.

Contents

- Typical C-band satellite use cases
 - Example services and link budgets
 - The specificities of TT&C use
- C-band satellite performance characteristics
- 5G deployment equipment types and deployment scenarios
 - Wide Area, Medium Range, and Local Area base stations (including indoors)
 - User equipment
- Critical satellite sharing criteria
- 5G interference mechanisms and modifications
- Basic interference and compatibility calculations
- Mechanisms for improving compatibility

Date

20. - 21.03.2023

Course Fee

1,495 € (excluding VAT)



Outcome of WRC 2023

1 Day (online)

Training Focus

Join us as we unpack the outcomes from the recent World Radio Conference held in Dubai over a vibrant four-week period during November/December 2023. As the dust settles post conference, this one-day session allows some time to digest the agreed resolutions and outcomes in a clear and practical way.

The session will capture the essence of key agreements and the heightened intensity of discussions, uncovering the conference's hot topics and most controversial agenda items such as AI 1.2, addressing IMT spectrum identification across diverse bands like the upper 6 GHz, and AI 1.5 which considered regulatory actions in the UHF band in Region 1.

We will also delve into agenda item 10, aiming to establish the groundwork for the agenda items slated for discussion at the next WRC in 2027, and will consider any newly proposed urgent issues which may have been raised, but not necessarily treated at the conference, such as the emerging satellite direct to handset topic. These agenda items, amongst others, will be explored to understand the implications to regulators adopting the newly agreed regulations in relation to the practicalities and challenges of incorporating them into national frequency plans and wider strategic developments and introducing new technologies and services.

Course Objectives

After completing the course, participants will have an understanding of how a number of agenda items could impact future use of spectrum and the practicalities and challenges of implementing new and amended radio regulations into National Frequency Plans and regulators future strategies and roadmaps.

Intended for

those who seek a comprehensive grasp of the outcomes from WRC-23 and may have been unable to get across all the of key issues discussed during the conference. The session is also tailored for those who want to better understand the regulatory frameworks which will shape the development of emerging technologies, such as 6G or satellite direct-to-handset communications.

Contents

- Overview of the agenda items considered at WRC23
- Matters arising during the conference (not on the agenda)
- Implications of adopting new regulations
- Scope for development of new strategies, technologies and services

Date

20.02.2024

Course Fee

795 € (excluding VAT)

SPECTRAplan S

3 - 5 Days

Training Focus

SPECTRAplan S is providing 2 modules:

1. SPECTRAplan S which is dedicated for the administration of important data for spectrum planning on various levels in the SPECTRA system
2. Vector Management which provides tools for the creation, import and management of various kinds of vectors for the usage in the SPECTRA system

Course Objectives

After the training the participants will be able to understand and apply the methods for frequency plan administration with SPECTRAplan S and the Vector Management very well.

Intended for

This course is intended for users that have to work with SPECTRAplan S and the Vector Management.

Contents SPECTRAplan S module

- Getting started with the new GUI concepts
- Master data management
- Administration of frequency allocation tables
- EFIS interface
- Administration of frequency assignment plans

Contents Vector Management module

- Getting started with the new GUI concepts
- Import of vectors from file
- Upload of vectors from Working to Live DB
- Display of selected vectors on map

Date

on demand

Course Fee

on request

SPECTRAemc Workflow Wizards Configuration | 3 Days

Training Focus

This training course is dedicated to the workflow automation capabilities of SPECTRAemc in order to let the trainees understand how SPECTRAemc can be configured via the Wizard Workflow Configurator tool to the requirements of the customer. The training involves the usage of SPECTRAemc and the Wizard Workflow Configurator tool.

Course Objectives

After the training the participants will be able to create/configure wizard workflows and are familiar with the standard reports for SPECTRAemc. In addition, the participants will be also able to maintain and further develop existing wizard workflows for SPECTRAemc.

Intended for

This course is intended for those who are interested to learn about the very comprehensive configuration capabilities of SPECTRAemc in terms of wizard. The training course will be useful both for new users but also for experienced users of the tool to learn about the new features. The attendees should already have participated in a SPECTRAemc basic/fundamental course as some knowledge of SPECTRAemc core functionalities and Radio Engineering is required in advance.

Contents

- Overview wizard workflows in SPECTRAemc
- Overview Wizard Workflow Configurator tool
- Detailed discussion of important wizard commands/statements
- Tasks and deadlines

Date

on demand

Course Fee

on request

SPECTRAemc Framework Functionalities

3 Days

Training Focus

The training is dedicated to the general SPECTRAemc handling (GUI), simple and complex database queries, data grid functions and general functions in order to let the trainees find the best way to understand the tools philosophy. The training involves the usage of SPECTRAemc.

Course Objectives

After the training the participants will be able to understand the main framework methods of SPECTRAemc very well. This is the absolutely necessary basis for the other more advanced training courses on radio calculations, wizards and AddOns.

Intended for

This course is intended for those who need to use SPECTRAemc in their daily work or those who want to learn about the SPECTRAemc framework capabilities. The training course will be useful both for new users but also for experienced users of the tool to learn about the new features.

Contents

- Display and GIS functions
- Database selection functionalities
- Creation of objects in SPECTRAemc
- Working with data grids
- Working with SPECTRAemc scenario files
- SPECTRAemc supporting tools
- Basic calculations

Date

on demand

Course Fee

on request

SPECTRAemc Radio Calculation Functionalities | 5 Days

Training Focus

This training course is dedicated to the radio engineering part of SPECTRAemc in order to let the trainees understand the comprehensive calculation capabilities of tool. The training involves the usage of SPECTRAemc.

Course Objectives

After the training the participants will be able to understand how the comprehensive calculation capabilities of SPECTRAemc can be applied to solve practical problems.

Intended for

This course is intended for those who need to use SPECTRAemc in their daily work. This course can be also useful for advanced SPECTRAemc users working in one particular radio service to learn how SPECTRAemc can be applied in other areas.

Contents

- Overview radio propagation models
- Basic calculations using radio propagation models
- Advanced interference calculations using radio propagation models
- Frequency assignment calculations (based on interference analysis)

Date

on demand

Course Fee

on request

SPECTRAemc Coordination AddOns

3 Days

Training Focus

This training course is dedicated to the question how SPECTRAemc with its various AddOns can be applied for the international coordination processes. This will let the trainees understand the calculation and the administrative capabilities of the tool for various standardized international coordination procedures like for example HCM. The training involves the usage of SPECTRAemc.

Course Objectives

After the training the participants will be able to understand which standardized international coordination procedures are available in SPECTRAemc and how to use the tool to solve practical problems.

Intended for

This course will be also useful for those who are interested first to learn about the comprehensive capabilities of SPECTRAemc in terms of international coordination to decide how the module can be applied in their environment to solve practical problems. The training course will be useful both for new users but also for experienced users of the tool to learn about the new features.

Contents

- Overview available AddOns for international coordination
- Coordination checks during frequency assignment
- Administrative functionalities for international coordination (example HCM FX)

Note:

The above training content is mainly for providing overview on the SPECTRAemc capabilities in terms of international coordination. The HCM FX coordination process will be used as example to illustrate these capabilities. It is not possible to cover completely all international coordination capabilities of SPECTRAemc within one training course.

But it is possible to arrange additional detailed training courses on specific topics like:

- HCM FX coordination process
- HCM LM coordination process
- ITU coordination and notification process for terrestrial services
- ITU coordination and notification process for space services
- FACSMAB coordination for Asian regions

These additional training courses can be scheduled in addition to the standard training courses case of sufficient number of participants is interested.

Date

on demand

Course Fee

on request

IT Architecture, Implementation & Maintenance for mySPECTRA Solutions | 3-5 Days

Training Focus

This course provides in-depth knowledge on how to set up and operate a server and network infrastructure for mySPECTRA solutions. After presenting the general architectural options, the course focuses on how to set up and configure the infrastructure as well as maintenance and troubleshooting skills. Advanced concepts regarding security, backup, recovery and virtualization complete the course. The training takes place in the LS telcom training facilities and includes some hands-on activities.

Course Objectives

After completing the training, delegates will be able to understand the architectural options for mySPECTRA solutions enabling them to operate mySPECTRA environments proficiently in day-to-day duties.

Intended for

This course is intended for ICT staff dedicated to the initial set-up, configuration, administration, maintenance and troubleshooting of an IT infrastructure for mySPECTRA solutions (not for users of SPECTRA for licensing/planning purposes). A good knowledge in several of the following areas is mandatory to be able to follow the training: server and data base (e.g. ORACLE®) administration, virtualization (e.g. VMware®), server/client architecture (CITRIX™).

Contents

- Server/client architecture for mySPECTRA solutions
- VMware based Virtualization solutions
- Backup concepts
- Security aspects
- Initial system installation
- System administration/mySPECTRA updates
- Preventive maintenance and troubleshooting

Date

on demand

Course Fee

on request



mySPECTRAcloud Report Management | 3 Days

Training Focus

mySPECTRAcloud is delivered with a comprehensive and practice proven set of report templates that are filled in an automated manner. This course will enable you to maintain, adjust and create new report templates. You will learn how to retrieve data from the various microservices APIs and data warehouse and utilize them in your templates. The templates are built based on "Jasper Reports®", so the training also includes instructions and guidance for the related editor.

Course Objectives

After completing the training, you will be able to maintain the report templates provided in line with the mySPECTRAcloud system. You will be able to modify and adjust static and dynamic content or even create new templates.

Intended for

This course is intended for users that are familiar with the structure and architecture of mySPECTRAcloud. A basic understanding of the system's database structure, the microservices and the related API's is helpful for the design of the corresponding reports.

Contents

- Overview about mySPECTRAcloud architecture and structure
- Interaction with mySPECTRA document service
- Utilize Jasper Reports® Editor
- Manage report templates (create, upload, download, delete)

Date

on demand

Course Fee

on request



mySPECTRAcloud Configuration Management | 3 - 5 Days

Training Focus

mySPECTRAcloud is a highly configurable system that allows its administrators to manage and maintain the system largely at runtime. This training course will allow you to manage and maintain the spectrum products that are available in your system. Configurable items are data entry forms, lists of values (LOVs), patterns for unique identifiers/invoice numbers/etc, BPMN workflows, user right and team management, fee definitions and many more.

Course Objectives

After completing the training course, you will be able to maintain and configure the mySPECTRAcloud system independently. This ranges from small adaptations of the available webforms to the introduction of completely new spectrum products.

Intended for

This course is intended for system administrators and configurators of mySPECTRAcloud. As all actions will be done via the systems front-end, programming skills are not required.

Contents

- Webform configuration (visibility, mandatory fields, validation rules, adaptation of labels)
- List of values management (introduction of new and management of existing LOVs)
- Pattern management
- Workflow adaptations using BPMN editors, templates and decision tables (DMN)
- User management, rights and roles
- Team management
- Text management (definition of the naming of menu items, buttons, commands)
- Fee schedules and discount settings

Date

on demand

Course Fee

on request



(Telephone) Number Management

3 Days

Training Focus

The Special Events mySPECTRA NMS (Numbering Management System) offers a comprehensive solution for the efficient management of numbering resources by delivering a powerful toolkit for streamlining administrative processes, intelligent number allocation, and fostering collaborative resource management. This course enables you to create numbering pools, categorize them, link them to specific areas and customers, etc.

Course Objectives

After completing the training, participants will be able to efficiently use the Numbering Management Module.

Intended for

This course is intended for new and existing mySPECTRA customers that need to handle and manage numbering resources efficiently.

Contents

- Number pool creation (ranges and individual numbers)
- Number categorization
- Number reservation and allocation
- Importing numbers from standard formats
- Master data management and filtering
- Messaging, document generation and invoicing

Date

on demand

Course Fee

on request



Special Event Management

3 Days

Training Focus

The Special Events Module offers a comprehensive solution for the planning and management of special events. This encompasses private gatherings, public festivals and fairs, major sporting events, and other events that take place outside of a host or sponsor's typical business operations. This course enables you to efficiently use LS telcom's special event module and covers topics like participant management, equipment registration and complaint management.

Course Objectives

After completing the training, participants will be able to efficiently use the Special Events Module.

Intended for

This course is intended for new and existing mySPECTRA customers that need to handle and manage a special event effectively.

Contents

- Participant management
- Venue management
- Spectrum license management
- Equipment management (incl. possible solutions for testing and tagging)
- Complaint handling
- Task management

Date

on demand

Course Fee

on request

Monitoring & Measurements - Overview

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LS OBSERVER – Sensor-based Monitoring and Direction Finding | 3 Days

Training Focus

The LS OBSERVER system training introduces the features of the LS OBSERVER based monitoring units and the principles of operation as sensor-based systems. The course contains the detailed description of the operation of all features and allows the participants to perform practical tasks with the LS OBSERVER system. The service-oriented system configuration and architecture, the remote control of measurement units, the measurement data download, multiple geolocation methods, the analysis of measurement results and direction finding techniques will be presented. The participants will have the possibility to use the equipment for practical tasks during the training. Information about maintenance requirements and configuration of the system are also covered by the training.

Course Objectives

The training enables the participants to become familiar with the LS OBSERVER monitoring units and the associated software module LS OBSERVER CMS. They will understand the functionalities, handling the GUI and learn how to perform measurements and analysis with the focus on remote controlled monitoring, geolocation and direction finding. Finally, they will see how a fully integrated spectrum management (e.g. SPECTRAplus) and monitoring system can be managed and be used for combined tasks (e.g. automatic violation detection).

Intended for

This course is intended for monitoring personal who have a basic knowledge of radio monitoring and geolocation methods and who need to operate LS OBSERVER units for measurement, direction finding and analysis tasks.

Contents

- Global overview of the LS OBSERVER service-oriented architecture
- Typical system and network setup and configuration
- GUI concept and handling
- Wide-band measurements
- Fixed frequency measurements
- Recording of the measurement results
- Direction Finding AoA measurements
- Geolocation with TDoA and GROA+®
- DF Time Travel® AoA combination of TDoA, GROA+® and AoA results
- Data handling, download from remote monitoring units

Date

08. - 10.10.2024

Course Fee

2,150 € (excluding VAT)

Spectrum Monitoring - Measurements and Techniques | 2 Days

Training Focus

This course is based on the latest ITU-R and CEPT 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 radio monitoring. The training concludes with number of practical examples.

Course Objectives

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.

Intended for

This course is intended for those who have a basic knowledge of radio communications and electromagnetic wave propagation, who are interested in spectrum monitoring measurement and techniques and who may be employed in regulatory authorities that supposed to execute spectrum monitoring measurements, reporting and providing early warnings to policy makers.

Contents

- General expectations of spectrum monitoring
- Utilization of radio monitoring results
- Manual monitoring (ITU/ECC references, proposed procedure)
- Channel & band occupancy (ITU R1, ERO/ECC)
- Monitoring of broadcast and digitally modulated signals
- Interference description, detection, reporting
- Analysis of results and reporting
- Automated monitoring
- Detection of regulatory unauthorized utilizations
- Inspection/certification/technical acceptance
- Real time radio occupancy monitoring (for utilizing of whitespace)
- 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)

Date

13. - 14.05.2024
18. - 19.11.2024

Course Fee

1,495 € (excluding VAT)

Practical Spectrum Monitoring Measurements | 3 Days

Training Focus

This course gives an introduction to practical spectrum monitoring measurements. Delegates will follow practical examples to illustrate the limitations of spectrum monitoring measurements. During hands-on measurements of the RF environment around our Training Academy in Lichtenau/Germany the delegates will put the learned techniques into practice.

Course Objectives

After completing the training delegates will be able to perform practical spectrum monitoring measurements under real-life conditions and understand the limitations in the RF field. They will also be able to make estimations of expected measurement results, judging the quality of the measurements performed and planning measurement campaigns.

Intended for

Regulatory authorities' staff members supposed to execute spectrum monitoring measurements.

Contents

- Overview of spectrum monitoring tasks
- Selecting equipment according to the actual task
- Distinguishing between real signals and intermodulation products
- Limitations due to the real-life environment
- Basic measurements
- Practical measurement on FM broadcast-/DVB-T-transmitters
- Basic signal analysis
- Automatic Violation detection
- Different usage of homing and direction finding
- Locating transmitters using different methods (AoA/GRoA+/TDOA)
- Hints and kinks performing measurements
- Quality of measurement results
- Planning measurement campaigns
- Practical hands-on measurements in the field
- Transfer of the learned skills to daily work

Date

15. - 17.05.2024
20. - 22.11.2024

Course Fee

2,550 € (excluding VAT)

Measurements of Human Exposure to RF Electromagnetic Fields (incl. practical measurements) | 3 Days

Training Focus

Radio transmitters produce electromagnetic fields which members of the public may be exposed to. In order to assess people's safety their exposure must be measured and compared with the appropriate limits. This course will focus on the measurement of general public exposure; in addition, some aspects of occupational exposure are discussed. The lecture will be supported by practical measurements of real-life radio signals by nearby RF transmitters.

Course Objectives

After completing the training, delegates will be able to perform measurements of RF exposure caused by different radio services which follow the correct measurement methodology, equipment settings and post processing. They will also understand the philosophy behind the exposure limits.

Intended for

This course is intended for those who have basic knowledge in RF wireless communication techniques and understanding in spectrum analyzer, who are interested in measurement of human exposure to RF electromagnetic fields and who may be employed in regulatory authorities, environmental agencies, radiation protection authorities, health and safety departments of network operators or measurement laboratories.

Contents

- ICNIRP's RF exposure limits philosophy
- Status of current biological research
- Basic measurement principles
- Derivation of an appropriate measurement methodology
- Correct measurements of FM, DAB, DVB-T, GSM, UMTS, LTE, 5G, TETRA, and radar exposures
- Measurement report and uncertainty budget, typical sources of error
- Measurement strategies
- Measurement practice on real-life signals

Date

23. - 25.09.2024

Course Fee

2,750 € (excluding VAT)

Measurements of Human Exposure to RF Electromagnetic Fields at 5G NR Base Stations | 1 Day

Training Focus

The main focus of the workshop is on the measurements and evaluation of high-frequency electromagnetic fields generated by 5G Base Stations to ensure compliance with RF exposure safety standards. The workshop is divided in the following blocks. It is mainly aimed at persons regularly working in the field of RF exposure measurement and assessment, e.g.

- Employees of regulatory and licensing authorities
- Employees of federal radiation protection authorities, environmental ministries and agencies
- Occupational safety officers of mobile network operators
- Personnel of expert offices for the measurement of electromagnetic fields in the context of personal protection.

Contents

The workshop will focus on the correct determination of the maximum possible radiofrequency fields generated by 5G base stations at the measurement location. In detail, the following topics will be covered

Basics

- Important differences of 5G systems compared to 4G (LTE) systems.
- Influence of beamforming antennas on the exposure situation.
- Challenges for a correct exposure determination at 5G sites with beamforming (mMIMO) antennas.

Measurement and Evaluation

- Measurement of actual 5G field strength level with a spectrum analyzer: Correct setting of the instrument.
- Possible strategies for the determination of maximum possible exposure.
- Determination of the maximum RF emission at 5G sites without mMIMO antennas.
- Determination of the maximum RF emission at 5G sites with mMIMO antennas.
- Comparison of frequency selective and code selective measurements
- Practical demonstration: Code selective measurement of SSS signal.
- Extrapolation of code-selective measurement results to the situation of maximum radiated power using the antenna patterns of broadcast and traffic beams.
- Some examples of measurement and extrapolation results at 5G sites.

Date

29.02.2024 (online)
26.09.2024

Course Fee

950 € (excluding VAT)

Broadcast - Overview

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FM, DAB, TV and 5G Broadcast Antennas

1 Day

Training Focus

The course is aimed at people working in the broadcast industry who want to get an understanding of the most important topics regarding broadcast antennas. It particularly covers the specifications of antenna components and the layout of broadcast antenna systems for Radio and TV (both analogue and digital) in the VHF- and UHF-Band. Additional aspects of the training are methods to design broadcast antenna systems and how to calculate antenna pattern. Finally the training is rounded off by several examples for planning antenna systems for digital terrestrial radio (DAB), digital terrestrial television (DTT) and 5G Broadcast. The course is presented in cooperation with Kathrein Broadcast.

Course Objectives

After completing the course, participants will have an understanding of the engineering and system design methods of broadcast antennas as well as the technical terms and characteristics. Several practical examples will assist the participants to solidify the theoretical knowledge.

Intended for

This course is intended for those who have a basic knowledge of radio communication technology, who are interested in broadcast antennas and who may be employed in broadcasters, network operators or regulators.

Contents

- Basics and technical terms of broadcast antennas
- Antenna radiators and their characteristics
- Broadcast antenna components and their characteristics
- Broadcast antenna systems design and pattern calculations methods
- Examples for planning of antenna systems for Digital Terrestrial Radio (DAB), Digital Terrestrial Television (DTT) and 5G Broadcast

Date

04.11.2024

Course Fee

795 € (excluding VAT)

DVB-T2 – 2nd Generation Digital Video Broadcast | 2.5 Days

Training Focus

This training course is aimed at those people working within the broadcast industry who have an interest in future development in terrestrial broadcasting. Participants will become familiar with the requirements, new features and consequences of DVB-T2 compared to DVB-T (such as its higher data capacity) and why it is needed for introducing terrestrial HDTV. Other features such as the possibility of more extended single frequency networks (SFN) will also be discussed. Additional aspects like the current status of DVB-T2 in the world and the compatibility issue between DVB-T2 and LTE complete this training. Finally the course will demonstrate also several practical planning examples using LS telcom's sophisticated broadcast planning tool.

Course Objectives

After completing this course, delegates will understand the technology behind DVB-T2, starting with its predecessor DVB-T. The course will also provide participants with basic guidance on planning a DVB-T2 network in respect of satisfying the coverage and capacity requirements including the consideration of possible coordination issues.

Intended for

This course is intended for those who have a basic knowledge of broadcast technology, who are interested in DVB-T2 and who may be employed in broadcasters, network operators or regulators.

Contents

- DVB-T basics
- DVB-T2 features
- DVB-T2 planning/coordination
- Choice of DVB-T2 parameters
- Current status of DVB-T2 deployments
- Compatibility LTE/NR vs. DTT
- Overview of other DTT technologies including ISDB-T and ATSC
- Entire terrestrial network planning procedure
- Alternative terrestrial broadcast distribution platforms like 5G broadcasting

Date

05. - 07.11.2024

Course Fee

1,850 € (excluding VAT)

DVB-T2 – Measurement Technology in Theory and Practice | 1.5 Days

Training Focus

This training course is aimed at those people working within the broadcast industry who have an interest in future development in terrestrial broadcasting. Participants will become familiar with the requirements, new features and consequences of DVB-T2 measurements compared to DVB-T. Beside the general aspects of digital broadcast measurements and measurement parameters the training provides interesting insights in practical demonstration of field measurements as well as receiver and transmitter tests. The training is presented in cooperation with Rohde & Schwarz.

Course Objectives

After completing this course, delegates will understand the technology behind DVB-T2 measurements as well as all associated measurement parameters. Several practical demonstrations will solidify the theoretical knowledge.

Intended for

This course is intended for those who have a basic knowledge of DVB-T2 technology, who are interested in DVB-T2 measurements and who may be employed in broadcasters, network operators or regulators.

Contents

- Basic of digital broadcast measurements (picture quality assessment, transport stream analysis, RF measurements)
- Basic RF measurement parameters in DTV (level, BER, MER, shoulder attenuation, impulse response)
- Repetition of DVB-T measurements
- DVB-T2 measurement technology (i.e. differences to DVB-T, T2-MI analysis, rotated constellations, PLP, SISO/MISO)
- Practical demonstration of different new T2 features (PLP, rotated constellations, SISO/MISO)
- DVB-T2 receiver test (theory and practical demonstration)
- DVB-T2 transmitter test (theory and practical demonstration)
- DVB-T2 field measurements, SFN measurements (theory and demonstration of a lab SFN)

Date

07. - 08.11.2024

Course Fee

1,495 € (excluding VAT)



FeMBMS – 4G/5G-based Broadcast

2 Days

Training Focus

This training course is aimed at those people working within the wireless communication business or broadcast business. Participants will get an overview on FeMBMS – 4G/5G-based broadcast. The seminar gives an overview on the requirements of broadcast and wireless communication technology and describes how 4G/5G-based broadcast is implemented in the 4G/5G standards. The training is presented in cooperation with Rohde & Schwarz.

Course Objectives

After completing this course, delegates will understand the technology behind FeMBMS – “Further evolved Multimedia Broadcast Multicast Services”. Focus is on the physical layer not on the protocol level.

Intended for

This course is intended for those who have a basic knowledge in information technology, who may be employed at broadcasters, network operators or regulators.

Contents

- Introduction to „FeMBMS“, 5G/4G-based broadcast
- Field trials 5G/4G-based broadcast
- Traditional broadcast
- DVBIP, IPTV, Streaming, OTT
- Overview wireless communications from 2G, 3G, 4G to 5G
- Former mobile broadcast trials and standards, DVB-H/SH, T-DMB, MediaFLO, etc.
- Traditional Mobile Communication Applications
- Identification of broadcast applications - for wireless communications
- “Traditional” and “Modern” use-cases in broadcast and in wireless communications
- Physical layer overview LTE and 5G
- Single-frequency networks, SFN-requirements
- FeMBMS – physical layer
- Comparison to DVB - data rates, robustness, properties, opportunities
- Summary and outlook

Date

03. - 04.07.2024

Course Fee

1,795 € (excluding VAT)

Broadcast Planning Tool CHIRplus_BC

(LF/MF) | 2 Days

Training Focus

This course will focus on LF/MF frequency and coverage planning using CHIRplus_BC. It will start with an overview on the international frequency plans covering the LF and MF frequency bands, i.e. GE75 and RJ81, available databases and coordination rules. Special focus will be given to the LF/MF specific ground wave and sky wave propagation, day time and night time coverage analysis as well as interference calculations. Examples and case studies will be shown for analog and digital (DRM) systems using CHIRplus_BC.

Course Objectives

After completing the course, participants will be able to use CHIRplus_BC in a very knowledgeable way. In addition to the use of the tool, delegates will also understand the theoretical and practical background to the calculations.

Intended for

This course is intended for those who have a basic knowledge of broadcast, who are interested in broadcast planning and who may be employed in broadcasters, network operators or regulators.

Contents

- The GE75 (RJ81) frequency plan
- BRIFIC interface and ITU notification
- Antenna modelling in LF/MF
- Ground wave and sky wave propagation
- Daytime and nighttime analysis
- Protection ratios and interference analysis
- Coverage contours and fading zones
- LF/MF Coordination calculations
- Analog and digital network examples

Date

on demand

Course Fee

on request

Broadcast Planning Tool CHIRplus_BC (Radio/TV, Analog/Digital) | 3 Days

Training Focus

The course will start by showing delegates how to configure CHIRplus_BC and the basics of field strength calculations and interference analysis. One focus of the training will be the usage of the network processor and the various calculation results. As well as the digital features of CHIRplus_BC its use for analog services will also be illustrated. Understanding the principles of the analog network analysis is a prerequisite for developing efficient networks for digital terrestrial broadcasting. Digital terrestrial networks (DAB+, DVB-T, DVB-T2, DVB-T2 LITE, ISDB-T, ATSC) bring a number of new requirements regarding the reception mode which will be covered. Planning for portable or mobile reception is linked with many new features such as single frequency networks (SFNs) and network gain. To meet these new requirements it is necessary to learn and use the numerous features of the tool efficiently. The course will impart both theoretical and practical knowledge. The training will involve the usage of CHIRplus_BC and some case studies.

Course Objectives

After completing the course, participants will be able to use CHIRplus_BC in a very efficient way. Furthermore the features and calculation results will be explained from both the theoretical as well as from the practical viewpoint.

Intended for

This course is intended for those who have basic knowledge of broadcast, who are interested in broadcast planning tools and who may be employed in broadcasters, network operators or regulators.

Contents

- Configuration and setup
- Graphical User Interface (GUI)
- Geographic Information System (GIS)
- Field strength calculations
- Coverage calculations and analyses
- Coordination procedures
- Analog and digital network analyses
- Compatibility DTT vs. other services (e.g. LTE/NR)
- Exercises

Date

22. - 24.04.2024

Course Fee

2,150 € (excluding VAT)

Broadcast Planning Exercises using CHIRplus_BC | 2 Days

Training Focus

This course provides a solid understanding of the design and planning of analog and digital broadcast networks using the LS telcom broadcast planning software CHIRplus_BC. The course follows the typical steps of radio network planning from selection of suitable sites and coverage planning to the compatibility checks with existing networks or international frequency plans. As well as theoretical explanations, much time is spent following practical exercises in the planning of broadcast networks using CHIRplus_BC to illustrate effects of different planning parameters and network configurations. The training will involve the usage of CHIRplus_BC and some case studies.

Course Objectives

After the course, participants will have a good understanding of the design and engineering of broadcast networks as well as the capability to use the broadcast planning tool CHIRplus_BC in a very efficient way.

Intended for

This course is intended for those who have a basic knowledge of broadcast planning and CHIRplus_BC tools usage, who are interested in broadcast planning exercises and who may be employed in broadcasters, network operators or regulators.

Contents

- Introduction of radio network planning
- Targets and procedures of radio network planning
- Active and passive interference calculations
- Frequency scan
- Coordination
- Coverage calculation
- Planning of analog and digital networks
- Analysis and optimization of broadcast networks
- Compatibility DTT vs. other services (e.g. LTE/NR)
- ...and a lot of hints and tricks

Date

25. - 26.04.2024

Course Fee

1,495 € (excluding VAT)

Registration Form

Seminar:

Title	
Date	
Fee	EUR (excluding VAT)

Please register the following delegate:

Organization

Delegate

Title	First Name
Family Name	
Job Title	
E-mail	

Authorized by:

Invoice Name	
Invoice Address	
VAT-Id-No.	
Date	Signature

Group Discount

Register 2-3 delegates for one seminar, *receive 5% discount*

Register 4 delegates for one seminar, *receive 10% discount*

Register 5-6 delegates for one seminar, *receive 15% discount*

Register 6+ delegates for one seminar, *receive 20% discount*

For more information, please contact our team at Training@LStelcom.com or via phone +49 (0) 7227 9535 482.



Send your completed form to:

LS telcom AG

Training@LStelcom.com
☎ +49 (0) 7227 9535 605

Online registration via:
www.webstore.LStelcom.com

Commercial Details

Training Time Schedule

If not marked differently, the training starts at 9:00 am and ends at 4:30 pm.

Course Fee

The fees are per participant. Each price is quoted in EURO and does not include Value Added Tax (VAT). Training courses that take place in Lichtenau will be invoiced with 19% VAT.

The course fee includes course material, refreshing beverages, coffee, snacks and lunch during training courses in Lichtenau. Travelling costs, accommodation and living expenses for the participants are not included. The course fee must be paid latest 2 weeks prior to the course start in order to guarantee a seat. Transfer should be made to:

Sparkasse Hanauerland

IBAN: DE93 6645 1862 0000 1036 98
SWIFT: SOLA DE 51 KEL
VAT-Id-No.: DE 211251018

Application

The application should be signed and returned to LS telcom by mail or fax at least 21 days prior to the training course start date or register online at www.webstore.LStelcom.com.

If enrolling, we ask you to provide us with the information required on the registration form.

Minimum number of attendees

LS telcom reserves the right to change the course date or cancel the course if the number of participants is insufficient.

Language

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

Certificates

LS telcom will award certificates of participation to all those who complete a course.

Location

The scheduled courses are held at our LS telcom Training Academy in Lichtenau, Germany, located between Strasbourg and Baden-Baden, unless stated otherwise.

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 about future training courses offered by us (please cross out this paragraph if you do not agree).

Withdrawal policy

Cancellations may be made free of charge up to 21 days prior to the start of the training course. After this time, a cancellation charge of 80% of the course fee applies. In all cases, withdrawals must be confirmed in writing prior to the course start date, otherwise the full amount will be due. Substitutions may be made prior to the course starting.

Disclaimer

LS telcom reserves the right to change or cancel any part of its published program due to unforeseen circumstances.

Your registration alone does not constitute a binding agreement and requires our written approval and order confirmation, which regularly can be assumed by our invoice.

No recording

Please observe that any picture, audio and/or video recording of our online training is strictly prohibited.