



LS telcom Training Academy



Professional Training Calendar

January 2020 - December 2021

Training, Seminars & Best Practice Education

Course Overview

	Training Course	Page	Information	Duration (days)	Price (€)	Combination (€)		
Radio Communications								
week	Spectrum Matters for 5G	08		2	1,290	} 2,500		
	Wireless Connectivity for the Internet of Things (IoT)	09		1	690			
	5G Readiness and Network Deployment	09	new	1	690			
week	Drahtlose Kommunikationssysteme für die Bereiche Industrie, BOS und Versorgung	10	update / German	2	1,290	} 2,400		
	Workshop zum 5G Antragsverfahren für die Industrie	10	new / German	1	690			
	Betriebs sichere Funkkommunikation und vorbeugender Funkschutz im industriellen Umfeld	11	new / German	1	690			
week	Radio Networks for Critical Communications	12	update	2	1,290	} 2,600		
	Radio Network Planning for Critical Communications Networks	12	update	2.5	1,590			
week	In-Building Wireless Network Design	13		2	1,290	} 2,800		
	LTE – Long Term Evolution / Private LTE	13	update	3	1,850			
	Planning and Coordination of Microwave Links (PtP/PtMP)	14		2	1,290			
	📁 Radio Link Calculation and Coordination Tool – CHIRplus_TC	14		3	1,850			
	📁 Wireless Systems for Industrial Applications – Industry 4.0	15		1	690			
	Wireless Networks Calculation Tool – CHIRplus_TC incl. Net Module	15	new	2	1,290			
	Digital Terrain Data – Requirements, Production and Usage	16		1	on request			
Spectrum Management								
week	Managing and Regulating the Radio Spectrum: A Practical Guide	18		4.5	2,590	} 2,400		
	Sharing and Dynamic Spectrum Access – Hidden Spectrum Resources?	19		2	1,290			
	Dealing with the Capacity Crunch	19		2	1,290			
	Technical Issues in Radio Spectrum Management	20		4.5	2,590			
week	Spectrum Matters for 5G	20		2	1,290	} 2,400		
	5G and Satellite Compatibility	21	new	2	1,290			
	📁 SPECTRAemc Framework Functionalities	21		3	1,850			
	📁 IT Architecture, Implementation and Maintenance for SPECTRA Solutions	22		3 - 4.5	on request			
	📁 SPECTRAemc Radio Calculation Functionalities	22		4.5	on request			
	📁 SPECTRAplan S	22		3 - 4.5	on request			
	📁 SPECTRAemc Workflow Wizards, Deadline Management and Reporting	23		4.5	on request			
	📁 SPECTRAemc Coordination AddOns	23		3	on request			
	Monitoring & Measurements							
	week	Spectrum Monitoring - Measurement and Techniques	24		2		1,290	} 3,100
Practical Spectrum Monitoring Measurements		25		3	2,190			
📁 LS OBSERVER – Sensor-based Monitoring and Direction Finding		25	new	3	1,850			
week	Measurements of Human Exposure to RF Electromagnetic Fields	26	update	3	2,370	} 3,300		
	EMF Measurements and Reporting	26		2	1,290			
Broadcast								
week	FM and TV Broadcast Antennas	28		1	690	} 3,100		
	DVB-T2 – 2 nd Generation Digital Video Broadcast	29		2.5	1,590			
	DVB-T2 – Measurement Technology in Theory and Practice	29		1.5	1,250			
	Modern Broadcast Planning	30		3	1,850			
	ITU Procedures and Notifications	30		1	690			
week	Reorganization of the Spectrum Usage and Future Broadcast Scenarios	31		1	690	} 2,900		
	📁 Broadcast Planning Tool CHIRplus_BC (Radio/TV, Analog/Digital)	32		3	1,850			
	📁 Broadcast Planning Exercises using CHIRplus_BC	32		2	1,290			
	📁 Broadcast Planning Tool CHIRplus_BC (LF/MF)	33		2	1,290			

📁 Tool Training **week:** bookable individually or as bundle **German:** in German language



System Solutions and Expertise for Radio Spectrum Management & Monitoring, Wireless Network Design, Planning & Optimization

LS telcom is the global leader in spectrum efficiency with customers in over 100 countries worldwide. In an increasingly connected world, we assure that all spectrum users achieve their radio communication objectives in the most optimal and cost-efficient way. We deliver technologies and services to national and international regulatory bodies, to mobile and broadcast operators, to transport, critical infrastructure, defense, PPDR and vertical markets. We optimize spectrum management and spectrum use and enable new business models based on the Internet of Things (IoT). Spectrum users in all markets rely on our experts and software for the planning and design of optimized radio networks. We plan networks of all generations and technologies, including IoT.

On the regulatory side, we supply consulting and support services for spectrum policy development, pricing, auctions, trading, dynamic and licensed spectrum access considering technical, economic and social parameters. Our highly modern SPECTRA Enterprise IT system provides regulators with fully automated workflow-based e-government capabilities in spectrum management. Combined with our flexible radio monitoring system, it is one of the most advanced systems for spectrum inventory and data mining, enabling highest spectrum efficiency.

Training on network technologies, standards, and regulations as well as spectrum monitoring system integration and optimization, transmitter installations and measurements complete our offer. Founded in 1992, LS telcom looks back on more than 28 years of experience in the radio communications market. Since then LS telcom, an ISO 9001:2015 certified company, has established memberships with many industry associations and organizations and cooperates with leading technology universities. This is how we ensure to be up-to-date with technologies, standards and regulations.

As a member of the UK's 5G Innovation Centre (at the University of Surrey) and the 5G Alliance for Connected Industries and Automation (5G-ACIA), we are at the leading edge of 5G developments.

LS telcom operates worldwide with its headquarters in Lichtenau/Germany and subsidiaries and affiliates in Australia, Canada, China, France, Hungary, South Africa, UAE, UK and USA as well as representations and support offices in Argentina, Malaysia and Oman. LS telcom is listed on the German stock exchange under ISIN DE 0005754402 since 2001.

We bring spectrum efficiency to the increasingly connected world. The spectrum is yours and we help you make the most of it.

**Our quality
is certified in...**



According to ISO 9001:2015

development, sales, consulting and engineering and project implementation of soft- and hardware systems and IT services in the field of spectrum management, radio monitoring, wireless network planning and concepts.

Welcome to the LS telcom Training Academy!

Since 2003 the LS telcom Training Academy has been offering a unique selection of trainings, workshops and seminars around the topics communication and radio spectrum. This includes training on latest radio technologies and regulations, broadcast, network planning, spectrum management and monitoring, as well as basic and advanced training on LS telcom's software tools.

In our seminars 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



Member of the Board: Roland Götz (COO)

Our Guarantee

All our course content is permanently revised and updated. The latest changes in recommendations, regulations and standards are immediately incorporated into our courses

Besides choosing our regular courses listed in this training calendar, feel free to ask us 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.

Our team is pleased to assist you in booking the overnight accommodation. We have special rates at several partner hotels in the city of Baden-Baden and around Lichtenau. Just ask!

Also 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 take up thereby gladly your desires and suggestions.

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

With kind regards,



Roland Götz
Chief Operating Officer





Customized Training

Tailored to your needs and your schedule!

The courses or dates in our standard training program may not entirely correspond with your training needs or that of your organization. This is why we offer customized training: Whether it be **individual training**, **group training**, or extensive **skill building programs** for your organization.

With customized training, you choose the time and the place, and we'll be there with a skill-building training program tailored to your organization's unique needs.

Flexibility in location, format and scheduling

Customized training can be held anywhere: At the LS telcom Training Academy, your headquarters, a branch office or even at a nearby conference center or hotel. You also have options in format: full day, three-day session, five-day programs or ongoing modules. Finally, you have flexibility in scheduling: training can be delivered on agreed days - whatever makes it most convenient and cost effective for your organization.

Here are a number of training possibilities that we can set up for you:

Standard seminars upon request

Our course dates don't correspond to your timing? Upon request, we can set our standard courses at a time and date of your convenience.

On-site training - skill-building training tailored to address your organization's training requirements

On-site training is the perfect choice for companies that need to train groups of employees. You get a maximum number of employees trained in new skills in a minimal amount of time for one flat fee.

We discuss together your organizational training needs and tailor a skill-building program for you. You can choose the different modules. We can even design a new course for your organization.

Training on the job

You need advice on how to make your daily work easier or on how to improve processes? Our experienced consultants, radio engineers and spectrum managers will accompany you during your work and will suggest ways for more efficiency.

Customized training with individual content - draw up your individual training according to your specific needs

Compose your own training course. Our contents allow you to create a tailored course according to your particular training needs. It was developed to improve flexibility compared to our standard training program.

The advantages of customized training

- You choose the location of the training
- You decide on the agenda and course content
- You can discuss confidential issues
- Your specific needs are considered

Language

Our courses are conducted in English. Upon request, most of the courses can also be offered in German, French and Spanish. Please ask for other languages.

LS telcom Professionals

Our faculty of more than 35 trainers is the key to our successful training. They are carefully selected for their experience and knowledge – and most importantly – their teaching methods and ability to impart knowledge.



Five reasons why you should participate in LS telcom's training:

- Our trainers are experts in their field and very experienced in teaching
- Flexible teaching approach: a mix of theory and practical 'hand-on' sessions, wherever appropriate
- Guarantee of up-to-date knowledge of regulations and technology
- Perfectly equipped training facilities
- Excellent organization and nice scenery of the Black Forest



Radio Communications - Overview

Spectrum Matters for 5G.....	8
Wireless Connectivity for the Internet of Things (IoT).....	9
5G Readiness and Network Deployment	9
Drahtlose Kommunikationssysteme für die Bereiche Industrie, BOS und Versorgung	10
Workshop zum 5G Antragsverfahren für die Industrie.....	11
Betriebssichere Funkkommunikation und vorbeugender Funkschutz im industriellen Umfeld	11
Radio Networks for Critical Communications	12
Radio Network Planning for Critical Communications Networks.....	12
In-Building Wireless Network Design.....	13
LTE – Long Term Evolution / Private LTE	13
Planning and Coordination of Microwave Links (PtP/PtMP)	14
Radio Link Calculation and Coordination Tool – CHIRplus_TC.....	14
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Wireless Networks Calculation Tool – CHIRplus_TC incl. Net Module.....	15
Digital Terrain Data – Requirements, Production and Usage	16

5G - Week

“Spectrum Matters for 5G”, “Wireless Connectivity for the Internet of Things (IoT)” and “5G Readiness and Network Deployment” can be booked as full package as well as single courses. Package price for all three courses: 2,500 € (excluding VAT).

Spectrum Matters for 5G | 2 Days

Training Focus

5G is driven 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 are working towards the commercialization of 5G services but fundamental questions remain such as what is 5G, what will 5G look like, and how will this impact spectrum demand, authorization and usage? There is also the question of technology: Will 5G be a new technology (and air-interface) or will it be a system of different technologies, each playing to their own strengths? 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) services is concentrated above 6 GHz. How feasible is it to deliver mobile services at such high frequencies? Are there ways to use existing spectrum more efficiently, or are technologies such as LTE Advanced already very close to the limit of what is achievable?

Course Objectives

After completing the course, participants will have an understanding 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 spectrum.

Intended for

those who need to better understand the spectrum implications of 5G technologies, 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 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

30.11. - 01.12.20
29.11. - 30.11.21

Course Fee

1,290 € (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

02.12.20
01.12.21

Course Fee

690 € (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 its 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

03.12.20
02.12.21

Course Fee

690 € (excluding VAT)

Industrie - Woche

“Drahtlose Kommunikationssysteme für die Bereiche Industrie, BOS und Versorgung”, “Workshop zum 5G Antragsverfahren für die Industrie” und “Betriebssichere Funkkommunikation und vorbeugender Funkschutz im industriellen Umfeld” können als Gesamtpaket sowie als Einzelkurse gebucht werden. Gesamtpaketpreis für alle 3 Seminare: 2.400 € (ohne MwSt.).



Drahtlose Kommunikationssysteme für die Bereiche Industrie, BOS und Versorgung | 2 Tage

Workshopbeschreibung

Nahezu in jedem professionellen Anwendungsgebiet sind moderne Kommunikationssysteme mit Funkkommunikation vernetzt. Sei es im Umfeld moderner Industrie 4.0 Fertigungsanlagen, für die Bereitstellung zuverlässiger Fernwartung bei Versorgern, zur sicheren Kommunikation in Behörden, Sicherstellung kritischer Funkvernetzung an Flughäfen oder Objektversorgungen in Tunneln oder Gebäudekomplexen. Die Liste der Anwender und Einsatzgebiete lässt sich beliebig verlängern. Aus Sicht des Anwenders sind einige Grundlagen und physikalische Rahmenbedingungen zu beachten, um das Medium Funk zuverlässig und stabil zu nutzen. Anhand von Beispielen werden Probleme der Funkkommunikation aufgezeigt und Lösungen präsentiert wie sie sich vermeiden lassen.

Der Workshop geht in einfachen Darstellungen auf die physikalischen Grundlagen der Funkanwendung ein und stellt die derzeit verfügbaren Technologien und Konzepte gegenüber. Darüber hinaus werden die operationellen Anforderungen der Nutzer betrachtet und die damit verbundenen Parameter wie Funkausbreitung, verfügbare Frequenzbänder, Technologien und Systeme näher beleuchtet.

Ein Überblick über die derzeit verfügbaren Systeme und Rahmenbedingungen wie IoT, LoRa, WiFi, WLAN, Bluetooth, M2M oder autonomes Fahren stehen dabei genauso im Fokus wie die verwendeten Frequenzbereiche und deren speziellen Anforderungen. Der Workshop besteht aus einer Mischung von theoretischen sowie praktischen Elementen und ist eingebettet in die begleitenden Trainings der Trainingswoche.

Ziel des Workshops

Nach Teilnahme an diesem Workshop kennen Teilnehmer die Besonderheiten des Mediums Funk, dessen physikalischen und regulatori-

schen Charakteristiken und die Möglichkeiten/Einschränkungen derzeit vorhandener Systeme.

Für wen ist der Workshop geeignet?

Der Workshop richtet sich an alle Anwender und Verantwortlichen für die drahtlose Kommunikation im professionellen Umfeld aus den Bereichen Industrie, Versorger, Transport, Häfen/Flughäfen, Behörden mit Sicherheitsaufgaben kommen.

Inhalte

- Einführung in die Funktechnik
- Ausbreitung von Funksignalen und deren Einschränkungen/Besonderheiten
- Regulatorische Rahmenbedingungen in Deutschland und Europa
- Funksysteme und deren Anwendung
- Problemstellungen und Lösungsansätze im Funkspektrum
- Schnittstellen und Vernetzung verschiedener Systeme
- Selbst machen vs. Lösungen einkaufen

Datum

12. - 13.10.20

04. - 05.10.21

Kursgebühren

1.290 € (ohne MwSt.)

Please note that this training course is only available in German.





Workshop zum 5G Antragsverfahren für die Industrie | 1 Tag

Workshopbeschreibung

Regulierung im Bereich der Spektrumsnutzung ist notwendig, um einen geordneten und möglichst störungsfreien Betrieb der verschiedenen Funknetze zu gewährleisten. Dies beginnt auf globaler Ebene durch die ITU (International Telecommunication Union) und endet bei der lokalen Nutzung von Frequenzen vor Ort. Zu Beginn des Workshops erfolgt eine kurze Übersicht der entsprechenden Strukturen und Mechanismen, um die Funktionsweise dieses Ansatzes zu verstehen. Anschließend folgt eine kurze Darstellung von typischen 5G Use Cases basierend auf den unterschiedlichen Anforderungen.

In dem Workshop werden die aktuellen, offiziellen Rahmenbedingungen zur Beantragung von lokalen 5G Frequenzen in Deutschland erläutert. Dies betrifft die administrativen und technischen Anforderungen der Antragsstellung. Dabei werden beispielhaft Planungen und Simulationen für lokale Netze dargestellt sowie die sich daraus ergebenden Auswirkung auf die Versorgung, die Störreichweite und Möglichkeiten der Einhaltung von Grenzwerten.

Ebenso wird aufgezeigt, was unter einem Frequenznutzungskonzept zu verstehen ist, was hierbei zu berücksichtigen ist und welche Inhalte üblicherweise gefordert werden. Zum besseren Verständnis wird dies anhand eines Beispiels exemplarisch dargestellt.

Der Workshop endet mit einem kurzen Wrap-up, bei dem die wesentlichen Punkte nochmals zusammengefasst werden.

Ziel des Workshops

Nach der Teilnahme an diesem Workshop kennen die Teilnehmer die grundlegenden Prinzipien des 5G Antragsverfahrens in Deutschland und die sich daraus ergebenden Anforderungen und Beistellungen die hierfür notwendig sind.

Für wen ist der Workshop geeignet?

Der Workshop richtet sich an Firmen, Messen und Institutionen, die über eine mögliche Nutzung von 5G im industriellen oder landwirtschaftlichen Umfeld nachdenken und sich mit den entsprechenden Anforderungen des 5G Antragsverfahrens vertraut machen wollen.

Inhalte

- Warum Antragsverfahren – Von der globalen Regulierung hin zur lokalen Frequenznutzung
- Use cases für 5G und Industrie 4.0
- Erläuterungen der aktuellen offiziellen Rahmenbedingungen zur Beantragung von lokalen 5G Frequenzen in Deutschland
- Administrative und technische Anforderungen zur Antragsstellung
- Was ist ein Frequenznutzungskonzept?
- Erforderliche Kapazitäten, Bandbreiten und Versorgungsreichweiten
- Planen und simulieren von lokalen Netzen – Versorgung, Störreichweite und Einhaltung von Grenzwerten

Datum

14.10.20
06.10.21

Kursgebühren

690 € (ohne MwSt.)

Please note that this training course is only available in German.



Betriebssichere Funkkommunikation und vorbeugender Funkschutz im industriellen Umfeld | 1 Tag

Workshopbeschreibung

Getrieben durch die Digitalisierung unserer Gesellschaft und Industrie, reflektiert durch die Megatrends IoT, Industrie 4.0 und Maschine zu Maschine Kommunikation werden hochwertige, sichere und zuverlässige Netzverbindungen sowohl im industriellen Umfeld als auch an Hotspots wie Flughäfen, Häfen und Bahnhöfen immer wichtiger.

Neben klassischem Mobilfunk sind zahlreiche weitere Funkanwendungen für den reibungslosen Betrieb entscheidend. Die Vielfalt reicht von schmalbandigen Datenübertragungen mittels RFID bis hin zu High-End Systemen, bei denen massive Datenmengen transportiert werden müssen. Alle diese Dienste basieren auf drahtloser Kommunikation, benötigen Spektrum und müssen nebeneinander sicher und zuverlässig funktionieren. Darüber hinaus wird es allein durch die große Anzahl von unterschiedlichen Elementen schwierig den Überblick über alle Systemkomponenten zu behalten.

Wie kann man eine betriebssichere Funkkommunikation gewährleisten? Welche vorbeugende Maßnahmen zum Funkschutz kann man treffen um Störungen gänzlich zu vermeiden, oder diese zumindest schnell identifizieren, orten und beheben und somit Ausfallzeiten minimieren zu können?

Im Workshop werden diese Fragen anhand von praktischen Beispielen bearbeitet.

Ziel des Workshops

Nach der Teilnahme an diesem Workshop kennen die Teilnehmer Maßnahmen und Werkzeuge mit denen eine betriebssichere Funkkommunikation und ein vorbeugender Funkschutz zur proaktiven Vermeidung und Minimierung von Störungen und Ausfallzeiten gewährleistet werden kann.

Für wen ist der Workshop geeignet?

Der Workshop richtet sich an Firmen, Häfen/Flughäfen, Versorger, Messen und Institutionen, die unterschiedlichste Funktechnologie vermehrt auch für kritische Aufgaben einsetzen und bei steigender Funknutzung weiterhin sichere, einwandfreie und durchgängige Kommunikationsdienste ermöglichen müssen.

Inhalte

- Betriebssichere Funkkommunikation zur proaktiven Störfallvermeidung
- Konzeption & Planung betriebssicherer, zuverlässiger Funkversorgung
- Spektrum Inventur zur Validierung der aktuellen Funknutzung und als Basis für die zukunftssichere Planung zuverlässiger Systeme
- Frequenznutzungs-Datenbank und Koexistenzanalyse
- Vorbeugender Funkschutz zur Minimierung von Störungen und Ausfallzeiten
- Aktives Spektrum Management: Einführung von Regelwerk und Spektrum-Datenbank zur Verwaltung der Funklizenzen und Genehmigungsprozessen
- Permanentes Spektrum Monitoring zur Vermeidung, Identifikation, Ortung und Behebung von Funkstörungen und daraus bedingten Systemausfällen

Datum

15.10.20
07.10.21

Kursgebühren

690 € (ohne MwSt.)

Please note that this training course is only available in German.

Critical Communications - Week

“Radio Networks for Critical Communications” and “Radio Network Planning for Critical Communications Networks” can be booked as full package as well as single courses. Package price for both courses: 2,600 € (excluding VAT).



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

20. - 21.04.20
19. - 20.04.21

Course Fee

1,290 € (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

22. - 24.04.20
21. - 23.04.21

Course Fee

1,590 € (excluding VAT)

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

1,290 € (excluding VAT)



LTE – Long Term Evolution / Private LTE | 3 Days

Training Focus

Data communication is one of the most important and growing requirements of modern mobile wireless networks. Data usage has grown quickly in networks as each new generation of mobile broadband technology has been introduced, average data consumption per month and per mobile subscriber exceeds several hundreds of megabytes and a few gigabytes where operators deliver high capacity and low cost of data.

Long Term Evolution (LTE), often known as 4G, is designed to meet the burgeoning data demands. In addition to use for commercial services, LTE is also being considered for private wireless networks across a wide range of vertical markets including next generation PPDR and critical communications networks.

The course is specifically designed to grow the delegates understanding of the design and use of radio systems based on LTE technology. Aspects of the LTE physical layer, network design and planning including LTE Advanced features will be covered. Delegates will learn about S-OFDMA/SC-TDMA, MIMO technology, LTE TDD and FDD multiple access modes, system architecture, in-building coverage issues, mobility and handover aspects and future evolution of LTE. Thus the course will cover all the essentials in the field of LTE networks.

Course Objectives

After completing the course, delegates will be familiar with LTE technology including network architecture, radio technology and typical deployment scenarios. They will understand the role of LTE in next generation networks and the evolution of mobile radio technologies.

Intended for

This course is intended for those who have general knowledge in radio network planning and who are interested in technical aspects of LTE technology and network design whether from a commercial, private organizations, PPDR or critical communications perspective and who may be employed in telecoms regulators, telecoms operators and utility or transportation companies.

Contents

- Overview on LTE physical layer
- Principles of MIMO
- System architecture and deployment concepts
- LTE network planning and design
- In-building coverage issues
- Evolution of LTE: LTE Advanced
- Self-organizing networks
- Carrier aggregation
- LTE for private networks
- LTE for critical communications

Date

03. - 05.11.20

12. - 14.10.21

Course Fee

1,850 € (excluding VAT)

Microwave Link Planning - Week

“Planning and Coordination of Microwave Links (PtP/PtMP)” and “Radio Link Calculation and Coordination Tool – CHIRplus_TC” can be booked as full package as well as single courses. Package price for both courses: 2,800 € (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. The topics 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

04. - 05.05.20

03. - 04.05.21

Course Fee

1,290 € (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

06. - 08.05.20

05. - 07.05.21

Course Fee

1,850 € (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, control, and monitoring 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, deployment scenarios and spectrum availability is therefore essential for a successful introduction of wireless systems for automation.

This course describes technologies and concepts for wireless communication for industrial applications. It describes 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 the industrial sector.

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

17.03.20
23.03.21

Course Fee

690 € (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

29. - 30.09.20
26. - 27.10.21

Course Fee

1,290 € (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

Spectrum Summit



LS telcom is proud to host the annual Spectrum Summit. We feel honored to welcome a yearly growing number of industry experts from the regulatory and industry sector to present and debate hot topics and trends in spectrum management, radio regulations, and monitoring as well as critical communications and broadcast.

The Spectrum Summit includes panel discussions with keynote speakers presenting perspectives from different angles; followed by contributions from various regulatory and industry representatives. Presentations from leading industry experts on a variety of topics complete the day's program. In addition to the conference, we keep our customers up-to-date about product enhancements at our exhibition and by providing live demonstrations.

Further information you will find on www.spectrum-summit.com.



Solutions for...

We bring spectrum efficiency to the increasingly connected world

The future of the digital world goes hand in hand with efficient spectrum management, regulation and use.



Spectrum Regulation

Frequency regulatory authorities find all the solutions to efficiently manage and use the RF spectrum.



Mobile Broadband

We help our customers to have enough bandwidth at hand for all their applications.



Broadcast

With technology evolution, digitization, and convergence of broadcast, fixed/wireless broadband and the Internet, new business models are emerging and bringing new challenges to spectrum policy.



Critical Communications

We are experts in critical communications radio network planning and optimization.



Public Safety

Mobile networks for security applications in particular have to be available indoor as well as outdoor.



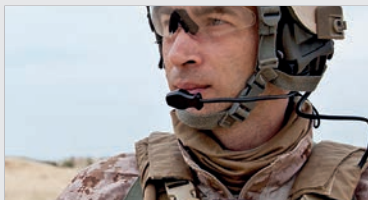
Airports, Ports & Hubs

We design and plan all kinds of radio frequency networks for the transportation sector.



Industries

Our experts help you to ensure smooth, constant and reliable communication within your manufacturing environment.



Defense & Security

We bring secure, reliable, and efficient radio communications to security agencies and military organizations.



Utilities / Oil & Gas

Rely on our team of radio engineers, technology experts and business analysts who have long-term experience in planning all kinds of networks for the utilities' industries.



Spectrum Management - Overview

Managing and Regulating the Radio Spectrum: A Practical Guide	18
Sharing and Dynamic Spectrum Access – Hidden Spectrum Resources?	19
Dealing with the Capacity Crunch	19
Technical Issues in Radio Spectrum Management	20
Spectrum Matters for 5G	20
5G and Satellite Compatibility.....	21
SPECTRAemc Framework Functionalities	21
IT Architecture, Implementation and Maintenance for SPECTRA Solutions.....	22
SPECTRAemc Radio Calculation Functionalities	22
SPECTRAplan S	22
SPECTRAemc Workflow Wizards, Deadline Management and Reporting	23
SPECTRAemc Coordination AddOns	23

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. - 13.11.20
08. - 12.11.21

Course Fee

2,590 € (excluding VAT)

Requisition on Spectrum Usage - **Week**

“Sharing and Dynamic Spectrum Access – Hidden Spectrum Resources?” and “Dealing with the Capacity Crunch” can be booked as full package as well as single courses. Package price for both courses: 2,400 € (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 usage and 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 advances 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 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

23. - 24.03.20

12. - 13.04.21

Course Fee

1,290 € (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 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 models
- The cost and energy implications of the various techniques

Date

25. - 26.03.20

14. - 15.04.21

Course Fee

1,290 € (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

16. - 20.11.20
15. - 19.11.21

Course Fee

2,590 € (excluding VAT)

Spectrum Matters for 5G | 2 Days

Training Focus

5G is driven 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 are working towards the commercialization of 5G services but fundamental questions remain such as what is 5G, what will 5G look like, and how will this impact spectrum demand, authorization and usage? There is also the question of technology: Will 5G be a new technology (and air-interface) or will it be a system of different technologies, each playing to their own strengths? 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) services is concentrated above 6 GHz. How feasible is it to deliver mobile services at such high frequencies? Are there ways to use existing spectrum more efficiently, or are technologies such as LTE Advanced already very close to the limit of what is achievable?

Course Objectives

After completing the course, participants will have an understanding 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 spectrum.

Intended for

those who need to better understand the spectrum implications of 5G technologies, 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 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

30.11. - 01.12.20
29.11. - 30.11.21

Course Fee

1,290 € (excluding VAT)



5G and Satellite Compatibility | 2 Days

Training Focus

Many countries are looking at introducing 5G mobile services into the frequency range 3400 – 3800 MHz. These frequencies are currently used by C-band satellite services which include 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

18. - 19.03.20
24. - 25.03.21

Course Fee

1,290 € (excluding VAT)

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

Date

on demand

Course Fee

1,850 € (excluding VAT)

IT Architecture, Implementation and Maintenance for SPECTRA Solutions | 3 - 4.5 Days

Training Focus

This course provides profound knowledge on how to conceive and build a server and network infrastructure to operate SPECTRA solutions. After presenting the general architectural options, the training will focus on how to set up and configure the environments. Furthermore, maintenance and troubleshooting competence will be trained. Extended concepts in terms of security, backup, disaster recovery, third party licensing, and virtualization will expand the course. The training will be held in LS telcom training facilities and involves some hands-on activities.

Course Objectives

After completing the training, delegates will be able to understand the architectural options for SPECTRA solutions and will be able to set up and maintain the environments in their day-to-day work.

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 SPECTRA solutions (not for users of SPECTRA for

licensing/planning purposes). Basic knowledge in several of the following areas is required to be able to follow the training: server and data base administration, virtualization, server/client architecture.

Contents

- Hardware server infrastructure and network topology for SPECTRA
- Server/client architecture for SPECTRA
- Virtualization solutions
- Workstations/laptop/tablets for SPECTRA
- Backup concepts
- Security aspects
- Licensing concepts for third party software
- Initial system installation
- System administration/SPECTRA updates
- Preventive maintenance and troubleshooting

Date

on demand

Course Fee

on request

SPECTRAemc Radio Calculation Functionalities | 4.5 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 and also for those who want to learn initially about the SPECTRAemc calculation capabilities.

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)
- Special calculations

Date

on demand

Course Fee

on request

SPECTRAplan S | 3 - 4.5 Days

Training Focus

SPECTRAplan S is the latest version of the classical SPECTRAplan module which is responsible for the administration of important data for spectrum planning on various levels in the SPECTRA system. The training is dedicated to the general SPECTRAplan S 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 tool's philosophy. The training involves the usage of SPECTRAplan S.

Course Objectives

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

Intended for

This course is intended for those who have been already using the classical SPECTRAplan module and now want to migrate to the new SPECTRAplan S solution. Also completely novice user of the SPECTRA

system starting directly with SPECTRAplan S will benefit from this training course.

Contents

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

Date

on demand

Course Fee

on request

SPECTRAemc Workflow Wizards, Deadline Management and Reporting | 4.5 Days

Training Focus

This training course is dedicated to the workflow and reporting related capabilities of SPECTRAemc in order to let the trainees understand how SPECTRAemc can be configured via the wizard workflow configurator tool and Crystal Reports Designer 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 Crystal Reports for SPECTRAemc. In addition the participants will be also able to maintain and further develop existing wizard workflows and Crystal Reports 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 workflows and/or Crystal Reports. The training course will be useful both for new users but also for experienced users of the tool to learn about the new features. Basic knowledge of SPECTRAemc core functionalities 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
- Overview Crystal Reports in SPECTRAemc
- Using Crystal Reports Designer for SPECTRAemc reports

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)

Date

on demand

Course Fee

on request

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.



Monitoring & Measurements - Overview

Spectrum Monitoring - Measurements and Techniques	24
Practical Spectrum Monitoring Measurements	25
LS OBSERVER – Sensor-based Monitoring and Direction Finding	25
Measurements of Human Exposure to RF Electromagnetic Fields (incl. practical measurements)	26
EMF Measurements and Reporting	26

Spectrum Monitoring - Week

“Spectrum Monitoring Measurements and Techniques” and “Practical Spectrum Monitoring Measurements” can be booked as full package as well as single courses. Package price for both courses: 3,100 € (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
- 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 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

30. - 31.03.20	07. - 08.06.21
07. - 08.12.20	06. - 07.12.21

Course Fee

1,290 € (excluding VAT)

EMF Measurement - **Week**

“Measurements of Human Exposure to RF Electromagnetic Fields” and “EMF Measurements and Reporting” can be booked as full package as well as single courses. Package price for both courses: 3,300 € (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 training will be held on classroom in LS telcom training facilities. 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, outlook to new ICNIRP RF guidelines
- Status of current biological research
- Basic measurement principles
- Derivation of an appropriate measurement methodology
- Review of existing measurement standards
- Correct measurements of FM, DAB, DVB-T, GSM, UMTS, LTE, TETRA, DECT, WLAN, and radar exposures; outlook to 5G
- Measurement report and uncertainty budget, typical sources of error
- Measurement strategies
- Measurement practice on real life signals

Date

21. - 23.09.20
20. - 22.09.21

Course Fee

2,370 € (excluding VAT)

EMF Measurements and Reporting | 2 Days

Training Focus

This course is on the job training complementing the “Measurements of Human Exposure to RF Electromagnetic Fields” course. It provides an introduction to practical EMF measurements and their evaluation using NARDA 550 & SRM 3006 together with LS OBSERVER. Delegates will execute practical examples with live measurements on standard service bands (FM Broadcast/DVB-T/GSM/UMTS/LTE), report the results and summarize in a group session the limitations of exposure measurements. Besides the training in the classroom, the training will also show how the measurement should be done using proper equipment.

Course Objectives

After completing the course, participants will be able to perform practical EMF measurements under real conditions and limitations in the RF field. They will also be able to correctly set-up measurements with a narrowband NARDA SRM 3006/LS OBSERVER measurement device. Additionally, they will also be able to evaluate the measurement results, judging the quality of the performed measurements.

Intended for

This course is intended for those who have basic knowledge of radio communication, electromagnetic wave propagation and measurement, who are interested in EMF measurements and reporting and who may be employed as regulatory authorities' staff members who will execute EMF measurements.

Contents

- Overview of EMF measurement tasks based on a fictive planned-measurement campaign
- Selecting the equipment according to the planned measurement campaign
- Basic measurements with NARDA NBM550 (Broadband) and SRM 3006 (Narrowband) or LS OBSERVER
- Live measurements in the real environment around Fremersberg and Lichtenau/Ulm
- Practical live measurement on FM broadcast/DVB-T/GSM/UMTS/LTE transmitters (with help of device-specific evaluation SW)
- Hints, do's and don'ts on performing live measurements
- Distinguishing between real signals and intermodulation products
- Evaluation and reporting of measurement results of used equipment
- Transfer of the learned skills to daily work

Date

24. - 25.09.20
23. - 24.09.21

Course Fee

1,290 € (excluding VAT)



Training Academy – Scheduled Training



Empower your organization

- ✓ Benefit from 28 years of first-hand experience
- ✓ More than 35 training professionals
- ✓ Theoretical & practical tool-training
- ✓ We show you how to use your knowledge

What our participants say...

Visar Halimi, Chief of Frequency Management Department, Regulatory Authority of Electronic and Postal Communications (Kosovo)

"Our team has already taken part in several courses of the LS telcom Training Academy. All the courses gave us great insight into the respective topics. The trainers were very knowledgeable and excellent in imparting their knowledge to the trainees. I especially liked the participation of people of different countries with different backgrounds. The interaction and exchange of experience between the participants was very useful and interesting. I will certainly visit the LS telcom Training Academy again in the future."



Broadcast - Overview

FM and TV Broadcast Antennas	28
DVB-T2 – 2 nd Generation Digital Video Broadcast.....	29
DVB-T2 – Measurement Technology in Theory and Practice.....	29
Modern Broadcast Planning.....	30
ITU Procedures and Notifications.....	30
Reorganization of the Spectrum Usage and Future Broadcast Scenarios.....	31
Broadcast Planning Tool CHIRplus_BC (Radio/TV, Analog/Digital).....	32
Broadcast Planning Exercises using CHIRplus_BC.....	32
Broadcast Planning Tool CHIRplus_BC (LF/MF).....	33

Digital Terrestrial TV - Week

“FM and TV Broadcast Antennas”, “DVB-T2 – 2nd Generation Digital Video Broadcast” and “DVB-T2 – Measurement Technology in Theory and Practice” can be booked as full package as well as single courses. Package price for all three courses: 3,100 € (excluding VAT).

FM and TV 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 analog 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) and digital terrestrial television (DTT). The course is presented in cooperation with Kathrein Broadcast GmbH.

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) and Digital Terrestrial Television (DTT)

Date

23.11.20
22.11.21

Course Fee

690 € (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 LITE profile
- DVB-T2 planning/coordination
- Choice of DVB-T2 Parameters
- Current status of DVB-T2 deployments
- Compatibility LTE vs. DTT
- Overview of other DTT technologies including ISDB-T and ATSC
- DTT switchover strategies

Date

24. - 26.11.20

23. - 25.11.21

Course Fee

1,590 € (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

26. - 27.11.20

25. - 26.11.21

Course Fee

1,250 € (excluding VAT)

Modern Broadcast Planning | 3 Days

Training Focus

The course is aimed at those people working within broadcast industry and focused on the planning and regulation of audio and television broadcast networks. To be highly effective when conducting broadcast planning requires up-to date knowledge of latest trends and technologies. Detailed knowledge about the huge variety of planning functionalities is as important as information about the technologies themselves. This course will furnish planners with the skills they need for the complex tasks of modern broadcast planning in respect of coverage planning as well as in respect of considering coordination issues. The course uses a number of practical examples to illustrate the theory based on using LS telcom's sophisticated broadcast planning tool.

Course Objectives

After completing this course, participants will have a thorough understanding of the more complex functions needed in the planning process. Many examples will be used to give detailed information about handling the special cases which can occur. The main focus of the course is digital networks.

Intended for

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

Contents

- Broadcast introduction
- Wave propagation effects
- Propagation models basics
- Interference theory
- Coordination procedures
- Broadcast network analysis
- Digital Radio (DAB(+), DRM(+)) etc.)
- Digital Television (DVB-T, DVB-T2, ISDB-T, ATSC, ATSC 3.0)
- Co-existence of DTT and other services
- Geneva 2006 Final Acts (Annex 2/Annex 4)
- Comparison of measurements (field measurements or remotely piloted aircraft measurements) with the calculated situation
- General future broadcast scenarios

Date

10. - 12.03.20
16. - 18.03.21

Course Fee

1,850 € (excluding VAT)

ITU Procedures and Notifications | 1 Day

Training Focus

This training is designed for those people working within the broadcast industry whose main emphasis is the planning and regulation of broadcast networks. The theoretical aspects of the Regional Radio Conference (RRC-06) including the outcome report of this conference (GE06 Final Acts) are part of the training. Additionally beside an overview of the most important digital terrestrial broadcast systems this training also shows and compares different coordination procedures and compatibility checks theoretically as well as based on practical demonstrations using LS telcom's sophisticated broadcast planning tool.

Course Objectives

After completing the course, participants will have an understanding of the outputs of the RRC-06. They will receive information about the elements and criteria that were used to develop the plan. The course will also impart knowledge of conformity and compatibility checks as well as different coordination procedures for plan modification purposes.

Intended for

This course is intended for those who are interested in ITU procedures and notifications and who may be employed in broadcasters, network operators or regulators.

Contents

- Conferences RRC-06
- Overview of digital broadcast services
- Technical elements and criteria used in the development of the plan
- Coordination distance and conformity check
- Article 4 coordination procedure
- Different coordination procedures

Date

29.04.20
28.04.21

Course Fee

690 € (excluding VAT)

Reorganization of the Spectrum Usage and Future Broadcast Scenarios | 1 Day

Training Focus

This training course is dedicated to all the people working for mobile operators, broadcast providers and regulatory authorities who deal with the issue of the UHF spectrum reorganization. Clearance of broadcast bands and coexistence of DTT and 4G, PMSE or other services will be discussed during the training. Also possible alternative broadcast content distribution platforms as well as general future broadcast scenarios using 4G or 5G platforms will be part of the training. The training will be held on classroom in LS telcom training facilities.

Course Objectives

This seminar explains the reorganization of the UHF spectrum as well as the potential interferences to DTT caused by new services close to the remaining broadcast band. After completing this course, delegates will also have a good understanding regarding potential future broadcast scenarios. Beside the theory behind, the trainer will also illustrate different scenarios on a sophisticated radio network planning tool.

Intended for

This course is intended for those who have a basic knowledge of radio communications technology, who are interested in reorganization of the spectrum usage and future broadcast scenarios and who may be employed in broadcast operators, mobile operators or regulators.

Contents

- Consequences of the past WRCs
- Scope and potential usage of the digital dividends
- Spectrum management constraints on digital dividend allocation and availability
- Coexistence of DTT and other services like IMT
- Alternative broadcast content distribution platforms
- General future broadcast scenarios using 4G and 5G networks

Date

28.04.20

27.04.21

Course Fee

690 € (excluding VAT)

Broadcast Planning - Week

“Broadcast Planning Tool CHIRplus_BC (Radio/TV, Analog/Digital)” and “Broadcast Planning Exercises using CHIRplus_BC” can be booked as full package as well as single courses. Package price for both courses: 2,900 € (excluding VAT).

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)
- Exercises

Date

11. - 13.05.20
17. - 19.05.21

Course Fee

1,850 € (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)
- ...and a lot of hints and tricks

Date

14. - 15.05.20
20. - 21.05.21

Course Fee

1,290 € (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

1,290 € (excluding VAT)

Terrestrial Broadcasting

- Software
- Spectrum consulting and radio engineering
- Network rollout and installation
- Radio monitoring and measurements



How to find us...

Please contact us to discuss your individual training needs!

Isabelle Gärtner & Daniela Ehinger

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+49 (0) 7227 9535 605

Training@LStelcom.com

www.LStelcom.com



How to get to the LS telcom Training Academy Lichtenau

Arrival by Car

LS telcom AG
Im Gewerbegebiet 31-33
77839 Lichtenau/Germany

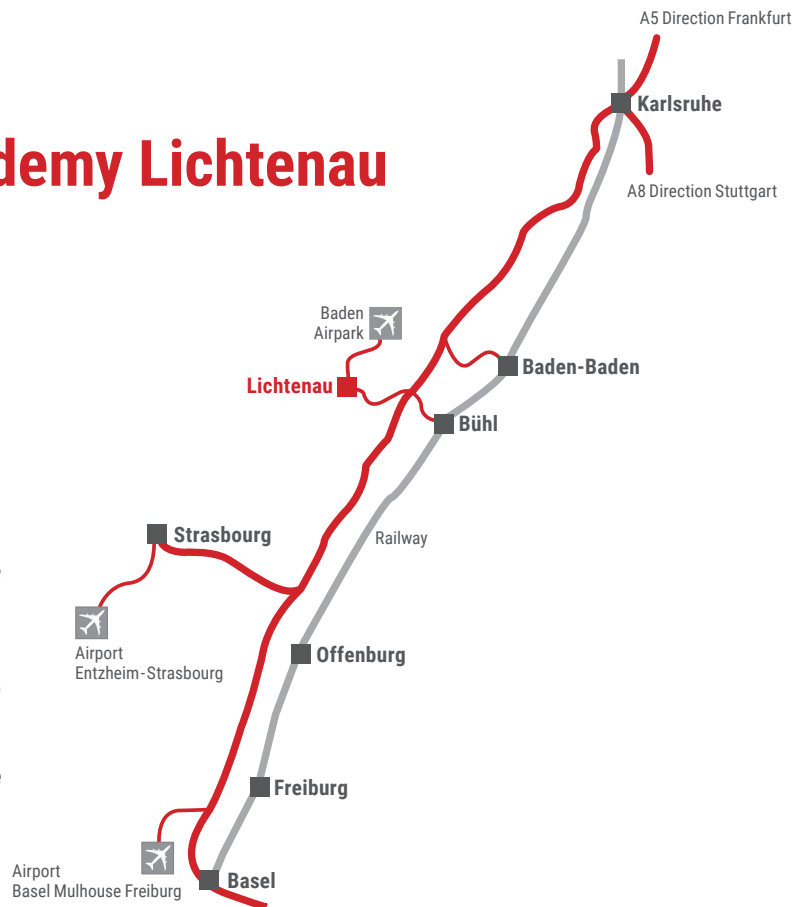
Arrival by Train

Should you decide to travel by train, you have the choice between Baden-Baden or Bühl main stations. From there a car or a cab will take you to LS telcom (Lichtenau) within approx. 20 minutes.

Arrival by Plane

You have the choice to arrive at Baden Airpark/Karlsruhe (10 min), Stuttgart (1 hour), Frankfurt (1,5 hours), Basel Mulhouse Freiburg (1,5 hours) or Strasbourg (approx. 45 min). To continue your journey, please take further details from above. If you wish to order an airport shuttle that brings you directly to your hotel please let us know – we will assist you in booking.

Should you need any further assistance, please do not hesitate to contact us!



LS telcom Training Academy headquarters in Lichtenau/Germany



LS telcom entrance hall Lichtenau/Germany

Enjoy your Stay in the Beautiful Black Forest...

Baden-Baden

Visit Baden-Baden and enjoy the architectural delights from the Belle Epoch period, quality art exhibitions and cultural events. There are plenty of recreational offerings and interesting places to visit nearby after a studios and busy training day. The well-known city of Baden-Baden is just 20 km away from the LS telcom Training Academy.

Your evenings in Baden-Baden

You may want to go for an evening walk and pass the Baden-Baden theatre, walk along the famous Lichtentaler Allee or visit the Baden-Baden castles. The Caracalla Spa, in the heart of Baden-Baden, offers wellness and relaxation on a heavenly scale. 12 natural springs provide an unforgettable bathing experience in this 3000 square foot glass temple. Or you may enjoy the fantastic restaurants. There is something for every taste, from savory regional cooking to international, Mediterranean style cuisine.



Festspielhaus Baden-Baden

Experience a memorable musical treat by taking your seats at the town's Festspielhaus, Europe's second largest opera and concert hall. Opened to the public in 1998, the Festspielhaus, with its world acclaimed acoustics, offers a diverse agenda of musical performances featuring top international artists.

Casino Baden-Baden

What could be better than to round off the day of training, in style, in the magnificent surroundings of Germany's oldest Casino, the Casino of Baden-Baden? You will be amazed at its extravagant interior and gripped by the thrilling suspense as you tempt fortune.



Black Forest Nature Park Central/North

The Black Forest is one of the most beautiful regions of Germany and a world-renowned holiday destination. In December 2000, the Black Forest Nature Park Central/North was founded with the aim of conserving and developing this region in a sustainable way. With an area of 926,625 acres (375,000 hectares) the Black Forest Nature Park Centre/North is the largest of its kind in Germany and has approximately 700,000 inhabitants.

But our nature park between the rivers Rhine and Neckar is special not only because of its size: Impressive landscapes, extensive forests, rock formations, deep canyons, clear springs, lakes, gushing rivers, beautiful meadows and peaceful pastures are all there for you to discover.

Strasbourg and the Alsace

Only a few minutes away from LS telcom you cross the river Rhine and will find Alsatian villages with half-timbered houses, potteries and many typical restaurants with Alsatian cooking. The most famous city in the Alsace is Strasbourg with its multitude of sights. In the heart of the historical center of Strasbourg you find the superb Cathedral of Notre Dame with its single tall spire and the famous astronomical clock. Not far from the center you can take a walk through the picturesque Petite France Quarter. And there is much more for you to discover...



LS telcom Surroundings



Visit the French capital Paris

If you book a full-week course, you may want to take the opportunity to go to Paris for the weekend. From Strasbourg to Paris it takes less than two hours by fast and very comfortable train, the "TGV".

Visit Europe's most popular theme park & resort: the Europa-Park

The Europa-Park offers a large variety of attractions for all tastes. There is a lot to discover and to experiment. Dare a roller coaster ride at 73 m above ground, at 100 km per hour or around two enormous mirrored towers. New sensations guaranteed! If you prefer the more quiet experience, you will enjoy the country-themed sections, the flying theatre – the biggest in Europe – the adventure land, enchanted forest or else the water park. You won't regret your day in the Europa-Park!



Heidelberg is beautiful

Heidelberg is considered to be one of the most beautiful cities in Germany. The city offers the ideal combination of romanticism and twenty-first century reality. Every year, the city which lies on the Neckar fascinates millions of guests and gives something to discover and experience for everyone. The picturesque ensemble of the castle, the Old Town, and the river Neckar surrounded by hills, which inspired the poets and artists of romanticism. But there's more to Heidelberg than romanticism. Heidelberg with its picturesque lanes and squares will invite you for shopping and strolling around. It will be an unforgettable experience!

Roppenheim The Style Outlets

Located directly on the border with Germany round about 20 minutes from Lichtenau, the Roppenheim Outlet Center is one of the largest in Europe. An interesting mix of internationally known and smaller French brands is offered. You can expect a cosy shopping atmosphere, reminiscent of a picturesque Alsatian small town. Small bistros and cafes will invite you for some fresh drinks and small snacks. Have fun shopping in Roppenheim!



Photos: www.europapark.de
www.istockphoto.com
www.fotolia.de

You will be awarded

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



Your certificate from the LS Training Academy

Our Industry Partners...



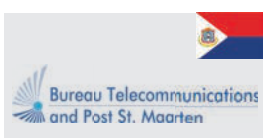
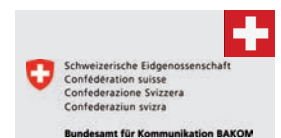
Our Partners

We are **member of...**



(1) Sector Member of ITU-R and ITU-D

These organizations, for example, attended our training. What about you?



Registration Form

Seminar

Title	_____
Date	_____
Fee	_____ <i>EUR (excluding VAT)</i>

Please register the following delegate:

Organization _____

Delegate

Title	_____	First Name	_____
Family Name	_____		
Job Title	_____		
E-mail	_____		

Authorized by:

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Date	_____	Signature	_____

Send your completed form to:

LS telcom AG

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

Online registration via:

www.LStelcom.com/training-registration

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.**

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). The course fee includes course material, refreshing beverages, coffee, snacks and lunch during training courses. 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 S1 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.LStelcom.com/training-registration.

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.

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28
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and experience

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Locations of LS telcom

The LS telcom Group, whose headquarters is in Lichtenau/Baden, Germany, has subsidiaries and regional offices all over the world:

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Info@LStelcom.com
www.LStelcom.com



LS telcom
Smart Spectrum Solutions

Our worldwide subsidiaries:

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