

Spectrum Management

System Solutions and Expertise for Radio Spectrum Management and Network Planning & Engineering



LS telcom Spectrum Management Software & Services

It's our experience of nearly two decades, our power for innovation and our customers that have made us the unchallenged worldwide market leader in the provision of Spectrum Management Systems and Services.

Customers in over 80 countries worldwide rely on us, why not you?

■ You Need ...

Software Solutions

to increase efficiency in all your spectrum management processes. That's what our integrated and automated SPECTRA spectrum management solution is there for. It supports you in your effort to optimise spectrum use and is based on the most advanced software and information technology available.

Integration of Monitoring Systems

We are vendor-independent and offer you our expertise in all the three disciplines - spectrum management, monitoring and system integration. Get the best mix of monitoring equipment and assure smooth operation and data flow between the different system components.

Software Implementation Services

to gain the full advantage of your software. This requires experts from various disciplines. We help you in scoping studies, software installation, adaptation and training to assure long-term operational efficiency and quick return on investment.

Strategic Consulting & Radio Engineering

We offer high-level strategic consulting and radio engineering to improve processes and help you make research-based decisions in spectrum management. Our experienced consultants and radio engineers work in close collaboration with our customer to guarantee excellent results.

Software & Tool Training

What's the point having sophisticated software, but you don't know how to use it? We give extensive software tool training and show you how to use your software to its full extend. Feel comfortable with the everyday use of your software and learn the little extra bit to optimise its use.

Training & Competence Centre

Our Training & Competence Centre proposes a variety of courses in spectrum management, covering technical as well as strategic issues.

Maintenance & Support

We don't leave you alone should you have any questions after the software installation. We offer hotline and help desk support and guarantee continuous quality through updates and upgrades.

Modern Spectrum Management is based on Office Automation

In line with the diversification and commercialisation of radio technologies there has been a constant increase in demand for frequency spectrum and its commercial value.

National regulatory authorities and network operators are under increasing pressure to make sure the radio spectrum is used efficiently. At the same time, new technologies and services mean licensing and frequency allocation have become more complicated than ever, while spectrum managers are having to adopt a market-driven approach that includes spectrum trading, dynamic frequency lease and white space management.

These changes mean that spectrum management increasingly depends on process optimisation and automation.

LS telcom has been in business since the very beginning of automated spectrum management and has grown with the market. We combine sound knowledge and expertise in the spectrum management profession with the most advanced software and information technology available.

- **LS telcom, the worldwide leader in spectrum management systems and services**



You are the
conductor
and we
support you!

The SPECTRA

Spectrum Management Solution

Our automated SPECTRA Spectrum Management System and our know-how are based on almost two decades of expert research & development, our capacity for innovation, our dedication to customers and our active participation in national and international organisations and study groups.

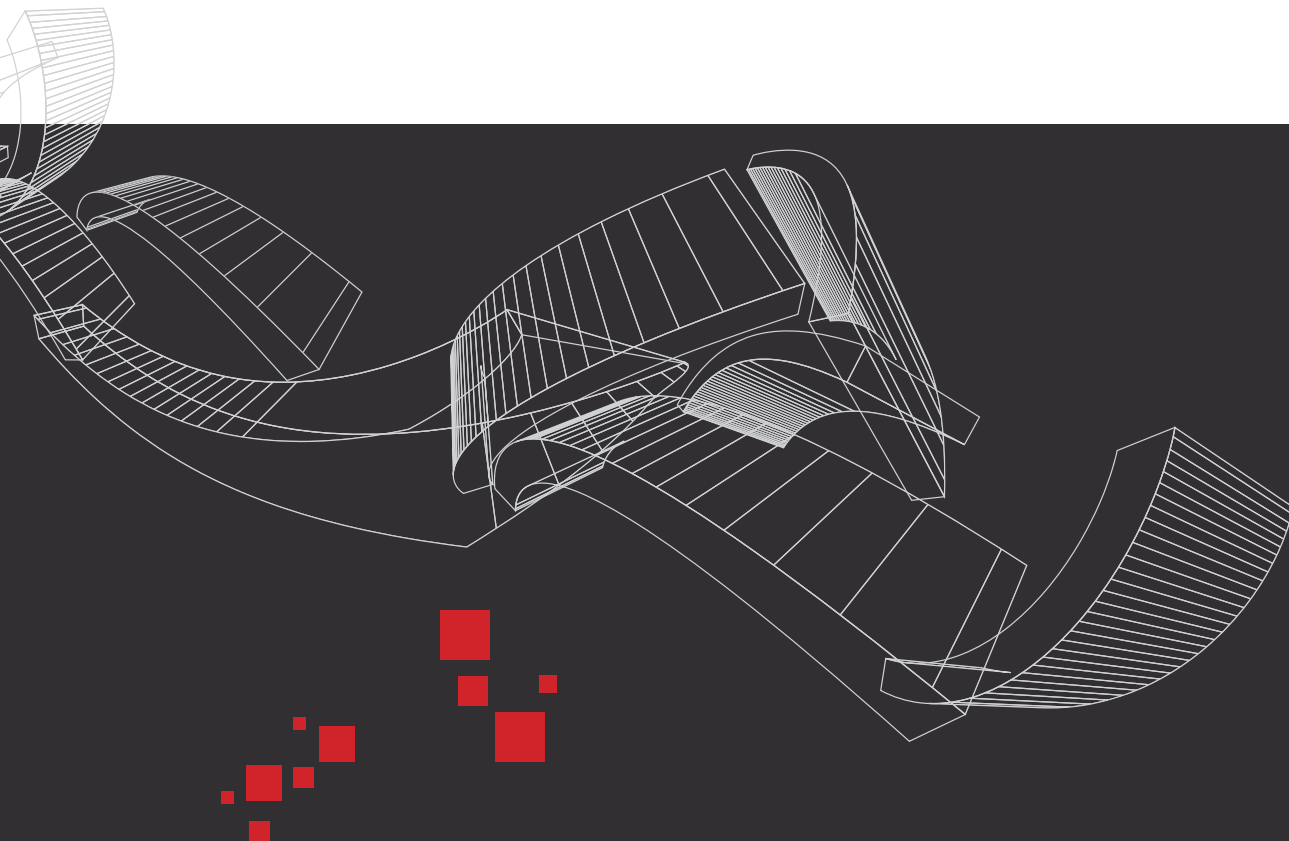
This is why we are able to offer professional spectrum management systems for fundamental requirements as well as entirely automated high technology systems which can be embedded in an enterprise environment.

The modularity of the SPECTRA System allows for solutions which are entirely tailored to the customer. The engineering, spectrum planning and radio monitoring modules are commercial-of-the-shelf avoiding costly from-scratch in-house development with high risk potential. As a result the customer benefits from continuous software enhancements and timely implementation. Application and licence management is specifically adapted where needed to fulfil the exact requirements of the organisation.

SPECTRA integrates with third-party products like Financial Software Systems, Customer Relationship Management Systems or any other software. In addition, our solutions adjust to the customer's level of automation needed for their daily operations, the customer's organisational size and budget available.

The latest relevant ITU and other national and international recommendations are incorporated into the SPECTRA System. It features high scalability and sustainability and spans all radio technologies.

Two solutions are available in our SPECTRA Spectrum Management System; SPECTRA Professional and SPECTRA Enterprise.



SPECTRA Professional

The highly modular and flexible **SPECTRA Professional** System relies on trusted industry methods and addresses the fundamental spectrum management tasks, such as:

- application and licence processing,
- spectrum planning,
- technical frequency assignment,
- national and international coordination,
- monitoring and control, as well as
- financial management.

Using **SPECTRA** reduces licence attribution periods and maximises efficiency in licence processing and national spectrum use.

SPECTRA Enterprise

SPECTRA Enterprise includes all **SPECTRA Professional** tasks and is based on most up-to-date support technology and online services enabling fully automated process flows and seamless integration between different departments and software modules. Online services and end-to-end automation of workflows allows users to “glide like a limousine” through the licence application process.

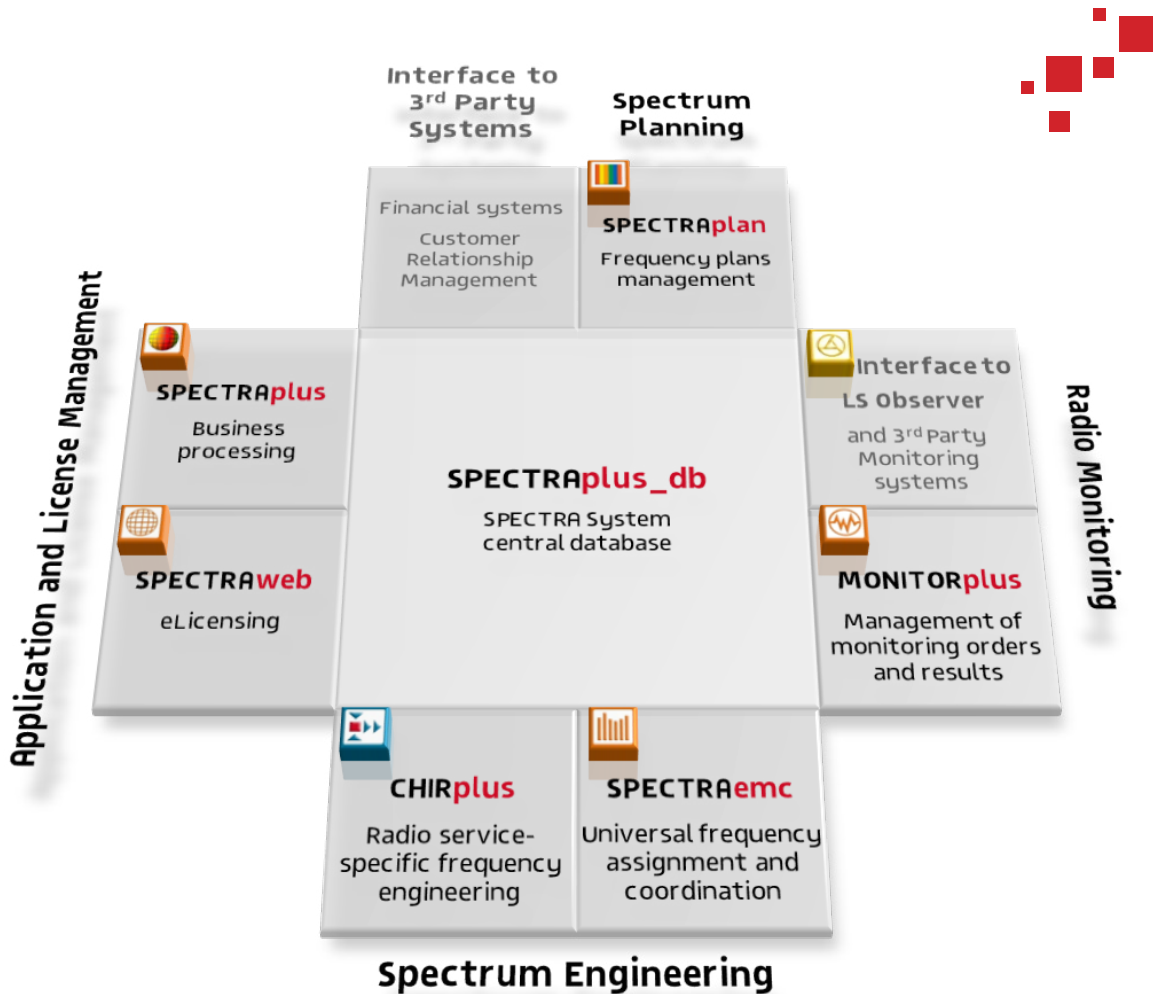
SPECTRA Enterprise supports regulatory authorities in their effort to provide proper **e-government services in spectrum management**.

You can offer customer-friendly services while reducing operation and maintenance cost. Your customers can apply, amend or cancel licences online and they can buy licences and pay online. Whether your customers need spectrum for immediate use, special events, frequent, temporary or permanent use – **SPECTRA Enterprise** optimises and automates all the underlying processes for **e-licensing and e-payment**.

It is one of the most advanced solutions in the world and is the flagship for modern office automation in spectrum management.

- Two solutions are available in our **SPECTRA** Spectrum Management System; **SPECTRA Professional** and **SPECTRA Enterprise**.





SPECTRAplus_db

The database stores and centralises all licence, billing, technical and monitoring data, frequency plans and ITU notifications. Keeps ALL your data in ONE place to give you a SINGLE VIEW of the spectrum.

SPECTRAplus

is your application and licence processing tool. Generate your licence documents quickly and send invoices on time.

SPECTRAweb

is an e-licensing platform supporting online application and licence processing. Use SPECTRAweb for fast and secure licence data entry. Your customers can apply for a new licence, amend an existing one and pay online via SPECTRAweb.

CHIRplus

includes technology and service specific radio planning and coordination.

SPECTRAplan

is your strategic spectrum planning tool designed to manage regional, national and international frequency plans. It includes the relevant frequency plans approved by the latest ITU World Radiocommunication Conference (WRC).

MONITORplus

is the interface between spectrum management and monitoring systems. Compare licence data in your database in real-time with live measurement and monitoring data. React quicker to fraudulent use of spectrum.

SPECTRAemc

is your tool for interference analysis, coordination and frequency assignment. It guarantees interference-free and optimised spectrum usage.

LS OBSERVER

is the next generation monitoring system for extremely fast data capture and automatic and long-term monitoring data storage. It is the foundation for intelligent spectrum policy analysis and evidence-based regulation.

Advantages of Using **SPECTRA**

End-to-End Process Automation

SPECTRA Enterprise uses **Web Services** to build **Service Oriented Architecture (SOA)**. The superior system design offers you unprecedented flexibility: You can create your own workflows with the help of the **Oracle BPEL** workflow engine. Workflows can be added or modified at any time.

Seamless integration and data exchange is guaranteed between the different administrative and technical system components as well as remote and third party software systems.

Technical calculation results are immediately available for administrative purposes just as changes in administrative data can be used instantly for calculations and coordination exercises. Latest technology allows the system modules to communicate in real time without any human interaction.

Automatic Frequency Assignment and Coordination

Automated Wizards take you step-by-step through the complete frequency assignment and coordination process. Save time and be consistent with wizard automation and standardisation. For each service and sub-service you can create a wizard to guide you through repetitive processes.

Online **Frequency Shopping**

For selected services it is even easier. **SPECTRA Enterprise** supports e-commerce for the purchase of frequency licences. You can buy frequencies via the Internet as easily as you buy any other commodity online.

The customer can choose from a set of alternatives the preferred mix of frequencies and corresponding price available for a given service. Once the "shopping basket" is filled the buyer proceeds to the checkout. An E-Payment Gateway allows for immediate online payment by credit card, such as Visa, MasterCard and American Express. It guarantees real-time authorisation and clearance of the payment transaction by the financial institution before any purchasing document is issued.





E-Licensing Services

Simplify the licence application process for your customers with **SPECTRA Enterprise's** web-based licensing. Customers can log in to a web application portal to access their profile including customer and licence data, just like in a Customer Relationship Management (CRM) system. Following predefined workflows the licence applicant can apply for a new licence or amend or cancel an existing one. Licence users may modify or cancel their current licence with a couple of mouse clicks. The licence amendment and cancellation is accepted or refused immediately – depending on the licence type.

The e-licensing also allows you to apply online for licences which require comprehensive technical calculation and assignment. You are guided step by step through the licence application form and you can see at which step you are at in your application process. You can save your application form and continue at a later stage, once registered with the system. When you have submitted your application form you can check the status of the application online.

Programme-Making and Special Events (PMSE)

You need frequencies for an event? Check hundreds of frequencies and device types online to find out whether you can operate a microphone or any other low power device in a certain location and at a certain time.

The Special Plug-In for event pre-planning allows for meticulous spectrum planning and minute time-slot management in a certain event area such as for the use of temporary event television or microphones.

White Space Management, Dynamic Frequency Lease and Secondary Markets...

...are all about using frequencies more efficiently to serve the increasing spectrum demand. There is local, timely and frequency White Space; the use of unused frequencies in a certain area; time sharing a frequency and the use of guard frequencies between services to avoid interference.

White Space Use needs to be managed efficiently and more importantly licensed spectrum in adjacent channels has to be protected from interference.

SPECTRA Enterprise provides facilities to build and operate a **White Space Management Database**. It is the foundation for the most efficient spectrum distribution methods. The solution supports spectrum trading and dynamic frequency lease as well as the operation of secondary markets. This new dimension of spectrum management is possible through the networking of communication devices, databases, calculation services and interference monitoring.

To be eligible to use white space spectrum in a certain area or at a certain time, the user has to register its device in the database in order to get information about free channels. An operator of low power or short range devices can easily check online which frequencies are still available and where. The Database Solution can be customised to support different payment models and payment can be made directly online through wire transfer or credit/debit card.

The online information is presented in a clear and understandable way, so that not only spectrum experts but also small and medium-sized enterprises (SMEs) can access the information and buy the spectrum. Any organisation in demand for spectrum can easily acquire spectrum for their needs. The national frequency spectrum is thus distributed and used in the most economic way.

Transparency with **Online Spectrum Portal**

An Online Frequency Information Portal can be integrated in the **SPECTRA** System. You can publish information and content in the Frequency Portal based on the Authority's regulations and requirements. According to your country, information on frequency bands, licence data and conditions, monitoring and geographical data can be presented on the portal to make licence application easier for your customers and to reduce interference. The portal can be interfaced to EFIS (European Radio-communication Office Frequency Information System).

Automated Interface with **Radio Monitoring Systems**

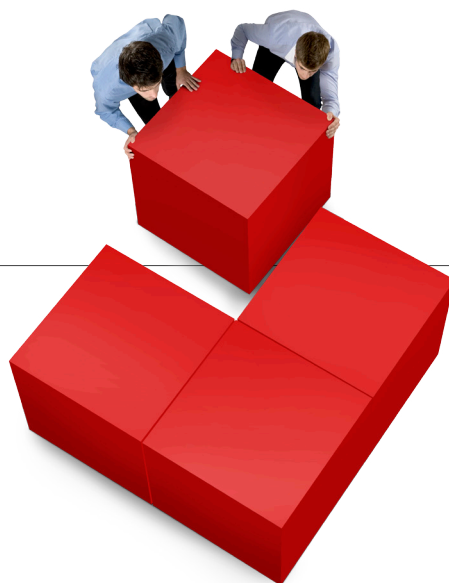
The **SPECTRA MONITORplus** interface supports all radio services in the search for interferers, unlicensed transmitters and transmitters not working under correct licence conditions. Through a unique interface design with relevant market standard monitoring systems, you can analyse data from several different radio monitoring systems in parallel within one session, including live measurement data. The radio controller can display on-screen real-time monitoring data together with licence data stored in the database. You can take immediate action and impose sanctions against the illegal use of frequency spectrum.

Our system integration team has long-standing experience in the integration of spectrum management and monitoring systems.

State-of-the-Art **Technology**

SPECTRA Enterprise also makes use of **Cloud Computing**, **private Clouds**, **different types of Virtualisation** and **Citrix** to save on server hardware and other IT resources, to improve scalability and to enable convenient, on-demand system access.

Based on these technologies **SPECTRA Enterprise** provides unique processing speed and process optimisation, which makes it one of the most efficient and user-friendly systems in the world.





SPECTRA Specific Versions for

Air Traffic Control

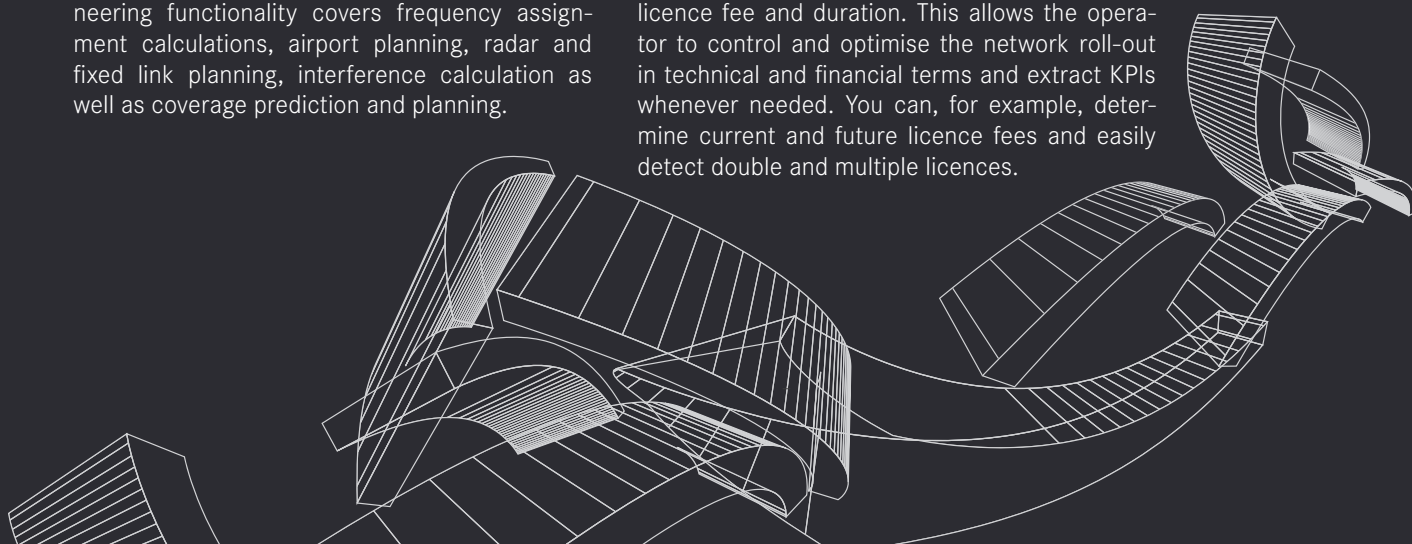
Our **SPECTRAair** System is an integrated solution for spectrum and frequency management of aeronautical radio services. It covers all aeronautical spectrum management tasks and supports the processes for frequency assignment, domestic licence requests, coordination with foreign countries, as well as incoming foreign coordination requests.

The comprehensive coordination and compatibility calculations are based on ICAO rules (ICAO COM2 COM5 calculations). The system's engineering functionality covers frequency assignment calculations, airport planning, radar and fixed link planning, interference calculation as well as coverage prediction and planning.

Spectrum Management for Operators

Network operators manage thousands of stations and links and a large range of frequencies, for which they pay high licence fees. It is therefore essential for them to operate the network in the most efficient way in order to guarantee profitability and network quality.

With our SPECTRA solution dedicated to operators you can store all data in one central database. This includes technical information about sites and equipment as well as information on licence fee and duration. This allows the operator to control and optimise the network roll-out in technical and financial terms and extract KPIs whenever needed. You can, for example, determine current and future licence fees and easily detect double and multiple licences.



Services for Spectrum Management



With our extensive service offering we can address any demand in spectrum management.

Whether you need to install and implement spectrum management software or systems, you want to integrate monitoring systems with your spectrum management solution or whether you need consulting or training - we have large multi-disciplinary, multi-cultural teams to assist you wherever and whenever needed.



Software and System Implementation

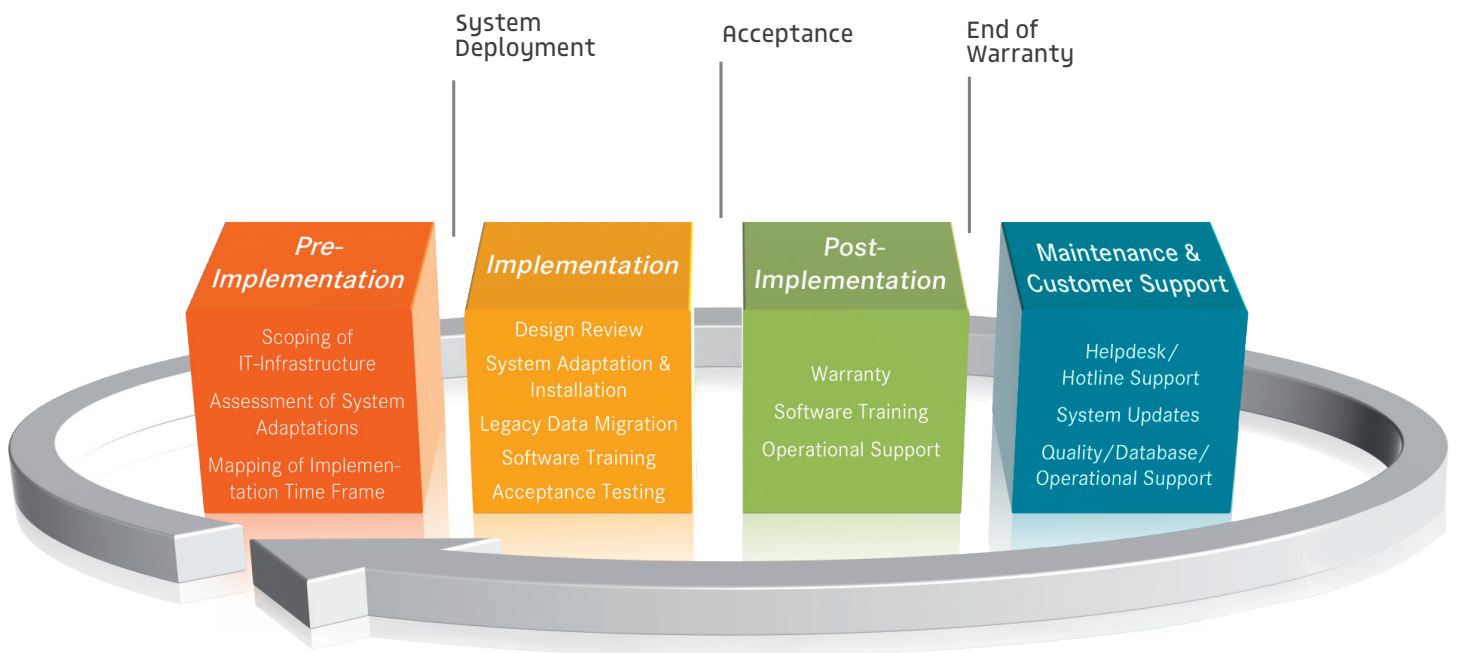
It needs more than the financial investment in top-class spectrum management software and systems to leverage their full advantage and to increase your operational efficiency.

You need software and systems which are perfectly implemented. This requires experts from various disciplines.

Our team consists of

- IT specialists
- business analysts
- radio engineers
- web designers
- software developers
- project managers
- configuration experts, and
- installation and deployment specialists

to assist you in every step of the implementation process:



We do not only deliver software – we deliver solutions.

You have to make sure that your system is operational as quickly as possible while being subject to budget constraints. Our professional implementation services are based on proven project methodology and many years of experience. We assure a timely implementation, enable you to fully exploit the benefits of the systems delivered and accelerate your return on investment.

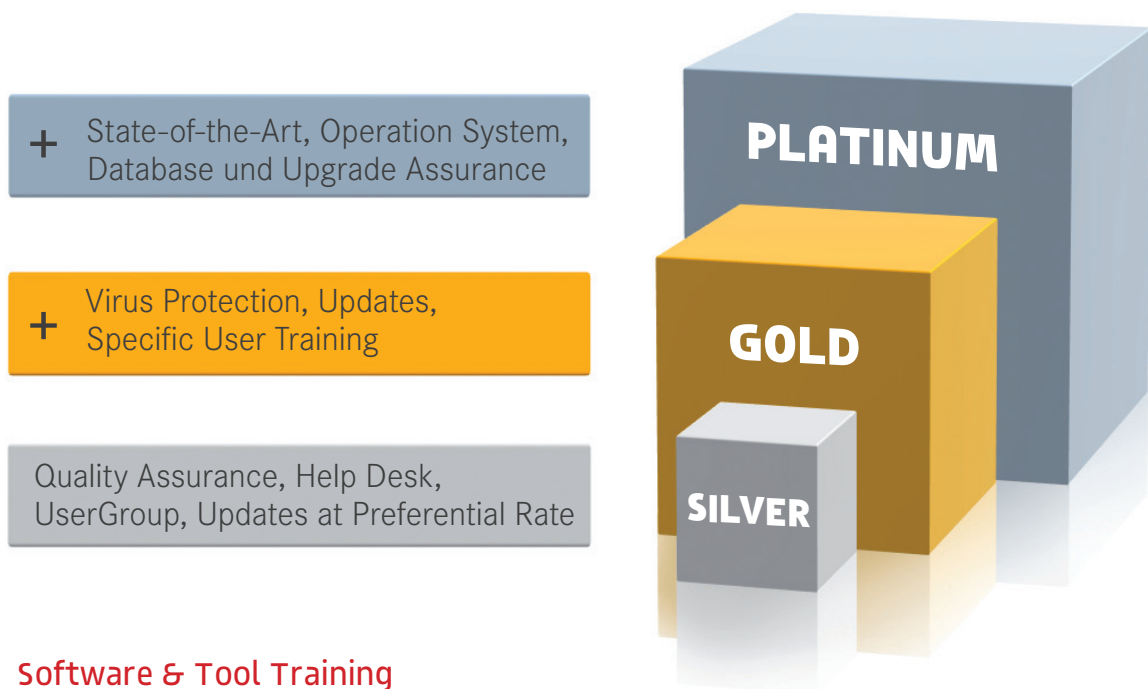


Maintenance & Customer Support

Excellence in what we do and our customers' utter satisfaction is our priority. We want our customers' satisfaction to last and our clients to be our long-lasting partners. This is why we offer an extensive and versatile Customer Maintenance & Support Programme.

Choose the programme that fits your team's skills and your system environment best. You are probably interested in the continuous quality of your system, help desk support or software updates. We offer that and much more; such as operating system, database, upgrade and update assurance, virus protection, etc. You can also exchange your experience with your counterparts and have a say in our software development in participating in our Annual UserGroup Meeting.

Our customers have the choice between Silver, Gold and Platinum Support & Maintenance Standard.



Software & Tool Training

Your system and software are successfully installed. Now you wonder where and how to start? Or you need a brush up of your software skills?

We give extensive software tool training and show you how to use our software to its full extend. Feel comfortable with the everyday use of our software and learn the little extra bit to optimise its use.

You can choose from a list of different course levels: beginner, intermediate and advanced.

Integration of Spectrum Management and Monitoring Systems

Professional integration of spectrum management and monitoring systems is vital to always have precise real time measurement data available for optimal spectrum management, licence attribution and calculations.

Our experts are dedicated to integrating monitoring vehicles, fixed and portable stations with spectrum management to assure smooth operation and data flow between the different system components. Our product and service portfolio spans the entire life cycle from design and development, through production and operation to maintenance and support, and, eventually, de-installation.

Monitoring: LS OBSERVER

Spectrum regulators and operators alike need to permanently “monitor” the real use of the entire spectrum to identify and locate both unused, underused frequencies and interference in order to effectively manage spectrum.

LS OBSERVER is the next generation of monitoring and has many advantages over traditional monitoring systems. It captures all frequencies at all times, automatically compresses and stores all monitoring data for about 2 years and you can scale your RF front end exactly according to the capability you need and the budget you have available by choosing from a variety of receivers, sensors and spectrum analysers. You can even integrate your existing monitoring system in our LS OBSERVER.

We are infrastructure vendor independent which enables us to offer a mix of different monitoring equipment which is most adapted to your needs and requirements.

Strategic Consulting & Radio Engineering

For frequency regulatory authorities and operators alike, operational efficiency and the optimised attribution and use of radio spectrum are critical to assure profitability while at the same time providing the quality and service level the end user expects.

You chose where you need our support:

- pre-tender and tender consulting
- capacity building
- development of spectrum strategies
- band re-farming, re-allocation & re-definition
- spectrum regulation
- radio, spectrum, capacity, parameter
- bid planning & support

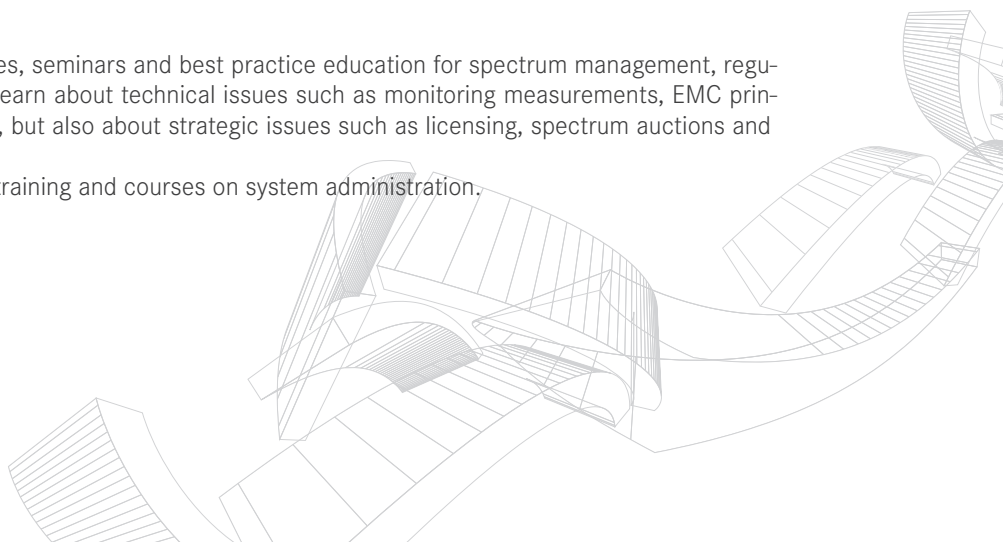


Training & Competence Centre

Do you agree that continuous education of your employees is the foundation of top performance? Offer them training and development:

We have a wide variety of courses, seminars and best practice education for spectrum management, regulation and monitoring. You can learn about technical issues such as monitoring measurements, EMC principles and satellite coordination, but also about strategic issues such as licensing, spectrum auctions and the Digital Dividend.

Of course, we also provide tool training and courses on system administration.



What our Customers say:

“This system is one of the most innovative spectrum management solutions available. Licensees benefit from a streamlined system which allows online licence applications and overview of their status at any time.”



Jill Ainscough, Chief Operating Officer at Ofcom, Independent regulator and competition authority for the UK communications industries, UK

“Our new system SPECTRA Enterprise supports the complete licence application process online - from the enquiry to technical spectrum analysis through to spectrum assignment and billing. This saves time, reduces the error rate and helps us to work more efficiently. The licence applicants can now view their application status online. I’m sure that our customers, too, appreciate the new system very much.”



Tariq Al Awadhi, Executive Director Spectrum and international Affairs at the Telecommunications Regulatory Authority (TRA) of the United Arab Emirates

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