LS telcom
Smart Spectrum Solutions

**Optimizing Network Quality and Costs**

Global Spectrum Experience

# Terrestrial Broadcasting

Software, spectrum consulting and radio engineering,
network rollout and installation, radio monitoring and measurements

# LS telcom: a World-leading Supplier of Terrestrial Broadcast Solutions

LS telcom provides world-leading broadcast network planning software and engineering, consulting, radio monitoring and measurement services.

Founded in 1992, LS telcom draws upon over 25 years of experience in the terrestrial broadcast market. Our software for broadcast network planning was the first of its kind on the market. With our success in digital TV planning dating back to 1999, we rank amongst the pioneers in the digital broadcast market.

Today, public and private broadcast network operators, regulatory and media authorities, transmitter and antenna manufacturers and content providers in over 100 countries worldwide rely on our significant investment in research and development and trust in our products, skills and experience.

Over 250 employees worldwide help you tackle any issue in terrestrial broadcasting that you may have.

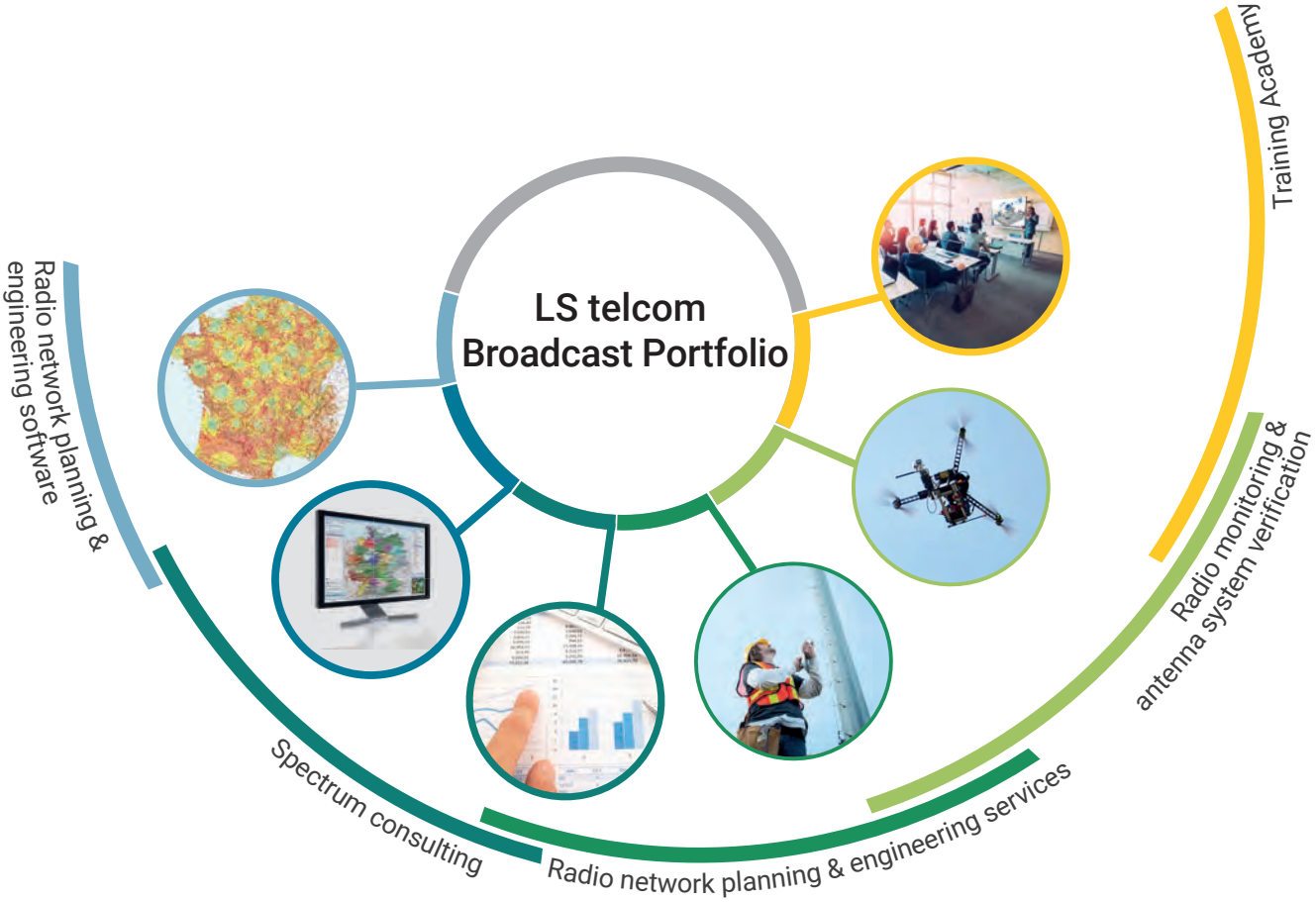
For over 25 years we have been working hand-in-hand with our customers worldwide earning their trust. When considering your issues, we can call upon our experience from around the world to ensure that your solution addresses local requirements as well drawing upon the best international practices.


LS telcom subsidiaries and offices

# Innovation and quality at LS telcom

LS telcom, an ISO 9001:2015 certified company, has become a member of many industry associations and organizations, and cooperates with leading technology universities. We are also an active sector member of the ITU-R and ITU-D. This ensures we are continually up-to-date on market and technology developments, standards and regulatory practices.


# LS telcom broadcast portfolio



# CHIRplus_BC for the Design, Planning, Coordination and Optimization of Broadcast Networks

Regulatory authorities and broadcast network operators in over 70 countries worldwide use our software tool CHIRplus_BC to plan, coordinate and optimize broadcast networks of all standards and technologies. They chose our software, because it is specifically aimed at them and their needs.

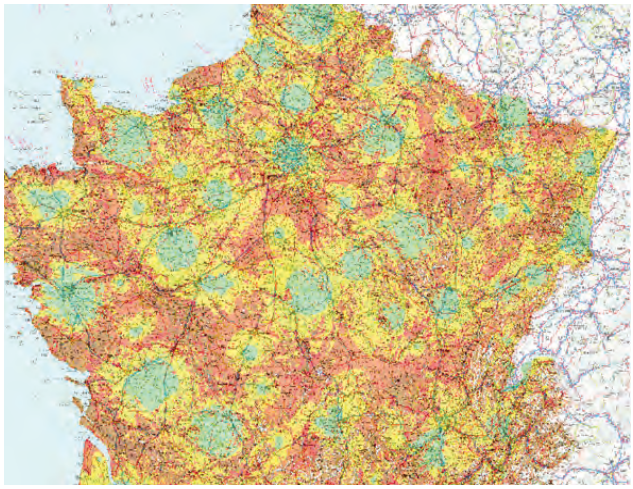
CHIRplus_BC was first sold in 1994 and since then has always included the latest ITU standards and recommendations, as well as continual improvements and enhancements through hands-on user experience and customer feedback.

Easily plan all terrestrial television and digital radio systems with CHIRplus_BC, including:

- DVB-T/T2, ISDB-T, DTMB, CMMB, ATSC/3.0, eMBMS
- T-DAB/T-DAB+, DRM, DRM+, IBOC (HD Radio™)
- FM, TV, LF/MF, HF

SFN delay spread

Our customers use CHIRplus_BC for the planning of a single transmitter to multiple networks with local, regional or nationwide channels, including single frequency networks (SFN).



Nationwide coverage calculation

The multithreading network processor, which calculates several results simultaneously, reduces the calculation time for nationwide network calculations considerably. For single frequency networks, the network processor also covers the calculation of self-interference and statistical network gain.

Thanks to the intuitive user interface and user dialogs, optimized for broadcast planning, and the implemented macros, broadcast engineers can quickly leverage all the capabilities of CHIRplus_BC.

The pre-set system parameters and variants for each network technology allow for faster click-through of the planning procedure and reduce errors.

Automated workflows for repetitive planning and calculation processes can be launched via a single mouse-click on implemented macros.

The software includes all interference calculations a broadcast planner and coordinator needs, also considering other services operating in the same or adjacent frequency bands. It covers, for instance, the interference from mobile services (e.g. LTE) which leads to a reduction in DTT coverage, and the interference of sound broadcasting stations (FM, DRM, HD Radio™) to aeronautical radio navigation services (ILS, VOR or GBAS) that may affect flight safety.

# Frequency Planning, International Coordination and Notification

## Following ITU standards & recommendations

- Coordination processes according to ITU and relevant international frequency plans (GE84, GE75, RJ81, GE06)
- Easy access, data query, and import from BR IFIC, IDWM (ITU Digitized World Map)
- GE06 functionality: allotment and assignment planning, including concept of allotments with various Reference Planning Configurations (RPCs) and Reference Networks (RNs) for compatibility and interference analysis
- ITU Region 2 specific coordination processes, import from public FCC and ISED sources, OET-69 interference calculations, HAAT calculations, etc.
- LS telcom representation in several ITU-R study groups, such as Working Party 6A and Working Party 3K.

All relevant ITU Recommendations are implemented into CHIRplus_BC immediately after their publication.

# Automatic channel assignment

The automatic channel assignment procedure considers the coverage of the network stations which can be assessed using either area interference calculations or a more generalized contour approach for single transmitters and for SFN networks. The user can re-assign all channels or channels for certain transmitters of the network only.

# Coverage verification and optimization

Measurement data import enables direct correlation of simulation data and measured data to calibrate propagation models for more accurate planning. The user can compare measured and predicted values per site or use raster result files which can also be compared with SFN results.

Measurement results display and analysis

# CHIRplus_BC features and benefits in brief:

- Pre-set system technology configuration for more user friendliness and ease of use
- Multicore network analysis – huge productivity gain for nationwide network calculations
- Macros can be launched via a single mouse-click to automate workflows for repetitive planning and calculation
- A central database containing pre-defined equipment, network infrastructure and maps
- 3D representation of antennas and multiple elevation diagrams for better visualization and clarity
- Sophisticated interference analysis, including self-interference, and from other services operating in the same or adjacent frequency bands (including interference between LTE and DTT networks)
- Network verification via comparison with measurement results for more accurate planning and network optimization

# CHIRplus_TC for IoT and Backbone Network Planning

As forecasts predict significant opportunities around devices that will be connected to the internet, many broadcast operators are looking into leveraging their broadcast networks to become a provider of IoT networks or to offer spectrum and connectivity to other IoT operators.

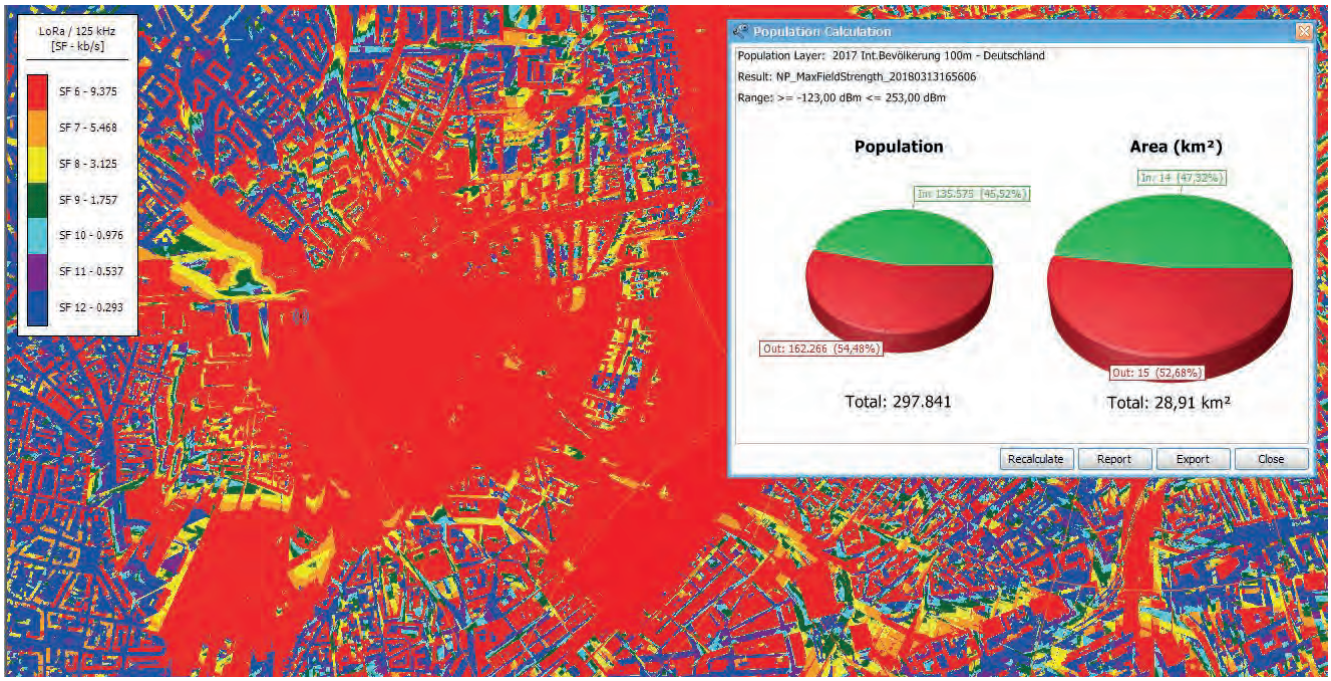
The variety of applications is endless, from weather sensors, parking sensors, automatic plant watering systems, to connected streetlamps, mousetraps, garbage bins, soap dispensers and many more.

A huge number of devices, as well as a growing number of standards and communication protocols, such as LoRa, Sigfox and NB-IoT will bring new challenges to network planning.

With CHIRplus_TC, broadcast planners can leverage their broadcast networks to offer optimized coverage and sufficient bandwidth for IoT devices.

The software includes the relevant frequency plans for IoT communications and a flexible data editor accommodating IoT devices and antennas. CHIRplus_TC analyzes specific parameters such as the LoRa spreading factors, and displays them graphically for a clear overview of network and connection performance. For the verification and validation of coverage predictions, measurement data can be imported and compared with simulations.

CHIRplus_TC is also well-known and widely used for the efficient planning of point-to-point and point-to-multipoint mobile and broadcast backbone networks.



CHIRplus_TC: coverage & population analysis

# Spectrum Consulting and Radio Engineering Services

For over 25 years, we have worked alongside regulatory authorities and broadcast network operators across all continents. We have planned broadcast networks and assisted in broadcast policy development, digital switch-over, frequency planning and technology selection in over 30 countries worldwide.

Whatever the broadcasting issues you are facing - count on us to help solve them.

## Spectrum policy and strategic consulting

The broadcast industry is undergoing rapid change as linear viewing is supplemented by OTT and catch-up. With technology evolution, regulations change and so does the need for frequency spectrum. Digitization has brought many opportunities, but also many challenges.

We can help you to fully exploit the opportunities and overcome the challenges.

We are experts in:

- Development of broadcast and spectrum strategy and policy
- Business case analysis
- Obtaining network licenses
- Mastering the digital switch-over
- Spectrum pricing and valuation
- TV white space management
- Wholesale tariff setting and analysis
- Regulatory impact assessment
- Developing broadcasting through new platforms (e.g. 5G, fibre)
- Spectrum audits and inventory
- International coordination
- Verification of terms of license conditions and coverage verification

# Frequency sharing studies

**DTT networks without mobile interference**

4G and 5G mobile services will bring significant benefit to many consumers but may cause interference to viewers of digital terrestrial television (DTT). Regulatory authorities as well as broadcast and mobile operators rely upon our help to deploy services in an optimal way while protecting DTT services from interference.

LS telcom experts can help regulators to calculate the potential impact that new mobile networks will have on DTT services, so that they can identify suitable mitigation techniques, and determine any conditions that need to be associated with mobile licenses (which may be countrywide or regional). Mobile network operators can benefit from LS telcom's expertise to ensure that any mitigations necessary to counteract interference into DTT services are effective, but also fit within budget constraints.

# LS Training Academy

The LS telcom Training Academy offers an enormous range of broadcast training courses all year round. Check out our standard course program and our customized courses. You will find training on broadcast and monitoring technologies, antennas, regulations, spectrum and network strategy as well as tool training.

*www.lstelcom.com/en/ls-training-academy/*

# Radio Engineering Services

## Network design, planning, procurement, implementation and optimization

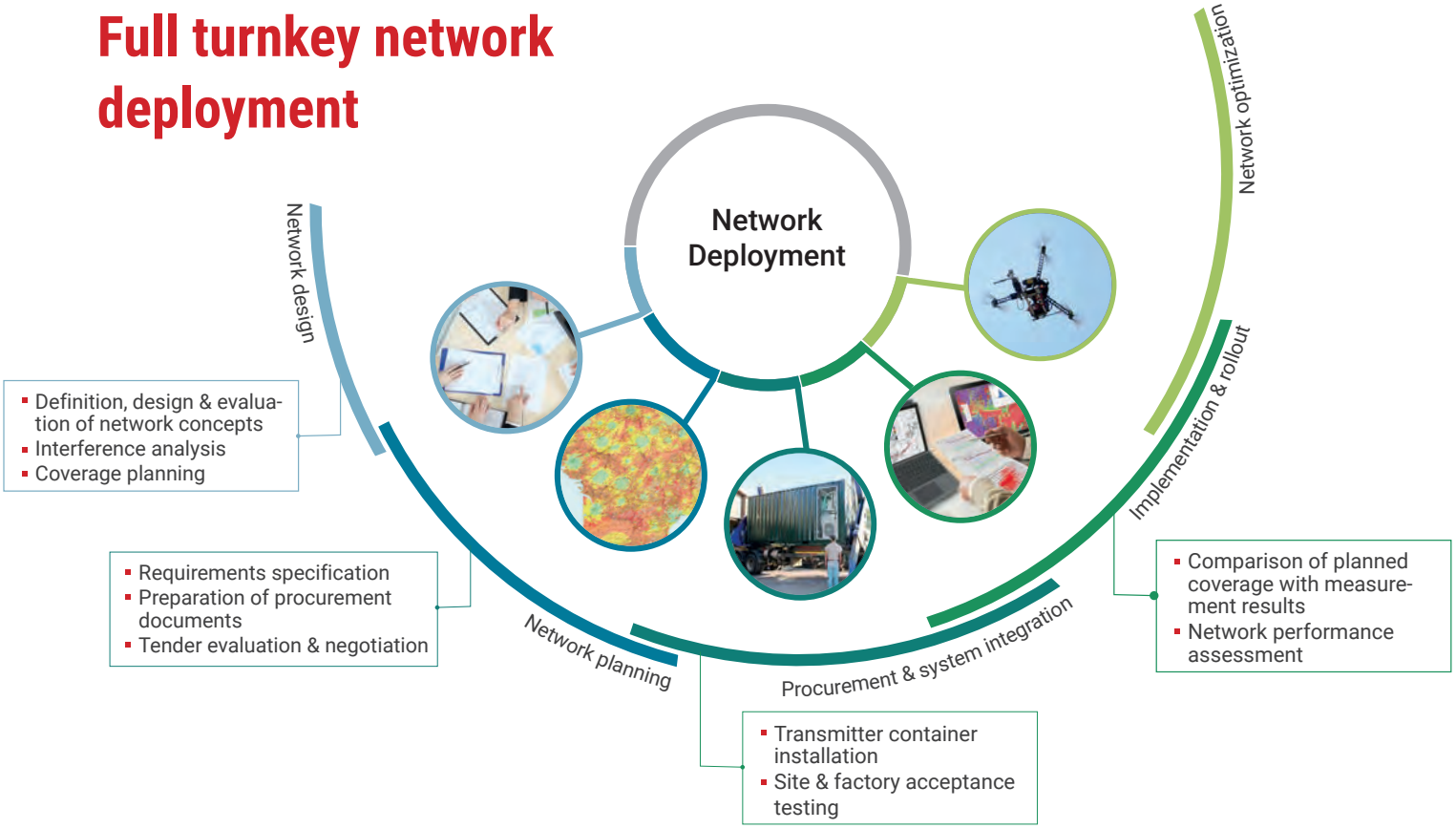
Our engineering team is knowledgeable on a wide range of broadcast technologies and comprises the various skills required for successful planning, implementation and optimization of broadcast networks. As well as technical studies and engineering, we can handle bid planning, project and procurement management.

## Network design and coverage planning

Professional network and coverage planning is the foundation of any robust and cost-effective broadcast network delivering high quality of service. We cover the end-to-end broadcast network planning process from spectrum strategy, planning and international coordination to initial and detailed coverage planning. This includes migration from analog to digital networks, analysis of different potential technologies and various planning and optimization simulations. Our planning results in an optimized coverage and minimized cost network rollout plan. We deliver equipment lists detailing the number of transmitters and antennas, equipment types, as well as detailed site surveys, antenna patterns, coverage plots and population analysis.

DVB SFN coverage calculation

# Full turnkey network deployment




# Implementation and rollout

LS telcom experts assist broadcast operators in network rollout, procurement, site surveys and acceptance testing. In addition to network planning, meticulous planning of all the steps in the rollout and implementation procedures is critical to the success of (timely) network commissioning.

Our installation team assures that transmitters, antennas, combiners, feeder cables, patch panels and all other necessary equipment are installed and validated on time. The testing procedures include acceptance tests (SAT) and site integration tests (SIT) through to final certification by the regulator.

Our implementation team also possesses the necessary skills to transfer knowledge to local installation teams, as well as to build their capacity.

## These are typical questions we can help you answer, taking into consideration your budget, business and technical requirements

- Which technology is best to deploy in my given case? Business case analysis
- How do I best use the liberated spectrum? Exploit the digital dividend
- How do I best migrate from analog to digital? Digital transition
- Can I reach more network coverage with the same infrastructure? Network optimization
- Does the real network correspond to the planned one? Coverage assurance

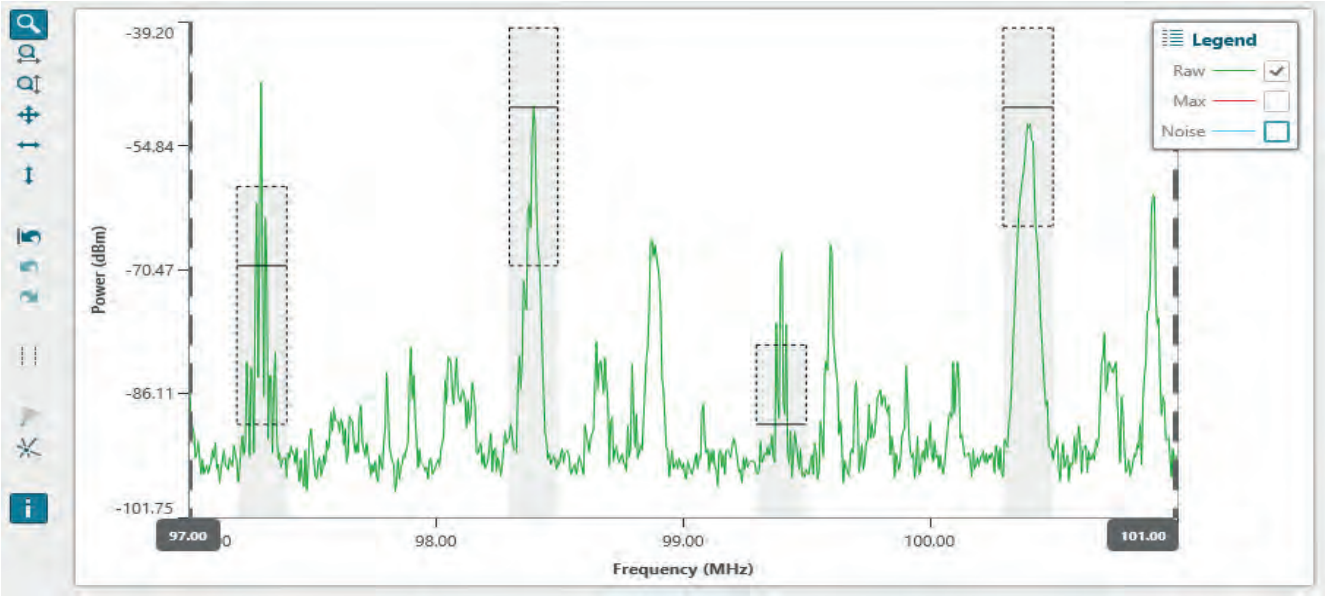
# Measurement & Optimization

An operational broadcast network needs to be optimized and maintained to guarantee continuous quality of service and careful use of network resources over time.

We optimize the quality of service, coverage, technology cost, and operational expenditure of your network, together with any other parameters that require validation. Our experts compare your stored network data with measurement data to calibrate your propagation models for more accurate planning, network adjustment and optimization.

We can perform the following measurements:

- Continuous spectrum monitoring
- Drone-based antenna measurements for mast inspection and site surveys
- Drive tests
- Continuous wave (CW)
- Radio coverage
- Human exposure measurements
- Electromagnetic emissions compliance reporting

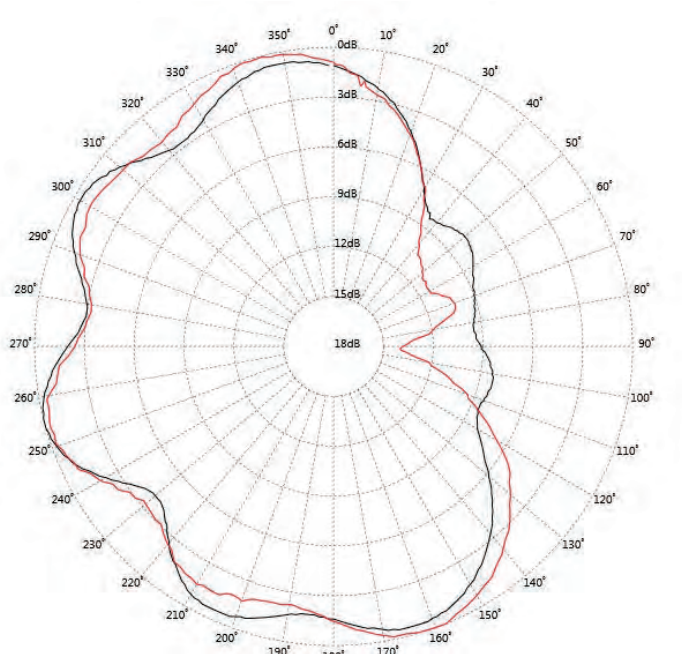



Correlation of simulated and measured data

# Drone-based antenna measurements

LS telcom offers drone-based antenna measurements, mast inspections and site surveys.

Operators can determine in an easy, rapid and cost-efficient way the true radiation characteristics of their RF transmission installations. They can measure the real antenna pattern and effective radiated power (ERP) and compare it to the planned pattern for adjustment and optimization before final commissioning and acceptance testing. The measurements provide horizontal and vertical radiation patterns, null fill and tilt values. Improve your network and guarantee the expected service level to your customers by comparing the predicted with the measured antenna pattern. A camera application on the drone can generate high-resolution video and photography of the ground facilities and the mast, in order to reduce site visits and infrastructure maintenance costs.




Simulated and measured antenna pattern

Regulators can easily verify whether licensed operators' transmission installations are compliant with the terms of their license. We offer drone-based measurements as a turnkey service or the fully equipped measurement drone.

# Continuous spectrum monitoring with LS OBSERVER

LS OBSERVER is a radio monitoring, intelligent data collection and analysis system. It features uncontested data storage capacities and several geolocation and direction finding techniques.

LS OBSERVER is used by broadcast operators for the control of broadcast stations, interference avoidance and broadcast coverage optimization.

LS OBSERVER consists of central monitoring software and remote monitoring units. A wide array of different monitoring units, such as handheld, portable, transportable, fixed and airborne devices are available. Each remote monitoring unit is an intelligent system, consisting of one or several receivers that can perform radio monitoring and direction finding in parallel. Each unit also includes data processing, data analysis and long-term data storage capacities.

LS OBSERVER Portable Monitoring Unit

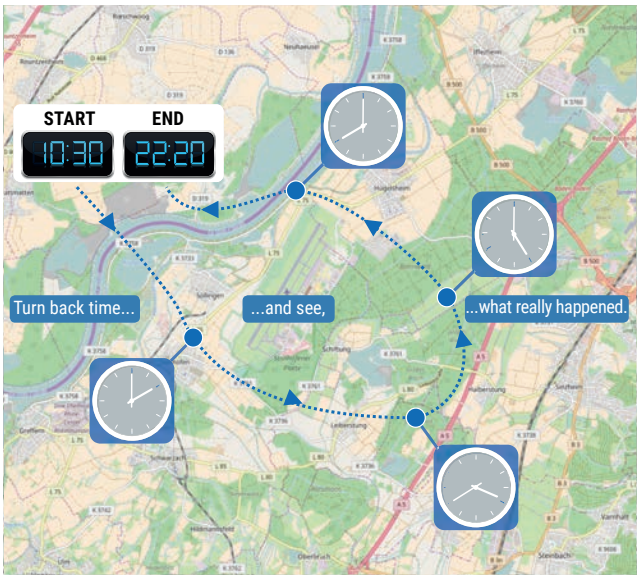
The central monitoring software controls and analyzes the data from all the monitoring units. Automatic violation detection, geolocation, direction finding and all other results are displayed and visualized with the software.

Our experts can also integrate the monitoring units into vehicles for mobile applications.

LS OBSERVER Fixed Monitoring Unit

# Detect interferers to your broadcast network when they are not on air

DF Time Travel® is a unique technology which enables you to locate transmitters based on recorded data. Using recorded frequency/level/time information stored in LS OBSERVER, DF Time Travel® can determine the direction of a signal that occurred in the past. No need to wait for the signal to be on air again, in order to locate it!




Drive test for DF Time Travel® technology

# React immediately to illegal frequency use with automatic violation detection in LS OBSERVER

Automatic violation detection software in LS OBSERVER automatically alerts the operator, when the measured signal strength does not correspond to the reference or “wanted” signal strength at a given location.

LS OBSERVER AVD (Automatic Violation Detection)

The reference signal strength that should be received by a given monitoring station is either calculated based on licensed transmitters’ parameters in the spectrum licensing database, or is extracted from historic measurement data. A logbook registers all the alerts - and emails, text messages or other events can be triggered, depending on your needs. Other criteria based on power level or bandwidth can also trigger alerts. This information can also be used to correct data in transmitter databases which can improve frequency re-use.

Mounted AoA antenna

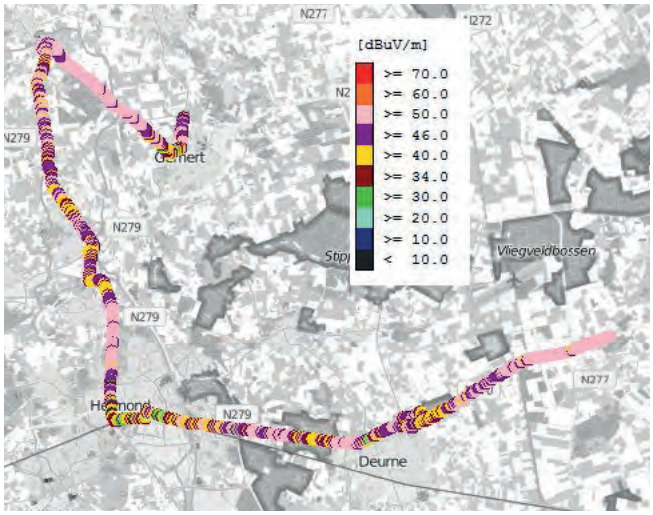
## Drive tests

Does the actual signal correspond to the planned one? Is the network coverage satisfactory? Do you experience sudden network outages?

We can perform drive tests to locate the source of interference and to rapidly identify, whether the real and planned coverage correspond, enabling you to adjust your network if needed.

We also integrate and sell fully equipped measurement vehicles.

All our measurements follow the general guidelines of the ITU for radio monitoring.



Trust in more than

# 28

years of know-how and experience

**ITU-R**

and

**ITU-D**

sector member

An

**ISO 9001:2015**

certified company

**Solutions for terrestrial broadcasting:**

- Radio network planning & engineering software
- Spectrum consulting
- Radio network planning & engineering services
- Radio monitoring & antenna system verification
- Training Academy

Customers in

# 100

countries worldwide

CFA

For more information on products and solutions, please visit our website at www.LStelcom.com or contact us: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