Integrated System Solutions
Enabling Spectrum Superiority

Spectrum Management, Spectrum Monitoring,
Network Planning, Mission Planning, Unmanned
Aerial Vehicles, System Integration

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Military spectrum needs are extremely varied and important, covering the whole radio spectrum. Frequencies are attributed for long-term operations and temporary missions, for peacetime and humanitarian operations as well as warfare. Besides, the importance and scope of homeland security, electronic warfare and communication between forces have been continuously expanding.

As many authorized users of communications and non-communications systems as possible must share the existing spectrum, depending on the used radio technology, the frequency range of the equipment, radio propagation conditions, user-specific operations, modulation schemes and bandwidths. What’s more is that authorized spectrum use is interfered by non-authorized users, which are not taken into account by regulatory spectrum management.

This is why the proactive management and the control of the occupied spectrum in military operations has a significant and direct impact on the effectiveness and reliability of communications and non-communications systems, and constitutes an essential support for SIGINT (signal intelligence) and COMINT (communications intelligence) surveillance systems.

Moreover, military spectrum management is becoming more and more complex with coalition and combined joint task forces involved with different users at all levels of command. In addition, an increasing number of systems is relying on wireless connectivity.

Military planners, spectrum and frequency managers and all other staff engaged in planning, coordinating and managing access to electromagnetic spectrum in military operations as well as (electronic) warfighters need coherent access and exchange information on spectrum usage quickly, to achieve information superiority and to optimize the use of the available spectrum for military dominance.

The system that takes you there
The Automated Military Spectrum Management and Electronic Warfare System SPECTRAmil integrated with the Next Generation Monitoring Solution LS OBSERVER addresses staff at each level of command involved in electromagnetic spectrum operations. The system’s vertical and horizontal interoperability enables the perfect orchestration of all underlying spectrum management and monitoring processes, respecting the military hierarchy and hierarchical Electronic Order of Battle (EOB).

LS telcom - more than 20 years of excellence in spectrum management and monitoring
LS telcom has been in the market since the very beginning of automated spectrum management systems and has grown with the market. Our spectrum management and monitoring solutions are based on twenty years of experience in radio frequency management and the most advanced software and information technology available. This is why civil and military radio frequency regulatory authorities and other organizations in over 90 countries worldwide rely on us.
Automated and Integrated Military Spectrum Management and Electronic Warfare System SPECTRAmil

LS telcom’s Military Spectrum Management and Electronic Warfare System SPECTRAmil covers all areas of electromagnetic spectrum operations from spectrum management, frequency assignment and allotment, policy, host nation and international coordination as well as electronic warfare operations.

Whatever position you are at - whether you are the strategic or tactical spectrum or frequency manager for combined and joint task forces or a soldier in need for frequencies – the graphic user interface (GUI), the user profile and information access to our system can be customized to your exact needs and to the tasks you have to accomplish.

Our SPECTRAmil system is a highly flexible and modular solution with a set of task specific software modules, which guarantees seamless integration and data exchange throughout the different spectrum and frequency management entities involved in military spectrum operations and electronic warfare. The software architecture has been designed and perfected over many years along with our user-friendly geographic information system (GIS) based GUI, a well proven, ruggedized database and a smart calculation engine which make up the solid foundation of the solution.

System Overview

The modular system is composed of the central database and set of task specific tools, which are military off-the-shelf and are adapted to customers’ specific requirements.
SPECTRAplus_db
The database stores and centralizes all technical and monitoring data, radio equipment, frequency plans as well as frequency use authorizations. The unique database concept guarantees up-to-date and consistent data to all users of the system.

SPECTRAplus
The tool to manage and process requests and issue frequency authorization for specific equipment. The tool backs the equipment and frequency supportability process from the acquisition of equipment, testing and final authorization.

SPECTRAweb
For easy, secured and consistent data entry and validation, SPETRAweb is utilized. The online data entry makes it possible to enter data from any location. System users from spectrum managers to soldiers on a mission can upload new pieces of equipment for battle space spectrum management (BSM) or mission planning. You need to check what equipment is used by a certain unit or which frequencies are temporarily in use? SPECTRAweb allows authorized users to query on equipment or frequencies in use by different units or platforms. Online frequency requests may even be prepared and processed on tablet PCs or smartphones.

SPECTRAplan
supports you in the multi-step military spectrum planning process. It is designed to manage frequency plans of own and friendly forces, international and civilian frequency assignment plans.

SPECTRAMpt
is the tool dedicated to tactical mission planning. It may be preconfigured to follow a strict mission planning process. It includes planning functions to find the optimal location for reconnaissance and jammers, based on hostile locations and multiple wave propagation analysis.

SPECTRAemc
is the engineering tool for interference and coordination calculations and analysis. It includes the computation of relative strengths of wanted and unwanted signals at the receiver and takes into account EMC effects for the reuse of frequencies and de-confliction. SPECTRAemc also manages JRFL (Joint Restricted Frequency List) for taboo, protected and guarded frequencies to minimize frequency conflicts between friendly forces’ frequency use and jamming equipment.

MONITORplus
is the interface between the spectrum management and monitoring system and enables dynamic spectrum management. Compare real-time measured data with spectrum usage data in the database to guarantee highly accurate spectrum information for all users. The system is compatible with all common radio monitoring systems.
An Interoperable and Secured System to Support Combined Joint Task Force (CJTF) Frequency Planning

**GIS & (Results) Display**
The system supports all types of geographic information such as DTM, clutter, raster, scanned and vector maps, satellite images and political boundary backgrounds in multi-resolution. Calculation results and frequency plans can be displayed graphically in 2D and 3D. Hierarchical relations of units are shown and you can follow moving units or networks directly on the map. You can also present calculation results in Google Earth.
The system includes the APP-6A military tactical symbols display for land based systems and Military Grid Reference System (MGRS) according to NATO to support a collaborative common operational picture (CCOP).

**Spectrum Supportability**
The SPECTRAmil system can support the complete spectrum supportability process from submission of the spectrum requirement for new equipment or modification of existing equipment to the issuance of a spectrum certification and validation of the equipment for use in a certain region or country. The process can be customized following specific national and international procedures.

**Adaptable State-of-the-Art Engineering**
The SPECTRAmil system was one of the first spectrum management solutions on the market and is today still the number one software system in its domain. Its robust and extensive engineering and calculation functions are being developed and continuously innovated and updated by radio frequency and communications engineering experts.
The engineering functionality covers all radio services throughout the whole radio spectrum, including radar, along with over twenty propagation models ranging from VLF to EHF (3kHz – 300GHz). Additional models can be integrated for specific needs.
Interference analysis, frequency assignment, engineering and calculation functions are adaptable depending on the level of command. They range from sophisticated calculation manipulation for high-level long-term frequency management, through the warfighter’s unique engineering and spectrum planning requirements, to simple ‘one-button-operations’ for immediate results presentation to soldiers in missions. The operational spectrum planning functions consider the impacts of wireless devices operating in a harsh congested and contested spectrum environment.

**Frequency Assignment & Interference Analysis**
Frequency assignment is based on frequency pre-selection and interference analysis. During missions or crisis management when promptness is an issue, you can carry out interference analysis automatically with pre-defined process flows (wizards). When looking at frequencies attributed on a long-term or permanent basis manual interference analysis allows for fine-tuning and optimal frequency use and re-use. Interference is highlighted on the map and you can choose from a list of available interference-free channels. Frequencies can be assigned for user-defined entities, available frequencies, equipment parameters or equipment location.

The frequency assignment functionality also accounts for frequency hopping. It supports all types of equipment operating from single frequency to frequency hopping modes. There is the option of specifying more than one operation mode for equipment, if it works in several modes.
Situational Awareness
A commander who is not aware of frequency- or bandwidth-availability problems cannot prioritize the use of available resources to best support the mission. Spectrum situational awareness is mission-critical and the foundation for optimum command and control. SPECTraMil supports situational awareness in many ways.

Connected to the LS OBSERVER sensor system you can picture the real spectrum use - which frequency is used when and where, including unauthorized and enemy spectrum use. 
Situational awareness is also facilitated through the support of the collaborative common operational picture.

'What-if' Simulations
In addition, you can create situational awareness by simulating the impact of spectrum usage for multiple assignment scenarios. SPECTraMil enables you to simulate various scenarios of different wireless systems in operation to deconflict spectrum based on priorities established by theater leadership, and opt for the best trade-off when spectrum is scarce. You can identify potential shortfalls in spectrum supply before the launch or operation of a system. For example, you can check the impact of sending an UAV (unmanned aerial vehicle) airborne before the launch and make sure that the system does not cause harmful interference to Blue Forces communications or other systems and will not be interfered. Also check whether you have enough frequencies and bandwidth available needed to support the system, including the control of the UAV in flight, its launch and recovery, as well as for communications to be passed between the aircraft and the ground system or other airborne vehicles.

System Interoperability
If you want interference free and efficient frequency assignment for your forces, you have to consider all existing frequency assignments such as ITU and other regional agreements. Our SPECTraMil system is interoperable with NATO Arcade database through SMADEF XML, and with all relevant ITU tools (BR-IFIC, interface with SRS databases for satellite services). In addition, the software includes extensive data exchange capabilities, such as XML file exchange format, and interoperability with allied and friendly forces' systems to assure secure wireless communication and coordination of actions, fundamental for successful operations in a multinational spectrum operational environment. The system can support the Pub 7 and Pub 8 data standard.

Secured and Consistent Data in a Centralized Database to support Combined and Joint Forces
The centralized database provides consistent and up-to-date information on radio spectrum and equipment to maximize performance for Combined and Joint Forces. The sophisticated user access and user profile management is set out for highest security standards and respects hierarchy, validation processes and flawless information flow. The information access level depends on user role profiles such as user, requester, or assigner.
The system can be adapted according to individual organizations' and users' requirements and runs in client-server mode and disconnected operations.
Next Generation Measurement & Monitoring Solution LS OBSERVER for the Forces

Efficient spectrum management today is the foundation for information superiority and military dominance. But....

As a soldier
How do you protect yourself in a convoy from improvised explosive devices (IED), if you don’t know who is emitting and where from?

As a spectrum manager
How do you assure without monitoring that the spectrum usage data in your database is absolutely correct to guarantee optimized spectrum usage to your forces?

As an area frequency coordinator (AFC)
How do you cope with un-authorized use of spectrum and prevent interference from it, if you don’t know who is emitting and where from?

Real-time monitoring and measurement of spectrum is indispensable for many military operations to guarantee impeccable data quality in the database, optimized spectrum use of communications and non-communications systems, interference free frequency assignment to and protection of the forces, as well as to support electronic warfare and intelligence and reconnaissance.

Detect, Measure and Monitor with LS OBSERVER
For many military operations you need to know exactly what’s going on in the frequency spectrum environment. With LS OBSERVER you can “observe” the entire frequency range and capture everything everywhere all the time. Who emits where when and at which frequency?

This is how LS OBSERVER works
With the LS OBSERVER monitoring system you can “observe” the complete frequency range and carry out detailed analysis on raw spectrum observation data that is stored for 30 days. The system then automatically compresses and stores the entire observed spectrum throughout the tuning range of the attached RF front, while noise and zero occupancy are removed. The compressed data can be stored for about two years. A complex backhaul solution is not necessary with the data being stored within the remote monitoring unit.

Real-time and future spectrum analysis
You can analyze the monitored spectrum usage data in real-time or check it at a later stage, depending on whether you are on a convoy needing an immediate fingerprint of your spectrum environment, or whether you analyze the stored “historic” data for strategic spectrum planning.
Two solutions are available in our SPECTRA Spectrum Management System; SPECTRA Professional and SPECTRA Enterprise.

Whatever connectivity you need
Intelligent software will sort out the necessary information. You can retrieve exactly the data you need for your specific tasks and requirements with the help of search filters. The sensors can work in a networked, stand-alone or mixed mode. In the networked or mixed mode only the data required for analysis is transferred to the central server. This is why only little infrastructure is needed to connect to the RF front end device. In addition, the transferred data is stored on the central server and, if needed once more, does not have to be retrieved again from the monitoring unit. The stored spectrum data is a 100% ITU compatible.

The LS OBSERVER system is highly scalable and flexible
Whatever the geographic area of responsibility or the size of the battle space, the number of sensors and the frequency range to be measured can be adjusted for any kind of operation and application. You can scale the RF front end exactly to the capability you need, by choosing from a variety of receivers, sensors and spectrum analyzers. This also guarantees vendor independency, a requirement of strategic importance for the military. The modular design with COTS products allows for easy field maintenance.

Small & Smart
As opposed to traditional very heavy monitoring equipment, LS OBSERVER RF front end devices have a very small footprint. The devices can be mounted on a “single pole” for fixed installations and also exist as mobile stations.

Our new mini-monitoring unit LS OBSERVER_MMU can be used as handheld, mobile or portable unit and is your constant companion in many locations and circumstances. It functions in the heat of the desert as well as the freezing cold of the polar range. The MMU takes a wide range of add-ons such as removable battery and hard-disk and has the same storage capacity as bigger units. The LS OBSERVER small and smart sensors are remote controlled and can run in stand-alone mode 24/7. They can also be included as a payload on an Unmanned Aerial Vehicles (UAV).

Geo-location
You can carry out direction finding and use Time-Difference-of-Arrival (TDOA) techniques to geo-locate enemy and unknown transmitters with accuracy using LS OBSERVER.

The Perfect Picture of the Spectrum Environment
LS OBSERVER can be integrated with the SPECTRamil spectrum management and electronic warfare solution for the smooth comparison of measured data with spectrum usage data stored in the database to obtain the perfect picture of your spectrum environment. The complete solution allows for automated analysis of military spectrum usage and quick identification of un-authorized, enemy and underused frequencies. Reports for all command levels can be generated automatically.

Intelligence Collection Management
LS OBSERVER “notices” even the shortest of voice transmissions. Much faster than traditional systems that often revisit a channel only every few minutes and miss a lot of transmissions. The meticulous information on real frequency use that the system provides you with enables you to figure out the tiniest bit of enemy action for identification through IRS (intelligence and reconnaissance systems).

LS OBSERVER smoothly interfaces with 3rd party SIGINT and COMINT analysis software.
LS OBSERVER - Typical Observer Network

**General Features**
- Flexible configuration, including redundancy capability
- Re-use existing monitoring equipment
- Scalable to customer’s requirements
- Easy to install

**Special Features**
- Powerful automated analysis capability
- Flexible resource prioritisation control
- Long term monitoring data storage
- 24 hours a day, 7 days a week total spectrum storage
- Up to 7.5 GHz per second spectrum monitoring

**Network Management**
- Central network management & centralized configuration of remote units
- Central backup capability
- Managed security access

**Integration & Interface with Other Systems**
- Integration with LS telcom back office products
- Export of data in ITU formats
- Able to import legacy data

**Sites**
- Very few site requirements; only low power and thin backhaul network connectivity necessary
- Small footprint installation
- Vehicle installation and mobile monitoring
- Integration of Geo-Location capability
Network Planning with SPECTRAemc

Military operations are based on the support of many different wireless network technologies.

Our SPECTRAemc software tool assists you in the planning, engineering and optimization of both, fixed and mobile radio technologies supporting military operations. This includes, but is not limited to 2G to 4G mobile networks, WiMAX, broadcast, PtP and HF links, as well as landmobile and satellite services.

The tool includes propagation models for the complete radio frequency range from LF to EHF. You can plan single transmitter stations or links, add them to an existing network, or design complete new area, regional or nationwide networks.

This is facilitated through the integrated intra- and inter-service frequency assignment procedure. When assigning a frequency for a station, link or area, other services are taken into consideration.

The system also suggests the “most suitable” or “best” available frequencies out of a pre-selected subset, based on an unlimited number of configurable test receivers. An automatically generated report indicates the frequency under investigation, the parameters for frequency selection and a quality value for each assignment, for the user to make the optimal decision on the assignment, depending on priority or a given strategy.

The tool’s interference analysis, too, takes into consideration other services within the frequency range under investigation and presents the user with a detailed carrier/interferer analysis report.
Overview of Detailed Calculations

Calculations of all radio services
- **Coverage** can be calculated for a single transmitter, an area or complete network.
- **Field strength calculations** can be carried out at a defined location, at receiver positions or along mobile measurements.
- **Shortwave frequencies**, usable frequencies calculated in month and day time
- **Horizon and elevation contours calculation** for different flight levels
- **Frequency assignment** takes into account all other services and is based on interference analysis. The frequency pre-selection can be based on:
  - user-defined entities
  - available frequencies
  - equipment parameters
  - equipment location

You can simulate the spectrum usage impact for multiple assignment scenarios
- **Interference analysis** can be carried out manually or automatically following pre-defined workflows and defined rules.
- **Inter-service inter-modulation** calculations for fixed and mobile transmitter and receiver stations based on predicted field strength and frequency values.
- **Radio link analysis and link engineering** with terrain profile display. Adjust link parameters directly in the GUI and visualize changes immediately.
- **Co-site analysis** based on spatial and frequency distance and co-site check as filter for frequency pre-scan.

Display of radio link with terrain profile

Mobile network coverage prediction
Mission Planning

Pre-configure Automatic Process Flows for Tactical Scenarios
Process flows can be pre-defined and configured, in order to prepare and model different mission scenarios for ad-hoc and real-time calculation during crisis and in wartime. Create wizards for frequency assignment and interference deconfliction, and various course of action (COA) schemes for faster reaction and response in crisis.

The wizard technology also allows for the complete automation of repetitive calculation processes. New wizards can be set and existing ones amended, whether manually or semi-automated, to adapt quickly to new situations and user profiles.

Tactical Mission Planning and Engineering during Crisis
In dynamic operations, time is of the essence whether it is convoys departing in less than an hour or an Unmanned Aerial Vehicle (UAV) getting ready for another ISR mission. Plan your mission in no time at all with automated wizards prepared in advance. Use the wizard feature for the automation of link analysis, frequency assignment support and interference deconfliction to save valuable time.

Whether you are a soldier in the battleground or on a convoy going through an area of conflict, plug in your GPS to the system for real-time tactical calculations and engineering with regards to your current location. Not only can you calculate in real-time the best position for the transmitter of your own troops and the reception areas of mobile vehicle transmitters with the integrated GPS receiver via USB/NMEA, but you can also detect hostile emitters around you.

Dynamic Mission Planning
Use LS OBSERVER in dynamic operations, for example, as a "mobile platform" embedded in a convoy to protect your troops from IEDs (improvised explosive devices). Identify the enemy frequencies for the functioning of IEDs in real-time and jam them to protect your convoy while it is driving past the roadside bomb. When a convoy is departing in less than an hour into a conflict area you certainly have no moment to set up an ad-hoc backhaul solution for your remote monitoring units. This is why the LS OBSERVER small and smart sensors are remote controlled and can run in stand-alone mode 24/7.
Electronic Counter-Measures
Be far ahead of the red forces, by identifying the optimum location and required power for jammers while protecting own radio stations or communication networks, including protection from IEDs, with the help of SPECTRAmpt’s interference analysis. A color code indicates a high or low jamming effect on the hostile radio depending on the jamming location.

Reconnaissance Locations
The SPECTRAmpt mission planning tool also allows you to find the optimum location for reconnaissance of hostile enemy radio networks based on hostile locations and multiple wave propagation analysis. For each reconnaissance location you can calculate the number of signals received depending on the reconnaissance receiver. Color codes on the map indicate high or low detection rates of hostile signals depending on the reconnaissance location.
Anywhere you want in the battle space HELI-Mon monitors frequencies and can detect, geo-locate and jam hostile transmitters. Alternatively, you can use HELI-Mon to establish a temporary repeater as redundancy link for emergency communication or immediate commands.

Our HELI-Mon solution consists of a miniature helicopter with an integrated payload for different applications. The size and reach of the helicopter can be adapted according to your environment and requirements. It can be fuel-driven, or if it should go more unnoticeable, runs on battery. Several ways of flight control exist for the helicopter. If line-of-sight (LOS) is guaranteed, it can simply be remote-controlled. For beyond-line-of-sight (BLOS) the miniature helicopter can either be remote-controlled by first-person view, whereby via an onboard video camera a real cockpit-view is transmitted, or through automated GPS locked waypoints. Including a GPS transmitter on the unmanned aerial vehicle, you can locate and follow it on a map.

One of the helicopter’s possible payloads is a light-weight radio-frequency sensor, LSXsensor, including storage and analysis capabilities like its bigger counterparts, with a running time of up to 30 minutes on battery power and permanent on external power. The data can be downloaded for measurement on a PC for offline analysis, reusing the sensor straight away. There is also the capability to stream data for online analysis to a local PC or laptop. You can integrate HELI-Mon with your monitoring system already in operation, with LS OBSERVER, or use it in stand-alone mode.

UAV Jamming
A jamming device can also be installed as a payload on the miniature helicopter. This allows you to operate multiple jamming platforms closer to the threat area, which constitutes a major advantage in tactics. You can jam behind enemy lines or other locations which cannot be reached through a fixed, handheld or mobile vehicle jammer.

Link Repair or Establishment
In addition, you can deploy a repeater on the miniature helicopter to establish or re-establish a temporary link between central command and battalions or for emergency communication. The duration of the link depends on the run-time of the helicopter.
Check Spectrum and Bandwidth Availability before Launching your Unmanned Aircraft Systems (UAS)

Unmanned Aircraft Systems require a lot of spectrum bandwidth, for the launch, control and recovery of the unmanned aerial vehicle as well as for communications to be passed between the aircraft and the ground system or other airborne vehicles.

With SPECTRAmil you can simulate the impact of sending an UAV (unmanned aerial vehicle) airborne before the launch and make sure that the system does not cause harmful interference to Blue Forces communications or other systems and will not be interfered. Also check whether you have enough frequencies and bandwidth available needed to support the system, including the flight control, launch and recovery, as well as for the communications sub-system.
If you want to gain military information superiority, then hardware, software and other system components have to be smoothly integrated and adapted to the needs of the specific military operation. Benefit from LS telcom’s experience and double expertise in spectrum management software as well as monitoring and system integration.

Depending on your system already in operation, you can work with us on the modernization, upgrade and extension of your existing system or order turnkey solutions of integrated spectrum management and monitoring systems from us. Our product and service portfolio spans the entire system life cycle, from design and development, through to production and operation, to maintenance and support, and, eventually de-installation.

Besides the strategic importance of not depending on one single supplier for your equipment - as we are vendor independent –with us you have the flexibility of selecting a mix of system components from various vendors to combine the most effective industry proven hardware and exactly match your needs for specific operations.

Whether it is for combined joint permanent or medium-term spectrum monitoring or ad-hoc monitoring and surveillance for in-theater operations, our experts are dedicated to integrating monitoring stations from monitoring vehicles, fixed and portable stations to flying platforms (also look at the section UAVs in this brochure). They assure smooth operation and data flow between the monitoring and spectrum management system.

**Car Integration**

You need a vehicle equipped for direction finding, HF frequency monitoring or radar? We can integrate systems and antennas covering the complete frequency range for measuring signal occupancy, bandwidth and signal level.

At LS telcom we deliver turnkey integration and installation of monitoring equipment in many types of vehicles, from all-terrain vehicles to trucks of any size. This includes the installation of anything else needed besides the monitoring equipment, such as seats for the system operators, air-condition, power generator as well as many other facilities needed.
Why LS telcom?

20 Years of Excellence

Solid experience
20 years of software development & expertise for approved and ruggedized system solutions

Excellence
Number 1 system solution for spectrum management

Trust & confidentiality
Customers in over 90 countries across all continents trust in us

Wide range of expertise
Multidisciplinary team of engineers, software developers, technology experts, network planners, strategic consultants, project managers and professional trainers

Sustainability
Our mission is to continue to excel in the delivery of most innovative products and services as well as in the relationship with our customers.