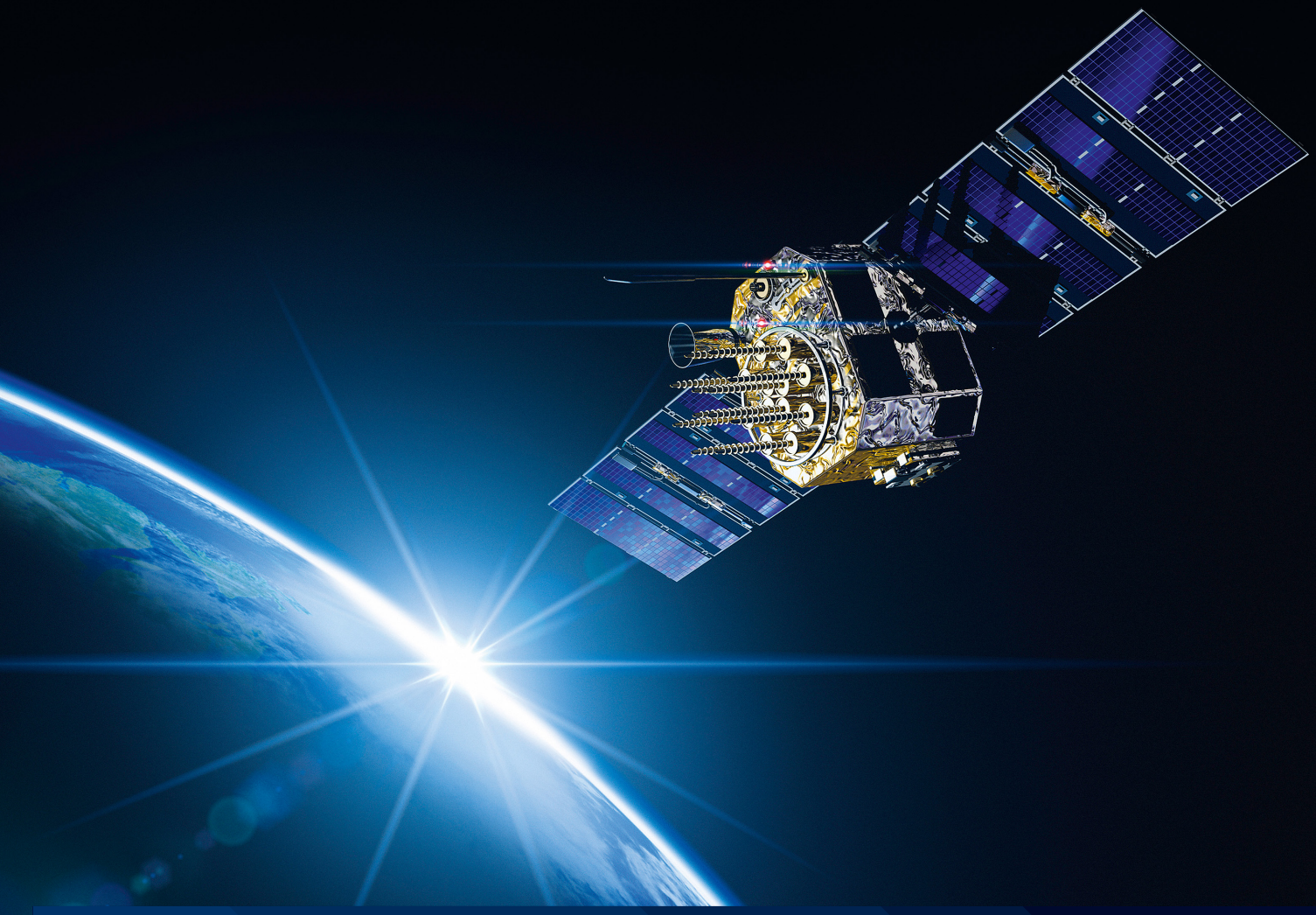
R&S®GSASLP
SATELLITE LINK PLANNER

Satcom mission planning



Product Brochure
Version 01.00

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

R&S®GSASLP is a satcom analysis and optimization software solution, covering all aspects of modern satellite communications. R&S®GSASLP perfectly supports major parts of the satcom value chain such as satellite system design, transmission planning and transponder usage optimization. R&S®GSASLP accurately models weather conditions, atmosphere effects and covers all RF transmission impairments of transparent payloads among all satcom bands of interest (C, X, Ku, Ka band etc.). Major signal degradations due to intermodulation, power robbing are accurately modeled and verified against vendor data and in orbit test campaigns.

Link budget calculation and optimization

R&S®GSASLP helps engineers simulate and model the impact of dedicated transponder distortions on satcom carriers. In this respect, the impact of dedicated signal distortions on mission planning or payload design can be quantified in terms of carrier-to-noise ratio loss or capacity degradations. R&S®GSASLP link budget calculations are based on a set of internationally recognized methods (ITU recommendations) which are often required.

Satellite network planning and optimization

Systems using R&S®GSASLP are capable to model ground stations with their specific parameters, e.g. the transmitting and receiving antenna gain, the maximum effective isotropic radiated power (EIRP) and the output power.

Additionally users can model the space segment as well by managing available satellites, transponders and their footprints. R&S®GSASLP uses a wide data base for satellites and footprints to simplify the work for the user.

Route planning and satellite payload optimization

R&S®GSASLP helps users planning mobile satcom scenarios by managing route navigations. Based on the given route and data rate requirements, R&S®GSASLP searches for the best possible transponders by following criteria, e.g. the data rate requirements, the coverage of the transponder beams which should provide coverage over the entire route and the satcom band of interest (C, X, Ku, Ka band etc.).

KEY FACTS

- ▶ Link budget analysis of complex multi-carrier scenarios
- ▶ Modelling of transponder RF impairments (intermodulation, power robbing, gain compression)
- ▶ Link budgets and transponder optimization to minimize power/bandwidth consumption of satcom scenarios
- ▶ Ground station equipment and antenna management
- ▶ Antenna footprint visualization
- ▶ Satellite beacon reception analysis
- ▶ Impairment calculation due to adjacent satellite interference (ASI)
- ▶ Impairment calculation due to ITU weather recommendations
- ▶ Route planning and optimization for mobile VSAT terminals, satcom on the move (SOTM) or UAV operations
- ▶ Attenuation coverage analysis
- ▶ Carrier planning over time and frequency
- ▶ Adaptive GUI and tailored special purpose solutions
- ▶ Data import/export, geopositioning and satellite footprint visualization
- ▶ Wide satcom modem database (SCPC, meshed, DTH, military CDMA/DSSS)

APPLICATIONS

Carrier scenario management
▶ page 4

Space segment management
▶ page 6

Ground station management
▶ page 8

Route management
▶ page 9

CARRIER SCENARIO MANAGEMENT

Analyzing complex multi-carrier satellite link budget scenarios easily

- Link budget calculations based on ITU weather recommendations
- Link budget calculations based on adjacent satellite interference (ASI) and intermodulation
- Link budget calculations based on satellite bands e.g. C, X, Ku and Ka
- PEB evaluation (power and bandwidth consumption)
- Earth station EIRP evaluation
- Total carrier availability calculation
- Intermodulation power density analysis
- Link margin calculations
- Spread spectrum link analysis
- Maximum acceptable pointing error analysis
- CDMA link analysis (evaluating interference towards other non-CDMA carriers as well)
- Following frequency coordination limits based on ITU radio communication
- Modeling multi-carrier scenarios being analyzed
- Clear visualization of the results with well-presented charts

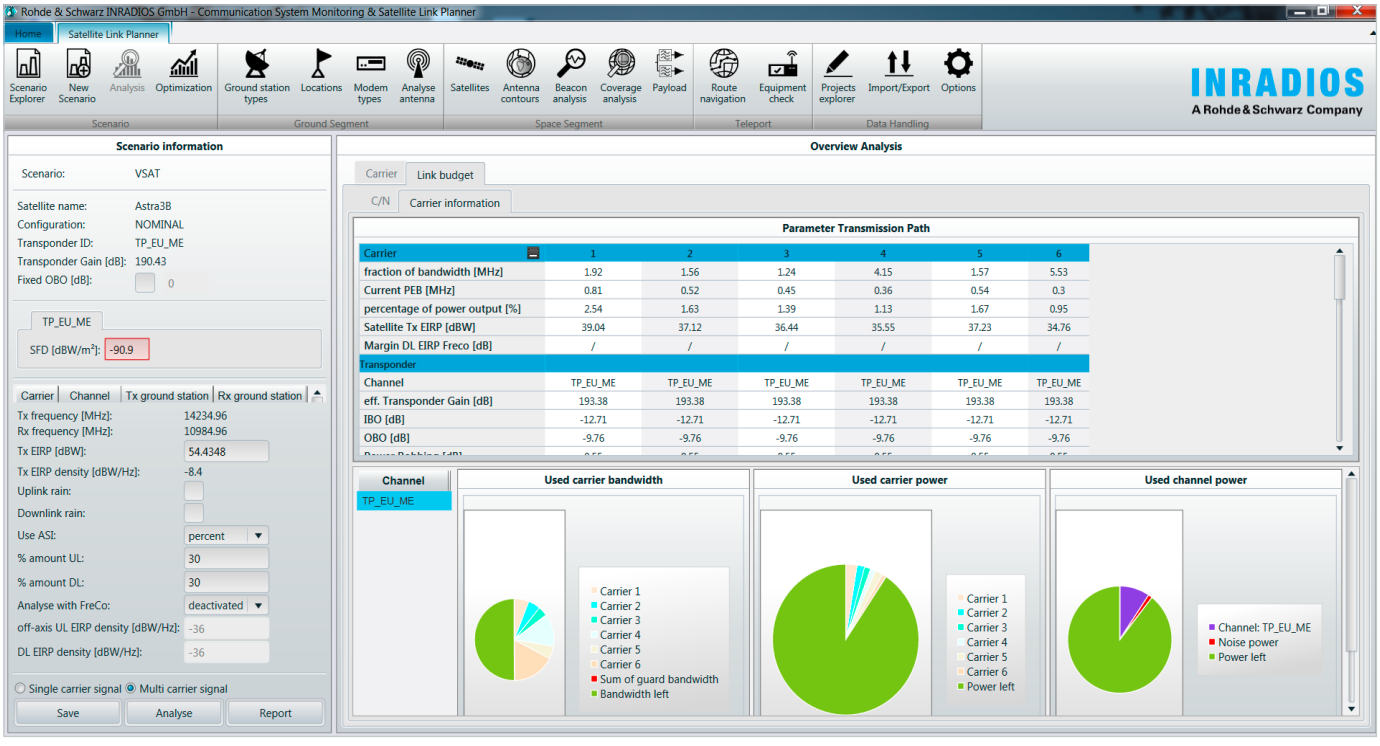
Systems using R&S®GSASLP are able to calculate link budgets for a wide range of satellite scenario use cases by including ITU weather recommendations (see also Specifications), e.g. rain rate, gas attenuation and surface temperature. The table shows the entire propagation impairments used by R&S®GSASLP which enables users to cover major atmospheric influences.

Additionally R&S®GSASLP covers ASI and intermodulation occurring in downlink and uplink communications. On the one hand, ground stations can receive significant signal power levels from other satellites. On the other hand, adjacent satellite can receive and broadcast heavy uplink signals from ground stations. Both types of disruption are included in the link budget calculations helping users to consider all possibilities which can occur through a transmission in satellite bands of interest.

Besides satcom channel impairments, R&S®GSASLP uses frequency coordination limits defined for scenario optimization. The screenshot below shows an analyzed multi-carrier scenario with its carrier-to-noise ratio results in well-presented charts and diagrams containing calculations for the described impairments. A detailed link budget analysis overview function is available as well as shown in the screenshot below. Here the carrier-wise bandwidth and power consumption (PEB) is detailed presented.

Systems using R&S®GSASLP use these link budget calculations to verify multi-carrier scenarios being managed by the user as shown in the upper screenshot on page 5. Users can easily generate their own multi-carrier scenarios with all necessary parameters that way.

Well-presented detailed carrier analysis results

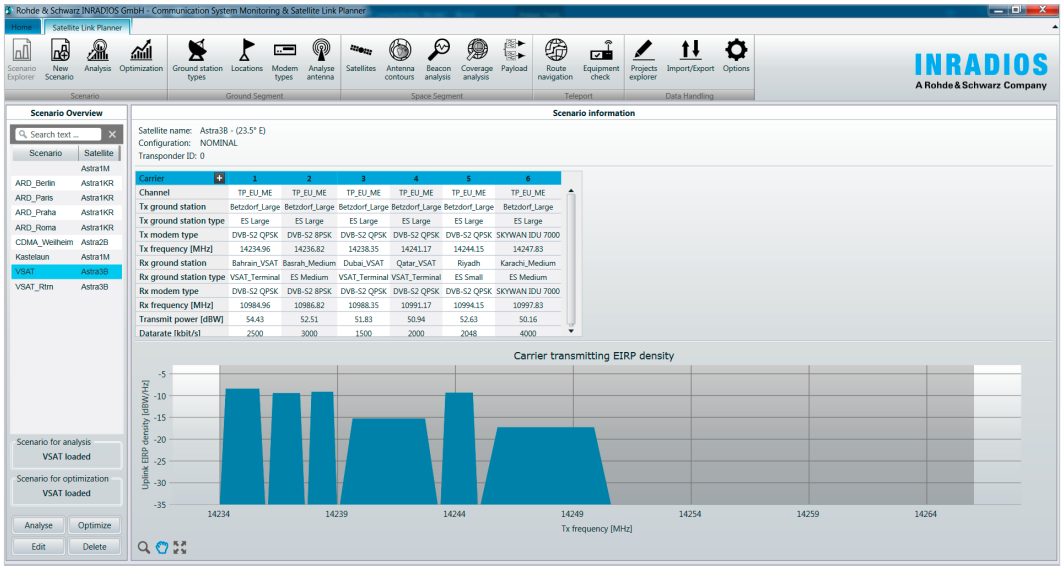


Optimizing complex multi-carrier satellite link budget scenarios easily

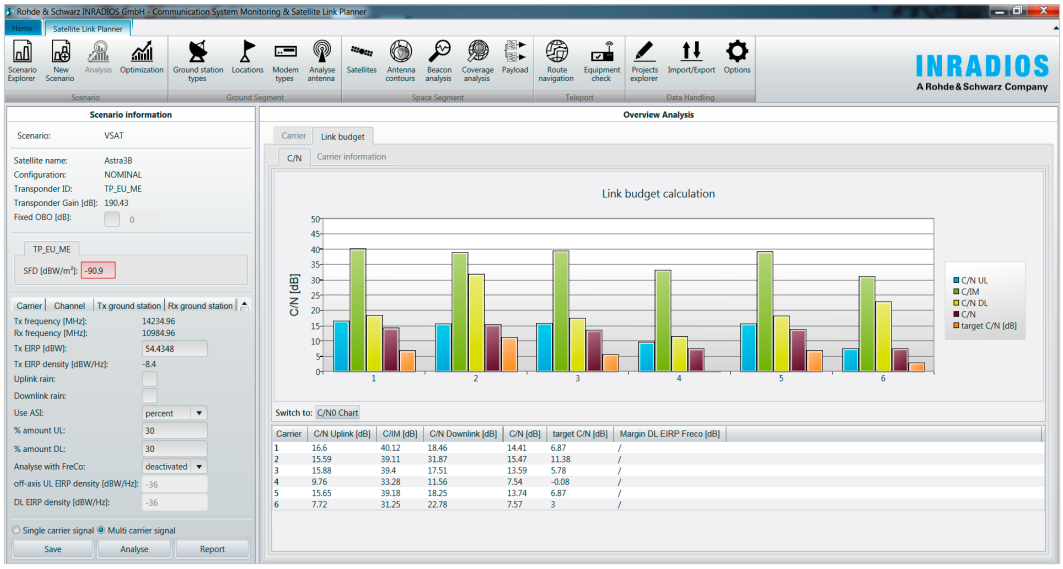
- PEB minimization due to EIRP adjustments of the individual carriers
- Throughput maximization towards desired link availability requirements (considering weather and atmospheric losses)
- Satellite beam EIRP optimization
- Symbol rate and MODCOD optimization of individual carriers
- Constraining of usable uplink amplifier power and bandwidth
- Minimizing transponder resources (power, bandwidth) for a given scenario
- Performing route (way point) optimization
- Performing equipment (dish size) optimizations

R&S®GSASLP multi-carrier scenario optimization provides a complete transponder allocation plan including ground segment parameters, modulation/coding schemes per carrier and the space segment gain setting. Multiple operational criteria are used to perform scenario optimization, e.g. required BER, required link availability or frequency coordination limits. Though users can easily optimize the previously generated results from the analysis process. Afterwards users can take the results to setup the carrier configuration in real test scenarios.

Managing multi-carrier scenarios



Analysis results of a multi-carrier scenario



SPACE SEGMENT MANAGEMENT

Parameterizing satellite objects for individual use cases

- Visualizing geographical information of satellite coverage
- Creating and populating satellite objects

Geographical information is one of the most important aspects in satcom link planning and optimization. It includes coverage information of satellite antennas as well as ephemerides data and geolocation data of earth stations. Systems using R&S®GSASLP can visualize locations and antenna footprints as shown below which gives a neat overview of all available footprints for the user.

R&S®GSALSP provides the possibility of creating and populating its own personal satellite objects, which shall be saved using persistent services.

Performing and visualizing satellite coverage analysis

- Analyzing impairment coverage, e.g. for rain based on a given antenna footprint
- Visualizing coverage results clearly to the user

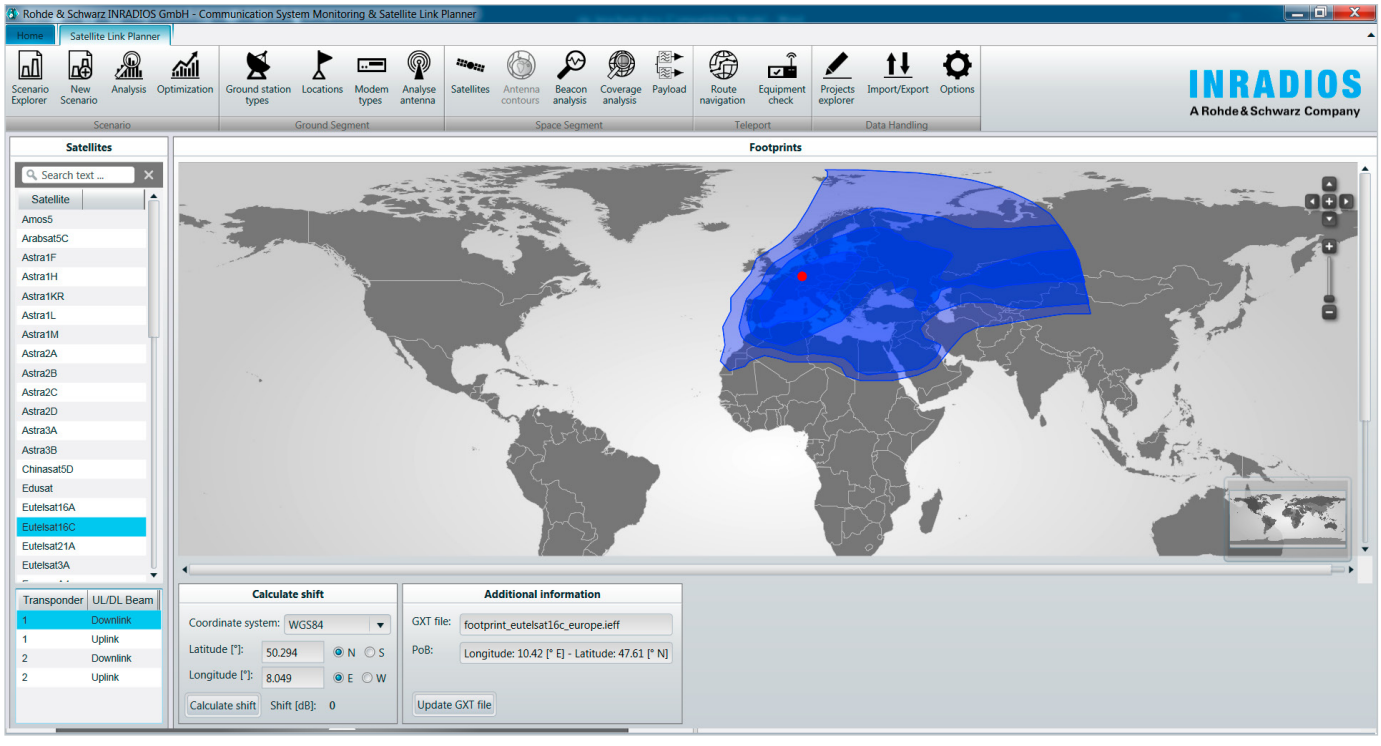
Coverage analysis can be performed as depicted in the screenshot on bottom of page 7. Here, the rain attenuation is displayed by means of a color code which is overlaid over the footprint, taking input parameters such as signal frequency, desired link availability and footprint file.

Optimizing satellite and transponder equipment

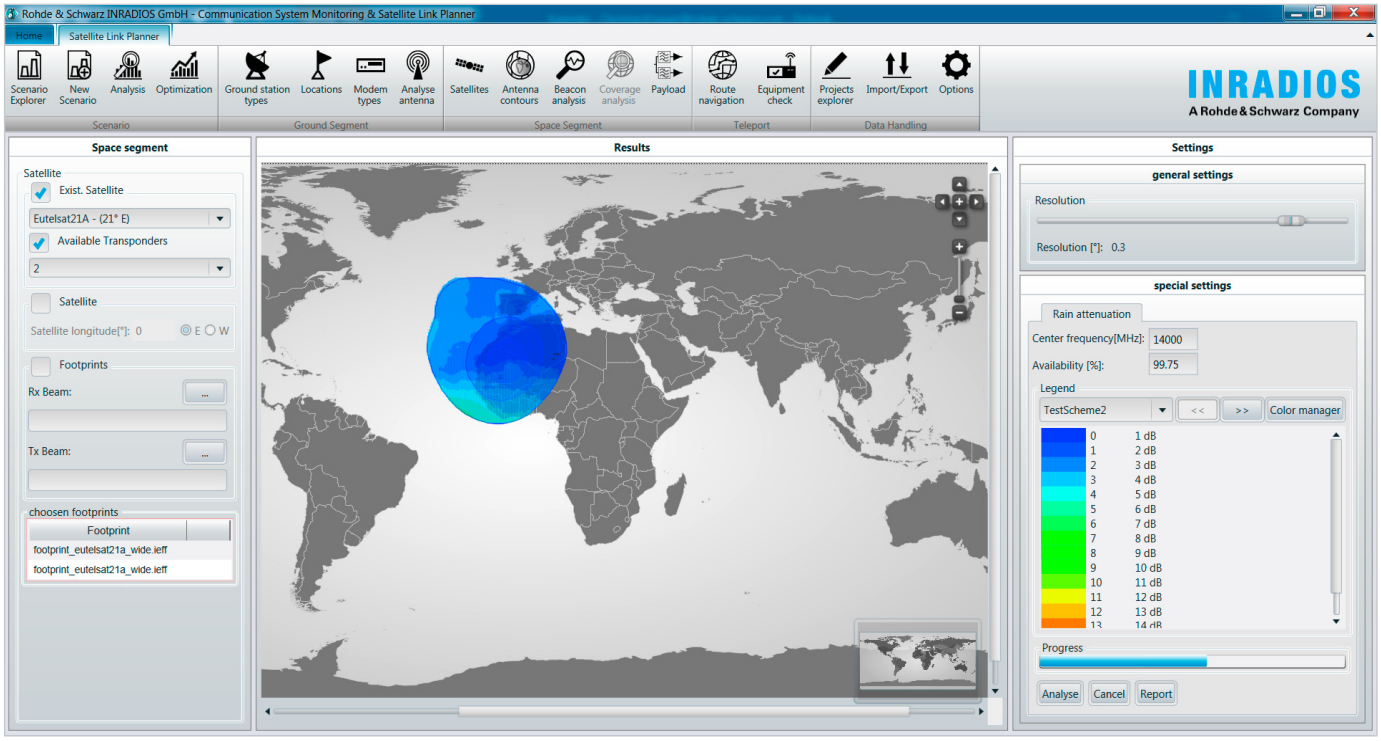
- Checking uplink and downlink data rate
- Checking modem types used
- Checking anchor station and remote station (e.g. a VSAT terminal)
- Checking used bands (e.g. C, X, Ku, Ka)

R&S®GSASLP equipment optimization provides the best suited satellite equipment and transponder to meet a given user data rate requirement as given in the screenshot below. Users can define the required PEB consumption if a dedicated transponder is used. Thus all transponders which are proposed by the optimization functions are checked to ensure full coverage of the uplink and downlink footprints. Antenna size, modem type and BUC power of remote equipment can be defined as well and will be taken for the equipment check. Finally a bandwidth and power optimized setting is proposed by R&S®GSASLP.

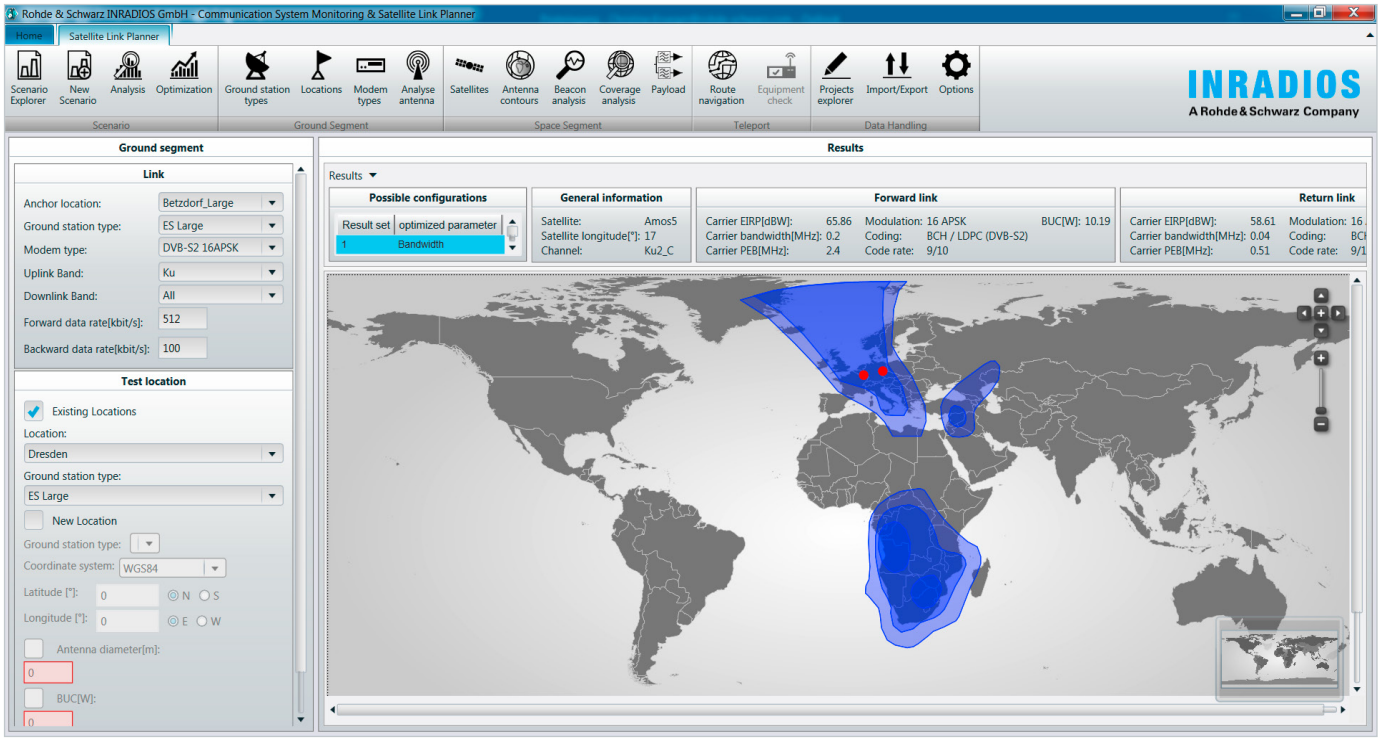
Antenna footprint visualization



Footprint visualization and rain attenuation visualization



Equipment and transponder optimization



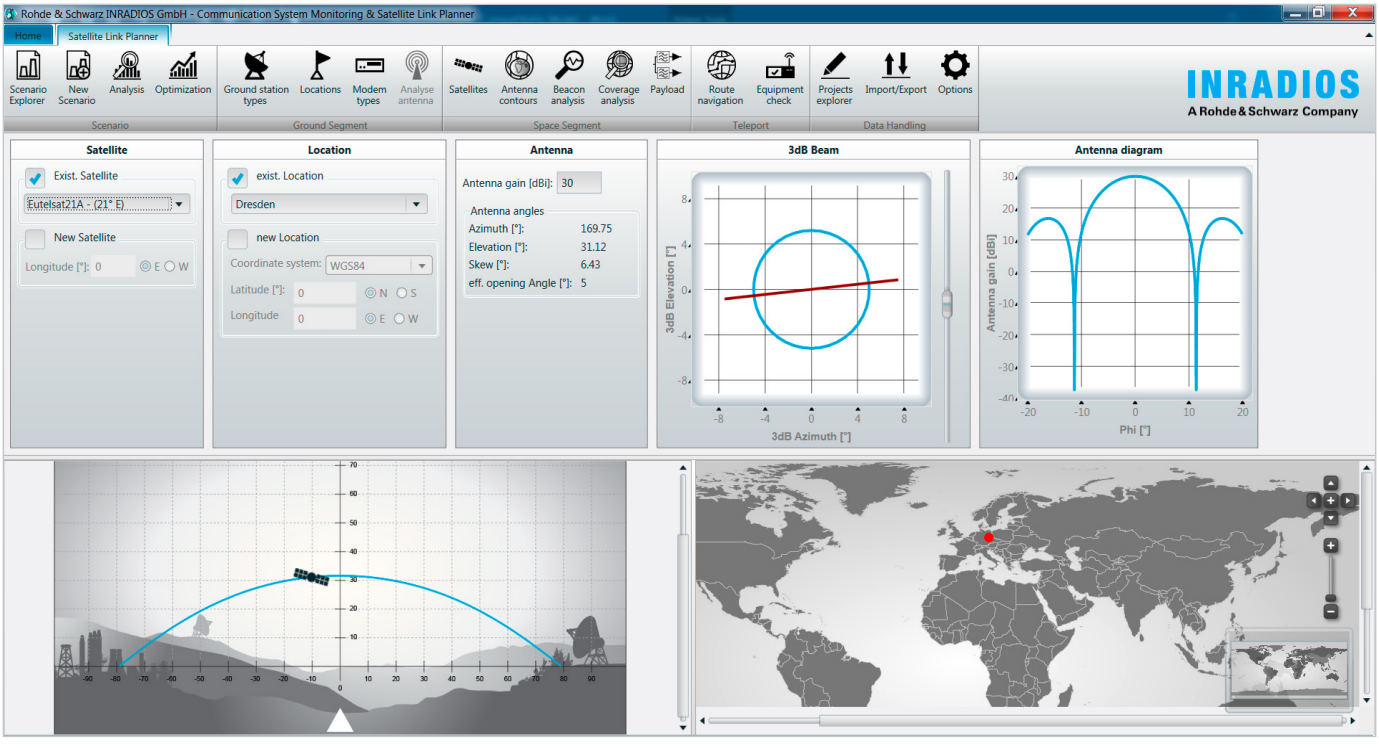
GROUND STATION MANAGEMENT

Modeling ground stations, modems and antenna radiation patterns

- Managing ground stations with their parameters and geographic locations
- Calculating the losses due to a pointing error entered in degrees or simply by means of dB antenna gain loss
- Calculating the impact of a rotation of the antenna reflector with respect to the GEO plane on the effective antenna gain and discrimination
- Calculating and visualizing of ASI and interference limits based on frequency regulation limits

Systems using R&S®GSASLP can add and modify ground station types, geographic locations and modem types which give users the ability to create a wide variety of ground stations being used for multi-carrier scenario analysis. R&S®GSASLP users can simply visualize the antenna gain results in the sidelobes and take this result to the corresponding EIRP limit based on frequency regulation limits.

Antenna diagram modeling and interference analysis



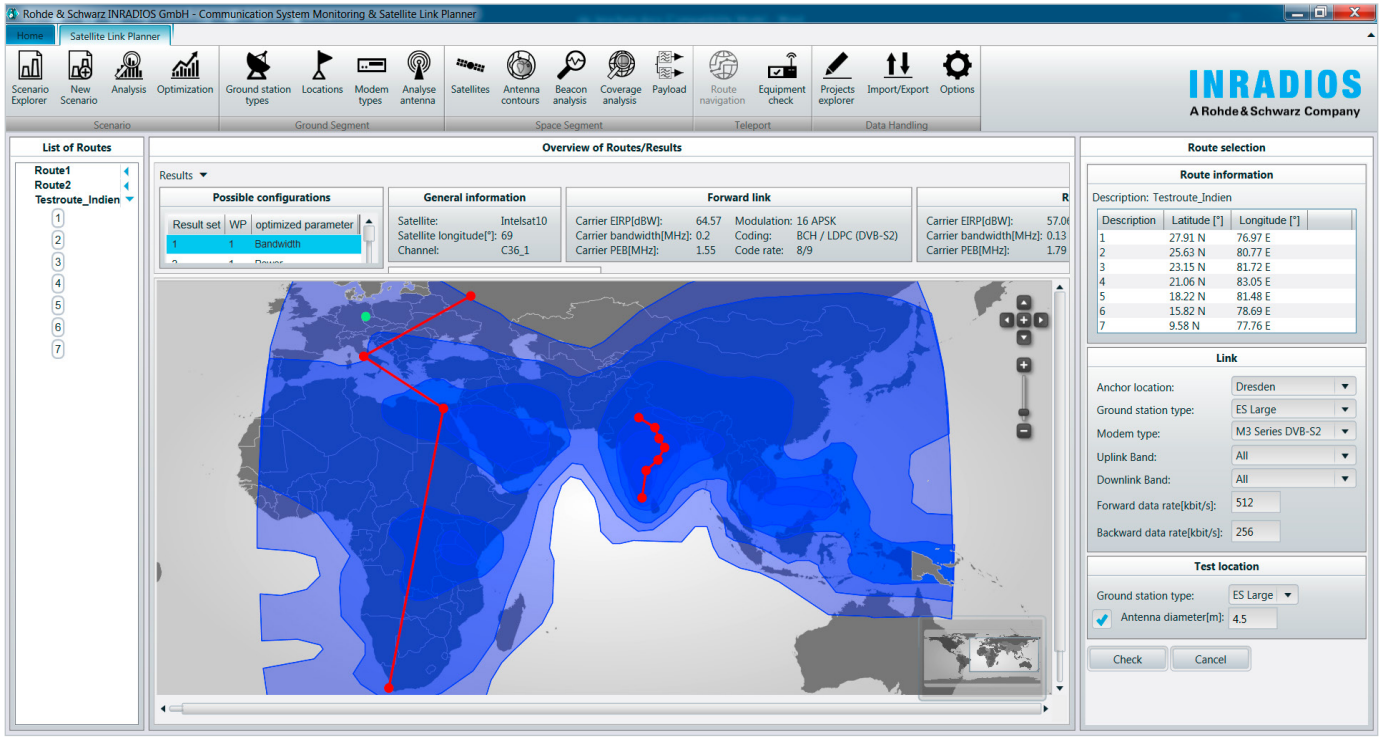
ROUTE MANAGEMENT

Planning and optimizing navigation routes

- Checking uplink and downlink data rate
- Checking modem types used
- Checking anchor station and remote station (e.g. a VSAT terminal)
- Checking used bands (e.g. C, X, Ku, Ka)

R&S®GSASLP route planning and optimization allows users to find the best suited transponder and carrier settings for a given geographical route. The screenshot shows this feature where a satcom on the move (SOTM) route through India is assigned. Routes can be easily configured manually through the GUI.

Satcom route planning and optimization, preparations before optimization run



SPECIFICATIONS

Specifications	
CPU and operating system	x86 CPU, Windows 7 or newer
.Net Framework required	.Net Framework version 4.5
Minimum HDD space required for installation	500 Mbyte
RAM required	min. 1 Gbyte, 2 Gbyte recommended
Sensor interfaces supported	LAN/WLAN connection, USB port optional
Application domains	satcom transponder modeling and carrier link budget analysis
	satcom operations, definition of modulation and coding
	satcom transponder optimization
Required impairment	**ITU recommendation**
Rain rate calculation	ITU-R Rec. P 837-6
Rainfall height calculation	ITU-R Rec. P 839-3
Specific attenuation due to rain calculation	ITU-R Rec. P 838-3
Rain attenuation, frequency scaling, scintillation	ITU-R Rec. P 618-10
Gas attenuation calculation	ITU-R P Rec. 676-9 and Rec. P 836-4
Cloud attenuation calculation	ITU-R Rec. P 840-4
Surface temperature calculation	ITU-R Rec. P 1510
Earth station height above sea level	ITU-R Rec. P 1511

ORDERING INFORMATION

Designation	Type	Order No.
Satellite link planner (SLP)		
Satellite link planner	R&S®GSASLP	3065.3555.02
Communication system monitoring (CSM) base package		
CSM client software (for Windows OS)	R&S®GSACSMCLNT	3065.3510.02

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- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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R&S®GSASLP Satellite Link Planner
Data without tolerance limits is not binding | Subject to change

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