sat-nms MNC System General Description

Introduction
SatService’s sat-nms MNC Monitoring & Control System is a comprehensive software-based system providing monitoring and control of any type of satellite ground station and associated baseband equipment. The system consists of two parts:

- **1HE 19” Industrial PC with Ethernet interface and serial interfaces connected to the ground station equipment or compact boxed server**
- **sat-nms IO-FEP for interfacing low level satellite ground station components and equipment like waveguide switch alarm contacts including logical functions like TWTA mute during waveguide switching**
- **Client PCs that are the operator consoles for the sat-nms MNC System. These are MS-Windows clients, but in principle due to the use of JAVA, independent to the operating system**

The sat-nms MNC Software is separated into two in Java implemented modules: sat-nms MNC Server and Client. Both modules are installed on the industrial PC and running under the Linux operating system. The platform independent client software can also run on every workstation connected via TCP/IP.

**sat-nms MNC Server**
The sat-nms MNC Server monitors and controls the equipment of a satellite ground station. The monitoring is performed locally without any influence and connection by any operator client. The connected equipment is polled and monitored continuously. Typical alarm flags of the equipment, like summary alarm, lock alarm, etc., thresholds or limits of data quality are detected. The alarm message is stored in the internal sat-nms MNC Database at the sat-nms MNC Server and the client operator is alerted via both a graphical and an audible alarm.

Virtual Device Drivers define families of Satellite Ground Station Equipment with common user interfaces for operator with multi-vendor equipment in the field, e.g. all satellite modems are presented to the operator in the same look and feel. This simplifies the handling because device specific details are hidden from the operator.

Logical Devices are also available like EIRP Adjustment, Data Logging (any parameter, which is displayed, can be logged to file), Redundancy Switching and Site Diversity Switching.

The monitoring is performed locally without any influence and connection to a central station. The equipment is polled and monitored continuously. The sat-nms MNC System can also work as a so-called VLC (VSAT Local Controller) if you want to control it from a central Network Management System (see below). If an alarm is detected, like summary alarm, lock alarm, thresholds or limits of data quality, this alarm is sent to the Network Management System and the alarm is stored in a central data base. The operator is alerted via graphical and audible alarm. The operator monitors the status of the equipment via the sat-nms NMS screen and can dial into the station.
The *sat-nms* MNC System can provide an SNMP MIB with selected system information to any higher level SNMP based network management system as an option.

**Key Features**

- Client Server Software Architecture
- TCP/IP-based Design
- Integrated Management for Dialup Connections
- Full remote Administration and Support
- Client is independent from Operating System
- An unlimited Number of Clients is possible
- Central Event- and Alarm Log with Filter Utilities
- Task- and device-oriented User Interfaces
- Macro Recording Functionality
- SNMP MIB of *sat-nms* MNC System is available for higher level Network Management Systems
- Software configurable Interface Device Configuration
- Integrated graphical Tool for User Interface Configuration
- Comparable Equipment of different Manufacturers has the same "Look and Feel"

**Interfaces to Satcom equipment**

The *sat-nms* MNC or *sat-nms* VLC are both able to monitor and control the attached equipment via the following types of interfaces:

- Serial RS232 Interface
- Serial RS422/RS485 Interface
- Network Interface (Ethernet, TCP/IP)
- HTTP GET Functions
- SNMP Interface over Network
- GPIP via National GPIP-to-Ethernet Converter
- Direct Interface to selected programmable Logic Circuits (PLC/SPS) like, for example, GE-FANUC
- Parallel Interface for Low Level Devices like Alarm Contacts or Waveguide/Coaxial Switches via the *sat-nms* IO-FEP

**sat-nms MNC Client**

The Client Software is the User Interface for the operator of the ground station. The operator accesses the *sat-nms* MNC System directly via the *sat-nms* MNC Industrial PC or via an arbitrary workstation in the network connected via TCP/IP. The number of clients is unlimited.

The platform independent Java Software requires only a Java Virtual Machine on the Client-PC. We have tested the software successfully on Windows XP/Vista/Win7/WIN8 and of course on Linux PCs.

With the purchase of the *sat-nms* MNC System you obtain the licenses for an unlimited number of clients. Therefore, no additonal costs will arise.
The client software shows a station window showing the equipment and a user configurable block diagram. Each equipment block is highlighted red if an alarm occurs. Also the status of the back-up equipment is shown.

If an operator clicks on one of the equipment boxes, the equipment window opens, shows the status of the equipment and allows the operator to control the parameters like bit-rate, TX power level frequency etc..

An event and alarm log book is provided that shows occurring alarms and also operator interventions like alarm acknowledgement. This event log can be searched through with easy command clicks.

This is also the way how we can and will support you from Germany. We will have here the same client running on one of our PCs and then dial in via our ISDN IP router to the customer site or via VPN connections over the Internet. So we see the same like you.

Remote Access
The sat-nms MNC Server is completely configurable and maintainable remotely. It only requires TCP/IP connection. Also the Clients require a TCP/IP connection to the sat-nms MNC Server. This can be an already existing network (LAN) or a dialup connection (e.g. PPP).

SatService also offers ISDN solutions to connect different locations on request. Via these routers, SatService will give you remote support if you need it.

Task- and device-oriented User Interface
There are two kinds of user interface available: task- and device-oriented user interface.

The device-oriented user interface provides all parameters of the satellite ground station equipment and a deep insight into the equipment for system engineers. It is part of the delivery and shows every attached device in a block diagram view. The device-oriented screen will be mostly used in stations with a static configuration for monitoring & control and redundancy switching (see following picture):

![Diagram showing station window with equipment and user configurable block diagram. Each equipment block is highlighted red if an alarm occurs. Other parameters such as TX power level, frequency, and bit-rate are also shown and can be controlled by the operator if clicked on. An event and alarm log book is provided for easy searching of occurrences. Remote access to SatService's MNC Server is possible via TCP/IP or ISDN connections. Device-oriented user interface provides all parameters for system engineers with a block diagram view of attached devices.]{fig:station_window_diagram}
Device-oriented View for an Uplink Station with 9:1 TX-Redundancy

Equipment-oriented Screen of a Satellite Ground Station
The task-oriented user interface is a customized user interface, fully configurable and reduces the user interface to the special requirements of the operator. Several task-oriented and/or device-oriented user interfaces can be used in parallel. SatService will be glad to offer you the configuration you need, but you are also able to do this on your own with the integrated graphical screen editor.
Task-oriented Screen SNG with Channel Database

SNG with 4 IRD Chains and 2 Transmit Chains, together with Channel Database
Graphical User Interface

The following chapters show examples of the user interface of a sat-nms MNC Monitoring & Control System. A full description of all screens can be found in the User Manual (see http://www.satservicegmbh.de/tl_files/doc/manuals/satnms/MNC-UM.pdf).

The sat-nms MNC Main Window

The sat-nms MNC Main Window gives access to the sat-nms MNC Interface of a sat-nms MNC. The sat-nms MNC Main Window is fully user configurable and usually contains a simplified block diagram of the equipment controlled by the sat-nms MNC.
The main window can also be designed in a **task-oriented way**. This means, you do not have a block diagram view of your station with icons representing the equipment but you have a screen with the parameters of the equipment. This screen can be exactly defined according to the tasks an operator has to perform, so that he needn’t struggle with unnecessary technical details that are not under his responsibility or capability.

It is also possible to configure **more than one screen** for each *sat-nms* MNC - with buttons you can switch between the different views.

The following example provides an overview screen for 4 antennas.
By clicking on the Button labeled with the antenna name in the middle you switch to a detailed block diagram screen for this specific antenna.
Event Report

The Event Report window lets you generate filtered reports from the event database maintained by the *sat-nms* NMS. This database contains all events (faults, warnings and information) messages issued by the *sat-nms* MNC.
An overview about all active alarms and warning is given with a separated window.

The *sat-nms* client is also configurable to show a pop-up window in case of detecting a new fault or warning. You can combine this with an audible alarm at the client PC.

*sat-nms* MNC Interface Configuration

The ‘Device Setup Editor’ gives you the possibility to define/modify the equipments setup, i.e. the assignment of monitored/controlled devices to the physical interfaces of an *sat-nms* MNC Computer. You need to be connected on-line and logged in as a fully authorized operator to edit the equipment setup.
Presets

Presets can be stored per equipment type, so it is easy to copy all settings from one device to another one, e.g. from IRD to IRD.

The Load Preset Dialog shows all device type (for which presets exists) and in the middle the presets are listed sorted by name. With the search field at the bottom you can filter the presets, e.g. show only Eutelsat Satellites in the example above. The right column shows the content of the preset, so you can see what you will apply if you select the preset.
**Screen Editor**

As already described in the first chapter, the operator screens are fully configurable. The integrated screen editor allows changing, adding, and deleting objects of the screen like parameter fields, strip charts, LED’s, devices icons, switches, lines of a block diagram and much more. The screen editor is an easy to use drawing tool.

The following elements are available at the moment:

- **Parameter / Read Only Parameter**: a parameter entry field

<table>
<thead>
<tr>
<th>TX-1</th>
<th>pol</th>
<th>tx on</th>
<th>eirp</th>
<th>measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>14239.675 MHz</td>
<td>V</td>
<td>ON</td>
<td>27 dBW</td>
<td>52.48 dBW</td>
</tr>
<tr>
<td>symbol rate 6.1130 Msps</td>
<td>QPSK-3/4</td>
<td>DVB-S</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

- **Fault Elements**: shows the textual description of the fault and its state in an entry field frame

<table>
<thead>
<tr>
<th>Faults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
</tr>
<tr>
<td>Carrier lock</td>
</tr>
<tr>
<td>Video lock</td>
</tr>
<tr>
<td>Signal quality</td>
</tr>
<tr>
<td>OK</td>
</tr>
<tr>
<td>Audio lock</td>
</tr>
</tbody>
</table>
• Label: displays a single line of text
• Sunken 3D Frame: draws a sunken 3D frame, may be used to group parameters
  
  ![Timer](image)

  • Rectangle: draws a rectangle.
  • Line / Arrow: draws a horizontal/vertical line or arrow
  • Icon: places a GIF or JPG image on the screen. Optionally, the icon can be programmed to change with a parameter value
  
  ![Device Icon](image)

  • Device Icon: represents a device and shows the operating/fault state by its color / shape.
  
  ![Switch Icon](image)

  • Switch Icon: displays the actual position of a switch
  
  ![Frame Button](image)

  • Frame Button: launches another screen, e.g. for detailed views
  • Parameter Button: a button sending a certain parameter value when pressed
  • Gauge: displaying a numeric parameter as a horizontal bar

  ![Gauge](image)

  • Strip Chart: displaying a numeric parameter as a y/t diagram that advances with 1 pixel/sec.
Status Indication by Line Width and Color

This feature allows line elements of the sat-nms graphical user interface to be used as status information. You can change both color and width of the interconnecting lines depending on the dependency of variables dynamically.

One example of this feature is to highlight the interconnecting lines of a TX chain when it is active or if a fault occurs. The following example shows an active TX chain with green lines.
Macro Recorder

The sat-nms Software includes a powerful macro recording and playback feature that gives you the possibility to automate complex equipment settings to one mouse click. This feature is built on the parameter message concept of the software. Recording a macro means recording the parameter messages you sent when you change the setting at the user interface.

The example above shows the list of already recorded macros: the first two are complete backups of all settings of the sat-nms MNC System and all connected devices. The third macro sets the redundant HPA to a default transmit EIRP and the fourth implements an emergency off for the whole ground stations.

Examples: „Emergency-off“ and „set to default EIRP“ Macros

Another feature performed by a macro is to record all parameters of all devices connected to the sat-nms MNC System into a macro to generate a snapshot of a station and to restore it later in one step. The system allows you to compare such macros and displays all changes between both snapshots. This includes all parameters like attenuation or frequency settings and configuration settings like serial interface settings or IP addresses.
Equipment / Device Windows

The software offers a device window for each type of equipment it supports. Device windows are launched by double clicking on the device icons in a sat-nms MNC User Interface Window. It shows all parameters read from the device and permits to alter each writable parameter. For clearance, the parameters are grouped to pages; you can switch between the pages using the tool-bar.

All Device Screens, regardless of the equipment type, have the same look and feel. The icons at the upper margin of the window are used to activate different functions. These are Load and Save of a Preset, then the device specific functions, a fault page, the information page, the maintenance page as well as the help button.

The fault page displays all fault flags the software knows about this device. Moreover, you can view and change the event priority for each particular fault flag.

Also available for all drivers is the Info Page. This page contains information about the driver and static parameters like equipment serial numbers.
Spectrum Analyzers

It is possible to connect spectrum analyzers to the *sat-nms* MNC System. We already provide drivers for:

- Agilent/HP ESA E44xx via GPIB or RS-232
- Advantech via GPIB or RS-232
- Rhode&Schwarz Analyzers via NI-VISA (TCP/IP / VXI-11)
- LP Technologies Analyzers via TCP/IP
- Narda NPA Analyzers via TCP/IP

The spectrum view shows the spectrum analyzer's output in a similar format as the local display would do. This display shows the measured spectrum (white) in front of gratitude and a summary of instrument settings.

Also the spectrum analyzer device provides the preset functionality, so also operators without deep spectrum analyzer knowledge can get the right configuration with just one mouse click.

Spectrum Analyzers can be combined with input switches that are operated under the full control of the *sat-nms* MNC System. Therefore, the operator can efficiently monitor different receive or transmit ports with the spectrum analyzer.

The *sat-nms* MNC System provides the spectrum view, allows to control the spectrum main analyzer settings like center frequency, span, etc. and gives you access to the first 16 instrument memories of the spectrum analyzer.
The spectrum view supports two markers. The main marker is the one provided by the instrument itself. The spectrum view colors this marker in yellow. You may set the marker manually by clicking with the left mouse button into the spectrum display. The instrument settings page provides some common marker functions like 'peak search' or 'marker to center'. These functions operate on this main marker. Additionally, the spectrum display provides a delta marker function.

The driver also allows defining multiple local oscillator frequencies depending on the position of an external switch (e.g., port selection of a switch matrix). This is useful if you connect your spectrum analyzer to an L-Band Switch Matrix with inputs of different antennas and you want to work with the RF frequencies instead of L-Band frequencies.
**sat-nms Drivers**

The Universal Device Driver concept reduces the costs for the configuration of new drivers. The user can configure its own drivers without writing software. Parallel to that, SatService will always provide the service to adapt new equipment with drivers to the system. Drivers are always the same for sat-nms MNC and sat-nms VLC Systems.

The sat-nms MNC System differentiates between hardware-related and software-related (“logical”) equipment.

**Virtual Device Driver Concept**

The software uses this abstraction to collect pieces of equipment belonging to one family that means to a so-called "virtual device". Equipment families are for example: Amplifiers, Up-Converters, or Satellite Modems. Devices of the same family provide the same user interface to the operator, e.g. the parameter to set a transmit frequency always looks the same, regardless of the manufacturer or the model type of the equipment finally receiving this command. If specific equipment does not provide a parameter like other equipment of the device family, this parameter will be disabled.

**Hardware Equipment Device Driver**

Hardware equipment monitored and controlled by the sat-nms MNC System is connected physically to the sat-nms MNC System via different hardware interfaces like Ethernet, RS232, 422 and 485 etc. The “connection” to the core sat-nms MNC Software is via device drivers. The device drivers allow a common interface to the sat-nms MNC System. Before the introduction of the sat-nms MNC System, device drivers were written in different software languages like C or Java, so that the coding and testing time had been a significant part of a sat-nms MNC project. With the introduction of our sat-nms MNC System, you are now in the comfortable position to configure a device driver with a common sat-nms configuration tool, so that you as our customer can now create new device drivers by yourself. The system also includes a graphical device screen editor to create new device screens for new drivers or to modify existing device screens. It is relatively easy to copy an appropriate old device driver from the same family of equipment and generate a new one. This is also the procedure how SatService GmbH configures new device drivers. But you also have the possibility to do this by yourself, especially if you want to upgrade your system later on. Nevertheless, SatService GmbH will never leave you alone and will assist you in performing the upgrade work for you. You will always have a competent partner by your side to adapt and add new equipment.

**Device Driver Development / Configuration**

Device drivers of the sat-nms MNC Software translate abstract parameter settings represented by parameter messages into commands sent to the physical device and vice versa. The basic idea is to modularize the software in a way, that one device in a station setup can be replaced by another model, perhaps even by a model made by another vendor, simply by selecting another device driver.

The sat-nms MNC advances this concept by introducing a 'universal device driver' completely user configurable. The configurable device driver gives you the possibility to write your own device drivers for device models not yet supported by the software. Most of the device drivers coming along with the software are built on top of this configurable driver, so there are a lot of examples you can use as a template.
To make it even easier for you to define your own drivers, the protocol overhead like start and stop byte, checksum etc. are separated from the driver. So you can just select an existing protocol like simple Terminal protocols, the “Miteq” protocol or high level protocols like SNMP or HTTP for your new driver.

An integrated screen editor allows you to create your own device screens or change existing device screens. But if you make use of the “virtual device drivers” concept than you can just reuse the existing screens.
Logical Devices

The sat-nms Software contains a set of so called logical devices, which in fact are software solutions to solve different tasks in a sat-nms MNC System. The range is from tool to logging device parameter until a full N:1 Protection Switch.

The following chapter shows only some selected examples of available logical devices.

There is a second family of devices in the sat-nms MNC System, the so-called “logical” device drivers. These are not related to hardware but allow the user of our sat-nms MNC System to perform actions and react on parameter changes. These devices are pure software and allow the quick and reliable reaction on parameter changes. It is important to understand that there is no restriction in parameters. Each logical device can work with any equipment parameter. This is again a huge advantage of our sat-nms MNC System Software: you can use each device very flexibly and cost-efficiently.

Some examples of logical device drivers are:

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strip Chart Recorder</td>
<td>Presents any parameter of any equipment like BER of a receiver, beacon level of a beacon receiver, azimuth angle of an ACU or any other parameter in a y/t diagram and presents the last 3 minutes. This shows very efficiently signal changes and fluctuations.</td>
</tr>
<tr>
<td>Recording Device</td>
<td>Performs data logging. Stores any parameter in a file with a defined sample time, whether it’s any 10 seconds for a beacon level or any 7 days for an HPA helix current to analyze TWT trend and end of life, just to highlight two applications</td>
</tr>
<tr>
<td>Site Diversity</td>
<td>Two MNC Systems are talking to each other and are switching coordinated TX on/off signals on each site for weather redundancy purposes.</td>
</tr>
<tr>
<td>Redundancy Switch</td>
<td>Redundancy switching of TX or RX chains.</td>
</tr>
<tr>
<td>Uplink Power Control</td>
<td>The Uplink-Power-Control logical device adjusts the level of a transmit signal in order to compensate the atmospheric attenuation in the signal uplink. To achieve this, the Uplink-Power-Control logical device reads, e.g. the level of the satellite’s beacon from a beacon receiver.</td>
</tr>
</tbody>
</table>

You will find a complete list of the logical devices in the sat-nms MNC System html.-based documentation on our website www.satnms.com and on our documentation CD.

File Recorder

One logical device is the File-Recorder capable to record arbitrary data like levels, antenna pointing data, etc. into a disc file. The History File Viewer is the user interface to inspect such files. The window can be accessed either from the File-Recorder’s device window or can be used as a stand-alone application as well (for details, please see below).

The sat-nms MNC Software allows the data logging of any parameter in the system. You can set-up an unlimited number of logical devices called “Recording”. Within each device you can define 4 parameters, the file name and the sampling time in seconds.
The following picture shows the configuration Setup Page of a recording device recording the Azimuth, Elevation, Polarization and Beacon Level of an antenna step-track system monitored by a sat-nms MNC System. Sample time is in this case every 60sec. A new file will be generated when the file size exceeds 4000kBytes. Even this can be configured.

The file name can be imported, for example, from Excel Spreadsheet to evaluate the measured data. In order to allow you a first graphical view on the data, the recording device also includes a graphical presentation software module.

**N:1 Redundancy**

The Protection-Switch-N-To-1 logical device provides a completely software-based solution for an N:1 redundancy switch. The device is preconfigured to handle 2 to 12 operative chains, but it can be extended quite easily to serve more chains. The block diagram below shows a typical application scenario for the Protection-Switch-N-To-1 device. Three operative transmit chains are backed up by one spare chain. A 'ladder' of waveguide switches at the chains' output controls the RF signal getting routed by the antenna.
The following screen shots present on the left side the device screen of the logical redundancy device and the screenshot on the right side shows an excerpt of the device-oriented user-screen (block diagram view) related to this redundancy switching.
The Band-Pol-4-to-1 logical device will be used to configure the correct logical routing of an IRD to the necessary input signals of horizontal and vertical polarization and 11 and 12GHz frequency band.

**Polarization / Band Select**

<table>
<thead>
<tr>
<th>frequency</th>
<th>polarization</th>
<th>switch position</th>
</tr>
</thead>
<tbody>
<tr>
<td>12558.000 MHz</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**ISELCT-1 Setup**

- verbose: TRUE
- address: 
- retries: 0
- logParameterChanges: FALSE
- frequencyId: IRD-1.frequency
- switchId: IRD-1.polarization
- freqThresh: 11800.000 MHz
- lowVertPos: Y
- hiVertPos: Y
- lowHorPos: X
- hiHorPos: X

**Diagram**

- 12 GHz vert
- 12 GHz hor
- 11 GHz vert
- 11 GHz hor

**Band-Pol-4-To-1**

- Position 2

**RECEIVER**

- 12,433 MHz

- H
Logical Gate

The Gate-Array device provides a set of 8 logical gates with 8 inputs: each of them can be used to merge status variables in a user programmed way. Each gate can be configured to work as an AND, NAND, OR, NOR, NE (XOR) or EQ gate. The eight inputs of a gate are so-called elements comparing the contents of a sat-nms Parameter to a fixed target value.

This example checks the on-air status of different equipment: Encoder/Modulator, HPA and Transceiver. Only if all the equipment is in a transmit state, the result of this gate will be true. In this case, you can use the result, e.g. to display an ON-AIR icon on the main screen or to make a line in a block diagram bold green to show that you are now transmitting to the satellite.
Channel Select Device

The RX-ChannelSelect logical device controls the basic parameters of an IRD and an input switch for the IRD selecting frequency band and polarization.

The RX-ChannelSelect device translates the user level parameters 'antenna', 'satellite', 'polarization' and 'frequency' into the frequency setting at the IRD and the position of the input selection switch / matrix output or turns the polarization of the antenna feed. The RX-ChannelSelect device does the translation of LO-frequencies, as these may vary for the different antennas.

Besides, the function described above, the RX-ChannelSelect device implements a locking mechanism preventing users from changing parameters at a receive chain currently in use. This protection only works on the parameters controlled by the RX-ChannelSelect device; it does not influence the operation of the IRD through its own screen.

The device includes a database with satellites and the according TX and RX channels, which is editable within the device screen.
The extended version of the Channel Database (Line Settings) includes more parameters per channel (see the next picture.)

<table>
<thead>
<tr>
<th>frequency</th>
<th>pol</th>
<th>symbol rate</th>
<th>fec</th>
</tr>
</thead>
<tbody>
<tr>
<td>11472.500 MHz</td>
<td>V</td>
<td>6.11300 Mbps</td>
<td>3/4</td>
</tr>
<tr>
<td>14272.500 MHz</td>
<td>H</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>
A possible task-oriented main screen could look similar to the following picture:

Here you have one line for each IRD. You can select the antenna, the satellite and a channel from the included database step-by-step and the complete receive chain will be configured automatically. This means:

- The appropriate ports on the switch matrix will be selected and
- The antenna will move to the selected satellite (if this is not a fixed antenna) and
- The basic parameters of the IRD are set (frequency, symbol rate, fec).

The following picture shows a screen for managing 16 IRDs getting signals from a switch matrix and a large number of antennas (fixed and movable):

The operators “work” from left to right: 1. Select the channel from the database (this sets frequency, mode, symbol rate, fec), 2. Select the input (the values in the input field do not only show the antenna name but also reflect the current position/satellite of movable dishes). In this application, the operator is responsible for moving an antenna to the requested satellite but the routing through the L-Band Switch Matrix is controlled automatically by the sat-nms MNC System.

Antenna Pointing
The Antenna-Pointing logical device is a 'high level' driver for motor driven antennas. It is used together with a driver for the type of antenna controller used.

While the plain driver for the antenna controller simply supports to set the azimuth / elevation / polarization offset parameters of the antenna, the Antenna-Pointing logical device extends this with additional capabilities:

- Antenna pointing by supplying a satellite orbit position.
- A list of satellite names, stored together with the orbit position of each satellite and the (manually fine tuned) antenna pointing values for each satellite.

### LineUp Control
The logical LineUp Control device allows a comfortable and easy to use LineUp. The EIRP levels for reduced and nominal EIRP are taken from the channel database if available. It is also possible to adjust the eirp level stepwise or via dedicated text entry as well as switching between clean carrier and modulated output.

### SNG Antenna Pointing
The SNG-Pointing logical device is a 'high level' driver for motor-driven, car-mounted antennas. It is used together with a driver for the type of antenna controller used.

The features of the SNG-Pointing device are:

- It supports the operator in calibrating the azimuth angle for the current position of the car.
- It permits to set the antenna pointing by supplying a satellite orbit position.
- Automatically reads the geodetic location from a GPS receiver.

**Improved EIRP Adjustment with graphical Analog Bars**

This device has the following features:

- Calculation of an equipment gain adjustment in a TX chain in dependency of signal chain and transmit frequency
- Calculates EIRP from TX power level (HPA or others) and antenna gain table
- Definition of a minimum and maximum value relative to nominal EIRP. Is the Device in RF ON mode and the EIRP is out of that window then an alarm is generated.
- Within the graphical user interface, these windows and current EIRP values are presented in a graphical form.
Antenna Control and Tracking Indoor Unit

The *sat-nms* ACU Antenna Controller and *sat-nms* ACU-SW-STEP Step-Track System can be fully integrated in the *sat-nms* MNC System. In this case, the *sat-nms* MNC acts as it does in our *sat-nms* ACU-IDU Indoor Unit, which visualizes the tracking data and moves the antenna along a satellite position calculated from ephemeris data like Keplerian or Intelsat elements.
IO-FEP

Based on the experience gained with satellite ground station system integration, SatService GmbH has developed the sat-nms IO-FEP as Frontend Processor interfacing to all kinds of IO contacts typically used in satellite ground stations as there are:

- Waveguide switches
- Coaxial switches
- RF carrier muting for waveguide switching systems including n:1 redundancy muting of correct TWTAs
- Input status and alarm contacts
- Output contacts
- Temperature measurement

This unit will be used if more than 8 IO contacts are used and is especially efficient because the configuration work is reduced to a minimum to also reduce the overall cost of cabling and configuration of IO contact interfaces.

SNMP Interface to a higher Level Network Management System

The sat-nms MNC System has a built-in SNMP agent. A third party, SNMP-based network management tool can monitor and control arbitrary parameters of the sat-nms MNC. The agent provided by the sat-nms Software is based on SNMPv1, it accepts requests at UDP port 2161. It permits read and write access from the 'public' community. Besides that, the sat-nms MNC may be configured to send SNMP traps on changes of certain parameters, e.g. fault flags.

Each sat-nms MNC System is configured individually for the device setup it controls. Therefore, also the SNMP agent configuration and the specific MIB for a sat-nms MNC have to be unique for each installed system. With the sat-nms MNC System, the SNMP agent gets configured by a (text-based) configuration file defining the sat-nms MNC Parameters, which shall be visible via SNMP.