20 Slot Optical Links

sat-nms LF20

User Manual

Version 1.2.010

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sat-nms LFTX/RX LF20 User Manual

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Abstract

> This document is the user manual provided with the ***sat-nms*** LFTXRX fibre optical link equipment. It contains all necessary information how to install, setup, and operate the unit. The user manual is available as a printed document and for on-line reading on the optical links itself as well.

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1 Introduction

The ***sat-nms*** LFTXRX fibre optical link is a high performance transmission system which transmits a complete frequency band, with all its separate carriers, over a single mode fibre with length up to 5km. The big advantages of fibre optical links are:

- Lightning protection
- Fully isolated between the two destinations
- No ground loops
- bug proof

Two types of optical converters are available

- ***sat-nms*** LFTX --- optical transmitter which converts from IF input spectrum to optical output at 1310nm
- ***sat-nms*** LFRX --- optical receiver which regenerates the optical signal back to an IF spectrum

SatService offer the LFTXRX modules for different frequency bands.

- ***sat-nms*** LFRX-L and LFTX-L --- 950 to 2150MHz
- ***sat-nms*** LFRX-B and LFTX-B --- 50 to 2150MHz
- ***sat-nms*** LFRX-10 and LFTX-10 --- 950 to 2150MHz and 10MHz reference frequency for BUC
- ***sat-nms*** LFRXO10 and LFTXO10 --- 10MHz only

Additional there are optional modules available which will be supported by the software and the backplane

- ***sat-nms*** LFSW --- RF-Transfer Switsch which allowes to build redundancy paths with the optical link
- ***sat-nms*** TBD --- More modules are possible, please define your request

The paragraphs below give a short overview to the contents of the documentation. A subset of this documentation is stored on the device itself, the complete documentation is available on the ***sat-nms*** documentation CD and at www.satnms.com.

- Installation : The installation chapter guides through the installation and setup of the ***sat-nms*** LFTXRX. It describes the mechanical concept of the chassis and the assignment of the connectors. Finally you learn in this chapter how to set the ***sat-nms*** LFTXRX's IP address, which is a essential precondition to operate the ***sat-nms*** LFTXRX by means of a web browser. This section is available in the printed version only.
- Operation : The ***sat-nms*** LFTXRX is operated using a standard web browser like the Internet-Explorer or Mozilla Firefox. The user interface design is straight forward and clearly structured. Operating the ***sat-nms*** LFTXRX is mostly self-explanatory. Nevertheless, the 'Operation' chapter outlines the map of web pages which make up the ***sat-nms*** LFTXRX user interface and elaborately describes the meaning of each alterable parameter.
- Remote Control : The ***sat-nms*** LFTXRX provides a versatile remote control interface. A monitoring & control software may fully operate the ***sat-nms*** LFTXRX either through a TCP/IP network connection or through the RS232 interface of the ***sat-nms*** LFTXRX. This chapter describes the communication protocol used for remote control and lists all parameters accessible through the remote interface.
- Theory of Operation : This chapter gives a short overview how the optical links work and which features are supported.
- Specifications : At the end of the document, the specifications applicable to the ***sat-nms*** LFTXRX are summarized in this chapter.

Support and Assistance

If you need any assistance regarding our ***sat-nms*** Optical Links, don't hesitate to contact us. We would be pleased to help you by answering your questions.

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1.1 Compliances

1.1.1 CE Compliances

1.1.1.1 EMC compliance

This equipment has been tested and meets the specification of following EMC standards:

- EN 55032
- EN 55024
- FCC, part 15B
- ICES003 To meet all EMC requirements it is necessary to keep with the cabling requirements mentioned in the installation chapter.

1.1.1.2 Safety compliance

This equipment has been tested and meets the specification of following safety standards:

- EN 60950
- EN 62368 Every single delivered unit is tested according to EN 60950 to ensure best possible user safety.

To meet all safety requirements it is necessary to keep with the cabling requirements mentioned in the installation chapter.

2 Installation

This chapter describes how to install the ***sat-nms*** LFTXRX Fibre Optical Link. You find a guide how to connect, configure and mechanically mount the equipment below.

Before you start, please first read the Safety Instructions chapter below. It contains some important recommendations to prevent damage from the equipment.

Then, we strongly recommend to do a first setup of the unit on a lab desk before installing it at it's final location. This is mainly for the following reason:

To setup the IP parameters, the PC used for configuring and the chassis must either be connected to the same Ethernet hub / switch or must be connected directly with a crossover cable. The initialization program does not work through routers intelligent or network switches.

Hence, the typical sequence of tasks when putting an ***sat-nms*** LFTXRX into operation is as follows:

1. Read the chapter Safety Instructions
2. Set the unit's IP address
3. Mechanically installation of the chassis
4. Connecting the LFTXRX
5. Configuring the LFTXRX

2.1 Safety Instructions

Failure to observe all Warnings and Cautions may result in personnel injury and/or equipment damage not covered by the warranty.

- **The equipment described in this manual is designed to be installed and used by properly trained personnel only!**
- **ATTENTION invisible Optical Radiation!**  If connected to a power supply, the unit provides invisible Laser-radiation. The source is class 3R Laser diode as defined in DIN EN 60825-1:2001-11. P0=2mW, Lambda=1310nm.
- **Never look into fibre-optical components** like connectors or fibres. Use an infrared viewer, optical power meter or fluorescent screen for optical output verification.
- Do not allow any dirt or foreign material to get into the optical connector bulkheads. This may cause damage to the polished optical connector end faces

- Follow standard Electrostatic Discharge (ESD) procedures when handling a the chassis and the modules of the LFTXRX.
- The ground terminal of the device has to be permanently connected to a grounding point for save operation. Otherwise, the device could be damaged.
- The power supplies are EMI filtered. The chassis is connected to earth ground in compliance with safety requirements. Always use the 3-prong AC plug with earth ground to avoid possibility of electrical shock hazard to personnel.
- Select and apply the appropriate 100-240AC voltage according to the data sheet and documentation **before** connecting power.
- Install suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) or overcurrent can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
- Depending on configuration, the chassis is equipped with user-changeable power supplies. Always disconnect the mains of the power supply that has to be changed. Wait at least 10s after disconnecting the mains (for internal discharge of the power supply) before removing the power supply **ATTENTION:** To avoid the possibility of an electrical shock, never handle with a power supply that is connected to mains!
- Before you connect the LFTXRX to an L-Band distributor or LNC , please make sure that the unit to which you connect can handle 15V D/C voltage on its RF L-Band input. Some L-Band IF distribution equipment does not have D/C blocks included and the unit could be damaged. If you are not sure how the interfacing equipment will behave, switch off the LNC supply voltage in the Setup menu or in case of local controlling by hardware switch before you connect the cable.
- The LFTXRX can be damaged if the total RF input power is higher than +10dBm specified maximum value. Do not connect equipment where the total output power is higher than the specified value of the data sheet or indicated on the LFTXRX unit.
- In case of a failure do not open the ***sat-nms*** LFTXRX, you will loose warranty, call SatService GmbH for a RMA number.
- Observe normal safety precautions when operating, servicing, and troubleshooting this equipment.
- Take standard safety precautions with hand and/or power tools.
- When connecting the units fault relay circuits, observe the maximum ratings: 48V D/C 300mA, 48V A/C 500mA.

2.2 Handling instructions for optical connectors

- Do not allow any kind of dust or dirt on the fibre.
- Do not touch the fibre! Otherwise you will get optical attenuation and the opposite fibre in the corresponding connector will be contaminated as well.
- When installing or changing optical connections, ensure that the environment of the room where the unit is installed is as dust-free as possible.
- If you install the unit on-site, make sure that the complete work that causes dust (e.g. plastering or concreting) is already finished and the resulted dust is cleaned up properly.
- Remove the fibre protection cap of the E2000 or FC/APC connectors just before you connect the optical connector.
- Store the protection caps in a closable box that is absolutely dirt- and dust-free.
- After disconnecting a fibre, put a dirt- and dust-free protection cap into the connector in order to avoid dust contamination.
- Before connecting, we strongly recommend to clean the fibre. We recommend to use clean compressed air spray like e.g. 'Kontakt 334' or a special cleaning device like e.g. 'CLETOP'

or 'one click cleaner'. Do not use compressed air produced by a standard air compressor, this air is not clean enough! If a dirty fibre (e.g. contaminated with dust) is connected to a LFRX or LFTX card, the internal fibre of the LFTX or LFRX card will be contaminated as well and you will get optical attenuation. In the worst case, the fibre-end might be irreparably damaged and has to be replaced.**You always have to consider: optical attenuation causes a twice RF-signal attenuation!** So e.g. an optical attenuation of 2dB causes 4dB RF signal attenuation.

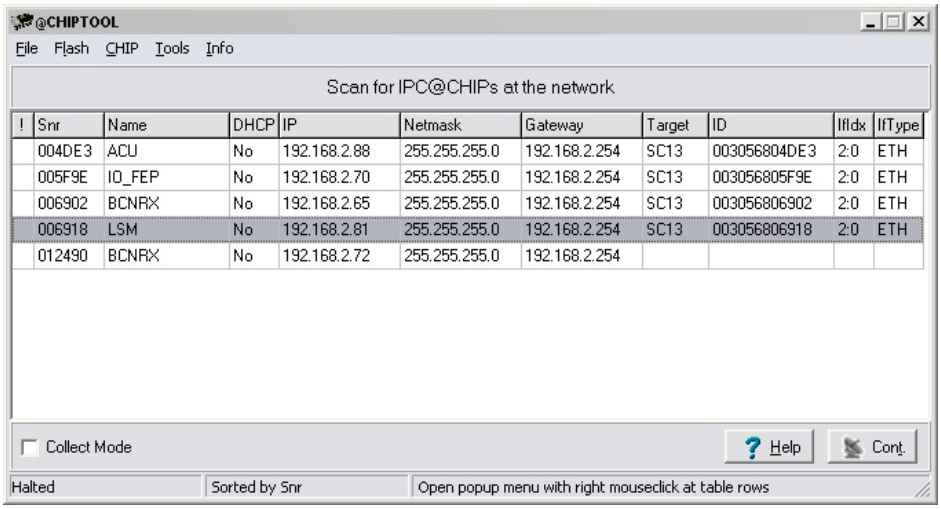
2.3 Setting the IP Address

Before you can operate the ***sat-nms*** LFTXRX Optical Link, you need to set the unit's IP address. There is a special configuration program on the documentation CD shipping with the unit for this purpose. We recommend to configure LFTXRX' TCP/IP settings before you install chassis at it's final place. To configure LFTXRX, the following equipment is required:

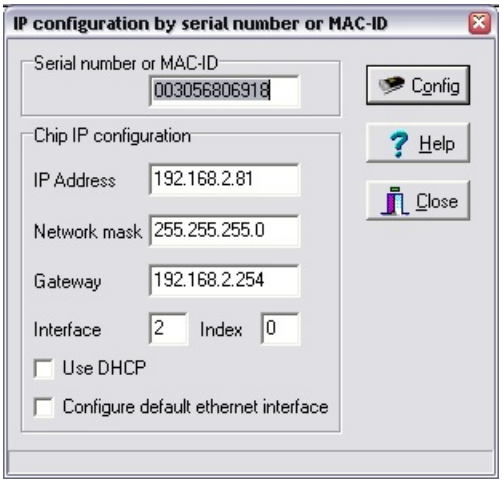
- The ***sat-nms*** LFTXRX L-Band Optical Link itself
- 110-240V A/C power
- A Computer running a Microsoft Windows operating system equipped with CD-ROM drive and Ethernet network card.
- A CAT5 crossover network cable or a Ethernet hub/switch and standard network cables to connect the LFTXRX and the computer.
- The CD-ROM shipping with the ***sat-nms*** LFTXRX.

Setting the chassis' IP parameters now is easily done within a few minutes.

1. First install a network cable between the LFTXRX chassis and your computer. If you have a crossover cable available, this is very easy: simply put the cable into the network connectors of computer and LFTXRX chassis. Without a crossover cable, you need to connect both, the computer and LFTXRX chassis to the same network hub or switch using two standard network cables. It is essential, that the computer and the LFTXRX chassis are connected to the same network segment, the configuration program is not able to find the LFTXRX chassis through routers or network switches.
2. Now power on your computer and connect LFTXRX chassis to the 110-240V A/C supply.
3. Insert the CD-ROM into the computer's drive and inspect it's contents through the 'My Computer' icon on your desktop. Double-click to the 'ChipTool.exe' program in the 'ChipTool' directory.
4. When the ChipTool program is running, type CTRL+F to make the program search the LFTXRX. The program shows a list containing at least one entry describing the actual network parameters of the LFTXRX.



5. The serial number shown in the first column of the list, must match the serial number printed on the processor's enclosure. If the list stays empty, the LFTXRX chassis is not connected properly. If there are more entries in the list, the configuration program has found other devices in this network segment which use the same technology.
6. Now type CTRL+I to open the IP configuration window of the program. In this form enter the processor's serial number, it's new IP address and network mask. If the LFTXRX later shall be operated through a router, enter the address of the router on the gateway field, otherwise leave this field blanc. Be sure, that the 'DHCP' mark is unchecked. Finally click to the 'Yes' button to set the new parameters at the LFTXRX chassis.



Now the IP configuration of the chassis is completed. You may finally want to test if the LFTXRX chassis is reachable now. Start your web browser and type the chassis' IP address into the URL field of the browser. The LFTXRX should reply with it's main page, provided that the chassis and your computer are configured for the same subnet.

2.4 Mechanical installation

The ***sat-nms*** LFTXRX enclosure is a standard 3HU 19" rack-mountable enclosure. Use slide bars to install the chassis, because the mounting angles will not be able to hold the chassis in the horizontal position. Fix the enclosure with 4 according screws to a 19" Rack. Don't forget to connect the "GND"-screw to the Rack.

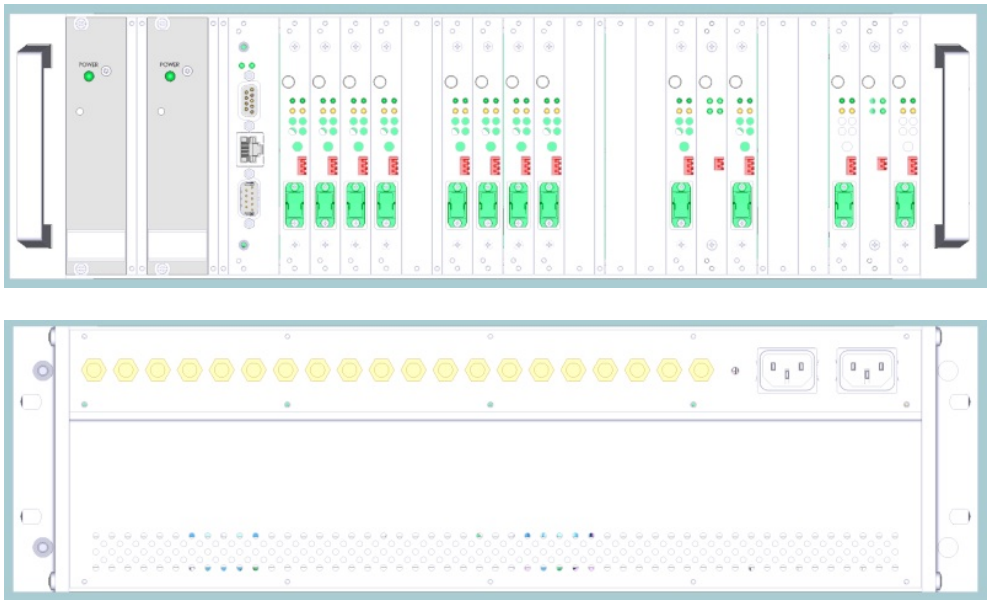
To ensure sufficient airflow for cooling the unit, we recommend to keep 1RU free space below and

above the unit. If you have not enough rack-space for meeting this requirement, call SatService to develop a suitable solution.

When planning the mechanical installation of the chassis, please consider that the connectors are placed at the front and the backside of the enclosure. Depending on the flexibility of the cables you are going to use, you will require about 10 centimetres space for cabling on both sides of the chassis.

2.5 Connecting the *sat-nms* LFTXRX

The connectors of the chassis are placed on the front and on the rear side. The Front side contains the fibre optic connectors and the L-Band test-ports, the rear side contains the corresponding L-Band In/Out connectors and also the the AC-power and Data-connectors.



When you connect the L-Band Optical Link chassis, please consider the following:

- J1.2 *LAN* is the Ethernet 10/100Base-T / RJ45 connector. Use a standard network cable to connect the LFTXRX to an Ethernet hub or switch. If you want to connect your computer and the unit directly without using a hub, you need a crossover cable for this with swapped RX/TX lines. To meet mentioned EMC standards, use double shielded twisted pair CAT7 S/FTP Network cable, e.g. DRAKA UC900 SS27 Cat.7 PUR. Take care, that cable shielding is connected properly.
- J1.1 *serial* is a standard 9-pin RS232 (DCE) SUB-D pin-connector. You may use a direct 9-pin cable to connect a PC to the LFTXRX. To meet mentioned EMC standards, use double shielded twisted pair CAT7 S/FTP Network cable, e.g. DRAKA UC900 SS27 Cat.7 PUR. Take care, that cable shielding is connected properly.
- J1.3 *Alarm* is a standard 9-pin SUB-D socket-connector. This connector contains the alarm contacts of the internal failure relays. To meet mentioned EMC standards, use double shielded twisted pair CAT7 S/FTP Network cable, e.g. DRAKA UC900 SS27 Cat.7 PUR. Take care, that cable shielding is connected properly.
- PS1 and PS2 are mains power-inputs. Only use IEC plugs with an earthing contact and protective earth connection to connect the power supplies. Do not forget to connect the "GND"-labelled screw to the PE potential.
- The input, output and test-port RF-connectors are all SMA/50Ohm female in the standard

configuration. 75Ohm F-type is available on special request. Use double shielded coaxial cables, e.g. RG223, only.

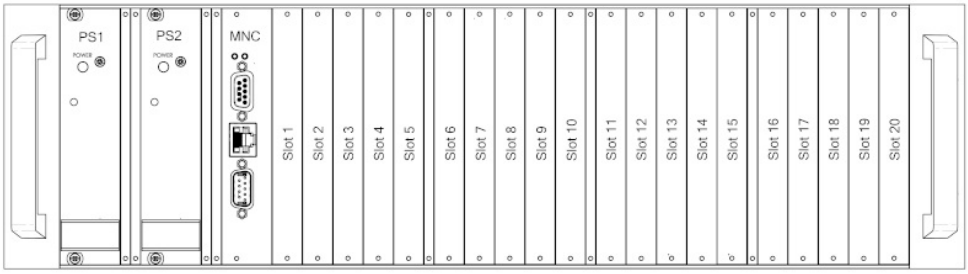
- The fibre optic connectors are E2000 or FC/APC types depending on the configuration. It is essentially to use single mode cables with 8° angled polish for proper function.

2.5.1 Optical receiver ,transmitter and switch cards

Attention: Optical Radiation!

If connected to a power supply, the LFTXRX provides invisible laser radiation. The source is class 3R Laser diode as defined in DIN EN 60825-1:2001-11 with P0=2mW, Lambda=1310nm. Never look into fibre-optical components like connectors or fibres. Use an infrared viewer, optical power meter or fluorescent screen for optical output verification.

It is possible to realize up to 20 optical links with one ***sat-nms*** LFTXRX chassis. Alternativ it is possible to plug in a ***sat-nms*** LFSW card, which allow to realize a rf redundancy switching. Please keep in mind that each ***sat-nms*** LFSW will need one slot in the chassis.



On the front side of the enclosure, you find 20 slots, where up to 20 cards can be placed in.

Read chapters Config Parameters and Setup Parameters for instructions how to use this configuration and how to configure the redundancy.

It is possible to place a LFRX, LFTX or LFSW card in every slot. To install the desired card, put it into the slide rail until the front plate of the card contacts the mounting rail. The card has to slide in smoothly. If not, pull the card out and try again. Otherwise the connectors on the card edge or on the backplane might be damaged. After that fix the card with the provided screws to ensure a proper contacting of the connectors on the LFRX, LFTX or LFSW card with the connectors on the backplane.

Now you have to configure the system after placing a LFRX, LFTX or LFSW card. How to do this, is described in chapter Config Parameters .

To release a card, open the screws with which the card is fixed at the mounting rail. Now turn in the screw into the screw thread beside to push the card out of its socket. After that you can pull the card out of the unit.

2.5.2 Power connectors and power supplies

Power connectors

At first, connect the screw, labelled with "GND" to Ground (e.g. to the 19"-Rack the chassis is mounted in).

After that connect the chassis to 90-240V A/C via IEC connectors. Use power cords with an earthing contact and protective earth connection only! The ***sat-nms*** LFTXRX is working with only one connected power supply as well, but we strongly recommend to use two different power supplies to ensure the maximum system availability. In case of one power supply breaking down, the system will still be working without interrupt.

Power supplies

The ***sat-nms*** LFTXRX frame is equipped with hot-swap power supply, Therefore the power supplies can be changed during the ***sat-nms*** LFTXRX frame is in operation. To change a power supply, always disconnect the mains of the power supply that has to be changed and wait at least 10s (for internal discharge). Open the 2 screws with which the power supply is mounted an pull the power supply, using the attached handle bar, out of the unit.

To put in a power supply, you have to do the same things in reverse chronology: Put the power supply into the slide rails, until the front plate contacts the mounting rail. After that fix the power supply with the provided screws to ensure a proper contacting of the connectors on the power supply with the connectors on the backplane.

ATTENTION: To avoid the possibility of an electrical shock, never handle with a power supply that is connected to mains!

2.5.3 DC and data connectors

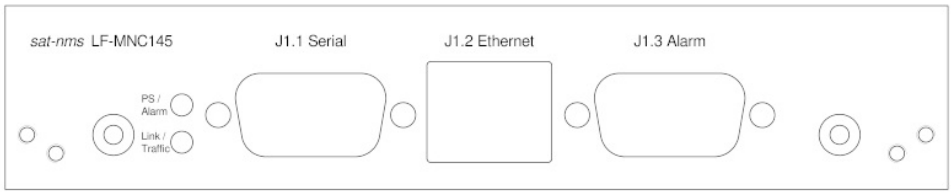
The Alarm and data connectors of the ***sat-nms*** LFTXRX chassis all are located at the front side of the enclosure. The figure below illustrates the location of the connectors and the pin out.

To meet mentioned EMC standards, use double shielded twisted pair CAT7 S/FTP Network cable, e.g. DRAKA UC900 SS27 Cat.7 PUR, for connecting network, serial and alarm interfaces. Ensure that the shield is connected properly.

The LED *PS/Alm* shows the presence of one or two power supply(ies) and the Alarm state of the Unit. The *LNK/Traffic* LED turns on, when there is some traffic on the LAN, the chassis is connected to.

To release the MNC board, open the screws with which the card is fixed at the mounting rail. Now turn in the screw into the screw thread beside to push the card out of its socket. After that you can pull the card out of the unit.

To install the MNC board again, put it into the slide rail until the front plate of the card contacts the mounting rail. Please pay attention: The board has to slide in smoothly. If not, pull the card out and try again. Otherwise the connectors on the MNC board or on the backplane might be damaged. After that fix the card with the provided screws to ensure a proper contacting of the connectors on the MNC board with the connectors on the backplane.



J1.1 Alarm connector

Dry alarm relay contacts represent a summary fault state of the unit. Both relays do switch parallel and show always the same state.

Pin	*Alarm contacts (DSUB-9 male)*	*Description*
1	NC1	closed if ok, open in fault state
2	COM1	common for fault relay 1
3	NO1	open if ok, closed in fault state
4	+5VDC internal	
5	GND internal	
6	NC2	closed if ok, open in fault state
7	COM2	common for fault relay 2
8	NO2	open if ok, closed in fault state
9	GND internal	

J1.3 Serial connector

Pin	*RS232 serial interface (DCE) (DSUB-9 female}*
1	not connected
2	TxD (output)
3	RxD (input)
4	not connected
5	GND
6	not connected
7	RTS
8	CTS
9	not connected

J1.2 Network Connector

Ethernet 10/100Base-T (RJ45)

2.5.4 RF connectors

On the rear side the in-/ out RF-connectors are placed. Depending, which card is placed in the corresponding slot, the connector is an in- or an output.

If e.g. in slot 1 a LFTX card is placed, the connector I/O 1 is a RF-input. If there is placed a LFRX-card, I/O 1 is a RF-output.

In the standard configuration all RF-connectors are SMA/ 50Ohm female connectors. If you need other connectors e.g. BNC or F or an 75Ohm impedance, contact SatService, we are able to customize the ***sat-nms*** LFTXRX.

See chapter, (50/75Ohm converter) , (1:4 splitter) or (dual coupler) for some options.

On the front side of every LFTX or LFRX card you can find a SMA-connector female labelled with *TPout -10dB* . Here it is possible to measure the RF Signal connected to the corresponding I/O-connector with an attenuation of approx. 10dB. This difference may vary due to different configurations of the ***sat-nms*** LFTXRX frame. On the LFTX card the attenuator is additionally taken into account (see block diagram).

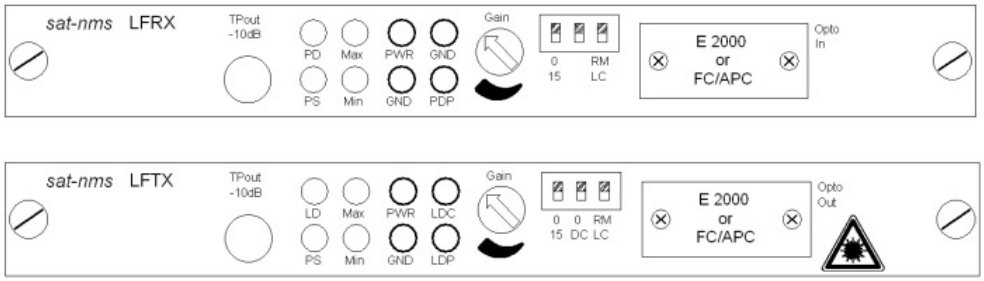
2.5.5 Optical connectors

ATTENTION: Optical Radiation!

If connected to a power supply, the ***sat-nms*** LFTXRX provides invisible laser radiation. The source is class 3R Laser diode as defined in DIN EN 60825-1:2001-11. P0=2mW, Lambda=1310nm. Never look into fibre-optical components like connectors or fibres. Use an infrared viewer, optical power meter or fluorescent screen for optical output verification.

Depending on the configuration of the LFTX- and the LFRX-cards, E2000 or FC/APC FOL-connectors are used. They are placed on the right side of the cards. Pay attention to the type of the connectors, only use single mode APC fibres with 8° angled polish. Otherwise the connectors or the fibres might be damaged.

Do not allow any dirt or foreign material to get into the optical connector bulkheads. This may cause damage to the polished optical connector end faces.



For details about the front panel operation of the ***sat-nms*** LFTX optical transmitter card and ***sat-nms*** LFRX optical receiver card please refer to the chapters Local operation LFRX Card and Local operation LFTX Card .

2.5.6 optional 75Ohm converter

The internal design of this unit is based on 50Ohm. To fit the ***sat-nms*** LFTXRX optical links to a 75Ohm system, internal 50/75Ohm converters with 75Ohm F-type connectors are available. Due to its low loss design, this option causes approx. 1dB attenuation and approx. 1dB negative slope over the hole L-Band. the internal DC bypass ensures the function of LNB power supply by an optical transmitter card.

2.5.7 optional 1:4 splitter 'LFRXv4'

The ***sat-nms*** LFTXRX might be optionally equipped with internal passive 1:4 RF-Splitters, called 'LFRXv4'. These splitters are designed for dividing the received RF signal equally to 4 output ports. They also might be used as passive combiners multiplexing different signals to an optical transmit module. This option is available for L-Band only. Signals below 950MHz will be blocked by this option and are not suitable for 10MHz or 50MHz...2150MHz broadband signals. The 'LFRXv4' Splitter option causes approx. 12dB attenuation and approx. 1dB negative slope over the hole L-Band. The 12dB attenuation is caused by additional internal attenuation, therefore unused ports do not have essentially to be terminated. A special Version with lower attenuation is available on request.

Up to 10 'LFRXv4' might be installed to one ***sat-nms*** LFTXRX frame. It is also possible to equip only some slots with this option to ensure maximum flexibility.

The splitter outputs come with 50Ohm SMA as standard, 75Ohm F-type connectors are available on request.

2.5.8 optional dual coupler 'LFC10TX' and 'LFC10RX'

As an alternative for the optional 1:4 splitters (see chapter above) dual couplers are available. These couplers provide the RF signal and additional 2 coupler outputs for e.g. monitoring purposes. The mainline has approx. 1.5dB attenuation with approx. 0.5dB negative slope over the whole L-Band. The 2 coupler outputs provide the mainline signal with approx. 10.5dB attenuation and the typical coupler curve with approx. 2dB slope over the whole L-Band. Signals below 950MHz will be blocked by this option and are not suitable for 10MHz or 50MHz...2150MHz broadband signals. The internal DC bypass on the mainline ensures the function of LNB power supply by an optical transmitter card. The coupler outputs are DC blocked.

Due to the directional coupler design, different coupler types are available for transmit and receive modules. 'LFC10TX' is designed to be used together with an optical transmit module, 'LFC10RX' is designed to be used together with an optical receive module. Depending on your

system design, both modules can be installed even in a mix configuration to your ***sat-nms*** LFTXRX frame.

2.6 Configuring the Optical Links

This chapter gives a short overview about some configuration parameters you want to set after you have installed the ***sat-nms*** LFTXRX. A complete reference of all available setup parameters is given in chapter Setup Parameters .

Setup / Config Parameter

The following settings have to be done or verify before the unit is connected to the network and to the RF interface:

- Set in the 'Setup' menu the Date/ Time und the Note to a specific Unit Name
- In the 'Config' menu define the 'Card Type' which is installed in each slot.
- Check the LNB-DC Setting to avoid external unit damages.
- If a switch card installed define the corrosponding connected slot card at No. Card Pas A and B. Make sure that the RF-interconnection is done in the same way.
- Set the Display calibration values 'RF Offset' and 'Diode RFOffset' for the RX and TX cards (seeTestreport of the card).

Please refer to Theory of operation for more detailed information about the Protection Mode configuration.

2.7 Line-up the Optical Links

Before lining up the optical links, you have to take care that the input signals do not exceed the maximum levels (see Specifications on last page of this document)!

Start with 0dB gain settings on LFRX and LFTX card. In this configuration you should have approx. +2..-2dB gain over the whole optical link. Due to variance of laser- and receive-diodes you might have some gain-spreading between different links. Depending on configuration of your ***sat-nms*** LFTXRX frame you might have additionally more attenuation:

option	option name	additional attenuation
1:1 redundant switch	LFSW	3dB each frame
50/75Ohm converter	LFCH...MNC75	0.7dB each frame
1:4 splitter	LFRXv4	12.5dB
dual coupler	LFC10TX or LFC10RX	1.5dB

When connecting an occasional use antenna, point your dish to the satellite with the highest total power. This is to ensure not to generate a maximum level fault during normal operation.

Now increase the gain setting of the LFTX transmitter card as long as a max. level fault is displayed. Now decrease gain setting 2..3dB.

After that, adjust the gain setting in the LFRX receiver card to adapt the signal strength to your receiver equipment. For sure you have to watch out not to exceed the alarm level. If a RF max. level is displayed on the LFRX card, decrease gain setting until alarm disappears.

3 Operation

The ***sat-nms*** LFTXRX Optical Link is designed to be controlled over a network link using a standard web browser. This means in practice, that the user interface to the unit appears in your browser window after you type in the chassis IP address in the address field of the browser program.

Operating the ***sat-nms*** LFTXRX is mostly self-explanatory.

3.1 The Web-based User Interface

After having connected the LFTXRX chassis to a power supply and set the IP address, you can access the user interface. To do this, start your favourite web browser program (Internet Explorer, Netscape Navigator, Opera or what else Program you prefer). At the address field, where you normally enter the URL of a web page you want to see, type in the IP address of the ***sat-nms*** LFTXRX chassis you want to control.

The LFTXRX shows a web page consisting of a navigation bar at the left side of the browser window and the actual readings of the fibre optical links in the main part of the window.

The navigation bar at the left contains six buttons which build the main menu:

- State --- This button switches back to the main page you already see when you connect to the unit. This page displays the actual readings of the chassis.
- Config --- By clicking to this button you switch to the 'Configuration' page where you can view and change the common operational settings of the optical links for the chassis.
- Alarm log --- The alarm log shows all occurred alarms with time and date.
- Setup --- This button switches to the 'Setup' page which lets you inspect or change less common parameters which usually are set only once to adapt the LFTXRX to it's working environment.
- Info --- This shows a table with information like the serial number of the device or the revision ID and compilation date of the software.
- Help --- Clicking to this button shows the on-line version of this user manual

3.2 State: Display Readings

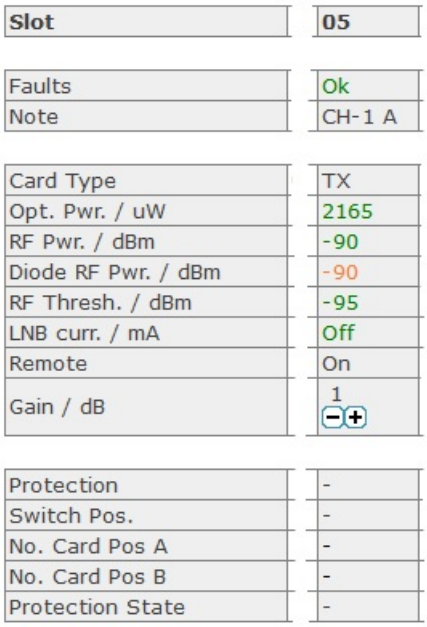
After entering the IP-address to the browser the local chassis parameter will be displayed. With pressing the *State* button, all the parameters of the chassis are displayed. On the top of the page, you can read the name of the unit, that can be set on the 'Setup' page. Also you can see the state of the 2 power supplies and the frame temperature.

Underneath all the measured parameters of the LFTX or LFRX cards are displayed for every slot. In the first line, you can read the number of the slot. Followed by the summary state 'Faults' and the induvidual 'Note' per Slot. The Name of every slot can be changed in the 'Config' menu. As next the Card Type is displayed, whether a LFRX-, a LFTX-, a LFSW´- or no card is placed to the corresponding slot. The next fields 'RF Pwr', 'Diode RF Pwr.', 'RF Threshold', 'LNB Current' define the measurement values of each slot. The colour code of the values define the actual state. The following states can be displayed:

Parameter Name	Description

green	All parameters are within the given range, everything is ok.
red	One or more parameters is out of range, fault state.
orange	One or more parameters is out of range, but defined as warning state.

3.2.1 Reading of LFRX receiver card

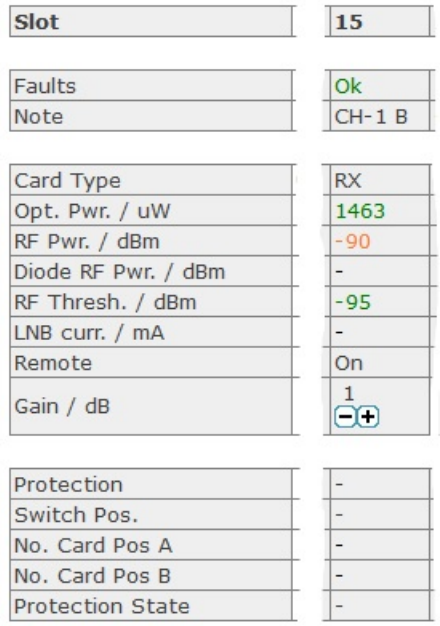


If a LFRX card is installed, you can read the following parameters:

Parameter Name	Description
Opt. Pwr	This parameter shows the received optical power. The colour code of this parameter tells you, if the value is in the range (green) or not (red). The values are given by the LFRX card and can not be changed. Alarm threshold values are: 0.22mW as low limit, 2.5mW as high limit. This is the first of 2 redundancy switching criteria (if the redundancy switching option is installed and activated). When this value falls below 0.22mW, redundancy switching will be initiated
RF Pwr	This value shows the output RF power of the LFRX card. The colour code of this parameter tells you if the value is in range (green) or not (orange). The values are given by the LFRX card and can not be changed. Alarm threshold values are: RFmin typ. -31dBm (-38...-28dBm), RFmax typ. -5dBm (-10...-3dBm) The measurement range is approx. -45...0dBm (range varies by changing RF offset on Setup page, provided values are valid for RF offset = -42dB)
	The RF threshold is a parameter that can bet set to any value >=-99dBm in the configuration menu. If the current RF power is below the RF threshold it

RF Thresh.	shows a (red) value to indicate a fault. If the RF power is above the limit it shows a (green) value. Software-limits configuration: <-90dBm will disable the Threshold Alarm, <-95dBm will also disable the RF-card Alarm/Warning (Hardware Limit Card) at the Web-page and the remote interface. This is the second of 2 redundancy switching criteria (if the redundancy switching option is installed and activated). When this value falls below configured threshold value, redundancy switching will be initiated.
Remote	It is possible to change some settings of the LFRX card remote (e.g. via web browser interface) or local (only on the front panel of the card). The current state of the hardware remote/local switch on the corresponding card is shown here.
Gain	An integrated attenuator makes it possible to attenuate the RF-signal in 1dB-steps from -16 to +15dB. The selected value is displayed here. If the parameter 'Remote' is 'ON', you can easily change the attenuation value by clicking on the '+' '-' buttons. If the parameter 'Remote' is 'OFF' it is not possible to change this parameter by remote control.

3.2.2 Reading of LFTX transmitter card



If a LFTX card is installed, you can read the following parameters:

Parameter Name	Description
Opt. Pwr	This parameter shows the received optical power. The colour code of this parameter tells you, if the value is in the range (green) or not (red). The values are given by the LFTX card and can not be changed.
	This value shows the input RF power of the LFTX card. The measurement

RF Pwr	range is approx. -45...0dBm (range varies by changing RF offset on Setup page and gain setting. Provided values are valid for RF offset = -61dB and gain setting = 0dB).
Diode RF Pwr	This value shows the input RF power of the LFTX cards to the Laser-diode. The colour code of this parameter tells you if the value is in range (green) or not (orange). The values are given by the LFTX card and can not be changed.. If a 'Warning' is displayed, the summary state of this slot is nevertheless 'OK', because this is not a fault. Alarm threshold values are: RFmin typ. -23dBm (-25...-20dBm), RFmax typ. -10dBm (-11...-5dBm)
RF Thresh.	The RF threshold is a parameter that can bet set to any value >=-99dBm in the configuration menu. If the current RF power is below the RF threshold it shows a (red) value to indicate a fault. If the RF power is above the limit it shows a (green) value. Software-limits configuration: <-90dBm will disable the Threshold Alarm, <-95dBm will also disable the RF-card Alarm/Warning (Hardware Limit Card) at the Web-page and the remote interface. This is the second of 2 redundancy switching criteria (if the redundancy switching option is installed and activated). When this value falls below configured threshold value, redundancy switching will be initiated.
LNB curr.	If the chassis is configured to supply LNCs, the actual current is shown here for every slot. The current limits can be changed on the 'Config' menu. If the current is within this range, a green 'OK' is shown, if the value is out of the range, a red 'FLT' is displayed here.
Remote	It is possible to change some settings of the LFTX card remote (e.g. via web browser interface) or local (only on the front panel of the card). The current state of the hardware remote/local switch on the corresponding card is shown here.
Gain	An integrated attenuator makes it possible to attenuate the RF-signal in 1dB-steps from -16 to +15dB. The selected value is displayed here. If the parameter 'Remote' is 'ON', you can easily change the attenuation value by clicking on the '+' '-' buttons. If the parameter 'Remote' is 'OFF' it is not possible to change this parameter by remote control.

3.2.3 Reading of LFSW switch card

Slot	09
Faults	Ok
Note	SW CH1
Card Type	SW
Opt. Pwr. / uW	-
RF Pwr. / dBm	-
Diode RF Pwr. / dBm	-
RF Thresh. / dBm	-
LNB curr. / mA	-
Remote	On
Gain / dB	-
Protection	ON
Switch Pos.	B
No. Card Pos A	5
No. Card Pos B	15
Protection State	

If a LFSW card is installed, you can read the following parameters:

Parameter Name	Description
Remote	It is possible to change some settings of the LFTX card remote (e.g. via web browser interface) or local (only on the front panel of the card). The current state of the hardware remote/local switch on the corresponding card is shown here.
Protection	This parameter shows if the protection is active (ON) or (OFF). If the protection is ON, the card will switchover to the standby card if a fault occurs in the active card.
Switch Position	The switch postion displayes the actual position setting A or B path.
No. Card Pos A	Display the Slot number of switch position A. This is a 'Config Parameter' in the software but also the hardware interconnection from the switch connector A to the slot with the defined number have to be done.
No. Card Pos B	Display the Slot number of switch position B. This is a 'Config Parameter' in the software but also the hardware interconnection from the switch connector B to the slot with the defined number have to be done.
Protection State	The protection state displays, if a redundancy switching has been performed with a button labled 'switched'. By pressing the button the state can be reseted.

3.2.4 Reading of empty slots

Slot	02
Faults	
Note	-
Card Type	non
Opt. Pwr. / uW	
RF Pwr. / dBm	
Diode RF Pwr. / dBm	
RF Thresh. / dBm	
LNB curr. / mA	
Remote	
Gain / dB	
Protection	
Switch Pos.	
No. Card Pos A	
No. Card Pos B	
Protection State	

If a slot is empty, besides slot number and slot name no parameters are displayed, the slot-summary-state is always 'OK'.

3.3 Configuration of operational parameters

The page 'Config' contains the operational parameters. Operational parameters are those which are assumed to be changed more frequently than the installation parameters on the Setup page.

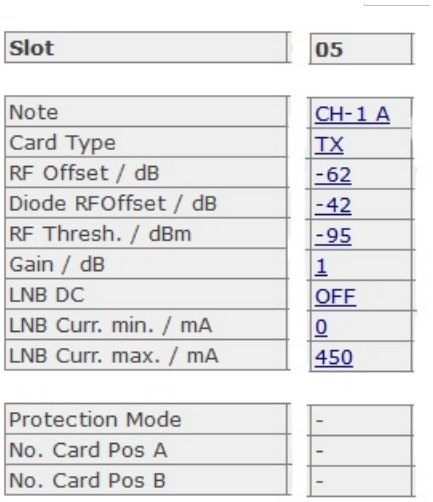
The page displays a table with the parameters actually set. Each parameter value is a hyper-link to a separate page which lets you change this parameter. This parameter change page shows the actual parameter setting either in an entry field or in a drop down box. You may change the parameter to the desired value and then click to the 'Submit' button to pass the changed value to the LFTXRX. The receiver automatically returns to the settings page when the parameter has been changed.

To cancel a parameter modification you already started, either use the 'Back' button of you web browser or click to the 'Config' button on navigation bar. Both returns to the config page without changing the parameter you edited.

You have to change the parameters for every Slot.

At first you have to set the parameter "Card". Choice "NONE" if no card is placed, "RX" if a LFRX card is placed, "TX" if a LFTX card or "SW" if a LFSW card is placed in the corresponding slot.

3.3.1 Configuration of LFRX receiver card

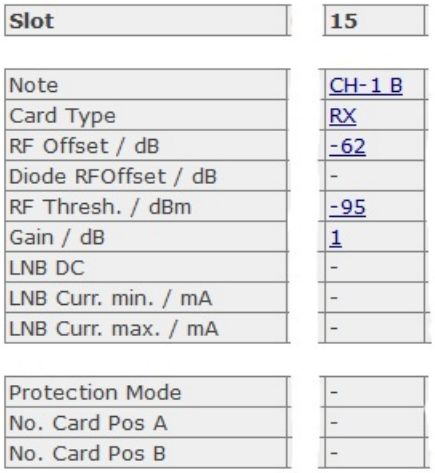


Slot	05
Note	CH-1 A
Card Type	TX
RF Offset / dB	-62
Diode RFOffset / dB	-42
RF Thresh. / dBm	-95
Gain / dB	1
LNB DC	OFF
LNB Curr. min. / mA	0
LNB Curr. max. / mA	450
Protection Mode	-
No. Card Pos A	-
No. Card Pos B	-

If "RX" is chosen as card type, you can change the following parameters:

Parameter Name	Description
Note	You can give every slot a name with up to 18 characters. Click on the Hyperlink, a page to change this parameter will be opened. Type in here the desired slot name and press the submit button.
Card Type	To change the card-type, click on the field and a new page will be opened. Now choose the desired parameter (RX, TX, SW, NONE) from the drop-down-menu and press the submit-button to pass the changed parameter to the chassis.
RF Offset	This parameter is a factory setting, that has not to be changed by the customer. Depending on the LFTXRX chassis configuration the card has different internal RF attenuation. This value defines the offset to guarantee that the displayed value matches the real values at the I/O-RF-connectors (without options about -42).
RF Thresh.	The RF threshold defines the RF fault level. If the RF level under-runs the threshold, the RF threshold alarm is set. To change the value click on it and enter the new RF threshold and press the submit button. Software-limits configuration: <-90dBm will disable the Threshold Alarm, <-95dBm will also disable the RF-card Alarm/Warning (Hardware Limit Card) at the Web-page and the remote interface.
Gain	An integrated attenuator makes it possible to attenuate the RF-signal in 1dB-steps from -16 to +15dB. The selected value is displayed here. If the parameter 'Remote' is 'ON', you can easily change the attenuation value by clicking on the Hyperlink, a page to change this parameter will be opened. Select in here the desired gain and press the submit button.

3.3.2 Configuration of LFTX transmitter card



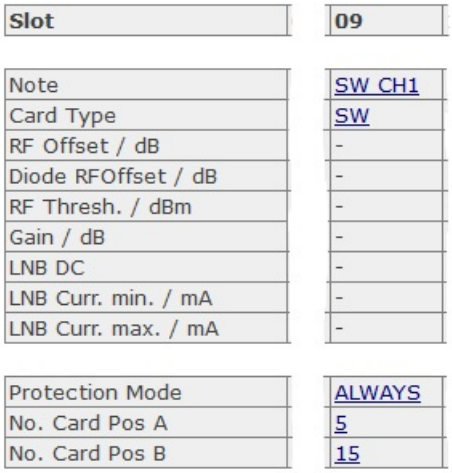
Slot	15
Note	CH-1 B
Card Type	RX
RF Offset / dB	-62
Diode RFOffset / dB	-
RF Thresh. / dBm	-95
Gain / dB	1
LNB DC	-
LNB Curr. min. / mA	-
LNB Curr. max. / mA	-
Protection Mode	-
No. Card Pos A	-
No. Card Pos B	-

If "TX" is chosen as card type, you can change the following parameters:

Parameter Name	Description
Note	You can give every slot a name with up to 18 characters. Click on the Hyperlink, a page to change this parameter will be opened. Type in here the desired slot name and press the submit button.
Card Type	To change the card-type, click on the field and a new page will be opened. Now choose the desired parameter (RX, TX, SW, NONE) from the drop-down-menu and press the submit-button to pass the changed parameter to the chassis.
RF Offset	This parameter is a factory setting, that has not to be changed by the customer. Depending on the LFTXRX chassis configuration the card has different internal RF attenuation. This value defines the offset to guarantee that the displayed value matches the real values at the I/O-RF-connectors (without options about -62).
Diode RF Offset	This parameter is a factory setting, that has not to be changed by the customer. Depending on the LFTXRX chassis configuration the card has different internal RF attenuation. This value defines the offset to guarantee that the displayed value matches the real values at the I/O-RF-connectors (without options about -42).
RF Thresh.	The RF threshold defines the RF fault level. If the RF level under-runs the threshold, the RF threshold alarm is set. To change the value click on it and enter the new RF threshold and press the submit button. Software-limits configuration: <-90dBm will disable the Threshold Alarm, <-95dBm will also disable the RF-card Alarm/Warning (Hardware Limit Card) at the Web-page and the remote interface.
Gain	An integrated attenuator makes it possible to attenuate the RF-signal in 1dB-steps from -16 to +15dB. The selected value is displayed here. If the parameter 'Remote' is 'ON', you can easily change the attenuation value by clicking on the Hyperlink, a page to change this parameter will be opened. Select in here the desired gain and press the submit button.

LNB DC	LFTX cards are able to power LNCs with 15VDC. This parameter switches the 15VDC to the on or off.
LNB Curr.Min	This parameter defines the LNB current minimum level. In case of under-running this level (e.g. if a cable break occurred) the LNB current alarm will be set.
LNB Curr.Max	This parameter defines the LNB current maximum level. In case of over-running this level (e.g. if a short-circuit occurred), the LNB current alarm will be set.

3.3.3 Configuration of LFSW switch card



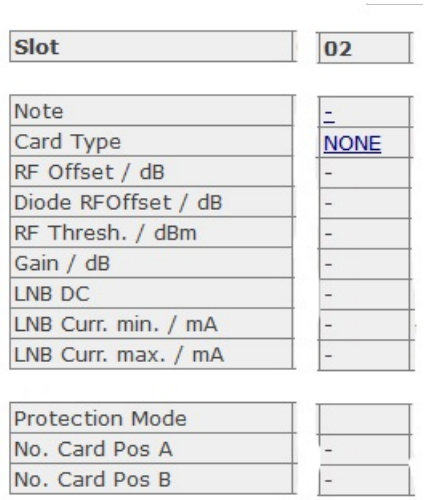
Slot	09
Note	SW CH1
Card Type	SW
RF Offset / dB	-
Diode RFOffset / dB	-
RF Thresh. / dBm	-
Gain / dB	-
LNB DC	-
LNB Curr. min. / mA	-
LNB Curr. max. / mA	-
Protection Mode	ALWAYS
No. Card Pos A	5
No. Card Pos B	15

If "SW" is chosen as card type, you can change the following parameters:

Parameter Name	Description
Note	You can give every slot a name with up to 18 characters. Click on the Hyperlink, a page to change this parameter will be opened. Type in here the desired slot name and press the submit button.
Card Type	To change the card-type, click on the field and a new page will be opened. Now choose the desired parameter (RX, TX, SW, NONE) from the drop-down-menu and press the submit-button to pass the changed parameter to the chassis.
Protection Mode	This parameter defines the Protection Mode following settings are possible: 'ONCE' if redundancy switching occours the protection will be set to OFF. 'ALWAYS' the redundancy is always active.
No. Card Pos A	Here the Slot number of switch position A can be defined. Keep in mind that also the hardware interconnection from the switch connector A to the slot with the defined number have to be done.
No. Card Pos B	Here the Slot number of switch position B can be defined. Keep in mind that also the hardware interconnection from the switch connector B to the slot with

	the defined number have to be done.

3.3.4 Empty slots



Slot	02
Note	-
Card Type	NONE
RF Offset / dB	-
Diode RFOffset / dB	-
RF Thresh. / dBm	-
Gain / dB	-
LNB DC	-
LNB Curr. min. / mA	-
LNB Curr. max. / mA	-
Protection Mode	
No. Card Pos A	-
No. Card Pos B	-

If "NONE" is chosen as card type, you can change the following parameters:

Parameter Name	Description
Note	You can give every slot a name with up to 18 characters. Click on the Hyperlink (in the picture beyond Rx1), a page to change this parameter will be opened. Type in here the desired slot name and press the submit button.
Card	To change the card-type, click on the field and a new page will be opened. Now choose the desired parameter (RX, TX, NONE) from the drop-down-menu and press the submit-button to pass the changed parameter to the chassis.

3.4 General Setup

The page 'Setup' contains the ***sat-nms*** LFTXRX installation parameters. Installation parameters are those which are assumed to be changed less frequently than the operational parameters on the configuration page .

The page displays a table with the parameters actually set. Each parameter value is a hyper-link to a separate page which lets you change this parameter. This parameter change page shows the actual parameter setting either in an entry field or in a drop down box. You may change the parameter to the desired value and then click to the 'Submit' button to pass the changed value to the LFTXRX. The receiver automatically returns to the settings page when the parameter has been changed.

To cancel a parameter modification you already started, either use the 'Back' button of you web browser or click to the 'Config' button on navigation bar. Both returns to the config page without changing the parameter you edited.

The table below lists the settings provided by this page.

Parameter Name	Description
General	
Note	Enter here the Name of the LFTXRX chassis. This name will be displayed on the top of the State page.
Date/ Time	If you want to set the Date and/ or the Time, type the actual Date and Time in the following syntax: YYYY-MM-DD HH:MM:SS It is not possible to change only one of both parameters. The ***sat-nms*** LFTXRX real time clock is backed up by a gold-cap capacitor. The gold cap supplies the RTC chip with power for several days if the main power is missing. If the off time periode to long the Date/ Time have to be set again.
Refresh rate	Here you can configure the automatic refresh time for the Master Ch. and the Slave Ch. pages. You can choose between 1s, 3s, 5s and 10s.
RS232 Baud rate	select here the bit rate for the RS232 Interface. You can choose between 9600, 19200, 38400, 57600, 115200 baud
RS232 Address	This parameter defines the communication address to be used with the serial interface. You may select an address 'A' .. 'G' for the packet mode communication protocol or 'NONE' to switch the communication mode to a plain text protocol.
SNMP Configuration	
Read Community	Sets the SNMP community string expected for read access. The default is 'public'.
Write Community	Sets the SNMP community string expected for write access. The default is 'public'.
Trap Community	Sets the SNMP community string sent with traps. The default is 'public'.
Trap Destination IP 1	Enter the trap destination IP address (dotted quad notation) to make the unit sending traps by UDP to this host. Setting the parameter to 0.0.0.0 disables the trap generation.
Trap Destination IP 2	Enter the trap destination IP address (dotted quad notation) to make the unit sending traps by UDP to this host. Setting the parameter to 0.0.0.0 disables the trap generation.
Trap Destination IP 3	Enter the trap destination IP address (dotted quad notation) to make the unit sending traps by UDP to this host. Setting the parameter to 0.0.0.0 disables the trap generation.
Trap Destination IP 4	Enter the trap destination IP address (dotted quad notation) to make the unit sending traps by UDP to this host. Setting the parameter to 0.0.0.0 disables the trap generation.
System Location	The unit replies to MIB-II sysLocation requests with the text entered at this place.

System Contact	The unit replies to MIB-II sysContact requests with the text entered at this place.
Access Control	
User password	Here you can define the password for the 'user' login. Default password is 'user'. When you are logged in as 'user' you are only able to change the parameters on the 'Master Ch.' And the 'Slave Ch.' page. All the other parameters can only be changed when you are logged in as 'admin'
Admin password	Here you can define the password for the 'admin' login. Default password is 'admin'. When you are logged in as "admin" you are only able to change all the parameters of the unit.

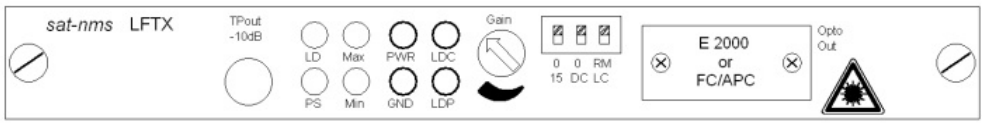
3.5 Local operation LFTX, LFRX, LFSW Card

All available cards can also local at the frontpanle controlled by setting the RM/LC DIP-switch in the *LC* position.

Please keep in mind that, if the switch is in the *LC* position, it is not possible, to change the parameters of this card via remote Interface (IP, RS232, SNMP). If you switch to local the local setting of the gain, DC out, switch position will taking in acount. If you switch back to remote the local settings will transfer to the MNC settings.

3.5.1 Local operation LFTX Card

The following picture shows you the front view of a LFTX card.



Depending on the card configuration, the 'Opto Out' connector is an E2000 or a FC/APC connector. Connect here the optical fibre to transmit the optical signal.

The following indicator LED's are located on the cards front panel:

Parameter	Description
LD	This (green) LED shows the state of the TX laser diode. The LED turns on, if the laser diode is working.
PS	The (green) PS-LED displays the power supply state of the card. The LED is on, if the power supply of the card is working.
Max	The (yellow) Max-LED turns on, if the RF input level is above the recommended level. RFmax Alarm level: typ. -10dBm (-11...-5dBm)
Min	The (yellow) Max-LED turns on, if the RF input level is below the recommended level. RFmin Alarm level: typ. -23dBm (-25...-20dBm)

You have the possibility to change the following parameters:

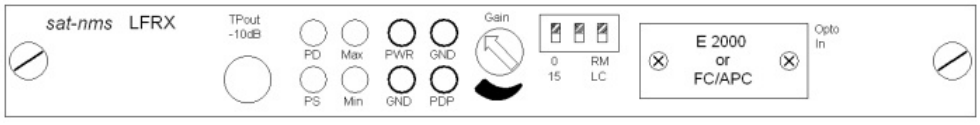
Parameter	Description
Gain	An integrated attenuator makes is possible to attenuate the RF-input-signal in 1dB-steps from 0 to 31dB. This switch has 16 steps. Use the *0..15* switch to select the attenuation range to 0-15dB or 16-31dB.
0..15	By setting this switch, you define the range of attenuation, that can be set by the gain switch. In the *0* position, it is possible to set the attenuator from 0-15dB, in the *15* position, the attenuation value can be set from 16-31dB.
0..DC	If your card is equipped with this functionality, you can switch here the 15VDC on and off to supply a LNC connected to the RF in of this slot. In the *0* position of the switch, 15VDC is off, in the *DC* position, the 15VDC is on.
RM/LC	This DIP-switch defines, if the card is controlled remote *RM* or local *LC* . If the switch is in the *LC* position, it is not possible, to change the parameters of this card via remote Interface (IP, RS232, SNMP) or via the front panel keyboard of the LFTX/RX chassis.

Additionally you can measure the following parameters:

Parameter	Description
TPout -10dB	The testport gives you the opportunity to measure the RF-Level on the Front panel. The Signal, that you can measure here is about 10dB lower than the output signal on the back side of the LFTX/RX chassis. This difference may vary due to optional configurations integrated to the ***sat-nms*** LFTX/RX Frame (e.g. redundancy switching, 1:4 splitter, 50/75 converter)
PWR	Here you can measure the level of the RF power. The scaling is 50mV/dB
GND	Reference Ground for the PWR, LDC and LDP measurement.
LDC	Here you can measure the current consumption of the laser diode. 100mV relates to 10mA.
LDP	Here you can measure the optical power. 100mV relates to 100uW.

3.5.2 Local operation LFRX Card

The following picture shows you the front view of a LFRX card.



Depending on the card configuration, the 'Opto IN' connector is an E2000 or a FC/APC connector. Connect here the optical fibre to transmit the optical signal.

The following indicator LED's are located on the cards front panel:

Parameter	Description

PD	This (green) LED shows the state of the RX Pin diode. The LED turns on, if the optical input is in range.
PS	The (green) PS-LED displays the power supply state of the card. The LED is on, if the power supply of the card is working.
Max	The (yellow) Max-LED turns on, if the RF output level is above the recommended level.
Min	The (yellow) Max-LED turns on, if the RF output level is below the recommended level.

You have the possibility to change the following parameters:

Parameter	Description
Gain	An integrated attenuator makes is possible to attenuate the RF-input-signal in 1dB-steps from 0 to 31dB. This switch has 16 steps. Use the *0..15* switch to select the attenuation range to 0-15dB or 16-31dB.
0..15	By setting this switch, you define the range of attenuation, that can be set by the gain switch. In the *0* position, it is possible to set the attenuator from 0-15dB, in the *15* position, the attenuation value can be set from 16-31dB.
RM/LC	This DIP-switch defines, if the card is controlled remote *RM* or local *LC* . If the switch is in the *LC* position, it is not possible, to change the parameters of this card via remote Interface (IP, RS232, SNMP) or via the front panel keyboard of the LFTX/RX chassis.

Additionally you can measure the following parameters:

Parameter	Description
TPout - 10dB	The testport gives you the opportunity to measure the RF-Level on the Front panel. The Signal, that you can measure here is about 10dB lower than the output signal on the back side of the LFTX/RX chassis. This difference may vary due to optional configurations integrated to the ***sat-nms*** LFTX/RX Frame (e.g. redundancy switching, 1:4 splitter, 50/75 converter)
PWR	Here you can measure the level of the RF power. The scaling is 50mV/dB
GND	Reference Ground for the PWR, LDC and LDP measurement.
PDP	Here you can measure the optical power. 100mV relates to 100uW.

3.5.3 Local operation LFSW Card

The following picture shows you the front view of a LFSW card.

The following indicator LED's are located on the cards front panel:

Parameter	Description
PS	The (green) PS-LED displays the power supply state of the card. The LED is on, if the power supply of the card is working.
LC	This (yellow) LED shows the state of the Remote Local setting. The LED turns on, if the card is in local.
A	The (green) LED turns on, if the RF switch in postion A.
B	The (green) LED turns on, if the RF switch in postion B.

You have the possibility to change the following parameters:

Parameter	Description
A/B	At local operation the Dip-Switch define the position of the RF-Switch A or B.
RM/LC	This DIP-switch defines, if the card is controlled remote *RM* or local *LC* . If the switch is in the *LC* position, it is not possible, to change the parameters of this card via remote Interface (IP, RS232, SNMP) or via the front panel keyboard of the LFTX/RX chassis.

Additionally you can measure the following parameters:

Parameter	Description
TPout	The testport gives you the opportunity to measure the RF-Level of the standby link.

4 Remote Control

The ***sat-nms*** LFTXRX L-Band Optical Link chassis may be controlled remotely by a monitoring and control application either through the TCP/IP interface or through a serial RS232 interface. Both communication methods use the same commands and parameters, however, there are different frames around each message depending communication method used. The third method is SNMP.

Controlling the device from the web interface, the TCP/IP remote control interface, the SNMP interface or via the serial interface is completely equal, commands may sent to any interface at any time, the LFTXRX will use the parameter it receives last.

4.1 General command syntax

The LFTXRX knows a number of parameters, each identified by a parameter name. To set a certain parameter to a new value, a message:

name=value

has to be sent to the device. The LFTXRX interprets this command, checks the range of *value* , sets the internal parameter and then answers:

name=value

The *value* in the reply is the value actually recognized by the device. For instance, if the requested value was out of range, the replied (and internally used) value is limited to the applicable minimum or maximum.

To read a parameter from the LFTXRX, instead of a new parameter value a question mark is sent:

name=?

The device replies the actual value in a complete message:

name=value

A complete list of the parameter the ***sat-nms*** LFTXRX knows is shown later in this document in chapter Parameter list . Below, some common rules applying to the remote control message syntax are summarized.

- Parameter names always are of lower case letters, most of them are four characters long.
- Non-numeric parameter values always are written in upper case.
- Numeric (floating point) values may be specified with an arbitrary precision, however the device will reply only a fixed number of places. The LFTXRX recognizes a decimal point ('.'), numbers must not contain any commas.
- There must not be any white space in front or after the '=' in a message.
- If the command/query is not of the form **name=value** or **name=?** , the LFTXRX replies the message **?SYNTAX** .
- If the message syntax is OK, but contains an unknown parameter name is used, the reply is **?UNKNOWN**
- Numeric parameters are cut to the limits defined for this particular parameter.
- Misspelled choice values cause the LFTXRX to set the first value of the choice list.
- Assigning a value to a read-only parameter will cause no fault, however the LFTXRX will overwrite this parameter immediately or some seconds later with the actual value.

4.2 The TCP/IP remote control interface

Controlling the ***sat-nms*** LFTXRX Optical Links through the network is done by means of HTTP GET requests. Setting parameter values or querying readings or settings, all is done by requesting HTTP documents from the unit. The message *to* the LFTXRX thereby is coded into the URL as a CGI form parameter. The device replies a one line document of the MIME type 'text/plain'.

The document name for remote control is **/rmt** , hence (assuming the LFTXRX is listening to the IP address 10.0.0.1), requesting a document with the URL

```
http://10.0.0.1/rmt?sver=?
```

will let the LFTXRX reply the software version in a one line text document:

sver=1.012 2007-12-01

This way all parameters may be queried or set, you may use your favourite web browser to try out the remote control of the LFTXRX manually.

4.3 The RS232 remote control interface

Beside the network interface, the ***sat-nms*** LFTXRX also provides an RS232 serial port which can be used to control the device remotely. Depending on the device address set, the LFTXRX either runs framed protocol with start/stop characters and checksum or it provides a dumb terminal interface. The RS232 interface operates by default at 9600 baud, no parity, 8 data bits, one stop bit.

You can configure the baud rate on the front panel.

If an address 'A' .. 'G' is selected , the LFTXRX expects each message it receives to be packed into a frame as described below.

char #	***example***	***description***
1	{	start character, always ' {'
2	A	device address (A..G)
3	t	first character of the message body
.	m	message body ...
.	p	..
.	0	..
.	=	..
n-1	?	last character of the message body
n .tc}	end character, always '} '	
n+1	.	checksum

The checksum byte is calculated using an algorithm as implemented by the following formula:

$$\text{sum} = 32 + \left(\sum_{i=1}^{n} \langle \text{byte}[i] - 32 \rangle \right) \text{ modulo } 95$$

This protocol type is known as *MOD95*- or *Miteq protocol* . The LFTXRX also packs it's reply in a protocol frame as described above. incomplete frames, checksum errors or address mismatches let the device ignore the message. The time between the characters of a message must be less than 5 seconds or the device will treat the message as incomplete.

If the LFTXRX is set to the device address 'NONE', it uses a simple line protocol instead of the framed protocol described above. Messages sent to the device have to be terminated with a carriage return character (ASCII 13), the device terminates replies with a CR/LF pair (ASCII 13/10). There is no echo for characters entered, hence this protocol easily may be used for computer based remote control.

4.4 SNMP Control

The ***sat-nms*** LFTXRX contains an SNMP agent listening at UDP port 161. The SNMP agent provides a common subset pf the MIB-II system / interface parameters and gives full access to the remote control capabilities of the LFTXRX with a number of MIB objects placed in the private.enterprises tree.

The actual MIB file defining the ***sat-nms*** LFTXRX Optical Link private MIB may be downloaded from the unit itself by FTP (user 'service', password 'service'). The file 'LFTXRX.MIB' contains all necessary information. A link to this MIB file is also included in the web interface on the 'setup page'.

4.5 Parameter list

The table below shows the complete list of M&C parameters the ***sat-nms*** LFTXRX chassis knows. For each parameter the valid range and a short description is given.

Common status queries and commands

Info related commands

name		range/format	description
snom	r/o		Device serial
svrm	r/o		Software version
atpm	r/o	[card1],..,[card20] : 0,1	Attenuator present of each slot (1=installed, 0=not installed)
remm	r/o	[card1],..,[card20] : 0,1	Remote (1) or Local (0) setting of each card
rdsw	r/w	[card1],..,[card20] : 0,1	Redundancy switched indication of each slot (1=has switched, clear with set to 0)

Setup related commands

name		range/format	description
addr	r/o	A,B,C,D,E,F,G,none	RS232 communication address
baud	r/o	DISABLED,9600,19200,38400,57600,115200	Interface baudrate
time	r/o	YYYY:MM:DD hh:mm:ss	Date / time
stim	o/w	YYYY:MM:DD hh:mm:ss	Set date / time
ipt1	r/w	aaa.bbb.ccc.ddd	SNMP Trap IP 1
ipt2	r/w	aaa.bbb.ccc.ddd	SNMP Trap IP 2
ipt3	r/w	aaa.bbb.ccc.ddd	SNMP Trap IP 3
ipt4	r/w	aaa.bbb.ccc.ddd	SNMP Trap IP 4
notm	r/o		Description/Note

Config related commands

name		range/format	description
plcm	r/o	[card1],..,[card20] :	Card type of each slots

p1cm	r/o	RX,TX,NONE	Card type of each slots
n05m	r/o	[card1],..,[card05]	Description/Note card 1..5
n10m	r/o	[card6],..,[card10]	Description/Note card 6..10
n15m	r/o	[card11],..,[card15]	Description/Note card 11..15
n20m	r/o	[card16],..,[card20]	Description/Note card 16..20
thrm	r/w	[card1],..,[card20] dBm	RF Threshold for each slot
diom	r/o	[card1],..,[card20] dB	Diode RF Offset for each slot
rfom	r/o	[card1],..,[card20] dB	RF RF Offset for each slot
lnim	r/o	[card1],..,[card20] mA	LNB current minimum limit for each slot
lnxm	r/o	[card1],..,[card20] mA	LNB current maximum limit for each slot
attm	r/w	[card1],..,[card20] : 0..31	Attenuator settings in dB for each slot (15dB attn = 0dB gain)
gaim	r/w	[card1],..,[card20] : -16..15	gain settings in dB for each slot
gstm	r/w	[card1],..,[card20] : n/a, u, d	gain step u = 1dB up, d = 1dB down, n/a = response
lnbm	r/o	[card1],..,[card20] : OFF,ON	LNB DC supply for each slot
rdpr	r/w	[card1],..,[card20] : OFF,ON	Redundancy setting for each individual slot (only valid for LFSW)
rdmd	r/o	[card1],..,[card20] : ONCE,ALWAYS	Redundancy Mode for each individual slot (only valid for LFSW)
rdsp	r/w	[card1],..,[card20] : A,B	Redundancy Switch position for each individual slot (only valid for LFSW)
rdnb	r/o	[card1],..,[card20] : NON,1..20	Number of Slot at Switch Position B (only valid for LFSW)
rdna	r/o	[card1],..,[card20] : NON,1..20	Number of Slot at Switch Position A (only valid for LFSW)

Measuremets related commands

name		range/format	description
rfvm	r/o	[card1],..,[card20] dBm	RF Power for each slot
divm	r/o	[card1],..,[card20] dBm	Diode RF Power for each slot
povm	r/o	[card1],..,[card20]	Optical input power (LFRX) or output power (LFTX)

[illegible]	[illegible]	uW	of each slot
lnvm	r/o	[card1],..,[card20] mA	LNB current for each slot
tmpm	r/o	[temp1],[temp2] ° C	Temperature chassis

Fault related commands

name		range/format	description
alrm	r/o	[see below]	Faults chassis

HTTP Only Setup related commands

name		range/format	description
sdes	r/o		SNMP System description
scon	r/w		SNMP System contact
snam	r/w		SNMP System name
sloc	r/w		SNMP System location
rcom	r/w		SNMP read community
wcom	r/w		SNMP write community
tcom	r/w		SNMP trap community
autr	r/w		enabled,disabledSNMP enable Auth traps
refr	r/o	1,3,5,10	Refresh Rate (secs)
clft	o/w	1	Clear latched faults

Fault Message

The commands 'alrm' return a text string which shows the fault status of the master or slave chassis.

Syntax: S[power supply faults]R[rf faults]O[optical faults]L[lnb faults]T[threshold faults]S[switch fault]C[internal fault]

The *power supply faults* list contains 2 characters for power supply 1 to 2. The *rf faults* , *optical faults* , *lnb faults* , *threshold faults* and *switch faults* lists contains 20 characters, representing the 20 slots of a ***sat-nms*** LFTXRX chassis. The *internal fault* shows that there is a problem with the internal communication between different components of the ***sat-nms*** LFTXRX chassis.

The meaning of the fault characters are: 0 means OK and 1 means FAULT.

`http://192.168.2.81/rmt?alrm=?`

```
alrm=
S10
R00001000010000000000
```

```
O00000000000000000000
L00000000000000000000
T00000000000000000000
S00000000000000000000
C00
```

(retrun of this command is one line. lines are wrapped in this example for better readability)

The example shows an master chassis, where the following alarms are active: power supply 1, rf fault of slot 5 and 10.

Please keep in mind, that not all slots have to be equipped with LFRX, LFTX or LFSW cards and the empty slot may show a fault.

Measurement and setting lists

Some commands returns a comma separated list of measurements or settings for all slots of a chassis. So you get 20 values at ones.

`http://10.0.0.1/rmt?powm=?`

This returns for each slot of the chassis the optical power level. Empty slots are marked with `-` .

```
povm=
-,-,1458,-,
1466,-,-,1454,
-,1454,-,-,
-,-,-,-,
-,-,-,-
```

(retrun of this command is one line. lines are wrapped in this example for better readability)

Plugged/unplugged Cards

The commands 'plcm' and return a comma separated list of the state of all boards.

`http://10.0.0.1/rmt?plcm=?`

This returns for each slot the configured card type. In this example are slot 1-5 are configured a receiver, 6-8 as transmitter and 9-10 are empty. Please keep in mind, that the LFTXRX chassis does not detect what kind of card is installed. The return value of the function shows you what the user has configured for each slot.

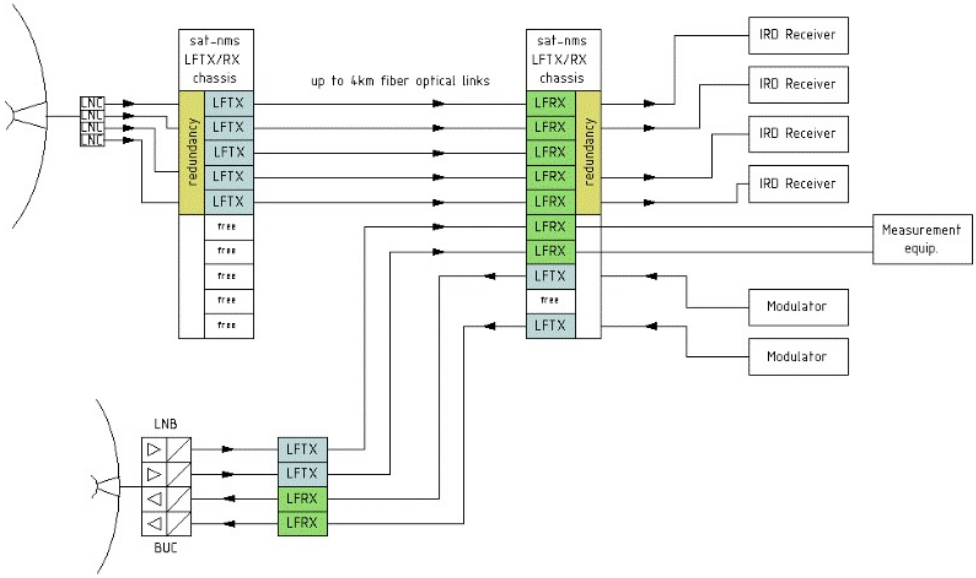
```
plcm=
RX,RX,RX,RX,
RX,TX,TX,TX,
NONE,NONE,NONE,NONE,
NONE,NONE,NONE,NONE,
NONE,NONE,NONE,NONE
```

(retrun of this command is one line. lines are wrapped this example for better readability)

5 Theory of Operation

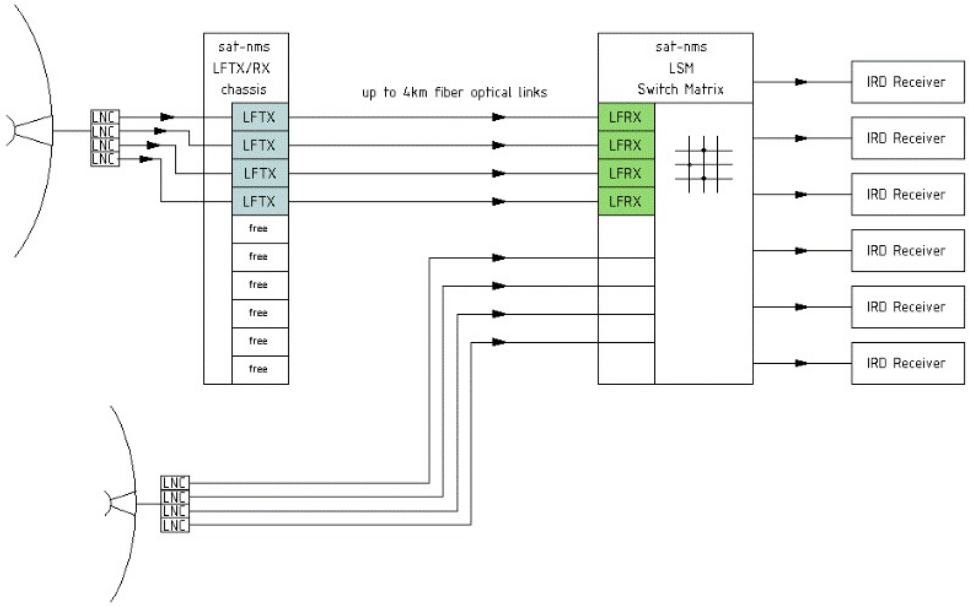
The ***sat-nms*** L-Band optical transmitters and receivers were developed to cover all applications in the field of satellite communication, satellite ground stations, VSAT and cable networks. The

following block diagram shows a typical scenario of a teleport. The LNCs at the different antennas provide L-Band output signals which have to be routed via long cable runs from the antennas to a central site, in this case a switch matrix. The optical transmitter converts the analog L-Band spectrum (or any other RF spectrum in the specification of the different modules) with the help of a laser diode to a optical output signal with a wavelength of 1310nm. This is the standard wavelength used by most of the laser diodes. But it is also possible to select another wavelength on request by selecting another laser diode.



This example shows a satellite receive and transmit application with two antennas and at different locations, but with one ***sat-nms*** LFTXRX chassis which handles all signals from both antennas and the uplink signal to the second antenna. In this case the satellite modulator delivers its L-Band or 70MHz signal to the optical transmitter located for example in the central building and at the end of the optical fibre link a optical receiver regenerates the RF signal spectrum which can be delivered for example to a block up-converter (BUC).

As already explained in this TX application it is also possible to provide the 10MHz reference frequency for the BUC via the same optical link. You can see in this block diagram also the redundant configuration of the receive path from the first antenna.



The second block diagram shows the combination of the ***sat-nms*** LSM L-Band Switch Matrix with the ***sat-nms*** LFRX L-Band Fibre Optical Receivers. So you use the LFRX card directly in our switch matrix.

5.1 Frequency bands

While the fibre optical links where designed by SatService GmbH mainly for the transmission of the satellite L-Band frequency band (950 to 2150MHz) also a broadband version from 50MHz to 2150MHz is available. So this link type can also be used to transmit the traditional 70 or 140MHz IF bands of satellite ground stations and a microwave link. But also other terrestrial applications are feasible like the transmission of GSM signals in the 800 and 1800MHz frequency bands.

- ***sat-nms*** LFRX-L and LFTX-L --- 950 to 2150MHz
- ***sat-nms*** LFRX-B and LFTX-B --- 50 to 2150MHz
- ***sat-nms*** LFRX-10 and LFTX-10 --- 950 to 2150MHz and 10MHz reference frequency for BUC
- ***sat-nms*** LFRXO10 and LFTXO10 --- 10MHz only

As a unique feature the ***sat-nms*** LFTXRX modules can transmit L-Band and 10MHz signals together on one single fibre connection. This is a growing application for VSAT and satellite ground station transmit chains which make use of Block Up-Converter (BUC). These BUCs very often need a 10MHz reference frequency signal for their internal local oscillators. This is generated within the satellite modem and also transmitted via the coaxial L-Band output.

By using the LFRX-10/LFTX-10 link, it is not possible to monitor or to adjust the level of the 10Mhz signal with the internal adjustable attenuator. If you have to do so, or if you want to set up a 10MHz only link, ***sat-nms*** LFRXO10/LFTXO10 Version is the right choice. It provides internal attenuation function as well as signal level measurement for your 10MHz signal.

The ***sat-nms*** LFTXRX fibre optical link can transmit this combined/multiplexed frequency signals. Each fibre optical link (FOL) consists of two destinations which are interconnected via a fibre optical cable. On one side of the link is the optical transmitter and on the other side is the optical receiver. Both modules are Euro card sized (100x160mm) printed circuit boards which are

plugged into a 2U 19" chassis. The chassis includes a redundant power supply, two backplanes to connect to the modules, a M&C printed circuit board and at the front panel a keyboard and display as local user interface. Each chassis can contain 10 of the optical link modules in any combination whether they are optical transmitters or receivers.

The ***sat-nms*** LFTXRX optical link is a broadband device and transmits transparently the complete RF spectrum from one site to the other. All modulation formats, whether they are analog or digital, can be transmitted transparently. The RF signal is directly modulated on to a high performance laser diode and adds no phase noise or frequency instability to the original signal. The result is a very good signal quality.

Due to the very stable design of the optical transmitter and receiver electronics there is no need for an Automatic Gain Control (AGC) within the circuits. So the link is compared to other vendor's solution really transparent. Certainly a Manual Gain Control (MGC).function is included which can be also adjusted from remote in a wide range of 31dB.

The optical L-Band transmitter module also provides LNC supply voltage including current monitoring and RF level detection.

We tried to realize all functionality in the baseline product so that you don't have to care about options. So LNC powering and other features are always included wherever possible. This is only not the case in the broadband and 10MHz boards as this makes no sense here in any case and the inductors of the LNC voltage supply would destroy low frequency performance.

5.2 Connectors

For the optical interface SatService provides E2000/APC connectors from Diamond or Huber & Suhner by default. But we are also in a position to deliver on request FC/APC or other single mode connectors. The optical interface is located at the front panel of the 19" chassis because the optical patch panels are most likely also at the front of a 19" rack. The connectors are slightly shifted backwards from the normal front plane of the 19" drawer, so they neither interfere at the front of the rack nor they can be destroyed or snapped off.

5.3 Controller Module

The Controller Module of the ***sat-nms*** LFTXRX is based on a separate 100x160mm printed circuit board. It performs the following functions:

- Monitor and control the optical transmitter cards LFTX
- Monitor and Control the optical receiver cards LFRX
- Monitor and Control the rf switch cards LFRX
- Manage the redundancy switching
- Control the Remote Interfaces (RS232 and LAN) The design of the monitoring & control board is based on the same controller with integrated web server which SatService has successfully used in all other products of the ***sat-nms*** family as well. The chip has the following advantages:
- Real Time Operation System with FTP, HTTP, SNMP over TCP/IP
- Serial Interfaces

- No external RAM and ROM components
- 10/100 BaseT RJ45 Interface

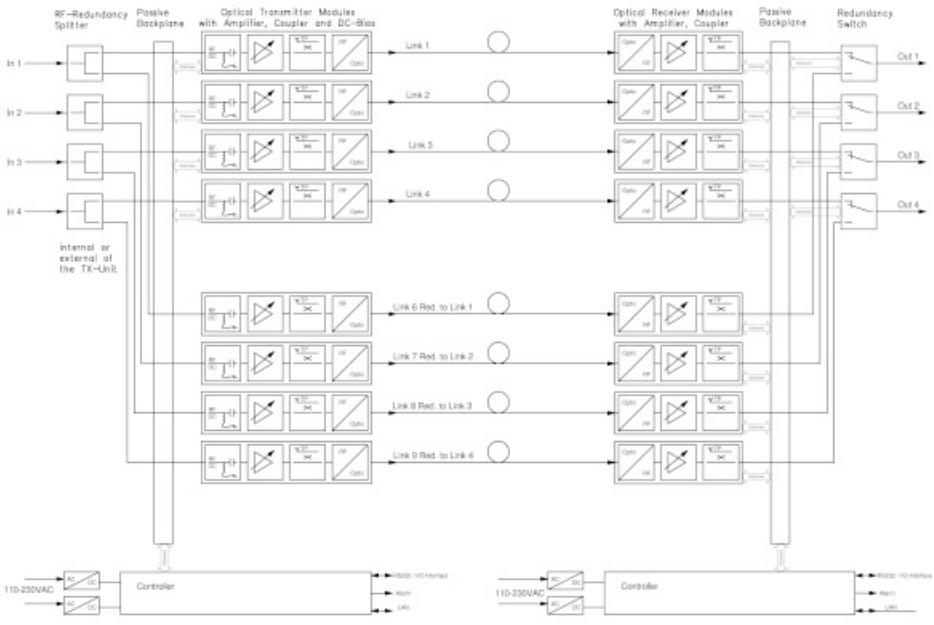
5.4 Redundancy switching

A novel and additional feature of the ***sat-nms*** LFTXRX system is the capability to switch complete optical links in a 1:1 Redundancy and restore operation within a second if one of the optical links gets defective. This can effectively increase the availability of optical transmission systems. In order to provide this feature the LFTXRX chassis can be equipped with a ***sat-nms*** LFSW switch card at the RX Unit and a internal or external 1:2 Splitter at the TX Unit and the software will support the redundancy switching capability.

The redundancy switching capability is defined by the use of the ***sat-nms*** LFSW switch card in the ***sat-nms*** LFTXRX chassis and how the switches are route internally to that card. There is no limitation of the use of the switching card, but at least it will be limited by the available 20 slots. Therefore maximum six ([2*RX+1*SW]*6 = 18 Slots) 1:1 Redundancy Links can be installed in one chassis. There are two free slots in this 6x 1:1 Red. configuration available for additional non redundant Links.

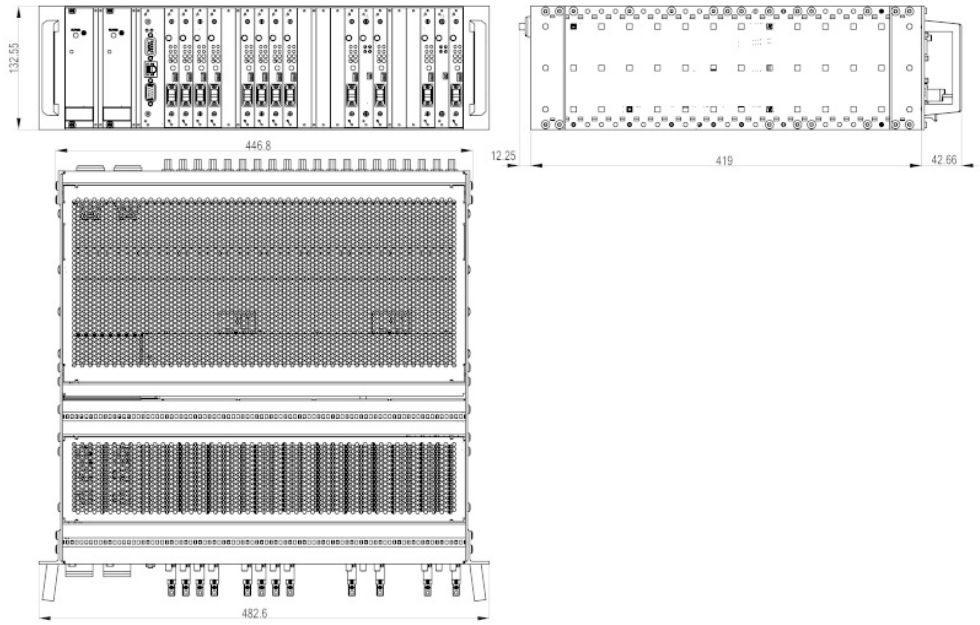
This configuration will be defined in the 'config' page of the M&C software via the web browser interface.

Please refere to the following bockdiagram to get a overview how one Redundant Link is build.



5.5 Outline Drawing

3 HU unit with 20 slots



6 Specifications

RF Specification	
Frequency range	950 to 2150MHz or 50 to 2150MHz or 950 to 2150MHz with multiplexed 10MHz or 10MHz only
L-Band Input Connectors (Transmitter)	SMA female 50Ohm or F-type female 75Ohm as option
L-Band Output Connector (Receiver)	SMA female 50Ohm or F-type female 75Ohm as option
L-band input test connector (Transmitter)	SMA female 50 Ohm
L-band output test connector (Receiver)	SMA female 50 Ohm
Optical connectors	E2000/APC or FC/APC
Input Return Loss	> 17dB
Output Return Loss	> 17dB
Input Noise Figure	< 30dB with 0dB gan setting (=15dB Attn)
Gain (adjustable via local and remote interface)	+15 to -16dB in 1dB steps
Flatness	+/-1.5 dB, +/-0.25dB in any 40MHz
Input signal max (total level directly at LFTX card)	-5 dBm

Output Level max (total power directly at LFRX card)	-5 dBm
Intermodulation at -13dBm Input Level (total level directly at LFTX card)	<-40 dBc
DC-output at L-band input connector	15+/-1V (for LFTXL Model only)
additional attenuation for optional modules	redundant card: typ. 3dB per frame 50/75Ohm converter: typ. 0.7dB per frame 1:4 splitter: typ. 12.5dB per frame dual coupler: typ. 1.5dB per frame

M&C Interface Specification	
Ethernet interface for M&C and user interface	10/100-Base-T, Via http GET requests
RS232 M&C Interface	D-SUB 9 female
Summary fault indication	Relay contact D-SUB 9 male

Electrical and Mechanical Specification, Environmental Conditions	
Supply voltage	100 to 240V AC 50 to 60Hz
Connector for the two mains voltage AC input	IEC
Redundant power supplies	Hot swap capability
Temperature range	-20 to + 50°C
Humidity	up to 90% non condensing
Mechanical size of mainframe	436 x 134 x 420(460) mm (WxHxD), 19" 2HU