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# AOCS System

Optical Communication Platform



Operating manual

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## Before starting operation of the device

**HINWEIS:** Read this operating manual attentively! It contains important information about installation, ambient conditions and maintenance of the device. Keep this operating manual for future use and for handover in the event of a change of owner. A PDF version of this manual is available to download on the ASTRO website (there may be a more recent version).

The ASTRO company confirms that the information in this manual was correct at the time of printing, but it reserves the right to make changes, without prior notice, to the specifications, the operation of the device and the operating manual.

## Symbols and conventions used

### Symbols used in these instructions

Pictograms are visual symbols with specific meanings. You will encounter the following pictograms in this installation and operating manual:

Warning about situations in which electrical voltage and non-observance of the instructions in this manual pose a risk of fatal injuries.



Warning about various dangers to health, the environment and material.



Warning about thermal dangers (risk of burns).



Warning about high laser radiation emitted from a device, connector or adapter (risk of eye damage).



Recycling symbol: indicates components or packaging materials which can be recycled (cardboard, inserts, plastic film and bags). Used batteries must be disposed of at approved recycling points. Batteries must be completely discharged before being disposed of.



This symbol indicates components which must not be disposed of with household rubbish.



## Proper use

The components of the optical communication system AOCS are exclusively designed for signal processing ie dienen ausschließlich der Signalaufbereitung in TV and data services via optical fibre networks.

Modification of the devices or use for any other purpose is not permitted, and will immediately void any guarantee provided by the manufacturer.

## Target group of this manual

### Installation and starting operation

The target group for installation and starting operation of the ASTRO optical transmission technology are qualified experts who have training enabling them to perform the work required in accordance with EN 60728-11 and EN 60065. Unqualified person are not allowed to install and start operation of the device.

### Device configuration

Target group for the configuration of the ASTRO transmitters are persons who have received instructions and have training enabling them to perform a configuration. Knowledge of EN 60728-11 and EN 60065 is not necessary for configuration.

## Important safety information

To avoid any hazardous situations to the extent possible, you must adhere to the following safety information:

**ACHTUNG:** *Failure to observe this safety information may result in personal injury due to electrical and thermal dangers!*

### Proper use

- ☐ Only use the device at the approved operating sites and in the ambient conditions allowed (as described in the following), and only for the purpose described in the section "Proper use".

### Before starting operation of the device

**HINWEIS:** *Read this operating manual attentively! It contains important information about installation, ambient conditions and maintenance of the device. Keep this operating manual for future use and for handover in the event of a change of owner or operator. A PDF version of this manual is available to download on the ASTRO website (there may be a more recent version).*

- ☐ Check the packaging and the device for transport damage immediately. Do not start operation of a device that has been damaged.
- ☐ Transporting the device by the power cable may damage the mains cable or the strain relief, and is therefore not permitted.

### Danger of optical radiation

This product is laser class 1M (according IEC 60825-1 Safety of Laser Products) and therefore several safety precautions must be applied.

- ☐ Exposure to class 1M laser radiation is possible on open connectors or connected fibre patch cords. Do not look into exposed fibre or connector ends when handling or maintaining optical equipment. Do not look through optical instruments into open connectors or fibre ends on devices that are switched on. Make sure that wherever a fibre inspection is required, the inspected fibre or connector is completely free of optical radiation.
- ☐ High optical radiation and improper handling of optical fibre connections and devices may pose risks for the operating and service personnel. Access should be restricted to trained personnel only.
- ☐ Never look directly or with optical inspection tools into the end of a fibre which is connected to a transmitter or optical amplifier and which is in operation. If the eyes are exposed to optical radiation above the acceptable maximum, this could cause permanent eye damage.

### Installation, operation, maintenance

- ☐ The device may only be installed and operated by qualified persons (in accordance with EN 60065) or by persons who have been instructed by qualified persons. Maintenance work may only be carried out by qualified service personnel.
- ☐ The installation site must be planned in a way that prevents children from playing with the device and its connections.
- ☐ Dangerous voltages and the threat of optical laser radiation are present within the powered on unit





at all times.

- ☐ Always replace protective caps on optical connectors and patch cords when not in use to avoid dust intake. Before connecting clean connectors with lint free cloth and pure alcohol or with any professional tools for cleaning connectors and adapters. The typical connectors fitted are SC/APC 8° or LC/APC 8° (green couplers).
- ☐ The electrical connection conditions must correspond to the specifications on the device type plate.
- ☐ The ambient temperatures specified in the technical data must be complied with, even when climatic conditions change (e.g. due to sunlight). If the device overheats, the insulation used to isolate the mains voltage may be damaged.
- ☐ The device and its cable may only be operated away from radiant heat and other sources of heat.
- ☐ To avoid trapped heat, ensure there is good ventilation on all sides. Installing the device in recesses or covering the installation location, e.g. with curtains, is not permitted. Ventilation openings may not be covered.
- ☐ If the device is installed in a cabinet, ensure adequate air convection is possible to avoid exceeding the maximum ambient temperature permitted for the device.
- ☐ No objects may be placed on the device.
- ☐ The subscriber network must be earthed in accordance with EN 60728-11, and must remain earthed even when the device is removed. Furthermore, the earth connection on the device can be used. Devices within hand's reach must be integrated into the potential equalisation together. Operating the device without an earth conductor, without earthing the device or without using device potential equalisation is not permitted.
- ☐ The device does not feature protection against water and may therefore only be operated and connected in dry rooms. It must not be exposed to spraying or dripping water, to condensation, or to similar sources of moisture.
- ☐ The electrical system supplying current to the device, e.g. a house installation, must incorporate safety devices against excessive current, earth leakages and short-circuiting in accordance with EN 60950-1.
- ☐ To operate the device (protection class I), it must be connected to mains power sockets with a protective earth conductor.
- ☐ Adhere to all applicable national safety regulations and standards.
- ☐ The mains plug is used as a mains voltage disconnect unit in the event of servicing and danger, and must therefore be accessible and be able to be operated at any time. The device is operational when connected to the mains power.
- ☐ Excess mechanical loads (e.g. falling, impacts, vibrations) may damage insulation used to provide protection from mains voltage.
- ☐ High excess currents (lightning strike, surges in the power utility grid) may damage insulation used to provide protection from mains voltage.
- ☐ Do not insert any objects through the ventilation slots.
- ☐ If there is no information about intended use (e.g. operating site, ambient conditions), or the operating manual does not include the corresponding information, then you must consult the manufacturer of this device to ensure that the device may be installed. If you do not receive any information on this from the manufacturer, do not start operating the device.

#### Maintenance

- ☐ The operating display only shows whether the DC current, which supplies the device components, has been disconnected. However, operating displays (on the power supply unit or the device) that are not lit up in no way indicate that the device is completely disconnected from the mains.
- ☐ Read carefully: EN 60728 - Part 1 Safety requirements: No service work during thunderstorms.

#### Repair

- ☐ Repairs may only be performed by the manufacturer. Improperly performed repairs may result in considerable dangers for the user.
- ☐ If malfunctions occur, the device must be disconnected from the mains and authorised experts must be consulted. The device may need to be sent to the manufacturer.



## Warranty conditions

The general terms and conditions of ASTRO Bit GmbH apply. You will find these in the current catalogue or on the Internet under "[www.astro-kom.de](http://www.astro-kom.de)".

## Disposal



All of our packaging material (cardboard boxes, inserts, plastic film and bags) is completely recyclable. Electronic devices must not be disposed of with household waste, but rather – according to DIRECTIVE 2012/19/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL from 4 July 2012, on waste electrical and electronic equipment – must be properly disposed of. When it is no longer of use, please bring the device for disposal to one of the public collection points for this purpose.

ASTRO Bit is a member of the Elektro system solution for the disposal of packaging materials. Our contract number is 80395.

# AOCS base unit

The delivery includes the following parts:

- ☐ AOCS base unit
- ☐ Operating manual

The rack has space for 16 plug-in units. It does not matter where each unit is plugged in. The following slots are defined in the slot management of the device:

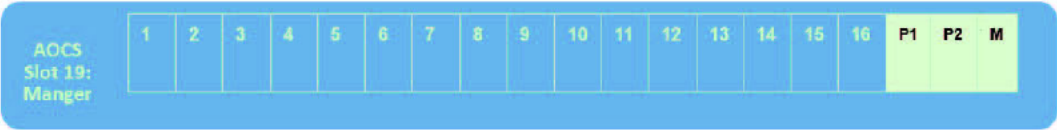


Figure 1: Slots of the AOCS base unit

- Front:
- [1] Display
  - [2] Keypad
- Rear:
- [3] Power cable connection 1
  - [4] RS-232 port
  - [5] LAN port
  - [6] Power cable connection 2
  - [7] Fan
  - [8] Connections, slot 1 - 16

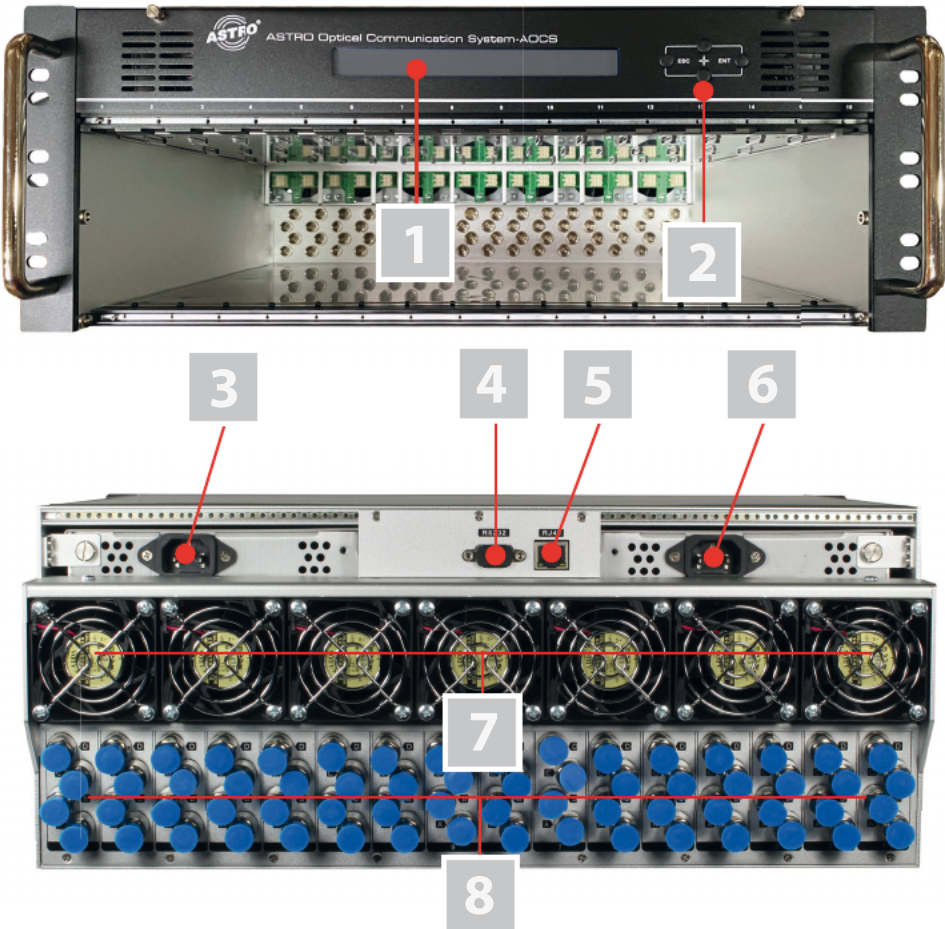
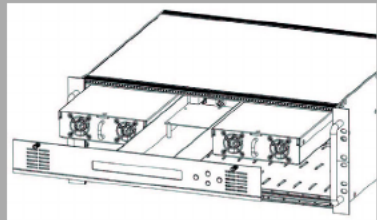


Figure 2: AOCS base unit - front and rear

At the top is the controller with the keypad [2]. The slots are arranged below it (numbered from 1 to 16). All module types can be plugged into any of the slots. There is no specified sequence. The controller automatically recognises the module type. To replace power supply units, undo the knurled screws at the top and pull out the front panel of the controller module (see figure on the left).



The two power cables, the F connections for coaxial cables and the network connection for web management are only connected from the rear.

On the rear there are also 7 interchangeable fans that turn on as required and configured.

Each slot position has up to 4 RF connections (F sockets), which are supplied via connectors from the module inserted at the front.

Some modules need all 4 coaxial connectors, others only one, two or three.

### Operation via the front panel

Operation takes place using the buttons to the right of the display.

- ☐ Arrow up: scroll up through the menu or change a value
- ☐ Arrow down: scroll down through the menu or change a value
- ☐ ENTER: Select a submenu or confirm a selected value
- ☐ ESC: Exit a submenu and change to the next higher menu level; cancel a selection

### Operation via the web browser

For operation via the web interface, the RS-232 port of the base unit must be connected to the PC (or also via an IP network). The currently set IP address of the chassis is shown on the front panel display. You can also use the front panel to change the IP address to match your own IP network. Use PING CMD to test whether the PC has an IP connection to the chassis. You can use the following data for access via the web browser:

User name: **admin**

Password: 123456



Figure 3: Login

After logging in, you should see the main menu.  
In the main menu, under “Platform”, you will find the two submenus “System” and “Update”.  
Here you can configure the IP settings and update the firmware.

PlatformModuleModifyPassword

SystemUpdate

Model

AOCS

SN

200626002

Version

6.21

Mac

30:71:B2:43:B0:C0

IP

192.168.14.167

192.168.14.167

set

gateway

192.168.1.1

192.168.1.1

set

mask

255.255.255.0

255.255.255.0

set

SNMP

trapIP1

192.168.1.156

192.168.1.156

set

trapIP2

0.0.0.0

0.0.0.0

set

Figure 4: Menu: Platform - System

PlatformModuleModifyPassword

Update

Update system firmware

Datei auswählen

Keine ausgewählt

Upload

Back

Figure 5: Menu: Platform - Update

To configure the modules plugged into the base unit, click on “Modules” in the main menu. You will now see the following input form (depending on the modules plugged in):

Platform
Module
ModifyPassword

Slots

| Index | Type         |
|-------|--------------|
| 0     | Fan          |
| 1     | Tx           |
| 2     | 1xEDFA       |
| 3     | NULL         |
| 4     | NULL         |
| 5     | NULL         |
| 6     | NULL         |
| 7     | NULL         |
| 8     | Rx           |
| 9     | NULL         |
| 10    | NULL         |
| 11    | NULL         |
| 12    | NULL         |
| 13    | NULL         |
| 14    | NULL         |
| 15    | NULL         |
| 16    | NULL         |
| 17    | Power Supply |
| 18    | Power Supply |

Parameter

| Name | Value | Configure |
|------|-------|-----------|
|------|-------|-----------|

Figure 6: Modules menu

The “Type” column shows the type of module inserted. You can access each module by clicking the button highlighted in blue.

In detail, the parameters of the following components are visible and can be configured if necessary:

- ☐ Slot 0 : Fan configuration
- ☐ Slot 1 - 16 : Configuration of the optical modules
- ☐ Slot 17 : Status of the first power supply
- ☐ Slot 18 : Status of the second power supply

To change the password, click on “Modify Password” in the main menu. Here you can assign a new password if you want.



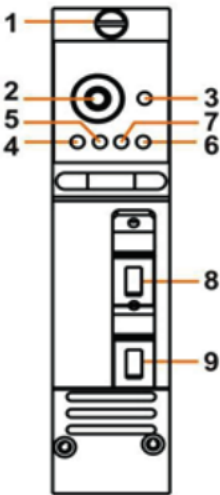
## Optical dual transmitter ODMTXm-1550

The delivery includes the following parts:

- ☐ ODMTXm-1550 module
- ☐ Operating manual

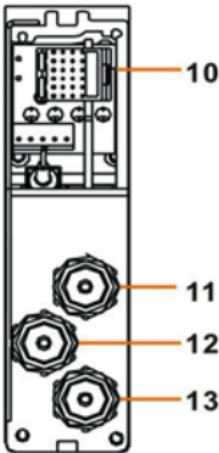
The ODMTXm-1550 is a broadcast + narrowcast DOCSIS 3.1 dual transmitter with two lasers each of wavelength 1550 nm /10 dBm. The module has three coaxial inputs; a separate narrowcast input for each of the two lasers and a common broadcast input.

Front:



| Number | Description  | Comment  |
|--------|--|--|
| 1      | nurled screw<br>rack mounting                          |  |
| 2      | laser test point 20 dB                                 |  |
| 3      | TP switching<br>from input laser 1<br>to input laser 2 |  |
| 4      | status transmitter 1                                   | off: laser alarm<br>flashing green : RF input alarm<br>permanent green: laser TX1<br>works correctly |
| 5      | status transmitter 2                                   | off: laser alarm<br>flashing green: RF input alarm<br>permanent green: laser TX2<br>works correctly  |
| 6      | TX2 TP active  | LED on, TP switched to<br>transmitter 1  |
| 7      | TX1 TP active  | LED on, TP switched to<br>transmitter 2  |
| 8      | Optical output<br>TX 1                                 |  |
| 9      | Optical output<br>TX 2                                 |  |

Rear:



| Number | Description           | Comment  |
|--------|-----------------------|--|
| 10     | Contact of module     |  |
| 11     | RF NC2 input          | At the back of the chassis<br>RF port C of a slot is<br>the NC input<br>of TX2                               |
| 12     | RF broadcast<br>input | At the back of the chassis<br>RF port B is the<br>broadcast input for<br>TX1 and TX2 of the plugged<br>slots |
| 13     | RF NC1 input          | At the back of the chassis<br>RF port A of a slot is<br>the NC input<br>of TX1                               |

## Operation via the web browser

First select “Module” in the main menu of the web interface. In the “Type” column, select the “TX” option for the slot containing the ODMTXm. The following input mask now appears. The upper section contains the parameters for transmitter 1; the second section contains those for transmitter 2.

Platform
Module
Modify Password

Slots

| Index | Type         |
|-------|--------------|
| 0     | Fan          |
| 1     | <b>Tx</b>    |
| 2     | txEDFA       |
| 3     | NULL         |
| 4     | NULL         |
| 5     | NULL         |
| 6     | NULL         |
| 7     | NULL         |
| 8     | Rx           |
| 9     | NULL         |
| 10    | NULL         |
| 11    | NULL         |
| 12    | NULL         |
| 13    | NULL         |
| 14    | NULL         |
| 15    | NULL         |
| 16    | NULL         |
| 17    | Power Supply |
| 18    | Power Supply |

Parameters

Tx Slot: 1
Help
Update
Refresh

Note
Edit

| Name                | Value      | Configure |
|---------------------|------------|-----------|
| Tx1RPin             | 0.0 dBuV   | Threshold |
| Tx1LaserTemperature | 25.5 °C    | Threshold |
| Tx1LaserBias        | 54 mA      | Threshold |
| Tx1OutputPower      | 10.2 dBm   | Threshold |
| Tx1LaserTEC         | -52 mA     | Threshold |
| Tx1AGCMode          | ON         | ON set    |
| Tx1ATT              | 11.5 dB    | 11.5 set  |
| Tx1OMI              | 20.1%      | 20.1% set |
| Tx1NCAIt            | 0 dB       | 0 set     |
| Tx1BCAIt            | 0 dB       | 0 set     |
| Tx1ChanNum          | 120        | 120 set   |
| Tx1Wavelength       | 1550.90 nm |           |
| Tx1LaserCtrl        | ON         | ON set    |
| Tx1FiberLength      | 20 Km      | 20 set    |
| Tx1SBS              | 18 dBm     | 18 set    |
| Tx2RPin             | 0.0 dBuV   | Threshold |
| Tx2LaserTemperature | 25.4 °C    | Threshold |
| Tx2LaserBias        | 52 mA      | Threshold |
| Tx2OutputPower      | 10.2 dBm   | Threshold |
| Tx2LaserTEC         | -23 mA     | Threshold |
| Tx2AGCMode          | ON         | ON set    |
| Tx2ATT              | 11.5 dB    | 11.5 set  |
| Tx2OMI              | 20.1%      | 20.1% set |
| Tx2NCAIt            | 0 dB       | 0 set     |
| Tx2BCAIt            | 0 dB       | 0 set     |
| Tx2ChanNum          | 120        | 120 set   |
| Tx2Wavelength       | 1550.90 nm |           |
| Tx2LaserCtrl        | ON         | ON set    |
| Tx2FiberLength      | 20 Km      | 20 set    |
| Tx2SBS              | 18 dBm     | 18 set    |
| Device Temperature  | 29.6 °C    |           |
| Version             | 6.32       |           |

Figure 7: Configuration of the ODMTXm

The parameters in detail:

| Parameter name                                     | Description  | Comment  |
|--|--|--|
| <b>Status parameters (green or red background)</b> |  |  |
| <b>Tx1RFIn / Tx2RFIn</b>                           | RF input level (BC and NC1/NC2 combined) at laser  | Green = Status O.K<br>Red = out of range   |
| <b>Tx1LaserTemperature / Tx2LaserTemperature</b>   | Laser temperature of laser 1 / laser 2   | Green = Status O.K<br>Red = out of range   |
| <b>Tx1LaserBias / Tx2LaserBias</b>                 | Bias-current of laser 1 / laser 2  | Green = Status O.K<br>Red = out of range   |
| <b>Tx1OutputPower / Tx2OutputPower</b>             | Optical output level in dBm of laser 1 / laser 2   | Green = Status O.K<br>Red = out of range   |
| <b>Tx1LaserTEC / Tx2LaserTEC</b>                   | Thermoelectric cooler current laser 1 / laser 2  | Green = Status O.K<br>Red = out of range   |
| <b>Adjustable parameters</b>                       |  |  |
| <b>Tx1AGC Mode</b>                                 | Automatic Gain Control for RF input on or off  | Recommendation: AGC = ON   |
| <b>Tx1ATT / Tx2ATT</b>                             | Attenuation at the amplifier in AGC=OFF mode<br>When AGC=ON the attenuation is adjusted automatically. | Recommendation: AGC = ON   |
| <b>Tx1OMI / Tx2OMI</b>                             | Option to adjust OMI   | OMI should be adjusted to 20-21 %<br>Low OMI causes less RF level at the and bad MER while too high OMI causes distortion at the laser (blasting).                           |
| <b>Tx1NCAtt / Tx2NCAtt</b>                         | Reduction of NC path of laser 1 / laser 2  |  |
| <b>Tx1BCAtt / Tx2BCAtt</b>                         | Reduction of BC path of laser 1 / laser 2  |  |
| <b>Tx1ChannNum / Tx2ChannNum</b>                   | Number of channels   | Has no effect on the performance of transmitter. Is used for conversion to achieve the right RF level.   |
| <b>Tx1Wavelength / Tx2Wavelength</b>               | Wavelength of the laser  |  |
| <b>Tx1LaserControl / Tx2LaserControl</b>           | Switch laser 1 / laser 2 on or off   |  |
| <b>Tx1FiberLength / Tx2FiberLength</b>             | Length of fibre in km<br>(Adjustment of preequalization to distance)                                   | Please insert medium value of distance in km of the area to be supplied. Important to achieve an optimum performance at the receiver.  |
| <b>Tx1SBS</b>                                      | SBS threshold of the laser<br>(optical power calculated for the fibre over the distance)               | Recommended default adjustm. 18 dBm<br>„Finetuning“ can be done to achieve optimum performance values.<br>If EDFAs are used, the transmitting level of the EDFA is relevant. |
| <b>Information</b>                                 |  |  |
| <b>Device Temperature</b>                          | Internal temperature sensing element of the device   | Recommended ambient temperature +10 °C to +45 °C<br>(max. range -5 °C to +55 °C, for a short period of time!!)   |

Figure 8: Parameters of the ODMTXm

To update the firmware of the module, click on “Platform” in the main menu. Here you can select the firmware file and start the update.

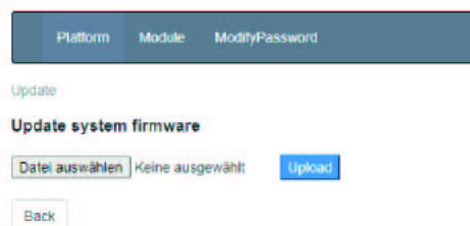


Figure 9: Menu: Platform - Update

## Optical transmitter ODMTXm-1310

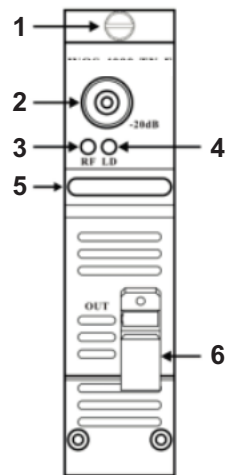
The delivery includes the following parts:

- ☐ ODMTXm-1310 module
- ☐ Operating manual

The ODMTXm-1310 is a broadcast + narrowcast DOCSIS 3.1 transmitter with a laser of 1310 nm wavelength.

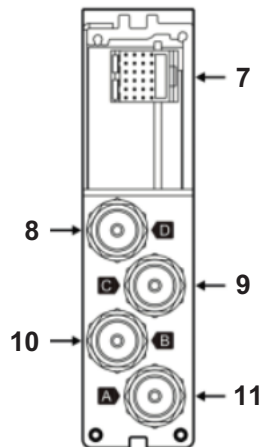
The module has three coaxial inputs; a separate narrowcast input for each of the two lasers and a common broadcast input.

Front:



| Number | Description                                 | Comment                                     |
|--------|---|---|
| 1      | nurled screw<br>rack mounting               |   |
| 2      | laser test point 20 dB                      |   |
| 3      | laser level indicator                       | green: 60 - 120 dBuV<br>red: out of range   |
| 4      | laser status                                | green: laser is active<br>red: laser is off |
| 5      | grip for pulling module<br>out of base unit |   |
| 6      | optical output                              |   |

Rear:



| Number | Description              | Comment |
|--------|--------------------------|---------|
| 7      | contact of module        |         |
| 8      | RF input 2<br>test point | -20 dB  |
| 9      | RF input 1<br>test point | -20 dB  |
| 10     | RF input 2               | -20 dB  |
| 11     | RF input 1               | -20 dB  |



Operation via the web browser

First select “Module” in the main menu of the web interface. In the “Type” column, select the “TX” option for the slot containing the ODMTXm. The following input mask now appears. The upper section contains the parameters for transmitter 1; the second section contains those for transmitter 2.

PlatformModuleModifyPassword

Slots

| Index | Type   | Note |
|-------|--------|------|
| 0     | Fan    |      |
| 1     | NULL   |      |
| 2     | NULL   |      |
| 3     | Tx     |      |
| 4     | F/Rx   |      |
| 5     | NULL   |      |
| 6     | NULL   |      |
| 7     | NULL   |      |
| 8     | NULL   |      |
| 9     | NULL   |      |
| 10    | Rx     |      |
| 11    | Tx1310 |      |
| 12    | NULL   |      |

Parameter

Optical Trans Slot: 11HelpUpdateRefresh

NoteEdit

| Name               | Value      | Configure |
|--------------------|------------|-----------|
| RFLevel            | 0.0 dBuV   | Threshold |
| LaserTemperature   | 23.1 °C    | Threshold |
| LaserBias          | 58 mA      | Threshold |
| OutPutPower        | 12.2 dBm   | Threshold |
| LaserTEC           | 17 mA      | Threshold |
| RF Model           | MGC        | MGCset    |
| MGC ATT            | 5 dB       | 5 dBset   |
| AGC Offset         | 0 dB       | 0 dBset   |
| ChanNum            | 84         | 84set     |
| Wavelength         | 1310.00 nm |           |
| Laser Control      | ON         | ONset     |
| Device Temperature | 25.8 °C    |           |
| Version            | 4.01       |           |
| WorkTime           | 327.5 Hour |           |
| SN                 |            |           |

Abbildung 10: Konfiguration des ODMTXm-1310

The parameters in detail:

| Parameter name                                     | Description  | Comment  |
|--|--|--|
| <b>Status parameters (green or red background)</b> |  |  |
| <b>RFLevel</b>                                     | RF input level at laser                            | Green = Status O.K<br>Red = out of range   |
| <b>LaserTemperature</b>                            | Laser temperature of laser 1                       | Green = Status O.K<br>Red = out of range   |
| <b>1LaserBias</b>                                  | Bias-current of laser 1 / laser 2                  | Green = Status O.K<br>Red = out of range   |
| <b>OutputPower</b>                                 | Optical output level in dBm of laser               | Green = Status O.K<br>Red = out of range   |
| <b>LaserTEC</b>                                    | Thermoelectric cooler current of laser             | Green = Status O.K<br>Red = out of range   |
| <b>Adjustable parameters</b>                       |  |  |
| <b>RFModel</b>                                     | Adjustment of RF model                             | manual or automatic gain control   |
| <b>MGCAtt</b>                                      | Attenuation at the amplifier                       |  |
| <b>AGCOffset</b>                                   | Option to adjust OMI                               | OMI should be adjusted to 20-21 %<br>Low OMI causes less RF level at the and bad MER while too high OMI causes distortion at the laser (blasting). |
| <b>ChannNum</b>                                    | Number of channels                                 | Has no effect on the performance of transmitter. Is used for conversion to achieve the right RF level.   |
| <b>Wavelength</b>                                  | Wavelength of the laser                            |  |
| <b>LaserControl</b>                                | Switch laser on or off                             |  |
| <b>Information</b>                                 |  |  |
| <b>Device Temperature</b>                          | Internal temperature sensing element of the device | Recommended ambient temperature +10 °C to +45 °C<br>(max. range -5 °C to +55 °C, for a short period of time!!)                                     |

Figure 11: Parameters of the ODMTXm

To update the firmware of the module, click on "Platform" in the main menu. Here you can select the firmware file and start the update.

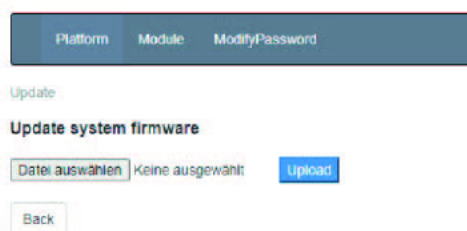


Figure 12: Menu: Platform - Update



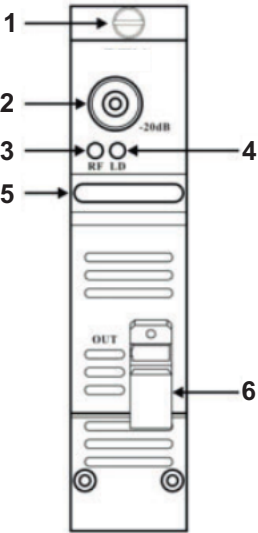
## Optical transmitter ODRMTXm-xxxx

The delivery includes the following parts:

- ☐ ODRMTXm-xxxx module
- ☐ Operating manual

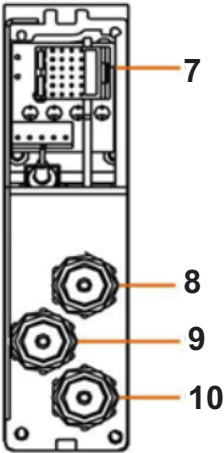
The ODRMTXm-xxxx is an optical, direct modulated DOCSIS 3.1 upstream transmitter. CWDM wavelength on request.

Front:



| Number | Description                              | Comment |
|--------|--|---------|
| 1      | nurled screw for rack mounting           |         |
| 2      | laser test point                         | -20 dB  |
| 3      | status LED RF                            |         |
| 4      | status LED output power                  |         |
| 5      | grip for pulling module out of base unit |         |
| 6      | optical output                           |         |

Rear:



| Number | Description         | Comment |
|--------|---------------------|---------|
| 7      | contact for module  |         |
| 8      | RF input test point | -20 dB  |
| 9      | RF input 1          |         |
| 10     | RF input 2          |         |

## Operation via the web browser

At the time of writing there is no screenshot of the module's webinterface.

To update the firmware of the module, click on "Platform" in the main menu. Here you can select the firmware file and start the update.

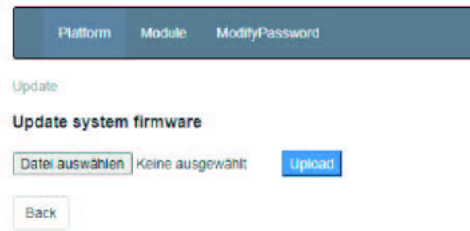


Figure 13: Menu: Platform - Update



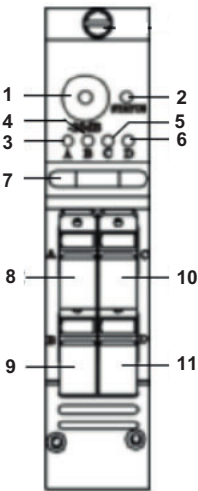
# Optical 4-way return path receiver ORRXm

The delivery includes the following parts:

- ☐ ORRXm module
- ☐ Operating manual

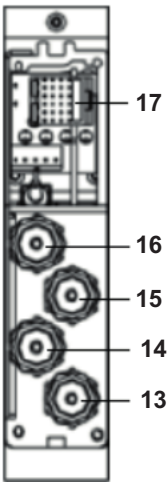
The ORRXm-1550 is an HFC return path receiver with 4 independent return paths. The RF bandwidth is 5-204 MHz and supports RFoG mode (burst mode) or HFC mode (continuous optical power = standard HFC network) of the fibre nodes. Either each channel can be output on the 4 RF ports (port A-D) or a combined output (port A) can be set.

Front:



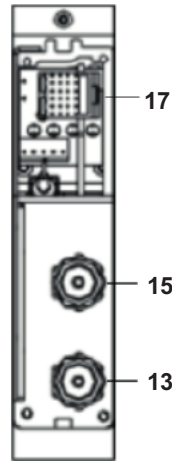
| Number    | Description                              | Comment   |
|-----------|--|---|
| 1         | RF Testpoint -20 dB                      | Can be switched through all diff. RX by using knob 2  |
| 2         | Testport selection knob                  | For RX1 to RX4 (selected channel lights up on LED 3)  |
| 3/4/5/6   | LED for Status RX1..RX4                  | LED green: opt. input power > -26 dBm<br>LED off: opt. input power < -26 dBm<br>LED flashing: Testport selected |
| 7         | Grip for pulling module out of base unit |   |
| 8/9/10/11 | Optical input Receivers 1..4             |   |
| 12        | Turned screw for rack mounting           |   |

Rear (when configured with 4 separate outputs (single RF output mode)):



| Number | Description       | Comment |
|--------|-------------------|---------|
| 13     | RF output RX1     | Port A  |
| 14     | RF output RX2     | Port B  |
| 15     | RF output RX3     | Port C  |
| 16     | RF output RX4     | Port D  |
| 17     | Contact of module |         |

Rear (when configured with 4:1 combination (mixed RF output mode):



| Number | Description                               | Comment   |
|--------|---|---|
| 13     | RF output RX1 .. RX4 combined to one port | At 4: combination 7,5 dB Loss in comparison to 1:1 Port A |
| 15     | Testpoint at 4:1 combination              | Port C  |
| 17     | Contact of module                         |   |

### Operation via the web browser

First select “Module” in the main menu of the web interface. In the “Type” column, select the “RX” option for the slot containing the ORRXm. The following input mask now appears.

Each parameter is indexed with Rx1 to Rx4 depending on which return path you want to set.

Platform
Module
ModifyPassword

Slots

| Index | Type         |
|-------|--------------|
| 0     | Fan          |
| 1     | Tx           |
| 2     | NULL         |
| 3     | NULL         |
| 4     | NULL         |
| 5     | NULL         |
| 6     | NULL         |
| 7     | NULL         |
| 8     | NULL         |
| 9     | Rx           |
| 10    | NULL         |
| 11    | NULL         |
| 12    | NULL         |
| 13    | NULL         |
| 14    | NULL         |
| 15    | NULL         |
| 16    | NULL         |
| 17    | Power Supply |
| 18    | Power Supply |

Parameter

Rx Slot: 9
Help
Update
Refresh

Note
Edit

| Name               | Value     | Configure  |
|--------------------|-----------|------------|
| Rx1RecvPower       | -7.2 dBm  | Threshold  |
| Rx2RecvPower       | -99.9 dBm | Threshold  |
| Rx3RecvPower       | -99.9 dBm | Threshold  |
| Rx4RecvPower       | -99.9 dBm | Threshold  |
| Rx1OutRFLevel      | 0.0 dBuV  | Threshold  |
| Rx2OutRFLevel      | 0.0 dBuV  | Threshold  |
| Rx3OutRFLevel      | 0.0 dBuV  | Threshold  |
| Rx4OutRFLevel      | 0.0 dBuV  | Threshold  |
| Rx1OptAGCCtrlEn    | Enable    | Enable set |
| Rx2OptAGCCtrlEn    | Enable    | Enable set |
| Rx3OptAGCCtrlEn    | Enable    | Enable set |
| Rx4OptAGCCtrlEn    | Enable    | Enable set |
| RFOutPutMode       | Single    | Single set |
| Rx1RFWorkMode      | HFC       | HFC set    |
| Rx2RFWorkMode      | HFC       | HFC set    |
| Rx3RFWorkMode      | HFC       | HFC set    |
| Rx4RFWorkMode      | HFC       | HFC set    |
| Rx1Att             | 20 dB     | 20 set     |
| Rx2Att             | 20 dB     | 20 set     |
| Rx3Att             | 20 dB     | 20 set     |
| Rx4Att             | 20 dB     | 20 set     |
| ChanNum            | 10        | 10 set     |
| Device Temperature | 31.9 °C   |            |
| Version            | 6.82      |            |

Figure 14: Configuration of the ORRXm

The parameters in detail:

| Parameter name                                     | Description   | Comment  |
|--|---|--|
| <b>Status parameters (green or red background)</b> |   |  |
| <b>Rx(n)RecvPower</b>                              | Opt. input level at input 1 (Port A) to input 4 (Port D)  | Green = Status O.K.<br>Red = out of range<br>Alarm thresholds can be defined via the threshold button.                       |
| <b>Rx(n)OutRFLevel</b>                             | RF output level for output 1..output 4  | Green = Status O.K.<br>Red = out of range  |
| <b>Adjustable parameters</b>                       |   |  |
| <b>Rx(n)OptAGCCntrEn</b>                           | Optical AGC (Automatic Gain Control)<br>Enable = AGC ON /<br>Disable = AGC OFF  |  |
| <b>RFOutPutMode</b>                                | Mixed: all RF ports are combined to output 1 (Port A)<br>Single: separate return channel ports 1..4   |  |
| <b>Rx(n)WorkMode</b>                               | HFC: standard operation for HFC mode<br>RFoG: burst mode operation (for example when several Nodes are combined via splitters and transmit in burst mode) | HFC = standard operation   |
| <b>Rx(n)Att</b>                                    | Attenuation for RF amplifier for RX1..RX4 at the output<br>HFC mode: 0 .. 30 dB<br>RFoG mode: 0 ..60 dB   | for level adjustment and to avoid blasting (maximum level: < 100 dB $\mu$ V at 1:1 and channle load 7xQAM64, 5-65 MHz at RX) |
| <b>ChanNum</b>                                     | Number of return channels ( for example at 7xQAM = 7)   | for internal calculation of RF levels  |
| <b>Device Temperature</b>                          | Temperature within the module   | Recommended ambient temperature +10 °C bis +45 °C (max. range -5 °C bis +55 °C, for a short period of time!!)                |

Figure 15: Parameters of the ORRXm

To update the firmware of the module, click on “Platform” in the main menu. Here you can select the firmware file and start the update.

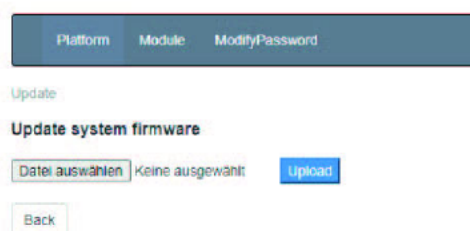
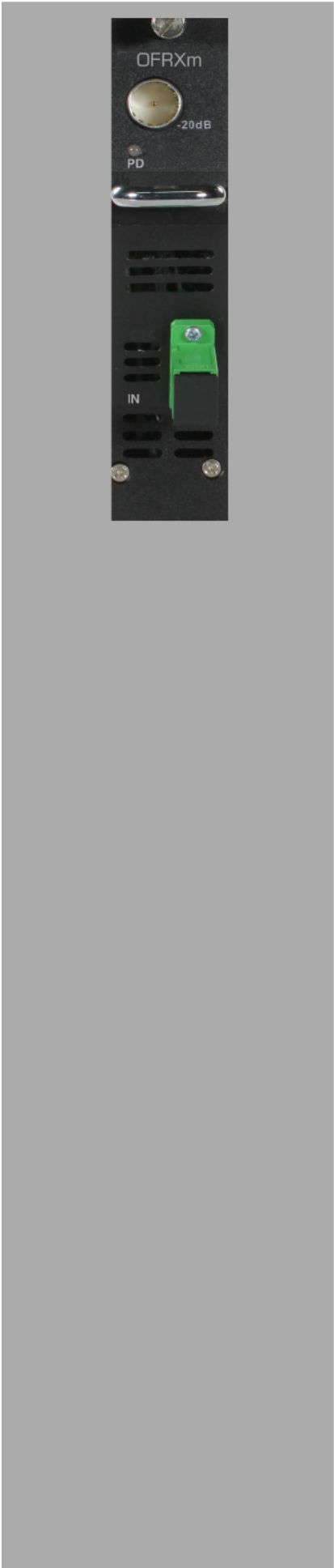


Figure 16: Menu: Platform - Update



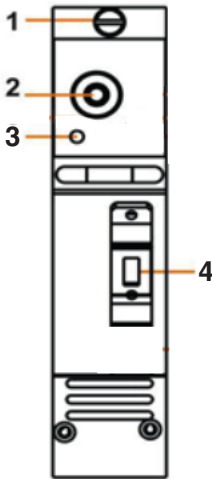
## Optical forward path receiver OFRXm-21

The delivery includes the following parts:

- ☐ Module OFRXm-21
- ☐ Operating manual

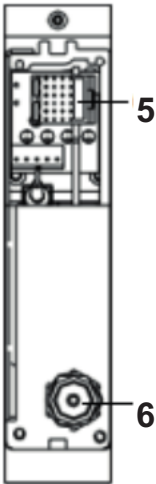
The OFRXm-21 is an optical forward path receiver. The output frequency range is 45-1006 MHz.

Front:



| Number | Description                   | Comment   |
|--------|-------------------------------|---|
| 1      | Rändelschraube<br>Rackmontage |   |
| 2      | RF test point                 | -20 dB  |
| 3      | status LED<br>optical power   | LED green: opt. input power<br>-10 to +3 dBm<br>LED red: opt. input power<br>less than -10 dBm or more than<br>+3 dBm |
| 4      | optical input                 |   |

Rear side:



| Number | Description       | Comment |
|--------|-------------------|---------|
| 5      | Conatct of module |         |
| 6      | RF output         |         |



Bedienung über den Webbrowser

First select “Module” in the main menu of the web interface. In the “Type” column, select the “RX” option for the slot containing the ORRXm. The following input mask now appears.

PlatformModuleModifyPassword

Slots

| Index | Type   | Note |
|-------|--------|------|
| 0     | Fan    |      |
| 1     | NULL   |      |
| 2     | NULL   |      |
| 3     | Tx     |      |
| 4     | FRx    |      |
| 5     | NULL   |      |
| 6     | NULL   |      |
| 7     | NULL   |      |
| 8     | NULL   |      |
| 9     | NULL   |      |
| 10    | Rx     |      |
| 11    | Tx1310 |      |
| 12    |        |      |

Parameter

Optical Recv slot: 4HelpUpdateRefresh

NoteEdit

| Name              | Value     | Configure |
|-------------------|-----------|-----------|
| RecvPower         | -99.9 dBm | Threshold |
| RFOutputLevel     | 0.0 dBuV  | Threshold |
| OptAGCValidPower  | 0 dBm     | 0Set      |
| Att               | 0 dB      | 0Set      |
| EQ                | 0 dB      | 0Set      |
| ChanNum           | 78        | 78Set     |
| DeviceTemperature | 22.1 °C   |           |
| Version           | 1.60      |           |
| WorkTime          | 2.0 Hour  |           |
| SN                |           |           |

Figure 17: Configuration of the OFRXm-21

The parameters in detail:

| Parameter name                              | Description   | Comment   |
|---|---|---|
| Status parameters (green or red background) |   |   |
| RecvPower                                   | Opt. input level at input   | Green = Status O.K.<br>Red = out of range<br>Alarm thresholds can be defined via the threshold button.                    |
| RFOutputLevel                               | RF output level   | Green = Status O.K.<br>Red = out of range   |
| Adjustable parameters                       |   |   |
| OptAGCValid Power                           | Optical AGC (Automatic Gain Control)  |   |
| EQ  | Equalizer   |   |
| Att   | Attenuation for RF amplifier for RX1..RX4 at the output<br>HFC mode: 0 .. 30 dB<br>RFoG mode: 0 ..60 dB | for level adjustment and to avoid blasting<br>(maximum level: < 100 dBuV at 1:1 and channle load 7xQAM64, 5-65 MHz at RX) |
| ChanNum                                     | Number of return channels ( for example at 7xQAM = 7)   | for internal calculation of RF levels   |
| Device Temperature                          | Temperature within the module   | Recommended ambient temperature +10 °C bis +45 °C (max. range 5 °C bis +55 °C, for a short period of time!!)              |

Figure 18: Parameters of the OFRXm-21

To update the firmware of the module, click on “Platform” in the main menu. Here you can select the firmware file and start the update.

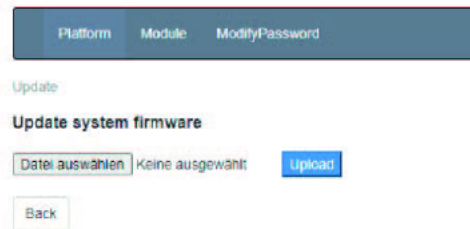


Figure 19: Menu: Platform - Update

# Optical amplifier OAMPm

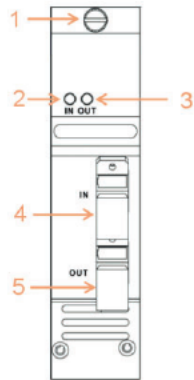


The delivery includes the following parts:

- ☐ OAMPXm module
- ☐ Operating manual

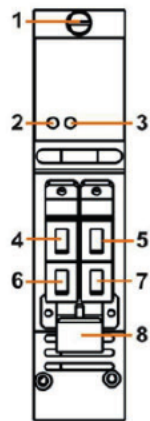
The OAMPm is an optical amplifier for HFC networks. The module requires one slot and is available as versions with 1 x 20dBm and 4 x 20 dBm.

OAMPm 120:



| Number | Description                       | Comment   |
|--------|-----------------------------------|---|
| 1      | nurled screw<br>rack mountin g    |   |
| 2      | Optical<br>input power indicator  | Green: between lower<br>threshold and +10 dBm<br>Red: under lower<br>threshold or over 10 dBm                         |
| 3      | Optical<br>output power indicator | Green: within margins<br>(> +/- 2dB around<br>power rating)<br>Red: without margins (<<br>+/- 2dB around power rat. ) |
| 4      | Opt. output port                  |   |
| 5      | Opt. input port                   |   |

OAMPm 420:



| Number  | Description                       | Comment   |
|---------|-----------------------------------|---|
| 1       | nurled screw<br>rack mountin g    |   |
| 2       | Optical<br>input power indicator  | Green: between lower<br>threshold and +10 dBm<br>Red: below lower<br>threshold or over<br>10 dBm                    |
| 3       | Optical<br>output power indicator | Green: within margins<br>(> +/- 2dB around<br>power rating)<br>Red: within margins (<<br>+/- 2dB around power rat.) |
| 4/5/6/7 | Opt. output ports<br>output 1..4  |   |
| 8       | Opt. input ports                  |   |

## Operation via the web browser

First select “Module” in the main menu of the web interface. In the “Type” column, select the “nxEDFA” option for the slot containing the ORRXm. The following input mask now appears.

Platform
Module
ModifyPassword

Slots

| Index | Type   |
|-------|--------|
| 0     | Fan    |
| 1     | Tx     |
| 2     | 1xEDFA |
| 3     | NULL   |
| 4     | NULL   |
| 5     | NULL   |
| 6     | NULL   |
| 7     | NULL   |
| 8     | Rx     |
| 9     | NULL   |
| 10    | NULL   |
| 11    | NULL   |
| 12    | NULL   |
| 13    | NULL   |
| 14    |        |

Parameter

EDFA Slot: 2
Help
Update
Refresh

Note
Edit

| Name                | Value     | Configure    |
|---------------------|-----------|--------------|
| Input power         | -59.9 dBm | Threshold    |
| Output Power        | -59.9 dBm | Threshold    |
| Pump1 Temperature   | 24.4 °C   | Threshold    |
| Pump1 Bias          | 0 mA      | Threshold    |
| Pump1 Tec           | 244 mA    | Threshold    |
| Pump2 Temperature   | 0.0 °C    | Threshold    |
| Pump2 Bias          | 0 mA      | Threshold    |
| Pump2 Tec           | 0 mA      | Threshold    |
| Output Att          | 0.0 dB    | 0.0 dB set   |
| Input Low Threshold | -5.0 dBm  | -5.0 dBm set |
| Pump Control        | on        | on set       |
| Device Temperature  | 22.8 °C   |              |
| Version             | 6.42      |              |

Figure 20: Configuration of the OAMPm

The parameters in detail:

| Parameter name                                     | Description                                   | Comment  |
|--|---|--|
| <b>Status parameters (green or red background)</b> |   |  |
| <b>Input Power</b>                                 | Opt. input level                              | Green: between lower threshold and +10 dBm<br>Red: below lower threshold or above 10 dBm<br>(above threshold values are definable)                             |
| <b>Output Power</b>                                | Optical output power                          | Green: within margins ( $> \pm 2$ dB around power rating)<br>Red: within margins ( $< \pm 2$ dB around power rating)<br>(above threshold values are definable) |
| <b>Pump1 Temperature</b>                           | Temperature of laser pump 1                   |  |
| <b>Pump1 Bias</b>                                  | Bias current of laser pump 1                  |  |
| <b>Pump1 Tec</b>                                   | Thermoelectric cooler current of laser pump 1 |  |
| <b>Pump2 Temperature</b>                           | Temperature of laser pump 2                   | If there is no pump 2, 0 °C is displayed.  |
| <b>Pump2 Bias</b>                                  | Bias current of laser pump 2                  | If there is no pump 2, 0 mA is displayed.  |
| <b>Pump2 Tec</b>                                   | Thermoelectric cooler current of laser pump 2 | If there is no pump 2, 0 mA is displayed.  |
| <b>Konfigurations Parameter</b>                    |   |  |
| <b>Output Att</b>                                  | Attenuation of output power in dB             | up to 3 dB optical attenuation possible  |
| <b>Input Lower Threshold</b>                       | Lower threshold of optical input power        | for alarm purpose when level at the input is too low   |
| <b>PumpControl</b>                                 | On = Laser active<br>Off = Laser inactive     |  |
| <b>Device Temperature</b>                          | Temperature within module                     | recommended temperature +10 °C to +45 °C<br>(max. range - 5 °C to +55 °C for a short period of time!!)   |

Figure 21: Parameters of the OAMPm

To update the firmware of the module, click on "Platform" in the main menu. Here you can select the firmware file and start the update.

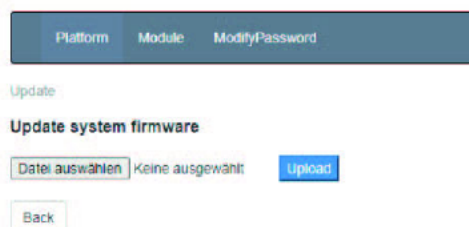


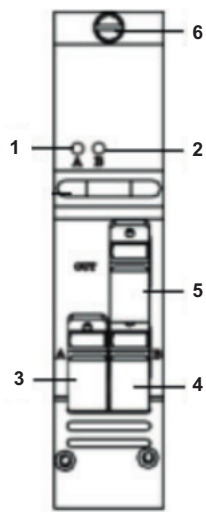
Figure 22 Menu: Platform - Update

# Optischer Schalter OSWm-21

Die Lieferung umfasst die folgenden Teile:

- ☐ Modul OSWm-21
- ☐ Betriebsanleitung

The OSWm-21 is an optical switch for HFC networks. .



| Number | Description                            | Comment  |
|--------|--|--|
| 1      | status LED channel A                   | green: -15 to +24 dBm<br>red: < -15 or > +24 dBm |
| 2      | status LED channel B                   | green: -15 to +24 dBm<br>red: < -15 or > +24 dBm |
| 3, 4   | 3: signal input A<br>4: signal input B |  |
| 5      | optical output                         |  |
| 6      | nurled screw for rack mountin g        | Lorem ipsum                                      |

## Operation via the web browser

At the time of writing there is no screenshot of the module's webinterface.

To update the firmware of the module, click on "Platform" in the main menu. Here you can select the firmware file and start the update.

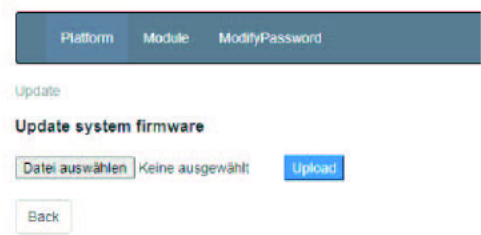


Figure 23: Menü Platform - Update

## Troubleshooting

If the device is not functioning correctly, please perform the following checks:

- ☐ Check whether the device is connected to the required mains voltage (230 V~, 50 Hz).
- ☐ Check whether the signal cable is connected correctly, and that there are no breaks or short circuits in the connectors.

If the problem cannot be resolved, please contact the ASTRO customer service.

## Maintenance and repair

**ACHTUNG:** *The following safety information must be observed when performing maintenance and repair work. Failure to observe this safety information may result in personal injury due to electrical and thermal dangers!*

- ☐ The operating display only shows whether the DC current, which supplies the device components, has been disconnected from the mains voltage. If the operating display (for the power supply unit or the device) does not light up, this does not mean that the device has been fully disconnected from the mains voltage. There may still be voltages in the device that are dangerous to touch. You may therefore not open the device.
- ☐ The cover for the power supply unit is designed to prevent accidental contact with voltages that are dangerous to touch, and must not be removed.
- ☐ Read carefully: EN 60728 - Part 1 Safety requirements: No service work during thunderstorms.
- ☐ A defective device may only be repaired by the manufacturer to ensure that components with the original specification are used (e.g. power cable, fuse). Improperly performed repairs may result in considerable dangers for the user or installer. If malfunctions occur, the device must therefore be disconnected from the mains and authorised experts must be consulted. The device may need to be sent to the manufacturer.

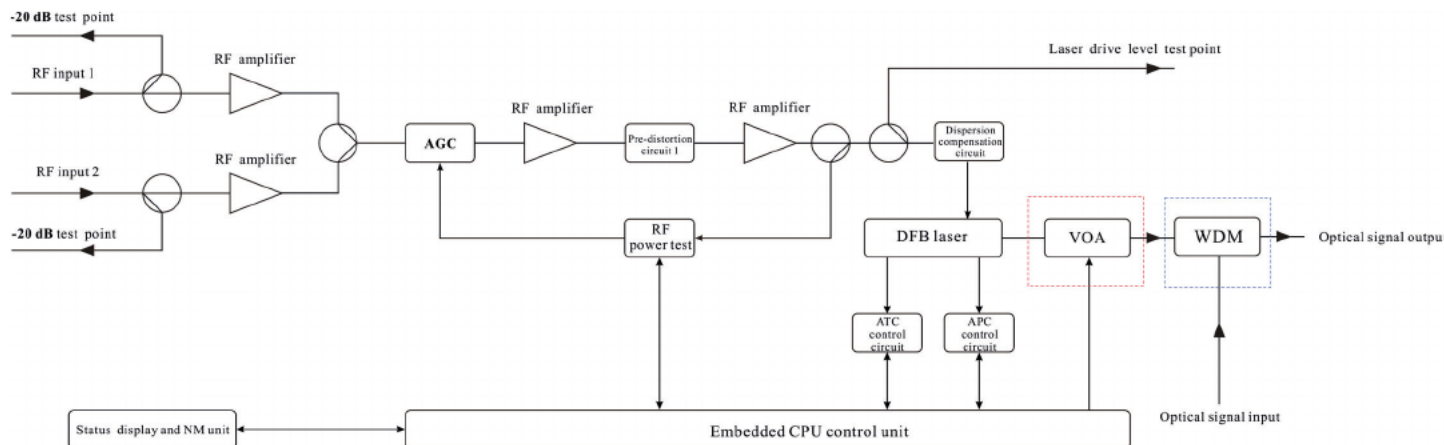
## Service tasks

**HINWEIS:** *The device must only be operated with the original power module!*

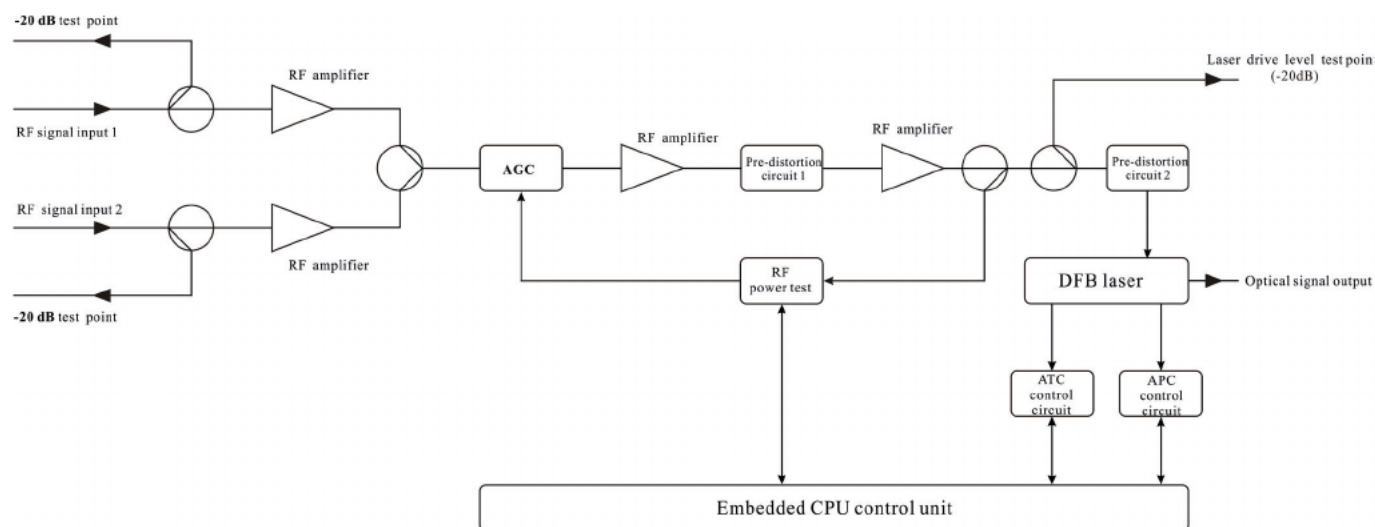


# Block diagrams

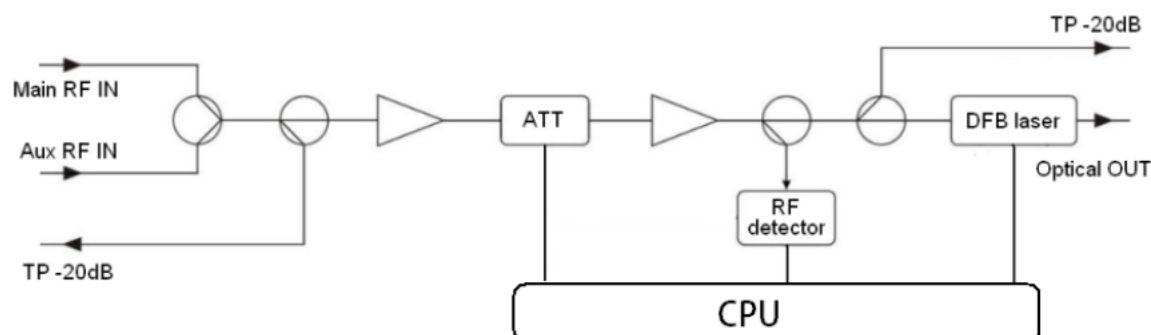
ODMTXm-1550:



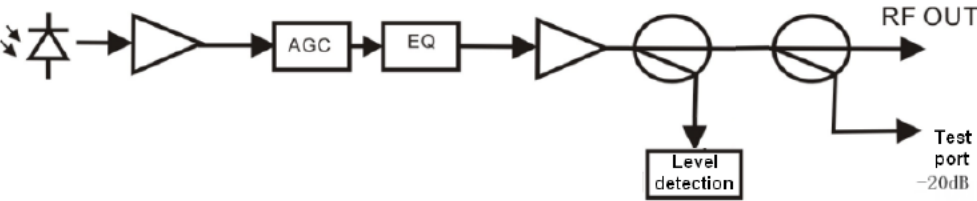
ODMTXm-1310:



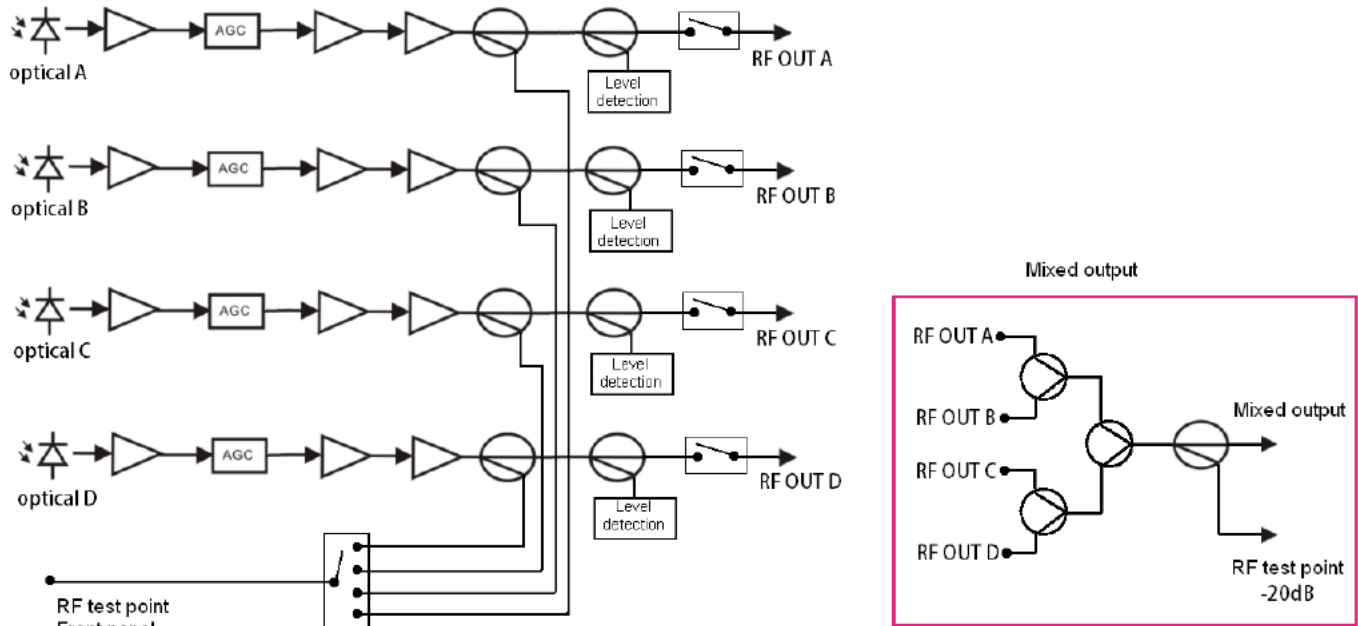
ODMRTXm-xxxx:



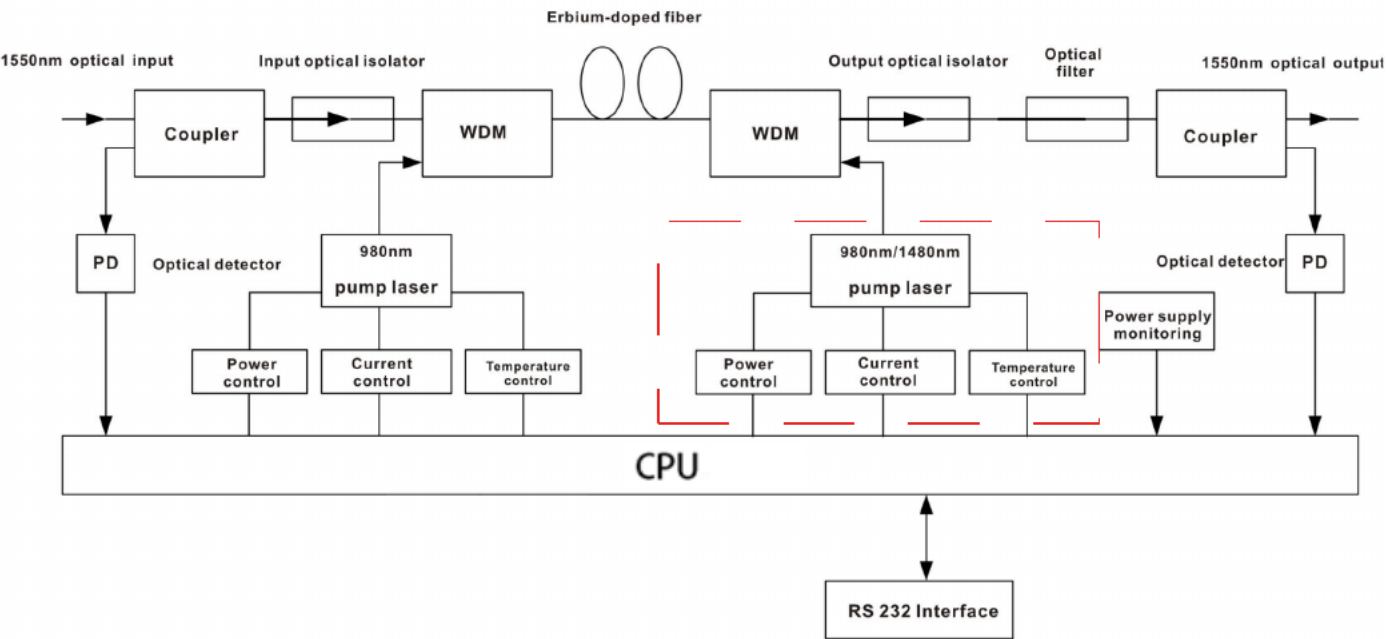
OFRXm-21:



ORRXm:



OAMPm:



## Technical data

| Type                   |      | AOCS-SR AC              | AOCS-SR DC     | AOCS-SR ACDC                       |
|------------------------|------|-------------------------|----------------|------------------------------------|
| Order number           |      | 212 185                 | 212 186        | 212 187                            |
| EAN-Code               |      | 4026187199074           | 4026187199081  | 4026187199098                      |
| Power supply           |      | 2x 100...260 VAC        | 2x 40...60 VDC | 1x 100...260 VAC<br>1x 40...60 VDC |
| Conversion efficiency  | [%]  | > 85                    |                |                                    |
| Power factor           |      | > 0,9                   |                |                                    |
| Dimensions (W x H x D) | [mm] | 483 x 176 x 420         |                |                                    |
| Weight                 | [kg] | 12                      |                |                                    |
| Operating humidity     | [%]  | max. 95, non-condensing |                |                                    |
| Storage temperature    | [°C] | -30...70                |                |                                    |
| Ambient temperature    | [°C] | -25...55                |                |                                    |

| Type   |         | ODMTXm-1310-07  | ODMTXm-1310-10              | ODMTXm-1310-13              |
|--|---------|---|-----------------------------|-----------------------------|
| Order number                                   |         | 212 070   | 212050                      | 212080                      |
| EAN-Code                                       |         | 4026187210441   | 4026187210458               | 4026187210465               |
| Optical characteristics                        |         |   |                             |                             |
| Optical input wavelength                       | [nm]    | 1310 ± 10<br>standard not selected ITU laser within range alternatively, specified DWDM laser |                             |                             |
| Optical output power                           | [dBm]   | 2 separate outputs, each 07   | 2 separate outputs, each 10 | 2 separate outputs, each 13 |
| Laser type                                     |         | DFB high performance laser  |                             |                             |
| Number of optical output ports                 |         | 2   |                             |                             |
| Modulation type                                |         | direct optical intensity modulation   |                             |                             |
| RIN  | [dB/Hz] | < -154  |                             |                             |
| Flatness                                       | [dB]    | ± 0,75  |                             |                             |
| Optical connector type                         |         | SC/APC on front   |                             |                             |
| RF characteristics                             |         |   |                             |                             |
| Frequency range                                | [MHz]   | 110 - 1218  |                             |                             |
| RF input level range (AGC working range)       | [dBμV]  | 72 - 85   |                             |                             |
| AGC control range / MGC range                  | [dB]    | ± 5,0 / 0 .. 20   |                             |                             |
| RF input test port (switchable between Inputs) | [dB]    | -20 ± 1,5   |                             |                             |
| RF input impedance                             | [Ω]     | 75  |                             |                             |
| RF input return loss                           | [dB]    | ≥ 16 (47 - 550 MHz); ≥ 14?550 - 862/1003 MHz?   |                             |                             |
| CTB*   | [dB]    | ≥ 62  |                             |                             |
| CSO*   | [dB]    | ≥ 59  |                             |                             |
| C/N*   | [dB]    | ≥ 50  |                             |                             |
| Common data                                    |         |   |                             |                             |
| Power consumption                              | [W]     | < 20  |                             |                             |
| Weight   | [kg]    | < 1   |                             |                             |
| Dimensions (W x H x D)                         | [mm]    | module for AOCS-SR  |                             |                             |
| Ambient temperature                            | [°C]    | -5 .. +55 (ETSI EN 300019-3 Class 3.2)  |                             |                             |

\*) Test link-1: Optical transmitter ?18 dBm EDFA?20 km Fiber link? Optical attenuator ? Optical Receiver (Optical power input level = 0 dBm, noise bandwidth 5 MHz, single optical wavelength), 25 PALBG channel 119,25-287,25 MHz + 114 256QAM-8 MHz Digital channel 302-1214 MHz

| Type   |         | ODMTXm-1550-2-10  |
|--|---------|---|
| Order number                                   |         | 212 030   |
| EAN-Code                                       |         | 4026187199180   |
| Optical characteristics                        |         |   |
| Optical input wavelength                       | [nm]    | 1550 ± 10<br>standard not selected ITU laser within range alternatively, specified DWDM Laser |
| Optical output power                           | [dBm]   | 2 separate outputs, each 10,0   |
| Laser type                                     |         | DFB high performance laser  |
| Number of optical output ports                 |         | 2   |
| Modulation type                                |         | direct optical intensity modulation   |
| RIN  | [dB/Hz] | < -154  |
| Flatness                                       | [dB]    | ± 1,0   |
| Optical connector type                         |         | SC/APC on front   |
| RF Characteristics                             |         |   |
| Frequency range                                | [MHz]   | 110 - 1218  |
| RF input level range (AGC working range)       | [dBμV]  | 72 - 85   |
| AGC control range / MGC range                  | [dB]    | ± 5,0 / 0 .. 20   |
| RF input test port (switchable between Inputs) | [dB]    | -20 ± 1,5   |
| RF input impedance                             | [Ω]     | 75  |
| RF input return loss                           | [dB]    | ≥ 16 (47 - 550 MHz); ≥ 14?550 - 862/1003 MHz?   |
| CTB*   | [dB]    | ≥ 62  |
| CSO*   | [dB]    | ≥ 59  |
| C/N*   | [dB]    | ≥ 50  |
| MER**  | [dB]    | > 40  |
| BER**  |         | < 10 <sup>-9</sup>  |
| BC-NC RF isolation                             | [dB]    | > 50  |
| Common data                                    |         |   |
| Power consumption                              | [W]     | < 20  |
| Weight   | [kg]    | < 1   |
| Dimensions (W x H x D)                         | [mm]    | module for AOCS-SR  |
| Ambient temperature                            | [°C]    | -5 .. +55 (ETSI EN 300019-3 Class 3.2)  |

\*) Test link-1: Optical transmitter ?18 dBm EDFA?20 km Fiber link? Optical attenuator ? Optical Receiver (Optical power input level = 0 dBm, noise bandwidth 5 MHz, single optical wavelength), 25 PALBG channel 119,25-287,25 MHz + 114 256QAM-8 MHz Digital channel 302-1214 MHz

\*\*) Test link-2: Optical transmitter ?18 dBm EDFA?20 km ? Fiber link ? Optical attenuator ? Optical Receiver (Optical power input level = 0 dBm, noise bandwidth 5 MHz, single optical wavelength), Full digital load 254-1214 MHz QAM256, OMI total between 19 - 26 %

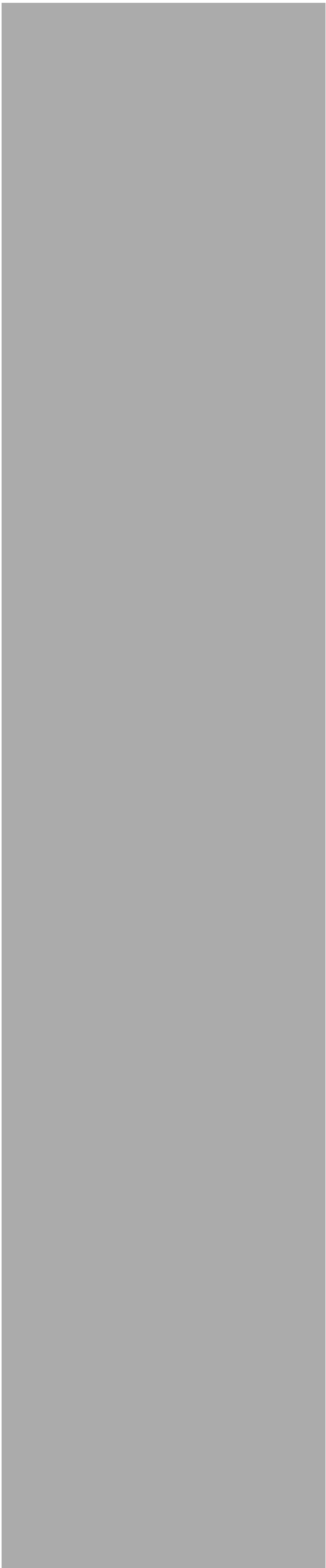
| Type   |        | ODMRTxxxx-06                             |
|--|--------|--|
| Order number                                   |        | 212 xxx (xxx depends on CWDM wavelength) |
| EAN-Code                                       |        | 4026187xxxxx                             |
| Optical characteristics                        |        |  |
| Optical output power                           | [dBm]  | 1 - 4                                    |
| Optical output wavelength                      | [nm]   | optional CWDM wavelength                 |
| Laser type                                     |        | DFB laser                                |
| Modulation type                                |        | direct optical intensity modulation      |
| Optical return loss                            | [dB]   | > 45                                     |
| Laser working mode                             |        | continuous mode                          |
| Optical connector type                         |        | SC/APC on front                          |
| RF Characteristics                             |        |  |
| Frequency range                                | [MHz]  | 5 - 300                                  |
| RF input level range (AGC working range)       | [dBμV] | 75 - 85                                  |
| RF input test port (switchable between Inputs) | [dB]   | -20 ± 1                                  |
| Laser drive level test port                    | [dB]   | -20 ± 1                                  |
| Flatness                                       | [dB]   | ± 0,75                                   |
| Return loss                                    | [dB]   | ≥ 16                                     |
| Input level adjusting range                    | [dB]   | 0 - 30                                   |
| NPR dynamic range                              | [dB]   | ≥10 (NPR≥30 dB) (Note 1)                 |
| Common data                                    |        |  |
| Power consumption                              | [W]    | ≤ 3                                      |
| Weight   | [kg]   | < 1                                      |
| Dimensions (W x H x D)                         | [mm]   | module for AOCS-SR                       |
| Ambient temperature                            | [°C]   | -5 .. +55 (ETSI EN 300019-3 Class 3.2)   |

| Type                         |        | OFRXm-21  |
|------------------------------|--------|---|
| Order number                 |        | 212 159   |
| EAN-Code                     |        | 4026187210380   |
| Optical characteristics      |        |   |
| Optical input wavelength     | [nm]   | 1100 - 1600   |
| Optical return loss          | [dB]   | < 45  |
| Optical connector type       |        | SC/APC  |
| Fibre type                   |        | Single mode   |
| RF characteristics           |        |   |
| Optical AGC range            | [dBm]  | -8...+2   |
| Optical AGC control point    | [dBm]  | -8/-7/-6/-5/-4/-3/-2 adjustable   |
| Frequency range              | [MHz]  | 45 - 862 / 1003   |
| Flatness in band             | [dB]   | ± 0,75  |
| Maximum output level         | [dBμV] | ≥ 104   |
| Output return loss           | [dB]   | ≥ 16  |
| Electronic control EQ range  | [dB]   | 0 - 15  |
| Electronic control ATT range | [dB]   | 0 - 15 : PIN diode<br>0 - 10: Integrated module   |
| C/N                          | [dB]   | 51  |
| C/CTB                        | [dB]   | 67, Optical receiving power: -1dBm<br>84 analog signals with an output level of 98 dBμV |
| C/CSO                        | [dB]   | 62  |
| Common data                  |        |   |
| Power consumption            | [W]    | < 18  |
| Weight                       | [kg]   | < 1   |
| Dimensions (W x H x D)       | [mm]   | module for AOCS-SR  |
| Ambient temperature          | [°C]   | -5 .. +55 (ETSI EN 300019-3 Class 3.2)  |

| Type   |              | ORRXm  |
|--|--------------|--|
| Order number   |              | 212 191  |
| EAN-Code   |              | 4026187199142  |
| Optical characteristics  |              |  |
| Optical input wavelength   | [nm]         | 1260 - 1620  |
| Optical input power range  | [dBm]        | HFC mode (constant power, typ. PtP structure): -15,0 .. -1,0<br>RFoG Mode (burst mode, PtMP structure over splitter): -25,0 .. -10,0   |
| AGC  | [dBm]        | AGC OFF or ON set-up on front panel of controller or web interface<br>(AGC ON used for HFC mode / AGC OFF RFoG mode)   |
| Attenuation adjustment range separately for each RX for different operation mode | [dB]         | 0 .. 30: HFC mode with AGC ON<br>0 .. 60: RFoG mode with AGC OFF   |
| Typical RF output level  | [dBμV]       | ≥ 105 (in optical range of -10...0 dBm)  |
| Optical return loss  | [dB]         | > 40   |
| Flatness   | [dB]         | ± 1  |
| Optical return loss  | [dB]         | ≥ 16   |
| Output Impedance   | [Ω]          | 75   |
| Optical connector type   |              | SC/APC (other on request)  |
| Receiver noise current (Pin=-5 dB)   | [pA/Sqrt Hz] | < 1,5  |
| Fibre type   |              | Single mode fiber 9/125  |
| RF characteristics   |              |  |
| Number of RF ports   |              | 4 (4:4 no combining / 4 separate RF outputs) or<br>1 (4:1 in RF combination mode, 1 RF output combined)  |
| Frequency range  | [MHz]        | 5...204  |
| Typical RF output level (on rear side)   | [dBμV]       | ≥ 90 HFC mode (for Pin= -15 dBm, OMI = 15%)<br>≥ 80 RFoG mode (for Pin= -25 dBm, OMI = 15%)  |
| RF test port (on front panel)  |              | 20 (each RF port can be switched by pressing a front panel button to the test port. The corresponding RF LED for input active on front panel is flashing for the selected channel) |
| Common data  |              |  |
| Power consumption  | [W]          | < 20   |
| Weight   | [kg]         | < 1  |
| Dimensions (W x H x D)   | [mm]         | module for AOCS-SR   |
| Ambient temperature  | [°C]         | -5 .. +55 (ETSI EN 300019-3 Class 3.2)   |

| Type                                   |       | OAMPm-120   | OAMPm-420   |
|--|-------|---|---|
| Order number                           |       | 212 193   | 212 194   |
| EAN-Code                               |       | 4026187199166   | 4026187199173   |
| RF and optical characteristics         |       |   |   |
| Optical input wavelength               | [nm]  | 1545...1561   |   |
| Rated optical input power range        | [dBm] | 0... +10  |   |
| Optical output power per port          | [dBm] | 20,0 ± 0,5  |   |
| Total optical output power             | [dBm] | 20,0 ± 0,5  | 27,0 ± 0,5  |
| Noise figure (Pin=0 dBm, λ=1550 nm)    | [dB]  | ≤ 5   |   |
| Number of optical output ports         |       | 1   | 4   |
| Polarization dependent loss            | [dB]  | ≤ 0,4   |   |
| Polarization dependent mode dispersion | [ps]  | ≤ 0,5   |   |
| Return loss at input                   | [dB]  | ≥ 40  |   |
| Return loss output                     | [dB]  | ≥ 45  |   |
| Optical Isolation input to output      | [dB]  | ≥ 30  |   |
| Optical output adjustable range        | [dB]  | 0...-3 in steps of 0,1 dB                                   |   |
| Optical connector type                 |       | 1x input: SC/APC<br>1x output: SC/APC<br>(other on request) | 1x input: SC/APC<br>4x output: SC/APC<br>(other on request) |
| Common data                            |       |   |   |
| Chassis type                           |       | module for AOCS-SR  |   |
| Power consumption                      | [W]   | ≤ 10  | ≤ 15  |
| Weight                                 | [kg]  | 1   |   |
| Operating relative humidity            | [%]   | 85, no condensation   |   |
| Ambient temperature                    | [°C]  | -5 .. +55 (ETSI EN 300019-3 Class 3.2)                      |   |

| Type                           |       | OSWm-21                                |
|--------------------------------|-------|--|
| Order number                   |       | 210 090                                |
| EAN-Code                       |       | 4026187210472                          |
| Optical and RF characteristics |       |  |
| Operating wavelength           | [nm]  | 1200 – 1600                            |
| Insertion loss                 | [dBm] | ≤ 1,3                                  |
| Switching time                 | [ms]  | ≤ 500                                  |
| Return loss                    | [dB]  | ≥ 55                                   |
| Maximum optical input power    | [mW]  | 500                                    |
| Switching times                |       | ≥ 10,000.000                           |
| Optical connector              |       | SC/APC                                 |
| Common data                    |       |  |
| Power consumption              | [W]   | ≤ 2                                    |
| Weight                         | [kg]  | 1                                      |
| Dimensions (W x H x D)         | [mm]  | module for AOCS-SR                     |
| Ambient temperature            | [°C]  | -5 .. +55 (ETSI EN 300019-3 Class 3.2) |





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