GOING FUTURE TODAY.

OFN210 FR

Optical Fibre Node

Operating Manual

Version 08-2021A

Contents

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 OFN210 Fibre Node can only be used for transmitting analogue modulated 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 62368-1 . Unqualified person are not allowed to install and start operation of the device.

Device configuration

Target group for the configuration of the ASTRO fibre nodes are persons who have received instructions and have training enabling them to perform a configuration. Knowledge of EN 60728-11 and EN 62368-1 is not necessary for configuration.

Device description

The delivery consists of the following parts:

- ☐ Optical Fibre Node OFN210 FR
- ☐ Operating Manual

OFN210 FR:

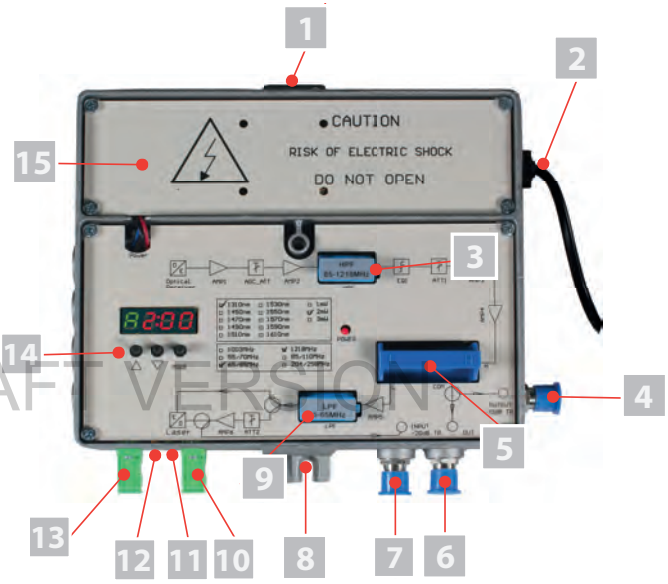


Figure 1: Fibre Node OFN210 FR

[1] Upper mounting handle with grounding point
[2] Power cord 150-265 VAC, 50-60 Hz
[3] High pass filter plugin
[4] Test port forward path -20 dB
[5] Diplex plugin
[6] RF In-/Output
[7] Reverse path RF test port
[8] Lower mounting handle with grounding point
[9] Low pass filter plugins
[10] Optical connector for reverse path (SC/APC)
[11] Reverse path TX status LED
[12] Optical power indication forward receiver
[13] Optical connector for forward path (SC/APC)
[14] Mode selection
(3 button configuration with LED display)
Enter button: press for 3 seconds to enter adjustment mode and long press for value confirmation; use arrow buttons for adjustment
[15] Power supply

CE

The OFN210 Fibre Nodes feature a CE marking. This confirms that the products conform to the relevant EC directives and adheres to the requirements specified therein.

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 view exposed fibre or connector ends when handling or maintaining optical equipment. Do not view with optical instruments into open connectors or fibre ends on switched on devices. Make sure all wherever a fibre inspection is required, that the inspected fibre or connector is completely optical radiation free.
- ☐ Due to the high optical radiation and improper handling of optical fibre connections and devices, there could be 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, which are above the acceptable maximum, this could cause permanent damage to the eye.

Installation, operation, maintenance

- The device may only be installed and operated by qualified persons (in accordance with EN 62368-1) 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.
- To avoid damage due to overheating, the device may only be installed on vertical surfaces. The installation basis should be level and non-flammable. Operating position: Device vertical, with power cable outlet at the bottom.
- 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.
- All 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.

Description of performance

The Fibre Node OFN210 type is a cost efficient forward and return path node, usable for DOCSIS 3.1 FTTB or FTTH bidirectional HFC networks.

It converts in forward path optical broadband signals in of the wavelength range from 1100 nm to 1610 nm to RF broadband signals in the frequency range from 87 or 258 MHz (depends on Diplex usage) to 1.218 GHz.

In the reverse path the transmitter sends the RF converted AM modulated signals on a separate fibre. The wavelength is 1310 nm/+3 dBm. The frequency range depending on the used diplex filter is either 5- 65 Mhz or 5-204 Mhz. The transmitter can be set electronically to “continuous mode” or in “burst transmitting mode”.

The optical reception is working with an AGC (Automatic Gain Control) control circuit. The optical input level range for the AGC signal can be setup with push buttons inside the device (see technical specification for details). Within the AGC range, the RF output level will be kept constant. Outside the AGC range, the RF level changes 2 dBµV for 1 dB optical level change. AGC range can be set electronically on the on the device set panel.

To adapt the required RF output level of the device, inter-stage attenuation can be electronically set up with the push button inside the device. For optimum performance, it is recommended to set an RF output level to max. 106 dBµV (according requirements for EN60728-3 with 119 QAM256 channels). Other channel loads and equalizer settings could of course allow a higher RF level.

The device also allows to set an electronically adjustable pre-emphasis in the forward path (equalizer circuit) for the signal, to compensate the coaxial loss on the high frequencies for the coax network connected to the RF output level. The pre-emphasis is working in such way that from the high to the low frequency a linear increasing attenuation will be set, meaning from high frequency to low frequency the attenuation will be a constant tilt, with maximum attenuation on the low frequency range. For example if you set the tilt to 8 dB, then the 8 dB attenuation will affect the low frequency. On the high frequency there is the same RF level as without the equalizer setting.

Features:

- ☐ die-cast housing fibre node for DOCSIS 3.1 specification
- ☐ Automatic Gain Control: -8 dBm to -5 dBm (lower AGC range by setting), up to 0 dBm (higher AGC range)
- ☐ high RF output level usable for MDU or larger coax networks
- ☐ standard 1310 nm DFB laser in return path (optional CWDM DFB laser)
- ☐ separate DS and US fibre connection 2 x SC/APC accessible form outside the device
- ☐ return path with “OBI free” burst or “continuous” mode
- ☐ equalizer and ATT electronical adjustable
- ☐ frequency range reverse 5 ..85 MHz (or 204 MHz) / forward 110 (or 258) ..1218 MHz
- ☐ high RF output level due to GaAS power double amplifier stage
- ☐ flexible plug diplexer set for 85/110 or 204/258
- ☐ forward and separate reverse path test port
- ☐ LED indication visible from outside the housing for forward reception status
- ☐ LED indication visible from outside the housing for reverse laser activity

Warranty conditions

The general terms and conditions of ASTRO Strobel GmbH apply. You will find these in the current catalogue or on the Internet under “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 Strobel is a member of the Elektro system solution for the disposal of packaging materials. Our contract number is 80395.

Configuring the device

After the device is physically installed and ready for commissioning, please follow the steps in the sequence as mentioned below.

1.Check optical input level before connecting to the device

Make sure that the optical input level is in the correct range (minimum -8 dBm, maximum about +0 dBm) to avoid damage of the optical receiver circuit. Before connecting to the device and power on, measure the optical level with the appropriate measurement equipment. If the level is too high, use optical attenuation to reach the recommended optical input range.
For the input optical wavelength, the signal must be in the specification of the device.
For optimized noise performance (CNR) it is recommended to provide an optical input level between -3 dBm and +0 dBm.
Lower optical levels will decrease the MER performance.

2.Grounding the device

Make sure that the device and also the coax cable shield is connected to protective ground to avoid floating potential, when connecting the coax cable and before power on.

3.Power on the device by plug-in the power adapter to the mains socket

Assure the mains voltage is in the range of 150..265 VAC / 50 or 60 Hz.

4.Set the AGC range (mode AG)

The AGC should be set within the required optical input level range. The lower AGC limit can be changed from -8 dBm .. -5 dBm. The higher AGC limit is fixed to +8 dBm.

5.Setup the required RF level with interstage attenuator (mode A1)

Do not set too high RF output levels, the performance will be worse.

6.Set the equalizer tilt for cable pre-equalization (mode E1)

The equalizer can be set between 0 dB and 15 dB. Higher equalizer settings will reduce the signal on lower frequency

and therefore it will allow a higher RF output level with still good distortion values.

7.Adjust the reverse level

The target RF input level in upstream at entry coaxial port of the Node is:

- ☐ with 7xQAM256 about 70 dBµV /Channel with a reverse A2 attenuation setting of about 7 dB
- ☐ with 6xQAM256 about 70 dBµV /Channel with a reverse A2 attenuation setting of about 7 dB

8.In case never open the device yourself, especially under power

In case of any problems please contact ASTRO Strobel Kommunikationssysteme GmbH or resend the device with the established valid RMA Procedure (RMA code/ Error description). If the device was opened by the installer/ customer, the warranty will be void.

Functional display settings

When device is opened, the settings panel will be visible. There are 3 read only values and 3 setup values in the forward path.
In the reverse path there are 2 read only values and 2 setup values.
There is a 3 button adjustment to enter or display different values:
- With arrow up and down the user can clockwise up or down step through the different menu values.
- If entered in a changeable parameter (blinking indication in LCD panel), with:
▲ the parameter is incremented,
with:
▼ the parameter is decremented.
- Whenever you press mode after changing, the parameter is written in the static parameter storage.

Mode button:
- Long pressing on the mode button (about 3 sec) will allow to enter the parameter for a change (if it is a changeable parameter). In this case the parameter in the LCD will start blinking.
- If you have adjusted with arrow up or down any parameter, another pressing on mode will store the parameter permanently.

Display indications for OFN210-FR:

Parameter Mode field	Display	Display (D) or Config. (C)	Description	comments
Forward path parameter				
Mode 1		D	Displays the optical input level in dBm or if too low shows Lo for low input level	Optical input level range depends on the AGC setting range
Mode 2		D	Display the DC power nominal 8VDC	This is a read only value only for information
Mode 3		D	Display the DC power nominal 12VDC	This is a read only value only for information
Mode AG		C	AGC range setting. The lower AGC limit could be set from -7dBm .. -5dBm. Upper AGC limit is fixed to +0dBm	Note: If the AGC range is changed for example from -7dBm to -5dBm (2dB optical increase), the RF level could be theoretical 4dB higher, which is 2x optical value.. Please make sure that the RF level is not higher than recommended 106dBµV for 119xQAM256 channels. For lower channel load the RF level can be higher.
Mode E1		C	Adjustment of the forward Equaliizer	Values 0-15dB are possible
Mode A1		C	Adjustment of the forward interstage Attenuation	Values 0-15dB are possible
Reverse path parameter				
Mode 4		D	Optical laser power in dBm	This field is just for information.
Mode 5		D	Laser current in mA	This field is just for information.
Mode AG		C	Mode of return channel operation burst or continous mode	b: burst mode C: continuous mode
Mode A2		C	Adjustment of the reverse interstage Attenuation	Values 0-15dB are possible

Figure 11: display indications of OFN210-FR explained

Troubleshooting

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

- ☐ `Device not working or LCD is dark when pressing Enter key:`
  Check the power connection. If power connection is okay, return device for repair or replacement according ASTRO RMA procedure.

- ☐ `No RF output signal:`
  - Check the optical input signal with an optical power meter.
  - Clean the patch cable and also the adapter on the device (one click cleaner or similar).
  - Check the connection of the optical cable.
  - Check the connection of the RF cable.
  - Check the internal voltage via information on display (mode 5) for +8 VDC.
  - Check the optical input value with information on display (mode 1) for a valid range (-8 ..0 dBm).
  - Disconnect the coaxial cable on the device. Measure the directly on the RF output port if RF signal is present. Check the coaxial cable/connector attached on the RF output and the further way of it..

- ☐ `RF Level too high or too low:`
  Commissioning according requirements with correct equalizer setting, attenuation setting in forward and reverse path as well as AGC range setting (mode E1, mode A1, mode AG).

- ☐ `MER in forward path is too low:`
  - Check optical input signal; lower optical input signal will reduce MER performance (check also the indication LED next to the optical SC/APC connector, which should show a green color).
  - Check the optical connection, clean the adapters.
  - The optical modulation index of the transmitter may be too low.
  - Total signal performance of the incoming signal may be too low.

- ☐ `MER and BER in reverse path is too low:`
  - Check about reverse path RF input levels for the correct target valuses:
  With 7xQAM256 about 70dBµV /Channel with a reverse A2 attenuation setting of about 7dB
  With 6xQAM256 about 70dBµV/Channel with a reverse A2 attenuation setting of about 7dBw.

- The TV picture shows analogue distortion bars or for digital it shows block areas:
  The performance of the total link could be too low.
  The RF level may be too high. Increase the interstage attenuation to reduce output level or change the equalizer settings and check picture quality again.

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

Maintenance and repair

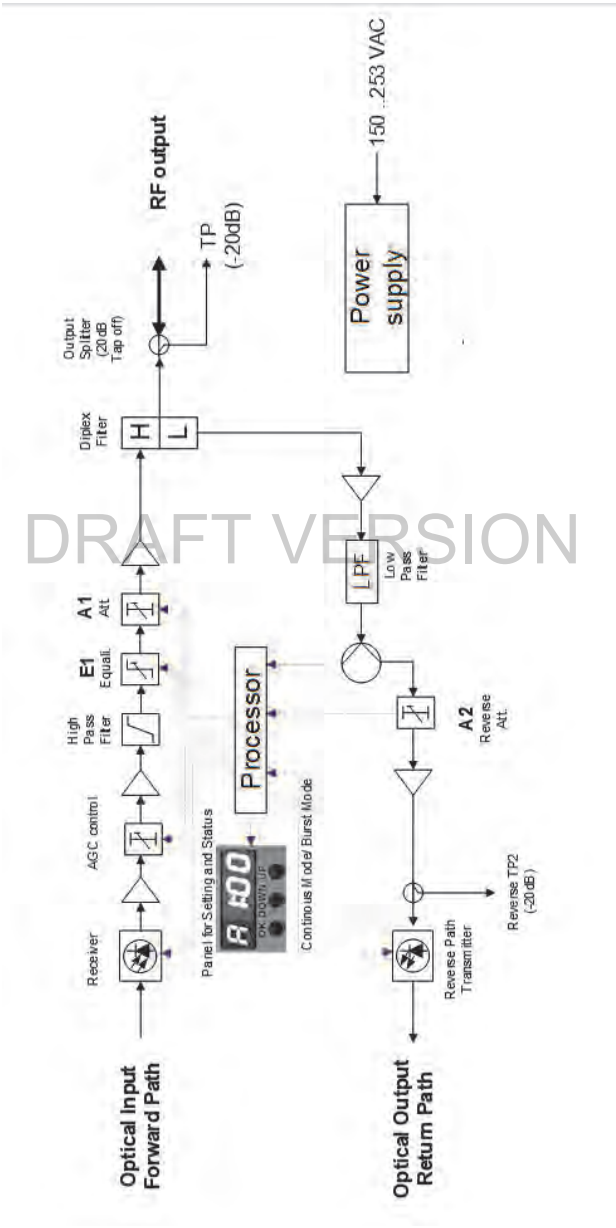
ACHTUNG: ***The following safety information must be observed when performing maintenance and repair work. Failure to observe this safety information may result in personal injury due to electrical and thermal dangers!***

- 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.

Block diagram

OFN210-FR:



Technical data

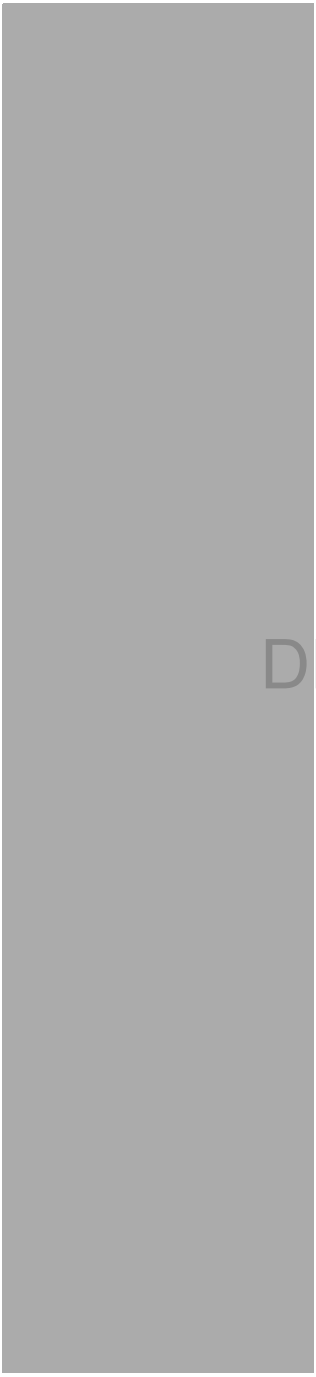
Type		OFN210-FR-1310-085-AC*
Order number		212 107
EAN-Code		4026187197797
Optical node type		Forward path and return path
Optical characteristics		
Optical input wavelength	[nm]	1100…1610
Optical input power	[dBm]	-8… 0
AGC range	[dB]	adjustable -7 / -6 / -5…0
Noise current typ.	[pa/√Hz]	≤ 5
Optical connector type		SC/APC; other on request
Fibre type		Single mode 9/125
RF characteristics forward path		
Frequency range (flexible diplex filter)	[MHz]	87 or 258…1218
Flatness (at Pin = -3 dBm)	[dB]	< ± 1,0
Typ. RF level (MER > 42,5 dB, BER < 1E-9)	[dBµV]	106 **
Interstage attenuation A1	[dB]	0…15, 1 dB steps
Interstage equalizer E1	[Ω]	0…15, 1 dB steps
Output Return Loss	[dB]	18
Output Impedance	[dB]	75
RF testpoint	[dB]	-20 ± 1,0
Optical characteristics return path		
Optical Wavelength	[nm]	1310 nm ±10, 1550 nm ±10 or CWDM
Optical Power	[dBm]	+3,0 ± 0,7 (DFB Laser)
Flatness	[dB]	±1.0
Fibre type		Single mode 9/125
RF characteristics return path		
Recommended RF input level / channel	[dBµV]	70 (A2 set to 7 dB) ***
Frequency range	[MHz]	5 .. 65 or 204 (diplexer dependent)
Attenuator A2	[dB]	0…15, 1 dB steps
Test Port @ Return Laser	[dB]	-20
Return Loss	[dB]	18
Common data		
Power supply	[VAC]	Mains: 150…265 / 50-60
Chassis type		diecast housing

IP Protection class		IP 41
RF Output connector / Test connector		F-female
Power consumption	[W]	≤ 15
Weight	[kg]	1,5
Dimension (L x W x H)	[mm]	220 x 175 x 60
Ambient temperature	[°C]	-30…+65

*) other wavelength and/or diplex filters on request

**) EN60728 Part 3 / 119 channels starting 258 MhH to 1218 MHz / QAM256 / 8 MHz / 6,9 MSym, 0 dB slope,
Pin = -2,5 dBm,TX parameter: 3% OMI, AGC ON, 0 dB slope

***) Return performance with Diplex 65/85 for performance of: MER ≥ 40 dB, BER ≤ 1E-9
(total link with return path RX, opt.input level or return RX -7 dBm, fibre distance < 10 km)
Signaltype: 6 x QAM256 / 8 MHz / 6,9 Msym / Roll off 0,15 %, f in MHz: 15 / 23 / 31/ 39 / 47 / 55
or Signaltype: 7 x QAM64 / 6,4 MHz / 5.175 Msym / Roll off 0,15 %, f in MHz: 18 / 24 / 30,8 / 37,4 / 45,2 / 51,8 / 58,4



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