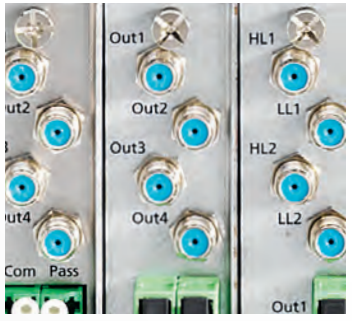
OPTOPUS

HIGH DENSITY OPTICAL PLATFORM



with OBI-FREE RFoG Solution

High Density Optical Platform

FROM HYBRID FIBER COAX TO FTTx AND DIGITAL FIBER COAX NETWORKS

OPTOPUS

Engineered to Perform

Solutions with **OPTOPUS**

HFC

From the Headend to the wall-outlet: Everything for the cable network.

RF OVER GLASS

RFoG is the solution for FTTH networks based on DVB and DOCSIS.

RF OVERLAY

Solutions for video services in GPON and Active Ethernet networks.

OPTOPUS
One Platform for All Networks

The WISI optical platform OPTOPUS is a remarkably flexible high density platform for all kinds of RF optical networks. The system may be used in any network, such as HFC, RF over Glass or RF Overlay in FTTX applications.

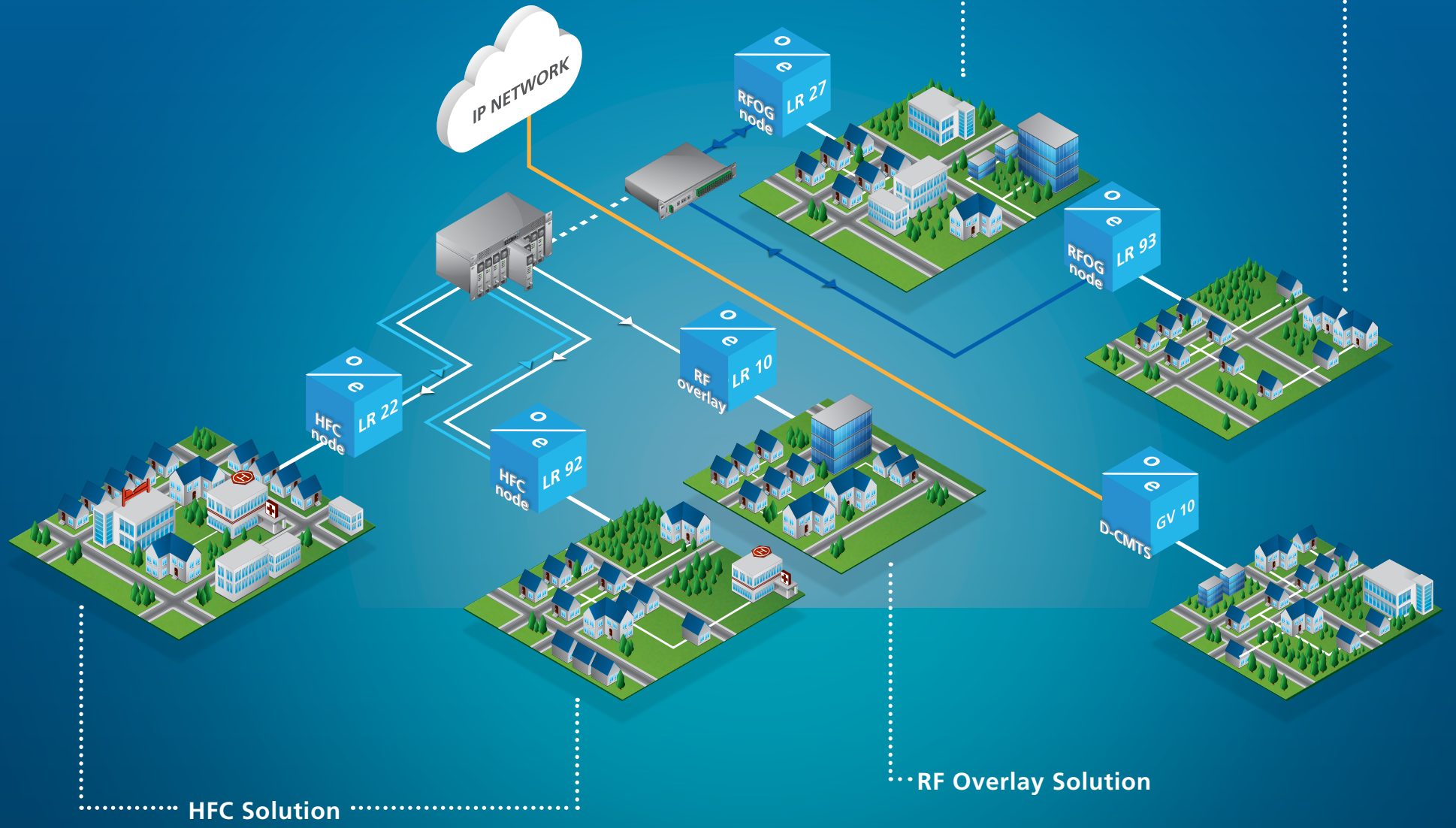
OPTOPUS is designed to meet any carrier's requirements necessary for today's networks. State-of-the-art features such as redundant AC and DC power supplies, pluggable fan units and advanced management features meet the carrier-grade demands of telecommunication and cable operators.

The OPTOPUS platform allows for the mounting of any module into any slot, thus giving the possibility for individual configuration depending on the desired applications.

With its 14 slots in a four-rack unit chassis, it utilises up to 28 transmitters, 56 receivers, or a mixture of these, including passive optics, power supply and management unit. OPTOPUS is the system of choice for every operator enabling powerful, flexible and cost-efficient optical access networks.

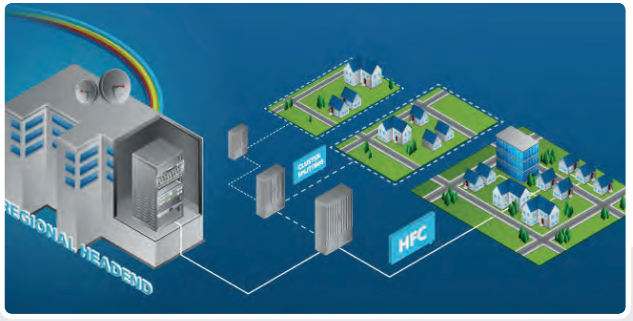
OPTOPUS at a glance

- **Headend processor for residential, regional and national networks**
- **Full modular concept allows every application mix**
- **Hot swappable modules simplify upgrades**
- **Passive backplate for easy cabling and maintenance simplification**
- **Redundant power supplies guarantee system availability**
- **Dust-free passive module cooling enlarges module lifetime**
- **Advanced management features for easy installation and operation**
- **DOCSIS 3.1 capable**


RFoG Solution
IP NETWORK
RFOG node
LR 27
RFOG node
LR 93
HFC node
LR 22
RF overlay
LR 10
HFC node
LR 92
D-CMTS
GV 10
HFC Solution
RF Overlay Solution

OPTOPUS Solutions

Everything for the cable network



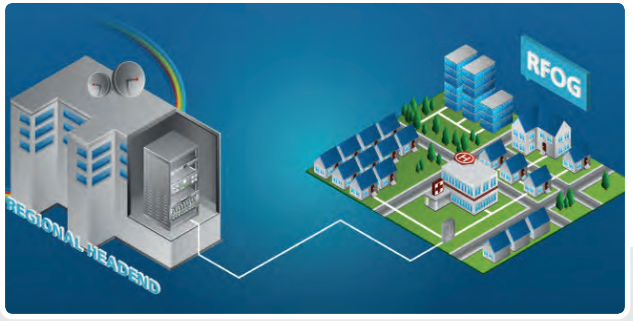
HFC

The HFC networks of network providers and city carriers are no longer designed solely for the broadcasting of analog and digital TV programmes. In the last few years, communication services such as broadband Internet access, Video-On-Demand and telephony have been added.

Beyond that, customers want to use more and more high definition content on their mobile end devices, which has to be provided by the network operator.

These new interactive TV and data services increase the requirements for flexibility and bandwidth, in the backbone as well as in the access network.

Fiber-to-the-Home with DOCSIS and DVB

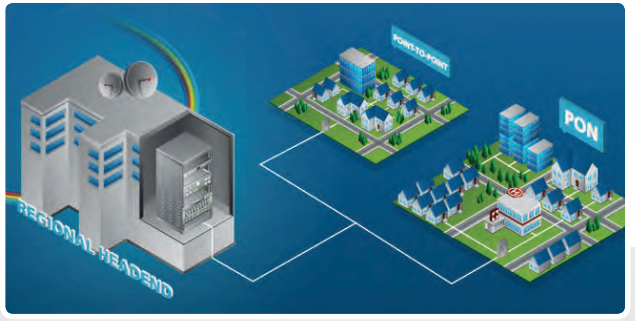


OBI-Free RFoG

Cable providers and city carriers are looking for cost-efficient ways to upgrade their existing network infrastructures to the level of FTTB (Fiber To The Building), or even FTTH (Fiber To The Home).

RFoG is a passive optical network that transmits HF signals via fiber to the subscriber, similar to a HFC network in the downstream direction. A key requirement for the RFoG implementation is to keep the existing DOCSIS infrastructure and provisioning services.

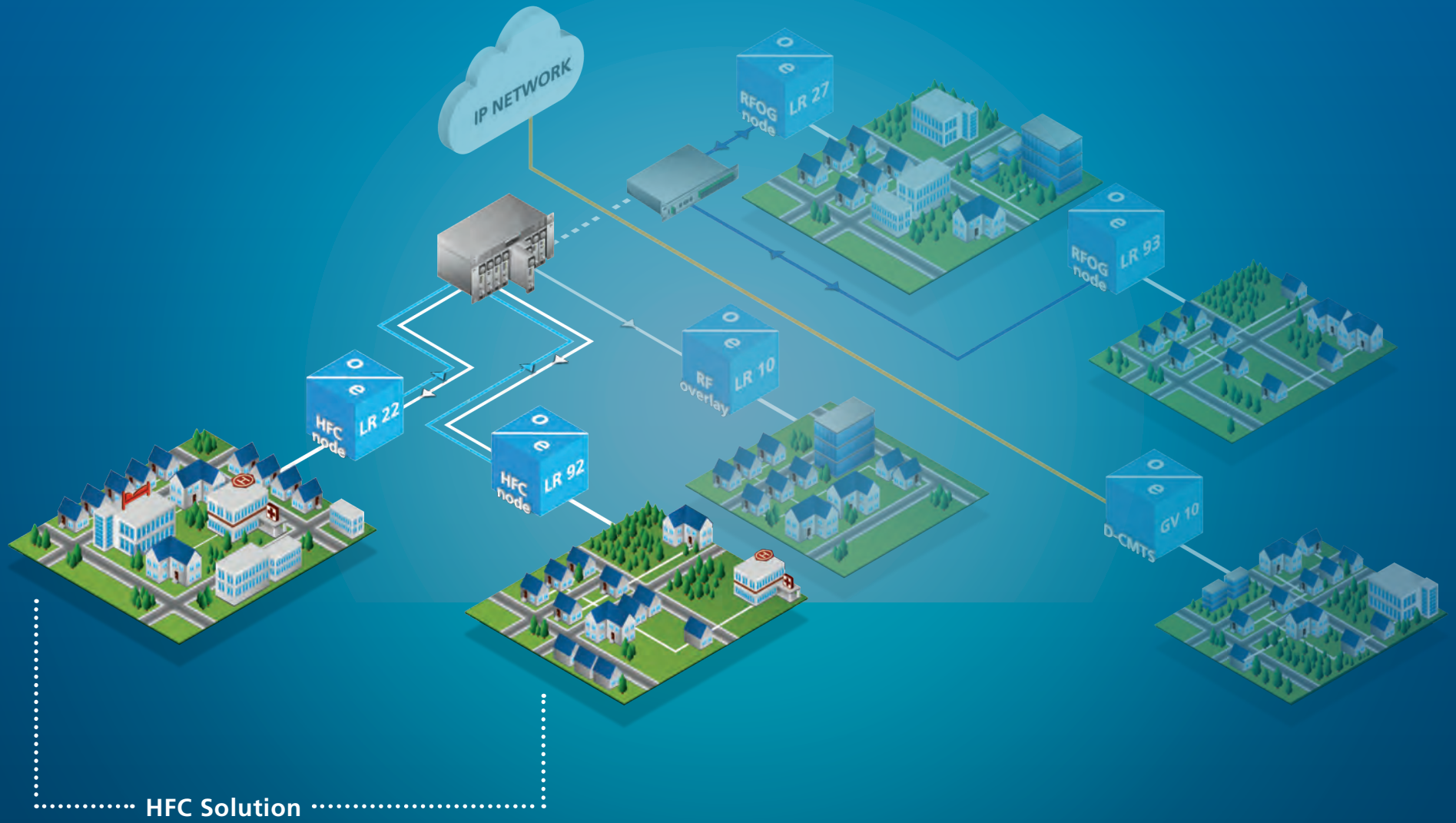
Simple TV distribution with Open Access



RF Overlay

The days of good old linear TV are far from being numbered. On the contrary, over the last years TV viewing time in private households has even further increased from an already high level. However, the way – and especially where – viewers use their TV is changing. In the course of Video-On-Demand, MultiScreen, SmartTV, and HbbTV, viewing habits and needs change from generation to generation.

As a rule, TV becomes more interactive and mobile the younger the viewer is. At the same time there is a trend towards HD technology. As a consequence, bandwidth requirements are rapidly increasing. Telecommunications service providers and city carriers have to take this development into account when expanding their existing network infrastructure.



HFC Solution

Everything you need for your cable network

HFC Solution

With the release of the new DOCSIS 3.1 standard, the requirements for cable operators have been increased drastically.

Due to new modulation schemes and higher frequency ranges, network operators face a completely new set of requirements. The increasing amount of bandwidth is the key to keeping the pace with other service providers and to avoid subscriber churn. Beside an extended bandwidth, the signal quality has to remain unimpaired.

To overcome these new challenges, network operators have to evolve their exisiting network infrastructure with new intellegent and cost-effective components.

There is a demand for solutions on how to meet the bandwidth requirements for providers who have developed their network with HFC technology in combination with DOCSIS cable systems. With the optical high-density platform OPTOPUS for HFC networks, WISI has the ideal answer. This includes amongst other things a portfolio of optical transmitters and amplifiers, as well as return path receivers for any HFC application.

The use of O-band WDM technology with corresponding WISI components minimises the HFC cluster and maximises the bandwidth for connected customers in an extremely cost-efficient way without using additional glass fibre.

- **DOCSIS 3.1 compliance with frequency ranges up to 1.2 GHz**
- **Full Spectrum Transmitter for easier service group clustering**
- **High linearity for bit error free transmission in full digital load network**
- **Complete range of DWDM downstream transmitter and CWDM and DWDM upstream transmitters**
- **Ultra dense and low power consuming return path receivers (quad)**
- **Highly scalable EDFA output configurations (power and no. of output ports)**
- **Compact fiber node for in-/outdoor usage incl. DOCSIS 3.1 compliance**

Products used for HFC solution

LX 10
Longhaul Broadcast Transmitter

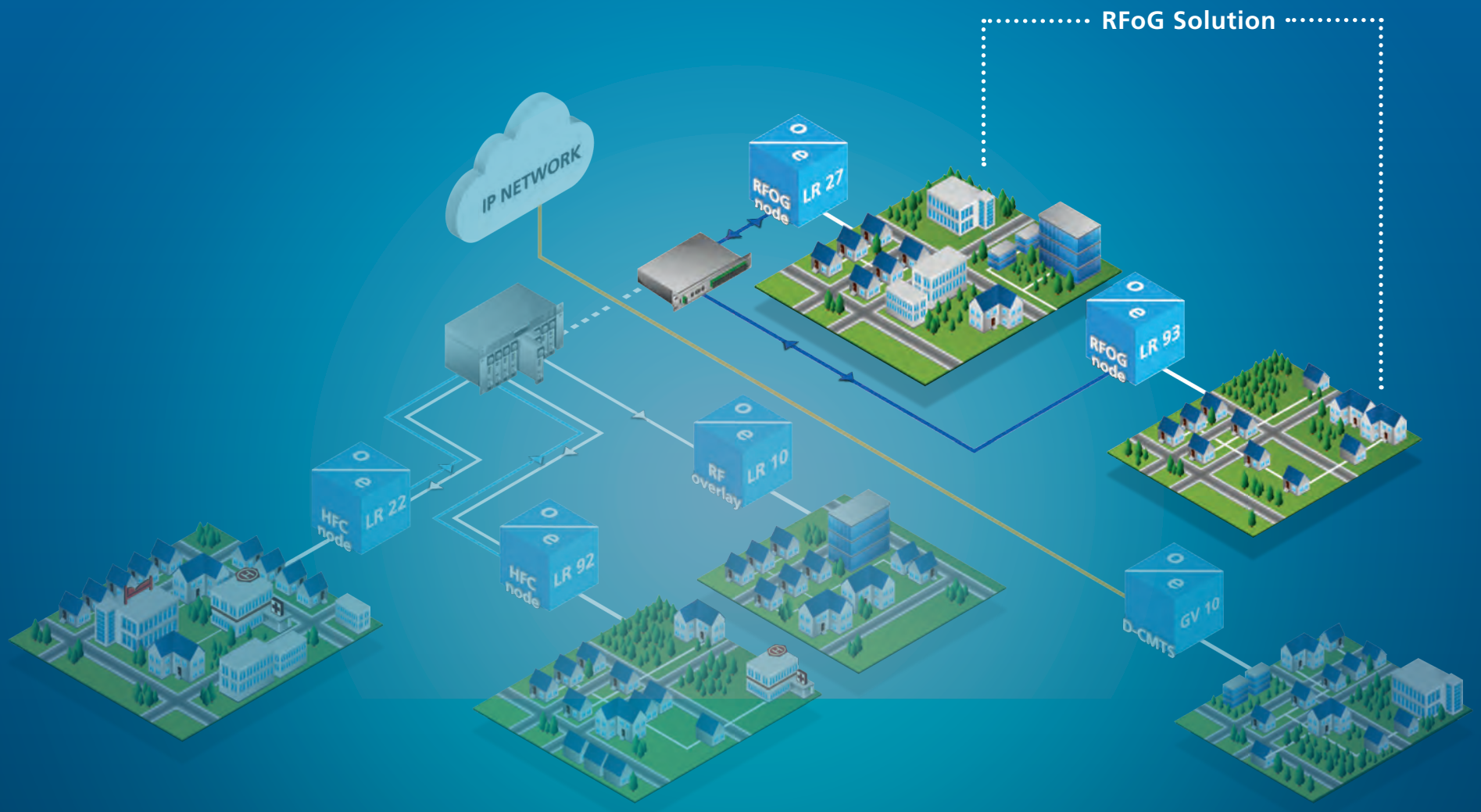
LX 15
Full Spectrum Transmitter

LX 17
Narrowcast Transmitter

LX 30
Optical Amplifier (EDFA)

LX 22
Return Path Receiver

LR 22
HFC Fiber Node

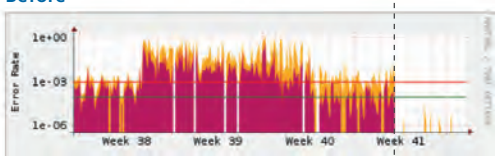

RFoG Solution
IP NETWORK
RFOG node
LR 27
RFOG node
LR 93
RF overlay
LR 10
HFC node
LR 22
HFC node
LR 92
D-CMTS
GV 10

Fiber-to-the-Home with DOCSIS and DVB

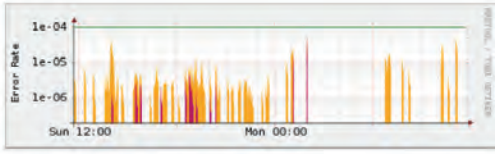
LX 24 - OBI-free RFoG Upstream Receiver

Dedicated upstream receivers for each RFoG node allow the LX 24 to eliminate Optical Beat Interference (OBI) completely. The pictures below show a direct comparison of uncorrectable error words in a network before and after the LX 24 was installed.

Before



After



OBI-Free RFoG Solution

Cable providers and city carriers are looking for cost-efficient solutions to upgrading their existing network infrastructures to the level of FTTB (Fiber To The Building), or even FTTH (Fiber To The Home).

RFoG is a passive optical network that transmits HF signals via fiber to the subscriber, similar to a HFC network in the downstream direction. A key requirement for the RFoG implementation is to keep the existing DOCSIS infrastructure and provisioning services.

As many providers experienced difficulties during the ramp up of new RFoG networks, which were caused by Optical Beat Interference (OBI), the large scale rollout of new networks has been delayed.

To overcome these challenges, WISI has developed the OBI FREE solution within the OPTOPUS platform. This enables network providers to heal existing OBI-infected RFoG networks without any need to swap existing end user equipment. The solution will work with any upstream wavelength and laser mode.

OPTOPUS and its OBI-free RFoG technology offer network providers a complete future-proof concept, while opening the doors for new FTTx deployments.

- **DOCSIS 3.1 compliant OBI-free solution**
- **Suitable rack dimensions for street cabinet usage**
- **Split ratios for 8, 16 and 32 ports**
- **WDM filters for open access network compliance**
- **Electrical or optical upstream for coax or fiber uplink**
- **Works with existing infrastructure**
- **Ultra low noise RFoG node with switchable output level for miscellaneous in-house architectures**
- **Pluggable diplex filters for easy migration towards DOCSIS 3.1**

Products used for RFoG solution

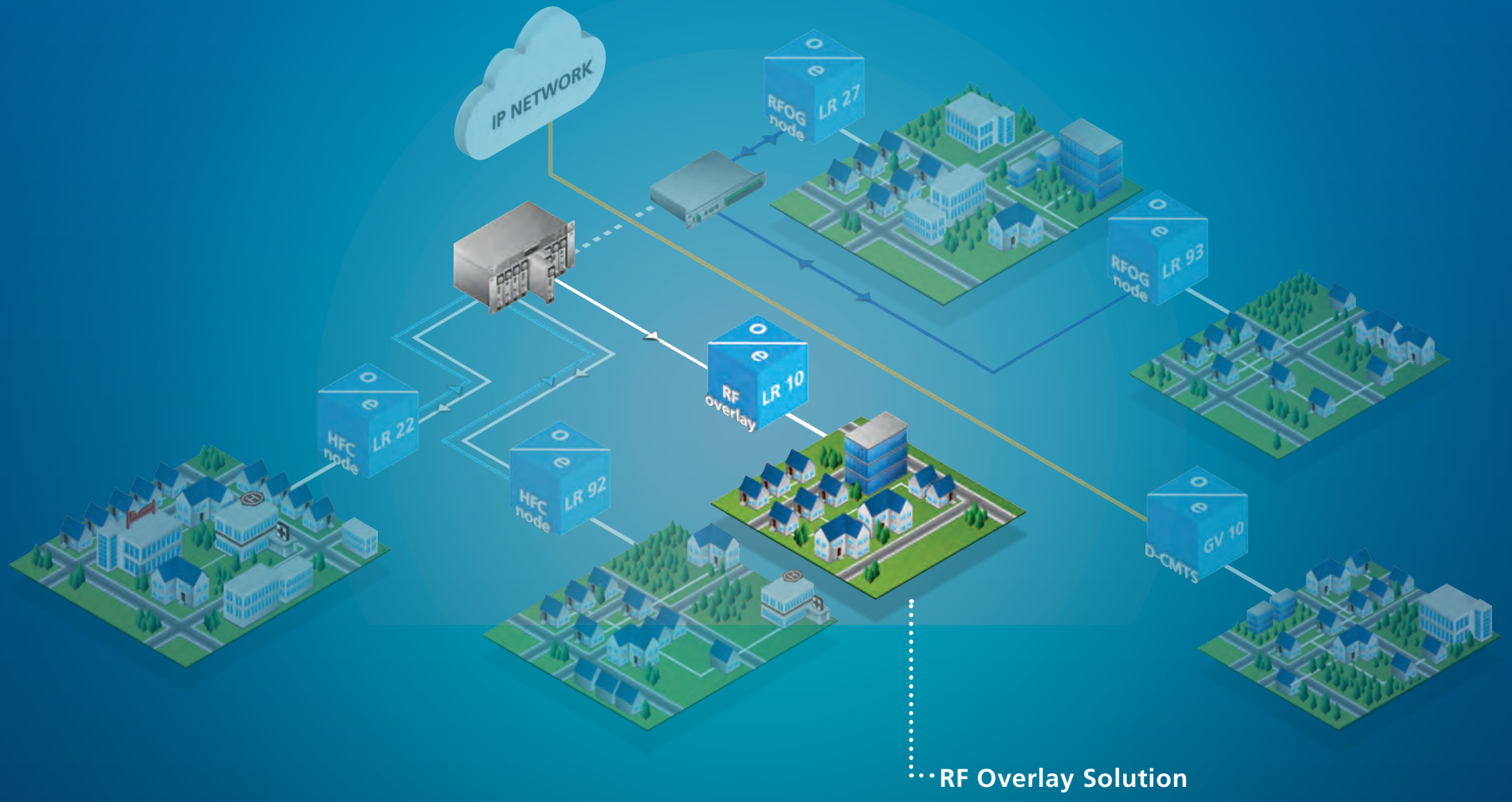
LX 15
Full Spectrum Transmitter

LX 23
RFoG Upstream Receiver

LX 30
Optical Amplifier (EDFA)

LX 24
Multidiode Receiver

LR 93
RFoG Node


IP NETWORK
RFOG node
LR 27
RFOG node
LR 93
RF overlay
LR 10
HFC node
LR 22
HFC node
LR 92
D-CMTS
GV 10
RF Overlay Solution

Solution for video services in open access networks

RF Overlay Solution

TV as a basic broadcast service is still mandatory, even for newly deployed facilities.

In the course of Video-On-Demand, MultiScreen, SmartTV, and HbbTV, viewing habits and needs change from generation to generation. To provide these services along the same distribution network, RF Overlay is key due to the Open Access capabilities for miscellaneous service distribution technologies, such as Passive Optical Networks.

Economically efficient expansion strategies are needed. For more distribution services such as TV, a point-to-multiple-point solution, such as RF Overlay is advisable. All analog and digital TV-channels are transmitted to the customer via an additional wavelength (1550nm), or through a dedicated fibre.

With its high-capacity optical platform OPTOPUS, WISI offers system operators a technically mature solution for the realisation of optical TV distribution in FTTx networks. The platform includes a wide range of 1550 nm transmitters, as well as powerful EDFAs, whose capacity vary with the dimension and topology of the respective network. Thereby it provides system operators with an ideal solution which is equally efficient and sustainable.

- **Highly integrated EDFA and splitter solution for blast & split architectures**
- **Very high internal power of up to 38 dBm (YEDFA)**
- **Up to 32x 20 dBm in a single rackunit**
- **64 output ports in two rack units (LX 37)**
- **Management via SNMP, web-interface and handset**
- **Redundant hot pluggable power supplies and fans**
- **Different connector styles available (SC/APC, LC/APC, E2000/APC)**

Products used for RF Overlay solution

LX 30
Optical Amplifier (EDFA)

LX 37
Standalone optical amplifier with integrated splitter

LP 90
Passive optical splitters

LR 10
FTTx platform for passive fiber termination incl. active extension modules

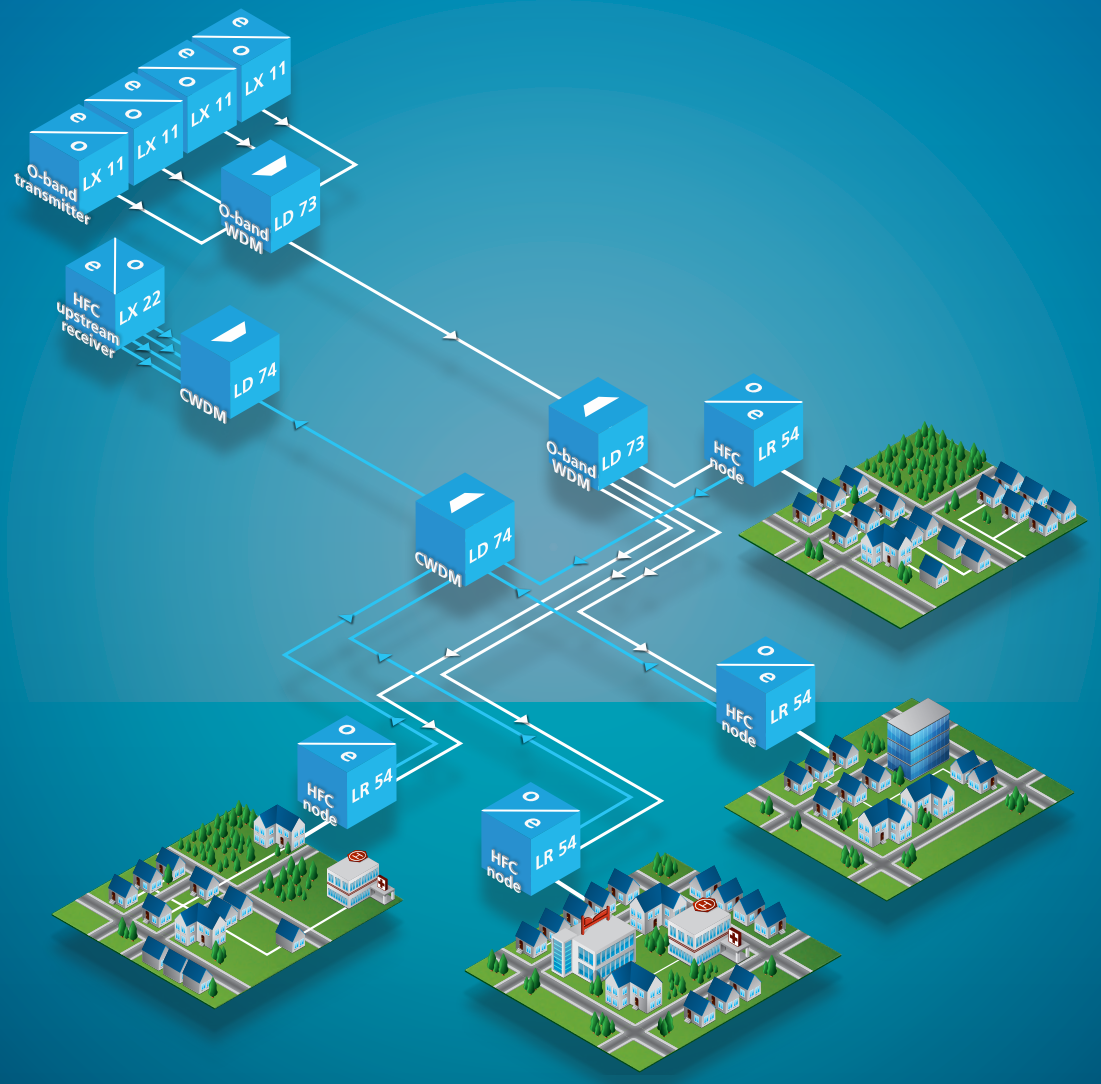
LR 91
RF Overlay Receiver

OPTOPUS Applications

HFC Distribution Networks

OPTOPUS includes the full range of transmitters, return receivers and optical passives for every HFC application.

By using O-Band WDM technology with the fullband transmitters LX 11, it is possible to reduce HFC cluster sizes without deployment of additional fiber. This reduces the cost of a bandwidth increase significantly.



OPTOPUS Applications

FTTH - RF over Glass

OPTOPUS includes the components for RF over Glass networks, the cable operators' choice for FTTH applications.

Depending on the size of network and distances to cover, OPTOPUS offers a range of externally or directly modulated transmitters and high power YEDFAs. The RF over Glass receiver LX 23, with its very low noise receivers, ensures optimization of the network even in challenging topologies.

OPTOPUS Applications

FTTx - RF Overlay

Offering broadcast TV services in today's FTTx networks is easily realized using 1550 nm transmitters together with high power YEDFAs.

The OPTOPUS product family includes externally modulated transmitters, LX 10, and very high power YEDFAs, LX 37, for large scale deployments. For smaller networks, a variant with directly modulated LX 15 transmitter is also possible.

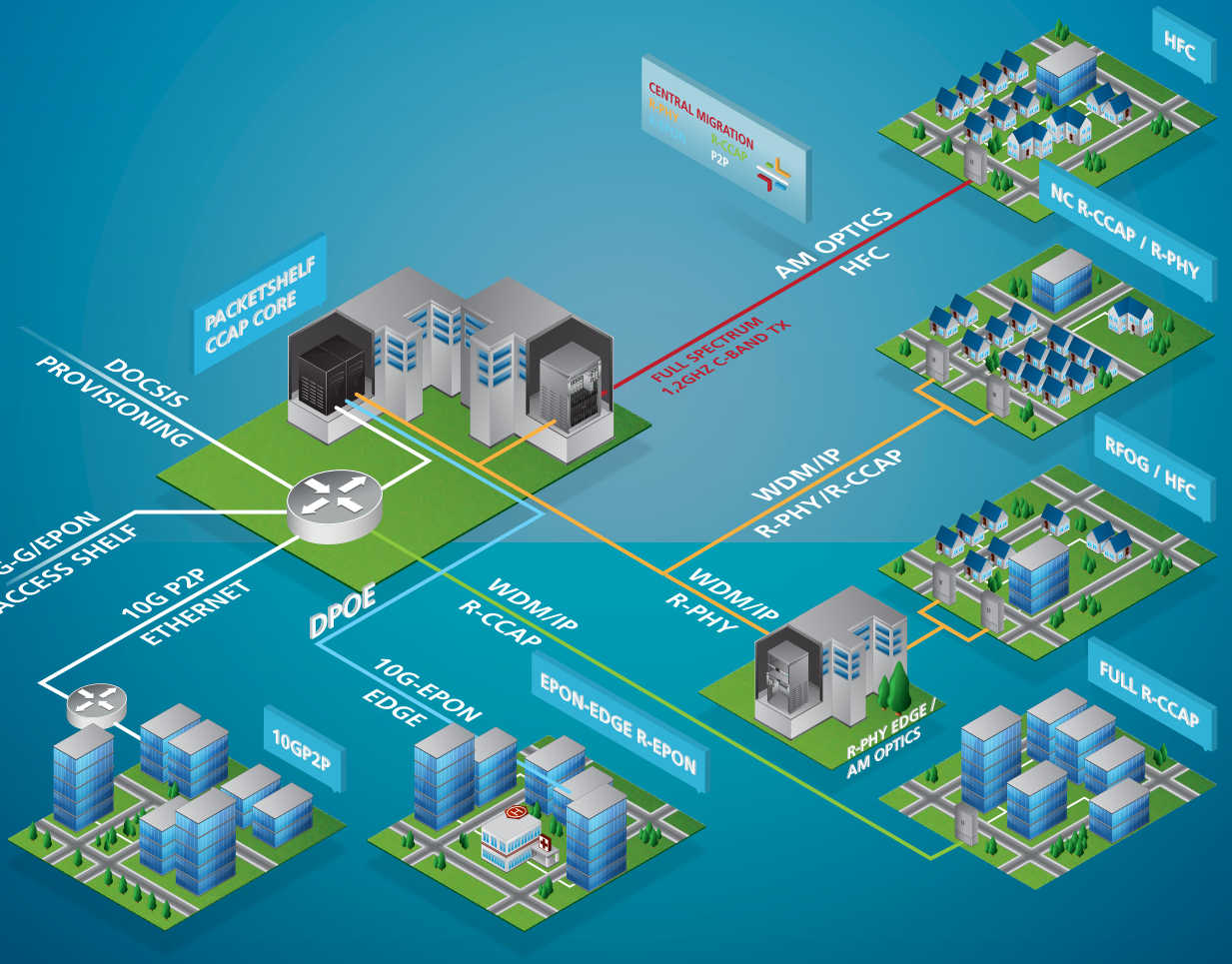
OPTOPUS Applications

CCAP - Converged Cable Access Platform

Paving the way towards digital fiber networks, the OPTOPUS platform is well prepared to provide the necessary support for these architectures.

Existing core architectures are divided into packet and access based functions to allow more flexibility in scaling. This allows further digital feeds towards the subscriber, while using existing OPTOPUS features to adopt to existing architectures like HFC or RFoG. With the use of Full Spectrum Transmitters, the handling of service groups will be simplified along with the cabling.

Furthermore, decentralized implementations will become more important with the availability of Remote-CCAP and Remote-PHY devices, while central components turn in multidimensional scaling architectures with the help of NFV (Network Function Virtualization) Features.



OPTOPUS Base Units

Visit wisi.de for more info about our products

LX 50
4 Rack Unit Chassis

BENEFITS
Scalability: single platform for all RF networks
Modularity: cost-effective modules for all applications
Ease of use: simplified planning, operation, sparing

KEY FEATURES
Carrier grade functionalities
High density: up to 14 modules per shelf
Very low power consumption

LX 52
1 Rack Unit Chassis

BENEFITS
2 OPTOPUS slots in a single rack unit
Cost and space efficient solution for smaller networks

KEY FEATURES
Carrier grade functionalities
Hot-swap of modules, fans and power supplies
Redundant power supply
Management via SNMP or web-UI

LX 55 0048/0110/0230 (LX 50 only)
LX PS A065/A230/B230(angled conn.)
LX 10 P 1000/2000 (AC/DC)
Power Supplies

KEY FEATURES
Hot pluggable
Redundant usage
Carrier grade
various input voltages
AC and DC versions

OPTOPUS Transmitter Modules

1510 NM

LX 15 S
2xxx / 3xxx / 4xxx
Full Spectrum
Transmitter

KEY FEATURES
DOCSIS 3.1 compliant
Long transmission reach
Price advantage compared to standard ExMods
High density
Up to 28 transmitters in one OPTOPUS chassis
Adjustable optical output power
DWDM, fixed and tunable version available

1310 NM

LX 12
Dual 1310 nm
Transmitter

KEY FEATURES
Extended DOCSIS 3.1 frequency range 10 … 1218 MHz
Uncooled isolated DFB laser with +3 dBm or +6 dBm
Adjustable OMI and Automatic Level Control (ALC)
Very low power consumption
Only 6 W per service group
Test point toggling
Monitoring the input signal or the OMI after ALC

DWDM / CWDM US

LX 13
Dual CWDM
Upstream
Transmitter

LX 16
DWDM
Upstream
Transmitter

KEY FEATURES
Future-proof frequency range
5 … 500 MHz
DOCSIS 3.1 compliant
Output power +3 dBm or +5 dBm
Adjustable OMI for optimized operation
Dual-Stage isolated DFB-laser ensures CNR performance

OPTOPUS Receiver Modules

LX 21
Downstream Receiver

KEY FEATURES
Frequency range 47 ... 1006 MHz
Automatic level control (ALC) for constant output level
Optical input power -7 ... +3 dBm
High output level
90 dBµV @ 4% OMI (ALC on)

LX 22
Upstream Receiver

KEY FEATURES
Wide input power range
-17 ... 0dBm
Low noise receiver
2 pA/√Hz for best CNR performance
4 independent upstreams per unitor 1 combined for cluster segmentation
Optical ALC for constant RF levelor manual configuration

LX 24
RFoG Upstream Receiver

KEY FEATURES
OBI-free RFOG solution
Legacy network/node support
Managment capabilities
Electrical or optical uplink
Street cabinet sizing

OPTOPUS Optical Amplifiers

LX 30

Optical Amplifier Module (EDFA)

KEY FEATURES
High power efficiency
Up to 24 dBm total output power in an OPTOPUS module (4x 17.5 dBm)
Carrier-grade functionalities via OPTOPUS chassis LX 50 / LX 52
Signal connections on the rear

LX 35

Standalone Optical Amplifier (EDFA)

KEY FEATURES	
High power, high density	64 output ports in 2 RU (LX 37)
Up to 38 dBm total output power in 1 RU (32x 20 dBm)	Management via SNMP, web-interface and handset
Stand-alone operation with remote management, redundant power supplies and fans	Redundant hot pluggable power supplies (AC/DC) and fans
Optional: Integrated multiplexers for PON overlay	Different connector styles: SC/APC, LC/APC, E2000/APC

LX 37

Standalone Optical Amplifier (EDFA)

VARIANTS*

- 1x 14 dBm, 2x 14 dBm
- 1x 17 dBm, 2x 17 dBm, 4x 17 dBm
- 1x 21 dBm, 2x 21 dBm

- 1x 14 dBm, 2x 14 dBm
- 1x 17 dBm, 2x 17 dBm, 4x 17 dBm, 32x 17 dBm
- 1x 21 dBm, 8x 21 dBm, 16x 21 dBm, 32x 21 dBm

- 54x 17 dBm

*Other versions on request

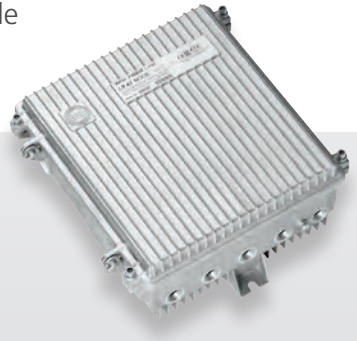
COMPACT LINE/GLOBAL LINE Nodes

Visit wisi.de for more info about our products

LR 54/ LR 55
HFC Node

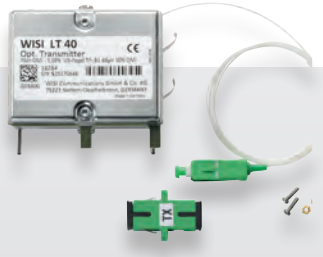
KEY FEATURES
1x1 Fiber Node for HFC / CATV applications
Optical automatic level control for constant output level
Easy handling with handset
Integrated fiber management
Output power CENELEC: 110 dBuV (flat) / 113 dBuV (9 dB slope)
Power consumption: < 25 W
Local power (LR 54) or remote power (LR 55)
Various pluggable upstream transmitter LT 4x
HMS management

LR 43 / LR 63
HFC Node



KEY FEATURES
1x2 fiber node with high output power
Pluggable optical transmitter and receiver modules meeting individual application
Electronic upstream clustering for bandwidth increase
Output power CENELEC: 2x 114 dBuV (6 dB slope)
Power consumption: < 45 W
Local power (LR 43) or remote power (LR 63)
Pluggable Upstream Transmitter LT 4x
HMS management
Two distribution output
One live output

LT 4x
Pluggable Upstream Transmitter



TECHNICAL INFO	
Laser type	Dual stage isolated DFB laser
Optical output power	+3 dBm/+6dBm
Wavelength	CWDM Grid
Frequency range	10 ... 85 MHz
Relative intensity noise	< -145 dB√Hz
Nominal input level	75 dBµV

VALUE LINE Nodes

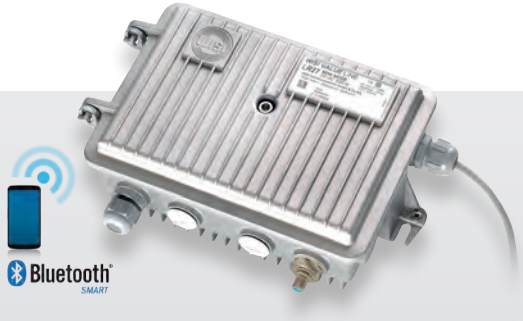
LR 22
HFC Fiber Node

KEY FEATURES
High output level for MDU applications 117 dBµV (6dB slope) / 114 dBµV (flat)
Two configurable RF outputs with pluggable splitters/taps
DOCSIS 3.1 compliant with Downstream up to 1.2 GHz and Upstream up to 204 MHz
Pluggable diplex filters for migration
Full adjustment control via wireless bluetooth app or handset OH 41
Full adjustment control via wireless bluetooth app or handset OH 41
Compact housing for outdoor use (IP66)
Locally powered (LR 2x 2xxx) or remote powered (LR 2x 6xxx)

LT 22
Optical Upstream Module

KEY FEATURES
Laser type isolated CWDM DFB lasers
Optical output power +3 dBm output power
Frequency range 5 to 204 MHz
Wave length 1270 … 1610 nm CWDM grid
Nominal input level (5 % OMI) 75 dBµV

LR 27
RFoG Node



KEY FEATURES
High output level for MDU applications 117 dBµV (6dB slope) / 114 dBµV (flat)
Two configurable RF outputs with pluggable splitters/taps
DOCSIS 3.1 compliant with Downstream up to 1.2 GHz and Upstream up to 204 MHz
Pluggable diplex filters for migration
Full adjustment control via wireless bluetooth app or handset OH 41
Remote control (compliant to IEC 60728-14) via FSK receiver module
Compact housing for outdoor use (IP66)
Locally powered (LR 2x 2xxx) or remote powered (LR 2x 6xxx)

OPTOPUS Micronodes

LR 91
RF Overlay Fiber Node

KEY FEATURES
Optical input power -8 … +1 dBm
Output power 100 dBuV (3 dB slope) or 80 dBµV (flat)
Variable input attenuator (20 dB)
Electrical downstream test port
LED monitoring of downstream input power
LR 91 W: integrated optical filter for PON-loop-through

LR 92
HFC Fiber Node

KEY FEATURES
Optical input power -8 … +1 dBm
Output power 98 dBuV (6 dB slope) or 80 dBµV (flat)
Variable input attenuator (20 dB)
Switchable downstream / upstream test port
LED monitoring of downstream input power and upstream laser operation
LR 92 W: integrated optical multiplexer for US and DS on one single fiber

LR 93
RFoG Fiber Node

KEY FEATURES
DOCSIS 3.1 compliant
Optical input power -6 … +2 dBm
Output power 98 dBuV (5 dB slope)or 80 dBµV (flat)
Pluggable Diplex Filter
Switchable downstream / upstream test port
LED monitoring of downstream input power and upstream laser activity
LR 93 W: integrated PON filter for open access architectures

OPTOPUS Attenuators etc.

LD 95
Varaible Attenuator

KEY FEATURES
Easy alignment of optical power level
Perfectly suited for merging broadcast and narrowcast signals
Two independent attenuators in one passive OPTOPUS module
Insertion loss 1…30 dB
Change attenuation without interruption

LP 40
Optical module tray

KEY FEATURES
Up to 4 passive optical modules LD in 19" 1RU
Different optical modules available, e.g. WDM filters, splitters
LP 14 with up to 14 passive modules

LP 90 / LP 90 W
PLC splitters for RFoG and FTTx networks

KEY FEATURES
Optical PLC splitter module LP90 for FTTx applications in 1RU
1:8 splitter LP90 0108
1:16 splitter LP90 0116
1:32 splitter LP90 0132
1:64 splitter LP90 0164
Insertion loss: ≤ 10.5 dB (1:8) ≤ 13.8 dB (1:16) ≤ 17 dB (1:32) ≤ 21 dB (01:64)

OPTOPUS System Advantages

Reduction of maintenance outages thanks to **FULL MODULAR CONCEPT**

The modular concept of OPTOPUS allows every application mix in a single system.

Modules can be inserted or exchanged during operation thus simplifying extension and reducing maintenance outages.

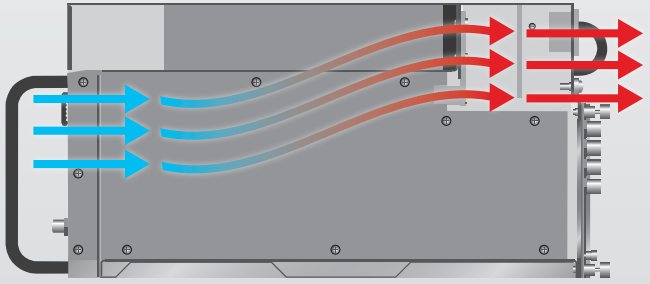
OPTOPUS System Advantages

Advanced **MANAGEMENT FEATURES**

The system offers **comprehensive local and remote monitoring features** for each and every module. Supervision and operation is realized using state-of-the-art SNMP features and/or a web interface.

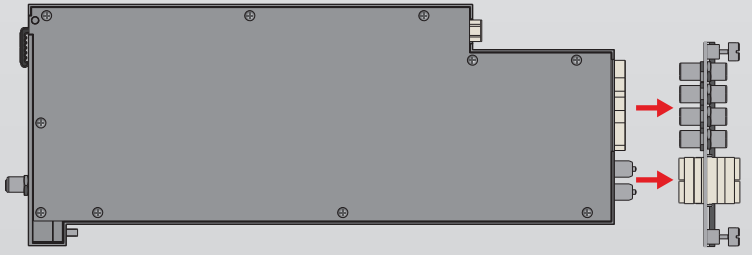
Prolonging the lifetime of modules thanks to **PASSIVE MODULE COOLING**

The cooling and ventilation system of OPTOPUS is designed to prolong the operating lifetime of modules. The equipment uses a passive cooling without active fans or ventilation holes in the modules.

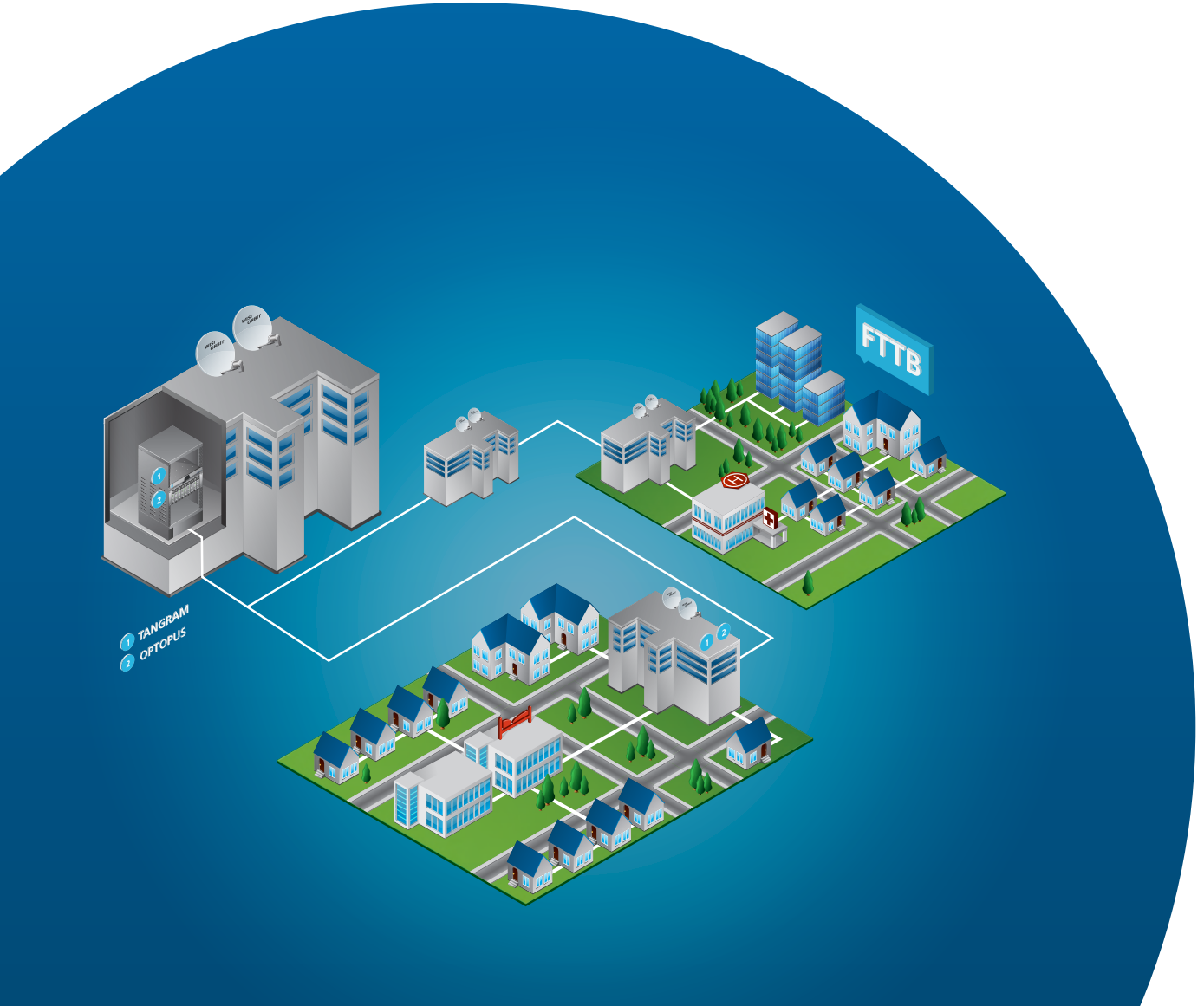


Reduction of maintenance outages thanks to **PASSIVE BACKPLATE**

The passive backplate system allows exchange of modules during operation without re-cabling. The system therefore significantly reduces maintenance outages.



OPTOPUS References



Deutsche Telekom AG: **TV and Internet for housing association**

Project Description

Deutsche Telekom AG connects the facilities of a nation-wide operating housing association. Many thousand households now have access to TV and Internet services using the new fiber infrastructure of Deutsche Telekom.

Application

EDGE Headend with Tangram provide digital and analog video and audio services. The optical broadband network is built with OPTOPUS using a Broadcast / Narrowcast architecture and CWDM return path.

"WISI has proven technical competence in some projects for us and convinced by its solutions"

Guido Schwarzfeld, Leiter PM, Deutsche Telekom

Engineered to Perform

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