



BKtel

FTTH-Solutions



High
Performance
Fiber-to-the-
Home
Networks

BKtel develops and manufactures leading edge active and passive equipment for FTTH and HFC broadband networks. Our products meet the various requirements for modular and flexible solutions in fiber optic network design, enabling high performance data, telephony, and TV services. With Research & Development and Production based in Germany and more than 14 years of experience, BKtel is a partner you can rely on.

Connecting the World at the Speed of Light



Fiber-to-the-Home: The Ultimate Solution

An all-fiber network up to the subscriber is the ultimate solution for broadband connectivity because it provides virtual unlimited bandwidth and enables simultaneous delivery of multiple services. It plays the key role in next generation access networks. Realized in a point-to-point architecture fiber shows its advantages for broadband bidirectional services such as data and telephony. Regarding TV services, the RF video overlay in point-to-multipoint architecture is the answer for a technological mature, cost efficient and reliable solution, with the plus of a high subscriber acceptance.

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BKtel Products

BKtel has generated a comprehensive product portfolio, based on point-to-point optical Ethernet and RF video overlay. Next to the optical transmitters, optical amplifiers and passive optical components such as splitters and WDM filters for RF video overlay BKtel has developed a series of customer premises equipment units. The equipment is designed with a future save system concept and a unified management. Interoperability with all major metro access switches present in the market, demonstrated in several projects, show seamless integration in turnkey FTTH systems. Complete management solution including autoprovisioning and remote firmware upgrade is available.



Gigabit FTTH: PtP Ethernet with 1Gb/s

BKtel's customer premises unit (CPE) XON1500 and the new ultra compact media converter OEA1000 allow the increase of the data rate up to 1 Gb/s, providing the subscriber with the experience of a new broadband dimension – ultra high speed surfing, Video-on-Demand in HD-quality and VoIP telephony. The next step for FTTH access networks is made possible by latest optical Ethernet technology.

RF Video Overlay: Multiple Options for TV-Services

All CPEs from BKtel are prepared for RF video overlay. The subscriber is not restricted to receive TV services in analog PAL or NTSC signals on his TV set but - by simply using common Set Top Boxes - also digital TV is available. The kind of signals transmitted by the RF Video Overlay can come from a whole range of different sources. The classical approach is the transmission of cable television (CATV) consisting of analog and digital cable TV (DVB-C, DVB-C2). But also terrestrial digital TV (DVB-T, DVB-T2) and satellite TV (DVB-S, DVB-S2) can be provided. Moreover digital terrestrial or cable TV in combi-

nation with satellite TV services can be offered simultaneously even as an Open Access video system with two different video service providers. The output signals of RF video overlay solutions are inherently compatible with standard TV or today's HD TV sets, assuming that it is equipped with an appropriate tuner or uses an external Set Top Box. The attached table shows the enormous DVB data rate capacity of the different RF video overlay options: The RF video overlay system offers between 3 and 7 Gbit/s capacity of video broadcast transmission equal to hundreds of TV programs.

RF video Overlay solution	No. of AM TV channels (PAL, NTSC)	No. of QAM256 channels (DVB-C)	No. of QAM64 channels (DVB-T)	No. of 8-PSK channels (DVB-S)	DVB total data rate
CATV	35	59	-	-	3,04
DVB-C	-	94	-	-	4,85
DVB-T	-	-	94	-	2,98
CATV + 1x DVB-S	35	59	-	25	5,54
DVB-C+ 1x DVB-S	-	94	-	25	7,35
DVB-T + 1x DVB-S	-	-	94	25	5,48
1x DVB-S	-	-	-	25	2,50

Notes:
 CATV: average number of TV channels
 AM-TV: Transmission usually with 36 FM radio channels
 DVB-T: QAM64 and 31.688 Mbit/s in 8 MHz and 7/8 FEC rate
 DVB-C: QAM256 with 6.8 MSym/s and 188/204 FEC rate
 DVB-S: L-band 950...2200 MHz with 8-PSK and 36 MSym/s, 9/10 BCH-LDPC and 188/204 RS FEC 188/204 FEC rate

Off-load the IP traffic

The advantages for the network operator are evident. The IP traffic in his network is not blocked by TV content reducing the complexity and the capacity needed. He can choose out of a wide variety of different business models from

traditional cable TV to simple community antenna sharing. Needless to say that there is no change for the subscribers' TV experience; it remains as simple as always.

FTTH Network Architectures

Optical Ethernet and RF Video Overlay: Two Broadband Connections to your Customer

Optical access networks based on point-to-point Ethernet offer a standardized environment with equipment available from several vendors. Since a well known technology is used these networks are easy to plan and manage.

Scalability is excellent and data rates can be adapted to the requirements of the individual customer, Fast Ethernet (100 Mb/s) up to 1 Gigabit Ethernet (1 Gb/s) are technically feasible.

Broadband video connectivity over optical fiber based on standards set by the cable-TV industry provides a bandwidth equivalent to several Gb/s. Analog TV, digital TV (DVB-C) and even satellite TV (DVB-S + DVB-S2) .

The following figure illustrates the set up of a modern FTTH network with its key elements: The POP (the Point of Presence, which can be installed in a building or an outdoor cabinet containing active and passive equipment) and the fiber optic feeder

and drop cables. In case of point to point FTTH each subscriber has a dedicated fiber connection from the POP to his premises. At the POP service providers have access to the FTTH network in order to launch their services.

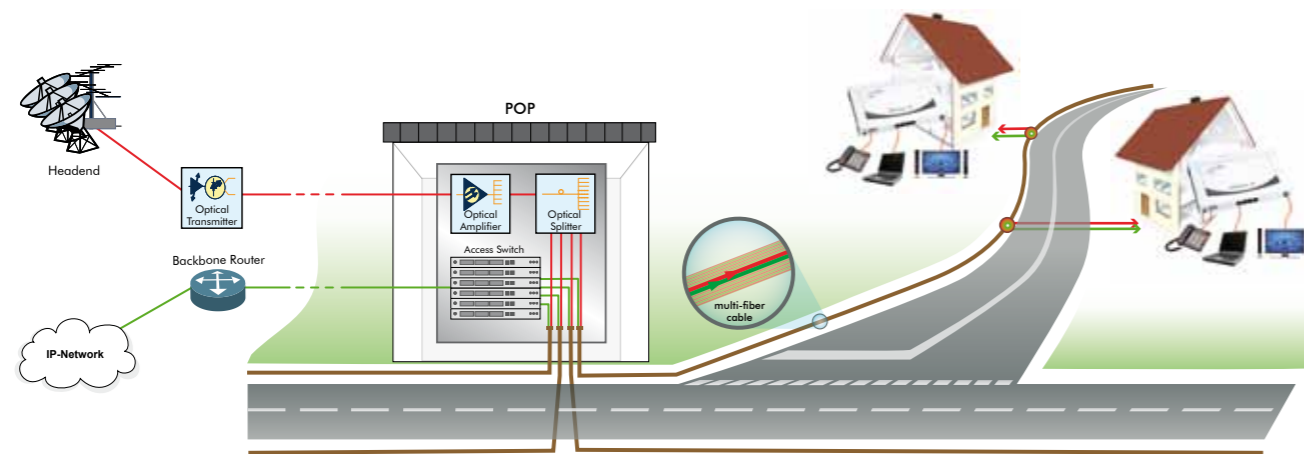


Fig. 1 and Fig. 2 display two general architectures used for point-to-point FTTH networks with RF video overlay. Fig. 1 shows the deployment of two separate fibers, one dedicated for data, one for the RF video. Fig. 2 shows the network based only on one fiber.

In this case the two services are multiplexed on 3 different optical wavelengths: 1550 nm for RF video overlay and 1490 nm/1310 nm for the bidirectional data connection.

Ethernet Point-to-Point Topology (EPTP) Two-Fiber-Solution

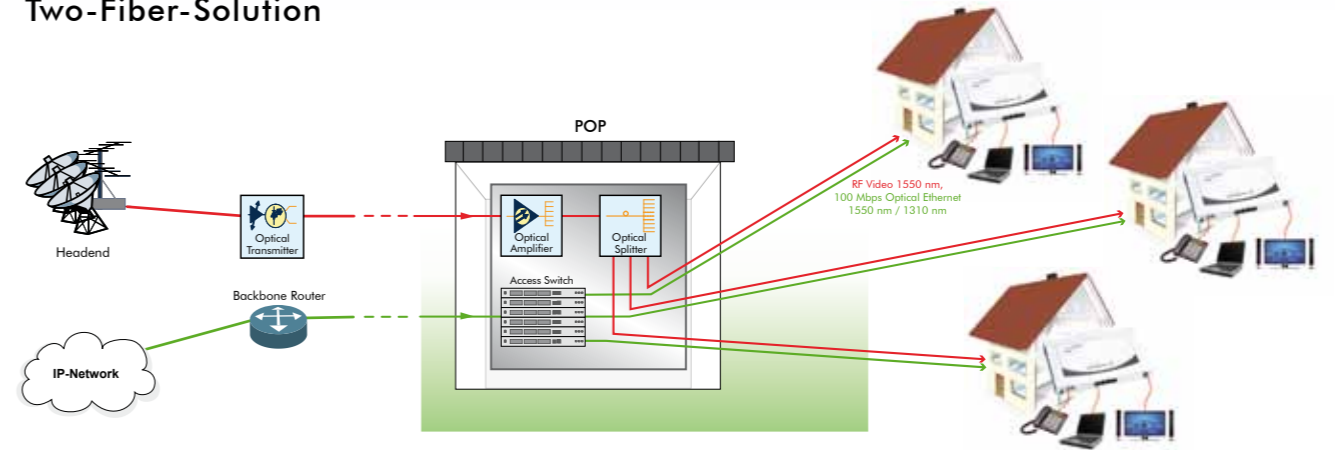


Fig. 1. The two-fiber solution for point-to-point FTTH networks: A separate fiber for data/telephony and TV-video

Ethernet Point-to-Point Topology (EPTP) One-Fiber-Solution

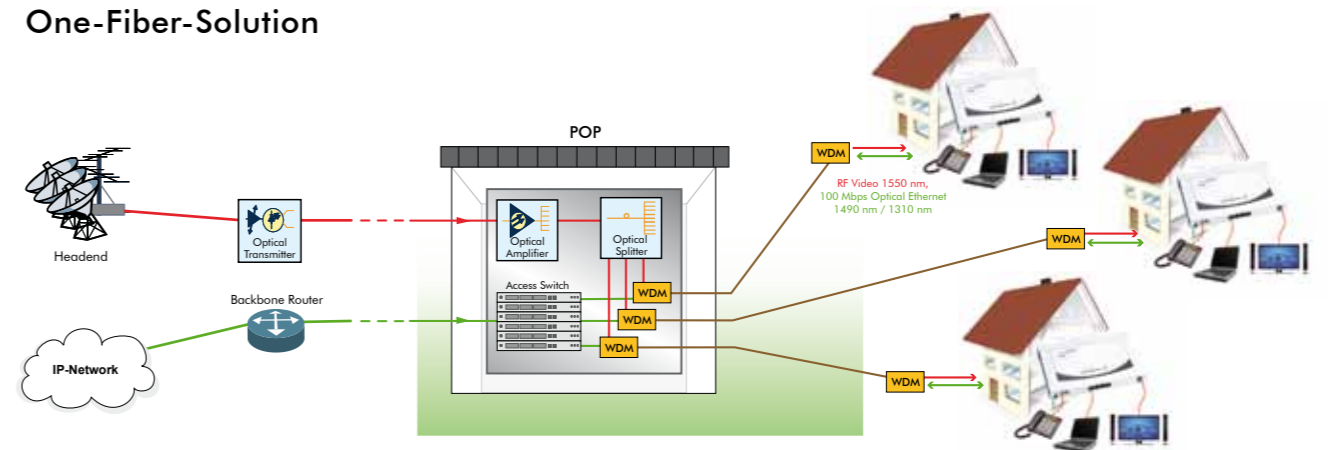
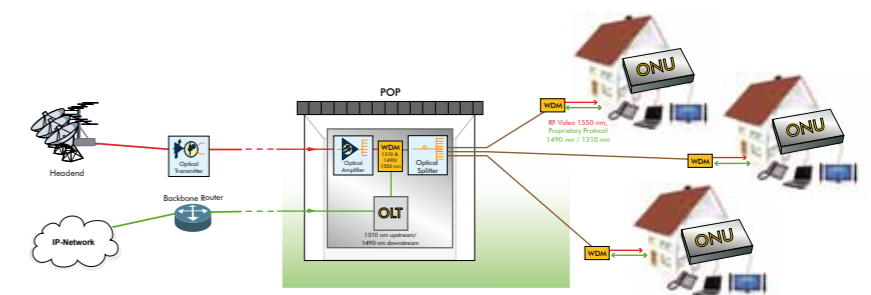


Fig.2. The one-fiber solution decreases the required fiber deployment by a factor of two, so that installation costs decrease dramatically. Port-density in the POP stays the same so that only half of the POPs are needed.

PON and RF Video Overlay

Also point-to-multipoint FTTH networks such as GPON and GEAPON can integrate RF video overlay.



The RF video overlay can be realized in point-to-multipoint architectures such as GPON or GEAPON. BKtel offers a complete range of active equipment to support this application.

Customer Premises Equipment

Triple Play Solutions

The XON1500 is the newest member of BKtel's XON CPE family. The speed of 1 Gb/s along with the well proven concept of a managed Ethernet switch and a solid metal housing makes it to the ideal FTTH network termination. Flexibility is one of the most obvious advantages of the point-to-point

network architecture. The XON1500 supports this flexibility with its multi-rate optical WAN interface. The CPE can be used with Fast Ethernet and upgraded any time to Gigabit Ethernet without any hardware exchange at the subscribers premises.

Gigabit Ethernet Managed Switch XON1500

- ◆ Multi-rate WAN Interface, 1000Base-BX10, 100Base-BX10
- ◆ 4 x 1000Base-T LAN Interfaces
- ◆ Integrated 10/100/1000 Mbps Ethernet switch
- ◆ IPv6 Support
- ◆ Virtual LAN (VLAN)
- ◆ Quality of Service / Class of Service
- ◆ IGMP Snooping/MLD
- ◆ Bandwidth Control
- ◆ SNMP Agent
- ◆ Remote Diagnostics
- ◆ Web-Interface
- ◆ Two FXS ports to connect two analog phones
- ◆ Ultra Low Noise Cable TV / SAT TV Receiver
- ◆ ISDN Adapter (optional)
- ◆ LAN SFP cage (optional)



Available Units

- ◆ **XON1500.SVC:**
Gigabit Ethernet, VoIP, Cable TV
- ◆ **XON1500.SVSAT:**
Gigabit Ethernet, VoIP, Cable & Satellite TV

All versions available in one-fiber (with additional WDM coupler) or standard two-fiber solution.

Unit colours

The standard range includes the unit colours white. OEM versions with RAL colours systems are available.



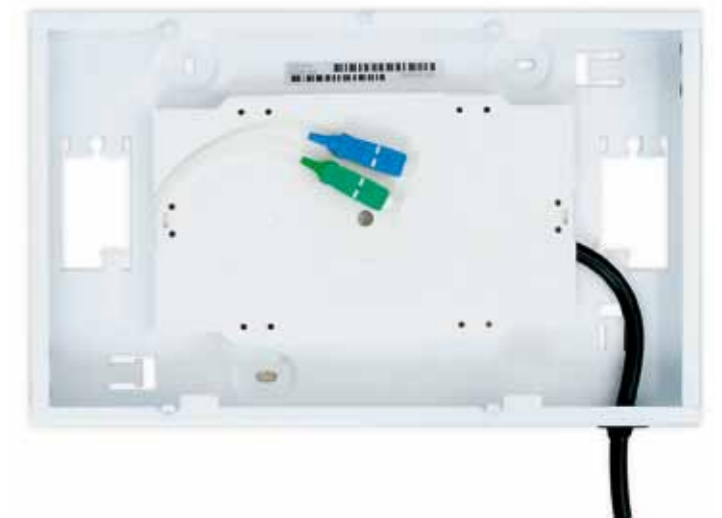
Standard colour
White



OEM /
RAL colours

Passive Fiber Management

The XON family is based on a wall mountable passive fiber termination unit. Secure termination of drop cables and inhouse cables is possible.



XON10.WP

Fiber Protection Unit

- ◆ Installation Platform for all XON500 / XON1500 series
- ◆ Wall-mountable module with integrated Fiber Management
- ◆ Seal Protection



XON10.W

Ultra Compact and Easy to Install

The ultra compact media converter OEA1000 is the latest device in Bktel's CPE product family. Next to the approved Optical Compact Receiver OCR1016 (CATV) and

OCR2209 (CATV + SAT-TV) the OEA1000 is available in a plastic housing (FWO) and suitable for fiber networks rollouts in multi-dwelling units.

Optical Ethernet Access

- ◆ Multi-rate WAN Interface
1000 Base-BX10, 100 Base-BX10
- ◆ 1 x 1000 Base-T LAN Interface
- ◆ IPv4/v6 Support
- ◆ Auto-crossover MDI/MDIX feature for plug-and-play
- ◆ Power consumption < 1.8 W



OEA1000

Optical CATV and SAT-TV Receiver Module

- ◆ Ultra low noise & low distortion
- ◆ Bandwidth: OCR1016E with 1.0 GHz, OCR2209E with 2.4 GHz
- ◆ Wide dynamic range of optical input
- ◆ Min. optical input: -10 dBm
- ◆ Output level: OCR1016E with 88 dBμV, OCR2209E with 80 dBμV
- ◆ F-female RF output



OCR1016E / OCR2209E

Passive FTTH Network Termination Box with integrated Optical CATV/SAT TV Receiver Module for drop and inhouse optical fiber cabling.



XON50.C / XON50.SAT22

Optical Transmission

A key component of an RF video overlay system is the optical transmitter converting the electrical TV signal into an optical modulated signal. The optical wavelength is generally chosen in the range of 1550 nm because optical amplifiers with high performance are available for this wavelength.

Bktel offers a range of optical transmitters: The high end external modulated type is required for extended networks with large distance to be covered. Direct modulated transmitters are only useful for short distance and their usage is therefore restricted to small networks with local available CATV or SAT TV feeds.

External Modulated Transmitter

- ◆ 1550 nm high performance Optical BC (broadcast) Transmitter for FTTH-Networks
- ◆ Bandwidth
ES10XL (CATV): 47 ... 1006 MHz
ES26XL (CATV + SAT):
47 ... 870 MHz CATV
950-2605 SAT-TV
- ◆ Long distance > 100 km
- ◆ SBS threshold adjustment
ES10XL (CATV):
up to +19 dBm for 65 km fiber
ES26XL (CATV + SAT):
up to +15 dBm for 40 km fiber
- ◆ Automatic Gain Control (AGC)
- ◆ Up to 2 x 10.5 dBm optical output power



Fx-ES10XL / FX-ES26XL

Direct Modulated Transmitter

- ◆ 1550 nm high performance Optical BC (broadcast) Transmitter for CATV and SAT-IF
- ◆ Bandwidth: 2.6 GHz
- ◆ Up to 10 km distance
- ◆ Automatic Gain Control (AGC)



Fx-DS26

RF Video Overlay

Optical Amplification

The optical amplifier, the second key component, is required in order to recover the optical signal level after transmission over long fiber distances

(inline amplifier, EDFA) or in order to boost its level for the final distribution (YEDFA) to a large number of end users.

Optical Amplifier (EDFA)

- ◆ Optical Amplification of CATV and SAT-IF signals in FTTH networks, 1540 nm - 1560 nm
- ◆ Adjustable Output Power
- ◆ Constant Output Power Mode and Constant Gain Mode
- ◆ SBS-Detection optional

Fx-OVxxxx



Very High Power Optical Amplifier (YEDFA)

- ◆ Video Overlay in FTTH Networks, used as Booster Amplifier on the last mile
- ◆ Amplification of CATV and SAT-IF Signals in FTTH networks, 1545 nm - 1565 nm
- ◆ Pre- and Booster Amplifier in one 19" device
- ◆ Usable in combination with external modulated Optical Transmitter (Fx-ES10, Fx-ES26)
- ◆ Adjustable output power
- ◆ Constant Output Power Mode and Constant Gain Mode

Fx-OV16145



Fx-OV32165



Available Versions

- ◆ 16 x 14.5 dBm (SC/APC or LC/APC) in 1 RU*
- ◆ 16 x 16.5 dBm (SC/APC or LC/APC) in 1 RU*
- ◆ 32 x 16.5 dBm (LC/APC) in 1 RU*
- ◆ 16 x 20 dBm (LC/APC) in 1 RU*
- ◆ 8 x 20 dBm (LC/APC) in 1 RU*

* RU = Rack Unit

Passive Optical Power splitting on an RF only System

The third key component is represented by passive optical splitters and optical wavelength division multiplexers (WDM). The components are required for splitting optical power

in order to supply adequate optical signal level to the end user or to combine or separate the different optical wavelengths on a fiber optic link.

Optical Splitter

- ◆ Video Overlay in FTTH-Networks
- ◆ 64 output ports available in 1 or 2 RU
- ◆ Optical connector: SC/APC or LC/APC
- ◆ Insertion loss < 19.7 dB
- ◆ Uniformity < 1.5 dB
- ◆ Wavelength range: 1260 -1620 nm

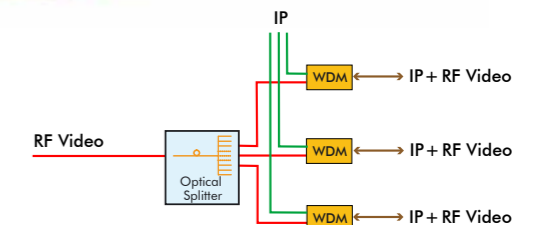
FOVnnn-PLC



Optical Splitter + Integrated WDM Array

- ◆ IP-Network and Video Overlay in FTTH-Networks over one fiber: 1310 & 1490 & 1610 nm IP / 1550 nm RF Video
- ◆ 1 Input port RF Video
- ◆ 1 RU

FOVnnn-PLC-IP



Available Versions:

FOV016-PLC-IP

- ◆ 16 In/Out ports IP (MPO APC)
- ◆ 16 combined Video and IP In/Out ports (LC APC)
- ◆ Insertion loss < 15 dB
- ◆ Uniformity < 1.9 dB

FOV032-PLC-IP

- ◆ 32 In/Out ports IP (MPO APC)
- ◆ 32 combined Video and IP In/Out ports (LC APC)
- ◆ Insertion loss < 18 dB
- ◆ Uniformity < 1.9 dB

FOV064-PLC-IP

- ◆ 64 In/Out ports IP (MPO APC)
- ◆ 64 combined Video and IP In/Out ports (LC APC)
- ◆ Insertion loss < 20.5 dB
- ◆ Uniformity < 2 dB

RF Video Overlay

Speciality Solutions GPON/GEAPON

A range of specialty equipment designed for RF video overlay in FTTH Point to Multipoint networks (GPON, GEAPON).

Very High Power Optical Amplifier + Integrated 1310 & 1490 & 1610 / 1550 nm WDM Array

- ◆ RF Video Overlay in PON-systems
- ◆ Up to 32 PON-Ports can be connected

Available Versions

- ◆ 32 x 15.5 dBm (SC/APC or LC/APC) + 32 WDM in 2 RU*
- ◆ 16 x 16.5 dBm (SC/APC or LC/APC) + 16 WDM in 2 RU*
- ◆ 8 x 17,5 dBm (SC/APC or LC/APC) + 8 WDM in 1 RU*
- ◆ 18 x 20 dBm (SC/APC or LC/APC) + 18 WDM in 2 RU*
- ◆ 16 x 19 dBm (SC/APC or LC/APC) + 16 WDM in 2 RU*
- ◆ 8 x 20 dBm (SC/APC or LC/APC) + 8 WDM in 1 RU*

16 x 1310 & 1490 & 1610 / 1550 nm WDM Array in 19" housing

- ◆ 16 x 1310 & 1490 & 1610 / 1550 nm WDM
- ◆ 16 SC/APC RF Video In
- ◆ 16 SC/PC GPON/GEAPON In/Out
- ◆ 16 LC/APC combined RF Video + GPON/GEAPON In/Out
- ◆ Insertion Loss RF Video: <1.0 dB
- ◆ Insertion Loss GPON/GEAPON: <0.6 dB
- ◆ 1 RU

Also available with 8 WDMs

Amplified Optical Transmitter for CATV and SAT IF Transmission

- ◆ Video overlay with 1550 nm wavelength in FTTH networks providing very high optical budget (GPON compatible)
- ◆ Bandwidth 2.6 GHz, 7 ... 2605 MHz
- ◆ Optical output power 8 (16) x + 20 dBm ± 0.5 dB
- ◆ Up to 10 km distance

Fx-OVnxxx-IP



FWM016-OLT



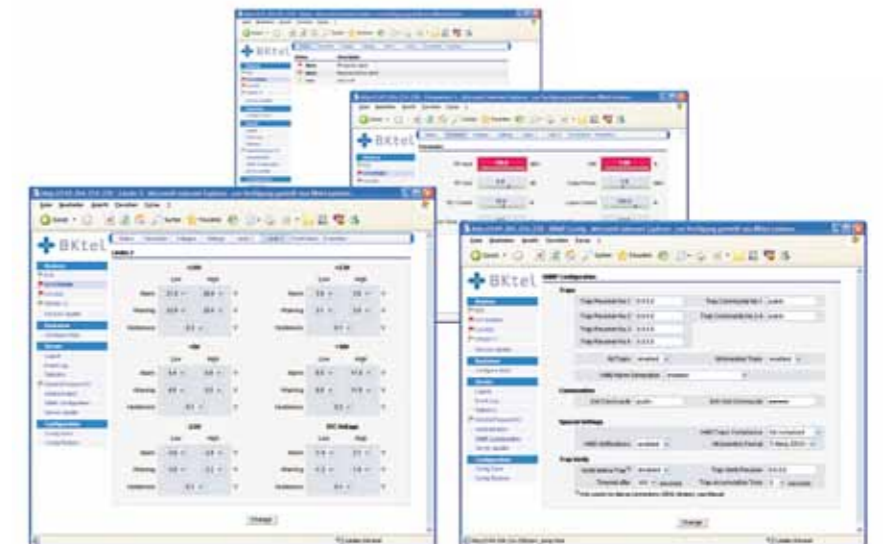
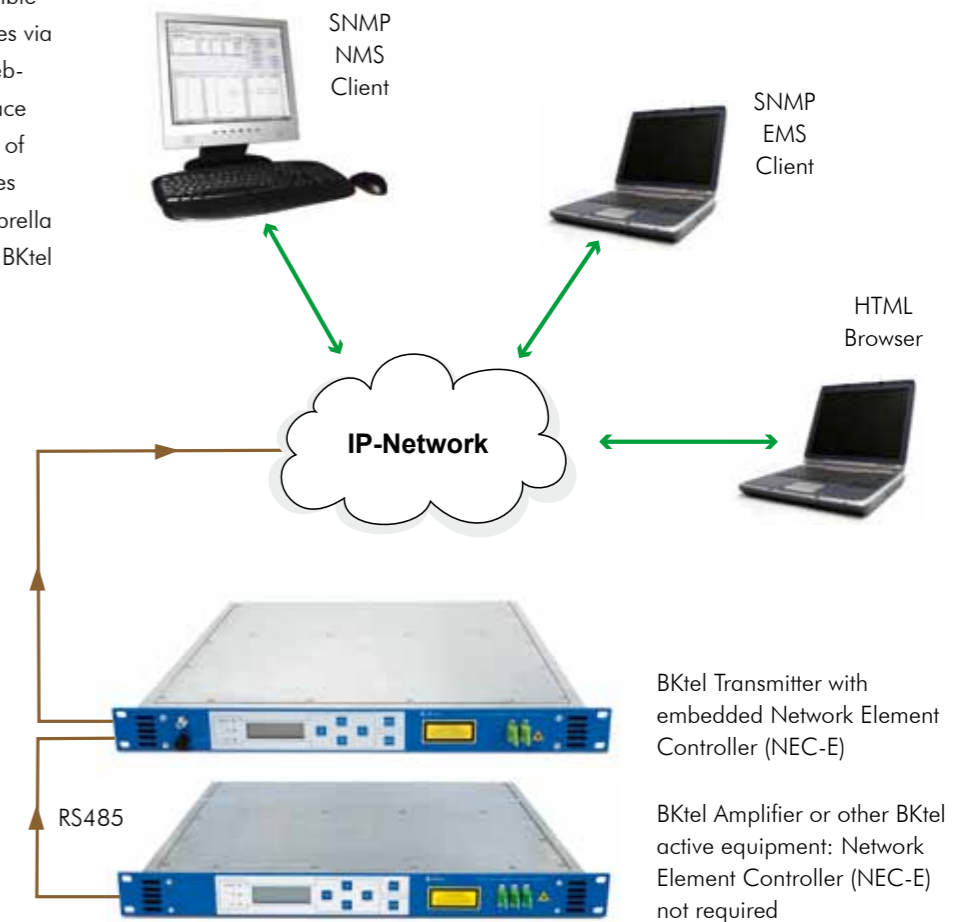
Fx-AOTnn200



* RU = Rack Unit

Network Management

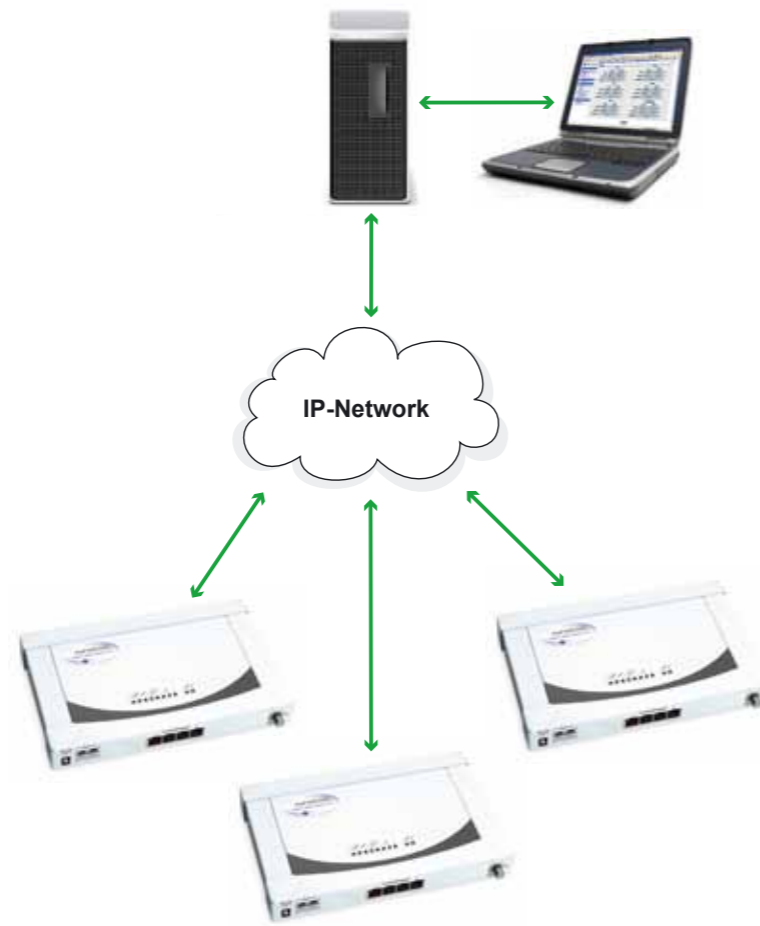
For monitoring, control and configuration of the active equipment a Network Element Controller (NEC-E) integrated in optical transmitters or optical amplifiers is available. The NEC-E is equipped with an embedded Web-Server, accessible by standardized security procedures via an Ethernet interface from any Web-Browser. The remote SNMP interface allows controlling and monitoring of all active components and provides the interface to a higher level Umbrella Management System, such as the BKtel CABLEwatch EMS.



To complete a FTTH network BKtel offers the Device Auto Configuration System (DACS). DACS is a software solution that automates the remote configuration process of all CPEs in FTTH networks without any customer hardware assignment. Based on DHCP Option 82 DACS allocates the subscribed services and provides each connected CPE device with the corresponding configuration parameters. The software system is especially designed for the operation with BKtel's XON product family.

Features

- ◆ Access port based configuration via DHCP Option 82
- ◆ Remote configuration of all parameters
- ◆ Automatic firmware management for each device type
- ◆ TFTP/DHCP management included
- ◆ Fully automated device configuration



BKtel Provisioning:

- ◆ IP address assignment (DHCP)
- ◆ Switch configuration (e.g. VLANs)
- ◆ VoIP configuration
- ◆ Firmware upgrade
- ◆ Default configuration upgrade

Remote Diagnostics of CPE:

- ◆ Optical Transceiver parameters
- ◆ Physical Port Status
- ◆ Voice Status
- ◆ Direct Link Detection
- ◆ Optical Input Power of the CATV Receiver



Our Company

BKtel was founded 1997 as a result of a management buy-out from Alcatel Cable and has currently a workforce of approx. 100 employees worldwide. The company is based in two locations in Germany, the headquarters in Hueckelhoven-Baal, near Düsseldorf and a second office in Kornwestheim, near Stuttgart. Further international offices were founded in China and Japan for the growing Asian market. The company develops and manufactures products in the field of interactive FTTH-, Video Overlay-, RFoG- and HFC-networks for high performance data, telephone and cable TV services. The active and passive components are designed and manufactured in company-own facilities. The high quality products as well as the comprehensive support in designing optical networks make BKtel to one of the leading international suppliers in the FTTH and HFC market.

Our Products

BKtel develops FTTH, Video Overlay, RFoG and HFC broadband networks and related network management. The product portfolio includes a wide range of products starting from optical transmitters, optical amplifiers, optical receivers, optical return channel systems, customer premises equipment up to DWDM technology for upstream and downstream applications. The own manufacturing facilities guarantee a high quality standard (ISO 9001 certified). Furthermore the company offers a complete range of services such as planning, installation and training.



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