2G6-FA
Modular Optical Platform for HFC and FTTH Networks
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Overview

The 2G6-FA product series provides a modular platform for analog optical transmission in state-of-the-art Hybrid Fiber Coax (HFC), Fiber to the Home (FTTH), and RF over Glass (RFoG) networks. It offers outstanding performance and high port density combined with a cost efficient and reliable design.

The platform enables a variety of applications:

- CATV-distribution over HFC networks including Targeted Services (high speed internet/voice over IP services and video on demand)
- Multimode 1550 nm (C-band) and 1310 nm (O-band) DWDM transmission of CATV signals to be used in fiber node segmentation
- RF video overlay (CATV & SAT TV) in FTTH networks
- Access networks realized with RFoG technology

DOCSIS 3.1-Ready

BKtel is continuously enhancing its products, so that upcoming technical changes in HFC technology are always accommodated in time. In line with this approach 2G6 has been successfully transformed to a product series satisfying the requirements of the latest DOCSIS-standard: All transmitters and receivers are upgraded in forward path to a RF frequency of 1218 MHz and in return path to 204 MHz complying with DOCSIS 3.1.

Optical Platform

- Modules ranging from optical transmitters, optical amplifiers, optical receivers, optical switches, and element controller
- Forward transmission 47 (70) … 1218 / 2800 MHz
- Return transmission 5…204 MHz, extendable to 450 MHz
- SNMP and Web browser based management
- Optical connectors: SC/APC, LC/APC, E2000
- RF connectors: F female
- 16 modules per subrack, 4 RU height
- Operation environmental conditions according ETS 300 019-1-3, class 3.1 (temperature controlled locations)

Optical Transmitters

The BKtel optical transmitter product series consists of three distinct transmitter families for the entire application range in HFC and FTTH networks:

- 1550 nm Broadcast transmitters
- DWDM Full Band transmitters
- DWDM Narrowcast transmitters

They are covering the complete range from direct modulated standard up to high end external modulated transmitters, from 1310 nm up to O-band and C-Band wavelengths. Various models are available with a broad selection of output power levels, a wide range of channels on the standard DWDM ITU grid. All featuring 1218 MHz bandwidth.

Optical Amplifier (EDFA)

Optical amplifiers are available for two different applications:

- EDFA: Recovery of optical signal level after transmission over long fiber distances (inline amplifier)
- YEDFA: Boosting optical signal level for the final distribution to a large number of end users.

BKtel offers amplifiers with up to 16 output ports and power level up to 20 dBm.

Optical Receiver

- Low noise optical receivers for forward path signals as well as quad port optical receiver modules for the return path with 1218 MHz / 204 MHz bandwidth
- Ultra-low noise receivers for RFoG applications

Optical Switch

- Redundancy switching between two optical inputs or outputs

Element Controller

- Ethernet interface, SNMP and Web, HMS compatible
- A single controller manages up to 60 modules
**HFC Transmission Applications**

**Typical Applications**

**Full RF band Multiwave Transmission in fiber node segmentation**

**Broadcast/Narrowcast RF Split Band in high performance HFC trunking networks**

**FTTH Network Applications**

**RF Video Overlay: CATV & SAT TV distribution over Fiber To The Home Networks**

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

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

**PON and RF Video Overlay**
Broadcast Transmitters

External Modulated 1550 nm Optical CATV Transmitter – ET12XL-FA

Application
- Electrical to optical conversion of multichannel CATV signals e.g. AM-VSB, FM and QAM signals in large scale HFC and FTTH networks

Features
- High performance Broadcast CATV transmitter
- Low phase noise, narrow linewidth cw-DFB laser
- LiNbO₃ modulator incorporating intensity and phase modulator
- C-Band DWDM wavelength according to ITU grid
- Wavelength adjustable +/- 100 GHz
- Bandwidth 47 ... 1218 MHz
- Two optical outputs with 8.5 or 10.0 dBm output power each
- Adjustable SBS threshold up to 19 dBm
- Enables usage of optical amplifiers (EDFAs, YEDFAs) as boosters or repeaters
- Excellent performance in optical point-to-multipoint links exceeding 100 km

External Modulated 1550 nm Optical CATV and SAT-IF Transmitter – ET28XL-FA

Application
- Electrical to optical conversion of multichannel CATV signals e.g. AM-VSB, FM and QAM signals & additional SAT-IF signals for RF Video Overlay in large scale FTTH networks

Features
- High performance Broadcast CATV & SAT TV transmitter
- Low phase noise, narrow linewidth cw-DFB laser
- LiNbO₃ modulator incorporating intensity and phase modulator
- C-Band DWDM wavelength according to ITU grid
- Wavelength adjustable +/- 100 GHz
- Bandwidth 47 ... 1218 MHz
- Two optical outputs with 8.5 or 10.0 dBm output power each
- Adjustable SBS threshold up to 19 dBm
- Enables usage of optical amplifiers (EDFAs, YEDFAs) as boosters or repeaters
- Excellent performance in optical point-to-multipoint links exceeding 40 km

Direct Modulated Transmitter – OTC12x-FA

Application
- Electrical to optical conversion of multichannel CATV signals e.g. AM-VSB, FM and QAM signals in HFC networks

Features
- Full Band CATV transmitter
- Cost efficient low phase noise, narrow linewidth DFB laser
- Multiple wavelength options: 1310 nm, O-band DWDM, C-band DWDM according to ITU grid
- Optical output power: +8.0 ... +13.0 dBm
- Predistortion technology

Full Band DWDM Transmitters

Dual Direct Modulated Transmitter – OTC212Nx-FA

Application
- Electrical to optical conversion of multichannel CATV signals e.g. AM-VSB, FM and QAM signals in HFC networks

Features
- Dual Full Band CATV transmitter
- Cost efficient low phase noise, narrow linewidth DFB laser
- Multiple wavelength options: 1310 nm, O-band DWDM, C-band DWDM according to ITU grid
- Optical output power: +8.0 ... +13.0 dBm
- Predistortion technology

- Pre-chirping technology for chromatic dispersion compensation
- Bandwidth 80 ... 1218 MHz
- High quality transmission in point-to-point links up to 25 km
- Dual RF inputs: low and high level input, optionally narrowcast input with high isolation
- Excellent performance in optical point-to-multipoint links exceeding 40 km
- Two optical outputs with 8.5 or 10.0 dBm output power each
- Adjustable SBS threshold up to 19 dBm
- Enables usage of optical amplifiers (EDFAs, YEDFAs) as boosters or repeaters
- Excellent performance in optical point-to-multipoint links exceeding 40 km
- Pre-chirping technology for chromatic dispersion compensation
- Bandwidth 5 ... 1218 MHz
- High quality transmission in point-to-point links up to 25 km
- Two individual Narrowcast inputs, one common Broadcast input and one testpoint
- Excellent performance in optical point-to-multipoint links exceeding 40 km
- Pre-chirping technology for chromatic dispersion compensation
- Bandwidth 80 ... 1218 MHz
- High quality transmission in point-to-point links up to 25 km
- Two optical outputs with 8.5 or 10.0 dBm output power each
- Adjustable SBS threshold up to 19 dBm
- Enables usage of optical amplifiers (EDFAs, YEDFAs) as boosters or repeaters
- Excellent performance in optical point-to-multipoint links exceeding 40 km
- Pre-chirping technology for chromatic dispersion compensation
- Bandwidth 5 ... 1218 MHz
- High quality transmission in point-to-point links up to 25 km
- Two individual Narrowcast inputs, one common Broadcast input and one testpoint
Narrowcast Transmitters

Direct Modulated Transmitter OTB-FA

**Application**
- Electrical to optical conversion of multichannel Narrowcast CATV signals e.g. QAM signals in HFC networks

**Features**
- Narrowcast CATV transmitter with clipping mitigation
- Cost efficient low phase noise, narrow linewidth DFB laser
- C-Band DWDM wavelength according to ITU grid
- Optical output power: +10.0 dBm
- Bandwidth: 470 ... 1218 MHz (optional 250 ... 1218 MHz)
- Very high optical modulation index due to clipping mitigation
- Predistortion technology
- Pre-chirping technology for chromatic dispersion compensation
- High quality transmission in point-to-point links up to 100 km

Optical Amplifiers

Standard Optical Amplifier – OAnxxx-FA

**Application**
- Amplification of 1550 nm optical signals on single mode fibers
- Booster, in-line or distribution amplifier in HFC networks

**Features**
- Erbium doped fiber amplifier (EDFA)
- +13...+25 dBm optical output power per port
- Up to 8 optical output ports (internal optical splitter)
- Input signal wavelength 1540 ... 1560 nm
- Constant output power control or constant gain control
- Optional measurement unit for SBS threshold of succeeding fiberoptic links (SBS detection)

Gain-Flattened Optical Amplifier – OAnxxx-GFF-FA

**Application**
- Amplification of optical DWDM signals on single mode fibers (1530 ... 1561 nm)
- In-line amplifier in HFC networks

**Features**
- Erbium doped fiber amplifier (EDFA)
- Fixed gain and variable gain versions
- +13...+20 dBm optical output power per port
- Up to 2 optical output ports (internal optical splitter)
- Input signal wavelength 1530 ... 1561 nm
- Constant output power control or constant gain control
- Optional measurement unit for SBS threshold of succeeding fiberoptic links (SBS detection)
- Fixed gain version: Nominal gain optimization for 10 dB (GFF10), 15 dB (GFF15), 20 dB (GFF20) and 25 dB (GFF25)
- Variable gain version: Adjustable gain 5...20 dB (GFF)
- Gain flatness @ nominal gain ± 1 dB

High Power Optical Amplifier – OAnnxxx-FA

**Application**
- Amplification of 1550 nm optical signals on single mode fibers
- Booster, in-line or distribution amplifier in HFC and FTTH networks

**Features**
- Cladding pumped Ytterbium / Erbium doped fiber amplifier (YEDFA)
- +16.5...+21 dBm optical output power per port
- Up to 16 optical output ports (internal optical splitter)
- Input signal wavelength 1545 ... 1565 nm
- Optical preamplifier (EDFA) included
- Broad optical input power range: 5 dBm ... +10 dBm
- Constant output power control
Optical Receivers

Optical Receiver – OR12-FA

Application
◆ Optical to electrical conversion of Broadcast signals in HFC networks

Features
◆ Broadcast Receiver with two RF output ports
◆ Design for extremely low noise and low intermodulations
◆ Optical input power ranges from -8 dBm up to +4 dBm
◆ Bandwidth 85 … 1218 MHz
◆ Automatic RF output level control using optical input level

Optical to electrical conversion of Broadcast signals in HFC networks

Quad Optical Return Channel Receiver – OR43-300-FA

Application
◆ Optical to electrical conversion of Return Channel signals in HFC networks

Features
◆ Quad Return Channel Receiver:
  - Four independent optical receivers
  - Wide optical input power range: -16… +2 dBm
  - Bandwidth 5 … 204 MHz
  - Each of the 4 receivers can be switched to the -20dB test port on front
  - Pilot tone controlled or optical input power controlled AGC mode to keep the RF level independent of the optical input power

28 dB optical budget in systems with BKtel RFoG nodes due to ultra low noise optical receiver technology

RF combination output 4:1

Optical power level detection with LED indication for all inputs suitable for pulsed optical RFoG (TDMA) signals or continuous wave detection (HFC mode)

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In order to realize highest port density BKtel offers quadruple optical return path receivers with front side access for optical ports and rear side access for RF Ports.
### Accessory Modules

#### Forward and Return Channel RF Amplifier – CA12-FA

**Application**
- Amplification of forward/return RF signals

**Features**
- Flexible forward/return RF amplifier with high linearity for headend and hub locations
- Wide frequency range (5 ... 1218 MHz)
- Broadcast and Narrowcast input port
- RF gain and slope and software configurable
- RF power detection

#### Optical Switch OS212-FA

**Application**
- Redundancy switching between two optical input signals in case of missing or insufficient optical power

**Features**
- 1:2 Optical Switch
- Nominal input power: -25 ... +23 dBm
- Wavelength range: 1280 ... 1340; 1520 ... 1625 nm
- Independent optical power control of both inputs
- Sensor and LED signalling for the switch position
- Automatic, remote and manual operation

#### Element Controller (Ethernet) – ECxE-FA

**Application**
- 2G6 device remote supervision and controlling

**Features**
- Automatically detecting and polling of all active 2G6 series modules connected to the serial RS485 bus for remote supervision and control
- Webserver/Ethernet management for easy local and remote management
- SNMP/Ethernet management to connect to Network Management Systems
- Easy software updates via Ethernet interface
- High secure network access using HTTPS and SNMPv3
- Four SFP standard cages for 1GbE SFP transceivers
- IPv6 support
- Eight-port Ethernet layer 2 switch
- Wirespeed switching interface
- Web interface GUI for mobile devices

### 2G6 Platform

#### 2G6 Module Chassis - SRx

**Application**
- Chassis for installation, powering and cooling of 2G6 modules

**Features**
- 19 inch / 4 RU chassis, adaptable to metric (ETSI) racks
- Available with standard brackets for regular mounting (SR19) and extended brackets for 5 cm reverse offset mounting (SR19-E)
- Up to 16 modules pluggable on front, together with up to two power supply and fan units mounted on the rear
- Dust safe cooling (no dust blows through the electronics of the modules)
- Redundancy option for power supply and fan unit (2 units hot pluggable)
- Automatic slot and chassis address detection of plugged modules
- Several chassis can be controlled by one ECE element controller unit
- Real time hot standby for module slots next to each other (slot 1-2, 3-4 ... 15-16)
- Maximum capacity:
  - 32 Optical transmitters (Dual transmitter in 1 slot)
  - 16 Optical amplifiers (1 slot)
  - 64 Return Channel receivers (Quad Receiver in 1 slot)
Chassis Power Modules - PMx

Application
- Power Supply and Fan Unit for 2G6 chassis

Features
- 90 ... 264 VAC or 36 ... 60 VDC powering
- Redundancy option for power supply and fan unit (2 units hot pluggable)

Network Management

For monitoring, control and configuration of the active equipment, the ECE-FA controller is available. The ECE-FA 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. One ECE-FA can manage modules in multiple chassis.
Our Inspiration - Our Aim

Inspiration
Our aim is the manufacture of technically leading products to the advantage of our customers. The term „engineering based“ defines exactly BKtel’s orientation: Our organisation serves solely to optimally support the creativity and flexibility of product and system development.

BKtel has enforced this philosophy consequently throughout the formation of the company and in day-to-day work. All tasks that do not directly serve research and development or the implementation of the products are carried out by third parties as services. As a result the organisation has a lean and efficient structure.

This organisation, with a strict „production to order“ philosophy, is able to manufacture products, which not only offer our customers technically forward-looking solutions but also economical communication solutions.

Aim
Innovative services such as fast internet, “Voice-over-IP” and modern cable TV revolutionise everyday life, inspire the telecommunication industry and determine the future of the telecommunication market. BKtel supplies today its worldwide customer base with system solutions which they require in order to create and operate interactive networks successfully. The core of our business is the development, in accordance with market requirements, of technically leading components and systems, high standard manufacturing and reliable delivery.

Outlook
Innovative broadband networks will offer worldwide a sole platform for the fast and economical data, voice and cable TV services. BKtel in close cooperation with its customers will deliver systems and relevant network management, which will play a key role in the formation of these broadband networks.

Our Company
The BKtel Group has its origin in the foundation of BKtel communications in 1997. The group was extended in 2002 with BKtel systems (merged with BKtel communications in 2009), BKtel components (2006), BKtel Photonics (2014) and BKtel networks (2017). Further international offices were founded in China and Japan for the growing Asian market. The entire group has currently a workforce of over 130 employees worldwide, based in Germany in Hueckelhoven (near Düsseldorf), in Rosenheim (near Munich) and in Kornwestheim (near Stuttgart).

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 high quality products as well as the comprehensive support in designing optical networks make BKtel to one of the leading suppliers in the FTTH and HFC market.

Our Products
BKtel develops equipment and software for FTTH and HFC broadband networks. The product portfolio includes a wide range of products starting from equipment for optical transmission such as optical transmitters, amplifiers, and receivers and customer premises equipment, CATV headends, coaxial cable amplifiers. BKtel 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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