Open Transport Network (OTN)

BORA-OTN150/155 AND BORA-OTN155/150

Introduction

Thanks to its design, the OTN (Open Transport Network) can handle nearly all existing communication standards for voice, data, LAN and video.

The system is based on a dual, counter-rotating optical ring, interconnecting up to 100 OTN nodes.

The ring is synchronous, bandwidth is reserved by the OMS (OTN Management System) for each application, which results in a never-blocking and fully predictable system behavior.

The BORA is the node's central control block, located between the interface cards and the optical ring. The BORA-OTN150, BORA-OTN155, BORA-OTN600 and the BORA2500 are used to build rings with respective capacities of 150 Mbps, 155 Mbps, 600 Mbps and 2500 Mbps. Installed systems can be simply upgraded in capacity by replacing the BORA card in each node.

The BORA-OTN155/150 common logic card allows conversion from the OTN-150 ring frame format to OTN-155 (STM-1/ OC-3c) format.

Features

The BORA-OTN155/150 common logic card allows conversion from the OTN-150 ring frame format to OTN-155 (STM-1/ OC-3c) format.

To adapt OTN-150 networks to SDH STM-1/ SONET OC-3c network environments

Provides 150 Mbps user bandwidth

Different modules for different distances are available for multimode and single-mode fiber.

Minor and Major alarm relay integrated. High temperature alarm sensor on board

On-board Engineering Order Wire with handsfree headset

10/100 Base-T port for connection of OMS (OTN Management System)

Allows software downloads without node shutdown

OTN Systems

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To complement this, the BORA-OTN150/155 common logic card allows conversion from the OTN-155 (STM-1/ OC-3c) format to OTN-150 ring frame format.

This can be useful if an OTN-150 ring needs to be closed via an SDH or SONET network, for example because no dedicated fibers are available, or when an SDH Microwave Radio system is used to interconnect the OTN-150 nodes.

The BORA-OTN150/155 has two hot-pluggable transceiver modules for the OTN ring connection. Optical Transceiver 1 (OTR1) is compatible with OTN-150 framing, OTR 2 is compatible with OTN-155 framing (SDH STM-1 and SONET OC-3c compatible). For BORA-OTN155/150, this is reversed. Different modules for different distances are available for multimode and single-mode fiber.

The BORA-OTN150/155 integrates the following functions on one card:

Controlling the node and interface cards

The BORA card tests and manages the node and the interface cards. A display on the BORA shows the actual ring and node status, facilitating fast troubleshooting.

Managing and interfacing the optical ring

The OTN ring is managed in a distributed way by all BORAs connected to it. Upon startup the BORAs select a ring master, initialize and close the ring. If required due to broken fibers or removed nodes, the BORAs will perform protection switching. This can be done by switching over to the standby ring or looping back the data on the ring, depending on the fault condition. No single point of failure exists.

Controlling the data exchange between interface cards and optical ring

The BORA determines which data is exchanged between interface cards and the ring, and guarantees that no interface card will disturb data from other interface cards. With a 32 kbps granularity, the BORA-OTN150/155 can extract up to 147.456 Mbps of data from the ring, and exchange this data with the interface cards in the node.

OTN Management System

The OTN Management System (OMS) is used to configure the BORA cards. Once configured, the BORA cards have all necessary intelligence on board to carry out all functions, including fault recovery, ring management and interface card replacement, without the OMS being on line. The OMS is connected to one of the BORAs, and uses an in-band channel to reach all nodes.

The BORA gathers all status information from the node, the ring and the interface cards, and makes them accessible to the OMS. The BORA also receives and checks all commands from the OMS, and carries them out or passes them on to the relevant interface card.

BORA-OTN150/155 types

BORA-OTN155/150-8 and BORA-OTN150/155-8 can be used in 8-slot N22 nodes and 4-slot N215 nodes.

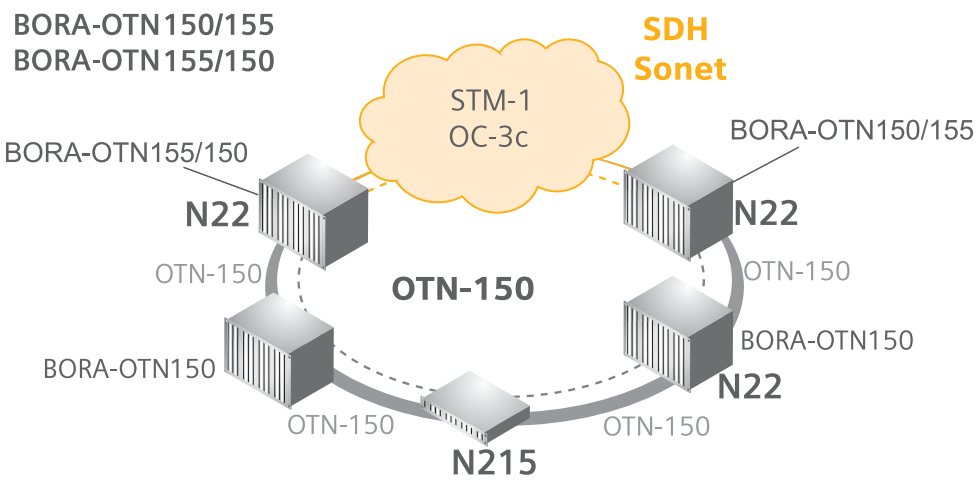
SFP transceivers

The BORA-OTN150/155 has two hot-pluggable optical transceiver modules for the OTN ring connection. The OTR1 converts the OTN-150 ring's optical signal to an equivalent electrical signal, OTR2 converts the OTN-155 optical STM-1/OC-3c signal to an equivalent electrical signal, and vice versa.

Different modules for different distances are available for multi-mode and single-mode fiber.

The transceiver modules are hot-pluggable SFP (Small Form Factor Pluggable) modules that can be replaced via the front of the BORA.

The I (Intra-Office), S1 (Short Haul), L1, L2 and V2 (Long Haul) transceiver types are available. Their optical characteristics are listed in a separate sheet.



Specifications

Connectors

ETH
A twisted pair RJ45 connector (10/100 BASE-T Ethernet standard) for the connection of the OMS.

EOW
Two 3.5 mm jacks for the EOW (Engineering Order Wire) headset with microphone.

SFP slots
Two slots for SFP optical modules. The SFP modules use LC optical connectors.

ALARM
An RJ45 connector offering the major and minor alarm contacts.

CLK
A BNC connector for the connection of an external TTL clock signal to which the master node synchronizes. Input signal can be 36.864 MHz, E1 or T1.

On-board indications
The 4-character alphanumeric display shows the BORA-OTN150/155 type and all kinds of data regarding node operation and control information. The Ethernet RJ45 connector LEDs indicate the OMS link status.

The SDH and BER LEDs report data transmission errors, whereas the SYNC LED indicates the ring's synchronization status.

An EOW LED ("CALL") is lit when an EOW headset is plugged in somewhere.

System data rate
BORA-OTN150/155 system data rate 147.456 Mbps

Optical data rate
BORA-OTN150/155 optical data rate is 184.32 Mbps on the OTN-150 side and 155.52 Mbps (STM-1/OC-3c) on the OTN-155 side.

Card size
The BORA-OTN150/155 uses one slot position in an N22 and N215 node (5TE width)

Weight
BORA-OTN150/155 approx. 440 g

Card MTBF at +25°C (+77°F) (without optics)
63.8 years

Electro Magnetic Compatibility
Emission: EN55022 Class B, EN61000-6-4
Immunity: EN61000-6-2

Power Consumption (without TRMs)
BORA-OTN150/155 +5V: 1.85A
+12V, -12V: negligible

Status information
The following status information is available from the board:
- BORA type
- Optical link status
- Transceiver type (I, S, L, …)
- Firmware version
- Interface card status

Temperature sensor
A temperature sensor is provided on the BORA-OTN150/155 indicating to the OMS when the temperature exceeds 65°C ± 4°C (139°F ± 7°F).

Operation

On the OTN-150 side of the BORA-OTN150/155, the data is transmitted between the nodes in the OTN-150 frame format. On the OTN-155 side, the OTN-150 frame is mapped into an STM-1 or OC-3c payload, using VC-4 containers. The SDH/SONET link layer carries out the clock synchronization, bit error rate measurement and word alignment. The OTN frame carries both data (for the interface cards) and control signals (such as the Engineering Order Wire-EOW and inter-node communication).

As a result, the SDH or SONET overhead bytes are not used by the OTN application, and may be modified by other devices without disturbing OTN.

The add/drop functionality between interface cards and OTN frame is implemented in the FPGA and works on a 32 kbps level (cf. the other members of the OTN family).
Error checking tests are carried out on the optical level (Optical Signal Loss), on the SDH level (B1, B2 and B3 Bit Error Rate tests) and on the embedded OTN frame (CRC check).

OTN's hardware-based design

Hardware-based versus software-based systems

The OTN multiplexing functionality is based on a hardware design, not a software approach. The advantages of hardware-based versus software-based system design are high reliability, high capacity and low delay.

Software-based systems have one or more fast microprocessors that interrogate the system data, and route and switch the data to the appropriate interface cards. The disadvantage of the software-based approach is the complexity of the control software.

OTN's hardware-based system design

The hardware-based design of the OTN executes the native transport of the user data between the optical ring interfaces and the chassis backplane and interface cards in the hardware, without invasive data analysis. In order to accomplish this goal, the OTN system is engineered to collect/distribute node user data, insert/drop the interface card data into a TDM-based frame structure and transmit/receive the TDM frame between OTN nodes without firmware interaction.

The OTN system provides reliable high-speed, fault-tolerant network transport with a variety of external interface protocol options.

With the exception of video and audio switching, OTN strictly provides transport functions and co-operates with external systems to provide further application functionality.

Video switching

OTN supports video switching. The OTN video interface cards have firmware to provide video switching functions on interface card level. Video switching uses pre-assigned bandwidth on the ring, which guarantees a non-blocking and fast switching system.

Ordering information

BORA-OTN150/155-8 for N22 and N215:
S30824-Q134-X109

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S30824-Q134-X110

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