



Highlights

Enables the industry's most economical expansion of downstream capacity

Architected for highly available and protected bandwidth via hitless RF redundancy support

Supports redundancy in three cards slots, whereas alternative offerings require five card slot redundancy configurations

Efficient power and space utilization enables flexible scaling of high-speed downstream broadband services

Investment protection for DOCSIS® 1.0, 1.1, and 2.0 cable modems while migrating deployed BSR 64000 CMTS/edge router platforms to the latest software release

Supports DOCSIS 3.0 channel bonding, AES, and IPv6 implementations

Decoupled downstream capabilities enable flexible downstream capacity growth without requiring a corresponding investment to increase upstream channels

Delivers major bandwidth increases for both DOCSIS 3.0 and legacy DOCSIS cable modems

Includes the 4QRM, the industry's lowest-power, highest-density upconverter that combines the functions of QAM modulation and RF upconversion for four channels in a single module

The Motorola TX32 allows cable operators to significantly increase “protected” downstream capacity while fundamentally changing the economics associated with ultra-broadband triple-play services. The TX32 is easily deployed into existing headends to support DOCSIS 3.0 I-CMTS architectures that enable flexible scaling of downstream bandwidth to support ultra-broadband services.

The Motorola BSR 64000 Decoupled Downstream TX32 module provides significantly increased downstream capacity and drastically reduces per-subscriber and channel costs for supporting the economical delivery of ultra-broadband services at speeds greater than 200 Mbps. It is an evolutionary product that provides major flexibility for operators so they can cost-effectively scale downstream bandwidth to deliver ultra-broadband services. With the TX32, cable operators can deliver increased bandwidth for DOCSIS 3.0 as well as legacy DOCSIS 1.0, 1.1, and 2.0 cable modems.

The TX32 incorporates DOCSIS 3.0 downstream channel bonding services, IPv6, and Advanced Encryption Services (AES) and 1 GHz downstream operation* to allow cable operators to deploy cost-effective, scalable, and secure ultra-broadband solutions. With the industry's leading downstream port density in a highly redundant platform, the TX32 allows cable operators to significantly lower the cost of downstream transmission while deploying proven

Integrated Cable Modem Termination System (I-CMTS) solutions. To provide 32 downstream channels, the BSR 64000 I-CMTS decoupled TX solution requires only one slot, whereas competitive alternatives require three slots to equal the same downstream density.

The TX32 supports independent scalability of CMTS downstream functions and provides cable operators greater flexibility in deploying new services. MSOs can add downstream ports without a corresponding increase in upstream capacity. The term “decoupled” specifically refers to the separation of the downstream and upstream into different physical modules. This provides cable operators with much higher density and far greater flexibility than current fixed CMTS modules that bound the limits in deploying ultra-broadband services.

***TX32 1GHz Module only**

**TX32**

BSR 64000 Decoupled Downstream Module

DOCSIS 3.0

The TX32 offers high downstream channel density and enables new DOCSIS 3.0 channel bonding and encryption functionality while simultaneously helping to decrease costs and protect operator investments in existing DOCSIS 1.0, 1.1, and 2.0 equipment. It also supports DOCSIS 3.0 IPv6, which offers much larger address space that allows greater flexibility in assigning addresses.

This advanced module supports DOCSIS 3.0 cable modems as well as legacy DOCSIS 1.x and 2.0 cable modems. Downstream channel bonding with unique RF channels from the BSR 64000 2:8 DOCSIS/EuroDOCSIS CMTS module can be bonded with downstreams on the TX32 ports to provide operators with flexible spectrum usage as new RF channels become available. In the future, Motorola plans to introduce a decoupled upstream module that will further expand a cable operator's flexibility to increase capacity.

I-CMTS

The BSR 64000 architecture supports the I-CMTS architecture, with the TX32 providing dramatically more downstream bandwidth to residential and commercial subscribers. By deploying the TX32 in a BSR 64000 platform, cable operators gain the flexibility to expand downstream offerings without the overhead of increased upstream capacity associated with alternative coupled downstream and upstream DOCSIS modules offered by other vendors. This I-CMTS approach allows cable operators to benefit from a protected module in a protected system that provides the lowest cost of operation for increasing downstream capacity.

Channel Bonding

Cable operators can leverage the high bandwidth gains provided by channel bonding technologies to provide ultra-broadband services to residential and commercial subscribers. Cable operators can bond up to four physical channels today to offer ultra-broadband services to successfully compete with telcos and satellite providers. Motorola will increase the number of downstream channels per bonding group from 4 to 32 in a future software release. Motorola's downstream channel bonding solution can deliver over 145 Mbps to a single DOCSIS cable modem and over 200 Mbps to a single EuroDOCSIS cable modem.

Bandwidth Expansion

Cable operators face varying demands for upstream and downstream bandwidth. For example, video-on-demand (VoD) and high-speed data services require increased downstream bandwidth but do not require increased upstream bandwidth.

As services evolve, the ratio of upstream to downstream capacities will similarly evolve. The TX32 enables significantly higher densities at a lower cost per downstream channel.

Investment Protection

The TX32 supports DOCSIS 3.0 channel bonding and helps provide the industry's highest I-CMTS density embedded downstream solution with each module supporting 32 QAM channels in a single slot within the fully redundant BSR 64000 chassis. The downstream channels on the TX32 can be coupled with the downstream and upstream channels on existing 2:8 CMTS modules already in production to provide up to 138 downstream channels and over 5 gigabits of aggregate downstream capacity in a single chassis. Because of its density, the TX32 decreases today's cost per downstream channel by an average of 60 percent. When added to a BSR 64000, the TX32 provides functionality to every installed 2:8 CMTS module, ensuring that existing investments are protected and offering the lowest incremental costs for capacity additions.

RF Redundancy

The BSR 64000 I-CMTS solution provides 1:N redundancy across a bank of three or five TX32 modules for high availability of services. The standby TX32 module occupies the center module slot within a TX32 bank of cards. A fully redundant BSR 64000 I-CMTS decoupled TX solution requires only two slots—active and standby—while competitive alternatives require five slots to match the same downstream density. The TX32 provides a dramatic increase in protected downstream capacity. It is a cost-effective solution for RF bandwidth protection, and supports uninterrupted service delivery or "hitless" RF redundancy.

Integrated Four-Channel QAM Modulator and Block Upconverter

The TX32 utilizes a custom four-channel QAM modulator with direct RF block upconversion to meet stringent DOCSIS 3.0 isolation requirements while delivering industry-leading downstream density on a single module. This custom four-channel QAM RF Modulator (4QRM) has unique low-power characteristics and serves as a highly dense upconverter with support of single, dual, and quad channel operation. The 4QRM's sophisticated design leverages an on-board microprocessor to control critical parameters, monitor operations, and provide status information on operating temperature, voltages, and RF output level.

4QRM Highlights**Low Noise**

Enables the TX32 to provide low phase noise and Modulation Error Ratio in all modes for demanding 256 QAM transmissions in HFC networks

Minimal Power Consumption

Innovative signal processing and output stage design produce a high RF power level while consuming on average only 2 W of DC power, enabling the TX32 density of up to 32 downstream channels per module

TX32

BSR 64000 Decoupled Downstream Module

Specifications

FLEXIBLE CONFIGURATIONS

Eight downstream RF ports
 Integrated four-channel QAM modulation and RF block-upconversion per RF port
 One, two, three*, or four adjacent DOCSIS downstream channels per RF port
 Maximum of 32 downstream QAMs per module
 Configurable DOCSIS, J-DOCSIS and EuroDOCSIS operation
 Deployable with existing SRM, HSIM, and 2:8 DOCSIS/EuroDOCSIS modules
 Combined 2:8 and TX32 downstream channel bonding with non-adjacent 2:8 downstream channels

STANDARDS-BASED INTEROPERABILITY

DOCSIS 1.x-, 2.0-, and 3.0-compliant
 Compatible with DOCSIS, J-DOCSIS, and EuroDOCSIS specifications
 Based on Broadcom BCM3215 Octal Downstream DOCSIS 3.0 Core MAC Chip

MANAGEMENT

Compatible with all relevant BSR 64000 CLI commands
 Supports all relevant DOCSIS 1.x, 2.0, and 3.0 MIBs
 Enables downstream per-flow queuing

RF

Downstream Frequency Range (fc)	
DOCSIS	91 to 870 (999*) MHz
EuroDOCSIS	112 to 869 (998*) MHz
Downstream Modulation	64 and 256 QAM
Downstream Per-Channel Bit Rates	
DOCSIS	27 to 38 Mbps
EuroDOCSIS	36 to 56 Mbps
Output Level	44 to 60 dBmV
Bandwidth	
DOCSIS	6 MHz
EuroDOCSIS	≤8 MHz
Typical Modulation Error Rate	47
Output Load Impedance	75 Ω

PHYSICAL

Occupies a single slot in the BSR 64000 chassis
 Hot-swappable with redundant rear I/O module
 F-type connector on rear I/O module for RF
 Diagnostic Port DB-9
 LEDs Fail, Status, Alarm, Link, Fault
 Dimensions 15.0 in x 15.0 in x 0.12 in
 (38.1 cm x 38.1 cm x 0.3 cm)
 Weight 6.8 lb

ENVIRONMENTAL

Operating Temperature	0 °C to 40 °C (32 °F to 104 °F)
Storage Temperature	-20 °C to 60 °C (-4 °F to 140 °F)
Operating Humidity	10% to 90% non-condensing
Storage Humidity	5% to 95% non-condensing

REGULATORY COMPLIANCE

Safety
 UL60950-1:2003 1st Ed.
 CSA C22.2 No. 60950-1-03 1st Ed.
 IEC 60950-1:2001, 1st Ed.
 EN 60950-1:2002, 1st Ed.
 2006/95/EC

Electromagnetic Emissions
 EN 300386 V 1.3.1: 2005, Telecom Centers
 IEC CISPR 22: 2003 Class A
 CFR 47 Part 15, Subpart B, Class A
 VCCI V3: 2005, Class A
 AS/NZS CISPR 22: 2002 Class A
 RRL Notice 2006-67, Class A
 2004/108/EC

Electromagnetic Immunity
 EN 300386 V 1.3.1: 2005, Telecom
 RRL Notice 2005-130

Environmental
 RoHS,WEEE
 2005/95/EC

Physical
 Designed for NEBS GR-63-CORE Level 3 Requirements
 ETS 300 019 Part 1-1 Class 1.1, Part 1-2 Class 2.2, Part 1-3 Class 3.1

POWER

Unit Power	130 (150*) W (typical)
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SOFTWARE

Minimum Software Revision	BSR 64000 Software Release 5.0, 5.1*
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***TX32 1GHz Module only**

For ordering information, contact your local Motorola sales representative.

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