(Euro)DOCSIS Module Overview
The Broadband Services Router™ 64000 (BSR 64000™) from Motorola™ is a highly integrated, carrier-class, multiservice IP switch/router with an integrated Cable Modem Termination System (CMTS). Multiple System Operators (MSOs) can save headend space, lower network operations costs, reduce headend complexity, simplify operations, and rapidly introduce new, value-added services by deploying the BSR 64000 system in distribution hubs or regional headends. The (Euro)DOCSIS Modules contain the broadband Hybrid Fiber Coax (HFC) network interfaces for the BSR 64000 and allow operators to terminate upstream flows from cable modems and cable telephony devices and then route them through the BSR 64000 to local servers or onto the backbone network while maintaining strict Quality of Service (QoS) policies.

High-Density Termination
The (Euro)DOCSIS Modules supports all (Euro)DOCSIS upstream and downstream modulation modes and symbol rates. The 1x4 (Euro)DOCSIS module supports one downstream transmitter and four upstream receivers with one (Euro)DOCSIS MAC domain and can deliver up to 38 Mbps downstream and 40 Mbps upstream. Up to 12 1x4 (Euro)DOCSIS Modules can be deployed to support up to 12 downstream transmitters and up to 48 upstream receivers in a single, space-saving chassis to provide the highest density and lowest price-per-port in the industry. The 1x8 (Euro)DOCSIS module supports one downstream transmitter and eight upstream receivers with one (Euro)DOCSIS MAC domain and can deliver up to 38 Mbps downstream and 80 Mbps upstream. Up to 12 1x8 (Euro)DOCSIS Modules can be deployed to support up to 12 downstream transmitters and up to 96 upstream receivers in a single, space-saving chassis to provide the highest density and lowest price-per-port in the industry.

Data packets are transported between the (Euro)DOCSIS Module and the Network Interface Modules via 2.1 Gbps ports to a fully redundant, 64 Gbps cross-connect switch fabric. Control and management information flows between the (Euro)DOCSIS Module and the Supervisory Routing Modules (SRMs) independent of the data via redundant, Ethernet-based buses. This distributed architecture provides the density and performance required to accelerate the mass deployment of new, revenue-generating services over the HFC infrastructure.

QoS Guarantees and Full-Spectrum, Tunable RF
The (Euro)DOCSIS Module leverages the (Euro)DOCSIS 1.1 QoS framework and implements fine-granularity SmartFlow™ Quality of Service (QoS) and per-flow packet classification at wire speed. Upstream flows from the cable modem to the BSR 64000 are policed by the (Euro)DOCSIS Module to ensure appropriate bandwidth allocations. The (Euro)DOCSIS Module reclassifies packets at wire speed according to (EURO)DOCSIS service flows, polices the packets according to policy, and forwards the packets to the appropriate Network Interface Module for full QoS treatment and transmission. Multiple internal queues are used for the interface to the Network Interface Modules to maintain the low-latency levels required for IP telephony and real-time applications.
The (Euro)DOCSIS Module provides a three-level, hierarchical QoS implementation for downstream traffic to subscribers on a per-flow basis with each MAC domain able to classify up to 8,000 service flows using standard (Euro)DOCSIS classifiers. Operators can also apply policy-based classifiers, and in Open Access environments allow service providers to deploy policy-based services. The (Euro)DOCSIS Module implements QoS levels based on established Service Level Agreements (SLAs), and will not admit a QoS reservation unless all systems resources required to support that reservation are available.

Accounting information is provided based on the Service Flow Identification Number (SFID). Each module offers integrated, tunable RF output that operates over the entire spectrum to simplify operations and eliminate the costs and management overhead of external up converters. The (Euro)DOCSIS Module allows operators to perform spectrum analysis to detect RF errors in upstream or downstream traffic flows and build a database of RF plant characteristics to support informed changes to modulation or frequency.

(Euro)DOCSIS Module Highlights
- Highest density cable modem termination available
- Lowest price-per-port in the industry
- Compliant with (Euro)DOCSIS 1.0, (Euro)DOCSIS 1.1, and PacketCable 1.0 specifications
- 1:N redundancy
- Per-service flow management and QoS guarantees with 16,000 service flows per-module
- Integrated, tunable RF eliminates the need for external up converter

High-Availability Aggregation
The BSR 64000 can be configured with up to 12 (Euro)DOCSIS Modules in a 1:N redundancy mode where a single spare serves as backup to all other (Euro)DOCSIS Modules in the chassis. Operators can start with just a couple of modules and scale the BSR 64000 by adding new (Euro)DOCSIS Modules to accommodate increased subscriber demands. This architecture enables a scalable, pay-as-you-grow solution that provides cost-effective entry and maximum ability to scale each system economically.

Each (Euro)DOCSIS Module uses a passive CMTS I/O interface to provide the physical connections to the HFC plant, and the data flows from an active (Euro)DOCSIS Module to its I/O interface via the RF switch matrix. In the unlikely event of a failure, the RF connections between the active and passive modules are automatically switched from the failed card to a spare. Established IP flows—including IP telephony calls—will remain operational as they are transitioned to the spare, and QoS treatments for each flow will also be seamlessly transitioned.

The (Euro)DOCSIS Modules monitor the behavior of the cable modems and report any anomalies. Failover is performed automatically without the need for manual intervention, allowing an operator to deploy high-density BSR 64000s in remote headends that lack expert technical staff. The (Euro)DOCSIS Module provides the highly dense termination required to optimize the use of headend space and provide the cost-effective scalability required to meet growing demands for innovative new services.

(Euro)DOCSIS Module Specifications	**1x4**	**1x8**
Downstream transmitters per-module	1	1
Upstream receivers per-module	4	8
(Euro)DOCSIS MAC domains per module	1	1
Maximum service flows per-module	16,000	16,000
Maximum modules per-chassis	12	12
Redundancy	1:N	1:N

(Euro)DOCSIS Standards Compliance

SP–BPI	Baseline Privacy Interface Specification
SP-CMTS-NSI	Cable Modem Termination System Network Side Interface Specification
SP-BPI+	Baseline Privacy Interface Plus Specification
SP-OSSI	Operations Support System Interface Specification
SP-OSSI-RF	Operations Support System Interface Radio Frequency MIB
SP-OSSI-BPI	Operations Support System Interface Baseline Privacy MIB
SP-RFI	Radio Frequency Interface Specification

PacketCable Standards Compliance

PKT-SP-DQOS	PacketCable Dynamic QoS Specification
PKT-SP-SEC	PacketCable Security Specification

Internet Protocol Cable Data Network (IPCDN) Standards Compliance

RFC 2669	Cable Device Management Information Base for (Euro)DOCSIS compliant Cable Modems and Cable Modem Termination Systems
RFC 2670	Radio Frequency (RF) Interface Management Information Base for MCNS/(Euro)DOCSIS compliant RF Interfaces
(Euro)DOCSIS QoS MIB	Data Over Cable System Quality of Service Management Information.
(Euro)DOCSIS IGMP MIB	(EURO)DOCSIS 1.1 IGMP MIB
(Euro)DOCSIS BPI+ MIB	
(Euro)DOCSIS Subscriber Management MIB	

Upstream PHY Specifications

Modulation	QPSK and 16 QAM
Input frequency range	5 ~ 42 MHz(5-65 MHz EuroDOCSIS)
Channel width	200/400/800/1600/3200 KHz
Per-channel bit rate	0.320 ~ 10.24 Mbps
FEC	Reed Solomon decoding
Receiver input power range	-16 ~ 35 dBmV
Input IF signal connector	75 Ohm F-type connectors

Downstream PHY Specifications

Modulation:	64 QAM and 256 QAM
Output frequency range:	88 ~ 857 MHz (channel center)
Output frequency step size:	12.5 KHz
Channel width:	6 MHz
Per-channel bit rate:	27 Mbps (64 QAM) and 38 Mbps (256 QAM)
Output power range:	50 ~ 61 dBmV
Output RF signal connector:	75 Ohm F-type connector

Upstream QoS

Per-service flow classification
Eight classes for queuing between the (Euro)DOCSIS Module and the Network Interface Module
Per-service flow scheduling
Per-service flow traffic rate limiting
Additional upstream QoS is provided in the Network Interface Module

Downstream QoS

Per-service flow classification
Per-service flow queuing
Per-service flow scheduling
Per-service flow traffic rate limiting
Hierarchical Prioritized Deficit Round Robin Scheduling
Eight classes per-channel
32 subclasses per-class
8,000 queues per downstream channel

(Euro)DOCSIS 1.1 Upstream QoS Scheduling Services

Best Effort (BE): Eight subclasses within best effort service class
Unsolicited Grant (UGS)
Unsolicited Grant Service with Activity Detection (UGS-AD)
Real-Time Polling Service (rtPS)
Non Real-Time Polling Service (nrtPS)

Supported Optional (Euro)DOCSIS 1.1 Features

Fragmentation
Concatenation
Payload header suppression