

Cisco uBR 3x10 RF Switch

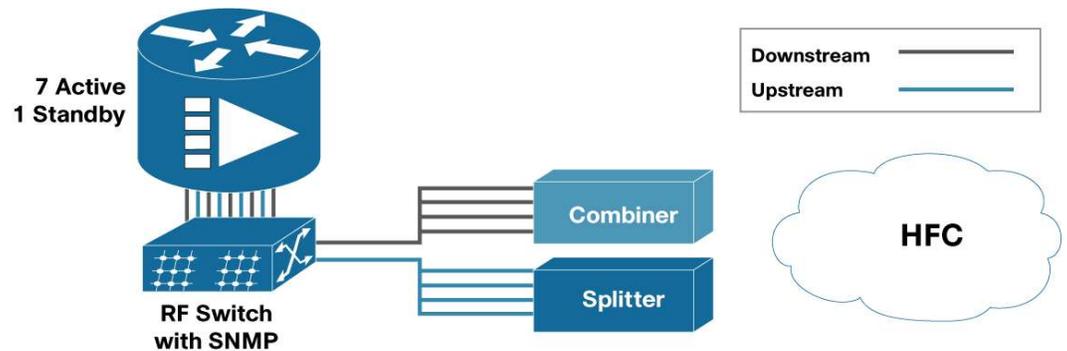
High availability for broadband cable IP services is becoming a requirement as multiple system operators (MSOs) enter voice over IP (VoIP) and commercial service markets. Cisco Systems® offers the Cisco uBR 3x10 RF Switch as part of its high-availability cable modem termination system (CMTS) solution set. The Cisco uBR 3x10 RF Switch works with the Cisco uBR10012 Universal Broadband Router to deliver unprecedented levels of availability, scalability, and flexibility when deploying advanced, revenue-generating services such as voice and virtual private networks (VPNs) over cable systems. The Cisco uBR 3x10 RF Switch, combined with the Cisco uBR10012, provides unmatched RF performance, high-availability, and configuration flexibility. The product supports Data Over Cable Service Interface Specifications (DOCSIS), European DOCSIS (Euro-DOCSIS), and PacketCable specifications. Together, the products enable a fully redundant system with no single point of failure.

The Cisco uBR 3x10 RF Switch supports three downstream switch modules and 10 upstream modules. The product provides an Ethernet controller module, an AC or DC power supply, and optional color-coded cabling that is terminated in advance. With connections to the Cisco uBR10012 and the hybrid fiber-coax (HFC) cable plant, the compact three-rack-unit (3-RU) Cisco uBR 3x10 RF Switch supports more than 250 connections and offers a new level of network redundancy suited for high-performance, high-density applications. The product works with Cisco communications-grade CMTSs to create a fully redundant system that enables cable operators to achieve PacketCable system availability, minimize service disruptions, and simplify operations. Each Cisco RF Switch is a multiplexing system that can reroute any of the RF cables connected to active Cisco RF line cards to a spare or backup set of RF line cards.

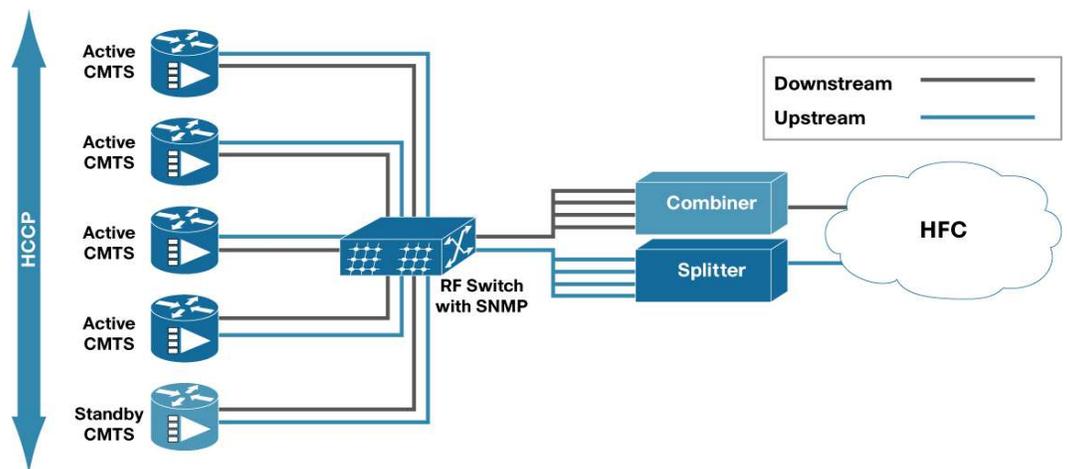
Figure 1. Cisco uBR 3x10 RF Switch



The Cisco RF Switch provides maximum reliability for the Cisco uBR10012. See Figure 2. The Cisco uBR10012 contains seven active line cards and one standby line card.

Figure 2. N+1 Redundancy on the Cisco uBR10012

The Cisco RF Switch also enables a fully redundant N+1 system configuration for the Cisco uBR10012 Universal Broadband Router. See Figure 3.

Figure 3. Redundancy on the Cisco uBR10012 Universal Broadband Router

With Cisco IOS[®] Software, each Cisco RF Switch delivers redundancy by sharing configuration and state information from “working” line cards to “protect” line cards. If a working line card fails, a protect line card assumes traffic responsibilities. The Cisco Hot Standby Connection-to-Connection Protocol (HCCP) maintains all necessary DOCSIS or Euro-DOCSIS state information-including service identifier (SID), service flow, and Media Access Control (MAC) and IP information that enable a standby line card to completely replace an active card when needed. HCCP automatically detects:

- Software or hardware failure, including an external upconverter failure
- Cable wiring failures
- Interface shutdowns
- Line card online insertion and removal (OIR)
- Manual switchover

The Cisco uBR system controls the Cisco RF Switch and external upconverters through Simple Network Management Protocol (SNMP) messages that switch the upstream or downstream frequency on a protect line card as needed. The Cisco RF Switch also offers an SNMP Ethernet interface that allows operators to control the unit without a Cisco uBR10012.

An external RF switch (instead of a line card with internal wiring that would operate as an RF switch) better addresses future scalability. The external Cisco uBR 3x10 RF Switch can be stacked and used for multiple scenarios and different densities. The external design allows cabling migration and line card swap-outs.

High Availability Through N+1 Configuration

The Cisco RF Switch can be installed in a system configuration that enables complete hardware and software redundancy. The advanced high-availability capabilities of the CMTS hardware and software exceed PacketCable specifications for expected downtime and call cutoff. The system hardware is designed to exceed “five nines” (99.999 percent) availability, including both unscheduled and scheduled outages.

Increased Operational Flexibility

Even when high availability is not initially needed to support a service deployment, full hardware redundancy provides the operator with the option to defer a service call until the following business day. Similarly, hardware redundancy reduces ongoing operational costs by eliminating the need for onsite spares. This is especially beneficial in remote areas or in situations where technicians support several installations over a broad geographical area.

Primary Benefits

- Creates revenue opportunities by enabling voice and commercial services with a fully redundant, highly available DOCSIS or Euro-DOCSIS cable infrastructure
- Lowers operational costs by optimizing Cisco uBR system serviceability
- Protects investments with flexible configuration options when Cisco uBR systems are upgraded or the RF cable plant is reconfigured
- Maintains the efficiency of the RF plant or the DOCSIS or Euro-DOCSIS specification
- Provides maximum reliability by allowing completely passive implementation in the “working path,” including latching relays to maintain operation during power disruptions
- Allows complete testability to help ensure that redundant components are functional and that RF performance remains consistent
- Maximizes headend rack space with unmatched port density

Table 1 describes the primary features.

Table 1. Primary Features

Feature	Description
Optimal RF performance	<ul style="list-style-type: none"> Planar waveguides for optimal signal containment and minimal crosstalk Tuned/matched trace lengths for maximum consistency across ports and frequencies Printed circuit boards (PCBs) for all traces, for maximum mechanical robustness and durability; leads to maximum RF consistency and manufacturability throughout the life of the product Gold-plated connections throughout the chassis for maximum reliability Microwave-standard MCX connectors, for maximum density while maintaining the stringent RF characteristics demanded by cable operators High-quality, premium RF switching relays for optimal RF switching performance Separate switch sections for protecting up to 14 distinct RF ports per CMTS coaxial card, with up to two protect line cards, in either 7+1 mode, 8+1 mode, or two times 4+1 mode Each module supports the full frequency range specified by DOCSIS and EuroDOCSIS standards, with consistent RF performance from 5 to 860 MHz Minimum port-to-port isolation of 60 dB Consistent loss across connections
Configuration flexibility	<ul style="list-style-type: none"> Supports the Cisco uBR10012 Each slot becomes a downstream or upstream port when the relevant module is employed Supports the highest density cabling in the industry—more than 250 RF connections in a 3-RU chassis Uses industry-standard Belden 1855A cabling and readily available connectors and headers
Operational efficiency	<ul style="list-style-type: none"> Dedicated 10BASE-T Ethernet maintenance interface Configuration, monitoring, and troubleshooting via SNMP support Visual indicators for working, protect, and channel problems

Table 2 outlines specifications for the product.

Table 2. Specifications

Item	Specification
Input power requirements	<ul style="list-style-type: none"> AC: 100 to 240 VAC, 0.6A, 50/60 Hz; operating range: 90 to 254 VAC DC: -48 to -60 VDC, 0.7A; operating range: -40.5 to -72 VDC, 200mVpp ripple/noise
Physical	<ul style="list-style-type: none"> RF connector: MCX AC power: IEC320 type DC power: Three terminal block Ethernet: RJ-45 RS-232 Bus: 9-pin male D Weight: approximately 36 lb (16.4 kg) Dimensions (H x W x D): 5.25 x 19.0 x 15.5 in. (13.2 x 48.2 x 38.4 cm)
Environmental	<ul style="list-style-type: none"> Storage temperature: -38 to 150°F (-40 to 70°C) Operating temperature: nominal = 41 to 104°F (5 to 40°C) Storage relative humidity: 5 to 95 percent relative humidity Operating relative humidity: nominal 5 to 85 percent relative humidity Operating altitude: -60 to 4000 m

RF	<ul style="list-style-type: none"> • Input/output impedance: 75 ohms • Maximum RF input power: +15 dBm (63.75 dBmV) • Switch type: electromechanical; absorptive for working path, nonabsorptive for protect path • Switch setting time per switch module: 20 ms maximum • Downstream frequency range: 54 to 860 MHz • Typical downstream insertion loss: +/-1.1 dB from CMTS to cable plant; +/- 2.1 dB from protect path to cable plant; 5.5 dB from working path to output; 8.0 dB from protect path to output • Downstream insertion loss flatness: +/- 1.1 dB from CMTS to cable plant; +/- 2.1 dB from protect path to cable plant • Downstream output return loss: >15.0 dB at <450 MHz, >12.0 dB at >= 450 MHz • Downstream input return loss: >15.0 dB • Downstream isolation: >60 dB from channel to channel in working mode; >52 dB from CMTS to protect path when in protect mode • Upstream frequency range: 5 to 70 MHz • Typical upstream insertion loss: 4.1 dB from cable plant to CMTS; 5.2 dB from cable plant to protect path • Upstream insertion loss flatness: +/- 0.4 dB from cable plant to CMTS, +/- 0.6 dB from cable plant to protect path • Upstream input return loss: >16 dB • Upstream isolation: >60 dB from channel to channel in working mode; >60 dB from CMTS to protect path when in protect mode • Protect mode: CMTS return loss >10 dB; cable plant return loss: >10 dB
Regulatory compliance	<ul style="list-style-type: none"> • UL 1950, Third Edition (Safety of Information Technology Equipment, Including Electrical Business Equipment) • CSA950 • EN 60950 (Safety of Information Technology Equipment, Including Electrical Business Equipment) • IEC950 • ACA TS001 1997 Test Report and Statement of Compliance • AS/NZ3260
Electronic emissions certification	<ul style="list-style-type: none"> • EN300386: 2000 • EN55022: 1998 Class B • CISPR 22: 1997 Class B • CFR 47 Part 15: 2000 • ICES - 003: 1994 • VCCI - 3 / 2000.4 • AS/NZS 3548: 1995 Class B • CNS - 13438: 1997 Class B
Immunity	<ul style="list-style-type: none"> • EN61000-3-2: 1995 • EN61000-3-3: 1995 • EN55024: 1998 • EN50082-1: 1992 • EN50082-1: 1997
Visual status indicators (front panel)	<ul style="list-style-type: none"> • Working/Protect Channel 1 (green/yellow, 1 per card) • Working/Protect Channel 2 (green/yellow, 1 per card) • Channel 1 Problem (off/yellow, 1 per card) • Channel 2 Problem (off/yellow, 1 per card)
Visual status indicators (rear panel)	<ul style="list-style-type: none"> • Power (off/green, 1 per system) • 10BASE-T Link (off/green, 1 per system) • 10BASE-T ACT (blinking green, 1 per system) • Receive (Rx) - serial port (blinking green, 1 per system) • Transmit (Tx) - serial port (blinking green, 1 per system) • SYS (green, 1 per system) • ERR (green, 1 per system)
Network management	SNMP



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