# Optical Node Series (NC)
RD2322 RxD Remote PHY Device (RPD)/ Remote MACPHY Device (RMD)
for NC4000® S and H Series Nodes

COMMSCOPE®

FEATURES

- As an RMD: Simple, all-in-one box distributed CMTS solution that moves both MAC and PHY functionality out of the headend
- As an RPD: Improves headend density and power efficiency by moving PHY functionality out of the headend
- Convenient lid upgrade path from legacy installed base of NC4000 nodes to DAA
- DOCSIS® 3.1 compliant
- Seamlessly upgrade from traditional optics to distributed access architectures
- Configurable as 1x1, 1x2 or 2x2 DS-SG x US-SG (S Series, H4)
- Configurable as 1x1 or 1x2 DS-SG x US-SG (H3, HG)
- Maximized fiber utilization and reach
- Upstream and downstream analog overlay options to utilize legacy analog signals as needed
- Available with or without a console port

The Remote PHY Device (RPD) and Remote MACPHY Device (RMD) are components in CommScope's Distributed Access Architecture (DAA) portfolio. Both offer significant operational benefits—including increased bandwidth capacity, greater fiber efficiencies (wavelengths and distance), simplified plant operations with digital optics, and reduced loads on facility space and power systems—by extending the digital portion of the headend or hub to the node and placing the digital/RF interface at the optical/coax boundary.

The deep lid RxD option for the NC4000 node enables operators to unlock the performance benefits of DAA, operating either as an RPD or an RMD. The deep lid option is available as part of a fully configured NC4000 node, for new node installations, or as a lid upgrade kit that includes the RxD module, which allows operators to leverage an installed base of NC4000 nodes.
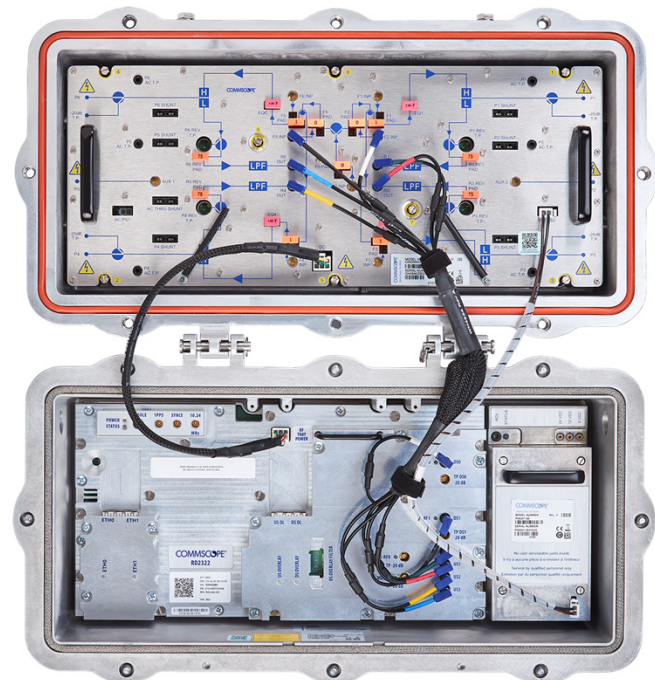
NC4000 with Deep Lid Upgrade

RD2322 RxD Module Operation

The RD2322 takes the place of traditional optics modules, such as downstream receivers and upstream transmitters, inside the node. The RD2322 operates in the same manner as a traditional forward receiver, with fine variable output level and tilt adjustments made via the RxD, and coarse level and tilt adjustments that can be made by installing RF attenuator pads and equalizers, respectively, in the node's RF module. When operating as an RPD, the module's channel configuration is received from the CCAP Core in the headend. When operating as an RMD, the module's service and channel configuration (as a configuration file) is downloaded from an external server.

The RD2322 is shipped in a 1x1 configuration and supports 1x1, 1x2, and 2x2 operation. In both RPD and RMD operation, additional downstream and/or upstream service groups are activated by installing the corresponding license. In RMD operation, MAC layer channel capacity is enabled by installing DOCSIS 3.0 and/or DOCSIS 3.1 channel licenses.

The RD2322 is factory installed in an NC4000 configured node or deep-lid upgrade kit. The upgrade kit allows users to modify existing NC4000 nodes to support Remote PHY/MACPHY applications. The deep lid node includes a modified "deep" housing lid that supports the RD2322 form factor, the RD2322 RxD module, a PS4201 power supply, and interconnecting cables as needed to support 1.2 GHz connections.

Network Flexibility

Today's technologies are developing at a rapid pace, which is why it is more important than ever for products to be flexible enough to support next-generation technologies, such as DAA, without a major forklift. Keeping these concerns in mind, the NC4000 node deep-lid upgrade kit allows operators to transition seamlessly from traditional node-based analog/digital optical delivery to a DAA architecture by using the NC4000 chassis as a base and leveraging their current network assets. When operators are ready to transition to DAA, the node's modular design allows them to upgrade previously deployed NC4000 nodes to support either R-PHY or R-MACPHY functionality by simply removing the node's existing optical modules and housing lid and replacing them with a deep lid upgrade kit. The ease and simplicity of transitioning the NC4000 to support DAA operation provides operators with several benefits, including a cost-effective roadmap for upgrading their current network assets and the ability to future-proof today's purchases for long term use.

Small Form-Factor Pluggable (SFPs)

CommScope offers temperature-hardened, high-speed 10 Gbps SFP+ modules for the RxD application. These SFP+ modules are carefully chosen by our design teams to ensure end-to-end performance and stability. Available in CWDM and DWDM 40 ITU wavelengths, CommScope SFP+ modules support lengths of up to 80 km. Rigorously tested, SFP+ modules are designed to withstand the increased thermal profile of the NC4000 while providing added long-term performance in the field with +95˚C max temperature specification across the family. The modules provide both design flexibility and the ability to maximize wavelength aggregation, making them the ideal choice to guarantee the RxD's link performance across a wide range of outdoor temperatures.

In addition to these standard SFP+ options, CommScope also offers downstream analog receivers and upstream analog transmitter SFP+ modules and associated plug-in filters that support RF overlay. These modules are capable of processing and transmitting customized, traditional RF signals in RF overlay scenarios, which allows cable operators to deploy RxDs in Distributed Access Architectures and still process these critical existing signals that the RxD would not otherwise be able to support.

SPECIFICATIONS

Characteristics	Specification						
Service Group Configurations	S4	S3	S2	SG	H4	H3*	HG*
	1x1	1x1	1x1	1x1	1x1	1x1	1x1
	1x2	1x2	1x2	1x2	1x2	1x2	1x2
	2x2	2x2	2x2	2x2	2x2		
	* 2x2 Configuration unavailable for the NC4000H3 and NC4000HG nodes.						
CIN Connectivity	Dual 10 GbE SFP+, Path Redundancy, LAG (LAG available only with RMD) Control/Management Plane—IPv4 (RMD); IPv4 or IPv6 (RPD) Data Plane/MPEG Video—IPv4 or IPv6						
Security/Encryption	802.1x Authentication & Authorization Secure Boot MACsec Encryption (MACsec available only with RMD) TACACS+ Protocol for Authentication, Authorization, and Accounting (AAA) Services (RMD only) RADIUS Protocol for Authentication (RMD only)						
Proactive Network Management (PNM)	Upstream Receive Modulation Error Ratio (RxMER) per subcarrier Upstream Capture for Active and Quiet Probes (UPC) Upstream Triggered Spectrum Capture (UTSC) IdleSID Trigger Mode, IdleSID triggering by SC-QAM or OFDMA channel UTSC FreeRun Trigger Mode with Repeat Capture or Continuous Capture						
High Split Support	OFDMA Upstream Data Profile (OUDP) scheduled grants for high split leakage detection and upstream measurement (RMD only)						
Channel Capacity[1]							
Downstream (per downstream service group)	Annex A or B: 6x192 MHz, configurable as SC-QAM or OFDM Annex A: 3 OFDM (up to 192 MHz each) with up to 72 Annex A SC-QAM, of which up to 32 may be DOCSIS Up to 2 OFDM (up to 192 MHz each) with up to 96 Annex A SC-QAM, of which up to 32 may be DOCSIS Annex B: 3 OFDM (up to 192 MHz each) with up to 96 Annex B SC-QAM, of which up to 48 may be DOCSIS Up to 2 OFDM (up to 192 MHz each) with up to 128 Annex A SC-QAM, of which up to 48 may be DOCSIS 1 OFDM (up to 192 MHz) with up to 123 Annex B SC-QAM, of which up to 63 may be DOCSIS No OFDM with up to 124 Annex B SC-QAM, of which up to 64 may be DOCSIS						
Upstream (per upstream service group)	12 SC-QAM and 2 OFDMA (up to 95 MHz each)						
Set Top Box Out-of-Band (OOB)	SCTE 55-1 SCTE 55-2						
Out-of-Band[2]	Narrowband Digital Forward (NDF)—two NDF channels per downstream service group Narrowband Digital Return (NDR)—one NDR channel per upstream service group Channel Widths: 25.6 MHz (NDF only); 1.28, 2.56, or 5.12 MHz (NDF and NDR); 160, 320, or 640 kHz (NDR only)						
CW Tone Generation	AGC, Alignment, Leakage Detection						
High Speed Data	DOCSIS 3.0, DOCSIS 3.1						
Video	Broadcast Video, Narrowcast Video Video Sync Mode (RPD and RMD—requires IEEE 1588 Precision Time Protocol (PTP)) Video Async Mode (RMD only—does not require PTP) Mixed Annex: Annex A video with Annex B DOCSIS; Annex C video with Annex B DOCSIS						
Designed for Compliance to CableLabs® MHAv2 Standards	CM-SP-R-PHY Remote PHY Specification CM-SP-R-DEPI Remote Downstream External PHY Interface Specification CM-SP-R-UEPI Remote Upstream External PHY Interface Specification CM-SP-R-GCP Generic Control Plane Specification CM-SP-R-DTI Remote DOCSIS Timing Interface Specification CM-SP-R-OOB Remote Out-of-Band Specification CM-SP-R-OSSI Remote PHY OSS Interface Specification CM-SP-DRFI Appendix D						

NOTES:

1. Future software releases will support greater OFDM and OFDMA channel capacity.
2. Hardware is capable of up to 3 NDF channels per DS-SG and up to 3 NDR channels per US-SG. Listed channel values are currently enabled in software.

SPECIFICATIONS CONTINUED

Characteristics	Specification
RF	
Downstream Operational Bandwidth	54–1218 MHz/85–1218 MHz/102–1218 MHz/258–1218 MHz
Upstream Operational Bandwidth	5–42 MHz/5–65 MHz/5–85 MHz/5–204 MHz
Output Level (RD2322)	Maximum output 42 dBmV
Output Level (Node)	Depends on the node the RD2322 is installed in. See specific node data sheet for its output level.
Output Linear Tilt (RD2322)	Up to +14 dB (54 to 1218 MHz) Up to +12 dB (54 to 1002 MHz)
RF Port Impedance	75 Ω
RF Return Loss	15 dB
Test Points	-20 dB (2 upstream, 2 downstream, SMB Connectors)
Output Level (Node)	Depends on the node installed in. See specific node data sheet.
RF Overlay (Optional)	
Connectivity	1 Forward SFP Receiver and 1 Return SFP Transmitter
Forward Rx	54–750 MHz or 54–550 MHz
Return Tx	Dependent on the node split's upstream bandwidth (5–42 MHz, 5–65 MHz, 5–85 MHz, or 5–204 MHz)
Node Power	
Power Consumption (Node with RD2322)	< 150 W AC (S Series) < 160 W AC (H Series)
Power Consumption (RD2322)	65 W typical
AC Input Voltage	44–90 V AC
AC Bypass Current	Depends on the node installed in. See specific node data sheet.
Environmental/Mechanical	
Dimensions (Deep Lid Housing)	20" L x 11" W x 10.75" H
Weight (RD2322)	7.6 lb
Weight (Node + RD2322 + PS4201)	< 60 lb
Operating Temperature (Node with RD2322)	-40° to +60°C (-40° to +140°F)
Operating Humidity	5%–95% non-condensing

RELATED PRODUCTS

E6000® CCAP Core	Headend Optics and Passives
NC4000 Fiber Deep Node	Network Interface SFP+
RF Overlay SFP	Installation Services

ORDERING INFORMATION

Part Number	Description
	RxD Deep Lid Option
NH4600-S-RP232A	S Series RxD Lid upgrade kit. Includes "Deep" housing lid, PS4201 Power Supply, FT4007 Fiber Tray, and RD2322 RxD module without console port
NH4600-S-RP232B	S Series RxD Lid upgrade kit. Includes "Deep" housing lid, PS4201 Power Supply, FT4007 Fiber Tray, and RD2322 RxD module with console port
NH4600-H-RP232A	H Series RxD Lid upgrade kit. Includes "Deep" housing lid, PS4201 Power Supply, FT4007 Fiber Tray, and RD2322 RxD module without console port
NH4600-H-RP232B	H Series RxD Lid upgrade kit. Includes "Deep" housing lid, PS4201 Power Supply, FT4007 Fiber Tray, and RD2322 RxD module with console port
	NC4000 RF Modules with RD2322 Installed (Contact CommScope for additional configurations)
NC462RPS4L0-232A0000	NC4000S4 Scalable 1.2 GHz GaN RF Node, 42/54 MHz split, 56 dBmV output
NC469RPS4L0-232A0000	NC4000S4 Scalable 1.2 GHz GaN RF Node, 85/102 MHz split, 56 dBmV output
NC46ARPS4L0-232A0000	NC4000S4 Scalable 1.2 GHz GaN RF Node, 204/258 MHz split, 56 dBmV output
NC469RPH4M0-232A0000	NC4000H4 Fiber Deep 1.2 GHz GaN RF Node, 85/102 MHz split, 60 dBmV output
	Ethernet SFP+ Optical Transceiver Modules
TTD4540-xx-PI (xx = 20–59)	10 Gbps 40 km DWDM Transceiver, 40 Wavelengths Supported (ITU Channels 20–59), -40° to +95°C
TTD4580-xx-PI (xx = 20–59)	10 Gbps 80 km DWDM Transceiver, 40 Wavelengths Supported (ITU Channels 20–59), -40° to +95°C
TUD4580-xx-PI (xx = 20–61)	10 Gbps 80 km DWDM Transceiver, 42 Wavelengths Supported (ITU Channels 20–61), -40° to +85°C
TTCxxxx-TL40 (xxxx = wavelength)	10 Gbps 40 km CWDM Transceiver, 8 Wavelengths Supported (1470 nm to 1610 nm), -40° to +95°C
TTCxxxx-TL80 (xxxx = wavelength)	10 Gbps 80 km CWDM Transceiver, 8 Wavelengths Supported (1470 nm to 1610 nm), -40° to +95°C
	Analog RF Overlay Filters
1513948*	RF Overlay Filter 550 MHz Low Pass Filter 54–550 MHz 75 OHM
1513949*	RF Overlay Filter 750 MHz Low Pass Filter 54–750 MHz 75 OHM
	* A Plug-in Low-pass Filter is required for downstream analog overlay functionality.
	Analog RF Overlay SFP+ Modules
1511835	Analog Forward Receiver, 1260–1620 nm, 54–750 MHz
1511837-0061	Analog Return Transmitter, 1611 nm, 5–204 MHz
	Accessories
1504945	Test point Adapter Cable Assembly F-Male to SMB-Female 75-Ohm RG-179 6-L
	RD2322 Modules
1001523	RD2322 module without console port licensed for 1 DS-SG x 1 US-SG; 2 SFP+ cages; HW capable of 2 DS-SG x 2 US-SG with additional DS-SG and US-SG licenses. For NC4-H3/H4/HG/S Series and OM4 Series. Node and transceivers not included, priced separately.
Z1001524	RD2322 module with console port licensed for 1 DS-SG x 1 US-SG; 2 SFP+ cages; HW capable of 2 DS-SG x 2 US-SG with additional DS-SG and US-SG licenses. For NC4-H3/H4/HG/S Series and OM4 Series. Node and transceivers not included, priced separately.

ORDERING INFORMATION CONTINUED

Part Number	Description
RD2322 Licenses for RPD or RMD Operation	
Z1001515	RD2322 RxD Initial DS and US Port License Bundle – Must purchase on same PO as the RxD or Node+RxD (one per RxD). Licenses "1x1 Capable" operation to "2x2 Capable"
1001516	RD2322 RxD Initial US Port License — Must purchase on the same PO as the RxD or the Node + RxD (one per RxD). Licenses "1x1 Capable" operation to "1x2 Capable"
1001525	RD2322 RxD Downstream Port License — Enable second DS port on the "2x2 Capable" RD2322 RxD previously licensed for 1 DS Port operation
1001526	RD2322 Upstream Port License — Enable second US port on the "2x2 Capable" RD2322 RxD previously licensed for 1 US Port operation
RD2322 Licenses for RMD Operation	
1001546	RMD System Legal Intercept License
1001547	RMD System LAES License
Z1001548	RMD System CALEA License
Z1001549	RMD MAC DOCSIS 3.0 Downstream Annex A SC-QAM Channel
Z1001550	RMD MAC DOCSIS 3.0 Downstream Annex B SC-QAM Channel
1001551	RMD MAC DOCSIS 3.0 Upstream SC-QAM Channel
Z1001552	RMD MAC DOCSIS 3.1 Downstream OFDM Spectrum — Enable 1 MHz OF OFDM Spectrum per License
1001553K	RMD MAC DOCSIS 3.1 Upstream OFDMA Spectrum — Enable 1 MHz OF OFDMA Spectrum per License
1001639	RMD Service Group Capacity License 1 DS x 2 US — Licenses the RMD Capacity to Full DOCSIS Spectrum (D3.0/D3.1 to 1.2 GHz DS and 204 MHz US — 1 DS by up to 2 US operation)
1001640	RMD Service Group Capacity License 1 DS x 1 US — Licenses the RMD Capacity to Full DOCSIS Spectrum (D3.0/D3.1 to 1.2 GHz DS and 204 MHz US — 1 DS by up to 1 US operation)
1001641	RMD Service Group License Upgrade Upstream — Adds one US Service Group Capacity License to an RMD for Full DOCSIS Upstream Spectrum (up to 204 MHz upstream)
1001662	Initial License Bundle: RMD SG Capacity License 1 DS x 1 US — Licenses Full DOCSIS Spectrum (D3.0/D3.1, 1.2 GHz DS & 204 MHz US); includes Port & HLX Domain Management License.
Z1001663	Initial License Bundle: RMD SG Capacity License 1 DS x 2 US — Licenses Full DOCSIS Spectrum (D3.0/D3.1, 1.2 GHz DS & 204 MHz US); includes Port & HLX Domain Management License
1001664	Initial License Bundle: RMD SG Capacity License 2 DS x 2 US — Licenses Full DOCSIS Spectrum (D3.0/D3.1, 1.2 GHz DS & 204 MHz US); includes Port & HLX Domain Management License
Z1001665	Upgrade: RMD SG Capacity License 1 DS (upgrade from 1x2 to 2x2) — Licenses Full DOCSIS Spectrum (D3.0/D3.1, 1.2 GHz DS) to 2 DS; includes Port & HLX Domain Management License
1001666	Upgrade: RMD SG Capacity License 1 US (upgrade from 1x1 to 1x2) — Licenses Full DOCSIS Spectrum (204 MHz US) to 2 US; includes Port & HLX Domain Management License
1001700	Initial License Bundle: RMD SG Capacity License 1 DS X 2 US – Licenses Full DOCSIS Spectrum (D3.0/D3.1 to 1.2 GHz DS and 204 MHz US) – 1 DS by up to 2 US Operation; includes Port Licenses
1001702	Upgrade: RMD SG Capacity License 1 DS (from 1x1 to 2x2) – Licenses Full DOCSIS Spectrum (D3.0/D3.1 to 1.2 GHz DS) to 2 DS; includes Applicable Port Licenses
1001705	Initial License Bundle: RMD Service Group Capacity License 1 DS x 1 US – Licenses the RMD Capacity to Full DOCSIS Spectrum (D3.0/D3.1 to 1.2 GHz DS and 204 MHz US) – 1 DS by 1 US Operation; includes Applicable Port Licenses
1001706	Initial License Bundle: RMD SG Capacity License 2 DS x 2 US – Licenses Full DOCSIS Spectrum (D3.0/D3.1 to 1.2 GHz DS and 204 MHz US) – 2 DS by up to 2 US Operation; includes Port Licenses
1001707	Upgrade: RMD SG Capacity License 1 US (from 1x1 to 1x2) – Licenses the RMD Capacity to Full DOCSIS Spectrum (204 MHz US) to 2 US; includes Applicable Port Licenses

Contact Technical Services for product support:
- United States: +1-888-944-4357
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