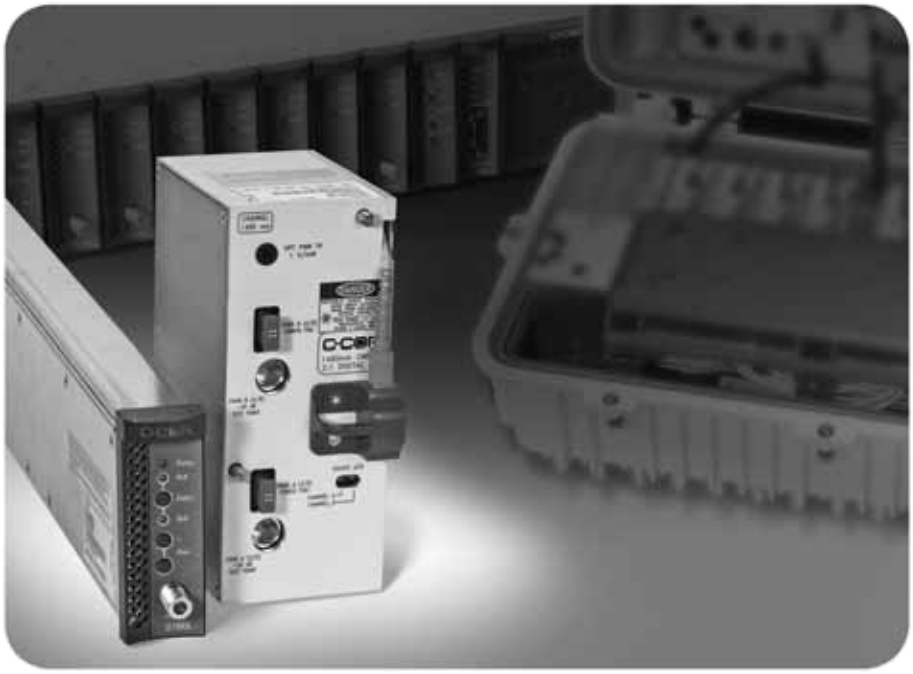
Digital Return Solution

C-COR® Opti Max4100



ARRIS introduces the Opti Max4100 Digital Return Solution, which provides longer reach and performance, while optimizing cost and fiber in your system. Bandwidth contention in the return path is greatly alleviated using a 2:1 time division multiplexed digital return transmitter in the Opti Max4100 node and a digital return receiver in the CHP Max5000.

The Opti Max4100 Advanced Fully Segmentable Node is The ARRIS 1 GHz, fully segmentable, modular, pay-as-you-grow node platform. The Opti Max4100 facilitates full 4 x 4 forward and return segmentation with an industry-leading 70 dB port-to-port isolation.

The CHP Max5000 Converged Headend Platform uses innovative technology to create a converged, high-density platform. The CHP Max5000 converges headend, hub, and digital transport onto one 2RU scalable system allowing service providers to accelerate deployment of advanced services such as VOD, HSD, and telephony.

Opti Max4100 digital return transmitters accept two return inputs, which are digitized and combined to produce a digital optical output at a given ITU CWDM wavelength for transmission over a long fiber link at 2.5 Gbps. At the end of this fiber link, the digital return receiver module located in the CHP Max5000 converts the digital bit stream back into two RF analog channels. With these transmitters installed in a node, you can take advantage of CWDM optics technology to maximize return bandwidth utilizing a single fiber.

Features

- 100 km link without repeaters or EDFAs
- Digital systems offer many benefits over traditional analog solutions
- Optically connect up to eight transmitters (16 return paths)
- Robust with respect to noise and ingress

Digital Return Applications

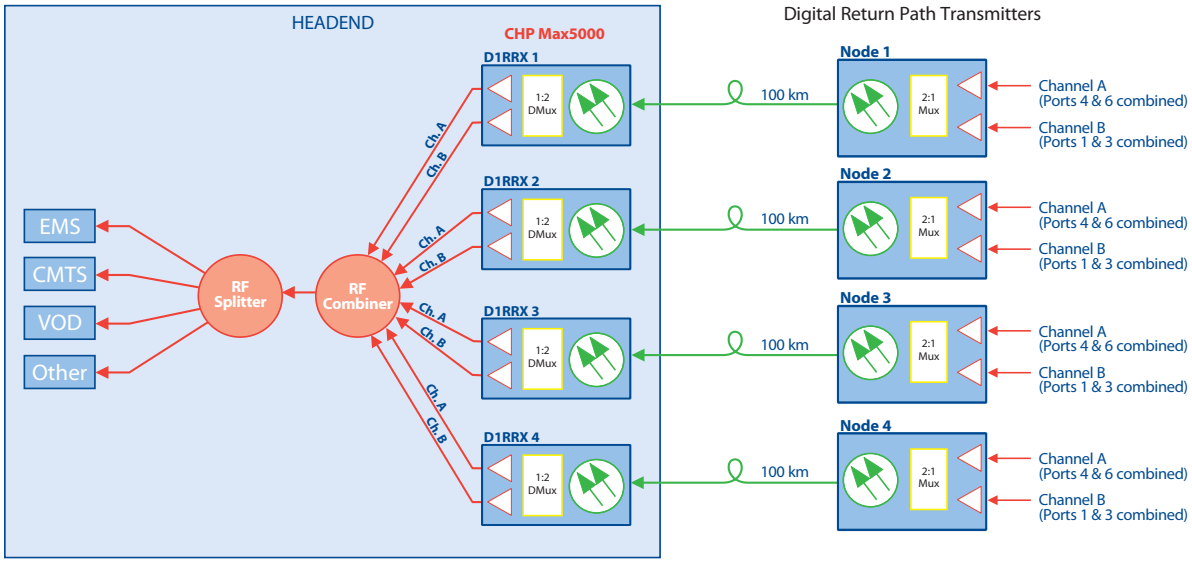
The Opti Max4100 Digital Return Solution supports the following basic applications:

- Direct Long Haul Digital Return with 2:1 RF multiplexing
- CWDM Digital Return

In Traditional Analog Return architectures, fiber optic nodes typically serve 500 homes or less. As demand for return services increases, these nodes can be modified by adding additional transmitters and segmenting return inputs. While this is definitely an advantage, the obvious disadvantages are that you need a separate fiber for each return path, and a return path receiver for each return transmitter. The cost of additional fiber and return path receivers can really add up. In addition, with the use of analog transmitters, link budgets are on the order of 10dB with maximum return optical links at 30km because of CNR limitations.

Direct Long Haul Digital Return

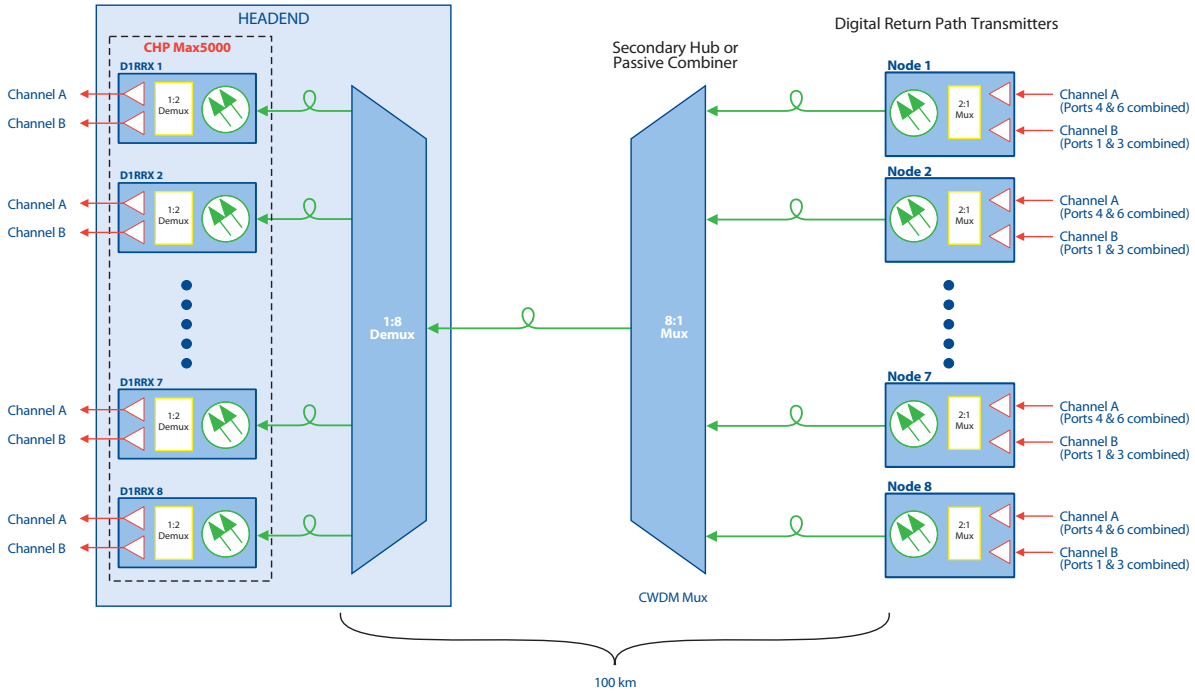
In this application, analog transmitters and receivers are simply replaced with digital transmitters and receivers. The same number of devices and the same amount of cable are required as in a traditional analog return system, but because digital transmitters and receivers are more robust—that is, less affected by noise and temperature—return optical links can be extended to as much as 100km at 1550nm without repeaters or optical amplifiers. Direct Long Haul Digital Return is a more cost-effective solution for extending optical links than adding EDFAs to an analog return system.



Direct Long Haul Digital Return

CWDM Digital Return

In this application, eight 1550nm digital return path transmitters at 20nm spacing are each used for a direct short- or medium-haul return from node to hub. These eight separate return paths are then coarse wave division multiplexed onto one fiber for transport to the headend using the following wavelengths: 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610nm. Eight digital return receivers (DRR) installed in a CHP Max5000 an the headend complete this application. CWDM Digital Return is a more economical solution to dense wave division multiplexing on the ITU-grid and is ideal for topologies with limited fiber count.



CWDM for Low Cost, Passive Optical Multiplexing with Limited Fiber

Digital Return Transmitter

Optical Specifications		
Output Power, dBm (Note 1)	3.5 ± 0.5	
Wavelength, nm, 25°C	1470 to 1610 (8 CWDM channels, 20 nm spacing)	
Wavelength Over Oper. Temp. Range, nm, typ.	±7.5 nm	
Laser Type	CWDM, Isolated DFB	
Optical Power Voltage Testpoint	1 V/mW ± 10%	
Optical Connector Type	SC/APC	
RF Specifications, each channel		
RF Bandpass, MHz	5 to 42	
Flatness, dB (Note 2)	±0.5	
Gain Slope, dB (Note 2)	0 ± 0.25	
Gain Stability Over Temp., dB	±0.5	
Input and Testpoint Impedance, Ohms	75	
Input and Testpoint Return Loss, dB	16	
RF Testpoint, dB (Note 3)	–20 ± 0.5	
CW Input Level at Peak NPR, dBmV/6 MHz, min.	12, with 0 dB attenuation	
LED Indicators	**Channel A LED**	**Channel B LED**
No Laser Installed/Laser Failure	solid red	solid red
Channel A RF Overdrive	flashing red	—
Channel B RF Overdrive	—	flashing red
Laser Power and RF OK	solid green	solid green
Powering Specifications		
Power Consumption, W	10	
Temperature Range		
Operating Temperature, °C (Note 4)	–20 to 85	
System Specifications (Note 5)		
NPR @ 12 dBmV TX input, dB, typ.	50, with 0 dB attenuation	
NPR Peak, dB, min.	48	
Dynamic Range @ ≥40 dB NPR, dB, typ./min.	18/16	
BER Dynamic Range @ < 10^{-6} BER, dB	45	
Link Gain, dB (Note 6)	32	
Link Flatness, dB, typ./min.	±0.75/±1.00	

Specification Document Number 1500189 Rev E

Notes:
1. Measured at output of bulkhead connector through a low loss (<0.3 dB) 1-meter (or less) fiber jumper at 25°C.
2. Flatness is measured with respect to gain slope. Gain slope is measured as a straight line from 5 to 42 MHz.
3. RF testpoint is –20 dB referenced to transmitter input.
4. Denotes transmitter temperature. Temperature range when installed in node must be –40 to 60°C, ambient.
5. System specifications with up 100 km fiber link.
6. With 0 dB input attenuation at transmitter and maximum gain at receiver.

Specifications subject to change without notice

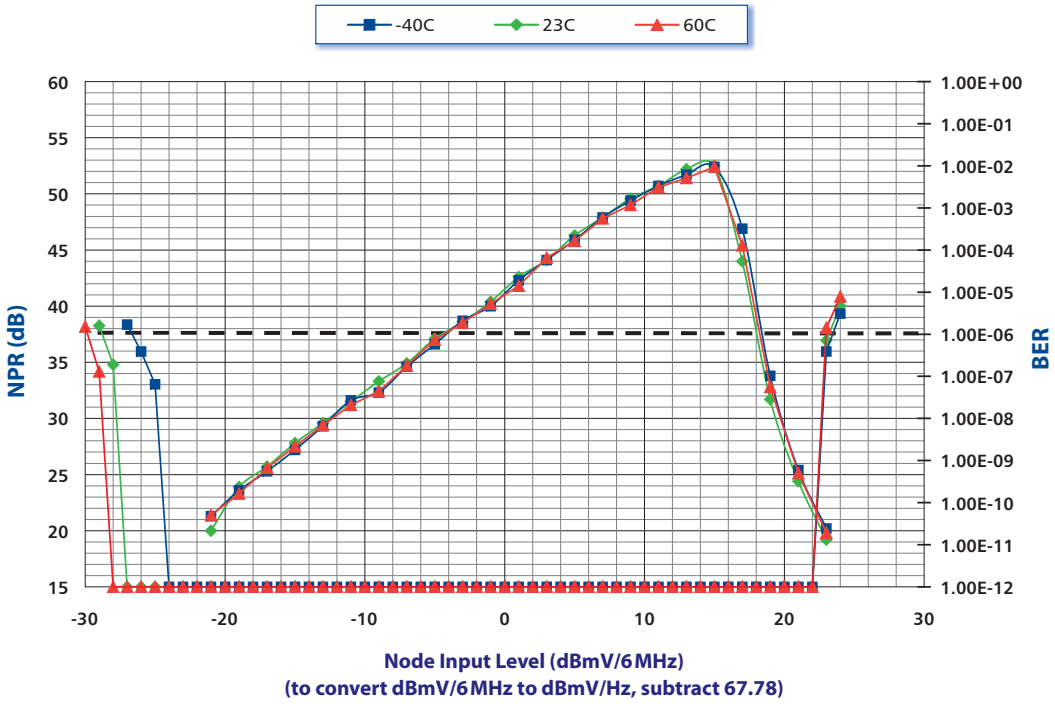
CHP-D1RRX Specifications

Optical	
Input Wavelength Range, nm, 25°C	1465 to 1615 nm (8 CWDM channels, 20 nm spacing)
Optical Power Input Range, dBm	–28 to –10
Detector Type	Avalanche Photo Detector (APD)
Optical Connector	SC/APC
Optical Return Loss, dB	≥55
Equivalent Input Noise, $pAHz^{-0.5}$	<7.0
RF	
RF Output Bandpass, MHz	5 to 42
Output and Testpoint Impedance, Ohms	75
CW Output Level, dBmV (Note 1)	44
Gain Stability Over Temperature, dB	± 0.5
Quantizing Noise and Spurs, dBc, below 500 MHz	–50
Gain Slope, dB (Note 2)	0±0.25
Flatness, dB (Note 2)	±0.50
Output and Testpoint Return Loss, dB, min.	16
RF Testpoint, dB (Note 3)	–20 ± 0.5
Redundancy and Attenuator	
Redundancy Switching Time, ms	<50 ms
Programmable RF Attenuator Range, dB	0 to 16.0 in 0.5 dB steps
Programmable RF Attenuator Resolution, dB	0.5 per step
Programmable RF Attenuator Accuracy, dB	±0.20
Performance (Note 4)	
Noise-Power Ratio (NPR), dB, typical (Note 5)	52
NPR, peak, dB, min.	48
Dynamic Range, dB, typical, @ ≥40 NPR	18
BER Dynamic Range, dB, @ $\geq 10^{-6}$ BER	45
Link Gain, dB, 0 dB input attenuation at TX, max. gain at RX	32
Link Flatness, dB, typical	±1.0
Power	
Power Consumption (typical/max.)	11.6/14.0 W
+12 VDC current (typical/max.)	711/780 mA
+5 VDC current (typical/max.)	580/820 mA
+3.3 VDC current (typical/max.)	96/140 mA
–5 VDC current (typical/max.)	1/10 mA
Mechanical	
Dimensions, cm (W x H x D)	3.18 x 8.74 x 46.99 cm (1.25 x 3.44 x 18.5 in.)
Weight	1.35 kg (3.0 lbs)
Environmental	
Operational Temperature Range, °C (°F)	0 to 50 (32 to 122)
Storage Temperature Range, °C (°F)	–40 to 85 (–40 to 185)
Humidity, %, max., noncondensing	5 to 90

Notes:
1. For 12 dBmV/6 MHz at TX input, 0 dB attenuation; RX at max. gain.
2. Slope measured from a straight line drawn from 5 to 42 MHz. Flatness measured with respect to gain slope.
3. Referenced to RF output and attenuator set to 0 dB.
4. Performance measurements made with 1550 nm optical input.
5. At 12 dBmV TX input, 0 dB attenuation.

Specifications subject to change without notice

NPR/BER Curve



***CWDM 2:1 TDM Digital Transmitter installed in Product Name (short) node with 100km link to D1RRX Digital Receiver, 12dBmV/channel input to node, 12dBmV/channel at transmitter testpoint, and 40dBmV/channel receiver output.**

Ordering Information

Digital Return Transmitter Modules for Opti Max4000/4100

Part Number	Description
152250-01	1470nm CWDM digital transmitter with SC/APC connector.
152251-01	1490nm CWDM digital transmitter with SC/APC connector.
152252-01	1510nm CWDM digital transmitter with SC/APC connector.
152253-01	1530nm CWDM digital transmitter with SC/APC connector.
152254-01	1550nm CWDM digital transmitter with SC/APC connector.
152255-01	1570nm CWDM digital transmitter with SC/APC connector.
152256-01	1590nm CWDM digital transmitter with SC/APC connector.
152257-01	1610nm CWDM digital transmitter with SC/APC connector.

Refer to the Opti Max4000 870 MHz Segmentable Node and the Opti Max4100 1 GHz Segmentable Node data sheets for additional information.

Digital Return Receiver Module for CHP Max5000

Model Series	Description
CHP-D1RRX-S	Digital return receiver with SC/APC connector.

Refer to the CHP Max5000 Converged Headend Platform data sheet for additional information.

OM4DRS-D-0508