The Opti Max4100 1GHz Segmentable Node is C-COR’s 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 port-to-port isolation. 1GHz will enable broadband service providers to increase forward capacity for HDTV over previous program offerings, thereby allowing a typically 40% increase over current HDTV channels in a lineup.

Our most advanced node platform, the Opti Max4100’s modular design allows a high level of scalability, which enables operators to deploy minimal configurations today and expand as subscriber demands increase. Future expansion options include forward and return segmentation and redundancy, analog and digital CWDM return transmitters, network powering redundancy, and element management options with major EMS protocols, including open-standard HMS protocol.

In addition, the Opti Max4100 1GHz node supports fiber-poor systems with a variety of return transmitter options and the future availability of an 85/105MHz option, which will double return bandwidth without capital expenditures for additional return transmitters.

Features

- High port-to-port isolation enables true segmentation upgrades
- Wavelength-stable, analog CWDM and 2:1 TDM digital CWDM return transmitters that meet the ±6.5nm ITU-T G.695 standard over the full –40 to 60°C temperature range
- Four active output ports with GaAs hybrids to achieve 53.5dBmV at 1GHz and –3dBm minimum optical input
- 85/105MHz option for future architectures
- 15 ampere power passing and surge termination

Features

- 1 GHz technology
- Future 85/105 MHz architecture support
- Full 4 x 4 forward and return segmentation capability
- Investment preservation through high level of scalability
- 1310nm and 1550nm transmitters
- Analog and digital CWDM return path options to optimize fiber
- Major EMS protocol support
- Advanced fiber management

Broadband Access
Applications

The Opti Max4100 can be deployed in three basic configurations and two redundant configurations to meet HFC system architecture needs: 1 x 4, 1 x 4 with redundancy, 2 x 2 segmentation, 2 x 2 with redundancy, and 4 x 4 segmentation, in addition to more unique configurations. Regardless of the configuration, the Opti Max4100 supports a variety of 1310nm, 1550nm, or CWDM downstream and upstream configurations and achieves the port-to-port isolation performance operators demand for analog and sophisticated digital modulation applications.

1 x 4 Forward/4 x 1 Return Configuration

The basic 1 x 4/4 x 1 configuration of the Opti Max4100 can be easily configured to provide redundant fiber routes in both the forward and return paths and redundant powering for operators who require increased network reliability.

2 x 2 Forward/Return Segmentation

To migrate to the 2 x 2 segmentation configuration, simply activate a spare fiber and install a second forward receiver, a second return transmitter, and the associated configuration modules. The 2 x 2 segmentation configuration can also be easily configured to provide redundant fiber routes in both the forward and return paths and redundant powering for those operators who require increased network reliability.

4 x 4 Forward/Return Segmentation

To migrate to the 4 x 4 segmentation configuration, activate two additional spare fibers and install two additional forward receivers, two additional return transmitters, and the associated configuration modules.
**CWDM Applications**

MSOs are continually pressured to increase the capacity of their HFC networks as subscribers demand HDTV, ever-increasing data download speed, business services, VoIP, and digital simulcast. The existing fiber infrastructure is rapidly becoming inadequate, if not already so, and at a cost of $10,000/mile or more, new fiber construction may not be an option. CWDM technology is the way to go. By implementing CWDM, MSOs can combine multiple return paths onto a single return fiber, or in a star architecture, point-to-point links between each node and a hub are possible with short fiber lengths, while maintaining a single, long fiber between the hub and headend.

The real advantage of CWDM technology can be seen in C-COR’s CWDM Multi-Wavelength Access Network, which is an even more targeted solution enabling MSOs to offer the full range of next-generation residential and business services by leveraging their existing network. Rigorously tested and field-proven, this new system delivers up to 10 multiplexed 20 nm spaced CWDM wavelengths of analog forward, return, and GigE services on a single fiber.

**Note:** Updating from Today’s Scenario to the Potential Deployment Scenario results in one spare fiber.
**Digital Return Application**

C-COR also offers a digital return solution using CWDM technology. 2:1 TDM digital return transmitters can be used in the Opti Max4100 to digitally combine two independent return path inputs onto a single fiber. With the use of CWDM transmitters, four independent return path signals can be multiplexed onto a single fiber from the Opti Max4100. In addition to allowing reduced node fiber counts, digital return technology can allow operators to achieve high performance over very long fiber links, thus eliminating potential distance problems in certain system architectures.
## General Node Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Active RF/AC Ports</td>
<td>4</td>
</tr>
<tr>
<td>Number of AC Only Ports</td>
<td>2</td>
</tr>
<tr>
<td>AC Current Passing, A (All Ports)</td>
<td>15</td>
</tr>
<tr>
<td>Physical Dimensions, (W x H x D), in (cm)</td>
<td>20 x 11.7 x 10.2 (50.8 x 29.7 x 25.9)</td>
</tr>
<tr>
<td>Weight, lbs (kg)</td>
<td>43 (19.5)</td>
</tr>
<tr>
<td>Operating Temperature Range, °C</td>
<td>–40 to 60</td>
</tr>
</tbody>
</table>

## Forward Path Specifications

### Optical Specifications

- Optical Input Wavelength, nm: 1290 to 1600
- Optical Input Range, dBm: –3 to 3

### RF Specifications

- Operating Passband, MHz: 54/70/85 to 1002
- Output Level @ 1002MHz, –3dBm input, 3% OMI, dBmV, min.: 53.5
- Level Stability, dB, max.: ±1.5
- Gain Slope, dB (Note 1): 17.0 ± 1.0
- Flatness @ Gain Slope, dB (Note 2): ±1.5
- Return Loss, dB, min. (all RF ports): 16.0
- Port to Port Isolation, dB, typ. (870/1002MHz): 70/60

### NTSC Channel Performance (Note 3)

<table>
<thead>
<tr>
<th>Channel</th>
<th>79 Channels (42/54 split)</th>
<th>76 Channels (55/70 split)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Frequency, MHz</td>
<td>1002/870/550/54</td>
<td>1002/870/550/70</td>
</tr>
<tr>
<td>Output Level, dBmV</td>
<td>53.5/51.2/45.4/36.5</td>
<td>53.5/51.2/45.4/36.8</td>
</tr>
<tr>
<td>Carrier to Noise Ratio, 4MHz, 75Ohm, dB</td>
<td>58.5</td>
<td>58.5</td>
</tr>
<tr>
<td>Composite Triple Beat, –dBc</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Composite 2IM, –dBc</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Cross Modulation (per NTCTA std.), –dB</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Composite Intermodulation Noise, dB (Note 4)</td>
<td>62.5</td>
<td>62.5</td>
</tr>
</tbody>
</table>

### PAL/CENELEC Channel Performance (Note 3)

<table>
<thead>
<tr>
<th>Channel</th>
<th>60 PAL Channels (65/85 split)</th>
<th>42 CENELEC Channels (65/85 split)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Frequency, MHz</td>
<td>1002/600/85</td>
<td>870/600/85</td>
</tr>
<tr>
<td>Output Level, dBmV</td>
<td>53.5/46.3/37.1</td>
<td>51.2/46.3/37.1</td>
</tr>
<tr>
<td>Carrier to Noise Ratio, 4MHz, 75Ohm, dB</td>
<td>57.5</td>
<td>57.5</td>
</tr>
<tr>
<td>Composite Triple Beat, –dBc</td>
<td>71</td>
<td>67</td>
</tr>
<tr>
<td>Composite 2IM, –dBc</td>
<td>69</td>
<td>65</td>
</tr>
<tr>
<td>Cross Modulation (per NTCTA std.), –dB</td>
<td>61</td>
<td>60</td>
</tr>
<tr>
<td>Composite Intermodulation Noise, dB (Note 4)</td>
<td>62</td>
<td>—</td>
</tr>
</tbody>
</table>

## Return Path Specifications

### RF Specifications

- Operating Passband, MHz: 5 to 42/55/65
- Optimum RF Input Level, dBmV/6MHz: 12
- Gain Slope, dB: ±1.0
- Flatness @ Gain Slope, dB: ±1.0
- Level Stability, dB: ±2.5
- Return Loss, dB (all RF ports): 16.0
- Port to Port Isolation, dB, typ.: 70
Opti Max4100 1 GHz Segmentable Nodes

General Node Specifications (cont’d)

Opti Max4100 w/ Isolated 1310nm and 1550nm DFB TX Specifications
Transmitted Wavelength, nm 1310 ± 20, 1550 ± 25
Output Power, @ output of connector, dBm 3.0 ± 1.0
NPR Dynamic Range, dB 41/12
Peak NPR, dB, typ. 48
BER Dynamic Range (QPSK), dB 35

Opti Max4100 w/ Isolated DFB Analog CWDM TX Specifications
Transmitted Wavelength, nm 1471 to 1611 ± 6.5nm (8 CWDM channels, 20nm spacing)
Output Power, @ output of connector, dBm 3.5 ± 0.5
NPR, @ 12dBmV TX Input, dB, typ. 50, with 0dB attenuation
Peak NPR, dB, min. 48
Dynamic Range @ 40dB NPR, dB, typ./min. 18/16
BER Dynamic Range (QPSK), dB 45
Link Gain, dB 32, with 0dB TX attenuation and max. gain at RX

Opti Max4100 w/ 2:1 TDM Digital TX Specifications (Note 5)
Transmitted Wavelength, nm 1471 to 1611 ±6.5nm (8 CWDM channels, 20nm spacing)
Output Power, @ output of connector, dBm 3.5 ± 0.5
NPR @ 12dBmV TX Input, dB, typ. 50, with 0dB attenuation
Peak NPR, dB, min. 48
Dynamic Range @ 12dBmV TX Input, dB, typ./min. 13/11
BER Dynamic Range (QPSK), dB 45
Link Gain, dB 32, with 0dB TX attenuation and max. gain at RX

Powering Requirements (Note 6)

<table>
<thead>
<tr>
<th>DC Current (mA, max.)</th>
<th>DC Power (W)</th>
<th>AC I/P Current (A)</th>
<th>AC I/P Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 5V</td>
<td>@ 12V</td>
<td>@ 24V</td>
<td>@ 60/90V (A)</td>
</tr>
<tr>
<td>1 x 4/4 x 1 w/ 1310/1550 IDFB TX</td>
<td>15</td>
<td>745</td>
<td>2275</td>
</tr>
<tr>
<td>1 x 4/4 x 1 w/ 1310/1550 IDFB TX &amp; EMT</td>
<td>315</td>
<td>745</td>
<td>2400</td>
</tr>
<tr>
<td>1 x 4/4 x 1 Redundant w/ 1310/1550 IDFB TX</td>
<td>20</td>
<td>805</td>
<td>2400</td>
</tr>
<tr>
<td>1 x 4/4 x 1 Redundant w/ 1310/1550 IDFB TX &amp; EMT</td>
<td>320</td>
<td>805</td>
<td>2525</td>
</tr>
<tr>
<td>2 x 2 w/ 1310/1550 IDFB TX</td>
<td>20</td>
<td>1320</td>
<td>2870</td>
</tr>
<tr>
<td>2 x 2 w/ 1310/1550 IDFB TX &amp; EMT</td>
<td>320</td>
<td>1320</td>
<td>2995</td>
</tr>
<tr>
<td>2 x 2 Redundant w/ 1310/1550 IDFB TX</td>
<td>30</td>
<td>1440</td>
<td>3120</td>
</tr>
<tr>
<td>2 x 2 Redundant w/ 1310/1550 IDFB TX &amp; EMT</td>
<td>320</td>
<td>1440</td>
<td>3245</td>
</tr>
<tr>
<td>4 x 4 w/ 1310/1550 IDFB TX</td>
<td>30</td>
<td>410</td>
<td>4060</td>
</tr>
<tr>
<td>4 x 4 w/ 1310/1550 IDFB TX &amp; EMT</td>
<td>330</td>
<td>410</td>
<td>4185</td>
</tr>
<tr>
<td>2 x 2 Redundant or 4 x 4 w/ 2:1 TDM TX</td>
<td>4610</td>
<td>1300</td>
<td>3630</td>
</tr>
</tbody>
</table>

Notes:
1. GEQL-1G-110 typically installed at each RF port at the factory to achieve specified tilt (17.0 dB, 42/54 split; 16.7 dB, 55/70 split; 16.4 dB, 65/85 split).
2. Maximum roll-off of 1 dB at 51.5 MHz.
3. Analog NTSC channels occupying the forward path frequency range up to 550 MHz (42/54 and 55/70 splits) or PAL B/G video channels occupying the 85 to 600 MHz frequency range (65/85 split) with digitally compressed channels or equivalent broadband noise to 1002 MHz at levels 6 dB below equivalent video channels. The distortion values listed are for the node only. To obtain a particular link performance, combine the listed node performance values with the applicable transmitter performance values.
4. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 54 to 550 MHz frequency spectrum.
5. Digital CWDM TXs are only available with the 42/54 MHz bandsplit.
6. DC current draw requirements for analog CWDM TXs: add 350mA @ 12V and 75mA @ 24V for each additional TX. DC current draw requirements for 2:1 TDM digital CWDM transmitters: add 1.5A @ 5V and 130mA @ 12V for each additional transmitter.
7. See specification document numbers 1500166 (42/54 split), 1501149 (65/85 split), 1501153 (55/70 split), 1500422 (forward RX), 1500237 (1310nm TX), 601241 (1550nm TX), 1500893 (analog CWDM TX), 1500189 (2:1 TDM digital CWDM TX), and 1500481 (power supply) for more detailed specifications.

Specifications subject to change without notice
Ordering Information

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| O | M | G | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |

1. Series
   - 1 OptiMax 4100 series

2. Bandwidth
   - G 1 Gbps with 50:1 driver/termination ratio

3. Frequency Split
   - J 42/54 MHz
   - H 65/85 MHz
   - O 55/70 MHz

4. Return Switch
   - 6.7 (6) None, (7) return switches
     - 6a Operation of return switches requires a transformer.

5. Output Configuration
   - A Four active outputs and -20 dB internal test points
   - B Four active outputs and -20 dB external test points
     - 6a Must select "C" in #7 block, Housing
     - 6b Must select "B" in #7 block, Housing

6. Powering
   - 2–3 2D single, 3D dual
     - 6a High efficiency, transformerless power supply.

7. Housing
   - B 6-port, 1 GHz, external test points
   - C 6-port, 1 GHz, internal test points
     - 7a Must select "B" in #5 block, Output Configuration
     - 7b Must select "B" in #5 block, Output Configuration

8. Housing Finish
   - 5 Corrosion protected

9. Forward Receiver
   - A 1 x 4
   - B 1 x 4, optical path redundancy
   - C 2 x 2 segmentation
   - D 2 x 2 segmentation, optical path redundancy
   - E 4 x 4 segmentation
     - 9a Includes RX(s), forward config. module, and either jumper module or A/B switch.
       - RF module PADs and EQs must be ordered separately.

10. Forward Receiver Connector
    - 1–4 (1) FC/APC, (2) SC/APC, (3) FC/UPC, (4) SC/UPC

11–12 Return Configuration
    - 00 None
    - BB 4 x 1, single 1310 nm IDFB TX
    - BC 2 x 4 segmentation, dual 1310 nm IDFB TX
    - BD 2 x 2 segmentation, quad 1310 nm IDFB TX, opt. path redundancy
    - BE 4 x 4 segmentation, dual 1310 nm IDFB TX
    - CA 4 x 1, single 1550 nm IDFB TX
    - CB 4 x 1, dual 1550 nm IDFB TX, opt. path redundancy
    - CC 2 x 2 segmentation, dual 1550 nm IDFB TX
    - CD 2 x 2 segmentation, quad 1550 nm IDFB TX, opt. path redundancy

13–16 Transmitter Options
    - 0000 None
    - 0002 One single-width transmitter for 4 x 1 segmentation (slot 6)
    - 002z Two single-width transmitters for 2 x 2 and 4 x 1 redundant segmentations (slots 5 and 6)
      - 00yz Four single-width transmitters for 4 x 4 and 2 x 2 redundant segmentations (slots 3 through 6)
    - 00yy One double-width transmitter for 2 x 2 segmentation (slots 5 and 6)
    - 0yxx Two double-width transmitters for 4 x 4 and 2 x 2 redundant segmentations (slots 3 through 6)
      - 1000 None
      - 100z One single-width transmitter for 4 x 1 segmentation (slot 6)
      - 102z Two single-width transmitters for 2 x 2 and 4 x 1 redundant segmentations (slots 5 and 6)
      - 10yz Four single-width transmitters for 4 x 4 and 2 x 2 redundant segmentations (slots 3 through 6)
      - 10yy One double-width transmitter for 2 x 2 segmentation (slots 5 and 6)
      - 1yyx Two double-width transmitters for 4 x 4 and 2 x 2 redundant segmentations (slots 3 through 6)

17 Return Transmitter Connector
    - 1 FC/UPC
    - 2 SC/UPC
    - 3 FC/UPC
    - 4 SC/UPC

- a) Connector available for analog CWDM, 1310 nm, and 1550 nm return TX.
- b) Connector available for digital CWDM return TX.

Continued on next page
**CWDM Transmitters**

### Analog CWDM Transmitters

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500814-xxx</td>
<td>1471 nm analog CWDM transmitter</td>
<td>1500818-xxx</td>
<td>1551 nm analog CWDM transmitter</td>
</tr>
<tr>
<td>1500815-xxx</td>
<td>1491 nm analog CWDM transmitter</td>
<td>1500819-xxx</td>
<td>1571 nm analog CWDM transmitter</td>
</tr>
<tr>
<td>1500816-xxx</td>
<td>1511 nm analog CWDM transmitter</td>
<td>1500820-xxx</td>
<td>1591 nm analog CWDM transmitter</td>
</tr>
<tr>
<td>1500817-xxx</td>
<td>1531 nm analog CWDM transmitter</td>
<td>1500821-xxx</td>
<td>1611 nm analog CWDM transmitter</td>
</tr>
</tbody>
</table>

Note: xxx = connector type (-001 = SC/APC, -002 = SC/UPC, -003 = FC/APC, -004 = FC/UPC).

### CWDM 2:1 TDM Digital Transmitters

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>152250-0x</td>
<td>1471 nm CWDM 2:1 TDM digital transmitter</td>
<td>152254-0x</td>
<td>1551 nm CWDM 2:1 TDM digital transmitter</td>
</tr>
<tr>
<td>152251-0x</td>
<td>1491 nm CWDM 2:1 TDM digital transmitter</td>
<td>152255-0x</td>
<td>1571 nm CWDM 2:1 TDM digital transmitter</td>
</tr>
<tr>
<td>152252-0x</td>
<td>1511 nm CWDM 2:1 TDM digital transmitter</td>
<td>152256-0x</td>
<td>1591 nm CWDM 2:1 TDM digital transmitter</td>
</tr>
<tr>
<td>152253-0x</td>
<td>1531 nm CWDM 2:1 TDM digital transmitter</td>
<td>152257-0x</td>
<td>1611 nm CWDM 2:1 TDM digital transmitter</td>
</tr>
</tbody>
</table>

Note: Where 0x is the connector type; -01 = SC/APC, -03 = FC/UPC connectors. Only available for 42/54 split Opti Max4100 nodes.

C-COR also offers a comprehensive suite of optical passive solutions to help you take full advantage of our new CWDM transmitters. Contact your C-COR sales professional for more details and to discuss how our exciting new 1 GHz products can add value to your network.

Refer to the C-COR HFC Product Accessories data sheet on our website for detailed ordering information and specifications on the complete set of plug-in accessories used in the Opti Max4100.