**Optoelectronics**

**Prisma II™ bdr™ Digital Reverse 2:1 Dual Multiplexing System for High Density Installations**

**Description**
The Prisma II™ “carrier-class” platform supports Scientific-Atlanta’s revolutionary bdr™ digital reverse technology. The Prisma II bdr™ Digital Reverse 2:1 Dual Multiplexing System includes a unique approach for incorporating cost-effective network redundancy as well as saving space and cost.

At the transmit end of the system, typically in a hub or remote terminal, four 5 to 42 MHz analog reverse path signals are input to a two slot wide Transmit Processor. The Transmit Processor converts each RF signal to its own baseband digital reverse stream. The data streams are paired and multiplexed together, resulting in two high data rate streams, one for each pair of inputs. Laser modules installed within the Transmit Processor Frame convert the high data rate stream to an optical signal for transmission at either 1310 nm or 1550 nm wavelengths. 1550 nm ITU grid wavelengths are used for Dense Wave Division Multiplexing (DWDM) applications.

On the receive end, typically in a large hub or headend, two Receiver Modules located in the Receive Processor frame receive the optical signal and perform conversion back to the baseband data stream. The Receive Processor de-multiplexes the data stream and converts the resultant data streams back to analog reverse path signals for routing to termination equipment.

**Features**
- High-performance baseband digital reverse technology with 12-bit encoding enables transmission of analog video and high-order digital modulation signals (e.g., 16 QAM, 64 QAM and 256 QAM)
- High Density deployment of two 2:1 digitally multiplexed 5-42 MHz reverse signals
- 2:1 time division multiplexing reduces requirements for costly 1550 nm ITU transmitters by 50%
- Long reach transmission capabilities eliminate need for optical amplifiers, reducing cost and space requirements
- Capable of sending 48 individual 5-42 MHz reverse signals over a single fiber
  - leverages 2:1 time division multiplexing for doubling fiber usage
  - compatible with Scientific-Atlanta’s 24 wavelength DWDM system
- Unique sub-module design provides functions for full path redundancy and dense product packaging in Prisma II platform
- Simplified set-up reduces installation time and expertise requirements
- Distance and temperature independent link performance simplifies engineering and maintenance requirements
- Space-saving, high-density deployment in Prisma II platform increases deployment cost efficiency
- Extended temperature performance enables Remote Terminal applications
- High-speed remote control and monitoring via Scientific-Atlanta’s Transmission Network Control System (TNCS)

Prisma II bdr Digital Reverse 2:1 Dual Multiplexing System for High Density Installations

Block Diagram

2: 1 Dual Transmit Processor Module

RF Input 1A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Laser Module
Laser Driver
DFB Laser
1310 nm or 1550 nm ITU Grid
Optical Output
RF Output 1A
-20 dB
0 to 10 dB
Variable Attenuator
D/A
RF Output 1B
-20 dB
A/D Input T.P.
-20 dB
RF Input 1B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 2A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 2B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network

2: 1 Dual Receive Processor Module

RF Output 2A
-20 dB
0 to 10 dB
Variable Attenuator
D/A
RF Output 2B
-20 dB
A/D Input T.P.
-20 dB
RF Input 2A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 2B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Receiver Module
Photo Detector
Limiting Amp
Data Output
RF Output 1B
-20 dB
A/D Input T.P.
-20 dB
RF Input 1B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 1A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network

Receiver Module
Photo Detector
Limiting Amp
Data Output
RF Output 1A
-20 dB
A/D Input T.P.
-20 dB
RF Input 1A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 1A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network

Laser Module
Laser Driver
DFB Laser
1310 nm or 1550 nm ITU Grid
Optical Output
RF Output 2A
-20 dB
0 to 10 dB
Variable Attenuator
D/A
RF Output 2B
-20 dB
A/D Input T.P.
-20 dB
RF Input 2A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 2B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network

Laser Module
Laser Driver
DFB Laser
1310 nm or 1550 nm ITU Grid
Optical Output
RF Output 1B
-20 dB
0 to 10 dB
Variable Attenuator
D/A
RF Output 1A
-20 dB
A/D Input T.P.
-20 dB
RF Input 1B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 1B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network

Receiver Module
Photo Detector
Limiting Amp
Data Output
RF Output 1B
-20 dB
A/D Input T.P.
-20 dB
RF Input 1B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 1B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network

Laser Module
Laser Driver
DFB Laser
1310 nm or 1550 nm ITU Grid
Optical Output
RF Output 2A
-20 dB
0 to 10 dB
Variable Attenuator
D/A
RF Output 2B
-20 dB
A/D Input T.P.
-20 dB
RF Input 2A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 2A
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network

Receiver Module
Photo Detector
Limiting Amp
Data Output
RF Output 2B
-20 dB
A/D Input T.P.
-20 dB
RF Input 2B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
RF Input 2B
A/D Input T.P.
-20 dB
0 to 10 dB
Variable Attenuator
A/D
TDM mux
Data Input
Optical Network
## Module Specifications

### 2:1D Transmit Processor

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Input Level Requirements</td>
<td>dBmV/Hz</td>
<td>See Link Performance Section</td>
</tr>
<tr>
<td>RF Input Return Loss</td>
<td>dB</td>
<td>16</td>
</tr>
<tr>
<td>Input RF Variable Attenuation Range</td>
<td>dB</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Power Consumption (maximum)</td>
<td>W</td>
<td>11</td>
</tr>
<tr>
<td>Data Output to Laser Module</td>
<td>Gbps</td>
<td>2.5</td>
</tr>
<tr>
<td>A/D Input Test Point</td>
<td>dB</td>
<td>-20 ± 0.5 1</td>
</tr>
</tbody>
</table>

### Laser Module

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Input from 2:1 Transmit Processor</td>
<td>Gbps</td>
<td>2.5</td>
</tr>
<tr>
<td>Optical Wavelength</td>
<td>nm</td>
<td>1550 ITU grid 200 GHz spacing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1550 non-ITU</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1310 nm</td>
</tr>
<tr>
<td>Power Consumption (maximum)</td>
<td>W</td>
<td>8 (1550 nm ITU)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.5 (1550 non-ITU) &amp; (1310 nm)</td>
</tr>
<tr>
<td>Optical Output Power (modulated)</td>
<td>dBm</td>
<td>0 or 7</td>
</tr>
<tr>
<td>Optical Interface</td>
<td></td>
<td>SC/APC Connector</td>
</tr>
</tbody>
</table>

### 2:1D Receive Processor

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Input from Receiver Module</td>
<td>Gbps</td>
<td>2.5</td>
</tr>
<tr>
<td>RF Output Level</td>
<td>dBmV/Hz</td>
<td>See Link Performance Section</td>
</tr>
<tr>
<td>RF Output Return Loss</td>
<td>dB</td>
<td>16</td>
</tr>
<tr>
<td>Output RF Variable Gain Control Range</td>
<td>dB</td>
<td>0 to -10</td>
</tr>
<tr>
<td>Power Consumption (maximum)</td>
<td>W</td>
<td>15</td>
</tr>
<tr>
<td>RF Output Test Point</td>
<td>dB</td>
<td>-20 (± 0.5 dB)</td>
</tr>
</tbody>
</table>

### Receiver Module

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical Input Power Range: SR module</td>
<td>dBm</td>
<td>-5 to -22</td>
</tr>
<tr>
<td>Optical Input Power Range: ER module</td>
<td>dBm</td>
<td>-10 to -29</td>
</tr>
<tr>
<td>Data Output to Laser Module</td>
<td>Gbps</td>
<td>2.5</td>
</tr>
<tr>
<td>Power Consumption (maximum)</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>Optical Interface</td>
<td></td>
<td>SC/APC connector</td>
</tr>
</tbody>
</table>

### Mechanical

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Range (ambient)</td>
<td>°C</td>
<td>-40 to +65</td>
</tr>
<tr>
<td></td>
<td>°F</td>
<td>-40 to +149</td>
</tr>
<tr>
<td>Physical Dimensions (any Processor with 2 Receiver or 2 Laser Modules)</td>
<td>in.</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>cm</td>
<td>24.9</td>
</tr>
<tr>
<td></td>
<td>in.</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>cm</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>in.</td>
<td>7.6</td>
</tr>
<tr>
<td></td>
<td>cm</td>
<td>19.3</td>
</tr>
<tr>
<td></td>
<td>lb</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>kg</td>
<td>2.3</td>
</tr>
</tbody>
</table>

**Notes:**

1. Test point level is –20 dB referenced to the RF input with attenuator set at 0 dB.
2. System designs should consider the effects of wavelength dispersion in long fiber lengths. This can result in up to 2 dB loss of Rx sensitivity over a 100 km distance.
3. Recommended for use only in non-condensing environments.
4. Receive Processor operating temperature range is –10 to +65°C.
Prisma II bdr Digital Reverse 2:1 Dual Multiplexing System for High Density Installations

Link Performance

<table>
<thead>
<tr>
<th>General</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandpass</td>
<td>MHz</td>
<td>5-42</td>
</tr>
<tr>
<td>Full Scale Single CW Carrier Amplitude</td>
<td>dBmV</td>
<td>54</td>
</tr>
<tr>
<td>Noise Floor Amplitude</td>
<td>dBmV/Hz</td>
<td>-85</td>
</tr>
<tr>
<td>Link Gain (minimum)</td>
<td>dB</td>
<td>17</td>
</tr>
<tr>
<td>Response Flatness</td>
<td>dB</td>
<td>± 0.5</td>
</tr>
</tbody>
</table>

Notes:
1. With respect to the input port on 2:1 Transmit Processor.
2. A CW carrier of this amplitude applied to the RF input will exercise the full-scale range of the A/D converter. Full scale is analogous to 100% OMI for Analog Lasers.
3. Variable Attenuator on 2:1 Transmit Processor set to 0 dB.
4. Variable Gain Control on 2:1 Receive Processor set to 0 dB.
5. Add Link Gain (dB) to Transmit Processor RF input level to determine Receive Processor RF output level.

Noise Power Ratio (NPR) Performance

(Applies to Constant Power / Hz Loading over 35 MHz band)

NPR Notes:
1. Input power is specified with respect to the input port of the Transmit Processor module.
2. Variable Attenuator on 2:1 Transmit Processor set to 0 dB and Variable Gain Control on 2:1 Receive Processor set to 0 dB.

Note:
Unless otherwise stated, all link performance specifications shown reflect minimum performance over the specified operating temperature range.
Prisma II bdr Digital Reverse 2:1 Dual Multiplexing System for High Density Installations

Ordering Information

For a complete system, a minimum of one each (Transmit Processor, Laser Module, Receive Processor and Receiver Module) is required.

**Prisma II 2:1 Transmit Processor** (each holds up to 2 Laser Modules)
**Prisma II 2:1 Receive Processor** (each holds up to 2 Receiver Modules)

**Sample**

```
        P 2 B D R T P 2 D
```

**Platform**

**Product**

bdr → B D R

**Module Type**

- Transmit Processor → T P
- Receive Processor → R P

**Multiplexing Configuration**

2:1 Dual Multiplexing → 2 D
Prisma II bdr Digital Reverse 2:1 Dual Multiplexing System for High Density Installations

Ordering Information, continued

Prisma II Laser Module

Sample

<table>
<thead>
<tr>
<th>P</th>
<th>2</th>
<th>B</th>
<th>D</th>
<th>R</th>
<th>L</th>
<th>S</th>
<th>M</th>
<th>I</th>
<th>T</th>
<th>U</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>S</th>
<th>A</th>
</tr>
</thead>
</table>

Platform

Product

Module Type

Laser Module

<table>
<thead>
<tr>
<th>Wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>1530.33 ITU59*</td>
</tr>
<tr>
<td>1531.90 ITU57*</td>
</tr>
<tr>
<td>1533.47 ITU55*</td>
</tr>
<tr>
<td>1535.04 ITU53*</td>
</tr>
<tr>
<td>1536.61 ITU51*</td>
</tr>
<tr>
<td>1538.19 ITU49*</td>
</tr>
<tr>
<td>1539.77 ITU47*</td>
</tr>
<tr>
<td>1541.35 ITU45*</td>
</tr>
<tr>
<td>1542.94 ITU43*</td>
</tr>
<tr>
<td>1544.53 ITU41*</td>
</tr>
<tr>
<td>1546.12 ITU39*</td>
</tr>
<tr>
<td>1547.72 ITU37*</td>
</tr>
<tr>
<td>1549.32 ITU35*</td>
</tr>
<tr>
<td>1550.92 ITU33*</td>
</tr>
<tr>
<td>1552.52 ITU31*</td>
</tr>
<tr>
<td>1554.13 ITU29*</td>
</tr>
<tr>
<td>1555.75 ITU27*</td>
</tr>
<tr>
<td>1557.36 ITU25*</td>
</tr>
<tr>
<td>1558.98 ITU23*</td>
</tr>
<tr>
<td>1560.61 ITU21*</td>
</tr>
<tr>
<td>1562.23 ITU19*</td>
</tr>
<tr>
<td>1563.86 ITU17*</td>
</tr>
<tr>
<td>1565.50 ITU15*</td>
</tr>
<tr>
<td>1567.13 ITU13*</td>
</tr>
<tr>
<td>1310 1310D</td>
</tr>
<tr>
<td>1550 1550D</td>
</tr>
</tbody>
</table>

Connectors

SC/APC S A

Output Power

0 dBm 00
*7 dBm 07

Note:

*ITU wavelengths ITU13 through ITU59 are also available in 7 dBm output.
ITU wavelengths ITU21 through ITU35 are primary wavelengths used in 8 channel DWDM systems.
The balance of wavelengths are incremental for greater DWDM density requirements.
Prisma II Receiver Module

Sample

Prisma II products include the industry’s most complete range of high performance optical components:

Platform
1310 nm Transmitters
1550 nm Transmitters
1550 nm Optical Amplifiers
Receivers
Ancillary Modules

For more information refer to:
Prisma II Data Sheet Part Number 739199
Prisma II Data Sheet Part Number 739200
Prisma II Data Sheet Part Number 739201
Prisma II Data Sheet Part Number 739202
Prisma II Data Sheet Part Number 739203
Prisma II Data Sheet Part Number 739204
Prisma II Data Sheet Part Number 739205