Optoelectronics

1310 nm, 1550 nm, and CWDM Analog Reverse Optical Transmitters For Model 6940, 6942, 6944 & GainMaker® Optoelectronic Stations

Description

The Models 6940, 6942, 6944, and GainMaker® Optoelectronic Receiver Stations (nodes) may be equipped with 1310 nm, 1550 nm, or CWDM (or any combination) analog reverse optical transmitters to facilitate reverse communications from node to headend or hub site.

There are two types of lasers used in the 1310 nm reverse optical transmitters. The distributed feedback (DFB) type is best suited for high-capacity reverse traffic, and can accommodate analog video carrier transmission. The Fabry-Perot (FP) type is lower priced and designed for data carrier transmission applications with less stringent performance requirements.

The 1550 nm reverse optical transmitter uses a DFB laser well suited for high-capacity reverse traffic, and can accommodate analog video carrier transmission.

The CWDM reverse optical transmitter is offered in a choice of 8 wavelengths from 1470 to 1610 nm. Up to 8 CWDM reverse optical transmitters can share a common return fiber when used with accompanying combining and splitting passive optics. The CWDM reverse optical transmitters use a DFB laser and are well suited for high capacity reverse traffic.

All of these reverse optical transmitters are available in standard and high gain versions, in order to allow flexibility in reverse path design. The high gain versions are typically used in the Model 6944 and Model 6942 segmentable nodes. The standard gain versions are typically used in the Model 6940 and GainMaker node.

A variety of transmitter configurations may be utilized in Scientific-Atlanta® nodes. In the Model 6944 node, four reverse transmitters are used for full four-way (quad) reverse segmentation, with a separate transmitter dedicated to each of the station's four reverse RF input ports. For two-way (dual) reverse segmentation, two transmitters are used, one for each combined pair of RF input ports. In the Model 6940, 6942 and 6944 nodes, for standard operation (no reverse segmentation) the stations may be configured with either a primary transmitter only, or with both a primary and redundant transmitter. The GainMaker node supports one transmitter.

The reverse optical transmitters specified in this data sheet include both a Power On LED and an Optical Power Alert LED, enabling quick visual confirmation of operational status. A DC test point that is scaled to the optical output power is also included.

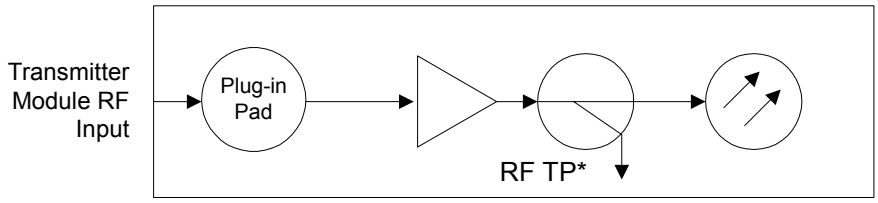
Optionally, to ensure maximum reliability and quick fault resolution, the reverse transmitters can be remotely monitored using the Scientific-Atlanta Transmission Network Control System (TNCS).

Features

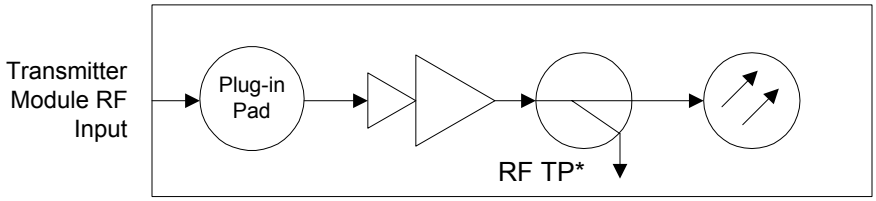
- Compact modular design for simple installation and removal
- Power On and Optical Power Alert LED indicators
- DC test point scaled to optical output power
- Plug-in input attenuator allows easy adjustment of RF drive level
- Provisioned with network monitoring capability (TNCS system required)

Block Diagrams

***Standard* DFB and FP Reverse Transmitter Module**



***High Gain* DFB and FP Reverse Transmitter Module**



***Important note concerning the transmitter module RF test point (TP):**

It is important to understand the RF level relationship between the RF test point and the transmitter module RF input. With a 0 dB pad installed in the plug-in pad location:

For *standard* DFB and FP transmitters, add 15 dB to the level measured at the test point to determine the module RF input level (the test point is -15 dB relative to module input).

For *high gain* DFB and FP transmitters, subtract 7 dB from the level measured at the test point to determine the module RF input level (the test point is +7 dB relative to module input).

For *standard* and *high gain* CWDM DFB transmitters add 20 dB to the level measured at the test point to determine the module RF input level (the test point is -20 dB relative to the module input).

1310 nm Module Specifications

DFB Reverse Transmitter Modules

	Units	All 1310 DFB TX's		Notes
Wavelength	nm	1310		
Pass Band	MHz	5 – 220		
Frequency Response	dB	± 0.5 (5 - 65 MHz) ± 0.75 (5 - 220 MHz)		1
Input Return Loss	dB	14		
Optical Output Test Point (± 10%)	V DC	1V/mW		
Optical Output Power	mW dBm	2.0 3.0		
		Std TX	**High Gain TX**	
Single CW carrier RF input level for 100% OMI	dBmV	55	33	2
Noise Power Ratio (NPR) Performance		see plot	see plot	
RF Test Point -relative to transmitter RF input (± 1 dB)	dB	-15	+7	3

FP Reverse Transmitter Modules

	Units	All 1310 FP TX's		Notes
Wavelength	nm	1310		
Pass Band	MHz	5 – 220		
Frequency Response	dB	± 0.5 (5 - 65 MHz) ± 0.75 (5 - 220 MHz)		1
Input Return Loss	dB	14		
Optical Output Test Point (± 10%)	V DC	1V/mW		
Optical Output Power	mW dBm	1.6 2.0		
		Std TX	**High Gain TX**	
Single CW carrier RF input level for 100% OMI	dBmV	51.5	29.5	2
Noise Power Ratio (NPR) Performance		see plot	see plot	
RF Test Point -relative to transmitter RF input (± 1 dB)	dB	-15	+7	3

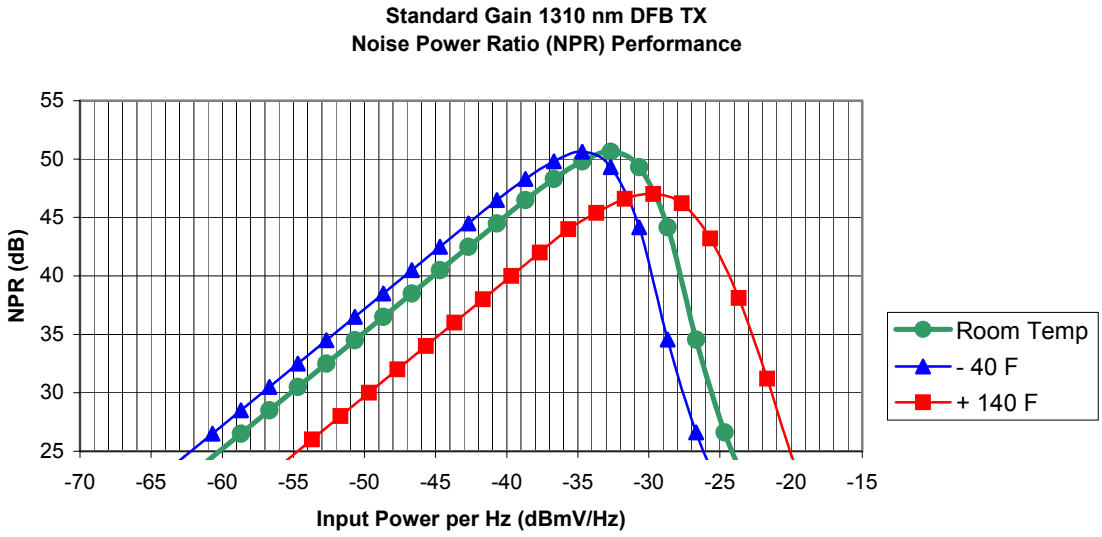
Notes:

1. Frequency response for transmitter module only. Does not include the frequency response contribution of an optical receiver.
2. This is the RF level that produces 100% composite Optical Modulation Index (OMI) with a 0 dB TX input pad at room temperature. This is used for reference purposes only and is NOT the recommended RF drive level. Consult with Scientific-Atlanta's Applications Engineering group in order to determine the appropriate RF drive level for a particular application.
3. The RF level measured at the TX module's RF test point is relative to the TX module RF input as specified, with a 0 dB input pad installed. While on early versions this was labeled a "-20 dB RF test point", it is -20 dB relative to the input of the test point directional coupler (in circuit), not to the TX module's RF input level.

1310 nm Link Specifications

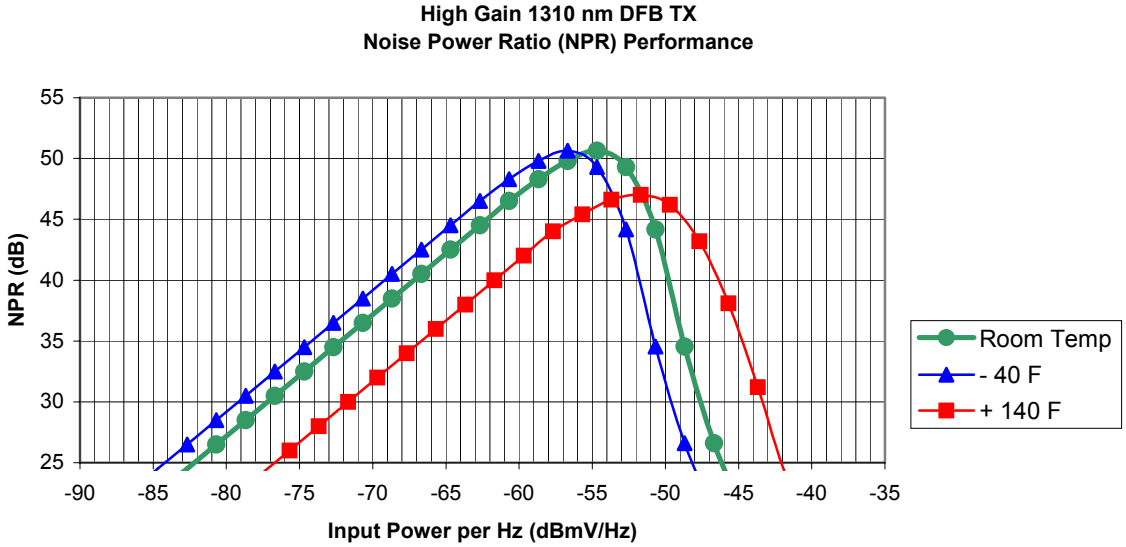
Standard Gain DFB Transmitter

Typical Noise Power Ratio (NPR) Performance with 7 dB Optic Link (15 km glass, plus passive loss)



High Gain DFB Transmitter

Typical Noise Power Ratio (NPR) Performance with 7 dB Optic Link (15 km glass, plus passive loss)

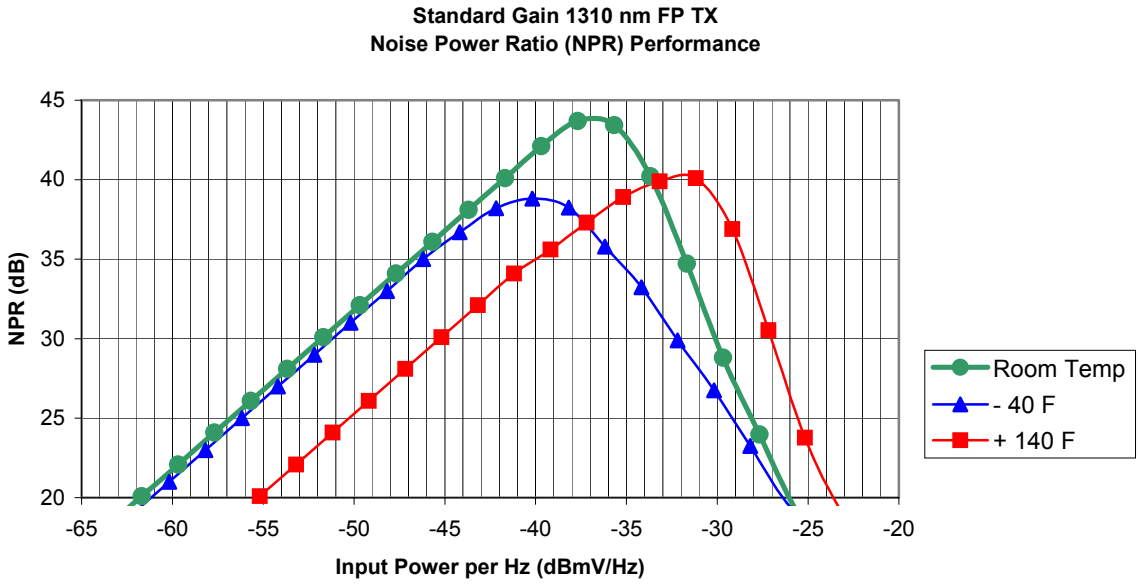


Note: NPR performance with noise loading from 5-42 MHz

1310 nm Link Specifications, continued

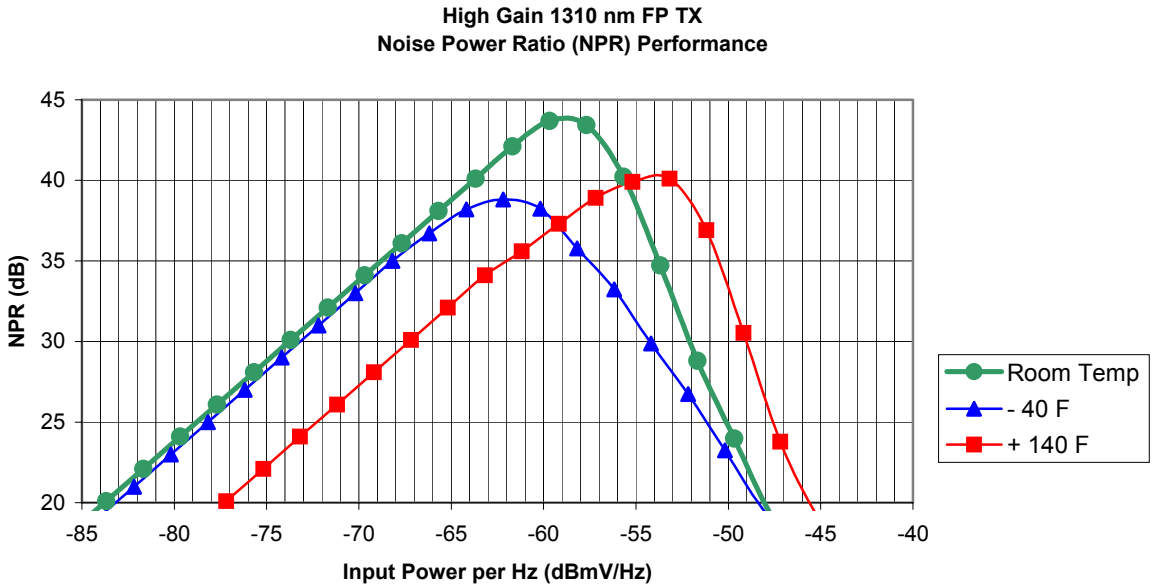
Standard Gain FP Transmitter

Typical Noise Power Ratio (NPR) Performance with 7 dB Optic Link (15 km glass, plus passive loss)



High Gain FP Transmitter

Typical Noise Power Ratio (NPR) Performance with 7 dB Optic Link (15 km glass, plus passive loss)



Note: NPR performance with noise loading from 5-42 MHz

1310 nm Link Specifications, continued

Link Loss (dB)	NPR 'Link Loss Correction Factor' (dB)	
	Model 6940/44 & GainMaker **DFB TX** (Std and High Gain)	Model 6940/44 & GainMaker **FP TX** (Std and High Gain)
1	+2	0
2	+2	0
3	+2	0
4	+1.5	0
5	+1	0
6	+1	0
7	**0**	**0**
8	-1	0
9	-2	-0.5
10	-3	-0.5
11	-4.5	-1
12	-6	-1.5
13	-7	-2
14	-9	-3
15	-11	-4
16	-12	-5
17	-14	-6.5
18	-16	-8
19	-18	-9.5
20	-20	-11

Using the NPR Link Loss Correction Factor *(applies to Model 6940, 6944, and GainMaker analog TXs only)*

The NPR performance plots contained in this document depict the NPR performance on a reference 7 dB fiber optic link.

With other link losses, both the:

- NPR dynamic range for a given minimum NPR (C/N) performance
- NPR value for a given transmitter RF input level

will vary from that shown on the reference 7 dB link plots.

To determine an NPR *dynamic range* for a different link loss, add (or subtract) the correction factor associated with the desired link loss to (or from) the dynamic range shown on the reference 7 dB link NPR plot. Note that the associated increase (or decrease) in dynamic range affects only the left side of the NPR curve (minimum RF input side) since that is the portion of the curve affected by changes to the traditional noise sources associated with the optical link.

To determine an NPR *value* for a different link loss, add (or subtract) the correction factor associated with the desired link loss to (or from) the NPR value shown on the 7 dB link NPR plot for a given RF input level. Again, only the NPR values on the left side of the NPR curve (pre-peak values) are to be adjusted. The NPR values and slope associated with the right side of the NPR curve (post peak values) are primarily due to laser clipping at high RF input levels, and therefore do not vary appreciably with link loss.

1550 nm and CWDM Module Specifications

DFB Reverse Transmitter Modules

	Units	All 1550 DFB TX's		Notes
Wavelength	nm	1550		
Pass Band	MHz	5 - 220		
Frequency Response	dB	±0.5 (5-65) ±0.75 (5-220)		1
Input Return Loss	dB	14		
Optical Output Test Point (± 10%)	V DC	1 V/mw		
Optical Output Power	mW dBm	2.0 3.0		
		Std TX	**High Gain TX**	
Single CW carrier RF input level for 100% OMI	dBmV	55	33	2
Noise Power Ratio (NPR) Performance		See plot	See plot	
RF Test Point -relative to transmitter RF input (± 1 dB)	dB	-15	+7	3

CWDM DFB Reverse Transmitter Modules

	Units	All CWDM DFB TX's		Notes
Wavelength	nm	1470, 1490, 1510, 1530 1550, 1570, 1590, 1610		
Pass Band	MHz	5 - 220		
Frequency Response	dB	±0.5 (5-65) ±0.75 (5-220)		1
Input Return Loss	dB	16		
Optical Output Test Point (± 10%)	V DC	1 V/mw		
Optical Output Power	mW dBm	2.0 3.0		
		Std TX	**High Gain TX**	
Single CW carrier RF input level for 100% OMI	dBmV	55	33	2
Noise Power Ratio (NPR) Performance		See plot	See plot	
RF Test Point -relative to transmitter RF input (± 1 dB)	dB	-20	-20	

Notes:

1. Frequency response for transmitter module only. Does not include the frequency response contribution of an optical receiver.
2. This is the RF level that produces 100% composite Optical Modulation Index (OMI) with a 0 dB TX input pad at room temperature. This is used for reference purposes only and is NOT the recommended RF drive level. Consult with Scientific-Atlanta's Applications Engineering group in order to determine the appropriate RF drive level for a particular application.
3. The RF level measured at the TX module's RF test point is relative to the TX module RF input as specified, with a 0 dB input pad installed. While on early versions this was labeled a "-20 dB RF test point", it is -20 dB relative to the input of the test point directional coupler (in circuit), not to the TX module's RF input level.

1310 nm, 1550 nm, and CWDM Specifications

Electrical	**Units**	**Component DC Power Consumption**	
		@ +24 V DC	**@ -6 V DC**
Standard DFB - Reverse Transmitter	Amps	.14	.09
High Gain DFB - Reverse Transmitter	Amps	.09	.09
Standard FP - Reverse Transmitter	Amps	.14	.07
High Gain FP - Reverse Transmitter	Amps	.09	.07
Standard DFB - CWDM Reverse Transmitter **(see note)*	Amps	.08	.09
High Gain DFB - CWDM Reverse Transmitter **(see note)*	Amps	.11	.09
Environmental	**Units**		
Operating Temperature Range (outdoor ambient)	°F °C	-40 to +140 -40 to +60	

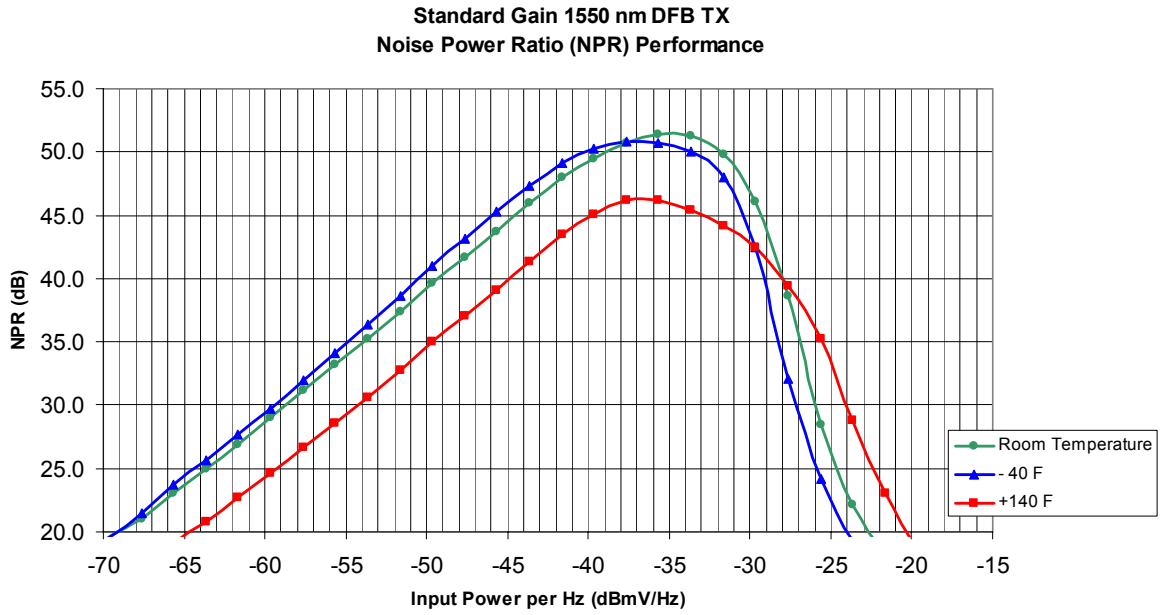
Mechanical					
Physical Dimensions	**Units**	**Length**	**Width**	**Height**	**Weight**
	in. / lbs.	5.8	1.5	1.2	0.5
	cm. / kg.	14.7	3.8	3.1	0.2

**Note: Heater can draw an additional .2A from +24 V DC when laser case below 0°C*

1550 nm and CWDM Link Specifications

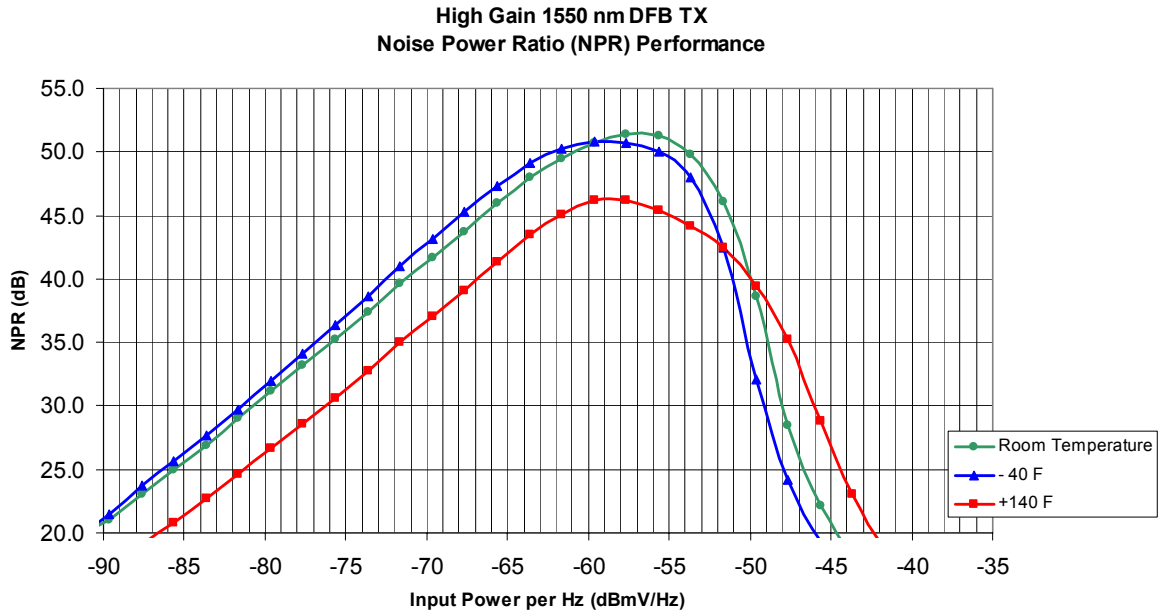
Standard Gain DFB Transmitter

Typical Noise Power Ratio (NPR) Performance with 7 dB Optic Link (15 km glass, plus passive loss)



High Gain DFB Transmitter

Typical Noise Power Ratio (NPR) Performance with 7 dB Optic Link (15 km glass, plus passive loss)



1550 nm and CWDM Link Specifications, continued

Link Loss (dB)	NPR 'Link Loss Correction Factor' (dB)
	Model 6940/42/44 & GainMaker **DFB TX** (Std and High Gain)
1	+2
2	+2
3	+2
4	+1.5
5	+1
6	+1
7	**0**
8	-1
9	-2
10	-3
11	-4.5
12	-6
13	-7
14	-9
15	-11
16	-12
17	-14
18	-16
19	-18
20	-20

Using the NPR Link Loss Correction Factor *(applies to Model 6940, 6944, and GainMaker analog TXs only)*

The NPR performance plots contained in this document depict the NPR performance on a reference 7 dB fiber optic link.

With other link losses, both the:

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To determine an NPR *value* for a different link loss, add (or subtract) the correction factor associated with the desired link loss to (or from) the NPR value shown on the 7 dB link NPR plot for a given RF input level. Again, only the NPR values on the left side of the NPR curve (pre-peak values) are to be adjusted. The NPR values and slope associated with the right side of the NPR curve (post peak values) are primarily due to laser clipping at high RF input levels, and therefore do not vary appreciably with link loss.

Ordering Information

The analog reverse optical transmitters for the Model 6940, 6942, 6944, and GainMaker nodes are applicable for a wide variety of station configurations. Please consult with Sales and Applications Engineering to determine the most suitable reverse transmitter configuration for your particular application.

Description	Part Number
1310 nm FP Optical Transmitter – Standard Gain, with SC/APC connector	590930
1310 nm FP Optical Transmitter – High Gain, with SC/APC connector	590942
1310 nm FP Optical Transmitter – Standard Gain, with SC/UPC connector	590931
1310 nm FP Optical Transmitter – High Gain, with SC/UPC connector	590943
1310 nm FP Optical Transmitter – Standard Gain, with FC/APC connector	590928
1310 nm FP Optical Transmitter – High Gain, with FC/APC connector	590940
1310 nm DFB Optical Transmitter – Standard Gain, with SC/APC connector	590934
1310 nm DFB Optical Transmitter – High Gain, with SC/APC connector	590938
1310 nm DFB Optical Transmitter – Standard Gain, with SC/UPC connector	590935
1310 nm DFB Optical Transmitter – High Gain, with SC/UPC connector	590939
1310 nm DFB Optical Transmitter – Standard Gain, with FC/APC connector	590932
1310 nm DFB Optical Transmitter – High Gain, with FC/APC connector	590936
1550 nm DFB Optical Transmitter – Standard Gain, with SC/APC connector	4005116
1550 nm DFB Optical Transmitter – High Gain, with SC/APC connector	4005119
1550 nm DFB Optical Transmitter – Standard Gain, with SC/UPC connector	4005118
1550 nm DFB Optical Transmitter – High Gain, with SC/UPC connector	4005121
1550 nm DFB Optical Transmitter – Standard Gain, with FC/APC connector	4005117
1550 nm DFB Optical Transmitter – High Gain, with FC/APC connector	4005120
1470 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006971
1490 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006972
1510 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006973
1530 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006974
1550 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006975
1570 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006976
1590 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006977
1610 nm CWDM DFB Optical Transmitter – Standard Gain with SC/APC connector	4006978
1470 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007003
1490 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007004
1510 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007005
1530 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007006
1550 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007007
1570 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007008
1590 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007009
1610 nm CWDM DFB Optical Transmitter – High Gain with SC/APC connector	4007010

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