

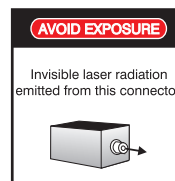
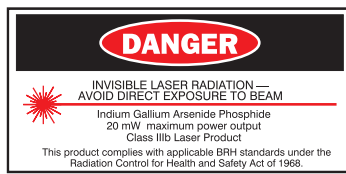




# Preface

## WARNING

**The optical emissions from the chassis and connected optical fiber are laser-based and may present eye hazards. Follow all safety precautions**



## About this Manual

This manual explains how to configure and install the Model 2805 Private Network Solution (PNS) transmitter. It is intended for engineers and technicians who will install the 2805 units and their companion receiver(s). While this guide provides basic information on how to configure and install the units, it assumes that you as the user are familiar with:

- the installation and manipulation of electronic and fiber optic equipment
- the installation and manipulation of CATV video/audio equipment

This manual is divided into the following sections:

- Section 1, page 1: Describes the Private Network Solution (PNS) transmitter, lists technical specifications, performance graphs, system applications, and ordering information.
- Section 2, page 9: Describes the installation of the PNS transmitter and its companion receiver(s).
- Section 3, page 15: Describes the operation of the PNS CATV link, troubleshooting, and user maintenance.

A quick-reference index completes the user manual.



## Related Documentation

- IOM2807: User manual for Model 2807 Mini-node Receiver
- IOM2808: User manual for Model 2808 PDS/PNS CATV Receiver
- AN123: North American Television Frequencies
- AN128: Care and Feeding of Analog CATV Fiber Optic Links
- AN141: System Solutions for CATV HFC Networks
- *Fiber Optic Reference Guide, 3rd Edition*. by David R. Goff (Focal Press 2002): General theory and operation of fiber optic units.
- Web Site: Our web site, <http://www.forceinc.com> may be used to download the latest versions of this manual.

## Technical Support

If you encounter any kind of problem after reading this manual, contact your local distributor or a Force, Inc. Applications Engineer. To reach technical support:

On the Web:	<a href="http://www.forceinc.com">http://www.forceinc.com</a>
By Phone (Monday through Friday 8:00 am to 5:00 pm EST):	USA (800) 732-5252 TEL (540) 382-0462
By Fax:	(540) 381-0392
By Email:	<a href="mailto:sales@forceinc.com">sales@forceinc.com</a>

## Warranty

Force, Incorporated standard products are warranted to be free from defects in materials and workmanship, meeting or exceeding factory specified performance standards for a period of three (3) years from date of purchase.

## Force Obligations

Force will, at its discretion and expense, repair any defect in materials or workmanship or replace the product with a new product. Force will, upon receipt of the return, evaluate the product and communicate to the customer the nature of the problem, and determine if the claim falls under warranty coverage.

If during the warranty period, Force is unable to repair the product to the original warranted state within a reasonable time, or if subcomponents of the unit have been obsoleted or discontinued, then Force has the option to provide an equivalent unit.



## Exclusions

This warranty does not extend to any product that has been damaged due to acts of God, accident, misuse, abuse, neglect, improper system design or application, improper installation, improper operation or maintenance, or connection to an improper voltage supply.

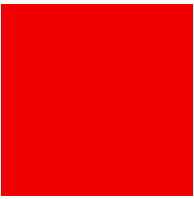
The Force warranty does not cover fuses, batteries, and lamps. Modifications or alterations of Force products (including but not limited to installation of non-Force equipment or computer programs), except as authorized by Force, will void this warranty. Removal or breaking of the seals on the product will also void the warranty. In addition, cost of repair by unauthorized persons within the warranty period of the product will not be covered by Force, Incorporated. Such repairs will void the warranty.

Force, Incorporated makes no other representation or warranty of any other kind, express or implied, with respect to the goods, whether as to merchantability, fitness for a particular purpose, or any other matter. Force, Incorporated's liability shall not include liability for any special, indirect or consequential damages, or for any damages arising from or attributable to loss of use, loss of data, loss of goodwill, or loss of anticipated or actual revenue or profit, or failure to realize expected savings, even if Force, Incorporated has been advised of the possibility of such damages. This warranty constitutes Force, Incorporated's entire liability and the customer's sole remedy for defects in material and workmanship.



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# Section 1 Product Technical Bulletin

## 1.1 Product Overview

The Force, Incorporated CATV<sup>Linx</sup>® Model 2805 110 Channel CATV Private Network Solution (PNS) Transmitter is part of a robust system for transferring up to 110 channels of VSB/AM modulated signals over a single-mode optical fiber. The Model 2805 provides 40-870 MHz of usable bandwidth for video signals stacked at 6 MHz intervals. A low loss single-mode fiber allows full channel loading to beyond 20 km while maintaining a good carrier-to-noise ratio. The Model 2805 may be used with the Model 2807 Mini-node receiver for use in return path and multiple splitter applications or with the Model 2808 PDS/PNS receiver for basic 110 channel CATV transmission. In all cases, the link provides excellent performance for many demanding applications such as broadband LANs, distance learning, and multiple data services.

## 1.2 FCC Notice

The Model 2805 has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions in this manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user must correct the interference at the user's own expense. Compliance with applicable regulations depends on the use of shielded I/O cables. The user is responsible for procuring the appropriate cables.

1.3 Optical, Video, Electrical Characteristics: @ 25 °C, SM Fiber (Note 13)

	Min.	Typ.	Max.	Units	Notes See Section 1.5
Channel Loading			110	Ch.	
Bandwidth	40		870	MHz	1
Operating Wavelength	1290	1310	1330	nm	
Optical Output Power	See Section 1.7				2
Required Fiber Bandwidth	2,000			MHz	3
Input/Output Impedance		75		Ohms	
Side Mode Suppression Ratio (SMSR)	30			dB	
Backreflection Tolerance			50	dB	4
Carrier-to-Noise Ratio (CNR)	See Figure 1.3				5
Composite Second Order (CSO)		-60		dB	
Composite Triple Beat (CTB)		-65		dB	
Input Signal Range (per ch.)	See Figures 1.4 and 1.5				6, 7
Power Supply Voltage	120		240	V <sub>AC</sub>	8
Power Supply Frequency	50		60	Hz	8
Power Dissipation		20		Watts	
Fuse (Slow-Blow)		1.25		A	9

1.4 Environmental and Physical Characteristics

	Min.	Typ.	Max.	Units	Notes See Section 1.5
Operating Temperature Range	0		+45	°C	10
Storage Temperature Range	-20		+70	°C	
Humidity	0		90	%	11
Weight		5.5		lbs.	
		2.5		kg	
Physical Dimensions	19 W x 1.72 H x 14.1 D			in.	12
	483 x 43.7 x 358			mm	12

1.5 Specification Notes

- Figure 1.1 shows the typical frequency response of a 2805 link over the specified frequency range. The gain flatness is typically  $\pm 1.0$  dB over this range. The flatness is typically less than  $\pm 0.1$  dB over a standard 6 MHz channel bandwidth. See Application Note AN123 for additional information on North American Television Frequencies.

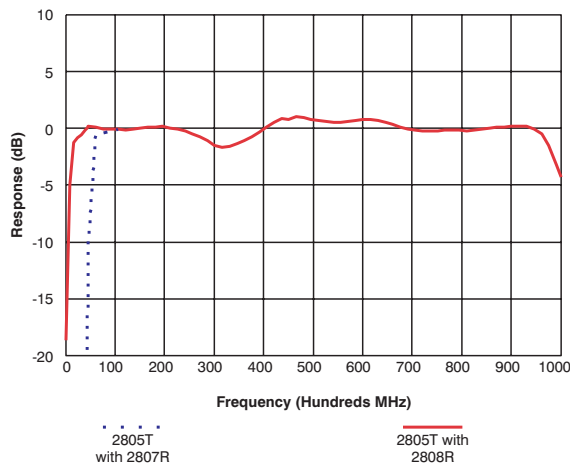


Figure 1.1 In-Band Frequency Response



Figure 1.2 shows an expanded view of the frequency response of a typical 2805T/2808R link.

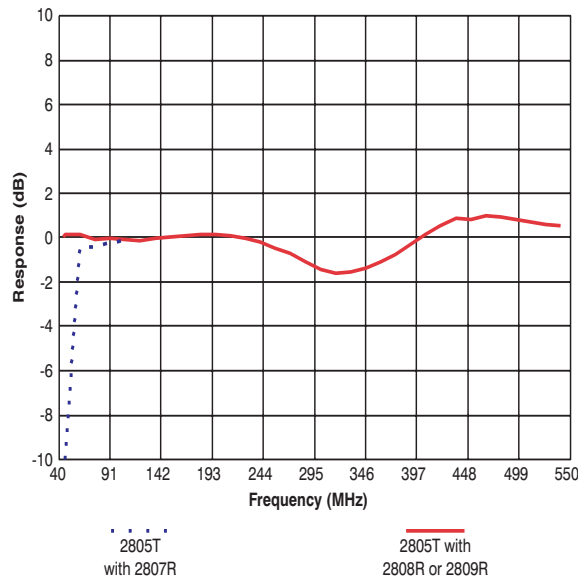


Figure 1.2 Expanded Frequency Response

- 2) All optical power levels are average values. Output is Class IIIb laser. See part numbers in Section 1.7, page 7 for available optical power options.
- 3) Be sure to compute your fiber bandwidth (end-to-end) as well as attenuation.
- 4) The Model 2805 incorporates an optical isolator in the laser package that reduces the effect of optical backreflections on the laser performance. However, all analog lasers are affected by optical backreflections. **The 2805 can only achieve published performance levels if the fiber between the transmitter and receiver has a maximum optical backreflection of -50 dB.** Optical backreflection levels above -50 dB will increase the noise floor of the laser (i.e. decrease the carrier-to-noise ratio), worsen both CSO and CTB performance, increase passband ripple, and dramatically increase cross modulation. The result will be a noisy, grainy picture with diagonal bars. **Force, Inc. recommends that all fiber connections be SC/APC type, FC/APC type or fusion spliced.** There is some folklore which suggests that the only critical backreflection is the one closest to the transmitter. Our experience does not support that view. We find that **all** backreflections matter, regardless of their distance from the transmitter.
- 5) Figure 1.3 presents a tremendous amount of performance data for the 2805 link. The horizontal axis is the amount of optical light that reaches the receiver. (It is not the loss between the transmitter and receiver.) The vertical axis shows the carrier-to-noise ratio at a given optical input level.

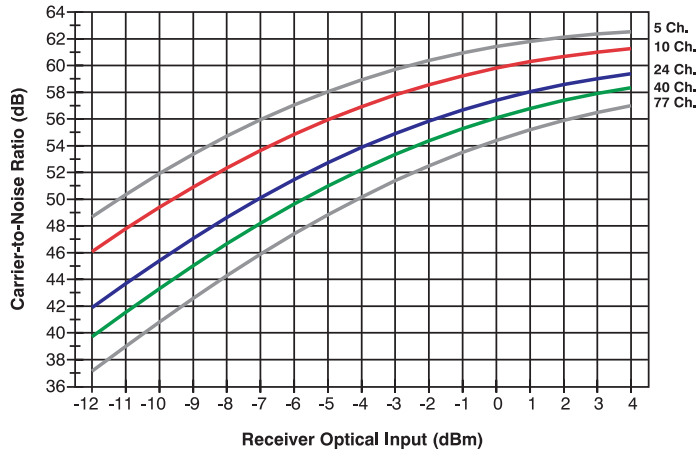


Figure 1.3 CNR vs. Rx Optical Input and Channel Loading (2805T with 2808R)

The vertical scale is the carrier-to-noise (CNR) ratio. Five curves are plotted against these axes. The top curve is the typical result when only 5 channels are transmitted through the link. It can be seen that very high CNR results and in fact the output is quite usable with receiver optical inputs as low as -12 dBm, corresponding to 22 dB of optical loss! As the channel loading gets higher, the maximum achievable CNR drops.

Note that the link CNR is usually specified for a received optical power of -2 dBm or more. Thus, a 2805TF-SCAP/12 optical transmitter, with an optical output of +12 dBm, will provide optimal performance with up to 14 dB of optical loss at full channel loading. If lower channel loading is used, then the link can operate at higher optical losses and still provide exceptional CNR.

- 6) The recommended RF input level is shown in Figures 1.4 and 1.5.

**WARNING**

Exceeding the RF input level may instantaneously destroy the transmitter.

Both figures show the same information, the transmitter level per channel versus the number of channels being transmitted; however, in Figure 1.5 the horizontal scale is a logarithmic scale. This shows that the underlying relationship is linear if plotted against the logarithm of the number of channels.

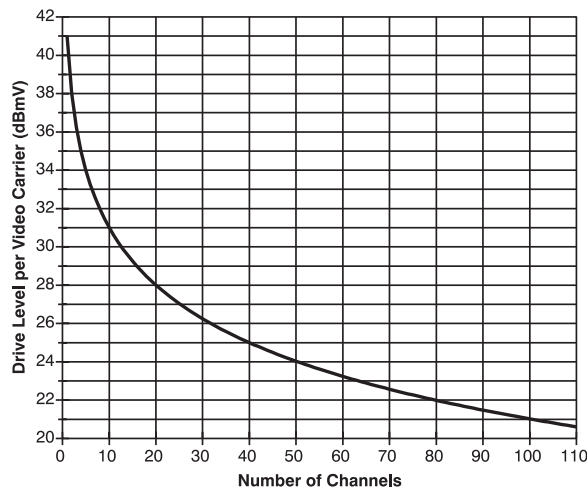


Figure 1.4 Transmitter Level per Channel vs. Number of Channels

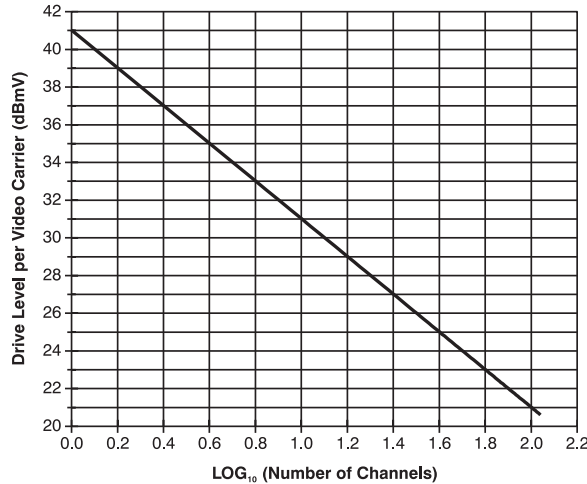


Figure 1.5 Transmitter Level per Channel vs. Log<sub>10</sub> (Number of Channels)

Figure 1.6 shows the response of the Model 2805 transmitter’s integral RF power meter. This meter is accessed via pin J4-5 of the 9-pin D-sub connector on the rear of the transmitter.

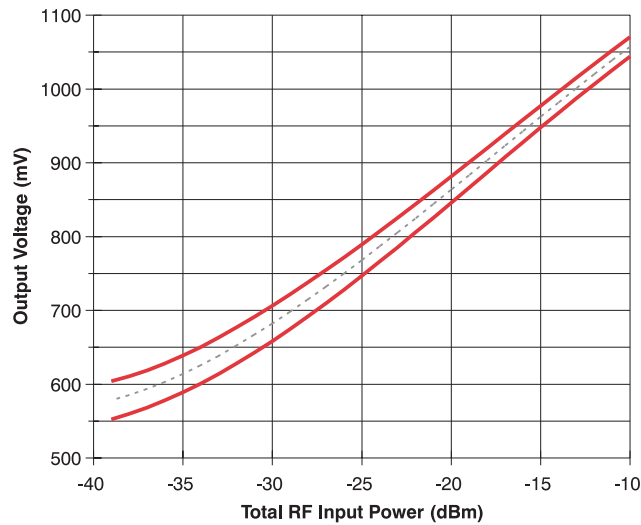


Figure 1.6 Response of Model 2805 RF Power Meter

- 7) Each transmitter has a label such as the one shown in Figure 1.7 that gives the RF input levels for the transmitter. The individual carrier levels should closely match each other to ensure consistent performance on all channels. In all cases, set the composite RF input level so that the RF INPUT LEVEL LED is green. The RF indicator LED only operates properly for rated channel loading and a flat input spectrum. To use the chart, look up the channel loading you will be presenting to the transmitter input and read off the drive level per video carrier. For instance, with 40-channel loading, each video carrier should be about +25.0 dBmV.





































