AT3550 1550 nm
Broadcast Transmitters
Installation and Activation Guide

TM 87-10265 Rev C

November 2010

Revision		Date	ECO
Rev. A	Initial release.	6/25/07	1500
Rev. B	Updated to meet TUV certification.	5/29/08	1827
Rev. C	Add auto shutdown feature.	11/8/10	2677

Visit www.aurora.com for the latest documentation release information.

Statements of Compliance and Safety Notices

FCC Compliance: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this device not expressly approved by Aurora Networks. may cause the operation of this device to be in violation of Part 76 of the FCC Rules, voiding the user's authority to operate the equipment.

FDA Compliance: This device complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

CE Compliance: Following the provisions of EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC of the European Union this product conforms with one or more of the following standards:

EMC Standards — EN 55013, EN 55022, EN55024, EN50083-2, CISPR-13, CISPR-22, and CISPR-24.

Safety Standards — IEC 60825-1:2007 laser safety standard, and is classified as a 1M product.
IEC 60950-1.

The labels shown below are affixed to the top surface of the module.

INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS
CLASS 1M LASER PRODUCT
101166

Complies with 21 CFR 1040.10 and 1040.11
except for deviations pursuant to Laser Notice
No. 50, dated June 24, 2007
100945
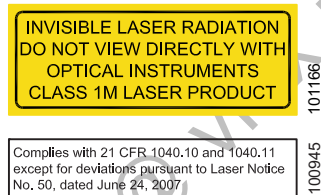
The following cautionary safety notices appear wherever applicable throughout this guide.

CAUTION! Laser Radiation – *Avoid any exposure to laser beams. Viewing the laser output with certain optical instruments (e.g. eye loupes, magnifiers and microscopes) may pose an eye hazard.*

CAUTION! Laser Radiation – *Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.*

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Chapter 1   Introduction

This chapter defines the intended audience and scope of this guide, and suggests how to use this guide to find specific information quickly and efficiently. Lists of tools, test equipment, and materials supporting the procedures in this guide are provided. A list of related documentation is also included.

1.1   Safety

Always work safely.

Observe all CAUTIONs and laser radiation notices in this guide.
See *Statements of Compliance and Safety Notices* on page iii.

Class 1M laser radiation may be present in various plug-in modules in the chassis.
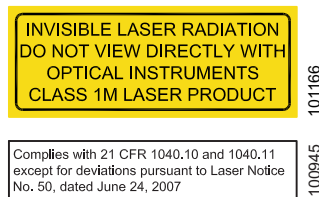
```
INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY WITH
    OPTICAL INSTRUMENTS
 CLASS 1M LASER PRODUCT          101166
```

```
Complies with 21 CFR 1040.10 and 1040.11
except for deviations pursuant to Laser Notice     100945
No. 50, dated June 24, 2007
```

CAUTION! Laser Radiation – *Avoid any exposure to laser beams. Viewing the laser output with certain optical instruments (e.g. eye loupes, magnifiers and microscopes) may pose an eye hazard.*

CAUTION! Laser Radiation – *Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.*

1.2   Intended Audience

The *AT3550 1550 nm Broadcast Transmitters—Installation and Activation Guide* is intended for network engineers and technicians responsible for planning, configuring, installing, and testing Aurora's headend and hub equipment. Installers should have a working knowledge of CATV systems, and optical cable systems and cabling practices.

1.3   How to Use this Guide

This guide is organized by specific tasks. See Table 1-1 for a summary of each chapter.

- If you want to learn about AT3550 Broadcast Transmitters,
  read Chapter 2—Overview of AT3550 Broadcast Transmitters.

- If you want to physically install and configure AT3550 Broadcast Transmitters,
  read Chapter 3—Installing AT3550 Broadcast Transmitters.

- If you want to review specific AT3550 Broadcast Transmitter specifications,
  read Chapter 4—Specifications—AT3550 Transmitters.

- If you want to review optical fiber connector cleaning hints,
  read Chapter 5—Cleaning Fiber Optic Connectors.

- If you want to find information quickly, use the Index at the back of this guide.

Table 1-1   Installation and Activation Guide Organization

Chapter	Description
Chapter 1, Introduction	This chapter defines the intended audience and scope of this guide, and suggests how to use this guide to find specific information quickly and efficiently. Lists of tools, test equipment, and materials supporting the procedures in this guide are provided. A list of related documentation is also included.
Chapter 2, Overview of AT3550 Broadcast Transmitters	This chapter provides a functional overview of Aurora Network's AT3550 broadcast transmitters.
Chapter 3, Installing AT3550 Broadcast Transmitters	This chapter describes the installation of AT3550 broadcast transmitters in a CH3000 chassis.
Chapter 4, Specifications—AT3550 Transmitters	This chapter lists specifications for Aurora Networks' AT3550 broadcast transmitters described in this guide.
Chapter 5 Cleaning Fiber Optic Connectors	This chapter describes how to clean fiber optic connectors and adapters. Cleaning materials are listed, and both wet and dry cleaning methods are described.
Index	Use the extensive index to find specific material quickly.
Technical Manual Comment Form	Use this form (or a copy) to submit comments or corrections to this guide to Aurora Networks.

1.4   Tools / Test Equipment / Supplies

The following tools, test equipment, and supplies are suggested for installing AT3550 Broadcast Transmitters. Specific tools and test equipment items are also listed as needed within the applicable procedures.

1.4.1   Tool List

- 1/4-inch flat tip screwdriver
- #1 Phillips tip screwdriver
- Module fastener tool / Nylatch gripper tool (provided with chassis)

1.4.2   Test Equipment List

- RF Spectrum Analyzer
- RF Power Meter
- Optical Power Meter

1.4.3   Material List

- Fiber optic cable and connector cleaning kit
- Cable ties (tie wraps)

1.5   Related Documentation

Refer to Aurora Networks' Web site at www.aurora.com for the latest product information and documentation updates. The Web site includes a special customer support area (password required) for Aurora customers.

Table 1-2   Related Documentation

Related Documentation	TM Number
CH3000 Chassis Installation and Activation Guide	87-10029
Opti-Trace OTS Shelf Management Software Installation and User Guide	See Note 1
Opti-Trace CMS Craft management Software Installation and User Guide	See Note 1

Note 1: TM numbers for software manuals depend on the software version (different manuals for different versions). See www.aurora.com for the latest software versions and TM numbers for the corresponding manuals.

Go to www.aurora.com and click on **Support** then **Software** for the latest software release information. This area requires a password. If you don't have a password, click *Customer Registration* and register to get your password. After logging in (with your e-mail address and password), select **Support** and **Software** to see the latest software versions. Select **Support** and **Tech Manuals** to see the corresponding TM numbers. You can also send e-mail to support@aurora.com.

1.6 Product Support

For technical support: phone 888.AURORA6 (888.287.6726) toll free or e-mail support@aurora.com.

For questions about or comments on this manual: phone 408.235.7061 or e-mail techpubs@aurora.com.
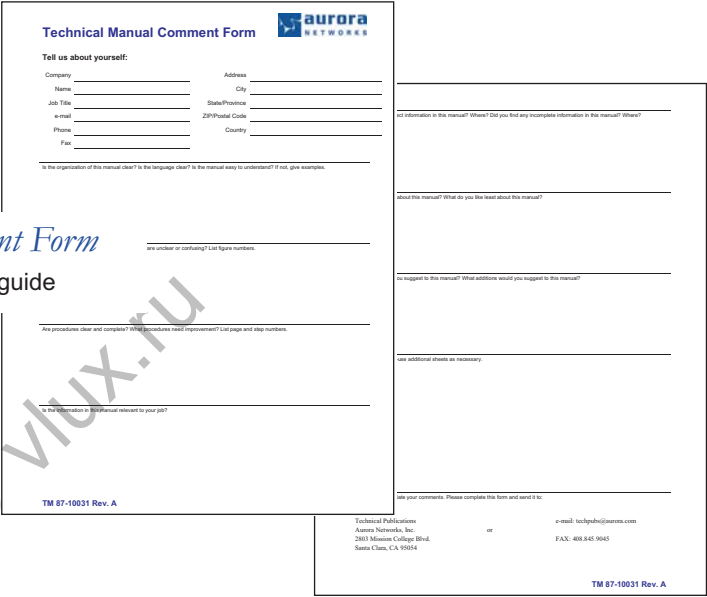
1.7 Comments and Feedback

We have made every effort to ensure that this manual describes the product completely and correctly, and we encourage your feedback—your comments and corrections are welcome. You may submit comments using the Technical Manual Comment Form provided at the back of this manual, by mail or fax, or by sending e-mail directly to techpubs@aurora.com.

You will find the

Technical Manual Comment Form

at the back of this guide

Chapter 2   Overview of AT3550 Broadcast Transmitters

This chapter provides a functional overview of Aurora Network's AT3550 Broadcast Transmitters.

2.1   Functional Overview

AT3550 broadcast transmitters are full-depth modules (Figure 2-1) that plug into any CH3000 chassis. These transmitters take +17 dBmV/chan composite RF inputs in manual mode, and 19 dBmV/chan in AGC mode, in the range of 46 to 1002 MHz, and in any of three channel plans (77-channel NTSC, 64-channel PAL B/G, or 42-channel CENELEC), and output an optical signal. The currently available AT3550 models are listed in Table 2-1. See Chapter 4 for detailed specifications.

AT3550 module status is displayed by front panel LEDs. A laser safety key switch and laser status LED are located near the bottom of the front panel. A "Laser On" LED is located on the rear panel (visible through the BP-A9 back plate. The –20 dB test point is used for setup and troubleshooting.

Each AT3550 transmitter is shipped with a companion BP-A9 back plate that includes one RF input (F-type) connector and one optical output (SC/APC) connector.

Figure 2-1   AT3550 Broadcast Transmitters
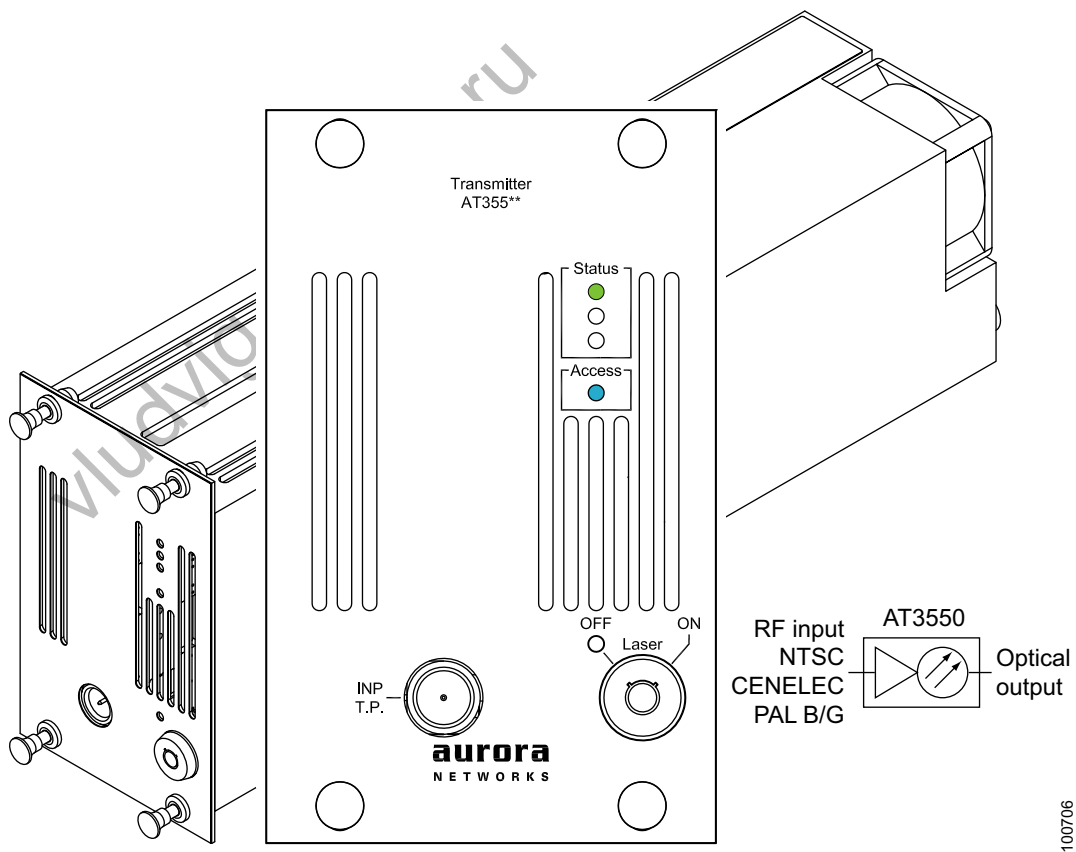
AT3550 transmitters are full-depth modules (13 inches deep) and can be plugged into the front or back of a CH3000 chassis (Figure 2-2 and Figure 3-1). AT3550 transmitters get +12 VDC power and management commands through the chassis midplane. Each AT3550 transmitter requires three chassis slots, and up to four transmitter modules can be installed in a single 3 RU high (5.25 inches) chassis with redundant power supplies.

AT3550 transmitters can be managed locally from the chassis management display on PS3xxxD power supplies, or from Aurora's CMS (craft management software) or OTS (shelf management software) applications.

Figure 2-2   CH3000 Chassis

Table 2-1 lists the AT3550 models covered by this guide. The variables indicated by the model number are (1) path length, (2) channel plan, and (3) wavelength. Table 2–1 lists the AT3550 transmitters available when this guide was published. You can go to www.aurora.com/products to see if additional models have been added since this guide was published. You can also contact support@aurora.com for the availability of specific products.

Table 2-1   AT3550 Broadcast Transmitter Models

Model	Path Length	Channel Plan	Wavelength
AT3553A-BA-00-AS	65 km	77-chan NTSC or 64-chan PAL B/G	1563 nm
AT3553A-BC-00-AS	65 km	77-chan NTSC or 64-chan PAL B/G	1545 nm
AT3553A-yy-00-AS	65 km	77-chan NTSC or 64-chan PAL B/G	Note 1
AT3553C-BA-00-AS	65 km	CENELEC 42	1563 nm
AT3554A-BA-00-AS	100 km	77-chan NTSC or 64-chan PAL B/G	1563 nm
AT3554A-BC-00-AS	100 km	77-chan NTSC or 64-chan PAL B/G	1545 nm
AT3554A-yy-00-AS	100 km	77-chan NTSC or 64-chan PAL B/G	Note 1
AT3554C-BA-00-AS	100 km	CENELEC 42	1563 nm

Note 1: See Table 2-2 for specific ITU channel wavelengths / frequencies.

2.2   AT3550 Model Number Structure

The AT3550 model number structure (AT355wx-yy-00-zz) is defined below. It is important to understand the model number structure so that you order the correct modules for your application.

AT3553A-BA-00-AS	Identifies this module as an analog transmitter.
AT***3***553A-BA-00-AS	Identifies this module as a plug-in for Aurora's 3 RU chassis.
AT3***55***3A-BA-00-AS	Identifies this module as a 1550 nm broadcast transmitter.
AT355***3***A-BA-00-AS	Indicates this module has 65 km reach.
AT355***4***A-BA-00-AS	Indicates this module has 100 km reach.
AT3553***A***-BA-00-AS	Indicates the channel plan for this module is 77-channel NTSC or 64-channel PAL B/G.
AT3553***C***-BA-00-AS	Indicates the channel plan for this module is CENELEC 42.
AT3553A-***BA***-00-AS	Indicates the optical output wavelength of this module is at 1563 nm.
AT3553A-***BC***-00-AS	Indicates the optical output wavelength of this module is at 1545 nm.
AT3553A-***xx***-00-AS	Indicates the optical output wavelength of this module is a specific ITU wavelength (see Table 2-2).
AT3553A-BA-***00***-AS	This is a reserved field.
AT3553A-BA-00-***AS***	Indicates the optical output connector is SC/APC.

2.3   ITU Channels

Table 2-2 shows the currently available AT3550 models that have optical outputs on specific ITU channel wavelengths. You can go to www.aurora.com/products or contact support@aurora.com to verify that specific ITU wavelengths are available.

Table 2-2   AT3550 Broadcast Transmitters and ITU Channels

AT3550 Models	Wavelength / Frequency	ITU Channel	Channel Group
AT355wx-16-00-AS	1564.68 nm / 191.6 THz	16	H
AT355wx-17-00-AS	1563.86 nm / 191.7 THz	17	
AT355wx-18-00-AS	1563.05 nm / 191.8 THz	18	
AT355wx-19-00-AS	1562.23 nm / 191.9 THz	19	
AT355wx-20-00-AS	1561.42 nm / 192.0 THz	20	J
AT355wx-21-00-AS	1560.61 nm / 192.1 THz	21	
AT355wx-22-00-AS	1559.79 nm / 192.2 THz	22	
AT355wx-23-00-AS	1558.98 nm / 192.3 THz	23	
AT355wx-24-00-AS	1558.17 nm / 192.4 THz	24	K
AT355wx-25-00-AS	1557.36 nm / 192.5 THz	25	
AT355wx-26-00-AS	1556.55 nm / 192.6 THz	26	
AT355wx-27-00-AS	1555.75 nm / 192.7 THz	27	
AT355wx-28-00-AS	1554.94 nm / 192.8 THz	28	L
AT355wx-29-00-AS	1554.13 nm / 192.9 THz	29	
AT355wx-30-00-AS	1553.33 nm / 193.0 THz	30	
AT355wx-31-00-AS	1552.52 nm / 193.1 THz	31	
AT355wx-32-00-AS	1551.72 nm / 193.2 THz	32	M
AT355wx-33-00-AS	1550.92 nm / 193.3 THz	33	
AT355wx-34-00-AS	1550.12 nm / 193.4 THz	34	
AT355wx-35-00-AS	1549.32 nm / 193.5 THz	35	
AT355wx-36-00-AS	1548.51 nm / 193.6 THz	36	N
AT355wx-37-00-AS	1547.72 nm / 193.7 THz	37	
AT355wx-38-00-AS	1546.92 nm / 193.8 THz	38	
AT355wx-39-00-AS	1546.12 nm / 193.9 THz	39	
AT355wx-40-00-AS	1545.32 nm / 194.0 THz	40	P
AT355wx-41-00-AS	1544.53 nm / 194.1 THz	41	
AT355wx-42-00-AS	1543.73 nm / 194.2 THz	42	
AT355wx-43-00-AS	1542.94 nm / 194.3 THz	43	
AT355wx-44-00-AS	1542.14 nm / 194.4 THz	44	R
AT355wx-45-00-AS	1541.35 nm / 194.5 THz	45	
AT355wx-46-00-AS	1540.56 nm / 194.6 THz	46	
AT355wx-47-00-AS	1539.77 nm / 194.7 THz	47	
AT355wx-48-00-AS	1538.98 nm / 194.8 THz	48	S
AT355wx-49-00-AS	1538.19 nm / 194.9 THz	49	
AT355wx-50-00-AS	1537.40 nm / 195.0 THz	50	
AT355wx-51-00-AS	1536.61 nm / 195.1 THz	51	
AT355wx-52-00-AS	1535.82 nm / 195.2 THz	52	T
AT355wx-53-00-AS	1535.04 nm / 195.3 THz	53	
AT355wx-54-00-AS	1534.25 nm / 195.4 THz	54	
AT355wx-55-00-AS	1533.47 nm / 195.5 THz	55	
AT355wx-56-00-AS	1532.68 nm / 195.6 THz	56	U
AT355wx-57-00-AS	1531.90 nm / 195.7 THz	57	
AT355wx-58-00-AS	1531.12 nm / 195.8 THz	58	
AT355wx-59-00-AS	1530.33 nm / 195.9 THz	59	

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Chapter 3   Installing AT3550 Broadcast Transmitters

This chapter describes the installation of AT3550 broadcast transmitters in a CH3000 chassis.

3.1   Planning Your Installation

Plan your installation, and document the plan, before you install any hardware. Consider the following:

- Locate AT3550 transmitters close to related system equipment to enable the easiest optical and RF cable connections and troubleshooting.

- Where applicable, consider the relative location of FA35xx EDFAs relative to AT3550s.

- Locate AT3550 transmitters for optimum fiber optic cable routing, taking advantage of existing cable management hardware and cableways.

- Locate AT3550 transmitters for optimum service access to troubleshoot and install/remove.

- Locate AT3550 transmitters away from heat sources (operating temperature is –20°C to +65°C).

- Build in capacity for the future when practical, to allow for system growth and spare module availability.

3.2   Setting RF Input Levels for AT3550 Transmitters

Note: *RF input levels are set on equipment that is upstream from Aurora's AT3550 transmitters. Refer to that equipment manufacturer's documentation for specific setup procedures.*

The RF input to AT3550 transmitters consists of a number of discrete channels, both analog and digital (QAM). All input channels should be set to the levels shown in Table 3-1, using a spectrum analyzer. The input levels are set differently for analog and digital channels, and if AGC is on (Video or CW modes) or off (Manual mode). The composite RF input depends on the number of analog and digital channels, and can be measured with an RF power meter at the –20 dB test point on the AT3550 front panel, or directly at the RF cable connector that connects to back plate BP-A9. See Table 4-4 for AT3550 channel plans.

Table 3-1   Recommended Input Levels for AT3550 Transmitters

Input	Manual Mode	Video or CW Mode
Analog	17 dBmV/ch	19 dBmV/ch
Digital	11 dBmV/ch	13 dBmV/ch

Note: AGC is on when Video or CW mode is selected.

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CAUTION! Laser Radiation – *Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.*

3.3   Installing AT3550 Broadcast Transmitters

AT3550 transmitters are hot-swappable and can be installed or removed from a CH3000 chassis with power on. They are full-depth modules (13 inches long) and can be plugged into the front or back of the CH3000 chassis (Figure 3-1). Each AT3550 is shipped with a companion BP-A9 back plate that includes RF input (F-type) and optical output (SC/APC) connectors. The AT3550 transmitters offer high packaging density, where up to 4 transmitters can be installed in a single chassis.

Figure 3-1   Installing AT3550 Broadcast Transmitters in the CH3000 Chassis
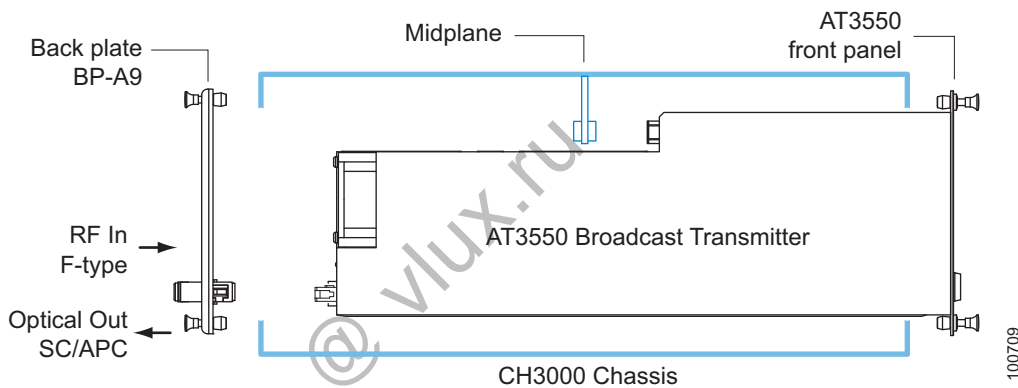
To install AT3550 transmitters:

1. Inspect AT3550 transmitters and BP-A9 back plates for any obvious damage. If a transmitter module or back plate appears to have been damaged in shipping or handling, contact the shipper and Aurora Networks or our local representative or reseller.

2. Determine which slots the AT3550 transmitters and corresponding BP-A9 back plates will be installed in. For example, if an AT3550 transmitter is installed in slots 3–5, the back plate must be installed in slots 28–30. Conversely, if the AT3550 is installed in slots 28–30, the corresponding back plate must be installed in slots 3–5.

Figure 3-2   Installing AT3550 Broadcast Transmitters
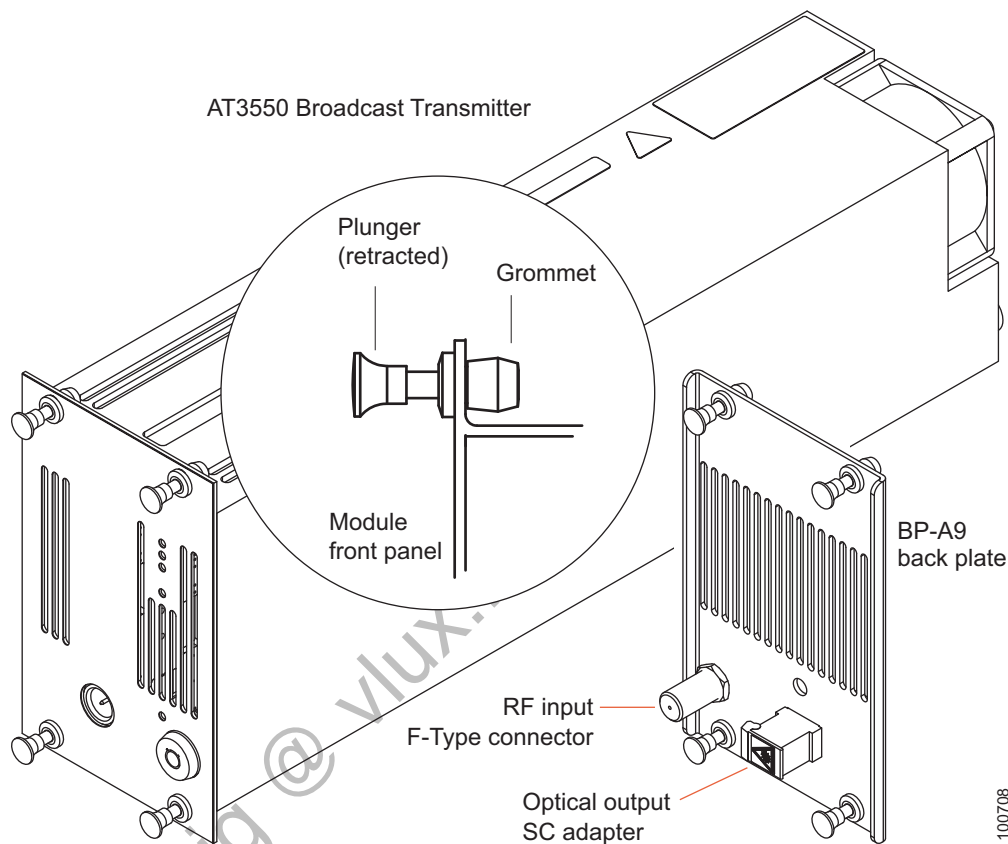
3. Remove the dust cap from the SC/APC connector on BP-A9 back plate (Figure 3-2).
   Pull the four fastener plungers out to the retracted position.
   Position the back plate at the appropriate slot (in the CH3000 chassis).
   Push the plungers in to hold the back plate in place.

Personnel safety must be everyone's first concern. When connecting fiber optics, know where (what equipment) specific fibers originate from and what power levels may be present. Shut the laser/LED source(s) off whenever possible. Use an optical power meter or optical spectrum analyzer when in doubt as to power levels at a fiber optic connector.

CAUTION! Laser Radiation – Avoid any exposure to laser beams. Viewing the laser output with certain optical instruments (e.g. eye loupes, magnifiers and microscopes) may pose an eye hazard.

CAUTION! Laser Radiation – Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Note: *RF input levels should be set as described in section 3.2 before connecting the RF cable to back plate BP-A9.*

4. Connect the RF input cable to the F-type connector on the back plate.
   Connect the optical output cable to the SC/APC connector on the back plate.

5. Remove the dust cap from the SC/APC connector on the back of the AT3550 and clean the SC/APC connector.

6. Insert the AT3550 into the CH3000 chassis.
   Verify that the corresponding BP-A9 back plate is in place.
   AT3550 LED behavior should be as shown in Table 3-2.

7. Turn the Laser key switch on. The red OFF LED will go out.

Table 3-2   AT3550 Broadcast Transmitter LED Behavior

LED	Color	During Power Up	5 Secs after Power Up	Normal Operation	Minor Alarm	Major Alarm	Laser Off	
Status (See Note 1)	Green	On	On	On	On	On		
	Amber	On	On	Off	On	On		
	Red	On	On	Off	Off	On	On	
Access (See Note 2)	Blue	On	Off	Off or blink	Off or blink	Off or blink		
Laser Off	Red	On	On	Off	Off	Off	On	
Laser On (On rear panel)	Green			On				

Note 1: The upper red LED (in the Status group) will be on if the Laser key switch is off, unless the "Front Key in OFF Position" alarm is disabled/masked. See Figure 3-13 for the Alarms tab.

Note 2: The blue Access LED will be on whenever the module is being accessed through the CH3000 midplane.

3.4 AT3550 Broadcast Transmitter Setup

AT3550 transmitters can be monitored and managed either manually (from the chassis management display on PS3002D or PS3048D power supply) or through software (CMS or OTS). Table 3-3 lists transmitter setup tasks, cross-referenced to the applicable sections in this chapter. Table 3-4 lists the AT3550 attributes that can be viewed or set. Column three shows user-settable attributes. Column four shows the applicable GUI tab to view or set an attribute. Column five shows the navigation sequence to view or set an attribute from the chassis management display.

Table 3-3   Transmitter Setup Tasks

Setup Task	From Chassis Management Display	From CMS or OTS
Viewing AT3550 Status	Section 3.5.1	Section 3.6.3
Setting AGC Mode and RF Attenuation	Section 3.5.2	Section 3.6.4
Setting RF Alarm Thresholds	Section 3.5.3	Section 3.6.5
Setting Auto Shutdown Mode	Section 3.5.4	Section 3.6.6
Monitoring AT3550 Alarms	Section 3.5.5	Section 3.6.7

Table 3-4   AT3550 Viewable / Settable Attributes

Parameter	Units	User-settable	GUI Tab	Chassis Management Display Navigation
12 V DC	VDC		Status	
5.0 V DC	VDC			
Temperature	°C			STATUS ▼ MODULE ▼… Temp
Output Power	dBm			STATUS ▼ MODULE► Poutput
RF Input Level	dB			STATUS ▼ MODULE ►►► RFlevel
Front Key Position	On/Off	Yes		
Fan Speed	Low/High			STATUS ▼ MODULE ▼… Fan
Current	mA			
Temperature	°C			
TEC Current	mA			
Remote Laser On/Off Control See Note 1	On/Off			

RF Atten Manual	dB		Status (cont.)	
RF Atten AGC	dB			
SBS Adjustment See Note 2	%			
AGC Mode				
RF Atten Manual	dB	Yes	User Setup	CONTROL ▼◄► AttnMAN ▼◄► (value)
RF Atten AGC	dB	Yes		CONTROL ▼◄► AttnAGC ▼◄► (value)
RF AGC Mode		Yes		CONTROL ▼◄► SetMODE ▼◄► (mode)
RF Min (Alarm threshold)	dB	Yes		CONTROL ▼ setALRM ▼ RF min
RF Max (Alarm threshold)	dB	Yes		CONTROL ▼ setALRM ▼► RF max
Shutdown Control		Yes		CONTROL ▼ Shutdwn
Resume Control		Yes		CONTROL ▼ Shutdwn ► Resume
Shutdown Threshold	dB	Yes		CONTROL ▼ Shutdwn ► Shutdwn Thresh
Serial Number			Module Info	STATUS ▼ MODULE ▼… Ser #
Model				
Manufacturing Date				
Revision				
Software Version				STATUS ▼ MODULE ▼… S/W rev
FPGA Version				
Loader Software Version				
Software Checksum				
FPGA Checksum				

Note 1: Remote Laser On/Off Control is not implemented in Aurora Opti-Trace software. Users can implement this as an added feature from 3rd party software. Contact Aurora for specific MIB information if you want to implement Remote Laser On/Off Control.

Note 2: SBS (Stimulated Brillouin scattering) suppression levels are defined in Table 4-1. SBS adjustment is currently factory set to 50% and cannot be changed by the user.

Table 3-5 lists AT3550 alarms. Alarm severity can be major (service affecting, red) or minor (non-service affecting, yellow) and can be viewed from the Alarms tab of the CMS or OTS GUI, or by navigating to ALARMS or HISTORY in the chassis management display.

Alarm history can be cleared by clicking the Clear Alarm History button in the GUI, or navigating to HISTORY > Clear History in the power supply display.

Table 3-5   AT3550 Alarms

Alarms	User-settable Alarm	Alarm Conditions
Module alarms		
12 V DC	x	Alarms when parameter exceeds factory acceptable limits.
5.0 V DC	x	
Fan	x	Alarms when fan failure is sensed.
Temperature	x	Alarms when parameter exceeds factory acceptable limits.
Front Key in Off Position	x	Alarm is on when key is off.
Laser alarms		
Laser Remotely Off See Note 1	x	Alarms when parameter exceeds factory acceptable limits.
Laser Temperature	x	
Laser Current	x	
Optical Output Power	x	
TEC Current	x	
Miscellaneous alarms		
CSO Error	x	Alarms when parameter exceeds factory acceptable limits.
SBS 6G Power	x	
SBS 2G Power	x	
AGC Unlocked	x	
RF < min	x	RF input below user setting from User Setup tab.
RF > max	x	RF input above user setting from User Setup tab.
Laser Shutdown	x	RF input below shutdown threshold from User Setup Tab

Note 1: This alarm will activate only if users implement Remote Laser On/Off Control from 3rd party software. See Note 1 in Table 3-4.

To view alarms: Click the Alarms tab in either GUI (CMS or OTS) or
navigate to ALARMS in chassis management display.
Go to section 3.5 to manage AT3550 transmitters from the local chassis management display
(on PS3002D or PS3048D power supplies in the CH3000 chassis).
Go to section 3.6 to manage AT3550 transmitters from software.

3.5   AT3550 Management from Chassis Management Display

Plug-in modules in a CH3000 chassis can be managed from the chassis management display on PS3002D or PS3048D power supplies (Figure 3-3). Operators can navigate through the display using the four-way navigation button (◄=left, ►=right, ▲=up, ▼=down) on the power supply front panel.

Each plug-in module type has its own unique display, but all displays share a common structure. Use Figure 3-4, Figure 3-5, and Figure 3-6 to manage AT3550 transmitters.

From the top level of the display, press ◄► to get to the applicable chassis slot (1 through 32), then press ▼ to get to the second level. From the second level, press ◄► to select (1) STATUS, (2) CONTROL, (3) ALARMS, or (4) HISTORY to get to the specific area of interest.

- Select STATUS and navigate deeper to view current transmitter status.
- Select CONTROL and navigate deeper to change transmitter attributes.
- Select ALARMS and navigate deeper to view current alarm status.
- Select HISTORY and navigate deeper to view (and clear) alarm history.

Figure 3-3   Chassis Management Display
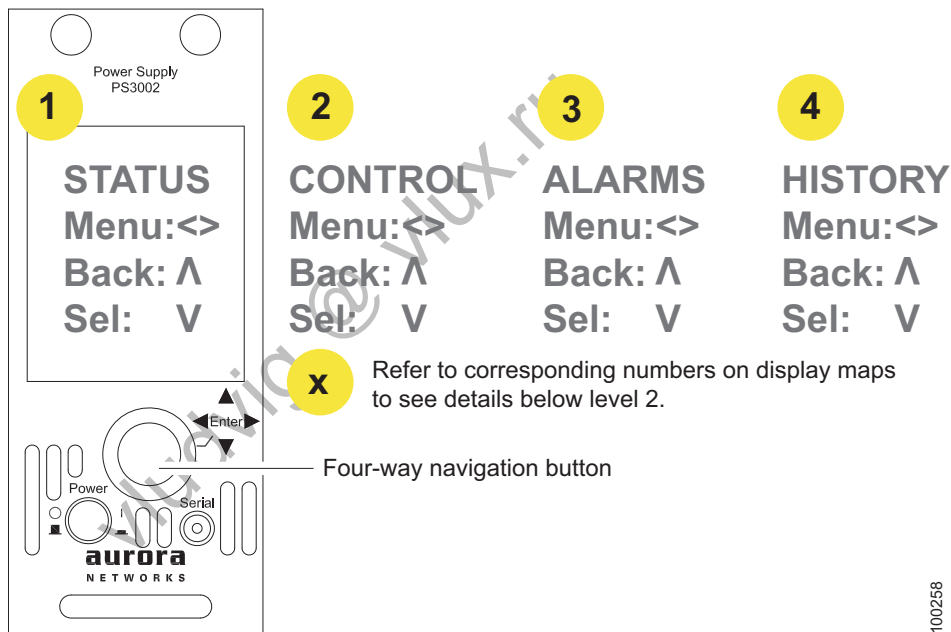
3.5.1 Viewing AT3550 Status from Chassis Management Display

To view the current status of a transmitter:

1. From the top level, press ◄► to select the applicable slot.

2. Press ▼ to select STATUS (#1 on display map—Figure 3-4).

3. Press ▼ and ◄► to navigate through the various STATUS displays.

See Table 3-4 for transmitter parameters that can be viewed.

Figure 3-4   AT3550 Display Map—Status

3.5.2 Setting AGC Mode and RF Attenuation from the Chassis Management Display

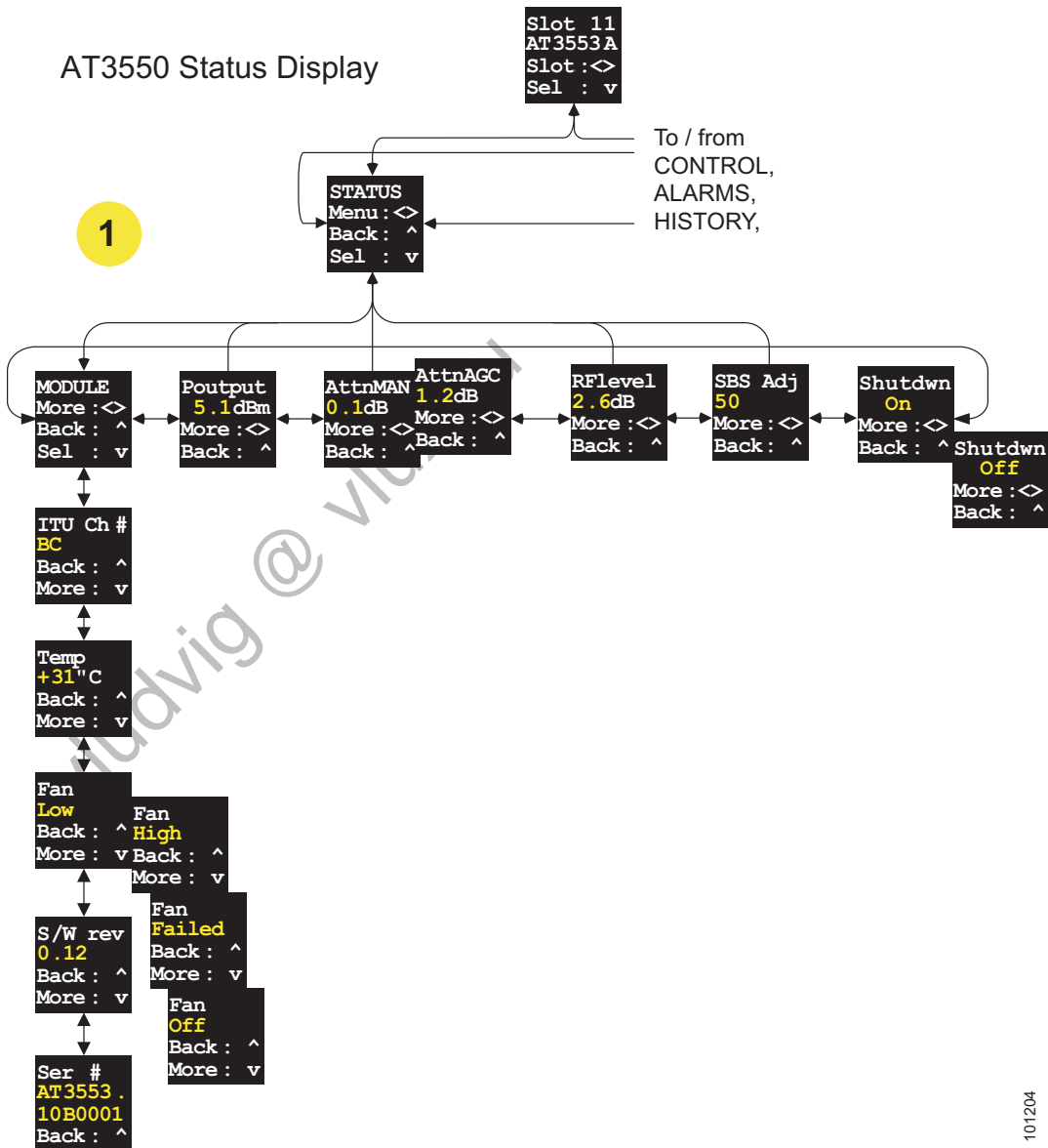The first step in configuring an AT3550 transmitter is setting the desired operating mode (MANUAL, AGC CW, or AGC Vid). The operating mode you choose also determines the input signal levels you set to the AT3550 (see Table 3-1).

To set the operating mode:

1. From the top level, press ◄► to select the applicable slot.

2. Press ▼ then ◄► to select CONTROL (#2 on display map—Figure 3-5).

3. Press ▼ then ◄► to select setMODE.

4. Press ▼ to see current mode.
   Press ◄► to step through modes (MANUAL, AGC CW, AGC Vid).

5. After selecting the desired mode, press ▼ ▼ to confirm entry.

Note: *All external RF input levels should be set per Table 3-1. Input levels depend on the mode selected. Once the input levels have been set correctly the RF input (inside the AT3550) will read 0 dB. If the RF input level displayed in the Status display (Figure 3-4) is higher than 0 dB, add the appropriate RF input attenuation as described here.*

To set RF input attenuation:

1. From the top level, press ◄► to select the applicable slot.

2. Press ▼ then ◄► to select CONTROL (#2 on display map—Figure 3-5).

3. Press ▼ then ◄► to select AttnMAN (or AttnAGC).
   AttnMAN will appear if the module is in the MANUAL mode.
   AttmAGC will appear if the module is in either the AGC Vid or AGC CW mode.

4. Press ▼ then ◄► to set the desired attenuation.

5. After setting the desired attenuation, press ▼ ▼ to confirm entry.

Note: *Adding attenuation here lowers the RF drive to the laser (inside the AT3550). It does not change the RF input level to the AT3550 (at back plate BP-A1).*

Note: *Always reset RF Min and RF Max alarms (section 3.5.3) after setting the input attenuator.*

3.5.3   Setting RF Alarm Thresholds from the Chassis Management Display

Once the input RF to the AT3550 is established, set the input alarms for RF Min and RF Max. The alarm settings (in dB) are relative to the input RF level set in section 3.2.

Note: *Alarm ranges are –12 to +5 db.*
Setting RF Min to –12.5 dB disables that alarm.
Setting RF Max to +5.5 dB disables that alarm.

To set RF input alarm levels, perform steps 1 through 9:
To enable/disable the alarms, perform steps 10 through 16:

1.   From the top level, press ◄► to select the applicable slot.

2.   Press ▼ then ◄► to select CONTROL (#2 on display map—Figure 3-5).

3.   Press ▼ then ◄► to select setALRM (set alarm).

4.   Press ▼ then ◄► to select RF min (set RF minimum alarm).

5.   Press ◄► to select the minimum RF input level alarm.
     If the RF input drops below this level, an alarm is generated.

6.   Press ▼ and ▼ to confirm.

7.   Press ▲ and ◄► to select RF max (set RF maximum alarm).

8.   Press ◄► to select the maximum RF input level alarm.
     If the RF input goes above this level, an alarm is generated.

9.   Press ▼ and ▼ to confirm.

To enable/disable the RF alarms:

10.   From the top level, press ◄► to select the applicable slot.

11.   Press ▼ then ◄► to select CONTROL (#2 on display map—Figure 3-5).

12.   Press ▼ then ◄► to select enALRM (enable alarm).

13.   Press ◄► to select the RF min or RF max alarm.

14.   Press ▼ and ▲ to enable/disable the RF min alarm.

15.   Press ◄► to select the RF max alarm.

16.   Press ▼ and ▲ to enable/disable the RF max alarm.

3.5.4 Setting Auto Shutdown Mode from the Chassis Management Display

Note: *The auto shutdown feature is available on AT3550 transmitters with software 2.95 or newer (see Table 3-6). The software version is displayed on the Status tab (see Figure 3-11).*

Why auto shutdown?

Without auto shutdown, the AT3550 optical output remains active even if the RF input is lost. The AT3550 will alarm on the loss of RF input, but any redundancy switching following the AT3550 output will not sense the loss of RF input.

With auto shutdown enabled, the AT3550 output shuts down when its RF input is lost. Any redundancy switch (in the AT3550 output path) sees the subsequent loss of optical output from AT3550 and switches to an alternate path.

To set auto shutdown mode and thresholds:

1. From the top level, press ◄► to select the applicable slot.

2. Press ▼ then ◄► to select CONTROL (#2 on display map—Figure 3-5).

3. Press ▼ then ◄► to select Shutdwn.

4. Press ▼ or ▲ to Enable or Disable auto shutdown.

5. With auto shutdown enabled press ◄► to select Shutdwn Thresh (thresholds).

6. Press ▼ then ◄► to set threshold.

7. Press ▼ and ▼ to confirm.

8. From step 4 (above) with auto shutdown enabled, press ◄► to select Resume Enable.

9. Press ▼ or ▲ to Resume Enable or Resume Disable.

3.5.5 Monitoring AT3550 Alarms from the Chassis Management Display

To monitor AT3550 alarms from the chassis management display:

1. From the top level, press ◄► to select the applicable slot.

2. Press ▼, then ◄► to select ALARMS (#3 on display map—Figure 3-6).

3. Press ▼ repeatedly to read all current alarms.
   Only active alarms are displayed, inactive alarms are bypassed.
   "History Log not empty" will be displayed in sequence if alarm history exists.

4. Press ▼, then ◄► to select HISTORY (#4 on display map—Figure 3-6) to read alarm history.

Note: *To clear the alarm history, press ▼ from the "Clear History" frame.*

Figure 3-5   AT3550 Display Map—Control
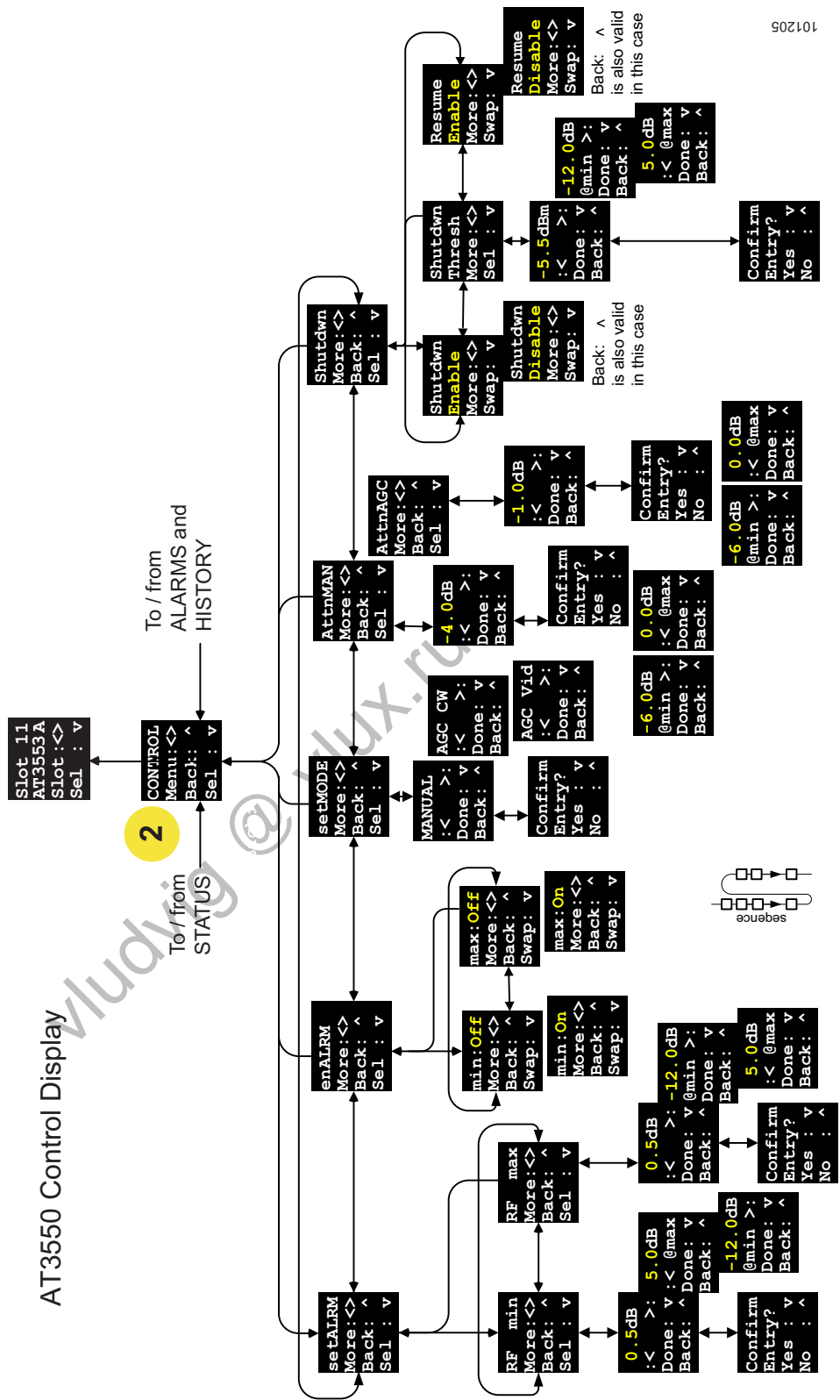
Figure 3-6   AT3550 Display Map—Alarms and History

AT3550 Alarms and History Display

Slot 11
AT3553A
Slot:<>
Sel : v

3

4

To / from
STATUS
and
CONTROL

ALARMS
Menu:<>
Back: ^
Sel : v

HISTORY
Menu:<>
Back: ^
Sel : v

Pressing ▲ returns to ALARMs

Pressing ▲ returns to HISTORY

Notes:

Only active alarm events
are displayed in sequence.
Inactive alarm events are
bypassed.

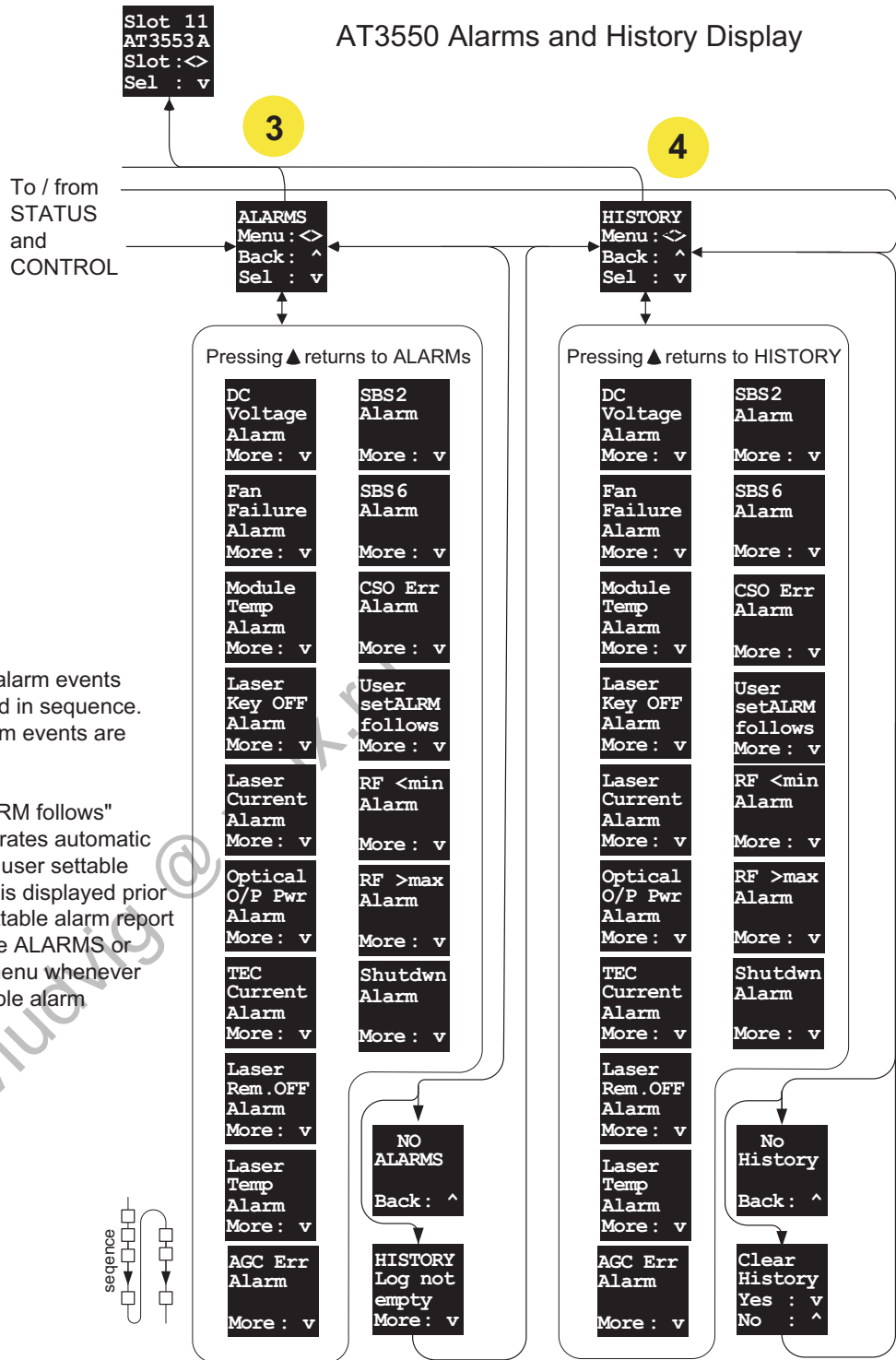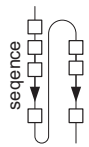"User setALRM follows"
screen separates automatic
alarms from user settable
alarms, and is displayed prior
to a user settable alarm report
as part of the ALARMS or
HISTORY menu whenever
a user settable alarm
is activated

DC
Voltage
Alarm
More: v

SBS2
Alarm

More: v

Fan
Failure
Alarm
More: v

SBS6
Alarm

More: v

Module
Temp
Alarm
More: v

CSO Err
Alarm

More: v

Laser
Key OFF
Alarm
More: v

User
setALRM
follows
More: v

Laser
Current
Alarm
More: v

RF <min
Alarm

More: v

Optical
O/P Pwr
Alarm
More: v

RF >max
Alarm

More: v

TEC
Current
Alarm
More: v

Shutdwn
Alarm

More: v

Laser
Rem.OFF
Alarm
More: v

NO
ALARMS

Back: ^

Laser
Temp
Alarm
More: v

HISTORY
Log not
empty
More: v

AGC Err
Alarm

More: v

seqence

DC
Voltage
Alarm
More: v

SBS2
Alarm

More: v

Fan
Failure
Alarm
More: v

SBS6
Alarm

More: v

Module
Temp
Alarm
More: v

CSO Err
Alarm

More: v

Laser
Key OFF
Alarm
More: v

User
setALRM
follows
More: v

Laser
Current
Alarm
More: v

RF <min
Alarm

More: v

Optical
O/P Pwr
Alarm
More: v

RF >max
Alarm

More: v

TEC
Current
Alarm
More: v

Shutdwn
Alarm

More: v

Laser
Rem.OFF
Alarm
More: v

No
History

Back: ^

Laser
Temp
Alarm
More: v

Clear
History
Yes : v
No : ^

AGC Err
Alarm

More: v

101206

3.6　AT3550 Setup from Software

You can manage AT3550 broadcast transmitters from CMS (craft management software) or OTS (shelf management software).

Use CMS to manage the AT3550 transmitters locally. To use CMS, connect the serial cable (part number 25-10012) from a COM port on a PC to the Serial port on the front of a PS3xxx power supply in the CH3000 chassis the transmitters are installed in.

Use OTS to manage the AT3550 transmitters via the network. To use OTS, connect via the network by entering the IP address of the CX3001 in the CH3000 chassis the transmitters are installed in.

3.6.1　Software Compatibility

To manage AT3550 transmitters effectively you must use compatible software (CMS or OTS). See Table 3-6 for the minimum acceptable software versions of CMS or OTS and CX3001. CX3001 software is only relevant when using OTS to manage transmitters.

Software compatibility is important—incompatible software (software versions older than specified in Table 3-6) may appear to work, but can give invalid results. For software versions newer than specified in Table 3-6, you may see minor differences in some dialog boxes.

Table 3-6　Software Compatibility

Transmitter Model	Transmitter Software Ver	Compatible CMS Ver	Compatible OTS Ver	Compatible CX3001/CX3002 Ver
AT3550	1.19	6.03.27	6.03.36	3.14/3.91
AT3550 with auto shutdown feature	2.95	7.01.04	7.01.03	3.14/3.91

Note: Go to www.aurora.com, enter your e-mail address and password and click on **Support** then **Software** for the latest software release information. If you don't have a password, click *Customer Registration* and register to get your password. After logging in (with your e-mail address and password), select **Support** and **Software** to see the latest software versions. You can also send e-mail to support@aurora.com.
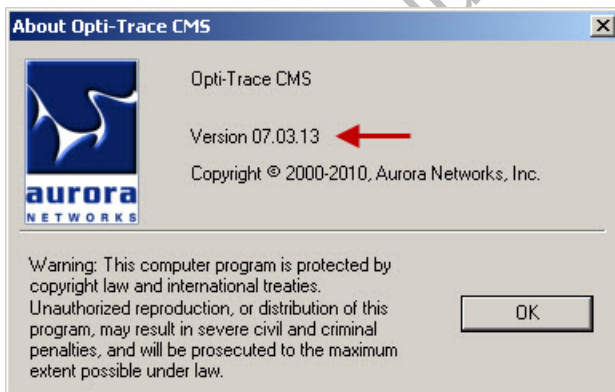
To find the software version of an AT3550 transmitter, open CMS (or OTS) and click on the transmitter slot to open the dialog box. Click the Module Info tab to see the software version of the transmitter (Figure 3-7).
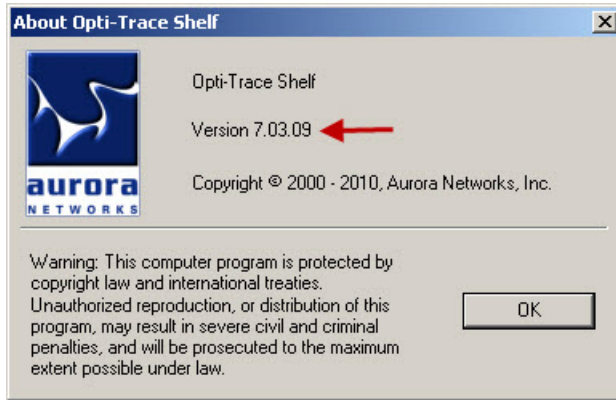
Figure 3-7   AT3550 Module Info Tab
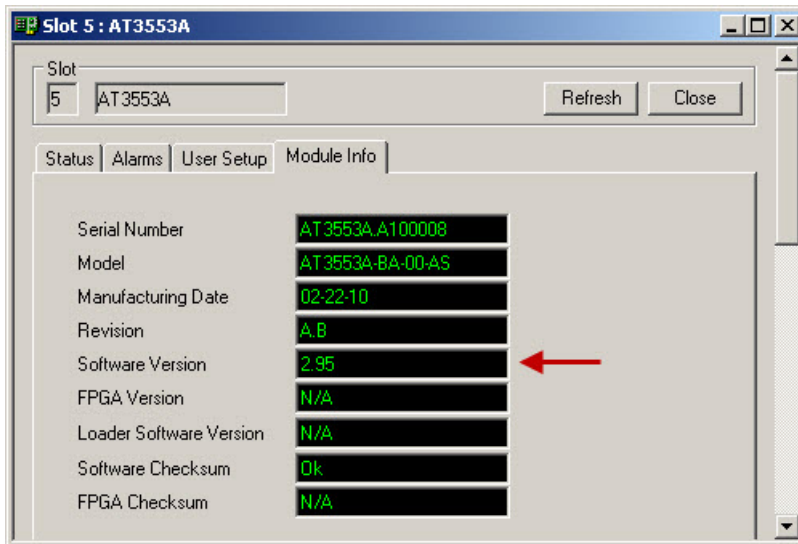
To find the CMS version, open CMS and click Help > About Opti-Trace CMS (Figure 3-8).

**Figure 3-8   Software Version Display—CMS**

To find the OTS version, open OTS and click Help > About Opti-Trace Shelf (Figure 3-9). If you are using OTS, you also need to check the software version of the CX3001 (Figure 3-10).

Figure 3-9   Software Version Display—OTS

To find the CX3001/CX3001 version, open CMS (or OTS) and click on the slot for the CX3001/CX3002 to open the dialog box. Click the Module Info tab to see the software version of the CX3001/CX3002 (Figure 3-10).

Figure 3-10   Software Version Display—CX3001/CX3002
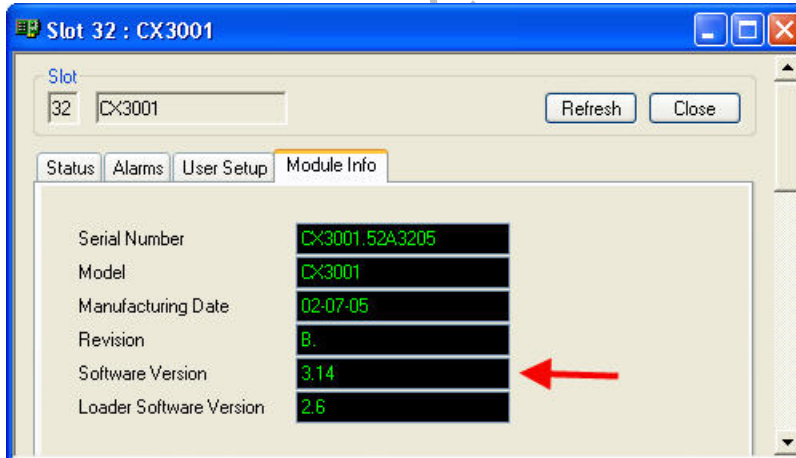
3.6.2   Downloading CMS or OTS from Aurora

If you don't have the required versions of CMS or OTS (see Table 3-6) installed, you can download the latest software from Aurora's Web site.

Note: *Go to www.aurora.com and click on **Support** then **Software** for the latest software release information. This area requires a password. If you don't have a password, click <u>Customer Registration</u> and register to get your password. After logging in (with your e-mail address and password), select **Support** and **Software** to see the latest software versions. You can also send e-mail to <u>support@aurora.com</u>.*

To download Opti-Trace CMS or OTS from Aurora's Web site:

1.   From your Internet browser, go to <u>http://www.aurora.com</u>.

2.   Enter your e-mail address and password and click the GO button.
     (If you don't have a password, see note above).

3.   Click **Support** and **Software**.

4.   Click on the software you want to download.
     For example, <u>Opti-Trace Shelf Management Software (OTS)</u>

5.   Click the **Accept** button to accept the license agreement.

6.   Click on the **Save File** button.

7.   Click on the .exe file and follow the instructions.

If you have any problems downloading or installing CMS or OTS, phone 888.AURORA6 (888.287.6726) toll free for technical support, or e-mail <u>support@aurora.com</u>.

### 3.6.3   Viewing AT3550 Status from CMS or OTS

The AT3550 Status tab (Figure 3-11) shows the current setup and status of the module, an AT3553A in this example.

See Table 3-4 for transmitter parameters that can be viewed.

See section 3.6.4 to set/change the AGC Mode displayed in this tab.

See section 3.6.6 to set/change the Auto Shutdown state displayed in this tab.

Figure 3-11   AT3550 Status Tab
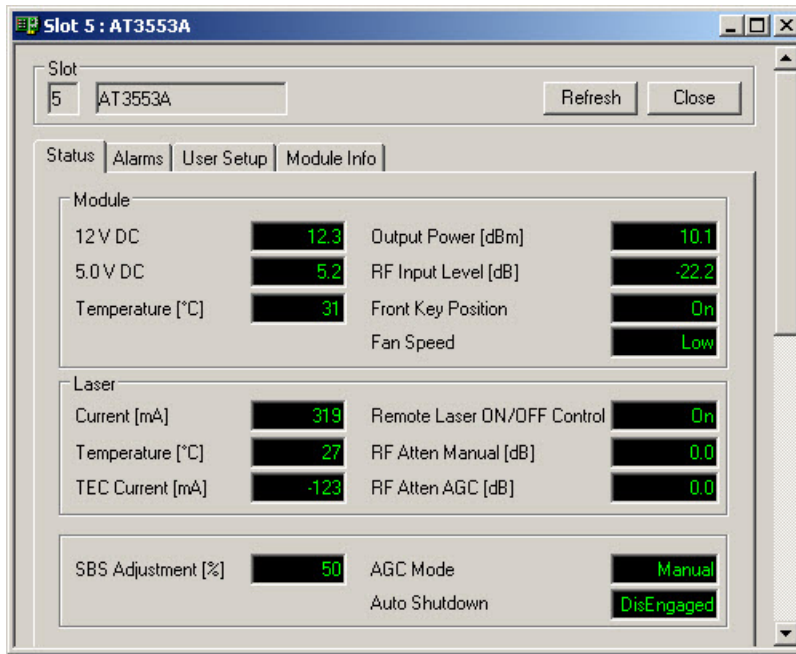
3.6.4 Setting AGC Mode and RF Attenuation from CMS or OTS

The first step in configuring an AT3550 transmitter is setting the desired operating mode (Video, CW, or Manual). The operating mode you choose also determines the input signal levels you set to the AT3550 (see Table 3-1).

To set the operating mode:

1. Click on the User Setup tab (Figure 3-12).

2. Select the appropriate mode from the drop-down menu of the RF Atten Mode field.
   Select Video mode to enable AGC.
   Select Manual mode to operate without AGC.
   CW mode also enables AGC. CW mode is for testing and is not a normal operating mode.

3. Click the Accept button to save your selection.

Figure 3-12   AT3550 User Setup Tab

Note: *All external input levels should be set per Table 3-1. Input levels depend on the mode selected. Once the input levels have been set correctly the RF input (inside the AT3550) will read 0 dB. If the RF input level displayed in the Status tab (Figure 3-11) is higher than 0 dB, add the appropriate RF input attenuation as described here.*

To set RF input attenuation (Figure 3-12):

1. Using the up/down arrows for the RF Atten Manual or RF Atten AGC field (depending on the current mode) add the appropriate attenuation.

2. Click the Accept button to save the new attenuation value.

Note: *Adding attenuation here lowers the RF drive to the laser (inside the AT3550). It does not change the RF input level to the AT3550 (at back plate BP-A1).*

Note: *Always reset RF Min and RF Max alarms (section 3.5.3) after setting the input attenuator.*

3.6.5 Setting RF Alarm Thresholds from CMS or OTS

Once the input RF to the AT3550 is established, set the input alarms for RF Min and RF Max. The alarm settings (in dB) are relative to the input RF level set in section 3.2.

Note: *Alarm ranges are –12 to +5 db. Setting RF Min to –12.5 dB disables that alarm. Setting RF Max to +5.5 dB disables that alarm.*

To set RF Min and Max alarm thresholds (Figure 3-12):

1. Enter the appropriate value in the RF Min field.

2. Click the Accept button.

3. Enter the appropriate value in the RF Max field.

4. Click the Accept button.

The RF < Min and RF > Max alarms are shown at the bottom of the Alarms tab (Figure 3-13)

3.6.6 Setting Auto Shutdown Mode from CMS or OTS

Why auto shutdown?

Without auto shutdown, the AT3550 optical output remains active even if the RF input is lost. The AT3550 will alarm on the loss of RF input, but any redundancy switching following the AT3550 optical output will not sense the loss of RF input.

With auto shutdown enabled, the AT3550 output shuts down when its RF input is lost. Any redundancy switch (in the AT3550 output path) sees the subsequent loss of optical output from the AT3550 and switches to an alternate path.

To set auto shutdown modes and alarm thresholds (Figure 3-12):

1. Enter the Shutdown Threshold (–12 to +5 dB in 0.5 dB increments) and click the Accept button.
   The shutdown threshold should be set just below the nominal input to the AT3550.
   Click the Accept button to the right of Shutdown Threshold field to save the value.

2. Select On from the Shutdown Control dropdown menu and click the Accept button.

3. Select On from the Resume Control dropdown menu if you want the AT3550 output to resume automatically if/when the RF input comes back on (above the threshold set in step 1).
   Set Resume Control to OFF if you want restore the AT3550 manually.
   Click the Accept button to save the setting.

3.6.7 Monitoring AT3550 Alarms from CMS or OTS

Alarms are shown as a mix of Major and Minor alarms in Figure 3-13. You can change alarm from the drop-down menu for each alarm. Click the Accept button to save any alarm severity changes.

Selected alarms can be disabled by unchecking the corresponding checkboxes in the Alarm Enable column. Click the Accept button to save the enable/disable changes. If an alarm is disabled (RF < min and RF > max in this example) the Major/Minor field and Alarm and History LEDs for that alarm are grayed out.

To monitor AT3550 alarms from CMS or OTS:

1. Click on the Alarms tab (Figure 3-13) to read current and historical alarms.

2. Click the Refresh button to update alarms.

3. Click the Clear Alarm History button to clear alarms history for this module.

Figure 3-13   AT3550 Alarms Tab
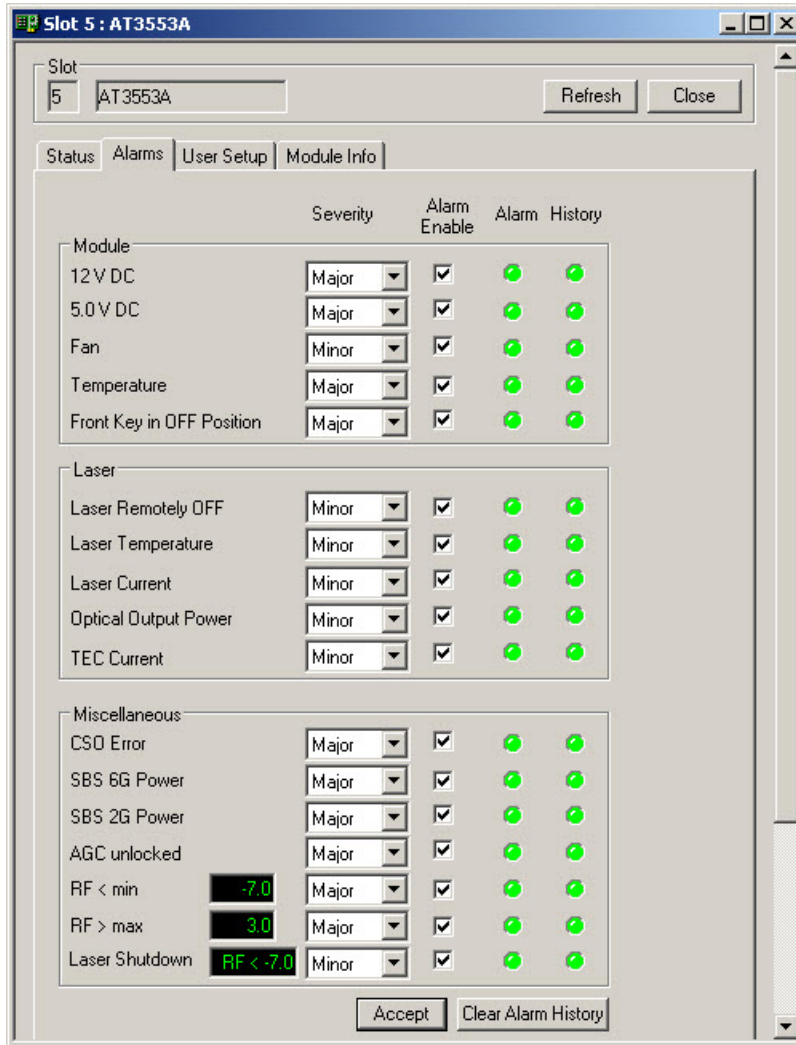
3.7 Cooling Fan Replacement

Cooling fans can be replaced in the field. Use only Aurora part number 73-10009+ .

To replace a cooling fan:

1. Remove the AT3550 from the chassis and place a dust cap on the optical connector.

2. Using a #0 Phillips tip screwdriver, remove the three screws (and lock washers) holding the fan.

4. Carefully lift the fan and remove the perforated plate behind the fan.

5. Disconnect the fan power connector and remove the fan from the unit.

6. Inspect the new fan for any obvious damage before installing it. If the fan appears to have been damaged in shipping or handling, contact the shipper and Aurora Networks or our local representative or reseller.

7. Connect the fan power connector (red to red, black to black).

8. Reinstall the perforated plate behind the new fan. Ensure that the fan leads are in the cutout so they will not be pinched between the fan and the module.

9. Replace the three screws (and lock washers) holding the fan in place.

10. Remove the dust cap from the optical connector just before replacing the AT3550 in the chassis.

Figure 3-14   Cooling Fan Replacement
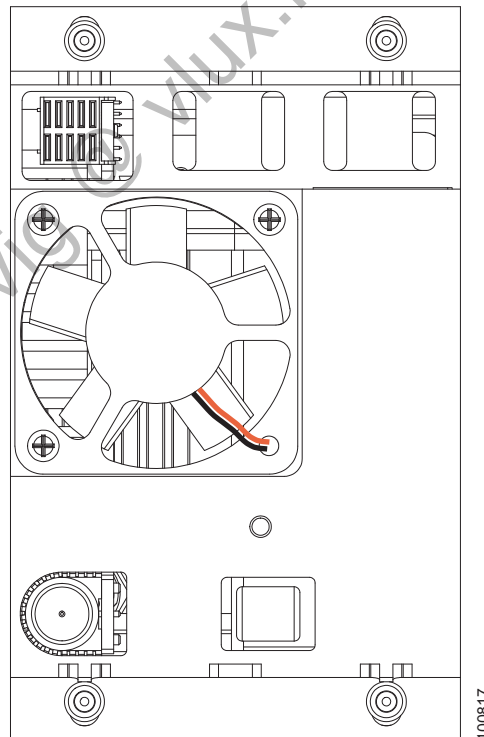
Chapter 4   Specifications—AT3550 Transmitters

This chapter lists specifications for Aurora Networks' AT3550 Broadcast Transmitters described in this guide.

4.1   Glossary

Acronym	Definition
AGC	Automatic gain control
BER	Bit error rate
CENELEC	European Committee for Electrotechnical Standardization
CNR	Carrier-to-noise ratio
CSO	Composite second order
CTB	Composite triple beat
CW	Continuous Wave
DWDM	Dense wave division multiplex
EDFA	Erbium-doped fiber amplifier
ITU	International Telecommunication Union
NTSC	National Television System Committee
OMI	Optical modulation index
PAL	Phase Alternating Line
QAM	Quadrature amplitude modulation
SBS	Stimulated Brillouin scattering
XMOD	Cross modulation

4.2 Specifications

The following tables list detailed specifications for the AT3550 broadcast transmitters.

Table 4-1   AT3550 Functional Specifications

Specification	Unit	Value	Conditions / Comments
General			
Operating temperature range	°C	0 to +50	External to the rack
Storage temperature range	°C	–40 to +85	
Module dimension D x H x W	inch	13.0 x 4.3 x 3.0	Approximately
Module weight	lbs	5.0	
Link specifications			See Table 4-3
Channel plans			See Table 4-4
RF interface			
Main RF input		F-type	Female connector at back plate BP-A9
Input test point		G-type	Male connector at front panel
Hot plug-in/out	–	Yes	
Regulatory requirements	–		UL/CSA
Laser safety requirements	–	Yes	FDA-CDRH/OSHA laser warning label
Alignment		Input attenuator	Manual
Powering	W	45 (max)	12 VDC

Specification	Unit	Value	Conditions / Comments
Electrical			
Pass band	MHz	46 to 1002	
Frequency response flatness (min)	dB		
46 to 870 MHz		±0.5	Including slope
46 to 1002 MHz		±0.75	Including slope
Input impedance	Ω	75	
Input return loss (min)			
46 to 1002 MHz	dB	17	
Level stability	dB	±0.6	over operating temperature range, 72 hours
Nominal input level–AGC mode	dBmV/ch	19	CW carriers 50 to 550 MHz
		13	QAM 552 to 1002 MHz
Nominal input level–Manual mode	dBmV/ch	17	CW carriers 50 to 550 MHz
		11	QAM 552 to 1002 MHz
AGC range	dB	−3 to +3	
Gain control range (MOD adjust)	dB	0.0 to −6.0	
Gain control step size (MOD adjust)	dB	0.25	
Optical			
Optical output power	dBm	9.5 min	
		11 max	
Wavelength			
AT355wx-BA-00-AS	nm	1563	
AT355wx-BC-00-AS		1545	
AT355wx-yy-00-AS		ITU channels	See Table 2-2 for specific ITU channels
Optical interface		SC/APC	At back plate BP-A9
SBS (Stimulated Brillouin scattering)			
AT3553	dBm	16	Factory set
AT3554		14	
Front Panel			
Status LED (green)	LED	green	Lit when module is powered
Status LED (yellow)	LED	yellow	Lit when any non-service-affecting (minor) alarm is activated
Status LED (red)	LED	red	Lit when any service-affecting (major) alarm is activated
Access LED	LED	blue	Lit when module is communicating with bus in CH3000 chassis
RF input test point	dB	−20 ± 1	G-male; return loss better than 16 dB
Key			Turns laser on/off status indicated by red LED

Specification	Unit	Value	Conditions / Comments
Rear Panel			
RF input connector on the back of the transmitter		G-type	
RF input connector on back plate BP-A9		F-type to G-type	
Optical output connector		SC/APC	
Laser ON LED		green	Lit when laser is on

Table 4-2   AT3550 Performance Specifications

Specifications	Unit	AT3553	AT3554
Optical output power	dBm	9.5 min	9.5 min
SBS suppression	dBm	16	14
Carrier-to-Noise (0–50°C) [4MHz NBW] See Note 1.	dB		
77 NTSC, 50 to 550 MHz, no QAM channels		53.0	51.5
450 MHz, 75 QAM channels up to 750 MHz		51.3	49.9
CENELEC 45 to 858 MHz		52.5	51.0
Carrier-to-CSO (0–50°C) See Note 1.	dB		
77 NTSC, 54 to 745 MHz		67.0	65.0
CENELEC 45 to 858 MHz		65.0	TBD
Carrier-to-CTB (0–50°C) See Note 1.	dB		
77 NTSC, 54 to 870 MHz		66.0	64.0
CENELEC 45 to 858 MHz		65.0	TBD
Carrier-to-XMOD1, 2 (0–50°C) See Note 1.	dB	65.0	64.0
256 QAM BER with CW analog carriers	BER	1.0 E-5	1.0 E-5
ITU-C before error correction, measured at 1 minute independent intervals over a period of 15 minutes.			

Note 1:   Channel loading (except CENELEC):
      54 to 552 MHz for CW
      552 to 1002 MHz for QAM (–6dB below CW)			

Table 4-3   Link Specifications

Link Parameter	AT3553 (Medium Link)	AT3554 (Extended Link)
Total link distance [km] / min fiber loss [dB] at 0.2 dB/km	65 km / 13 dB	100 km / 20 dB
Maximum launch power into fiber [dBm]	16 dBm	14 dBm
First fiber link	65 km	45 km
Mid-span EDFA output power into fiber [dBm]	None	14 dBm

Table 4-4   Channel Plans

Chan Plans	Analog	Digital
NTSC 77	77 CW channels between 54 and 552 MHz	Up to 75 QAM 256 channels, 6 MHz spacing, from 552 to 1002 MHz. Set at −6 dBc relative to analog carriers.
PAL B/G 64	64 CW channels between 47 and 552 MHz	Up to 55 QAM 256 channels, 8 MHz spacing, from 552 to 1002 MHz. Set at −6 dBc relative to analog carriers.
CENELEC 42	42 channels per CENELEC definition	None

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Chapter 5   Cleaning Fiber Optic Connectors

This chapter describes how to clean fiber optic connectors and adapters. Cleaning materials are listed, and both wet and dry cleaning methods are described.

CAUTION! Laser Radiation – Avoid any exposure to laser beams. Viewing the laser output with certain optical instruments (e.g. eye loupes, magnifiers and microscopes) may pose an eye hazard.

Note: *Do not attempt to clean fiber optic ports or connectors with laser light present..*

5.1   Introduction

Many fiber optic system problems can be traced to dirty connectors or faulty connections. For best results, use the cleaning procedures offered here, or procedures prescribed by your facility/employer.

The general area around fiber optic equipment should be maintained as clean as possible to minimize the risk of connector contamination. The diameter of the fiber core of a single mode fiber is about 8.2 µm. Dust, oil and other particles can easily be larger than 1 µm and could cause significant optical losses and other impairments in transmission performance.

5.2   Handling Fiber Optic Cables and Connectors

Use the following guidelines when handling fiber optic cables and connectors:

- Avoid touching the end of a fiber connector with your fingers or any surface other than the mating connector.

- Keep dust caps on connectors when the connectors are not being used. Air dust the caps before reuse.

- Mate fiber optic connectors only with other connectors of the same type (APC to APC, UPC to UPC). That is, an APC (angled polished connector) should only be mated with another APC connector. Physical connector damage will result if a UPC (ultra polished connector), which has a flat polished end surface, is mated with an APC connector.

- To avoid fiber breaks, do not pull, twist, crimp or apply excessive stress to the fiber cable.

- Avoid excessive tilting of the connector during insertion of the connector to prevent damage or scratching of the fiber end.

## 5.3   Inspection Equipment and Cleaning Materials

The following inspection equipment and cleaning materials are recommended:

- Hand held optical inspection fiber scope (400x recommended) microscope (Figure 5-1) or video fiber scope (not shown).

- Connector cleaner cassette (Figure 5-2 A).

- 2.5mm cleaning sticks or 1.25 mm sticks: CLETOP cleaning stick is recommended. Do not use cotton Q-tips (Figure 5-2 B). Cotton swaps leave residues and threads behind.

- Chemtronics ES 1020 canned filtered air (0.02µm) (Figure 5-2 C).

- Lint-free cloth/paper such as Kim Wipes (Figure 5-2 C).

- Solvent dispenser and optics grade (>99% pure) Isopropyl alcohol.

Figure 5-1   Fiber Scope

Figure 5-2   Connector Cleaning Materials

A

B

C
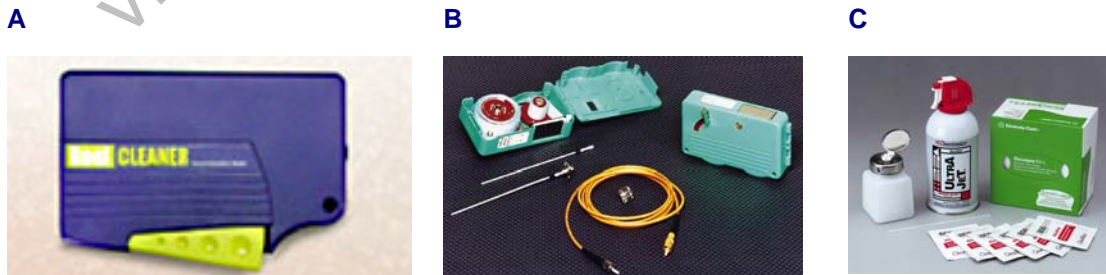
## 5.4   Inspecting Fiber Optic Cables and Connectors

CAUTION! Laser Radiation – *Avoid any exposure to laser beams. Viewing the laser output with certain optical instruments (e.g. eye loupes, magnifiers and microscopes) may pose an eye hazard.*

Optical connectors should be inspected for cleanliness using a viewer such as the fiber scope shown in Figure 5-1. For eye safety, make sure light sources are turned off. Special adapters may be required to inspect the various types of optical connectors (SC, FC, LC). Ensure that the adapters themselves are cleaned first, as dirt can easily migrate or transfer from one surface to another.

Figure 5-3 shows some typical examples of connector contamination and damage:

- Clean connector (Figure 5-3 A).
- Connector with dirt such as dust particle (Figure 5-3 B).
- Connector with oil such as fingerprint oil (Figure 5-3 C).
- Connector with scratches (Figure 5-3 D).

Figure 5-3   Fiber Optic Cable with Typical Faults
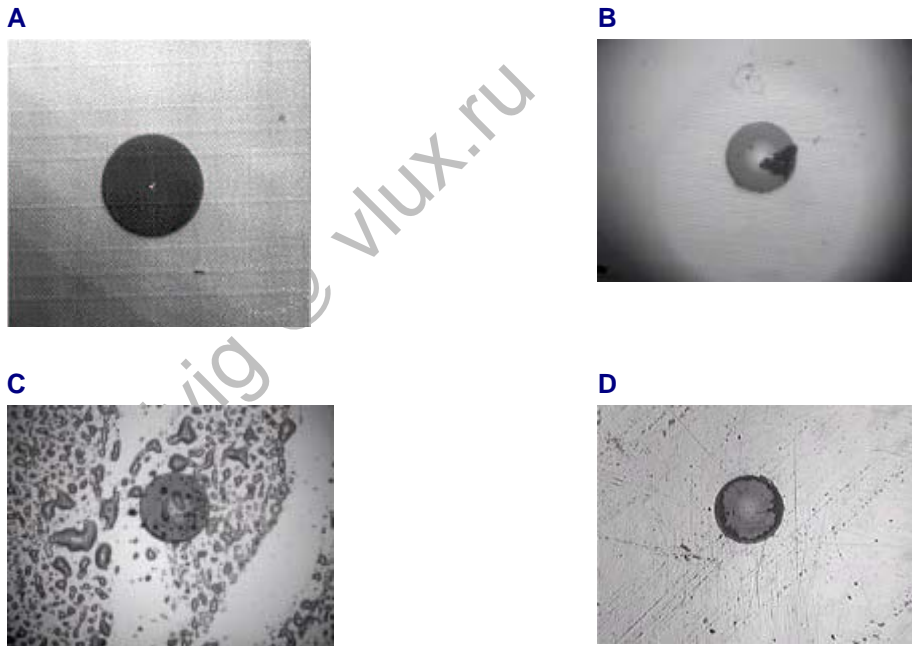
A connector withdrawn from a mating sleeve (adapter) that is found contaminated would usually indicate that the other side of the mating connector is contaminated also. Therefore, both connectors and the adapter should be properly cleaned before re-mating them.

5.5   Cleaning Procedures

Every fiber optic end face should be cleaned before each connection. Ensure that optical power is turned OFF before cleaning a connector.

5.5.1   Connector Cleaning—Dry Method

Perform the following steps to clean fiber optic connectors using the dry method (see Figure 5-4).

- Use CLETOP or lint-free tissue/cloth to wipe gently across the connector end-face.

- Do not apply excessive pressure to "scrub" off dirt unless repeated attempts had failed. Do not use the edge of the lint-free tissue/cloth to clean a connector.

- When picking up a piece of lint-free tissue, use the side that's facing down for cleaning. Do not use the same area of the lint-free cloth/tissue more than once. When using CLETOP, slide the connector only once over the cleaning surface.

- If the end-face is still dirty, proceed to wet-cleaning (section 5.5.2).

Figure 5-4   Connector Cleaning—Dry Method
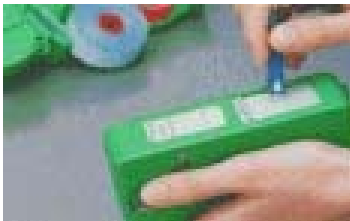
5.5.2 Connector Cleaning—Wet Method

Perform the following steps to clean fiber optic connectors using the wet method (see Figure 5-5).

- Wipe the dispenser clean with lint-free tissue/cloth.

- When picking up a piece of lint-free tissue, use the side that's facing down for cleaning. Do not use the same area of the lint-free cloth/tissue more than once.

- Moisten the lint-free tissue/cloth with Isopropyl alcohol (>99%) and draw it across the end-face of the optical connector.

- Use a dry lint-free tissue/cloth to wipe it dry. Do not let the surface air dry, as this may result in residue being left behind on the connector.

Figure 5-5 Connector Cleaning—Wet Method

After cleaning, connect the fiber end to the intended port or device to minimize air exposure with possible contamination. If the end-face of the fiber jumper is damaged or scratched beyond cleaning or repair, replace the fiber jumper with a new one whose end-faces are acceptable.

5.5.3 Adapter Cleaning

Using pressurized canned air, such as Chemtronics ES 1020, blow away any dust particles that may be on the interior surface of the adapter, particularly the inside walls of the alignment sleeve. Hold the can approximately 2 inches from the receptacle to be cleaned and apply 2-3 short blasts of air. Short burst should be used; long burst of air may cause condensation to form.

- Do not shake or invert the pressurized can before or during use.
  Do not apply pressurized canned air directly to end surface of a connector.

- In most cases, this is sufficient for cleaning an adapter. However, if some dust particle still adhere to the interior surface, wet cleaning might be required.

- To wet-clean the adapter, moisten the end of a swab (CLETOP stick highly recommended) with isopropyl alcohol, and insert it into the adapter.

- Insert the moistened swab fully into the bulkhead and rotate the swab back and forth 90 degrees twice, twisting the swab between your thumb and finger to assure a thorough cleaning.

- Remove and discard the swab. Do not use the same swab on more than one adapter.

- Dry the inside of the receptacle by holding the pressurized canned air approximately two inches from the end of the bulkhead and apply two or three short blasts of air.

5.5.4   Transceiver Interface Cleaning

Use the following procedure to clean optical ports on TR4000-PI (and similar) plug-in optical transceiver modules.

- When using compressed air, do not shake the can. Hold the can upright and apply short bursts only, as mentioned in adapter cleaning section above.

- Do not apply compressed air directly into the receptacle where the connector ferrule would enter. Direct air to the surrounding outer perimeter to reduce potential contaminants from entering into the optical interface.

- Moisten a clean, unused CLETOP stick with Isopropyl alcohol (>99%). Shake off excess alcohol. Gently insert the stick into the receptacle sleeve and rotate it twice (Figure 5-6). Do not to apply excessive force when pushing the stick into the receptacle.

- Discard the stick and insert a new clean CLETOP stick and again, rotate it twice.

- You can use a video inspection scope to verify transceiver interface cleanliness.

- The operation can be repeated. If you cannot get the interface clean after multiple tries, or the interface doesn't work when connected, contact customer support.

Figure 5-6   Cleaning Plug-in Optical Transceiver Interfaces
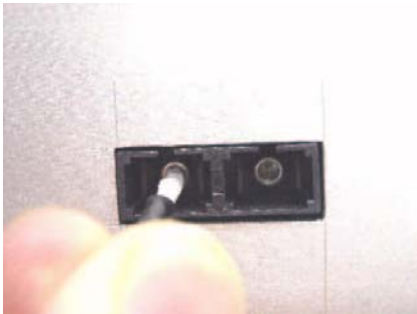
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