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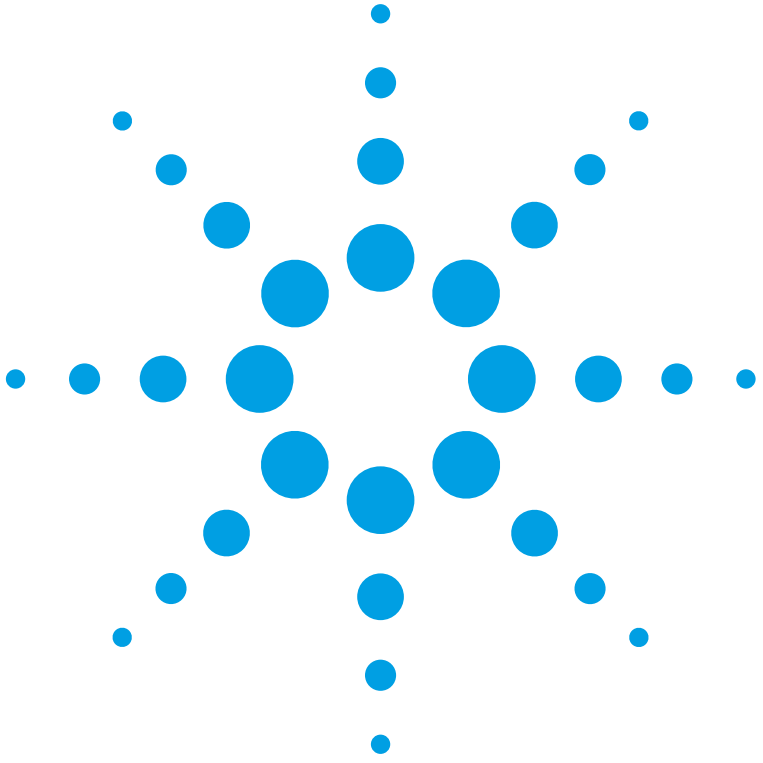
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Agilent 83438A Erbium ASE Source User's Guide



Agilent Technologies

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Agilent Part No. 83438-90010
Printed in USA
February 2000

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CAUTION

The *caution* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING

The *warning* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning sign until the indicated conditions are fully understood and met.


The instruction manual symbol. The product is marked with this warning symbol when it is necessary for the user to refer to the instructions in the manual.


The laser radiation symbol. This warning symbol is marked on products which have a laser output.


The AC symbol is used to indicate the required nature of the line module input power.


The ON symbols are used to mark the positions of the instrument power line switch.


The OFF symbols are used to mark the positions of the instrument power line switch.


The CE mark is a registered trademark of the European Community.


The CSA mark is a registered trademark of the Canadian Standards Association.


The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.

ISM1-A This text denotes the instrument is an Industrial Scientific and Medical Group 1 Class A product.

Typographical Conventions.
The following conventions are used in this book:

Key type for keys or text located on the keyboard or instrument.

Softkey type for key names that are displayed on the instrument's screen.

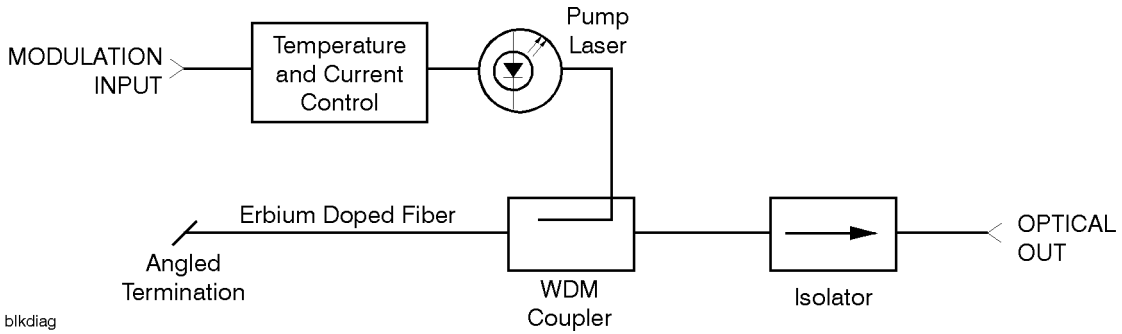
`Display type` for words or characters displayed on the computer's screen or instrument's display.

User type for words or characters that you type or enter.

Emphasis type for words or characters that emphasize some point or that are used as place holders for text that you type.

The Agilent 83438A—At a Glance

The Agilent 83438A Erbium ASE Source provides incoherent light for characterizing fiber-optic components. Its output is centered at approximately 1550 nm. Because it has a relatively high-power spectral density, you can probe devices with medium or high insertion loss. Its single-mode output originates from the amplified spontaneous emission (ASE) of an Erbium doped fiber amplifier. The power spectral density of the output is up to one hundred times (20 dB) greater than that of edge emitting LEDs (for example, the Agilent 83437A Broadband Light Source) and up to 100,000 times (50 dB) greater than white-light tungsten lamp sources. An internal optical isolator protects the Agilent 83438A from back reflections from the device under test. This greatly improves the power stability of the Agilent 83438A.



Block Diagram of Agilent 83438A

The output can be modulated or turned off

You can digitally modulate the output using a TTL compatible signal. For a complete discussion of modulating the output light and making measurements with your Agilent 83438A, refer to Chapter 2, "Making Measurements".

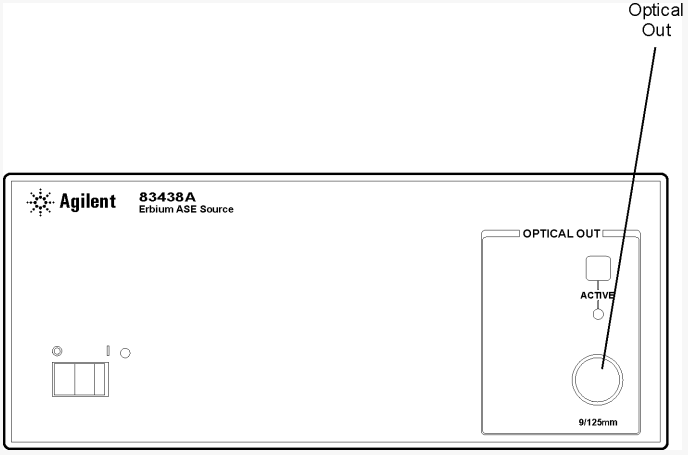
Measurement accuracy—it's up to you!

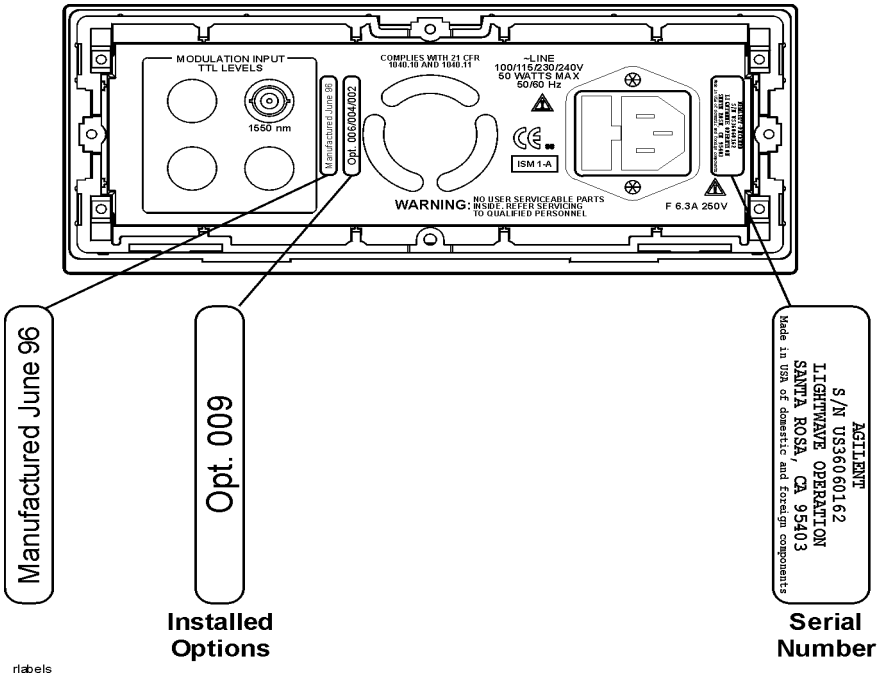
Fiber-optic connectors are easily damaged when connected to dirty or damaged cables and accessories. The Agilent 83438A's front-panel OPTICAL OUT connector is no exception. When you use improper cleaning and handling techniques, you risk expensive instrument repairs, damaged cables, and compromised measurements.

Before you connect any fiber-optic cable to the Agilent 83438A, refer to "Cleaning Connections for Accurate Measurements" on page 2-11.

Laser classification

The Agilent 83438A is classified as an IEC LASER Class 1. The total power of light energy radiated out of the OPTICAL OUT connector is no greater than +8.1 dBm (6.5 mW) at a wavelength of 1550 nm. Operator maintenance or precautions are not necessary to maintain safety. No controls, adjustments, or performance of procedures result in hazardous radiation exposure.





rlabels

Rear view of instrument

General Safety Considerations

This product has been designed and tested in accordance with IEC Publication 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, and has been supplied in a safe condition. The instruction documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

WARNING **If this instrument is not used as specified, the protection provided by the equipment could be impaired. This instrument must be used in a normal condition (in which all means for protection are intact) only.**

WARNING **To prevent electrical shock, disconnect the Agilent 83438A from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

WARNING **This is a Safety Class 1 product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**

WARNING **For continued protection against fire hazard, replace line fuse only with same type and ratings, (type T 0.315A/250V for 100/120V operation and 0.16A/250V for 220/240V operation). The use of other fuses or materials is prohibited. Verify that the value of the line-voltage fuse is correct.**

- For 100/120V operation, use an IEC 127 5×20 mm, 0.315 A, 250 V, Agilent part number 2110-0449.
- For 220/240V operation, use an IEC 127 5×20 mm, 0.16 A, 250 V, Agilent Technologies part number 2110-0448.

CAUTION Before switching on this instrument, make sure that the line voltage selector switch is set to the line voltage of the power supply and the correct fuse is installed. Assure the supply voltage is in the specified range.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

CAUTION VENTILATION REQUIREMENTS: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4°C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

CAUTION Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause instrument damage.

CAUTION *Do not* connect ac power until you have verified the line voltage is correct as described in "Line Power Requirements" on page 1-6. Damage to the equipment could result.

CAUTION This instrument has autoranging line voltage input. Be sure the supply voltage is within the specified range.

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Getting Started

Getting Started

The instructions in this chapter show you how to install your Agilent 83438A. You should be able to finish these procedures in about ten to twenty minutes. After you've completed this chapter, continue with Chapter 2, "Making Measurements".

Refer to Chapter 3, "Specifications and Regulatory Information" for information on operating conditions such as temperature.

If you should ever need to clean the cabinet, use a damp cloth only.

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

CAUTION This product has autoranging line voltage input. Be sure the supply voltage is within the specified range.

CAUTION VENTILATION REQUIREMENTS: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4°C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

CAUTION This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 1010 and 664 respectively.

Measurement accuracy—it's up to you!

Fiber-optic connectors are easily damaged when connected to dirty or damaged cables and accessories. The Agilent 83438A's front-panel OPTICAL OUT connector is no exception. When you use improper cleaning and handling techniques, you risk expensive instrument repairs, damaged cables, and compromised measurements.

Before you connect any fiber-optic cable to the Agilent 83438A, refer to "Cleaning Connections for Accurate Measurements" on page 2-11.

Step 1. Inspect the Shipment

1 Verify that all components ordered have arrived by comparing the shipping forms to the original purchase order. Inspect all shipping containers.

If your shipment is damaged or incomplete, save the packing materials and notify both the shipping carrier and the nearest Agilent Technologies service office. Agilent Technologies will arrange for repair or replacement of damaged or incomplete shipments without waiting for a settlement from the transportation company. Notify the Agilent Technologies customer engineer of any problems.

2 Make sure that the serial number and options listed on the instrument's rear-panel label match the serial number and options listed on the shipping document. The following figure is an example of the rear-panel serial number label:

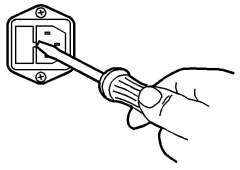


Table 1-1. Agilent 83438A Options

Option	Description
009	Built-in polarizer
011	Diamond HMS-10 fiber-optic input connector interface
013	DIN 47256 fiber-optic input connector interface
014	ST fiber-optic input connector interface
017	SC fiber-optic input connector interface
022	Angled contact fiber-optic output interface

Step 2. Check the Fuse

1. Locate the line-input connector on the instrument's rear panel.
2. Disconnect the line-power cable if it is connected.
3. Use a small flat-blade screwdriver to open the pull-out fuse drawer.



4. Verify that the value of the line-voltage fuse in the pull-out drawer is correct. The recommended fuse is an IEC 127 5×20 mm, 6.3A, 250 V, Agilent part number 2110-0703.

   Notice that an extra fuse is provided in a drawer located on the fuse holder.

WARNING **For continued protection against fire hazard, replace line fuse only with same type and ratings, (type T 6.3A/250V for 100/240V operation). The use of other fuses or materials is prohibited.**

Step 3. Connect the Line-Power Cable

CAUTION Always use the three-prong AC power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause instrument damage.

CAUTION *Do not* connect ac power until you have verified the line voltage is correct as described in the following paragraphs. Damage to the equipment could result.

CAUTION This instrument has autoranging line voltage input. Be sure the supply voltage is within the specified range.

1 Verify that the line power meets the requirements shown in the following table.

Line Power Requirements

Power:	115 VAC: 50 WATTS MAX. 230 VAC: 50 WATTS MAX.
Voltage	nominal: 115 VAC / 230 VAC range 115 VAC: 90-132 V range 230 VAC: 198-254 V
Frequency	nominals: 50 Hz / 60 Hz range: 47-63 Hz

2 Connect the line-power cord to the instrument's rear-panel connector.

3 Connect the other end of the line-power cord to the power receptacle.

Various power cables are available to connect the Agilent 83438A to ac power outlets unique to specific geographic areas. The cable appropriate for the area to which the Agilent 83438A is originally shipped is included with the unit. You can order additional ac power cables for use in different geographic areas. Refer to "Power Cords" on page 4-4.

Step 4. Turn on the Agilent 83438A

1 Press the front-panel LINE key.

The front-panel LINE switch disconnects the mains circuits from the mains supply after the EMC filters and before other parts of the instrument.

2 Use the front-panel ACTIVE key to turn the light output on and off.

If the Agilent 83438A fails to turn on properly, consider the following possibilities:

- Is the line fuse good?
- Does the line socket have power?
- Is it plugged into the proper ac power source?

If the instrument still fails, return it to Agilent Technologies for repair. Refer to “Returning the Instrument for Service” on page 1-8.

Returning the Instrument for Service

The instructions in this section show you how to properly return the instrument for repair or calibration. Always call the Agilent Technologies Instrument Support Center first to initiate service *before* returning your instrument to a service office. This ensures that the repair (or calibration) can be properly tracked and that your instrument will be returned to you as quickly as possible. Call this number regardless of where you are located. Refer to "Agilent Technologies Service Offices" on page 4-5 for a list of service offices.

Agilent Technologies Instrument Support Center . . . . . (800) 403-0801

If the instrument is still under warranty or is covered by an Agilent Technologies maintenance contract, it will be repaired under the terms of the warranty or contract (the warranty is at the front of this manual). If the instrument is no longer under warranty or is not covered by an Agilent Technologies maintenance plan, Agilent Technologies will notify you of the cost of the repair after examining the unit.

When an instrument is returned to a Agilent Technologies service office for servicing, it must be adequately packaged and have a complete description of the failure symptoms attached. When describing the failure, please be as specific as possible about the nature of the problem. Include copies of additional failure information (such as the instrument failure settings, data related to instrument failure, and error messages) along with the instrument being returned.

Preparing the instrument for shipping

1 Write a complete description of the failure and attach it to the instrument. Include any specific performance details related to the problem. The following

information should be returned with the instrument.

- Type of service required.
- Date instrument was returned for repair.
- Description of the problem:
  - Whether problem is constant or intermittent.
  - Whether instrument is temperature-sensitive.
  - Whether instrument is vibration-sensitive.
  - Instrument settings required to reproduce the problem.
  - Performance data.
- Company name and return address.
- Name and phone number of technical contact person.
- Model number of returned instrument.
- Full serial number of returned instrument.
- List of any accessories returned with instrument.

2 Cover all front or rear-panel connectors that were originally covered when you first received the instrument.

CAUTION Cover electrical connectors to protect sensitive components from electrostatic damage. Cover optical connectors to protect them from damage due to physical contact or dust.

CAUTION Instrument damage can result from using packaging materials other than the original materials. Never use styrene pellets as packaging material. They do not adequately cushion the instrument or prevent it from shifting in the carton. They may also cause instrument damage by generating static electricity.

3 Pack the instrument in the original shipping containers. Original materials are available through any Agilent Technologies office. Or, use the following guidelines:

- Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
- For instruments weighing less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength.
- The carton must be large enough to allow approximately 7 cm (3 inches) on all sides of the instrument for packing material, and strong enough to accommodate the weight of the instrument.
- Surround the equipment with approximately 7 cm (3 inches) of packing material, to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D-240 Air Cap™ from

Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with air bubbles. Use the pink (antistatic) Air Cap™ to reduce static electricity. Wrapping the instrument several times in this material will protect the instrument and prevent it from moving in the carton.

4 Seal the carton with strong nylon adhesive tape.

5 Mark the carton “FRAGILE, HANDLE WITH CARE”.

6 Retain copies of all shipping papers.

2

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Making Measurements

Making Measurements

In this chapter, you'll find examples of making measurements using the Agilent 83438A. These examples use your Agilent 83438A in conjunction with an Agilent 71450/1/2B optical spectrum analyzer. This combination provides up to 70 dB of measurement range. And, because of the Agilent 83438A's relatively high power density, the optical spectrum analyzer can sweep much faster than if a white light source, surface emitting LED, or even an EELED were used.

The last section of this chapter explains how to maintain top performance of your instrument by using proper handling and cleaning techniques. Be sure to read this section before using your Agilent 83438A.

Performing Stimulus-Response Measurements

This section shows you how to perform stimulus-response measurements. The combination of using the Agilent 83438A for broadband stimulus and the optical spectrum analyzer for selective response provides the following benefits:

- All wavelengths are available simultaneously
- Fast measurement speeds
- Small coherence length
- High dynamic range and high resolution

Measurements for DWDM systems

The following figure shows a system which is well suited for characterizing dense wavelength-division multiplexed (DWDM) components. Because of the high-power density of the Agilent 83438A, you can easily characterize such items as the crosstalk of dimultiplexers and the reverse path of optical isolators.

The polarization controller is used to characterize polarization dependencies of a device. For example, the center wavelength shift or the polarization dependent loss of a demultiplexer. If your instrument has Option 009 installed, it contains a built-in polarizer.

Increasing wavelength accuracy

When measuring deep-notch filters, increased absolute wavelength accuracy may be required. To increase wavelength accuracy, the combination of an Agilent 8168E/F tunable laser source and the Agilent 86120A multi-wavelength meter can be used to calibrate the optical spectrum analyzer. Simply enter the difference between the two wavelength readings (optical spectrum analyzer and multi-wavelength meter) into the optical spectrum analyzer as a correction factor. Refer to the user's guide for the optical spectrum analyzer to learn how to enter correction factors. If you use this technique, be aware that the Agilent 8168E/F measures wavelength in a vacuum and the optical spectrum analyzer measures wavelength in air unless you change its settings.

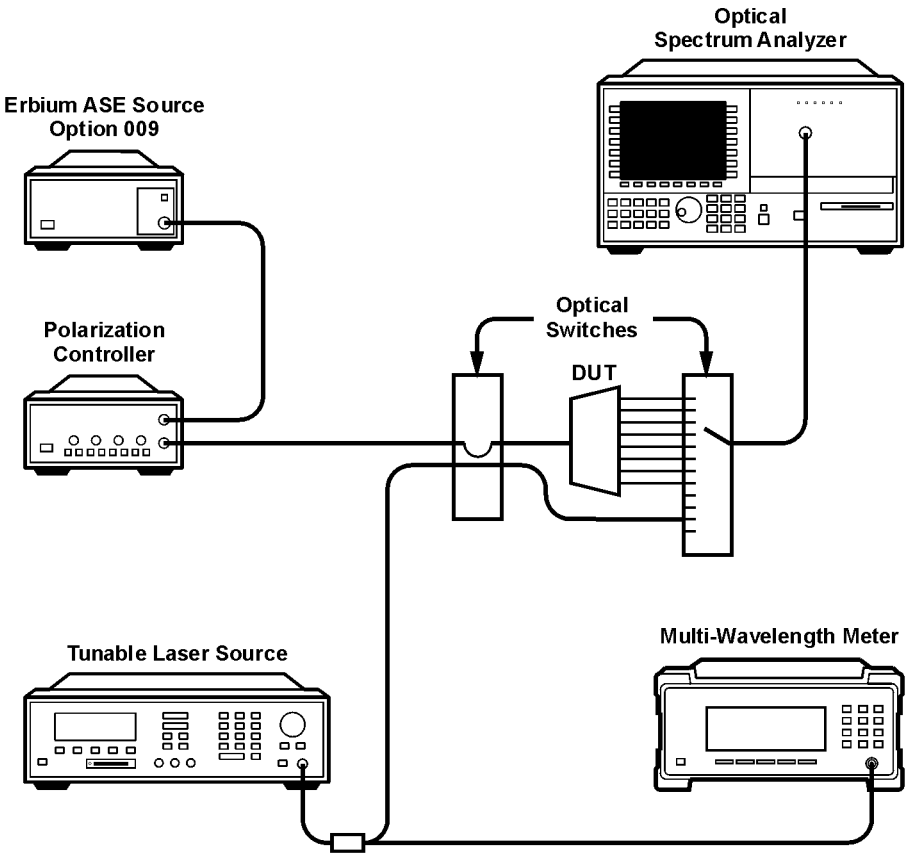

Optical
Spectrum Analyzer
Erbium ASE Source
Option 009
Polarization
Controller
Optical
Switches
DUT
Tunable Laser Source
Multi-Wavelength Meter

fig8

To characterize a passive device

1. Turn on the optical spectrum analyzer and the Agilent 83438A, and allow them to warm up for 1 hour.
2. Use a fiber optic cable to connect the Agilent 83438A's output to the input of the optical spectrum analyzer.

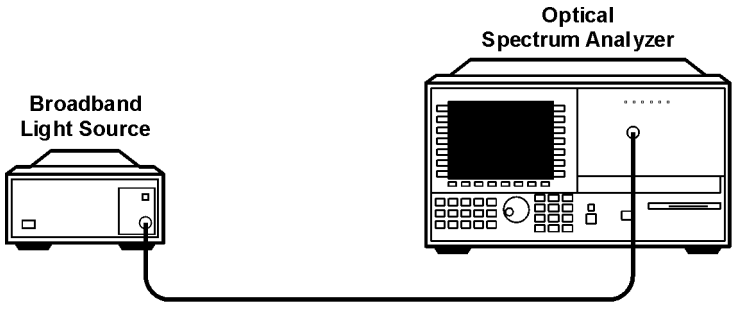


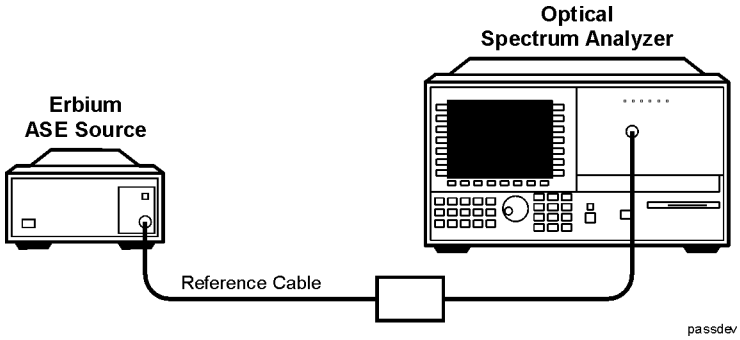
fig9

3. On the optical spectrum analyzer, press INSTR PRESET, AUTO MEAS, and then AUTO ALIGN.
4. On the optical spectrum analyzer, use the START and STOP keys to set the proper wavelength range.
5. Press REF LEVEL, and set the reference level to –10 dBm.
6. Press SENS, and set the sensitivity to –70 dBm. You can increase the sensitivity beyond this value if needed.
7. If you are measuring a deep-notch filter, more sensitivity may be required. Perform the following steps:
   a. Press Amptd, *MORE*, and then *CHOP On* so that *On* is underlined.
   b. Press BW,Swp, *SWPTIME AutoMan*, and set the sweep time to 50 seconds.

   These steps cause the optical spectrum analyzer to compensate for the effect of stray light inside the analyzer's monochromator.
8. Press State, *instr modes*, and then *STM/RESP*.
9. Press *STORE THRU->B,* and then *NORM On Off* to normalize the response.

If changes to wavelength range or resolution bandwidth are made after this trace is stored, repeat this step.

10 Insert the device you are testing between the optical spectrum analyzer and the Agilent 83438A.



11 Press NORMAL ON/OFF to turn the marker on. Rotate the front-panel knob to read the values along the response.

Ambient Light Suppression

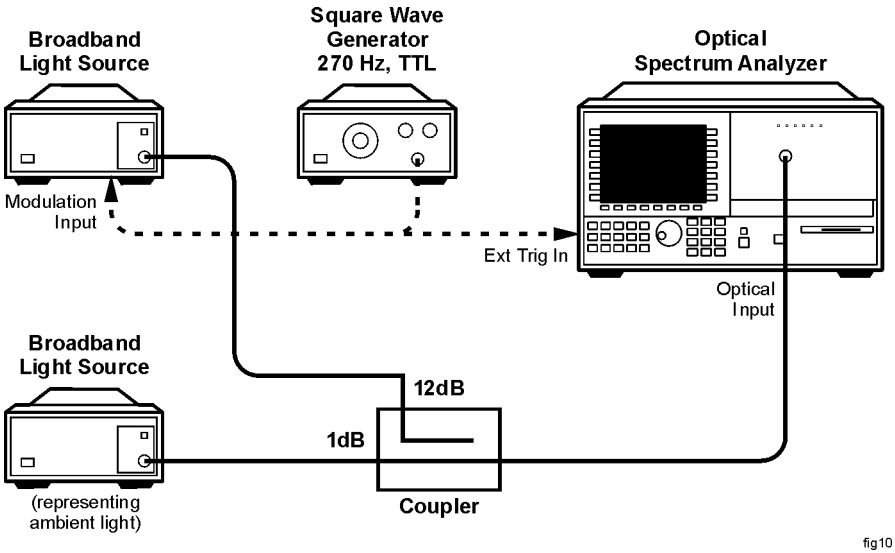
Ambient light can add significant errors to optical power measurements. This is especially true when you are using or characterizing open beam devices. The following example shows how the combination of the Agilent 83438A and an Agilent 71450/1/2B optical spectrum analyzer can be used to eliminate this error.

In order to perform this measurement, the Agilent 83438A's output is modulated at 270 Hz. Because the optical spectrum analyzer has the ability to synchronize its data acquisition with the modulated light, it can subtract out the effects of ambient light. To learn more about using the optical spectrum analyzer's adc trigger feature, refer to Agilent Technologies Product Note 71452–4, "Pulsed or Time-Dependent Optical Spectra Measurements."

To suppress ambient light

This example uses specific equipment and settings to demonstrate how to make accurate measurements in the presence of ambient light. As shown in the equipment setup drawing, two Agilent 83438As are used. One Agilent 83438A represents the broadband contribution of ambient light. Because a 12 dB coupler is used, the ambient light contributes approximately 10 dB more power to the optical spectrum analyzer than the desired source.

1 Connect the equipment as shown in the following figure.



2 Set the square-wave generator for a frequency of 270 Hz. Set its voltage output to TTL levels.

The TTL low state is defined to be within 0 to 0.8 Vdc. The TTL high state is defined to be within 2.0 to 5 Vdc. If you use a different modulation frequency, set the optical spectrum analyzer's resolution bandwidth to a value that is at least six times greater than the modulation frequency.

3 On the optical spectrum analyzer, press INSTR PRESET.

4 Use the START and STOP keys to set the wavelength range from 1500 nm to 1600 nm.

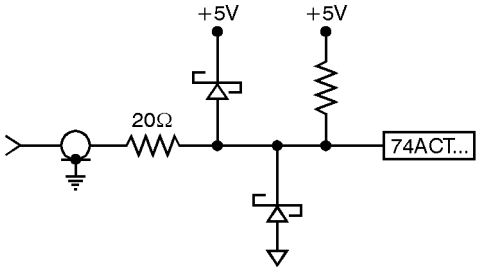
5. Press REF LEVEL, and set the reference level to –10 dBm.
6. Press Amptd, *LOG dB/DIV*, and enter 5 dB.
7. Press *MORE*, *CHOP On Off* so that Off is underlined.
8. Press BW,Swp, *SWPTIME AutoMan*, and set the sweep time to 10 seconds.
9. Press *MORE*, *MORE*, *adc trigger*, and then *ADCTRIG AC*.
10. Press *ADCTRIG DELAY*, and enter a value of 1 ms.
11. The display should now show the proper amplitude values with the effect of the ambient light subtracted out.

Modulating the Output Light

The rear panel of the instrument is equipped with a MODULATION INPUT connector. You can use this connector to digitally modulate the source for applications using lock-in techniques. (Refer to “Ambient Light Suppression” on page 2-7.) Or, you can completely disable its output light.

Digital modulation requires a TTL compatible signal. Modulation rates can range from DC to 300 Hz. A “high” TTL value turns the source on. A “low” TTL value turns the source off. The TTL low state is defined to be within 0 to 0.8 Vdc. The TTL high state is defined to be within 2.0 to 5 Vdc.

The following schematic shows the input circuitry for the MODULATION INPUT connector.



74act

If no signal is present on the MODULATION INPUT connector, the source is turned on. If you want to turn the output off, simply connect a BNC short to the rear-panel modulation input. You can order a BNC short from Agilent Technologies using the following part number: 1250-0774.

Cleaning Connections for Accurate Measurements

Today, advances in measurement capabilities make connectors and connection techniques more important than ever. Damage to the connectors on calibration and verification devices, test ports, cables, and other devices can degrade measurement accuracy and damage instruments. Replacing a damaged connector can cost thousands of dollars, not to mention lost time! This expense can be avoided by observing the simple precautions presented in this book. This book also contains a brief list of tips for caring for electrical connectors.

Choosing the Right Connector

A critical but often overlooked factor in making a good lightwave measurement is the selection of the fiber-optic connector. The differences in connector types are mainly in the mechanical assembly that holds the ferrule in position against another identical ferrule. Connectors also vary in the polish, curve, and concentricity of the core within the cladding. Mating one style of cable to another requires an adapter. Agilent Technologies offers adapters for most instruments to allow testing with many different cables. Figure 2-1 on page 2-12 shows the basic components of a typical connectors.

The system tolerance for reflection and insertion loss must be known when selecting a connector from the wide variety of currently available connectors. Some items to consider when selecting a connector are:

- How much insertion loss can be allowed?
- Will the connector need to make multiple connections? Some connectors are better than others, and some are very poor for making repeated connections.
- What is the reflection tolerance? Can the system take reflection degradation?
- Is an instrument-grade connector with a precision core alignment required?
- Is repeatability tolerance for reflection and loss important? Do your specifica-

tions take repeatability uncertainty into account?

- Will a connector degrade the return loss too much, or will a fusion splice be required? For example, many DFB lasers cannot operate with reflections from connectors. Often as much as 90 dB isolation is needed.

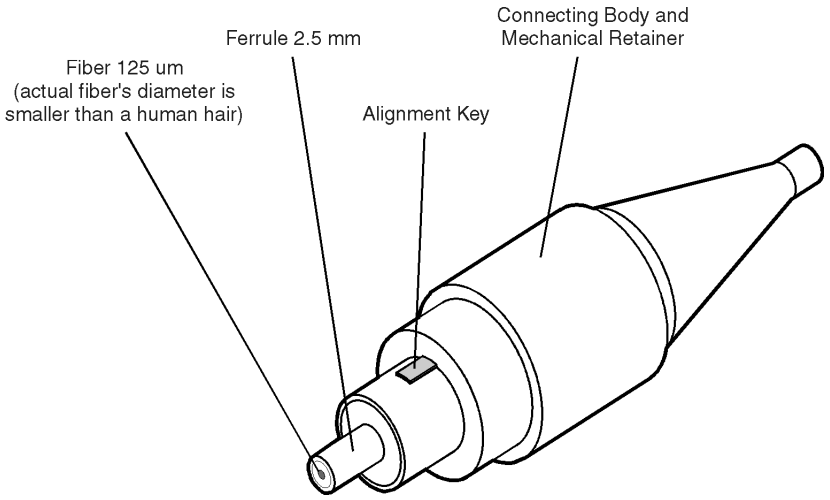


Figure 2-1. Basic components of a connector.

Over the last few years, the FC/PC style connector has emerged as the most popular connector for fiber-optic applications. While not the highest performing connector, it represents a good compromise between performance, reliability, and cost. If properly maintained and cleaned, this connector can withstand many repeated connections.

However, many instrument specifications require tighter tolerances than most connectors, including the FC/PC style, can deliver. These instruments cannot tolerate connectors with the large non-concentricities of the fiber common with ceramic style ferrules. When tighter alignment is required, Agilent Technologies instruments typically use a connector such as the Diamond HMS-10, which has concentric tolerances within a few tenths of a micron. Agilent Technologies then uses a special universal adapter, which allows other cable types to mate with this precision connector. See Figure 2-2.



Figure 2-2. Universal adapters to Diamond HMS-10.

The HMS-10 encases the fiber within a soft nickel silver (Cu/Ni/Zn) center which is surrounded by a tough tungsten carbide casing, as shown in Figure 2-3.

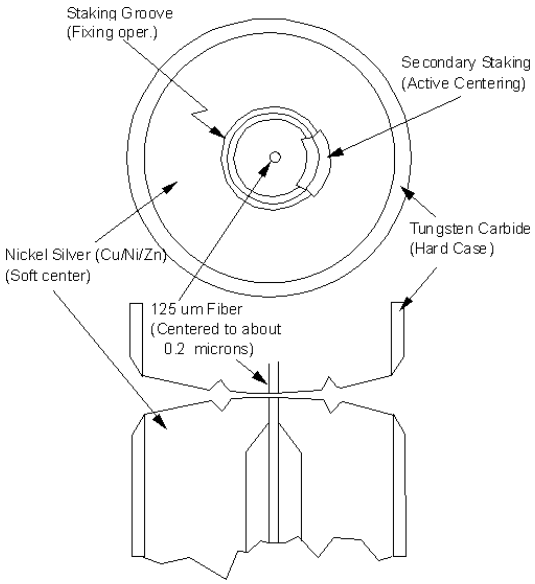


Figure 2-3. Cross-section of the Diamond HMS-10 connector.

The nickel silver allows an active centering process that permits the glass fiber to be moved to the desired position. This process first stakes the soft nickel silver to fix the fiber in a near-center location, then uses a post-active staking to shift the fiber into the desired position within 0.2 µm. This process, plus the keyed axis, allows very precise core-to-core alignments. This connector is found on most Agilent Technologies lightwave instruments.

The soft core, while allowing precise centering, is also the chief liability of the connector. The soft material is easily damaged. Care must be taken to minimize excessive scratching and wear. While minor wear is not a problem if the glass face is not affected, scratches or grit can cause the glass fiber to move out of alignment. Also, if unkeyed connectors are used, the nickel silver can be pushed onto the glass surface. Scratches, fiber movement, or glass contamination will cause loss of signal and increased reflections, resulting in poor return loss.

Inspecting Connectors

Because fiber-optic connectors are susceptible to damage that is not immediately obvious to the naked eye, poor measurements result without the user being aware. Microscopic examination and return loss measurements are the best way to ensure good measurements. Good cleaning practices can help ensure that optimum connector performance is maintained. With glass-to-glass interfaces, any degradation of a ferrule or the end of the fiber, any stray particles, or finger oil can have a significant effect on connector performance. Where many repeat connections are required, use of a connector saver or patch cable is recommended.

Figure 2-4 shows the end of a clean fiber-optic cable. The dark circle in the center of the micrograph is the fiber's 125 µm core and cladding which carries the light. The surrounding area is the soft nickel-silver ferrule. Figure 2-5 shows a dirty fiber end from neglect or perhaps improper cleaning. Material is smeared and ground into the end of the fiber causing light scattering and poor reflection. Not only is the precision polish lost, but this action can grind off the glass face and destroy the connector.

Figure 2-6 shows physical damage to the glass fiber end caused by either repeated connections made without removing loose particles or using improper cleaning tools. When severe, the damage of one connector end can be transferred to another good connector endface that comes in contact with the damaged one. Periodic checks of fiber ends, and replacing connecting cables after many connections is a wise practice.

The cure for these problems is disciplined connector care as described in the following list and in "Cleaning Connectors" on page 2-18.

Use the following guidelines to achieve the best possible performance when making measurements on a fiber-optic system:

- Never use metal or sharp objects to clean a connector and never scrape the connector.
- Avoid matching gel and oils.

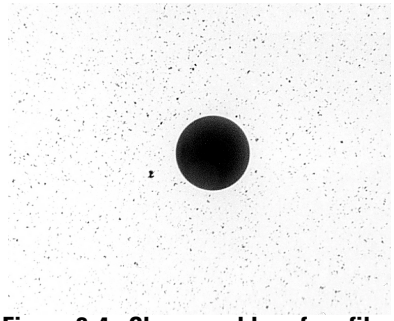


Figure 2-4. Clean, problem-free fiber end and ferrule.

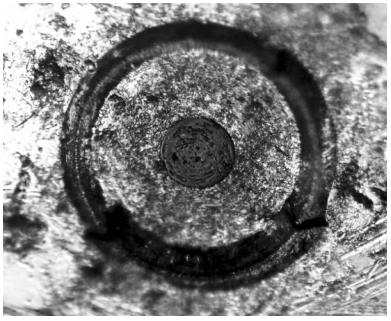


Figure 2-5. Dirty fiber end and ferrule from poor cleaning.



Figure 2-6. Damage from improper cleaning.

While these often work well on first insertion, they are great dirt magnets. The oil or gel grabs and holds grit that is then ground into the end of the fiber. Also, some early gels were designed for use with the FC, non-contacting connectors, using small glass spheres. When used with contacting connectors, these glass balls can scratch and pit the fiber. If an index matching gel or oil must be used, apply it to a freshly cleaned connector, make the measurement, and then immediately clean it off. Never use a gel for longer-term connections and never use it to improve a damaged connector. The gel can mask the extent of damage and continued use of a damaged fiber can transfer damage to the instrument.

- When inserting a fiber-optic cable into a connector, gently insert it in as straight a line as possible. Tipping and inserting at an angle can scrape material off the inside of the connector or even break the inside sleeve of connectors made with ceramic material.
- When inserting a fiber-optic connector into a connector, make sure that the fiber end does not touch the outside of the mating connector or adapter.
- Avoid over tightening connections.

  Unlike common electrical connections, tighter is *not* better. The purpose of the connector is to bring two fiber ends together. Once they touch, tightening only causes a greater force to be applied to the delicate fibers. With connectors that have a convex fiber end, the end can be pushed off-axis resulting in misalignment and excessive return loss. Many measurements are actually improved by backing off the connector pressure. Also, if a piece of grit does happen to get by the cleaning procedure, the tighter connection is more likely to damage the glass. Tighten the connectors just until the two fibers touch.

- Keep connectors covered when not in use.
- Use fusion splices on the more permanent critical nodes. Choose the best connector possible. Replace connecting cables regularly. Frequently measure the return loss of the connector to check for degradation, and clean every connector, every time.

  All connectors should be treated like the high-quality lens of a good camera. The weak link in instrument and system reliability is often the inappropriate use and care of the connector. Because current connectors are so easy to use, there tends to be reduced vigilance in connector care and cleaning. It takes only one missed cleaning for a piece of grit to permanently damage the glass and ruin the connector.

Measuring insertion loss and return loss

Consistent measurements with your lightwave equipment are a good indication that you have good connections. Since return loss and insertion loss are key factors in determining optical connector performance they can be used to determine connector degradation. A smooth, polished fiber end should produce a good return-loss measurement. The quality of the polish establishes the difference between the “PC” (physical contact) and the “Super PC” connectors. Most connectors today are physical contact which make glass-to-glass connections, therefore it is critical that the area around the glass core be clean and free of scratches. Although the major area of a connector, excluding the glass, may show scratches and wear, if the glass has maintained its polished smoothness, the connector can still provide a good low level return loss connection.

If you test your cables and accessories for insertion loss and return loss upon receipt, and retain the measured data for comparison, you will be able to tell in the future if any degradation has occurred. Typical values are less than 0.5 dB of loss, and sometimes as little as 0.1 dB of loss with high performance connectors. Return loss is a measure of reflection: the less reflection the better (the larger the return loss, the smaller the reflection). The best physically contacting connectors have return losses better than 50 dB, although 30 to 40 dB is more common.

Visual inspection of fiber ends

Visual inspection of fiber ends can be helpful. Contamination or imperfections on the cable end face can be detected as well as cracks or chips in the fiber itself. Use a microscope (100X to 200X magnification) to inspect the entire end face for contamination, raised metal, or dents in the metal as well as any other imperfections. Inspect the fiber for cracks and chips. Visible imperfections not touching the fiber core may not affect performance (unless the imperfections keep the fibers from contacting).

WARNING

Always remove both ends of fiber-optic cables from any instrument, system, or device before visually inspecting the fiber ends. Disable all optical sources before disconnecting fiber-optic cables. Failure to do so may result in permanent injury to your eyes.

Cleaning Connectors

The procedures in this section provide the proper steps for cleaning fiber-optic cables and Agilent Technologies universal adapters. The initial cleaning, using the alcohol as a solvent, gently removes any grit and oil. If a caked-on layer of material is still present, (this can happen if the beryllium-copper sides of the ferrule retainer get scraped and deposited on the end of the fiber during insertion of the cable), a second cleaning should be performed. It is not uncommon for a cable or connector to require more than one cleaning.

CAUTION

Agilent Technologies strongly recommends that index matching compounds *not* be applied to their instruments and accessories. Some compounds, such as gels, may be difficult to remove and can contain damaging particulates. If you think the use of such compounds is necessary, refer to the compound manufacturer for information on application and cleaning procedures.

Table 2-1. Cleaning Accessories

Item	Agilent Part Number
Any commercially available denatured alcohol	—
Cotton swabs	8520-0023
Small foam swabs	9300-1223
Compressed dust remover (non-residue)	8500-5262

Table 2-2. Dust Caps Provided with Lightwave Instruments

Item	Agilent Part Number
Laser shutter cap	08145-64521
FC/PC dust cap	08154-44102
Biconic dust cap	08154-44105
DIN dust cap	5040-9364
HMS10/dust cap	5040-9361
ST dust cap	5040-9366

To clean a non-lensed connector

CAUTION Do not use any type of foam swab to clean optical fiber ends. Foam swabs can leave filmy deposits on fiber ends that can degrade performance.

1. Apply pure isopropyl alcohol to a clean lint-free cotton swab or lens paper.

   Cotton swabs can be used as long as no cotton fibers remain on the fiber end after cleaning.

2. Clean the ferrules and other parts of the connector while avoiding the end of the fiber.
3. Apply isopropyl alcohol to a new clean lint-free cotton swab or lens paper.
4. Clean the fiber end with the swab or lens paper.

   Do *not* scrub during this initial cleaning because grit can be caught in the swab and become a gouging element.

5. Immediately dry the fiber end with a clean, dry, lint-free cotton swab or lens paper.
6. Blow across the connector end face from a distance of 6 to 8 inches using filtered, dry, compressed air. Aim the compressed air at a shallow angle to the fiber end face.

   Nitrogen gas or compressed dust remover can also be used.

CAUTION Do not shake, tip, or invert compressed air canisters, because this releases particles in the can into the air. Refer to instructions provided on the compressed air canister.

7 As soon as the connector is dry, connect or cover it for later use.

If the performance, after the initial cleaning, seems poor try cleaning the connector again. Often a second cleaning will restore proper performance. The second cleaning should be more arduous with a scrubbing action.

To clean an adapter

The fiber-optic input and output connectors on many Agilent Technologies instruments employ a universal adapter such as those shown in the following picture. These adapters allow you to connect the instrument to different types of fiber-optic cables.



Figure 2-7. Universal adapters.

1 Apply isopropyl alcohol to a clean foam swab.

Cotton swabs can be used as long as no cotton fibers remain after cleaning. The foam swabs listed in this section's introduction are small enough to fit into adapters.

Although foam swabs can leave filmy deposits, these deposits are very thin, and the risk of other contamination buildup on the inside of adapters greatly outweighs the risk of contamination by foam swabs.

2 Clean the adapter with the foam swab.

3 Dry the inside of the adapter with a clean, dry, foam swab.

4 Blow through the adapter using filtered, dry, compressed air.

Nitrogen gas or compressed dust remover can also be used. Do not shake, tip, or invert compressed air canisters, because this releases particles in the can into the air. Refer to instructions provided on the compressed air canister.

3

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Specifications and Regulatory Information

Specifications and Regulatory Information

This chapter lists specification and characteristics of the instrument. The distinction between these terms is described as follows:

- Specifications describe warranted performance over the temperature range 0°C to +45°C and relative humidity <95% (unless otherwise noted). All specifications apply after the instrument's temperature has been stabilized after 15 minutes of continuous operation.
- *Characteristics* provide useful information by giving functional, but nonwarranted, performance parameters. *Characteristics are printed in italics.*

Calibration cycle
This instrument requires periodic verification of performance. The instrument should have a complete verification of specifications at least once every two years.

Instrument block diagram
You can find a block diagram of the instrument in the front of this book. Refer to "Block Diagram of Agilent 83438A" on page iii.

Specifications

General Specifications

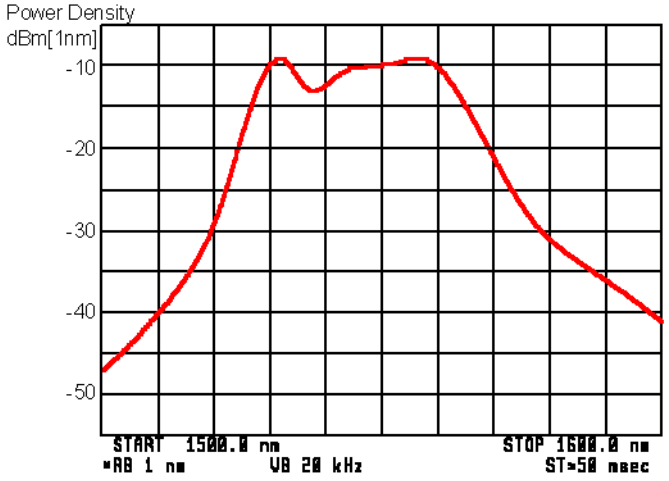
Total output power[a]	+8.1 dBm maximum (6.5 mW) +5.5 dBm minimum (3.5 mW) +5.1 dBm maximum (3.2 mW) (Option 009) +2.5 dBm minimum (1.8 mW) (Option 009)
Power stability[b]	< ±0.02 dB (15 minutes) < ±0.05 dB (6 hours)
Compatible fiber	9/125 μm, single mode

a. Measured with an InGaAs power sensor.
b. Ambient temperature change < ±1°C measured with power meter having >30 dB return loss and after one hour warm-up time.

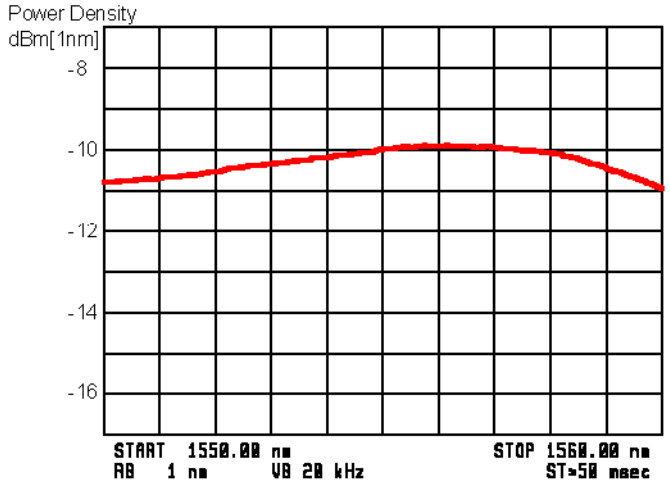
General Characteristics

Spectral density	
1530 nm	> –13 dBm [1 nm] (> 50 μW/nm) > –16 dBm [1 nm] (> 25μW/nm) (Option 009)
1550 nm	> –13 dBm [1 nm] (> 50 μW/nm) > –16 dBm [1 nm] (> 25μW/nm) (Option 009)
1560 nm	> –13 dBm [1 nm] (> 50 μW/nm) > –16 dBm [1 nm] (> 25μW/nm) (Option 009)
Output return loss	*> 30 dB (characteristic)* *> 50 dB (characteristic)*[a]
Degree of polarization	*< 5%, standard (characteristic)* *> 95%, Option 009 (characteristic)*
Modulation	Digital (TTL compatible), *DC to 300 Hz (characteristic)*

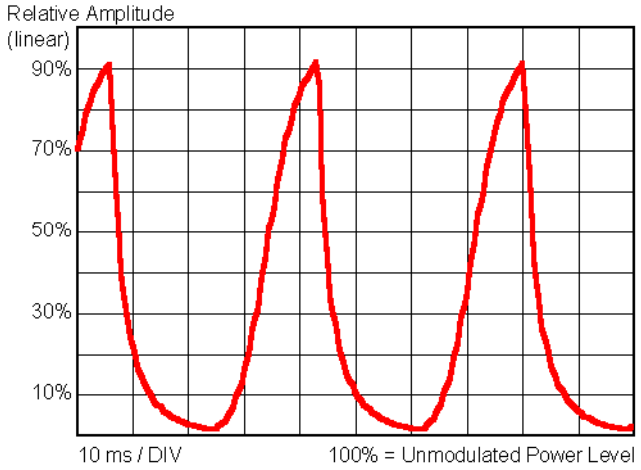
a. Measured at 1550 nm with FC/APC connector (Option 022).



Characteristic output spectrum (1500 nm to 1600 nm)



Characteristic output spectrum (1550 nm to 1560 nm)



Characteristic output waveform when modulated with 270 Hz square wave

Operating Specifications

Use	Indoor
Power:	115 VAC: 50 WATTS MAX. 230 VAC: 50 WATTS MAX.
Voltage	nominal: 115 VAC / 230 VAC range 115 VAC: 90-132 V range 230 VAC: 198-254 V
Frequency	nominals: 50 Hz / 60 Hz range: 47-63 Hz
Altitude	Up to 15,000 feet (4,572 meters)
Operating temperature	0°C to +45°C
Storage temperature	– 40°C to +70°C
Maximum relative humidity	80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C
Laser Classification	FDA Laser Class I according to 21 CFR 1040.10 IEC Laser 1 according to IEC 60825
Weight	5.5 kg (12 lb)
Dimensions (H x W x D)	102 x 213 x 450 mm (4.02 x 8.39 x 17.72 in) System II chassis (half module, 3.5" height, 1.75" hole spacing)

Regulatory Information

- Laser Classification: This product contains an IEC LASER Class 1.
- This product complies with 21 CFR 1040.10 Class 1, IEC 825-1 Class 1.
- This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 1010 and 664 respectively.

Notice for Germany: Noise Declaration

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnumg –3.GSGV Deutschland).

Acoustic Noise Emission	Geraeuschemission
LpA < 70 dB- Operator position Normal position per ISO 7779	LpA < 70 dB am Arbeitsplatz normaler Betrieb nach DIN 45635 t.19

Declaration of Conformity

I'll

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Co.

Manufacturer's Address: 1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799
USA

declares that the product:

Product Name: Erbium ASE Source

Model Number: HP 83438A

Product Options: This declaration covers all options of the above product.

conforms to the following Product specifications:

Safety: IEC 1010-1:1990+A1 / EN 61010-1:1993
CAN/CSA-C22.2 No. 1010.1-92

EMC: CISPR 11:1990/EN 55011:1991 Group 1, Class A
IEC 801-2:1984/EN 50082-1:1992 4 kV CD, 8 kV AD
IEC 801-3:1984/EN 50082-1:1992 3 V/m, 27-500 MHz
IEC 801-4:1988/EN 50082-1:1992 0.5 kV Sig. Lines, 1 kV Power Lines

Supplementary Information:

These product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE-marking accordingly.

Santa Rosa, California, USA 13 June 1996

Dixon Browder/Quality Manager

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ/Standards Europe, Herrenberger Strasse 130, D-71034 Böblingen, Germany (FAX: +49-7031-14-3143)

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Reference

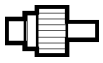
Instrument Options

Option	Description
009	Built-in polarizer
011	Diamond HMS-10 fiber-optic input connector interface
013	DIN 47256 fiber-optic input connector interface
014	ST fiber-optic input connector interface
017	SC fiber-optic input connector interface
022	Angled contact fiber-optic output interface

Accessories

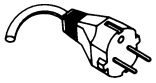
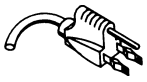
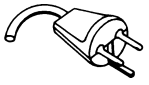
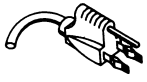
- BNC short (m) for rear-panel MODULATION INPUT connectors. Disables selected source. Agilent Technologies part number 1250-0774.
- Agilent 81113PC DIN 4108 (angled) to Super-PC (straight) patchcord for use with Option 022 and Option 013 instruments.

Front-Panel Fiber-Optic Adapters

Front Panel Fiber-Optic Adapter	Description	Agilent Part Number
	Diamond HMS-10	81000AI
	FC/PC[a]	81000FI
	D4	81000GI
	SC	81000KI
	DIN	81000SI
	ST	81000VI
	Biconic	81000WI
Dust Covers		
FC connector		1005-0594
Diamond HMS-10 connector		1005-0593
DIN connector		1005-0595
ST connector		1005-0596
SC connector		1005-0597

a. The FC/PC adapter is the standard adapter supplied with the instrument.

Power Cords

Plug Type	Cable Part No.	Plug Description	Length (in/cm)	Color	Country
250V 	8120-1351 8120-1703	Straight *BS1363A 90°	90/228 90/228	Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V 	8120-1369 8120-0696	Straight *NZSS198/ASC 90°	79/200 87/221	Gray Mint Gray	Australia, New Zealand
250V 	8120-1689 8120-1692 8120-2857p	Straight *CEE7-Y11 90° Straight (Shielded)	79/200 79/200 79/200	Mint Gray Mint Gray Coco Brown	East and West Europe, Saudi Arabia, So. Africa, India (unpolarized in many nations)
125V 	8120-1378 8120-1521 8120-1992	Straight *NEMA5-15P 90° Straight (Medical) UL544	90/228 90/228 96/244	Jade Gray Jade Gray Black	United States, Canada, Mexico, Philippines, Taiwan
250V 	8120-2104 8120-2296	Straight *SEV1011 1959-24507 Type 12 90°	79/200 79/200	Mint Gray Mint Gray	Switzerland
220V 	8120-2956 8120-2957	Straight *DHCK107 90°	79/200 79/200	Mint Gray Mint Gray	Denmark
250V 	8120-4211 8120-4600	Straight SABS164 90°	79/200 79/200	Jade Gray	Republic of South Africa India
100V 	8120-4753 8120-4754	Straight MITI 90°	90/230 90/230	Dark Gray	Japan

* Part number shown for plug is the industry identifier for the plug only. Number shown for cable is the Agilent Technologies part number for the complete cable including the plug.

Agilent Technologies Service Offices

Before returning an instrument for service, call the Agilent Technologies Instrument Support Center at (800) 403-0801, visit the Test and Measurement Web Sites by Country page at http://www.tm.agilent.com/tmo/country/English/index.html, or call one of the numbers listed below.

Agilent Technologies Service Numbers

Austria	01/25125-7171
Belgium	32-2-778.37.71
Brazil	(11) 7297-8600
China	86 10 6261 3819
Denmark	45 99 12 88
Finland	358-10-855-2360
France	01.69.82.66.66
Germany	0180/524-6330
India	080-34 35788
Italy	+39 02 9212 2701
Ireland	01 615 8222
Japan	(81)-426-56-7832
Korea	82/2-3770-0419
Mexico	(5) 258-4826
Netherlands	020-547 6463
Norway	22 73 57 59
Russia	+7-095-797-3930
Spain	(34/91) 631 1213
Sweden	08-5064 8700
Switzerland	(01) 735 7200
United Kingdom	01 344 366666
United States/Canada	(800) 403-0801

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Servicing

Servicing

In this chapter, you'll find information on troubleshooting, testing performance, adjusting, and replacing parts in the instrument.

Safety first!
Before servicing the Agilent 83438A, familiarize yourself with the safety markings on the instrument and the safety instructions in this manual. This instrument has been manufactured and tested according to international safety standards. To ensure safe operation of the instrument and the personal safety of the user and service personnel, the cautions and warnings in this manual must be heeded. Refer to the summary of safety considerations at the front of this manual.

WARNING **These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

WARNING **The power cord is connected to internal capacitors that may remain live for five seconds after disconnecting the plug from its power supply.**

WARNING **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **For continued protection against fire hazard, replace line fuse only with same type and ratings, (type T 6.3A/250V for 100/240V operation). The use of other fuses or materials is prohibited.**

WARNING **Use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.**

General Information

Whenever you contact Agilent Technologies about your Agilent 83438A, have the complete serial number and option designation available. This will ensure you obtain accurate service information.

- Refer to Table 5-1 on page 5-5 for a list of internal labels.
- Refer to Table 5-2 on page 5-6 for a list of service tools.
- Refer to Table 5-3 on page 5-6 for the location of each instrument assembly.
- Refer to Table 5-4 on page 5-8 for the location of each cable.

Clean the cabinet using a damp cloth only.

Protect against ESD damage
Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. Refer to "Electrostatic Discharge Information" on page 5-10 for more information on preventing ESD.

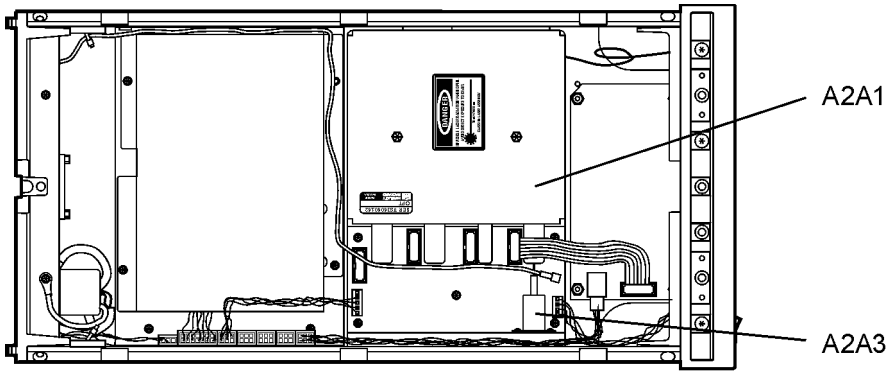
A2 ASE Source Assembly
The A2 ASE Source Assembly can not be repaired. It must be returned to Agilent Technologies for service as a complete unit. The following assemblies are included in the A2 ASE Source Assembly. Refer to "Major Assemblies" on page 5-6.

A2A1 Fiber Track Assembly
A2A2 Laser Modulation Board Assembly
A2A3 Pump Laser
A2MP1 Laser heat sink
A2MP2 Optical deck sheet metal

CAUTION

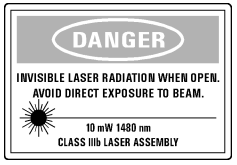
Do not remove any of the screws or open the cover on the A2A1 Fiber Track Assembly. Disturbing the routing of the internal fiber-optic cable could degrade instrument performance. There are no serviceable components inside this assembly. Return the complete A2 ASE Source Assembly to Agilent Technologies for service.

WARNING **To avoid exposure to the laser path of a CLASS IIIb LASER PRODUCT, do not open the A2A1 assembly. There are no serviceable components inside. Do not damage the fiber-optic cable that connects the CLASS IIIb pump laser, A2A3, to the A2A1 assembly. Other laser paths outside of the A2A1 assembly do not require precautions to maintain safety.**

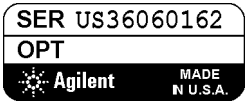


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Table 5-1. Internal Labels



This label warns you that removing the A2A1 Fiber Track Assembly's cover exposes the path of a CLASS IIIb LASER PRODUCT. *Never* remove this cover.



This label identifies the A2A1 Fiber Track Assembly. The serial and option numbers listed on the label are for the instrument that the A2A1 assembly is installed in.

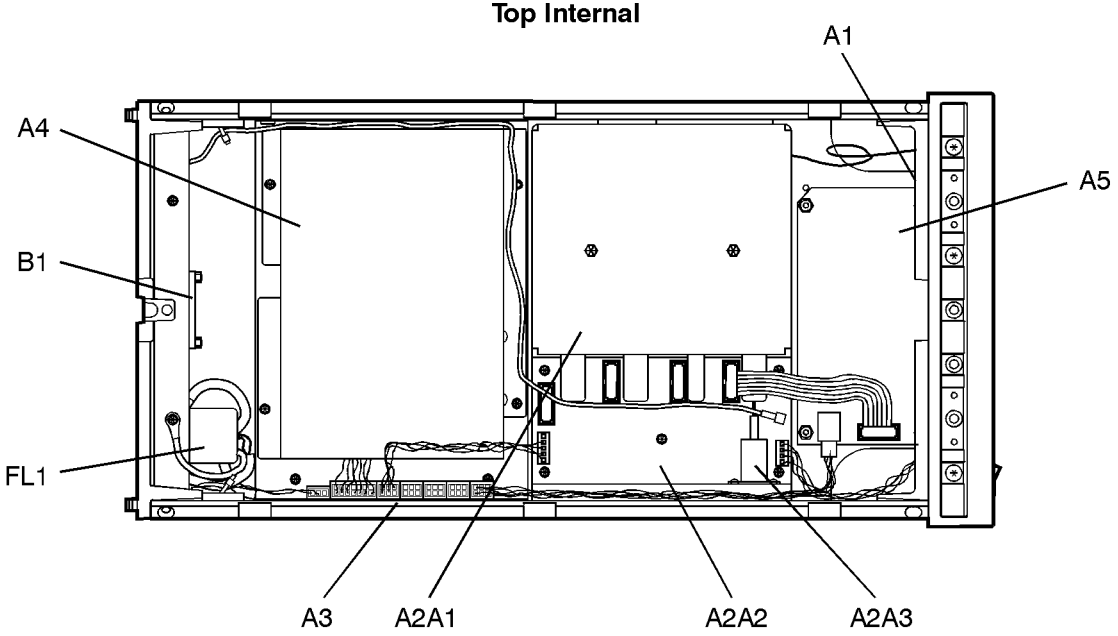
Table 5-2. Service Tools

Tool	Agilent Part Number
Small Pozidriv screwdriver	8710-0899
Wire cutter	8710-0012
Long-nose pliers	8710-1107
5.5 mm nut driver	8710-1220
7 mm nut driver	8710-1217
TORX T-10 driver	8710-1623
TORX T-15 driver	8710-1622

Table 5-3. Major Assemblies

Reference Designator	Description
A1	Keyboard Assembly
A2	ASE Source Assembly *(Not orderable, return A2 to Agilent Technologies)*
A2A1	Fiber Track Assembly *(Not orderable, return A2 to Agilent Technologies)*
A2A2	Laser Modulation Board Assembly
A2A3	Pump laser *(Not orderable, return A2 to Agilent Technologies)*
A3	Power Distribution Board Assembly
A4	Power Supply Board Assembly
A5	Laser Driver Board Assembly
B1	Fan Assembly
FL1	Line-Module Filter. Also part of W2

Top Internal

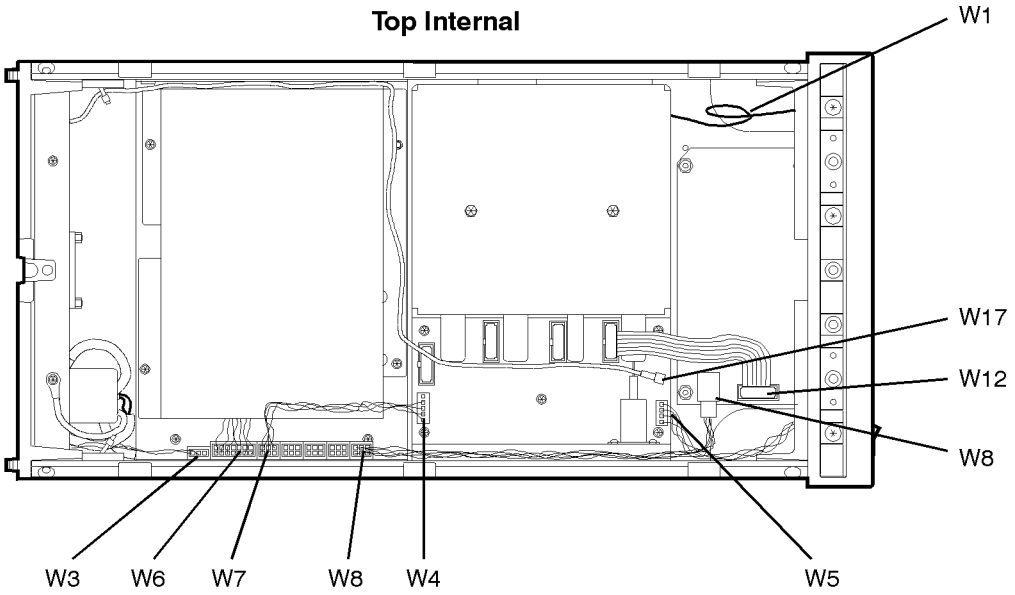


rptbaref

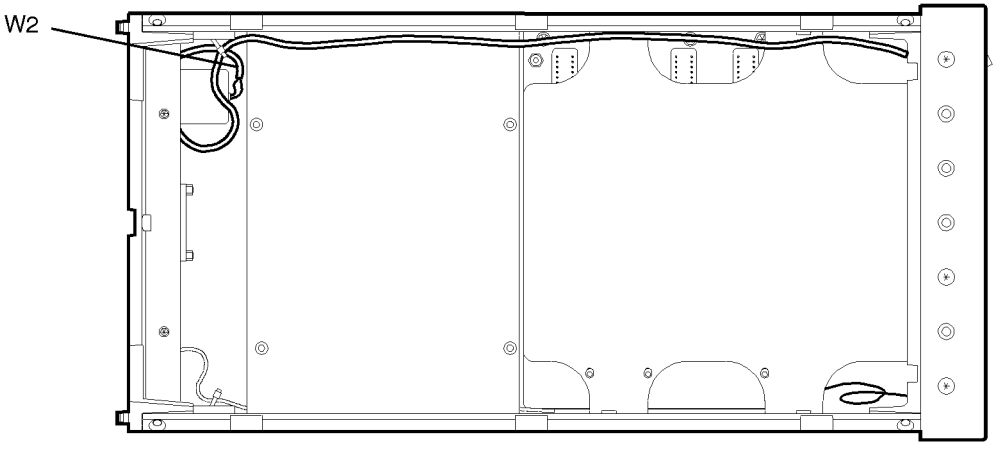
Table 5-4. Cable Assemblies

Reference Designator	Description
W1	Input fiber optic cable *(Part of A2 assembly)*
W2	Line switch cable (includes FL1 and LINE switch), to A4J1
W3	A3J7 to B1 *(Part of B1)*
W4	Power supply cable, A2A2J2 pin 5 to front-panel "LINE" LED indicator *(green wire)*
W5	Power supply cable, A2A2J1 to front-panel "ACTIVE" LED and A1 assembly
W6	Power distribution cable, A4J2 to A3J6
W7	Modulation cable, A3J5 to A2A2J2
W8	Driver 1 cable, A3J1 to A5J2
W9 - W11	Not assigned
W12	Ribbon cable, A2A2J91 to A5J1
W13 - W16	Not assigned
W17	SMB to BNC cable, rear-panel J1 to A2A2J21

Top Internal



Bottom Internal

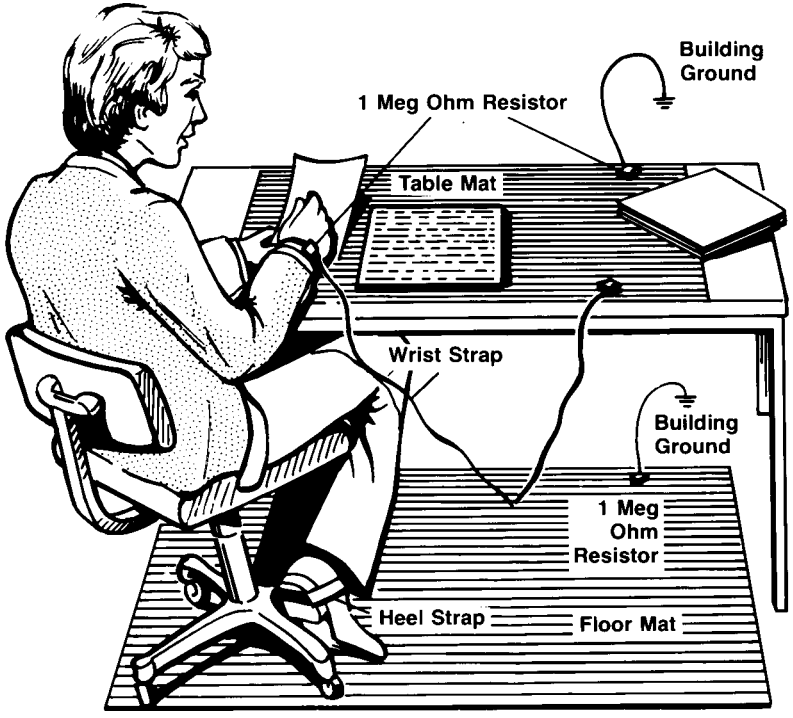


rptbwire

Electrostatic Discharge Information

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. The following figure shows an example of a static-safe work station using two types of ESD protection:

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.



Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone.

To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground. Refer to Table 5-5 on page 5-11 for information on ordering static-safe accessories.

WARNING **These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.**

Table 5-5. Static-Safe Accessories

Agilent Part Number	Description
9300-0797	3M static control mat 0.6 m × 1.2 m (2 ft× 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169	ESD heel-strap (reusable 6 to 12 months).

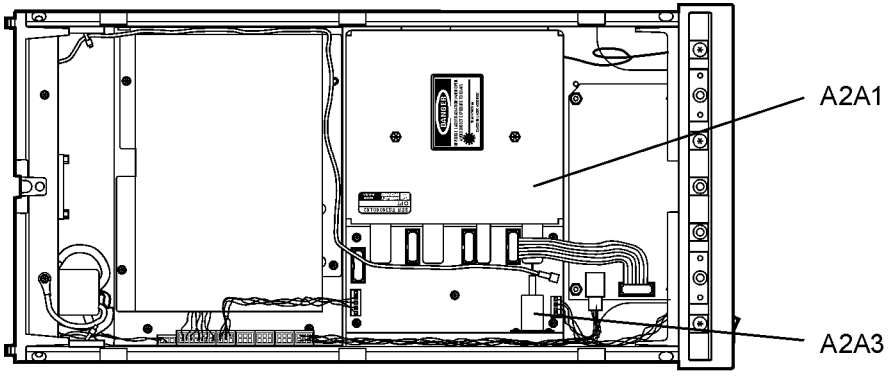
Troubleshooting

The following procedures are located in this section:

If the output power is low 5-14
To check the A5 Laser Driver Board Assembly 5-15
To check the A2A2 Laser Modulation Board Assembly 5-17
To check the A4 Power Supply Board Assembly 5-18
To check the line-power fuse 5-19

WARNING

To avoid exposure to the laser path of a CLASS IIIb LASER PRODUCT, do not open the A2A1 assembly. There are no serviceable components inside. Do not damage the fiber-optic cable that connects the CLASS IIIb pump laser, A2A3, to the A2A1 assembly. Other laser paths outside of the A2A1 assembly do not require precautions to maintain safety.



rptaref

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

WARNING **The power cord is connected to internal capacitors that may remain live for five seconds after disconnecting the plug from its power supply.**

If the output power is low

1 Check for the following common problems:

- ❒ Check that the front-panel ACTIVE key is on. If the ACTIVE or LINE LEDs do not light, refer to "To check the A4 Power Supply Board Assembly" on page 5-18.
- ❒ Clean the OPTICAL OUT connector as described in "Cleaning Connections for Accurate Measurements" on page 2-11.
- ❒ Remove any modulating signal from the rear-panel MODULATION INPUT connector. Modulation reduces the average output power. Of course, the decrease in power is tied to the duty cycle of the modulating signal.
- ❒ Check the rear-panel MODULATION INPUT connector. If a BNC short is connected, the output is turned off.

2 Perform the adjustment procedure "To adjust total power" on page 5-24.

Confirm that the power is low and cannot be adjusted within the specification.

3 Perform the procedure "To check the A4 Power Supply Board Assembly" on page 5-18.

4 Perform the procedure "To check the A5 Laser Driver Board Assembly" on page 5-15.

5 Perform the procedure "To check the A2A2 Laser Modulation Board Assembly" on page 5-17.

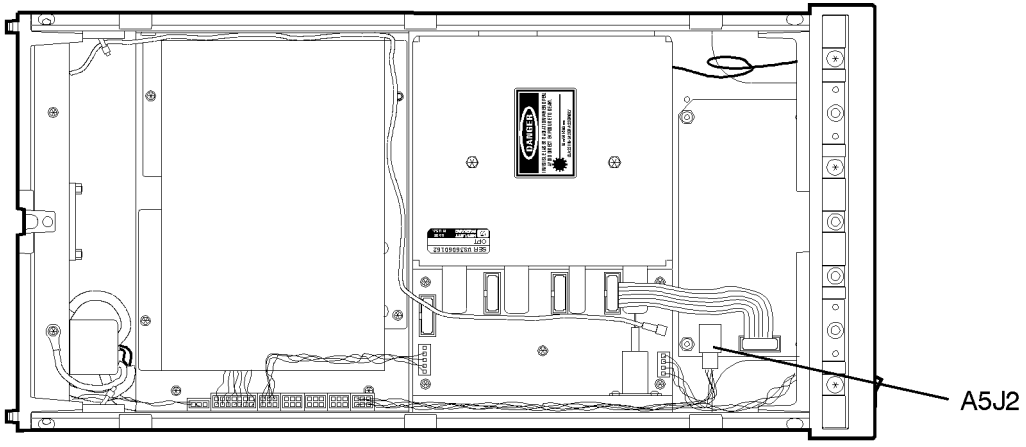
To check the A5 Laser Driver Board Assembly

If the A5 Laser Driver Board Assembly needs to be replaced, perform the instructions in "To replace the A5 Laser Driver Board Assembly" on page 5-30. New A5 assemblies are shipped with three resistors unloaded. You must match the values of these resistors to the values loaded in the original A5 assembly. A bag of resistors is supplied with the new assembly.

WARNING **Failure to fallow the proper procedure to replace the A5 assembly could destroy the laser or result in increased laser output power from the front-panel** OPTICAL OUT **connector. Increased laser output power may change the laser classification of the product.**

1 Remove the power supply cable from J2 on the A5 Laser Driver Board Assembly. The end of this cable can be probed to measure all of the dc voltages supplied in the assembly. The following list shows each wire color, its color code, and its purpose:

- Red (2) wire: +15V
- White/red (92) wire: +5V
- Violet (7) wire: –15V
- Black (0) wire: ground
- White/black (90) wire: ground



a5j2

2 Located the two indicator LEDs (green DS1 and yellow DS2) on the Laser Driver Board Assembly.

3 If the green LED is on, the current source driving the pump laser is operating correctly. If the yellow LED is on, the pump laser's temperature stabilization loop is not functioning; the current to the pump laser is automatically turned off which turns the green LED off.

4 If the yellow LED is *off*, check ribbon cable W12.

To check the A2A2 Laser Modulation Board Assembly

1. Check the +5V supply by probing the center pin of J11. The modulation input cable from the rear panel connects to this jack.
2. Check the –15V supply by probing any of the three resistors that are located next to J2. These resistors are loaded in a straight line and have the label "1471" printed on them.
3. Locate the large 3W black resistor on the assembly that is closest to the pump laser.
4. Measure the voltage on the end of the resistor that is furthest from the pump laser. The voltage should measure approximately –1V to –2V.
5. The pump laser is being driven by the current source and should be turned on.
6. Press the front-panel ACTIVE key so that the front-panel ACTIVE light is turned off. The voltage measured at the 3W resistor should now be approximately +0.7V.

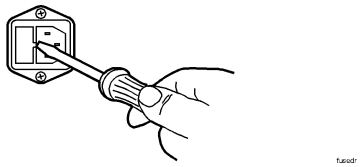
   The pump laser is turned off.
7. If the voltage measured across the resistor is incorrect, return the instrument to Agilent Technologies for servicing.

To check the A4 Power Supply Board Assembly

1. Check the 6.3A fuse in the rear-panel's line module FL1. Refer to "To check the line-power fuse" on page 5-19.
2. Remove the power supply cable from J2 on the A5 Laser Driver Board Assembly. The end of this cable can be probed to measure all of the dc voltages supplied in the instrument. The following list shows each wire color, its color code, and its purpose:
   - Red (2) wire: +15V
   - White/red (92) wire: +5V
   - Violet (7) wire: –15V
   - Black (0) wire: ground
   - White/black (90) wire: ground
3. If no voltages are detected, check that the ac line input voltage at the cable that connects to J1 on the A4 Power Supply Board Assembly. Measure the line voltage across the white/gray/red wire and the gray wire. If the ac line voltage is present, replace the A4 Power Supply Board Assembly.

To check the line-power fuse

1. Locate the line-input connector on the instrument's rear panel.
2. Disconnect the line-power cable if it is connected.
3. Use a small flat-blade screwdriver to open the pull-out fuse drawer.



The recommended fuse is an IEC 127 5×20 mm, 6.3A, 250 V, Agilent Technologies part number 2110-0703. Notice that an extra fuse is provided in a drawer located on the fuse holder.

WARNING **For continued protection against fire hazard, replace line fuse only with same type and ratings, (type T 6.3A/250V for 100/240V operation). The use of other fuses or materials is prohibited.**

Performance Tests

The procedures in this section test the Agilent 83438A's performance using the specifications listed in Chapter 3, "Specifications and Regulatory Information" as the performance standard. All of the tests are done manually without the aid of a computer. None of these tests require access to the interior of the instrument. Allow the Agilent 83438A to warm up for 15 minutes before doing any of the performance tests.

Test 1. Total Output Power 5-21
Test 2. Power Stability 5-22

Calibration Cycle

This instrument requires periodic verification of performance. The instrument should have a complete verification of specifications at least once every two years.

CAUTION

Option 022 instruments have an angled-fiber output. Be sure to use an angled-fiber patchcord during testing. If you do not have an angled-fiber patchcord available, you can purchase the required accessories from Agilent Technologies. These include the Agilent 81000SI DIN connector interface and the Agilent 81113PC DIN 4108 (angled) to Super-PC patchcord.

Test 1. Total Output Power

Description

Total power is verified using the following devices:

- Power meter

Procedure

1. Connect a power meter to the Agilent 83438A's front-panel OPTICAL OUT connector.
2. Measure the total power.

Test 2. Power Stability

Description

Power stability is verified using a power meter (> 30 dB return loss)

This test must be performed in a stable environment where the ambient temperature changes less than 1°C throughout the test.

Procedure

1. Turn on the Agilent 83438A and the power meter. Allow them to warm up for one hour.
2. Connect a power meter to the Agilent 83438A's front-panel OPTICAL OUT connector.
3. Remove any BNC termination on the rear-panel MODULATION INPUT connector.
4. Configure the power meter to measure total drift in output power over 15 minutes. Start the test.
5. After 15 minutes have passed, the total output power should not have drifted more than ±0.02 dB. Record the maximum drift on the following line:

   Maximum drift (15 minutes): _____ dB
6. Configure the power meter to measure total drift in output power over 6 hours.
7. After 6 hours have passed, the total output power should not have drifted more than ±0.05 dB. Record the maximum drift on the following line:

   Maximum drift (6 hours): _____ dB

Adjustment Procedure

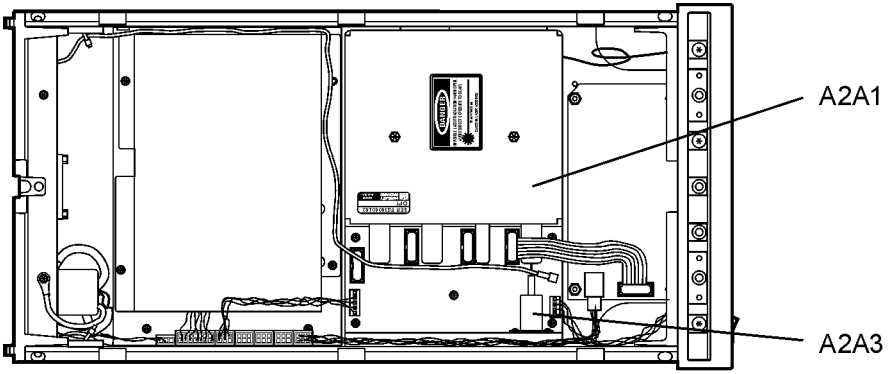
The Agilent 83438A has only one adjustment procedure, total power. Periodic adjustment is *not* required to maintain safety.

CAUTION

Option 022 instruments have an angled-fiber output. Be sure to use an angled-fiber patchcord during testing. If you do not have an angled-fiber patchcord available, you can purchase the required accessories from Agilent Technologies. These include the Agilent 81000SI DIN connector interface and the Agilent 81113PC DIN 4108 (angled) to Super-PC patchcord.

WARNING

To avoid exposure to the laser path of a CLASS IIIb LASER PRODUCT, do not open the A2A1 assembly. There are no serviceable components inside. Do not damage the fiber-optic cable that connects the CLASS IIIb pump laser, A2A3, to the A2A1 assembly. Other laser paths outside of the A2A1 assembly do not require precautions to maintain safety.



rptaref

To adjust total power

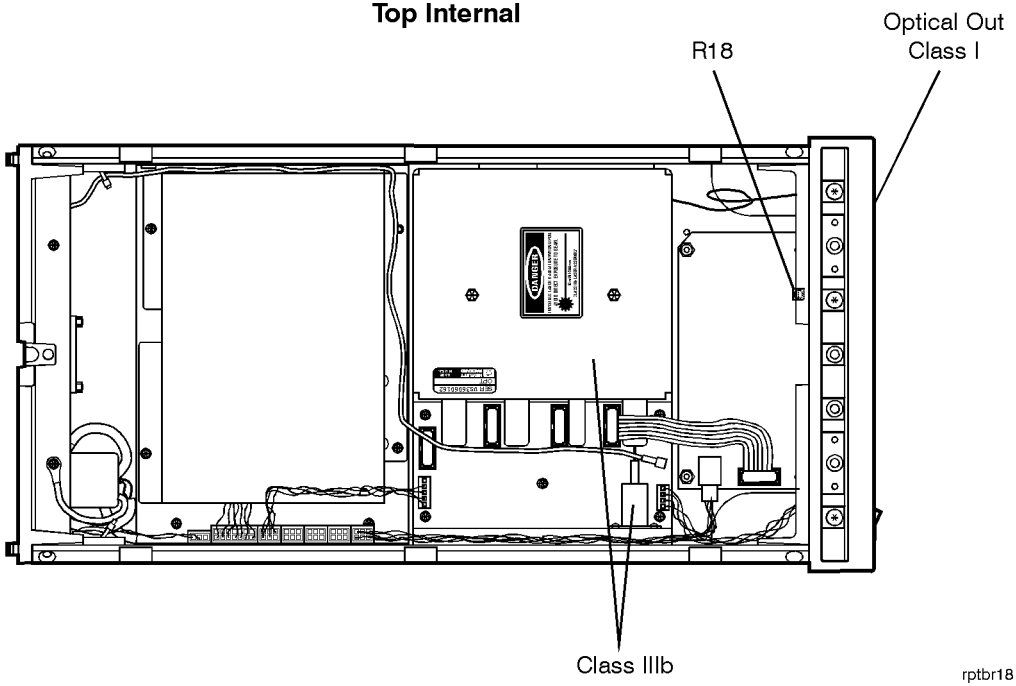
Description

The total power is adjusted by a potentiometer. The potentiometer is located on the A5 Laser Driver Board Assembly.

Procedure

1. Remove the instrument's top and bottom covers.
2. Connect a power meter to the Agilent 83438A's front-panel OPTICAL OUT connector.
3. Locate R18 on the A5 Laser driver board assembly for the pump laser. See the following figure.
4. Adjust potentiometer R18 on the A5 Laser driver board assembly to set the output power between +5.5 dBm and +8.1 dBm (3.6 mW to 6.5 mW).

Top Internal



rptbr18

Replacing Instrument Assemblies

This section provides step-by-step procedures to remove and replace the major instrument assemblies. These include the following procedures:

To remove the instrument cover 5-27
To replace the A2 Source assembly 5-28
To replace the A5 Laser Driver Board Assembly 5-30
To route the rear-panel BNC modulation cable 5-32
To replace line filter assembly FL1 5-33
To replace a cable clip 5-34

To remove the instrument cover

1. Disconnect the power cord from the instrument.
2. Position the instrument so that you are looking at the rear panel.
3. Use a T-15 TORX driver to back out the screw that attaches the top cover to the instrument.

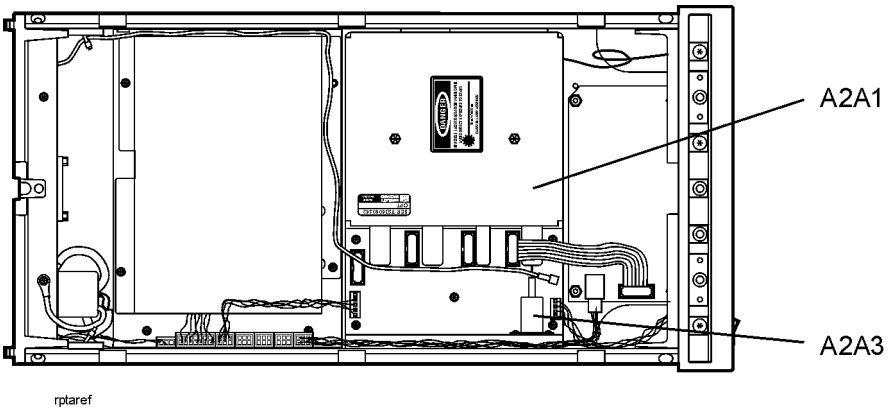
   Note that the screw is permanently secured to the cover.
4. After the screw is backed out, slide the cover toward the rear of the instrument to remove it.
5. Remove the bottom cover using the same technique as used for the top cover.
6. Remove the two side covers.

To replace the A2 Source assembly

The A2 assembly, which includes A2A1, A2A2, A2A3, A2MP1, and A2MP2, must be replaced as a complete unit. Individual components cannot be repaired.

WARNING

To avoid exposure to the laser path of a CLASS IIIb LASER PRODUCT, do not open the A2A1 assembly. There are no serviceable components inside. Do not damage the fiber-optic cable that connects the CLASS IIIb pump laser, A2A3, to the A2A1 assembly. Other laser paths outside of the A2A1 assembly do not require precautions to maintain safety.



rptaref

1. Remove the instrument's top, bottom, and right-side covers.
2. Remove all cables attached to the A2A2 Laser Modulation Board Assembly.
3. Remove the trim strip located on the top of the front frame.
4. Use a T-10 TORX driver to remove the six screws that secure the front panel to the front frame. They are located along the top and bottom of the front frame.
5. Gently move the front panel out to gain access to the back side of the front-panel OPTICAL OUT connector. Unscrew the fiber-optic cable from the connector.

   You may need to cut the cable tie that secures the line switch cable.

6. Be sure to cover the exposed end of the fiber-optic cable.
7. Use a T-10 TORX driver to remove the four screws securing the A2 assembly to the instrument's right-side frame.
8. Place the instrument on it's right side.
9. Use a T-10 TORX driver to remove the three screws securing the A2 assembly to the bottom of the instrument's main deck sheet metal assembly.
10. Remove the A2 assembly.

To replace the A5 Laser Driver Board Assembly

Three resistors on the A5 Laser Driver Board Assembly limit the maximum current to the A2A3 Pump Laser. These resistors are matched to the particular pump laser installed in your instrument. New A5 assemblies are shipped with these three resistors unloaded. You must load new resistors, which match the values loaded in the original A5 assembly, into the new A5 assembly. A bag of resistors is supplied with the new assembly. Refer to “Major Assemblies” on page 5-37 for the part number of the A5 replacement assembly.

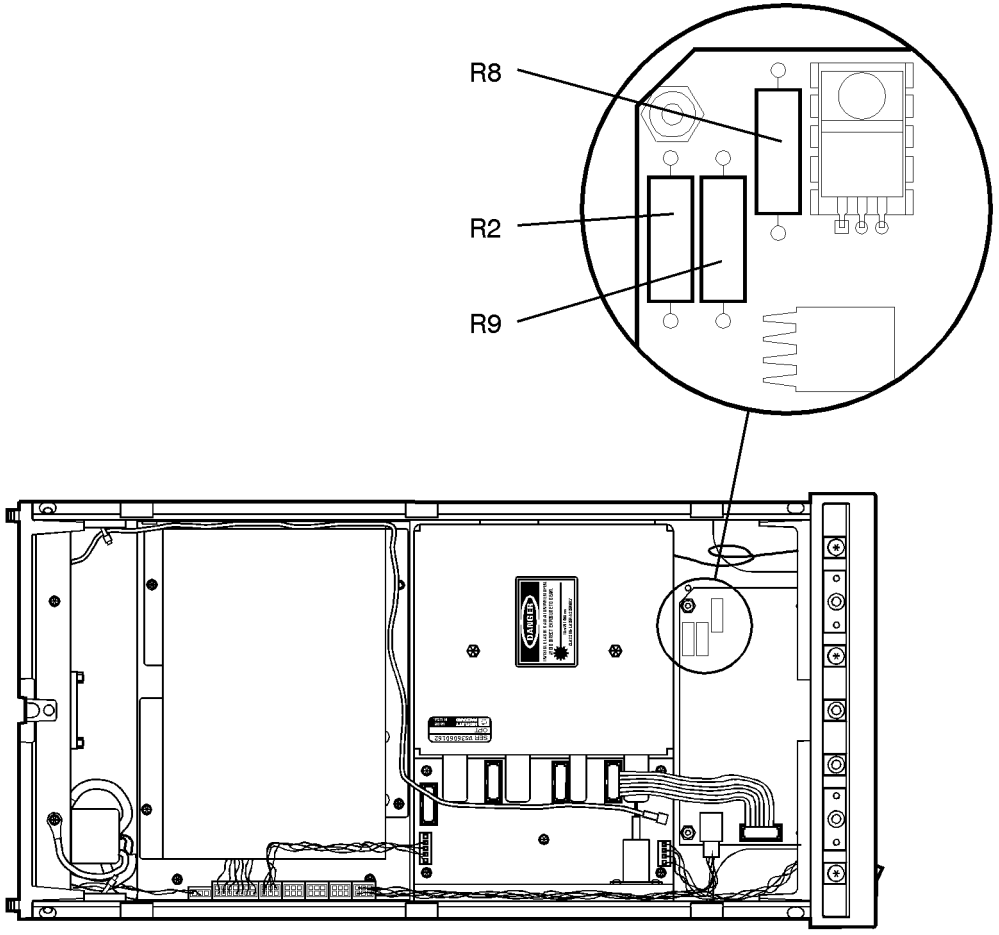
WARNING **Failure to load the proper resistor values as described in this procedure could destroy the laser or result in increased laser output power from the front-panel** OPTICAL OUT **connector. Increased laser output power may change the laser classification of the product.**

1. Remove the A5 Laser Driver Board Assembly from the instrument.
2. Locate resistors R2, R8, and R9 as shown on the following diagram.
3. Read the values of each of these three resistors, and write them down. The values should be printed on the sides of each resistor.

   The possible values of each of resistors is 82Ω, 100Ω, 125Ω, or 150Ω. In the circuit, they are wired in parallel.
4. Locate the bag of resistors that was shipped with the new A5 Laser Driver Board Assembly. Find three resistors with identical values to those identified in the previous step.
5. Solder these resistors into the new A5 Laser Driver Board Assembly.
6. Installed the new assembly into the instrument.
7. Use an optical power meter to confirm that the total output power emitted from the front-panel OPTICAL OUT connector does not exceed the following limits:

   Maximum: +8.1 dBm (6.5 mW)
   Minimum: +5.5 dBm (3.5 mW)

   Maximum: +5.1 dBm (3.2 mW) (Option 009)
   Minimum: +2.5 dBm (1.8 mW) (Option 009)

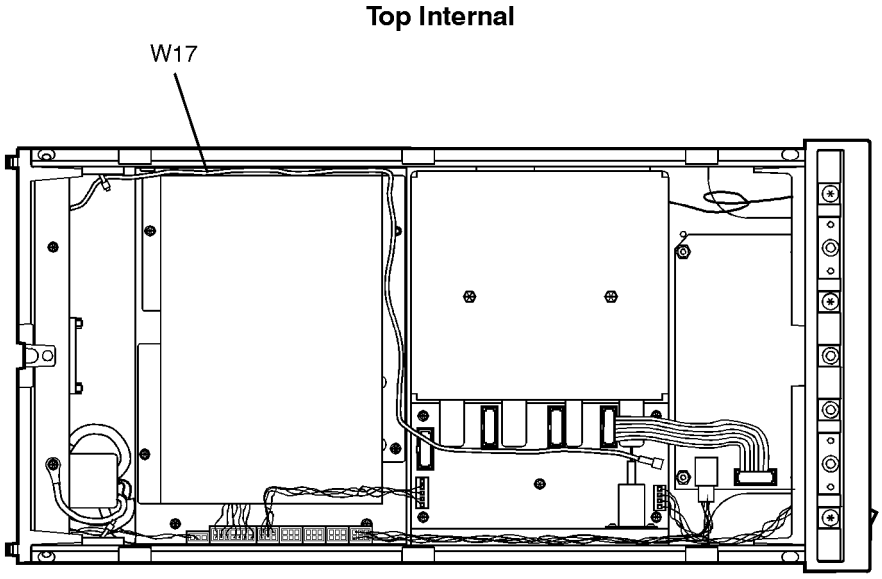


rpresist

Location of resistors R2, R8, and R9

To route the rear-panel BNC modulation cable

The figure below shows the correct path for the rear-panel BNC cable. Be sure to route this cable as shown.



rptwire

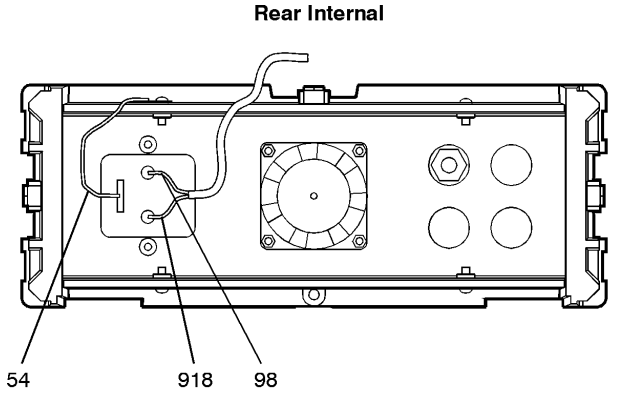
To replace line filter assembly FL1

Although replacing FL1 is straightforward, be sure to observe the following points:

- Tighten the screws that attach FL1 to 6 in-lbs. Do not use the recommended torque for M3 screws. Over tightening these screws will damage the line filter's flange.
- Observe the following warning about correct wire attachment. The wire color codes in the figure refer to the following cable colors:

  54 green/yellow
  98 white/gray
  918 white/brown/gray

WARNING **Be sure to solder the wires to FL1 in the correct positions as shown in the following figure. Failure to attach these wires correctly could result in damage to the instrument and injury to the user.**



rprpluç

To replace a cable clip

Cable clips are used throughout the instrument to attach cables to sheet-metal housings. They attach with self-adhesive bonds.

1. Remove the old clip.
2. Remove any remaining glue.
3. Clean the surface using isopropyl alcohol.
4. Remove the paper backing from the bottom of the new clip.
5. Press the clip firmly onto the surface.

Replaceable Parts

In this section, you'll find figures that identify each mechanical and electrical assembly in the instrument. An Agilent Technologies part number is provided for each available part. The following identification figures are provided:

Table 5-6, "Major Assemblies," on page 5-37
Table 5-7, "Cable Assemblies," on page 5-39
Table 5-8, "Front-Panel Parts," on page 5-41
Table 5-9, "Rear-Panel Parts," on page 5-43
Table 5-10, "Top and Bottom View Parts," on page 5-45
Table 5-11, "Side View Parts," on page 5-47
Table 5-12, "Instrument Cover Parts," on page 5-48

Part ordering information

To order an assembly or mechanical part, quote the Agilent Technologies part number, and indicate the quantity required. To order a part that is not listed, include the following information with the order:

- Agilent 83438A model number
- Instrument serial number
- Description of where the part is located, what it looks like, and its function (if known)
- Quantity needed

Parts can be ordered by addressing the order to the nearest Agilent Technologies office. Refer to "Agilent Technologies Service Offices" on page 4-5. Customers within the USA can also use either the direct mail-order system or the direct phone-order system described below. The direct phone-order system has a toll-free phone number available.

Direct mail-order system
Within the USA, Agilent Technologies can supply parts through a direct mail-order system. Advantages of using the system are as follows:

- Direct ordering and shipment from Agilent Technologies
- No maximum or minimum on any mail order. (There is a minimum order amount for parts ordered through a local Agilent Technologies office when the orders require billing and invoicing.)
- Prepaid transportation. (There is a small handling charge for each order.)
- No invoices

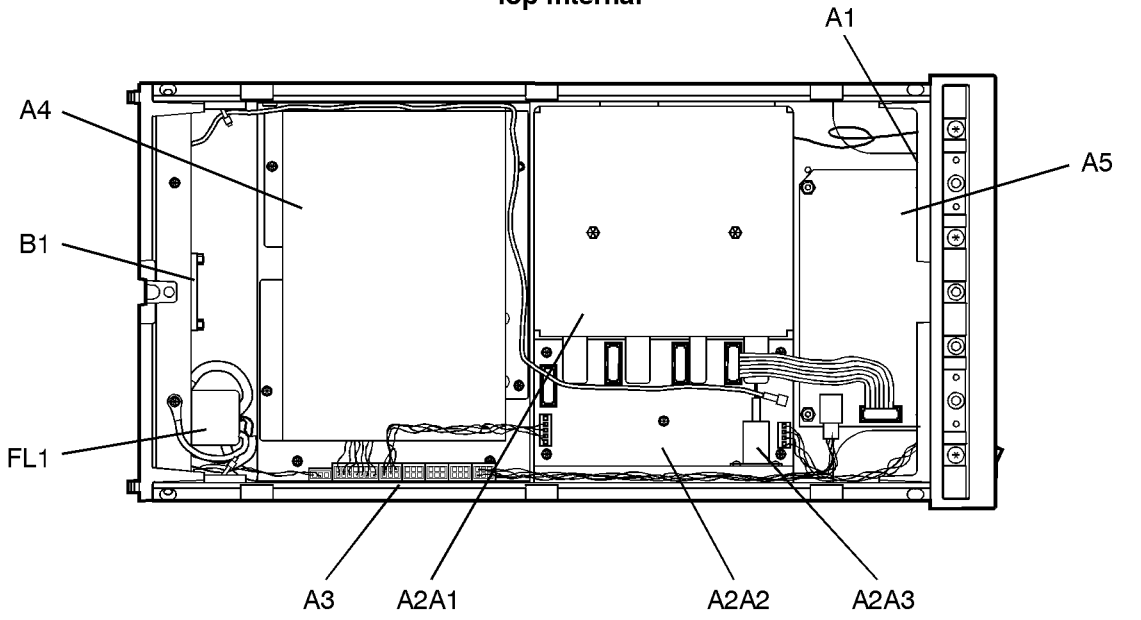
To provide these advantages, a check or money order must accompany each order. Mail-order forms and specific ordering information are available through your local Agilent Technologies office.

Direct phone-order system
The toll-free phone number, (800) 227-8164, is available Monday through Friday, 6 am to 5 pm (Pacific time). Regular orders have a 4-day delivery time.

Table 5-6. Major Assemblies

Reference Designator	Agilent Part Number	Description
A1	54710-66512	Keyboard Assembly
A2	—	ASE Source Assembly *(Not orderable, return A2 to Agilent Technologies)*
A2A1	—	Fiber Track Assembly *(Not orderable, return A2 to Agilent Technologies)*
A2A2	—	Laser Modulation Board Assembly *(Not orderable, return A2 to Agilent Technologies)*
A2A3	—	Pump laser
A3	83437-60012	Power Distribution Board Assembly
A4	0950-2293	Power Supply Board Assembly
A5	83438-60004	Laser Driver Board Assembly (includes packet of resistors)
B1	83437-20006	Fan Assembly
FL1	9135-0270	Line-Module Filter. Also part of W2

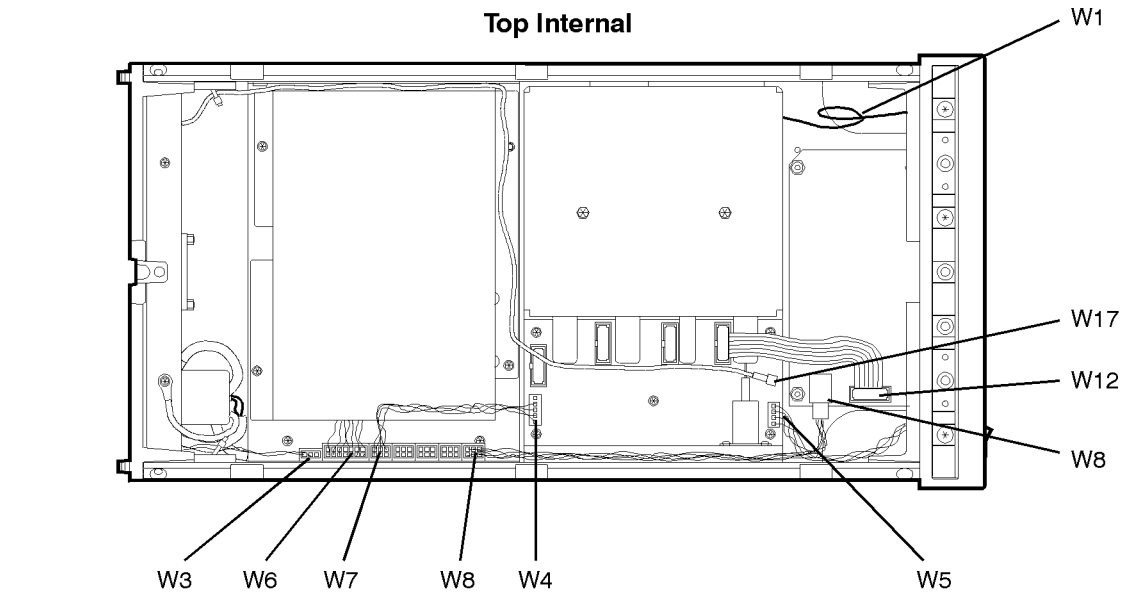
Top Internal

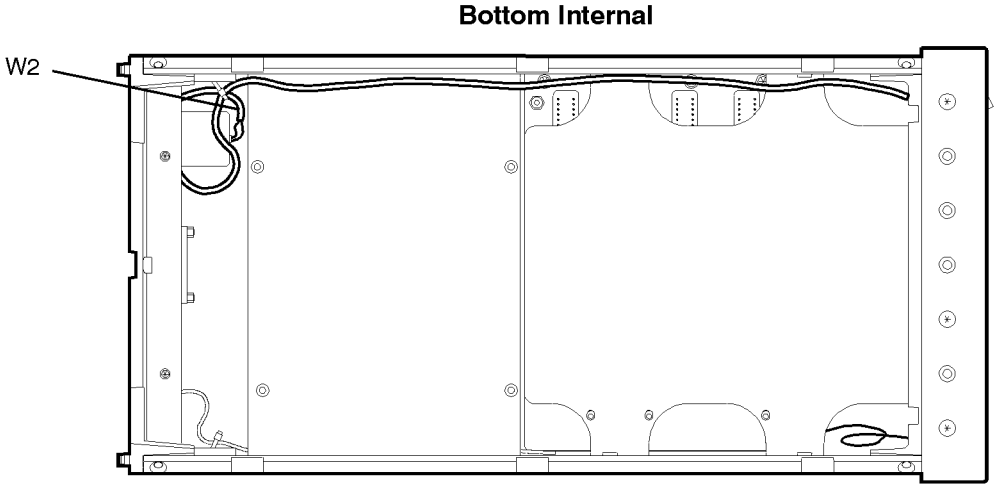


rptbaref

Table 5-7. Cable Assemblies

Reference Designator	Agilent Part Number	Description
W1	—	Input fiber optic cable *(Part of A2 assembly)*
W2	83437-60008	Line switch cable (includes FL1 and LINE switch), to A4J1
W3	—	A3J7 to B1 *(Part of B1)*
W4	83437-60003	Power supply cable, A2A2J2 pin 5 to front-panel "LINE" LED indicator *(green wire)*
W5	83437-60004	Power supply cable, A2A2J1 to front-panel "ACTIVE" LED and A1 assembly
W6	83437-60001	Power distribution cable, A4J2 to A3J6
W7	83437-60002	Modulation cable, A3J5 to A2A2J2
W8	83437-60013	Driver cable, 11 inches long, A3J1 to A5J2
W9 - W11	—	Not assigned
W12	83437-60020	Ribbon cable, A2A2J91 to A5J1
W13 - W16	—	Not assigned
W17	8120-5056	SMB to BNC cable, 55.5 cm, rear-panel J1 to A2A2J21
—	1252-7513	Ribbon cable clip for W12, W13, W14, and W15.

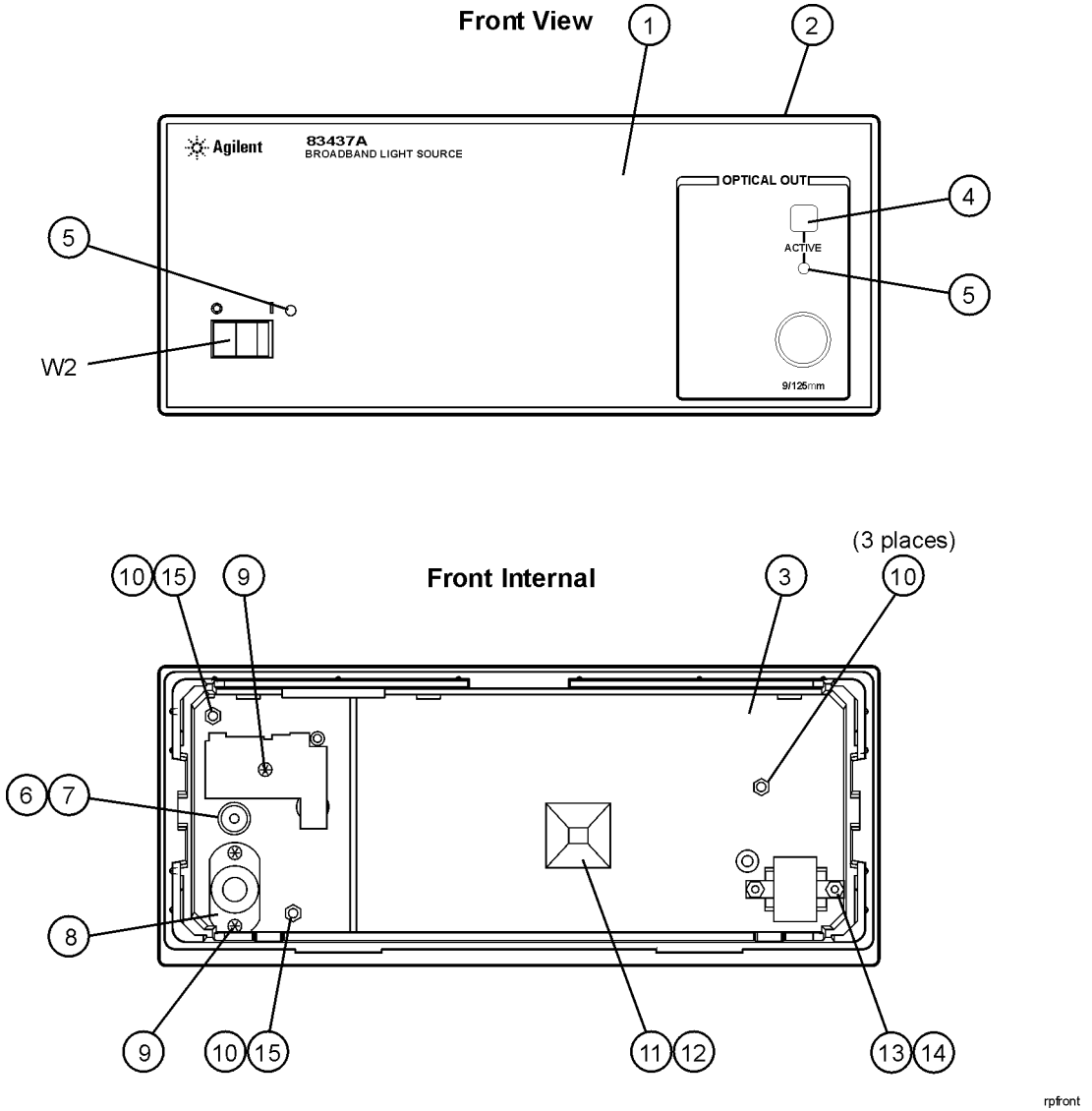




rptbwire

Table 5-8. Front-Panel Parts

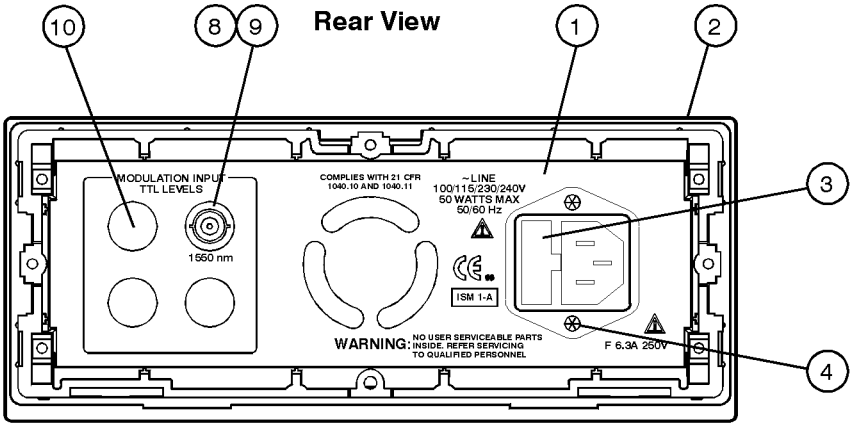
Item	Agilent Part Number	Qty	Description
1	83437-00002	1	Front panel, dress
2	5021-8413	1	Front frame
3	83437-00001	1	Front subpanel
4	54714-41903	1	ACTIVE key
5	1990-1213	2	LED lamp IF=15 mA maximum
6	85680-40004	2	LED mount
7	83437-20004	1	LED spacer
8	83410-20003	1	Adapter
9	0515-0430	3	Screw with washer, TORX T10 Pan Head, M3 X 0.5, 6 mm long
10	0535-0042	3	Nut, hex PLSTC-LKG M3 X 0.5
11	1400-0755	3	Component clip 0.75 in x 0.75 in
12	1400-0249	1	Cable tie wrap
13	0380-0019	2	Spacer, round 0.188 IN LNG
14	0590-0106	2	Nut, hex PLSTC-LKG 2-56-THD
15	3050-0891	2	Washer, flat M3.0 3.3 mm inner diameter *(not shown, fits between dress panel and subpanel)*

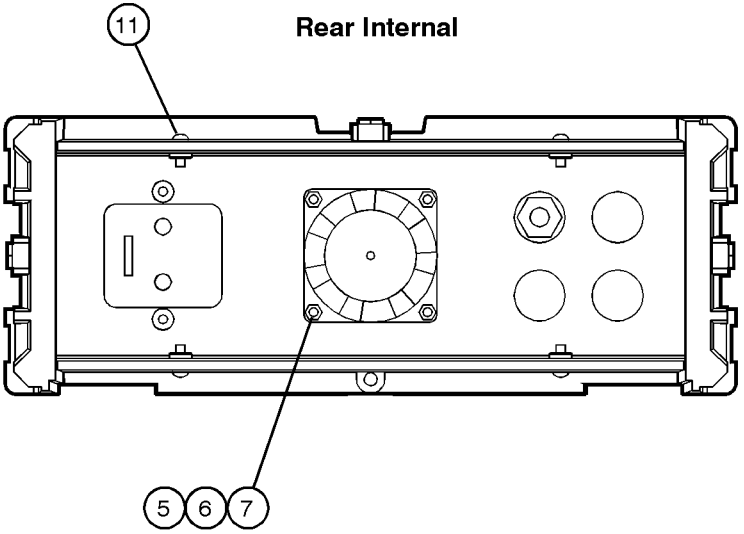

Front View
1
2
Agilent
83437A
BROADBAND LIGHT SOURCE
OPTICAL OUT
4
ACTIVE
5
5
W2
9/125µm
Front Internal
(3 places)
10
15
9
3
10
6
7
8
9
10
15
11
12
13
14

rpfront

Table 5-9. Rear-Panel Parts

Item	Agilent Part Number	Qty	Description
1	83437-00005	1	Rear panel, dress
2	5021-5814	1	Rear frame
3	2110-0703	1	Fuse, 6.3A 250V NTD FE IEC
4	0515-2032	2	Screw, TORX T10 Flat Head, M3 X 0.5, 8 mm long
5	0535-0033	4	Nut, hex M3.5 X 0.6
6	2190-0585	4	Washer, flat HLLC 3.6 mm inside diameter
7	3050-0892	4	Washer, flat MTLC 3.8 mm inside diameter
8	2950-0035	4	Nut, hex 15/32-32
9	2190-0102	4	Washer, lock 0.472" inside diameter
10	6960-0002	3	Hole plug for 0.5 inner diameter hole
11	0515-0372	4	Screw, TORX T10 Pan Head, M3 x 0.5, 8 mm long


Rear View
10
8
9
1
2
3
4
MODULATION INPUT
TTL LEVELS
1550 nm
COMPLIES WITH 21 CFR
1040.10 AND 1040.11
~LINE
100/115/230/240V
50 WATTS MAX
50/60 Hz
ISM 1-A
WARNING:
NO USER SERVICEABLE PARTS
INSIDE. REFER SERVICING
TO QUALIFIED PERSONNEL
F 6.3A 250V


Rear Internal
11
5
6
7

rprear

Table 5-10. Top and Bottom View Parts

Item	Agilent Part Number	Qty	Description
1	0515-1400	6	Screw, TORX T10 90° Flat Head, M3.5 x 0.6, 8mm long
2	5041-8803	1	Trim strip, top *(not shown)*
3	1252-7513	8	Ribbon cable clip
4	83437-00004	1	A2MP2, Sheet-metal optical deck *(part of A2 assembly)*
5	83437-00008	1	Sheet-metal power supply deck
6	86120-00011	1	Shield for A4 Power Supply
7	1400-0755	2	Component clip 0.75 in x 0.75 in
8	1400-0249	1	Cable tie wrap
9	—	1	A2MP1, LED heat sink *(part of A2 assembly)*
10	—	1	Fiber container lid *(part of A2 assembly, not separately orderable)*
11	—	1	Fiber container *(part of A2 assembly, not separately orderable)*
12	—	1	Fiber track *(part of A2 assembly, not separately orderable)*
13	0515-0830	2	Screw, TORX T10 Pan Head, M3 x 0.5, 28 mm long
14	0515-0380	4	Screw, TORX T15 Pan Head, M4 x 0.7,10 mm long
15	0515-0372	14	Screw, TORX T10 Pan Head, M3 x 0.5, 8 mm long
16	—	8	Screw *(part of A2 assembly, not separately orderable)*

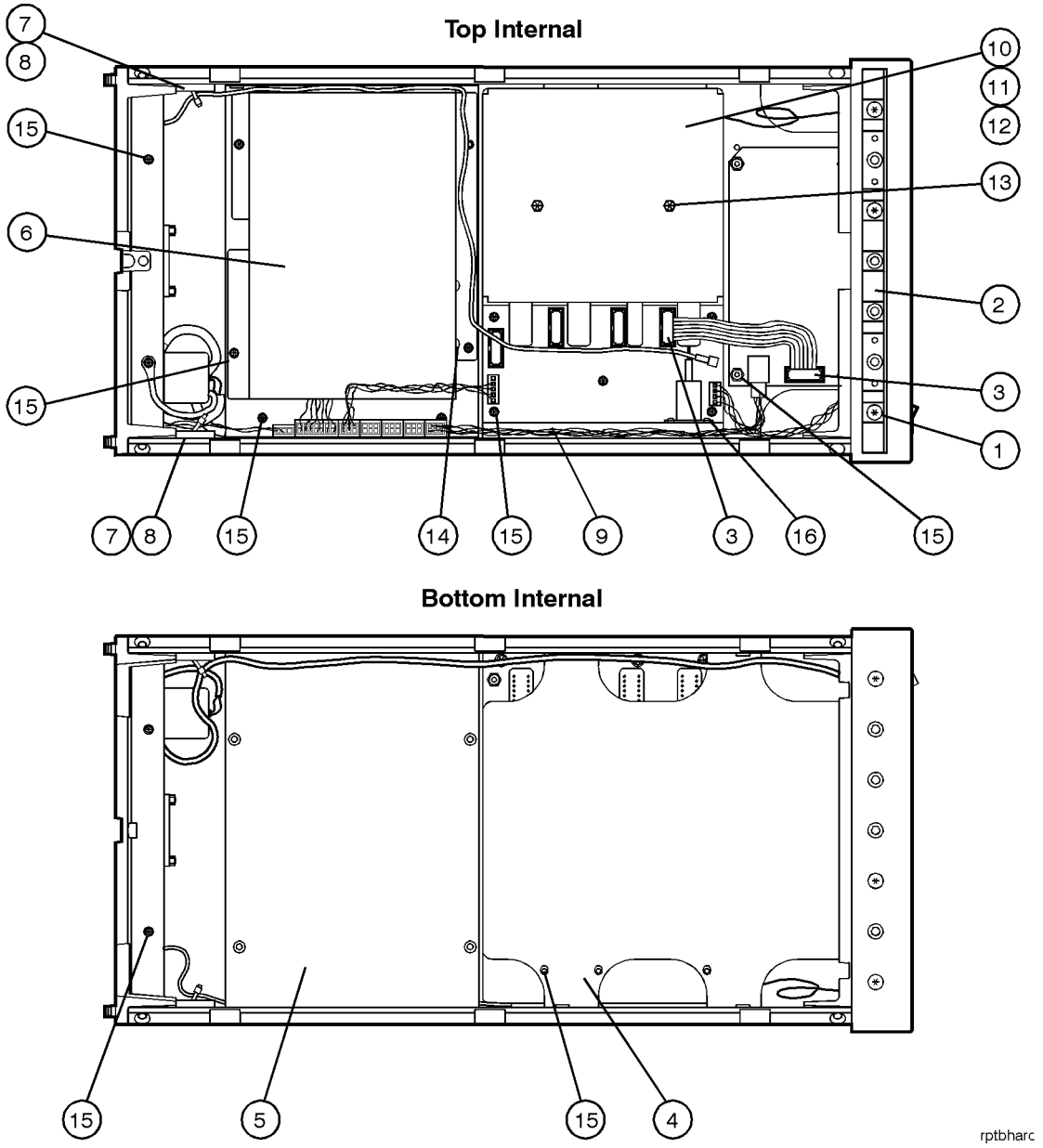
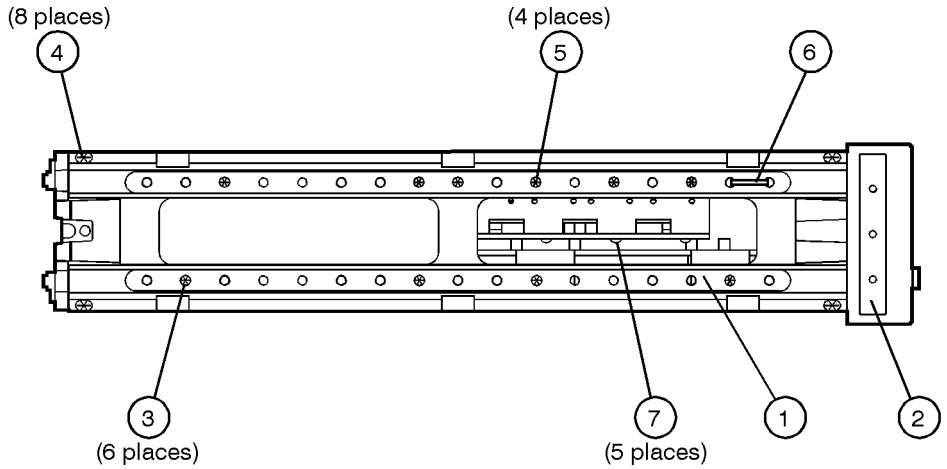

Top Internal
7
8
15
6
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12
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2
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1
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8
15
14
15
9
3
16
15
Bottom Internal
15
5
15
4
rptbharc

Table 5-11. Side View Parts

Item	Agilent Part Number	Qty	Description
1	5021-5831	2	Side frame
2	5001-0538	2	Trim strip, side *(not shown)*
3	0515-0458	10	Screw, TORX T10 Pan Head, M3.5 x 0.6, 8 mm long
4	0515-2086	8	Screw, TORX T15 Flat Head, M4 x 0.7, 7 mm long
5	0515-0377	4	Screw, TORX T10 Pan Head, M3.5 x 0.6, 10 mm long
6	1400-0249	1	Cable tie wrap
7	—	5	Screw *(part of A2 assembly, not separately orderable)*



rpside

Table 5-12. Instrument Cover Parts

Item	Agilent Part Number	Qty	Description
—	5062-3730	1	Cover, top
—	5062-3742	1	Cover, bottom
—	5062-3751	1	Cover, left side
—	83437-00009	1	Cover, right side
—	5041-8801	4	Molded feet

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