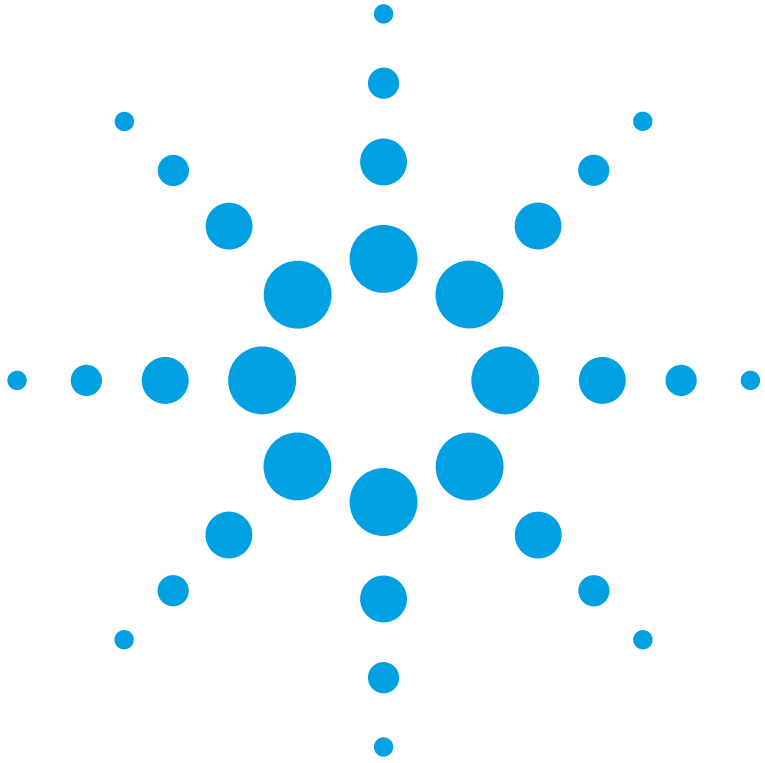
Agilent 81950A
Compact Tunable Laser Source module

User's Guide



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In This Guide...

Chapter 1, “Getting Started"

This chapter contains an introductory description of the modules and aims to make the modules familiar to you.

Chapter 2, “Accessories"

This chapter contains details of the various modules and options available.

Chapter 3, “Operating Instructions"

This chapter provides a general description of the specific features of the 81950A compact tunable laser module.

Chapter 4, “Programming Instructions"

This chapter describes the SCPI Commands for use of 81950A compact tunable laser modules and N7711A, N7714A single and 4-port Tunable Laser System Sources.

Chapter 5, “Specifications"

This chapter contains the specifications of the 81950A module.

Chapter 6, “Cleaning Information"

This chapter provides the cleaning instructions

Chapter 7, “Index"

Table of Contents

Getting Started 11

Safety Considerations 12
- Safety Symbols 12
- Initial Inspection 13
- Line Power Requirements 13
- Operating Environment 13
- Input/Output Signals 14
- Storage and Shipment 14

Initial Safety Information for Tunable Laser Modules 15

Laser Safety Labels 16
- Laser class 1M label 16

Introduction 17
- What is a Tunable Laser Source? 17
- Installation 17
- Front Panels 17
- Front Panel Controls and Indicators 18

Typical Use Models 19

Optical Output 21
- Polarization Maintaining Fiber 21
- Angled and Straight Contact Connectors 22

Signal Input and Output 23

Accessories 25

Modules and Options 26
- Modules 27
- Options 27
- Connector Interfaces 28

User's Guides 29

Operating Instructions 31

Operation 33
Parameters 33
Output Frequency 33
Limitations 33
Changing the Grid (f0, s) 34
Operation Modes 34
Switching Modes 34
Preset Values 35
Differences to Other Tunable Laser Source Modules 35
The Graphical User Interface 36
Differences among 8164A/B, 8163A/B and 8166A/B 36
Soft Lock 36
How to Set a Parameter 37
How to Set the Power 39
How to Switch Operation Mode 40
How to Set the Wavelength or Frequency 43
How to Switch On the Laser 44
How to set Frequency Parameters in Grid Mode 45
How to Check the Output Frequency or Wavelength 46
How to Modulate a Signal 47
The User Interface 49
The Module's Front Panel 49

Programming Instructions 51

Summary 52
Detailed Description 54
The OUTPut sub tree 54
The SOURce:CHANnel:POWer sub tree 56
The SOURce:CHANnel:WAVelength sub tree 59
The SOURce:CHANnel:FREQuency sub tree 61
The SOURce:CHANnel:MODUlation sub tree 67
Error Messages 71
Status Bits 72

Differences among 81950A, N7711A and N7714A 73
81950A Only 73
N771A, N7714A Only 73

Specifications 75

Definition of Terms 77
Absolute wavelength (frequency) accuracy 78
External analog modulation - modulation depth 78
Linewidth 78
Maximum output power 79
Operating temperature and humidity 79
Output isolation 79
Polarization extinction ratio 80
Power flatness versus wavelength 81
Power repeatability 81
Power stability 82
Relative intensity noise (RIN) 82
Relative wavelength (frequency) accuracy 83
Return loss 83
SBS suppression - effective linewidth 84
Side-mode suppression ratio 84
Signal to source spontaneous emission ratio 84
Tuning time 85
Wavelength range 85
Wavelength (frequency) repeatability 86
Wavelength resolution 86
Wavelength (frequency) stability 86
Compact Tunable Laser Module Specifications 87
Agilent 81950A Compact Tunable Laser Source 88
Specifications 89

Cleaning Information 91

Cleaning Instructions 92
Safety Precautions 92
Why is it important to clean optical devices ? 93
What do I need for proper cleaning? 94

Preserving Connectors 98
Cleaning Instrument Housings 98
Which Cleaning Procedure should I use? 99
How to clean connectors 100
How to clean connector interfaces 102
How to clean bare fiber adapters 103
How to clean instruments with a fixed connector interface 104
Additional Cleaning Information 105
Other Cleaning Hints 106

Index 107

1
Getting Started

This chapter provides a general description of Agilent 81950A Compact TLS module.

Safety Considerations 12
- Safety Symbols 12
- Initial Inspection 13
- Line Power Requirements 13
- Operating Environment 13
- Input/Output Signals 14
- Storage and Shipment 14

Initial Safety Information for Tunable Laser Modules . . . 15

Laser Safety Labels 16

Introduction 17
- What is a Tunable Laser Source? 17
- Installation 17
- Front Panels 17
- Front Panel Controls and Indicators 18

Typical Use Models 19

Optical Output 21
- Polarization Maintaining Fiber 21
- Angled and Straight Contact Connectors 22

Signal Input and Output 23

Safety Considerations

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies Inc. assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and manual, including the red safety page, for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice or the like, 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.

Safety Symbols

The apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.

Hazardous laser radiation.

Invisible laser radiation.

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or cushioning, keep them until you have checked the contents of the shipment for completeness and verified the instrument both mechanically and electrically.

The Performance Tests give procedures for checking the operation of the instrument. If the contents are incomplete, mechanical damage or defect is apparent, or if an instrument does not pass the operator's checks, notify the nearest Agilent Technologies Sales/Service Office.

WARNING **To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, etc.).**

WARNING **You *MUST* return instruments with malfunctioning laser modules to an Agilent Technologies Sales/Service Center for repair and calibration.**

Line Power Requirements

The Agilent 81950A Compact Tunable Laser Source modules operate when installed in Agilent 8163A/B Lightwave Multimeters, Agilent 8164A/B Lightwave Measurement Systems, and Agilent 8166A/B Lightwave Multichannel Systems.

Operating Environment

The safety information in your mainframe's User's Guide summarizes the operating ranges for the Agilent 81950A Compact Tunable Laser Source modules. In order for these modules to meet specifications, the operating environment must be within the limits specified for your mainframe.

Input/Output Signals

CAUTION

There is one BNC input connector on the front panel of an Agilent 81950A Compact Tunable Laser Source module.

To prevent the BNC interface from damage, do not exceed the voltage limit of +- 5V when applying external voltage.

Storage and Shipment

An Agilent 81950A Compact Tunable Laser Source module can be stored or shipped at temperatures between - 40°C and + 70°C.

Protect the module from temperature extremes that may cause condensation within it.

Initial Safety Information for Tunable Laser Modules

The laser sources specified by this user guide are classified according to IEC 60825-1 (2007) Laser Notice No. 50 dated 2007-June-24.

The laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50 dated 2001-July-26:

	Agilent 81950A Option 210	**Agilent 81950A Option 201**
Laser Type	ECL-Laser InGaAsP	ECL-Laser InGaAsP
Wavelength range	1527nm-1566nm	1570nm-1609nm
*Max. CW output power**	50 mW	50 mW
Beam waist diameter	9 µm	9 µm
Numerical aperture	0.1	0.1
Laser Class according to IEC 60825-1 (2001)- Intl.	1M	1M
*Max. permissible CW output power***	163 mW	163 mW

* *Max. CW output power* is defined as the highest possible optical power that the laser source can produce at its output connector.
** *Max. permissible CW output power* is the highest optical power that is permitted within the appropriate laser class.

Laser Safety Labels

Laser class 1M label

Figure 1 Class 1M Safety Label - 81950A

A sheet of laser safety labels is included with the laser module as required. In order to meet the requirements of IEC 60825-1 we recommend that you stick the laser safety labels, in your language, onto a suitable location on the outside of the instrument where they are clearly visible to anyone using the instrument.

WARNING

Please pay attention to the following laser safety warning:

Under no circumstances look into the end of an optical cable attached to the optical output when the device is operational. The laser radiation can seriously damage your eyesight.

Do not enable the laser when there is no fiber attached to the optical output connector.

The laser is enabled by pressing the 'active' button close to the optical output connector on the front panel of the module. The laser is on when the green LED on the front panel of the instrument is lit.

The use of optical instruments with this product will increase eye hazard.

The laser module has a built-in safety circuitry which will disable the optical output in the case of a fault condition

Refer servicing only to qualified and authorized personnel.

Introduction

What is a Tunable Laser Source?

A Tunable Laser Source (TLS) is a laser source for which the wavelength can be varied through a specified range. The Agilent Technologies range of TLS modules also allow you to set the output power, and to choose between continuous wave or modulated power.

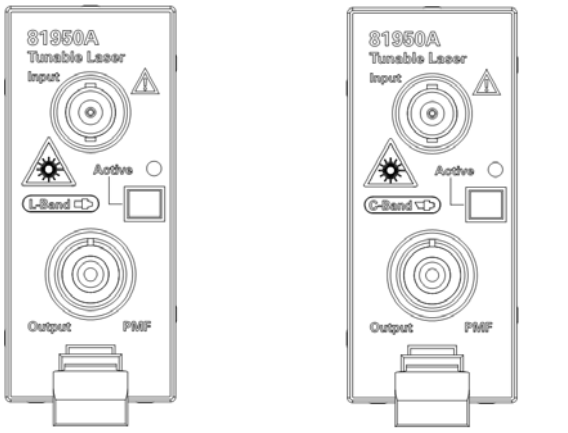
The Agilent Technologies range of compact TLS modules are flexible stimulus modules suitable for applications such as the testing of optical amplifiers, DWDM components, and complete DWDM systems.

Installation

The Agilent 81950A Compact TLS module is a front-loadable module.

For a description of how to install your module, refer to “How to Fit and Remove Modules” in the Installation and Maintenance chapter of your mainframe’s User’s Guide.

Front Panels



Agilent 81950A with Straight Contact Connector

Agilent 81950A with Angled Contact Connector

Figure 2 Agilent 81950A Compact Tunable Laser Module

Front Panel Controls and Indicators

Switch the laser source on or off using the switch on its front panel, using the [*State*] parameter in the instrument's Graphical User Interface, or remotely using SCPI commands. When the Active LED is lit the source is emitting radiation. When the Active LED is not lit the source is not emitting radiation.

Typical Use Models

The Agilent 81950A Compact TLS module provides high output power up to +15.5 dBm.

This module covers a total wavelength range of 40 nm, either:

- In the C-band
  with the 81950A Option 210, or
- In the L-band
  with the 81950A Option 201.

Their compact single-slot format makes them a flexible and cost-effective stimulus for single channel and multichannel DWDM applications

Device Characterization at high power levels

The high optical output power of the Agilent 81950A Compact TLS module improves the testing of all types of optical amplifiers and other active components as well as broadband passive optical components. It helps overcome losses in test setups or in the device under test itself. Thus, engineers can test optical amplifiers such as EDFAs, Raman amplifiers, SOAs and EDWAs to their limits. This tunable laser provides the high power levels required to help speed the development of innovative devices by enabling the test and measurement of nonlinear effects.

Low linewidth source for complex modulation formats

The low linewidth of the Agilent 81950A Compact TLS module makes this module an ideal light source for transmission systems with (D)QPSK and higher order modulation formats and and as local oscillator for coherent receivers. The fine tuning capability allows to precisely set the intermediate frequency in the coherent receiver.

SBS suppression feature enables high launch power

The SBS Suppression feature avoids the reflection of light induced by Stimulated Brillouin Scattering (SBS). It enables the launch of the high optical output power into long fibers without intensity modulation to avoid impairment in time-domain measurements.

Specifications:

For further details on specifications, see the “Specifications” on page 75.

Optical Output

Polarization Maintaining Fiber

A Polarization maintaining fiber (PMF) output is standard for Agilent 81950A Compact TLS modules.

PMF is aligned to maintain the state of polarization. A well defined state of polarization helps ensure constant measurement conditions.

The fiber is of Panda type, with TE mode in the slow axis in line with the connector key.

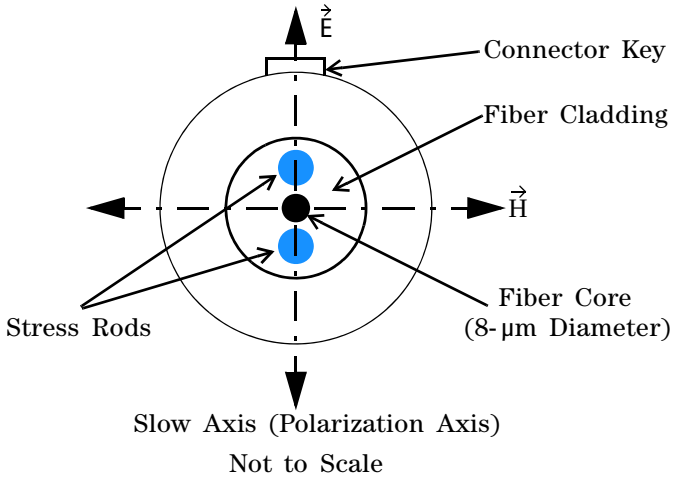


Figure 3 PMF Output Connector

See Chapter 2, “Modules and Options" for further details on connector interfaces and accessories.

Angled and Straight Contact Connectors

Angled contact connectors are available as an option for Agilent 81950A Compact TLS modules.

Angled contact connectors help you to control return loss, since reflected light tends to reflect into the cladding, reducing the amount of light that reflects back to the source.

CAUTION If the contact connector on your instrument is angled, you can only use cables with angled connectors with the instrument

Figure 4 Angled and Straight Contact Connector Symbols

Figure 4 shows the symbols that tell you whether the contact connector of your Tunable Laser module is angled or straight. The angled contact connector symbol is colored green.

You should connect straight contact fiber end connectors with neutral sleeves to straight contact connectors and connect angled contact fiber end connectors with green sleeves to angled contact connectors.

NOTE **Angled non-contact fiber end connectors** with orange sleeves cannot be directly connected to the instrument.

See “Connector Interfaces” on page 28 for further details on connector interfaces and accessories.

Signal Input and Output

CAUTION

There is one BNC input connector on the front panel of an Agilent 81950A Compact Tunable Laser Source module.

To prevent the BNC interface from damage, do not exceed the voltage limit of +- 5V when applying external voltage.

2
Accessories

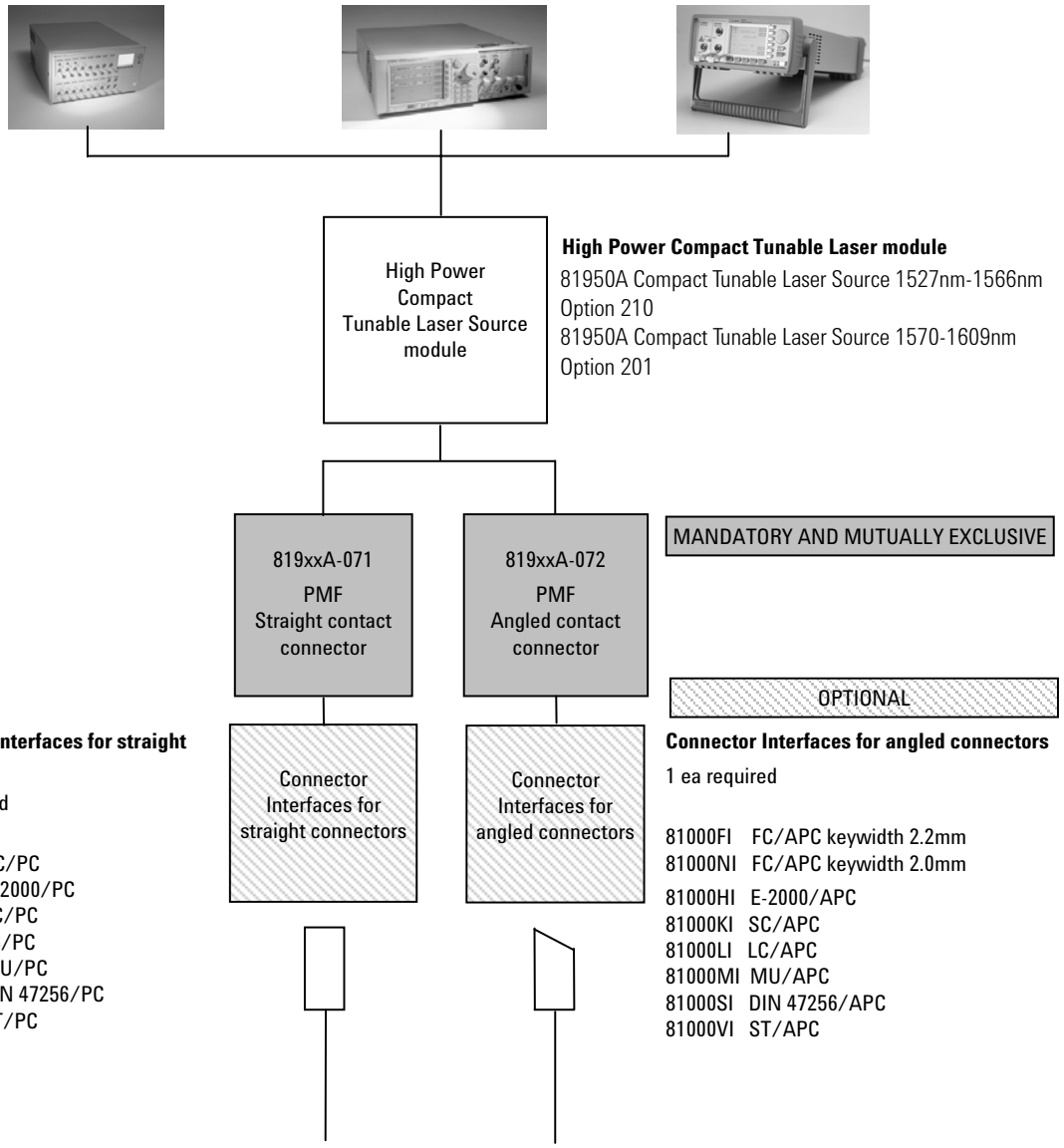
The Agilent 81950A Compact TLS module is available in various configurations for the best possible match to the most common applications.

This chapter provides information on the available options and accessories.

Modules and Options 26
Modules 27
Options 27
Option 210 27
Option 201 27
Connector Interfaces 28
Option 071 28
Option 072 28
User's Guides 29

Modules and Options

Figure 5 shows all the options that are available for Agilent 81950A Compact TLS module, and the instruments that support these modules.



Note: 819xxA - 072 is highly recommended over 819xxA - 071 to reduce front-panel reflections, which will greatly reduce interference noise and spectral ripple in the test setup.

Figure 5 Mainframes, Tunable Laser Module, and Options

Modules

Agilent 81950A Compact TLS module can be hosted by:

- Agilent 8163A and Agilent 8163B Lightwave Multimeters,
- Agilent 8164A and Agilent 8164B Lightwave Measurement Systems,
- Agilent 8166A and Agilent 8166B Lightwave Multichannel Systems.

Table 1 Compact Tunable Laser Modules

Model Number	Description
Agilent 81950A Option 210	High Power Compact Tunable Laser, 1527 nm - 1566 nm
Agilent 81950A Option 201	High Power Compact Tunable Laser, 1570 nm - 1609 nm

Options

The following options are available for these Compact TLS module:

Option 210

High Power Tunable Laser, C-band, 1527-1566nm

Option 201

High Power Tunable Laser, L-band, 1570-1609nm

Option 071

Polarization-maintaining fiber, Panda-type, for straight contact connectors.

Option 072

Polarization-maintaining fiber, Panda-type, for angled contact connectors.

NOTE

Option 072 recommended 819xxA - 072 is highly recommended over 819xxA - 071, which will greatly reduce interference noise and spectral ripple in the test setup.

Connector Interfaces

The following connector interfaces are available for these Compact TLS module:

Option 071

Straight Contact Connectors

If you want to use straight connectors (such as FC/PC/SPC, E-2000, SC/PC/SPC, DIN 47256 or ST) to connect to the instrument, you must do the following:

1 Attach your connector interface to the interface adapter.

2 See Table 2 for a list of the available connector interfaces.

Table 2 Straight Contact Connector Interfaces

Description	Model number
FC/PC/SPC	Agilent 81000 FI
E-2000	Agilent 81000 HI
SC/PC/SPC	Agilent 81000 KI
DIN 47256 / 4108.6	Agilent 81000 SI
ST	Agilent 81000 VI

3 Connect your cable.

Option 072

Angled Contact Connectors

If you want to use angled connectors (such as E-2000 APC, SC/APC, FC/APC or DIN 4108.6/4108.6) to connect to the instrument, you must do the following:

1 Attach your connector interface to the interface adapter.

2 See Table 3 for a list of the available connector interfaces.

Table 3 Angled Contact Connector Interfaces

Description	Model number
E-2000 APC	Agilent 81000 HI
SC/APC	Agilent 81000 KI
FC/APC	Agilent 81000 NI
DIN 47256 / 4108.6	Agilent 81000 SI

3 Connect your cable.

User's Guides

The following User's Guides are applicable to these Compact TLS module:

Table 4 User's Guides

Description	Part Number
Agilent 81950A Compact Tunable Laser Source module User's Guide.	81950-91020
Agilent 8163A/B Lightwave Multimeter, Agilent 8164A/B Lightwave Measurement System, & Agilent 8166A/B Lightwave Multichannel System User's Guide.	08164-90B15
Agilent 8163A/B Lightwave Multimeter, Agilent 8164A/B Lightwave Measurement System, & Agilent 8166A/B Lightwave Multichannel System Programming Guide.	08164-90B64
Agilent 8163B Lightwave Multimeter, Agilent 8164B Lightwave Measurement System LAN Interface Addendum to the User and Programming Guides	5989-9352EN

3
Operating Instructions

This chapter provides a general description of the specific features of instruments using the 81950A compact tunable laser module.

Operation 33
Parameters 33
Output Frequency 33
Limitations 33
Changing the Grid (f0, s) 34
Operation Modes 34
Switching Modes 34
Preset Values 35
Differences to Other Tunable Laser Source Modules 35
The Graphical User Interface 36
Differences among 8164A/B, 8163A/B and 8166A/B 36
Soft Lock 36
How to Set a Parameter 37
How to Set the Power 39
How to Switch Operation Mode 40
How to Set the Wavelength or Frequency 43
How to Switch On the Laser 44
How to set Frequency Parameters in Grid Mode 45
How to Check the Output Frequency or Wavelength 46
How to Modulate a Signal 47
The User Interface 49
The Module's Front Panel 49

Symbols used in this chapter

Symbols	Description
λ	wavelength
f	frequency
fo	reference frequency
Δf	frequency offset
s	grid spacing
c	channel number (i.e. ITU grid channel number)

Operation

Parameters

The instrument allows setting the following parameters:

- Laser State
- Optical Output Power
- Operation Mode ("Auto Mode" or "Grid Mode")
- Frequency, Wavelength
- Reference Frequency
- Grid Spacing
- Channel Number
- Frequency Offset (or "Fine Tune Frequency")
- Modulation
  - State
  - SBS suppression FM frequency
  - Signaling or trace tone AM level

The AM modulation is only available with the Agilent 81950A module using the BNC connector at the module's front panel. The N7711A / N7714A instruments platform features no such connector.

Output Frequency

The output frequency is calculated using this equation:

$$f = fo + c \times s + \Delta f$$

Limitations

- Reference frequency and grid spacing can only be changed when the laser is off.
- Operation mode can only be changed when the laser is off.
- The maximum grid spacing value the underlying hardware can handle is 3.2767 THz and depending on the specific instrument it may be less than that.

Changing the Grid (f_0, s)

When changing the grid parameters (reference frequency and grid spacing) the instrument will try to keep the resulting frequency, i.e. the channel number c is changed, so that $|f_{before} - f_{after}|$ is minimized.

If the laser module is on, you have to explicitly switch it off before a grid parameter can be changed.

Operation Modes

The "native" parameters used by the underlying hardware are reference frequency, grid spacing, channel number and frequency offset. In some applications however, you may just want to set a frequency (or wavelength) without thinking about the details. So the instrument offers two operation modes: "Auto Mode" and "Grid Mode".

- Auto Mode: You can set a frequency (or wavelength) and the instrument calculates and sets its parameters accordingly. f_o, s, c, and Δf are read-only.
- Grid Mode: You can set f_o and s manually. You can also edit c and Δf to get the desired frequency. The resulting output frequency and wavelength are read-only.

NOTE The term "Auto Mode off" is used instead of "Grid Mode" in SCPI commands and on the Graphical User Interface.

Switching Modes

- Auto Mode to Grid Mode: f is saved and f_o, s, c, and Δf are restored.
- Grid Mode to Auto Mode: The manually set values f_o, s, c, and Δf are saved.

  The last frequency set in Auto Mode before is restored.

Preset Values

- f_o = 193.1THz
- s = 100GHz
- c = 0 (C-band), c = -50 (L-band)
- Δf = 0
- f = 193.1THz (C-Band), f = 1881.1THz (L-Band)
- P = 20mW
- Operation mode: *Auto Mode* (81950A), *Grid Mode* (N7711A, N7714A).
- Modulation: off, FM = 0, AM = 0

Differences to Other Tunable Laser Source Modules

The 81950A compact tunable laser source modules are intended for use as a highly stable high power laser source. They use a different technology which makes them slower when switching on the laser or changing the power or wavelength.

The 81950A tunable lasers do not support wavelength sweeps and triggering. Besides they have different modulation capabilities.

The Graphical User Interface

Differences among 8164A/B, 8163A/B and 8166A/B

Apart from the main parameters Wavelength (or Frequency or Channel, depending on the instrument state), Power, and State (i.e. laser on or off), there is only limited space on the 8163 and 8166 displays.

Depending on the selected Operation Mode the following is displayed or hidden:

- Auto Mode: Output group box visible, Grid and Modulation group boxes hidden.
- Grid Mode (= Auto Mode off)
  - 8163B, 8166B: Grid group box visible, Output and Modulation group boxes hidden.
  - 8163A, 8166A: Grid, Output, and Modulation group boxes hidden.

Soft Lock

When you use high-power Tunable Laser Source modules, you must enter the password to unlock the instrument. This feature is called "Soft Lock" as opposed to a lock using a key.

At power on the instrument shows a dialog and prompts the user to enter a code to unlock it. Later you can lock or unlock the instrument any time: press the [Config] key, and then select "Lock" or "Unlock". The dialog opens again and you can enter the password.

The default password is "1234".

If the instrument is locked, the status line shows "SL" (8163 A/B, 8166 A/B) or "SLock" (8164 A/B).

NOTE

The instrument can also be locked and unlocked using a remote command: "LOCK 0|1, <password>".

Example: unlock the instrument using password "1234": lock 0,1234

How to Set a Parameter

General Description

This chapter is a general description on how to set a parameter. The following chapters only describe specific details for particular parameters.

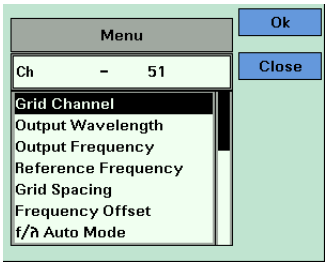
NOTE The Modify Knob and the numerical key pad are only available on the 8164 A/B.

- First select the correct module using the [Channel] hard key.
- You can switch from the Overview Screen, where you see all modules, to the Details Screen, where the whole screen is used to show a single module, and back using the topmost soft key. It is either labeled "Overview" or "Details" depending on the current view.
- Move to the parameter you want to change using the arrow keys or the Modify Knob.
- For some parameters you can now change the unit (e.g. W <–> dBm for power) or switch between frequency and wavelength using the soft keys.
- Press [Enter], the Modify Knob, or the [Edit] soft key to start editing the value.
- Enter the desired value using the Up/Down/Left/Right keys, the Modify Knob or the numerical key pad.
- When finished press [Enter], the Modify Knob, or the [OK] soft key. You can also cancel the operation using the [Cancel] soft key.

NOTE Not all parameters are available in all operation modes or instrument states.

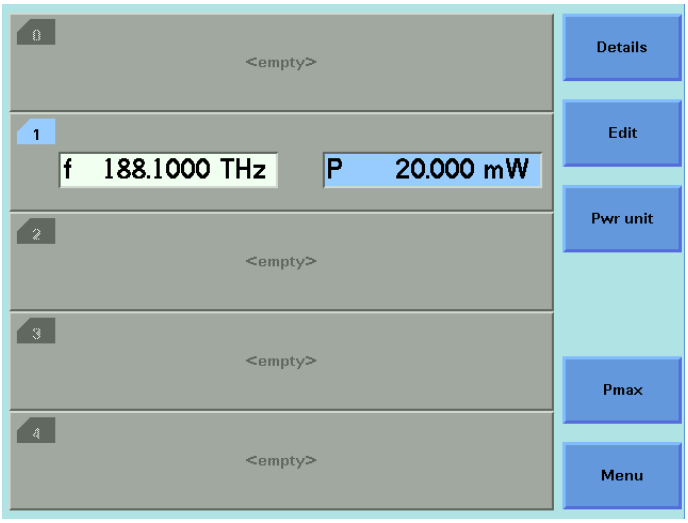
- If a parameter is not displayed on the screen, it can alternatively be accessed using the [Menu] soft key, which opens a menu with all currently available parameters:

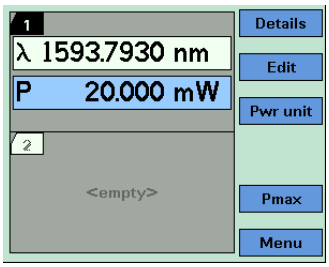
Menu
Ch - 51
Grid Channel
Reference Frequency
Grid Spacing
Frequency Offset
f/λ Auto Mode
Source state
Power
Pwr unit
Pmax
Modulation State
External Mod. Input
SBSC Level
AM Level
Ok
Close
Ch -
20.000 mW


Menu
Ch - 51
Grid Channel
Output Wavelength
Output Frequency
Reference Frequency
Grid Spacing
Frequency Offset
f/λ Auto Mode
Ok
Close

How to Set the Power

- Move to the power parameter, [P].





- If you want to change the unit (W → dBm or vice versa), press the [Pwr unit] soft key.
- Use the [Pmax] soft key to set the maximum power, or
- Change the value as described in chapter "How to Set a Parameter" on page 37.

How to Switch Operation Mode

Refer to chapter “Operation Modes” on page 34.

NOTE

The operation mode can only be changed if the laser is off.

8164 A/B

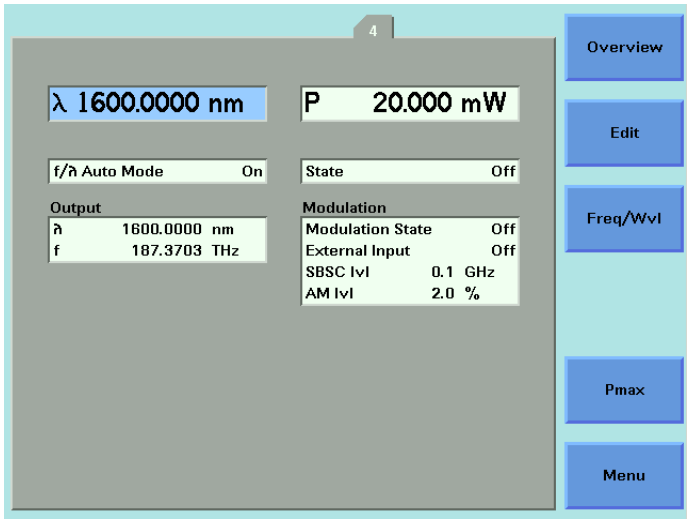
- Move to parameter "$f/\ \lambda$ Auto Mode".
- Press [Enter], the Modify Knob, or the [Edit] soft key to start editing the value.
- Use the Up or Down key or the Modify Knob to select an operation mode.
- When finished press [Enter], the Modify Knob, or the [OK] soft key. You can also cancel the operation using the [Cancel] soft key.

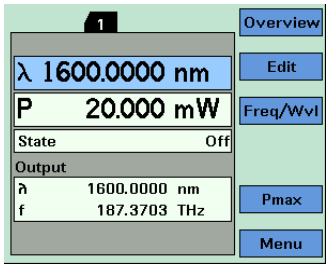
8163 A/B, 8166 A/B

Note: This also works on the 8164 A/B, though it is not necessary to use the menu there.

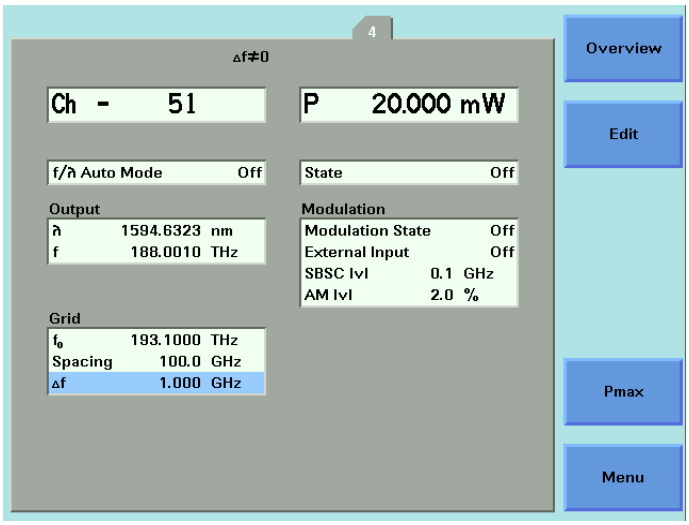
- Press the [Menu] soft key then use the Up or Down button to move to parameter "$f/\ \lambda$ Auto Mode".
- Press the [OK] soft key.
- Use the Up or Down key to select an operation mode.
- Press the [OK] soft key to apply the changed value.

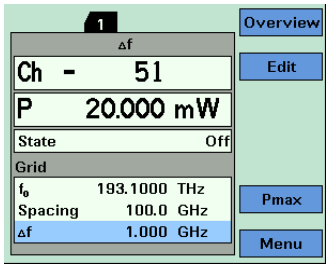
Details Screen in Auto Mode





Details Screen in Grid Mode (i.e. Auto Mode off)





How to Set the Wavelength or Frequency

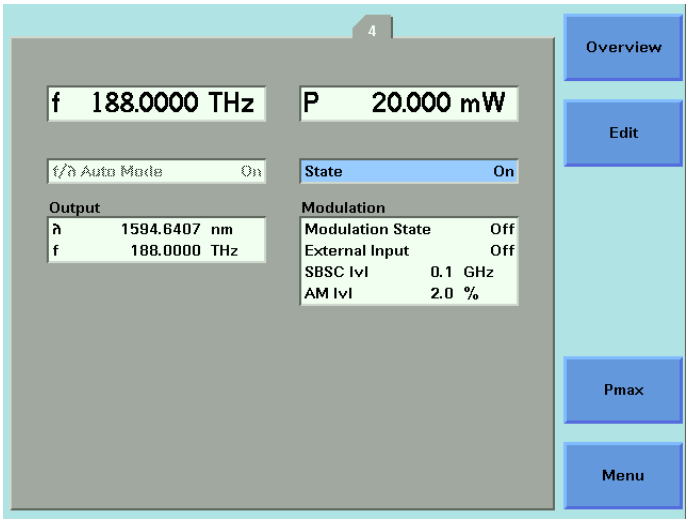
Note: This applies to "Auto Mode" only. For more information, refer to the chapters “Operation Modes” on page 34 and “How to Switch Operation Mode” on page 40.

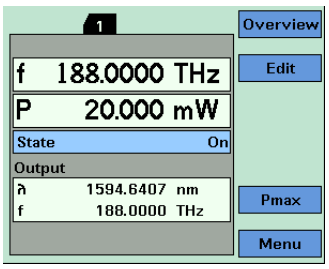
- Move to parameter wavelength [λ] or frequency [*f*] .
- If you want to switch from wavelength to frequency or back press the [Freq/Wvl] soft key.
- Change the value as described in chapter “How to Set a Parameter 37” on page 31.

How to Switch On the Laser

Note: If parameter "state" is grayed out and "SLock" or "SL" is shown in the status line, refer to chapter “Soft Lock” on page 36.

- Move to parameter "state".





- Press [Enter], the Modify Knob, or the [Edit] soft key to start editing the value.
- Use the Up or Down key or the Modify Knob to select the laser state.
- When finished press [Enter], the Modify Knob, or the [OK] soft key. You can also cancel the operation using the [Cancel] soft key.

NOTE You can also use the module's front panel key to switch the laser state.

How to set Frequency Parameters in Grid Mode

In "Grid Mode" (i.e. "Auto Mode off") the main parameter (i.e. the parameter shown in the topmost line) is the channel number [Ch].

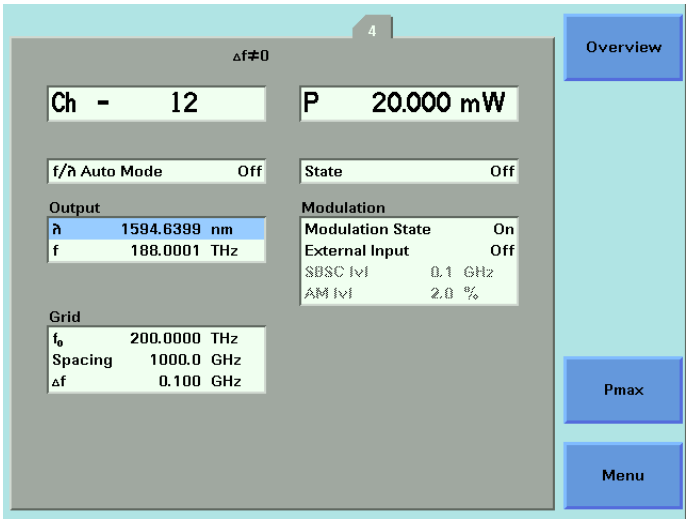
The resulting output frequency must be set using the reference frequency, grid spacing, frequency offset, and channel number.

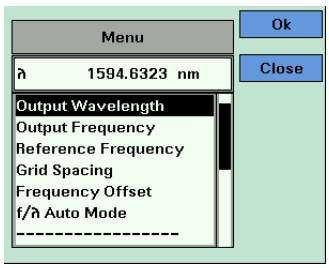
- Move to the parameter you want to change (it may be necessary to open the menu by pressing the [Menu] soft key to access it).
- Change the value as described in chapter “How to Set a Parameter” on page 37.

NOTE Reference frequency and grid spacing can only be changed if the laser is off.

How to Check the Output Frequency or Wavelength

Sometimes it may be interesting to know the output frequency or wavelength, e.g. if you edit the channel number or frequency you might want to know the corresponding wavelength.





Depending on the instrument type and state these values are displayed in the "Output" group box on the "Details Screen" or can be checked in the menu. (Press the [Menu] soft key to open the menu.)

NOTE These values are read only.

How to Modulate a Signal

Modulation concerning the new compact tunable laser source is also called digital dither.

The use of dither generally falls into two categories:

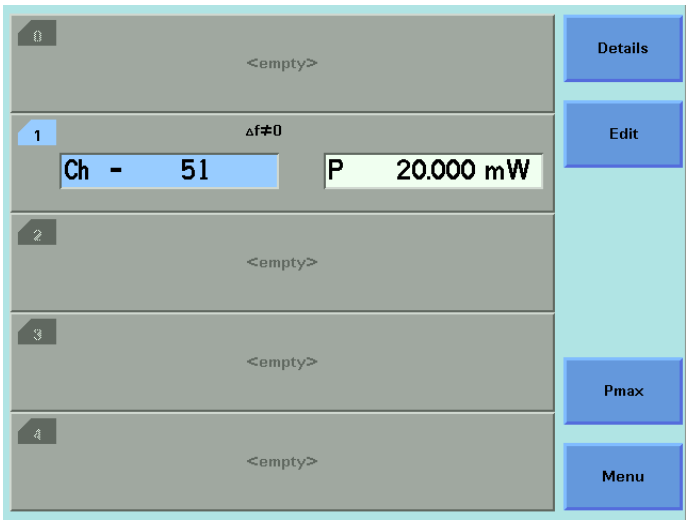
- SBS control (or SBS suppression): parameter "SBSC lvl"
- Signaling (parameter "AM lvl") can make use of an AM modulation signal supplied via the BNC connector on the module's front panel. Use parameter "External Input" to connect the external input to the laser.

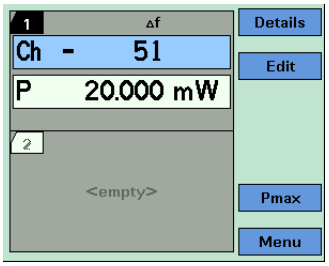
NOTES

- Parameter "Modulation State" enables (or disables), SBS Control and "External Input" enables (or disables) Signaling.
- The signal supplied via the front panel BNC connector has no effect unless the AM level is non-null.

Status Line

The Status line displays " $\Delta f \neq 0$ " (8164x) or " Δf " (8163x, 8166x) if the frequency offset doesn't equal 0:





In *Auto Mode* the frequency offset symbol is not shown.

Modify Knob, Up/Down Keys

When editing values using the Modify Knob or the up/down keys, the values are not sent to the module before the user explicitly presses the RPG, the [OK] soft key, or the [Enter] hard key.

This behavior differs from other modules where changed values are sent immediately.

The User Interface

The Module's Front Panel

Key

The module's front panel key can be used to switch the laser on or off.

NOTES

- When the instrument's user interface is used, the laser can be switched off any time using the module's front panel key.
- The module's front panel key is disabled when the instrument is remote controlled or if it is locked.
- When the instrument is remote controlled and the [Local] soft key is pressed, the front panel key is not re-enabled until the last remote command is finished.

LED

The module's front panel LED is used to inform about the state of the module:

LED State	Module State
blinking slowly (at boot time)	initializing hardware
blinking fast	boot error
off	laser is off
blinking slowly	laser is on and working, i.e. changing frequency, power or laser state
on	laser is on, frequency and power are stable

4
Programming Instructions

This chapter describes the SCPI Commands for use of 81950A compact tunable laser modules and N7711A, N7714A single and 4-port Tunable Laser System Sources.

Summary 52
Detailed Description 54
The OUTPut sub tree 54
The SOURce:CHANnel:POWer sub tree 56
The SOURce:CHANnel:WAVelength sub tree 59
The SOURce:CHANnel:FREQuency sub tree. 61
The SOURce:CHANnel:MODUlation sub tree. 67
Error Messages 71
Status Bits 72
Differences among 81950A, N7711A and N7714A 73
81950A Only. 73
N771A, N7714A Only 73

Summary

- This chapter refers to both the 81950A module and the N7711A/N7714A instruments. The N771xA command set is derived from the 8163A/B, 8164A/B, and 8166A/B command set.
- Please refer to the *Agilent 8163A/B, 8164A/B, 8166A/B Programming Guide* for an introduction to programming instruments and for information about programming and syntax conventions. If you are using an 8163B or 8164B with LAN support please also refer to the *Agilent 8163B Lightwave Multimeter, Agilent 8164B Lightwave Measurement System LAN Interface Addendum to the User and Programming Guides*.
- An "X" in the "New" column in the table below means that the command was not implemented in previous instruments and is not yet described in another manual.
- Source specific commands not listed in the table below are not supported.
- The "[:CHANnel[m]]" part means the channel (i.e. sub-module) of a module in a modular instrument like the 8163A/B, 8164A/B, 8166A/B platform. The 81950A module and the N7711A, N7714A instruments accept only ":CHANnel1" which is the default anyway, so this optional part can be omitted.

Command	Description	New	Page
:OUTPut[n][:CHANnel[m]			
:POWer:UNit/?	Sets or returns the power unit used (dBm or W).		page 54
[:STATe]/?	Sets a source's output state or returns its current state.		page 54
[:SOURce[n]][:CHANnel[m]]:POWer			
[:LEVel][:IMMediate][:AMPLitude]/?	Sets or returns the laser output power.		page 56
:STATe/?	Sets or returns the state of the source output signal.		page 57
:UNIT/?	Sets or returns the power unit.		page 57
[:SOURce[n]][:CHANnel[m]]:WAVelength			
[:CW|:FIXED]/?	Sets or returns the wavelength of a source.		page 59
:TOGRid	Sets the wavelength to the nearest grid point, only changing the channel number.	X	page 60
:AUTO/?	Sets auto mode on or off or returns its current state.	X	page 60

Command	Description	New	Page
[:SOURce[n]][:CHANnel[m]]:FREQuency			
/?	Sets or returns the frequency.	X	page 61
:REFerence/?	Sets or returns the reference frequency	X	page 61
:GRID/?	Sets or returns the grid spacing.	X	page 62
:CHANnel/?	Sets or returns the channel number	X	page 63
:OFFSet/?	Sets or returns the frequency offset (aka fine tune frequency).	X	page 64
:TOGRid	Sets the frequency to the nearest grid point, only changing the channel number.	X	page 65
:AUTO/?	Sets auto mode on or off or returns its current state.	X	page 65
[:SOURce[n]][:CHANnel[m]]:MODUlation			
:INTernal[:STATe]/?	Enable or disable the SBS suppression or return its current state	X	page 67
:INTernal:SBSControl[:LEVel]/?	Sets or returns the SBS suppression frequency.	X	page 67
:INTernal:RATE?	Internal modulation rate.	X	page 68
:INTernal:WAVeform?	Internal modulation waveform.	X	page 69
:EXTernal[:STATe]/?	Sets or returns the state of the amplitude modulation.	X	page 69
:EXTernal:AM[:LEVel]/?	Sets or returns signaling or trace tone AM level.	X	page 70

Detailed Description

The OUTPut sub tree

Command	:OUTPut[n][:CHANnel[m]:POWer:UNit
Syntax	:OUTPut[n][:CHANnel[m]]:POWer:UNit<wsp>DBM|0|Watt|1
Description	Sets whether the power unit used is dBm or W.
Parameters	DBM or 0: Sets the power unit to dBm Watt or 1: Sets the power unit to W
Response	none
Example	outp1:pow:un w
Affects	
Notes	This is the same as [:SOURce[n]][:CHANnel[m]:POWer:UNIT

Command	:OUTPut[n][:CHANnel[m]:POWer:UNit?
Syntax	:OUTPut[n][:CHANnel[m]]:POWer:UNit?
Description	Queries whether the power unit used is dBm or W.
Parameters	none
Response	0: the power unit is dBm +1: the power unit is W
Example	outp1:pow:un? → +1<END>
Affects	
Notes	This is the same as [:SOURce[n]][:CHANnel[m]:POWer:UNIT?

Command	:OUTPut[n][:CHANnel[m][:STATe]
Syntax	:OUTPut[n][:CHANnel[m][:STATe]<wsp>OFF|0|ON|1
Description	Switches the laser on or off.
Parameters	OFF or 0: Disable the output ON or 1: Enable the output
Response	none
Example	outp1 on
Affects	
Notes	This is the same as [:SOURce[n]][:CHANnel[m]:POWer:STATe

Command	**:OUTPut[n][:CHANnel[m][:STATe]?**
Syntax	:OUTPut[n][:CHANnel[m][:STATe]?
Description	Queries the laser state.
Parameters	none
Response	0: Disabled 1: Enabled
Example	outp1? → 1
Affects	
Notes	This is the same as [:SOURce[n]][:CHANnel[m]:POWer:STATe?

The SOURce:CHANnel:POWer sub tree

Command	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel][:IMMediate][:AMPLitude]
Syntax	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel][:IMMediate][:AMPLitude]<wsp> <value>[MW|Watt|DBM]|MIN|MAX|DEF
Description	Sets the power of the laser output.
Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	none
Example	sour1:pow 19mW
Affects	
Notes	

Command	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel][:IMMediate][:AMPLitude]?
Syntax	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel][:IMMediate][:AMPLitude]?<wsp> [MIN|MAX|DEF]
Description	Returns the power of the laser output in the unit selected with the unit command.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current power value or the minimum, maximum, or default power value.
Example	sour1:pow? → +2.00000000E-002
Affects	
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:POWer:STATe**
Syntax	[:SOURce[n]][:CHANnel[m]:POWer:STATe<wsp>OFF|0|ON|1
Description	Switches the laser on or off.
Parameters	OFF or 0: Disable the output ON or 1: Enable the output
Response	none
Example	sour1:pow:stat on
Affects	
Notes	This is the same as :OUTPut[n][:CHANnel[m]:STATe

Command	**[:SOURce[n]][:CHANnel[m]]:POWer:STATe?**
Syntax	[:SOURce[n]][:CHANnel[m]]:POWer:STATe?
Description	Queries the laser state.
Parameters	none
Response	0: Disabled 1: Enabled
Example	sour1:pow:stat? → 1
Affects	
Notes	This is the same as :OUTPut[n][:CHANnel[m]:STATe?

Command	**[:SOURce[n]][:CHANnel[m]]:POWer:UNIT**
Syntax	[:SOURce[n]][:CHANnel[m]]:POWer:UNIT<wsp>DBM|0|Watt|1
Description	Sets whether the power unit used is dBm or W.
Parameters	DBM or 0: Sets the power unit to dBm Watt or 1: Sets the power unit to W
Response	none
Example	sour1:pow:unit w
Affects	
Notes	This is the same as :OUTPut[n][:CHANnel[m]:POWer:UNIT

Command	**[:SOURce[n]][:CHANnel[m]]:POWer:UNIT?**
Syntax	[:SOURce[n]][:CHANnel[m]]:POWer:UNIT?
Description	Queries whether the power unit used is dBm or W.
Parameters	none
Response	0: the power unit is dBm +1: the power unit is W
Example	outp1:pow:un? → +1<END>
Affects	
Notes	This is the same as :OUTPut[n][:CHANnel[m]:POWer:UNIT?

The SOURce:CHANnel:WAVelength sub tree

Command	**[:SOURce[n]][:CHANnel[m]]:WAVelength[:CW|:FIXED]**
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength[:CW|:FIXED]<wsp> <value>[PM|NM|UM|MM|M]|MIN|MAX|DEF
Description	Sets the laser wavelength
Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	none
Example	sour1:wav 1600nm
Affects	
Notes	Only available in "Auto Mode". "CW" and "FIXED" have no specific meaning, these mnemonics were just added for backward compatibility.

Command	**[:SOURce[n]][:CHANnel[m]]:WAVelength[:CW|:FIXED]?**
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength[:CW|:FIXED]? <wsp>[MIN|MAX|DEF]
Description	Returns the wavelength value in meters.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current wavelength value or the minimum, maximum, or default wavelength value.
Example	sour1:wav? → +1.60000000E-006
Affects	
Notes	"CW" and "FIXED" have no specific meaning, these mnemonics were just added for backward compatibility

Command	[:SOURce[n]][:CHANnel[m]]:WAVelength:TOGRid
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:TOGRid<wsp> <value>[PM|NM|UM|MM|M]
Description	Set the wavelength to the nearest grid point only changing the channel number.
Parameters	The wavelength value.
Response	none
Example	sour4:wav:togr 1.6um
Affects	
Notes	Only available in "Grid Mode" The frequency offset is neither changed nor taken into account when calculating the nearest channel.

Command	[:SOURce[n]][:CHANnel[m]]:WAVelength:AUTO
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:AUTO<wsp>OFF|0|ON|1
Description	Switch between "Auto Mode" and "Grid Mode", Refer to the chapter “Operation Modes” on page 34.
Parameters	OFF or 0: "Grid Mode" (= Auto Mode off) ON or 1: "Auto Mode"
Response	none
Example	sour1:wav:auto on
Affects	
Notes	This command is equivalent to [:SOURce[n][:CHANnel[m]]:FREQuency:AUTO

Command	[:SOURce[n]][:CHANnel[m]]:WAVelength:AUTO?
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:AUTO?
Description	Returns the current operation mode.
Parameters	none
Response	0: "Grid Mode" (= Auto Mode off) 1: "Auto Mode"
Example	sour1:wav:auto? → 0
Affects	
Notes	This query is equivalent to [:SOURce[n][:CHANnel[m]]:FREQuency:AUTO?

The SOURce:CHANnel:FREQuency sub tree

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency<wsp> <value>[HZ|KHZ|MHZ|GHZ|THZ]|MIN|MAX|DEF
Description	Sets the laser frequency.
Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	None
Example	sour1:freq 188THz
Affects	
Notes	Only available in "Auto Mode".

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency?**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency?<wsp>[MIN|MAX|DEF]
Description	Returns the frequency value in Hz.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current frequency value or the minimum, maximum, or default frequency value.
Example	sour1:freq? → +1.88000000E+014
Affects	
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:REFerence**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:REFerence<wsp> <value>[HZ|KHZ|MHZ|GHZ|THZ]|MIN|MAX|DEF

Description	Set the reference frequency for the frequency grid used by the instrument.
Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	None
Example	sour1:freq:ref 193.1THz
Affects	
Notes	Only available in "Grid Mode"

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:REFerence?**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:REFerence?<wsp>[MIN|MAX|DEF]
Description	Returns the reference frequency for the frequency grid used by the instrument.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current reference frequency value or the minimum, maximum, or default reference frequency value in Hz.
Example	sour1:freq:ref? → +1.93100000E+014
Affects	
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:GRID**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:GRID<wsp> <value>[HZ|KHZ|MHZ|GHZ|THZ]|MIN|MAX|DEF
Description	Set the grid spacing for the frequency grid used by the instrument.
Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value

Response	None
Example	sour1:freq:grid 50e9
Affects	
Notes	Only available in "Grid Mode"

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:GRID?**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:GRID?<wsp>[MIN|MAX|DEF]
Description	Returns the grid spacing for the frequency grid used by the instrument.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current grid spacing value or the minimum, maximum, or default grid spacing value in Hz.
Example	sour1:freq:grid? → +5.00000000E+010
Affects	
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:CHANnel**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:CHANnel<wsp> <value>|MIN|MAX|DEF
Description	Sets the laser's grid channel.
Parameters	Any value resulting in a valid frequency, refer to the chapter “Output Frequency” on page 33. Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	None
Example	sour1:freq:chan -20
Affects	
Notes	Only available in "Grid Mode". The minimum, maximum, and default value depend on the current reference frequency and grid spacing values.

Command	[:SOURce[n]][:CHANnel[m]]:FREQuency:CHANnel?
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:CHANnel?<wsp>[MIN|MAX|DEF]
Description	Returns the laser's grid channel.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current grid channel value or the minimum, maximum, or default grid channel value.
Example	sour1:freq:chan? → -20
Affects	
Notes	The minimum, maximum, and default value depend on the current reference frequency and grid spacing values.

Command	[:SOURce[n]][:CHANnel[m]]:FREQuency:OFFSet
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:OFFset<wsp> <value>[HZ|KHZ|MHZ|GHZ|THZ]|MIN|MAX|DEF
Description	Set the frequency offset used by the instrument, Refer to the chapter “Output Frequency” on page 33.
Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	None
Example	sour1:freq:offs 0.1e9
Affects	
Notes	Only available in "Grid Mode"

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:OFFSet?**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:OFFSet?<wsp>[MIN|MAX|DEF]
Description	Returns the frequency offset used by the instrument in Hz.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current frequency offset value or the minimum, maximum, or default frequency offset value in Hz.
Example	sour1:freq:offs? → +1.00000000E+008
Affects	
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:TOGRid**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:TOGRid <wsp> <value>[HZ|KHZ|MHZ|GHZ|THZ]
Description	Set the frequency to the nearest grid point only changing the channel number.
Parameters	The frequency value.
Response	None
Example	sour4:freq:togr 188.5thz
Affects	
Notes	Only available in "Grid Mode" The frequency offset is neither changed nor taken into account when calculating the nearest channel.

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:AUTO**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:AUTO<wsp>OFF|0|ON|1
Description	Switch between "Auto Mode" and "Grid Mode", Refer to the chapter “Operation Modes” on page 34.
Parameters	OFF or 0: "Grid Mode" (= Auto Mode off) ON or 1: "Auto Mode"
Response	None
Example	sour1:freq:auto on

Affects	
Notes	This command is equivalent to [:SOURce[n][:CHANnel[m]]:WAVelength:AUTO

Command	**[:SOURce[n]][:CHANnel[m]]:FREQuency:AUTO?**
Syntax	[:SOURce[n]][:CHANnel[m]]:FREQuency:AUTO?
Description	Returns the current operation mode.
Parameters	none
Response	0: "Grid Mode" (= Auto Mode off) 1: "Auto Mode"
Example	sour1:freq:auto? → 0
Affects	
Notes	This query is equivalent to [:SOURce[n][:CHANnel[m]]:WAVelength:AUTO?

The SOURce:CHANnel:MODUlation sub tree

Command	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal[:STATe]
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal[:STATe]<wsp>OFF|0|ON|1
Description	Switches the internal modulation (SBS suppression) on or off.
Parameters	OFF or 0: Disable the modulation ON or 1: Enable the modulation
Response	None
Example	sour1:modu:int on
Affects	
Notes	SBSControl must be set to an appropriate value, too.

Command	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal[:STATe]?
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal[:STATe]?
Description	Returns the internal modulation state.
Parameters	None
Response	0: off 1: on
Example	sour1:modu:int? → 0
Affects	
Notes	

Command	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:SBSControl[:LEVel]
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:SBSControl[:LEVel] <wsp> <value>[HZ|KHZ|MHZ|GHZ|THZ]|MIN|MAX|DEF
Description	Sets the internal frequency modulation frequency.

Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	None
Example	sour1:modu:int:sbsc 0.2GHz
Affects	
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:SBSControl[:LEVel]?**
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:SBSControl[:LEVel]?<wsp> [MIN|MAX|DEF]
Description	Returns the internal frequency modulation frequency in Hz.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current modulation frequency value or the minimum, maximum, or default modulation frequency value in Hz.
Example	sour1:modu:int:sbsc? → +2.00000000E+008
Affects	
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:RATE?**
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:RATE?
Description	Returns the internal modulation rate in Hz.
Parameters	None
Response	The internal modulation rate in Hz.
Example	sour:modu:int:rate? → +2.00000000E+004
Affects	N7711A, N7714A only
Notes	There is no corresponding command, because the hardware does not allow setting this value.

Command	**[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:WAVeform?**
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:WAVeform?
Description	Returns the internal modulation waveform.
Parameters	None
Response	SIN: sinusoidal TRI: triangular
Example	sour:modu:int:wav? -> SIN
Affects	N7711A, N7714A only
Notes	There is no corresponding command, because the hardware does not allow setting this value.

Command	**[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal[:STATe]**
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal[:STATe]<wsp>OFF|0|ON|1
Description	Sets the state of the external amplitude modulation.
Parameters	OFF or 0: off ON or 1: on
Response	None
Example	sour1:modu:ext on
Affects	81950A only
Notes	

Command	**[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal[:STATe]?**
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal[:STATe]?
Description	Returns the state of the external amplitude modulation.
Parameters	None
Response	0: off 1: on
Example	sour1:modu:ext? → 1
Affects	81950A only
Notes	

Command	[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal:AM[:LEVel]
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal:AM[:LEVel] <wsp> <value> | MIN | MAX | DEF
Description	Sets the amplitude modulation level in %.
Parameters	Any value in the specified range (see appropriate User's Guide) Also allowed: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	None
Example	sour1:modu:ext:am 2.0
Affects	81950A only
Notes	

Command	[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal:AM[:LEVel]?
Syntax	[:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal:AM[:LEVel]?<wsp> [MIN | MAX | DEF]
Description	Returns the amplitude modulation level in %.
Parameters	Optional: MIN - minimum programmable value MAX - maximum programmable value DEF - default value
Response	The current amplitude modulation level or the minimum, maximum, or default amplitude modulation level.
Example	sour1:modu:ext:am? → +2.00000000E+000
Affects	81950A only
Notes	

Error Messages

Error messages returned by the "SYSTem:ERRor?" query:

- ***-221, "Not allowed while laser is on"*** - you tried to set grid spacing or reference frequency without switching off the laser.
- ***-221, "Not allowed while frequency auto mode is on"*** - you tried to issue a command which is only supported in grid mode.
- ***-221, "Not allowed while frequency auto mode is off"*** - you tried to issue a command which is only supported in auto mode.
- ***-221, "Settings conflict"*** - returned if the laser module reports an invalid configuration

Status Bits

If the frequency offset doesn't equal 0, bit 12 in the module's questionable status register is set (= value 4096).

Note: This only applies to *Grid Mode*; in *Auto Mode* the frequency offset status bit is not set.

The questionable condition and event registers can be queried using

- :STATus[m]:QUEStionable:CONDition?
- :STATus[m]:QUEStionable:EVENt?

Please refer to the Agilent 8163A/B, 8164A/B, 8166A/B Programming Guide for detailed information about the status model.

Differences among 81950A, N7711A and N7714A

Some commands are not available on both platforms

81950A Only

- [:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal[:STATe]/?
- [:SOURce[n]][:CHANnel[m]]:MODUlation:EXTernal:AM[:LEVel]/?

N771A, N7714A Only

- [:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:RATE?
- [:SOURce[n]][:CHANnel[m]]:MODUlation:INTernal:WAVeform?

5 Specifications

Agilent 81950A Compact TLS module is produced to the ISO 9001 international quality system standard as part of Agilent's commitment to continually increasing customer satisfaction through improved quality control.

Definition of Terms 77
- Absolute wavelength (frequency) accuracy 78
- External analog modulation - modulation depth 78
- Linewidth 78
- Maximum output power 79
- Operating temperature and humidity 79
- Output isolation 79
- Polarization extinction ratio 80
- Power flatness versus wavelength 81
- Power repeatability 81
- Power stability 82
- Relative intensity noise (RIN) 82
- Relative wavelength (frequency) accuracy 83
- Return loss 83
- SBS suppression - effective linewidth 84
- Side-mode suppression ratio 84
- Signal to source spontaneous emission ratio 84
- Tuning time 85
- Wavelength range 85
- Wavelength (frequency) repeatability 86
- Wavelength resolution 86
- Wavelength (frequency) stability 86

Compact Tunable Laser Module Specifications 87
- Agilent 81950A Compact Tunable Laser Source 88
- Specifications 89

Specifications:

Specifications apply, unless otherwise noted, for the stated environmental conditions, after warm-up, in CW mode (unmodulated output, SBS suppression off) and at uninterrupted line voltage. “Constant temperature” is a stable operating temperature within ±1 K.

Definition of Terms

This section defines terms that are used in this chapter.

Measurement principles are indicated. Alternative measurement principles of equal value are also acceptable.

Absolute wavelength (frequency) accuracy 78
External analog modulation - modulation depth 78
Linewidth 78
Maximum output power 79
Operating temperature and humidity 79
Output isolation 79
Polarization extinction ratio 80
Power flatness versus wavelength 81
Power repeatability 81
Power stability 82
Relative intensity noise (RIN) 82
Relative wavelength (frequency) accuracy 83
Return loss 83
SBS suppression - effective linewidth 84
Side-mode suppression ratio 84
Signal to source spontaneous emission ratio 84
Tuning time 85
Wavelength range 85
Wavelength (frequency) repeatability 86
Wavelength resolution 86
Wavelength (frequency) stability 86

Absolute wavelength (frequency) accuracy

The maximum difference between the displayed wavelength (frequency) and the actual wavelength (frequency) of the tunable laser source. Wavelength is defined as wavelength in vacuum.

External analog modulation - modulation depth

Specifies half the peak-to-peak optical power change divided by the average optical power for a sinusoidal input voltage at the analog modulation input. The average power is defined as half the sum of maximum and minimum power.

Conditions:

Modulation input signal as specified, modulation frequency as specified.

Measurement:

Using a photoreceiver (of sufficient bandwidth) and an oscilloscope.

Linewidth

The 3 dB width of the optical spectrum, expressed in Hertz.

Conditions:

SBS suppression off.

Measurement:

Using a self-heterodyning technique: The output of the laser under test is sent through a Mach-Zehnder interferometer in which the length difference of the two arms is longer than the coherence length of the laser. The electrical noise spectrum of the photodetector current is measured with Agilent lightwave signal analyzer, and the linewidth is calculated from the heterodyne spectrum.

Alternatively, *Using a heterodyning technique*: The output of the laser under test is mixed with another laser of the same type on a wide bandwidth photodetector. The electrical noise spectrum of the photodetector current is measured with Agilent Lightwave signal analyzer,

and the linewidth is calculated from the heterodyne spectrum. (Lightwave signal analyzer settings: resolution bandwidth 1 MHz, video bandwidth 10 kHz, sweep time 20 ms, single scan).

Maximum output power

The maximum achievable output power of the tunable laser source and the maximum output power for which the tunable laser source specifications apply.

Conditions:

As specified.

Measurement:

Using a power meter at the output of the instrument.

Operating temperature and humidity

The ambient temperature range and humidity range of the tunable laser source for which the specifications apply.

NOTE If the optical mainframe hosting the tunable laser source module is rack-mounted the temperature and humidity within the rack apply.

Output isolation

The insertion loss of the built-in isolator in the backward direction.

Measurement:

This characteristic cannot be measured from outside the module. It is based on known isolator characteristics.

Polarization extinction ratio

Specifies the ratio of the optical power in the slow axis of a connected polarization-maintaining fiber to optical power in the fast axis, expressed in dB

Conditions:

Applicable to tunable laser sources utilizing polarization maintaining fiber that has its TE mode in the slow axis and aligned with the connector key.

Measurement:

Using a polarization analyzer at the end of a polarization-maintaining patchcord, by sweeping the wavelength to create circular traces on the Poincaré sphere. Calculate the polarization extinction ratio from the diameters of these circles.

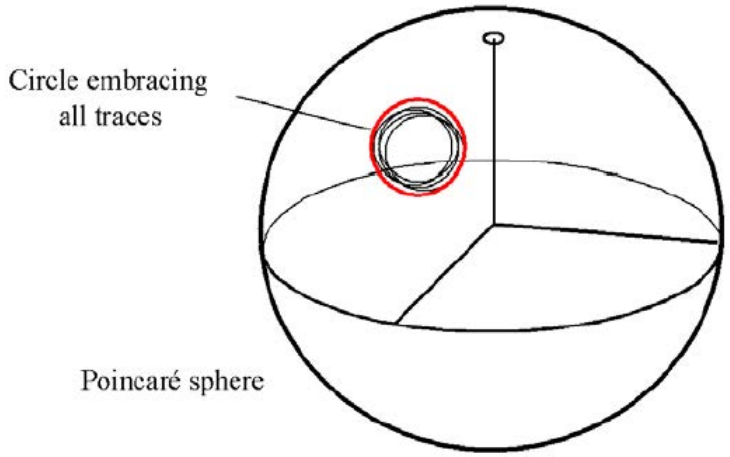


Figure 6 Circular traces on the Poincaré sphere used to calculate polarization extinction ratio.

Power flatness versus wavelength

Specifies ± half the span (in dB) between the maximum and the minimum actual power levels of the tunable laser source when changing the wavelength.

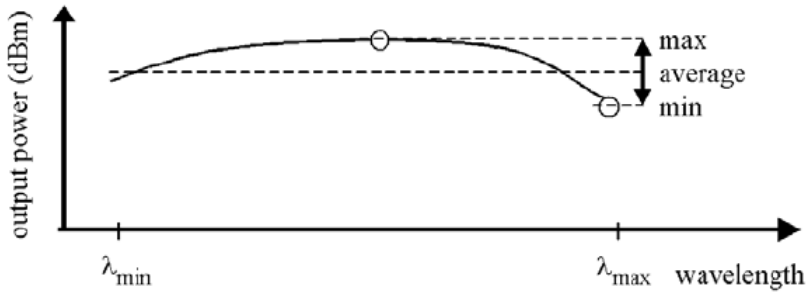


Figure 7 Power flatness vs. wavelength.

Conditions:

Uninterrupted tunable laser source output power, constant power setting, constant temperature.

Power repeatability

The uncertainty in reproducing the power level after changing and re-setting the power level. The power repeatability is ± half the span between the highest and lowest actual power (in dBm).

Conditions:

Uninterrupted tunable laser source output power, constant wavelength setting, constant temperature.

NOTE The long-term power repeatability can be obtained by taking the power repeatability and power stability into account.

Power stability

Specifies the change of the power level of the tunable laser source over time, expressed as ± half the span (in dB) between the highest and lowest actual power.

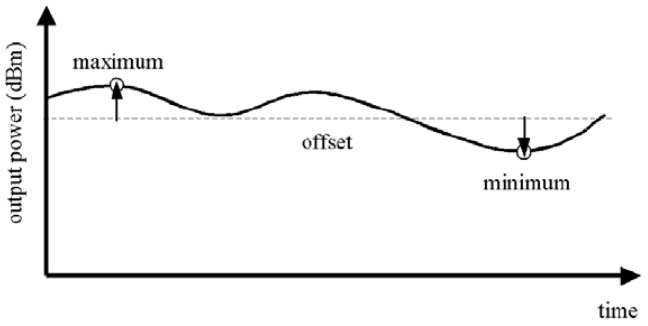


Figure 8 Power stability.

Conditions:

Time span as specified. Uninterrupted tunable laser source output power, constant wavelength and power level settings, constant temperature.

Relative intensity noise (RIN)

Specifies the ratio between the mean-square of the optical power fluctuation amplitude $\Delta P_{f,B}$ within a specified frequency range f and for bandwidth B, and the square of the average optical power P_{avg}.

$$RIN = \frac{\left\langle \Delta P_{f,B}^2 \right\rangle}{P_{avg}^{\ 2} \cdot B} \left[\frac{1}{\text{Hz}}\right]$$

RIN, if expressed as “dB/Hz”, is calculated by:

$$RIN_{\text{dB/Hz}} = 10 \cdot \log\left(\frac{\Delta P_{f,B}^2 \cdot 1\text{Hz}}{P_{avg}^{\ 2} \cdot B}\right)$$

Conditions:

As specified.

Measurement:

Using an Agilent Lightwave signal analyzer and bandwidth set to 3 MHz.

Relative wavelength (frequency) accuracy

When randomly changing the wavelength (frequency) of the tunable laser source and measuring the differences between the displayed and the actual wavelength (frequency), the relative wavelength (frequency) accuracy is ± half the span between the maximum and the minimum value of all differences.

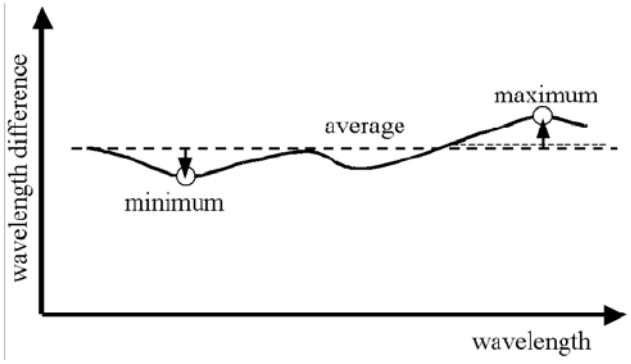


Figure 9 Relative wavelength accuracy.

Conditions:

Uninterrupted tunable laser source output power, constant power setting, constant temperature.

Return loss

Specifies the ratio of the optical power incident to the tunable laser source output port at the wavelength set on the tunable laser source, to the power reflected from the tunable laser source output port.

Conditions:

Tunable laser source output off.

SBS suppression - effective linewidth

Specifies the peak-to-peak change of the periodically modulated wavelength resulting from the SBS suppression feature, expressed in Hertz.

Side-mode suppression ratio

The ratio of optical power in the main mode to the optical power of the highest sidemode, expressed in dB:

$$SSR_{dB} = 10 \cdot \log\left(\frac{P_{signal}}{P_{highestsidemode}}\right)$$

Conditions:

Within a distance from 0.1 to 6 GHz to the signal's optical frequency.

Measurement:

Using the Agilent Lightwave signal analyzer, by analyzing the heterodyning between the main signal and the highest sidemode.

Signal to source spontaneous emission ratio

Specifies the ratio between signal power and maximum spontaneous emission (SSE) power. The SSE power is determined in a specified bandwidth within a ±3 nm window around the signal wavelength, where ±1 nm around the signal wavelength are excluded, expressed in dB per nm.

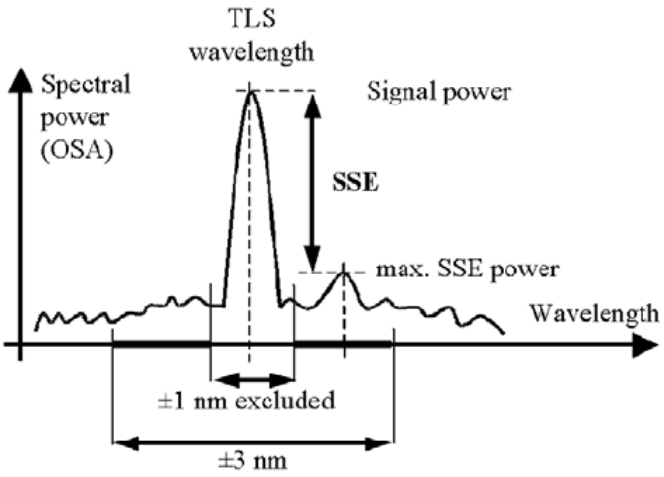


Figure 10 Signal to source spontaneous emission ratio.

Conditions:

As specified.

Measurement:

Using an optical spectrum analyzer at 0.5 nm resolution bandwidth (to address the possibility of higher SSE within a narrower bandwidth), then extrapolated to 1 nm bandwidth.

Tuning time

*S*pecifies the time needed to tune to another wavelength.

Conditions:

Tuning distance as specified. The time is measured from sending the command to the TLS until the tuning operation has finished.

Wavelength range

The range of wavelengths for which the specifications apply (if not otherwise specified).

Wavelength (frequency) repeatability

The random uncertainty in reproducing a wavelength (frequency) of the tunable laser source after changing and re-setting the wavelength (frequency). The wavelength (frequency) repeatability is ± half the span between the maximum and the minimum of all actual values of this wavelength (frequency).

Conditions:

Uninterrupted tunable laser source output power, constant power setting, constant temperature.

NOTE The long-term wavelength repeatability can be obtained by taking the wavelength repeatability and wavelength stability into account.

Wavelength resolution

The smallest selectable wavelength (frequency) increment or decrement.

Wavelength (frequency) stability

Specifies the change of the actual wavelength (frequency) of the tunable laser source over time, expressed as ± half the span between the maximum and minimum of all wavelengths (frequencies).

Conditions:

Time span as specified, uninterrupted tunable laser source output power, constant wavelength and power level settings, constant temperature.

Compact Tunable Laser Module Specifications

Agilent 81950A Compact Tunable Laser Source 88
Specifications 89

Specifications:

Describe guaranteed product performance that is valid under stated conditions. The confidence level is 95%, as recommended by the ISO standard.

Typical Values:

Describe product performance that is usually met but not guaranteed.

Supplementary performance characteristics:

Describe the module's non-warranted typical performance.

Because of the modular nature of the instrument, these performance specifications apply to these modules rather than the mainframe unit.

Agilent 81950A Compact Tunable Laser Source

	Agilent 81950A
Wavelength (frequency) range • Option 210 • Option 201	 1527.6 to 1565.50 nm (196.25 to 191.50 THz) 1570.01 to 1608.76 nm (190.95 to 186.35 THz)
Frequency resolution	100 MHz, 0.8 pm at 1550 nm
Tuning time (typical)	< 30 s [3]
Fine tuning range	Typical ± 6 GHz
Fine tuning resolution	Typical 1 MHz
Absolute wavelength (frequency) accuracy	± 22 pm (± 2.5 GHz)
Relative wavelength (frequency) accuracy	± 12 pm (± 1.5 GHz)
Wavelength (frequency) repeatability [2]	Typical ± 2.5 pm (± 0.3 GHz)
Wavelength (frequency) stability (typical, over 24 hours) [2]	Typical ± 2.5 pm (± 0.3 GHz), 24 hours
Linewidth (typical), SBS suppression off	<100 kHz
Maximum output power	≥ +13.5 dBm (typical +15 dBm)
Power stability	Typical ± 0.03 dB over 1 hour [2]
Power flatness	Typical ± 0.2 dB (full wavelength range)
Power repeatability	Typical ± 0.05 dB [2]
Side-mode suppression ratio (typical)	Typical 50 dB
Signal to source spontaneous emission ratio	Typical 50 dB/1 nm [1] Typical 60 dB/0.1 nm [1]
Relative intensity noise (RIN) (typical)	Typical –145 dB/Hz [1] (10 MHz to 40 GHz)
Dimensions (H x W x D)	75 x 32 x 335 mm
Weight	0.45 kg

[1] At maximum output power, as specified, per wavelength range
[2] At constant temperature ± 0.5 K
[3] Including power stabilization

Specifications

Conditions	
Storage temperature	– 40°C to + 70 °C
Operating temperature	10°C to 35 °C
Humidity	< 80% R.H. at 10°C to 35 °C
Warm-up time	1 hour, immediate operation after boot-up
Output power	Specifications are valid at output power ≥ +5 dBm Specifications are valid in non-condensing conditions, in CW operation
Laser Safety Information 	All laser sources specified by this data sheet are classified as Class 1M according to IEC 60825-1 (2007). All laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated 2007, June 24.
Supplementary performance characteristics	
External analog modulation	5% pp at 2.5 Vp-p input voltage swing (max) 10 Hz to 1000 kHz Modulation input: max 5 Vp-p Input impedance: 50 Ω
SBS suppression	FM p-p modulation range: 0 GHz to 1 GHz (typical) Dither frequency: 20.8 kHz
Power setting	Power attenuation range: 8 dB Power setting resolution: 0.1 dB Residual output power (shutter closed): ≤ –45 dBm
Fine tuning speed	15 sec from –6 to +6 GHz
Grid spacing	100 GHz, 50 GHz, 25 GHz, or arbitrary grid
General	
Output isolation (typical) 81950A	30 dB
Wavelength stability (typical, over 1 min)	± 0.5 pm
Polarization maintaining fiber Fiber type	Options 071 and 072 Panda
Orientation	TE mode in slow axis, in line with connector key

Specifications	
Polarization extinction ratio	16 dB typical
Recommended re-calibration period	2 years
Connector option (required)	Tunable laser must be ordered with one connector option
Option 071	PMF, straight contact output connector
Option 072	PMF, angled contact output connector
Connector interface	One Agilent 81000xI-Series connector interface is required

6
Cleaning Information

The Cleaning Instructions provided in this chapter apply to a number of different types of Optical Equipment.

Cleaning Instructions for this Module If you must clean the Agilent Compact TLS module, please refer the module to the skilled personnel of Agilent's service team.

Cleaning Instructions. 92
- Safety Precautions 92
- Why is it important to clean optical devices ? 93
- What do I need for proper cleaning? 94
- Preserving Connectors. 98
- Cleaning Instrument Housings 98
- Which Cleaning Procedure should I use? 99
- How to clean connectors. 100
- How to clean connector interfaces 102
- How to clean bare fiber adapters 103
- How to clean instruments with a fixed connector interface . 104
- Additional Cleaning Information. 105
- Other Cleaning Hints 106

Cleaning Instructions

The following Cleaning Instructions contain some general safety precautions, which must be observed during all phases of cleaning. Consult your specific optical device manuals or guides for full information on safety matters.

Please try, whenever possible, to use physically contacting connectors, and dry connections. Clean the connectors, interfaces, and bushings carefully after use.

If you are unsure of the correct cleaning procedure for your optical device, we recommend that you first try cleaning a dummy or test device.

Agilent Technologies assume no liability for the customer's failure to comply with these requirements.

Safety Precautions

Please follow the following safety rules:

- Do not remove instrument covers when operating.
- Ensure that the instrument is switched off throughout the cleaning procedures.
- Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.
- Make sure that you disable all sources when you are cleaning any optical interfaces.
- Under no circumstances look into the end of an optical device attached to optical outputs when the device is operational. The laser radiation is not visible to the human eye, but it can seriously damage your eyesight.
- To prevent electrical shock, disconnect the instrument from the 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.
- Do not install parts or perform any unauthorized modification to optical devices.
- Refer servicing only to qualified and authorized personnel.

Why is it important to clean optical devices ?

In transmission links optical fiber cores are about 9 µm (0.00035") in diameter. Dust and other particles, however, can range from tenths to hundredths of microns in diameter. Their comparative size means that they can cover a part of the end of a fiber core, and as a result will reduce the performance of your system.

Furthermore, the power density may burn dust into the fiber and cause additional damage (for example, 0 dBm optical power in a single mode fiber causes a power density of approximately 16 million W/m^2). If this happens, measurements become inaccurate and non-repeatable.

Cleaning is, therefore, an essential yet difficult task. Unfortunately, when comparing most published cleaning recommendations, you will discover that they contain several inconsistencies. In this section, we want to suggest ways to help you clean your various optical devices, and thus significantly improve the accuracy and repeatability of your lightwave measurements.

What do I need for proper cleaning?

Some Standard Cleaning Equipment is necessary for cleaning your instrument. For certain cleaning procedures, you may also require certain Additional Cleaning Equipment.

Standard Cleaning Equipment

Before you can start your cleaning procedure you need the following standard equipment:

- Dust and shutter caps
- Isopropyl alcohol
- Cotton swabs
- Soft tissues
- Pipe cleaner
- Compressed air

Dust and shutter caps All of Agilent Technologies' lightwave instruments are delivered with either laser shutter caps or dust caps on the lightwave adapter. Any cables come with covers to protect the cable ends from damage or contamination.

We suggest these protected coverings should be kept on the equipment at all times, except when your optical device is in use. Be careful when replacing dust caps after use. Do not press the bottom of the cap onto the fiber too hard, as any dust in the cap can scratch or pollute your fiber surface.

If you need further dust caps, please contact your nearest Agilent Technologies sales office.

Isopropyl alcohol This solvent is usually available from any local pharmaceutical supplier or chemist's shop.

If you use isopropyl alcohol to clean your optical device, do not immediately dry the surface with compressed air (except when you are cleaning very sensitive optical devices). This is because the dust and the dirt is solved and will leave behind filmy deposits after the alcohol is evaporated. You should therefore first remove the alcohol and the dust with a soft tissue, and then use compressed air to blow away any remaining filaments.

If possible avoid using denatured alcohol containing additives. Instead, apply alcohol used for medical purposes.

Never try to drink this alcohol, as it may seriously damage your health.

Do not use any other solvents, as some may damage plastic materials and claddings. Acetone, for example, will dissolve the epoxy used with fiber optic connectors. To avoid damage, only use isopropyl alcohol.

Cotton swabs We recommend that you use swabs such as Q-tips or other cotton swabs normally available from local distributors of medical and hygiene products (for example, a supermarket or a chemist's shop). You may be able to obtain various sizes of swab. If this is the case, select the smallest size for your smallest devices.

Ensure that you use natural cotton swabs. Foam swabs will often leave behind filmy deposits after cleaning.

Use care when cleaning, and avoid pressing too hard onto your optical device with the swab. Too much pressure may scratch the surface, and could cause your device to become misaligned. It is advisable to rub gently over the surface using only a small circular movement.

Swabs should be used straight out of the packet, and never used twice. This is because dust and dirt in the atmosphere, or from a first cleaning, may collect on your swab and scratch the surface of your optical device.

Soft tissues These are available from most stores and distributors of medical and hygiene products such as supermarkets or chemists' shops.

We recommend that you do not use normal cotton tissues, but multi-layered soft tissues made from non-recycled cellulose. Cellulose tissues are very absorbent and softer. Consequently, they will not scratch the surface of your device over time.

Use care when cleaning, and avoid pressing on your optical device with the tissue. Pressing too hard may lead to scratches on the surface or misalignment of your device. Just rub gently over the surface using a small circular movement.

Use only clean, fresh soft tissues and never apply them twice. Any dust and dirt from the air which collects on your tissue, or which has gathered after initial cleaning, may scratch and pollute your optical device.

Pipe cleaner Pipe cleaners can be purchased from tobacconists, and come in various shapes and sizes.The most suitable one to select for cleaning purposes has soft bristles, which will not produces scratches.

There are many different kinds of pipe cleaner available from tobacco shops.

The best way to use a pipe cleaner is to push it in and out of the device opening (for example, when cleaning an interface). While you are cleaning, you should slowly rotate the pipe cleaner.

Only use pipe cleaners on connector interfaces or on feed through adapters. Do not use them on optical head adapters, as the center of a pipe cleaner is hard metal and can damage the bottom of the adapter.

Your pipe cleaner should be new when you use it. If it has collected any dust or dirt, this can scratch or contaminate your device.

The tip and center of the pipe cleaner are made of metal. Avoid accidentally pressing these metal parts against the inside of the device, as this can cause scratches.

Compressed air Compressed air can be purchased from any laboratory supplier.

It is essential that your compressed air is free of dust, water and oil. Only use clean, dry air. If not, this can lead to filmy deposits or scratches on the surface of your connector. This will reduce the performance of your transmission system.

When spraying compressed air, hold the can upright. If the can is held at a slant, propellant could escape and dirty your optical device. First spray into the air, as the initial stream of compressed air could contain some condensation or propellant. Such condensation leaves behind a filmy deposit.

Please be friendly to your environment and use a CFC-free aerosol.

Additional Cleaning Equipment

Some Cleaning Procedures need the following equipment, which is not required to clean each instrument:

- Microscope with a magnification range about 50X up to 300X
- Ultrasonic bath
- Warm water and liquid soap
- Premoistened cleaning wipes
- Polymer film
- Infrared Sensor Card

Microscope with a magnification range about 50X up to 300X A microscope can be found in most photography stores, or can be obtained through or specialist mail order companies. Special fiber-scopes are available from suppliers of splicing equipment.

Ideally, the light source on your microscope should be very flexible. This will allow you to examine your device closely and from different angles.

A microscope helps you to estimate the type and degree of dirt on your device. You can use a microscope to choose an appropriate cleaning

method, and then to examine the results. You can also use your microscope to judge whether your optical device (such as a connector) is severely scratched and is, therefore, causing inaccurate measurements.

Ultrasonic bath Ultrasonic baths are also available from photography or laboratory suppliers or specialist mail order companies.

An ultrasonic bath will gently remove fat and other stubborn dirt from your optical devices. This helps increase the life span of the optical devices.

Only use isopropyl alcohol in your ultrasonic bath, as other solvents may damage.

Warm water and liquid soap Only use water if you are sure that there is no other way of cleaning your optical device without corrosion or damage. Do not use hot water, as this may cause mechanical stress, which can damage your optical device.

Ensure that your liquid soap has no abrasive properties or perfume in it. You should also avoid normal washing-up liquid, as it can cover your device in an iridescent film after it has been air-dried.

Some lenses and mirrors also have a special coating, which may be sensitive to mechanical stress, or to fat and liquids. For this reason we recommend you do not touch them.

If you are not sure how sensitive your device is to cleaning, please contact the manufacturer or your sales distributor.

Premoistened cleaning wipes Use pre-moistened cleaning wipes as described in each individual cleaning procedure. Cleaning wipes may be used in every instance where a moistened soft tissue or cotton swab is applied.

Polymer film Polymer film is available from laboratory suppliers or specialist mail order companies.

Using polymer film is a gentle method of cleaning extremely sensitive devices, such as reference reflectors and mirrors.

Infrared Sensor Card Infrared sensor cards are available from laboratory suppliers or specialist mail order companies.

With this card you are able to control the shape of laser light emitted. The invisible laser beam is projected onto the sensor card, then becomes visible to the normal eye as a round spot.

Take care never to look into the end of a fiber or any other optical component, when they are in use. This is because the laser can seriously damage your eyes.

Preserving Connectors

Listed below are some hints on how best to keep your connectors in the best possible condition.

Making Connections Before you make any connection you must ensure that all cables and connectors are clean. If they are dirty, use the appropriate cleaning procedure.

When inserting the ferrule of a patchcord into a connector or an adapter, make sure that the fiber end does not touch the outside of the mating connector or adapter. Otherwise you will rub the fiber end against an unsuitable surface, producing scratches and dirt deposits on the surface of your fiber.

Dust Caps and Shutter Caps Be careful when replacing dust caps after use. Do not press the bottom of the cap onto the fiber as any dust in the cap can scratch or dirty your fiber surface.

When you have finished cleaning, put the dust cap back on, or close the shutter cap if the equipment is not going to be used immediately.

Keep the caps on the equipment always when it is not in use.

All of Agilent Technologies' lightwave instruments and accessories are shipped with either laser shutter caps or dust caps. If you need additional or replacement dust caps, contact your nearest Agilent Technologies Sales/Service Office.

Immersion Oil and Other Index Matching Compounds Where it is possible, do not use immersion oil or other index matching compounds with your device. They are liable to impair and dirty the surface of the device. In addition, the characteristics of your device can be changed and your measurement results affected.

Cleaning Instrument Housings

Use a dry and very soft cotton tissue to clean the instrument housing and the keypad. Do not open the instruments as there is a danger of electric shock, or electrostatic discharge. Opening the instrument can cause damage to sensitive components, and in addition your warranty will be voided.

Which Cleaning Procedure should I use?

Light dirt

If you just want to clean away light dirt, observe the following procedure for all devices:

- Use compressed air to blow away large particles.
- Clean the device with a dry cotton swab.
- Use compressed air to blow away any remaining filament left by the swab.

Heavy dirt

If the above procedure is not enough to clean your instrument, follow one of the procedures below. Please consult “Cleaning Instructions for this Module” on page 91 for the procedure relevant for this instrument.

If you are unsure of how sensitive your device is to cleaning, please contact the manufacturer or your sales distributor.

How to clean connectors

Cleaning connectors is difficult as the core diameter of a single-mode fiber is only about 9 mm. This generally means you cannot see streaks or scratches on the surface. To be certain of the condition of the surface of your connector and to check it after cleaning, you need a microscope.

In the case of scratches, or of dust that has been burnt onto the surface of the connector, you may have no option but to polish the connector. This depends on the degree of dirtiness, or the depth of the scratches. This is a difficult procedure and should only be performed by skilled personal, and as a last resort as it wears out your connector.

WARNING **Never look into the end of an optical cable that is connected to an active source.**

To assess the projection of the emitted light beam you can use an infrared sensor card. Hold the card approximately 5 cm from the output of the connector. The invisible emitted light is project onto the card and becomes visible as a small circular spot.

Preferred Procedure

Use the following procedure on most occasions.

1. Clean the connector by rubbing a new, dry cotton-swab over the surface using a small circular movement.
2. Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the connector:

1. Moisten a new cotton-swab with isopropyl alcohol.
2. Clean the connector by rubbing the cotton-swab over the surface using a small circular movement.
3. Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.
4. Blow away any remaining lint with compressed air.

An Alternative Procedure

A better, more gentle, but more expensive cleaning procedure is to use an ultrasonic bath with isopropyl alcohol.

1. Hold the tip of the connector in the bath for at least three minutes.
2. Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.
3. Blow away any remaining lint with compressed air.

How to clean connector interfaces

CAUTION

Be careful when using pipe-cleaners, as the core and the bristles of the pipe-cleaner are hard and can damage the interface.

Do not use pipe-cleaners on optical head adapters, as the hard core of normal pipe cleaners can damage the bottom of an adapter.

Preferred Procedure

Use the following procedure on most occasions.

1. Clean the interface by pushing and pulling a new, dry pipe-cleaner into the opening. Rotate the pipe-cleaner slowly as you do this.
2. Then clean the interface by rubbing a new, dry cotton-swab over the surface using a small circular movement.
3. Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the interface:

1. Moisten a new pipe-cleaner with isopropyl alcohol.
2. Clean the interface by pushing and pulling the pipe-cleaner into the opening. Rotate the pipe-cleaner slowly as you do this.
3. Moisten a new cotton-swab with isopropyl alcohol.
4. Clean the interface by rubbing the cotton-swab over the surface using a small circular movement.
5. Using a new, dry pipe-cleaner, and a new, dry cotton-swab remove the alcohol, any dissolved sediment and dust.
6. Blow away any remaining lint with compressed air.

How to clean bare fiber adapters

Bare fiber adapters are difficult to clean. Protect from dust unless they are in use.

CAUTION

Never use any kind of solvent when cleaning a bare fiber adapter as solvents can damage the foam inside some adapters.

They can deposit dissolved dirt in the groove, which can then dirty the surface of an inserted fiber.

Preferred Procedure

Use the following procedure on most occasions.

1 Blow away any dust or dirt with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the adapter:

1 Clean the adapter by pushing and pulling a new, dry pipe-cleaner into the opening. Rotate the pipe-cleaner slowly as you do this.

CAUTION

Be careful when using pipe-cleaners, as the core and the bristles of the pipe-cleaner are hard and can damage the adapter.

2 Clean the adapter by rubbing a new, dry cotton-swab over the surface using a small circular movement.

3 Blow away any remaining lint with compressed air.

How to clean instruments with a fixed connector interface

You should only clean instruments with a fixed connector interface when it is absolutely necessary. This is because it is difficult to remove any used alcohol or filaments from the input of the optical block.

It is important, therefore, to keep dust caps on the equipment at all times, except when your optical device is in use.

If you do discover filaments or particles, the only way to clean a fixed connector interface and the input of the optical block is to use compressed air.

If there are fluids or fat in the connector, please refer the instrument to the skilled personnel of Agilent's service team.

CAUTION

Only use clean, dry compressed air. Make sure that the air is free of dust, water, and oil. If the air that you use is not clean and dry, this can lead to filmy deposits or scratches on the surface of your connector interface. This will degrade the performance of your transmission system.

Never try to open the instrument and clean the optical block by yourself, because it is easy to scratch optical components, and cause them to be misaligned.

Additional Cleaning Information

The following cleaning procedure may be used with other optical equipment:

How to clean bare fiber ends

Bare fiber ends are often used for splices or, together with other optical components, to create a parallel beam. The end of a fiber can often be scratched. You make a new cleave. To do this:

1. Strip off the cladding.
2. Take a new soft-tissue and moisten it with isopropyl alcohol.
3. Carefully clean the bare fiber with this tissue.
4. Make your cleave and immediately insert the fiber into your bare fiber adapter in order to protect the surface from dirt.

Other Cleaning Hints

Selecting the correct cleaning method is an important element in maintaining your equipment and saving you time and money. This Appendix highlights the main cleaning methods, but cannot address every individual circumstance.

This section contain some additional hints which we hope will help you further. For further information, please contact your local Agilent Technologies representative.

Making the connection Before you make any connection you must ensure that all lightwave cables and connectors are clean. If not, then use appropriate the cleaning methods.

When you insert the ferrule of a patchcord into a connector or an adapter, ensure that the fiber end does not touch the outside of the mating connector or adapter. Otherwise, the fiber end will rub up against something which could scratch it and leave deposits.

Lens cleaning papers Note that some special lens cleaning papers are not suitable for cleaning optical devices like connectors, interfaces, lenses, mirrors and so on. To be absolutely certain that a cleaning paper is applicable, please ask the salesperson or the manufacturer.

Immersion oil and other index matching compounds Do not use immersion oil or other index matching compounds with optical sensors equipped with recessed lenses. They are liable to dirty the detector and impair its performance. They may also alter the property of depiction of your optical device, thus rendering your measurements inaccurate.

Cleaning the housing and the mainframe When cleaning either the mainframe or the housing of your instrument, only use a dry and very soft cotton tissue on the surfaces and the numeric pad.

Never open the instruments as they can be damaged. Opening the instruments puts you in danger of receiving an electrical shock from your device, and renders your warranty void.

Index

A

Absolute wavelength (frequency) 78
Additional Cleaning Equipment 96
Agilent 81950A Compact Tunable Laser Source 88

C

Cleaning connectors 100
Compact TLS module 75
Connectors
  angled contact 22, 28
  straight contact 22, 28

D

Definition
  absolute wavelength accuracy 78
  external analog modulation - modulation depth 78
  linewidth 78
  maximum output power 79
  operating temperature and humidity 79
  output isolation 79
  polarization extinction ratio 80
  power flatness vs. wavelength 81
  power repeatability 81
  power stability 82
  relative wavelength accuracy 83
  return loss 83
  RIN 82
  SBS Supp - effective linewidth 84
  side-mode suppression ratio 84
  signal to source SSE 84
  tuning time 85
  wavelength range 85
  Wavelength repeatability 86
  wavelength resolution 86
  wavelength stability 86

E

External analog modulation 78

F

Front Panel
  Controls and Indicators 18

I

Initial Inspection 13
Input/Output Signals 14
Inspection 13
Installation 17

L

Laser Safety Labels 16
Line Power Requirements 13

M

Modules
  connector interfaces 28
  interface options 27
  optional features 26
  User's Guides 29

O

Operating Environment 13
Optical Output 21
Option 071 28

P

Polarization Maintaining Fiber 21
Preserving Connectors 98

S

Safety
  Line Power 13
  Operating Environment 13
  Symbols 12
Safety Considerations 12
Safety Symbols 12
Signal Input 23
Signal Output 23
Specifications 89
Standard Cleaning Equipment 94
Status Bits 72
Storage 14

T

Tunable Laser Source 17
Typical Use Models 19

U

Use Models 19
User's Guides 29

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