

Operating and Programming Manual

HP 81551MM Lightwave Multimeter Source Module

SERIAL NUMBERS

This manual applies to all instruments.



HP Part No. 81551-90011
Printed in the Federal Republic of Germany

Second Edition
E1294

Control Serial Number: Edition 2 applies directly to all instruments.

Edition 1 : 1st May 1990 : 81551-90011 : E0590

Edition 2 : 1st November 1990 : 81551-90011 : E1190

1st August 1991 : 81551-90011 : E0891

1st December 1994 : 81551-90011 : E1294

Safety Considerations

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.

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 Hewlett-Packard 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.).

Line Power Requirements

The HP 81551MM operates when installed into the HP 8153A Lightwave Multimeter mainframe

Operating Environment

The HP 8153A safety information summarizes the HP 81551MM operating environment ranges. In order for the HP 81551MM to meet specifications, the operating environment must be within the limits specified for the HP 8153A.

Storage and Shipment

The module can be stored or shipped at temperatures between -40°C and $+70^{\circ}\text{C}$. Protect the module from temperature extremes that may cause condensation within it.

Initial Safety Information for Laser Source Modules

The specifications for these modules are as follows:

	HP 81551MM
Laser Type	FP-Laser InGaAsP
Laser Class According to IEC 825-1 (not USA) (EN 60825-1 Europe)	3A
According to 21 CFR 1040.10 (USA)	1
Output Power	>-2dBm
Beam Diameter	50 μ m
Numerical Aperture	0.2
Wavelength	850 $\pm$ 10nm

Sicherheitsinformation für Laser Quellen

Die Spezifikationen für die Lasereinschübe sind wie folgt:

	HP 81551MM
Laser Typ	FP-Laser InGaAsP
Laser Klasse	
Entsprechend IEC 825-1 (EN 60825-1 Europa)	3A
Ausgangsleistung	>-2dBm
Strahldurchmesser	50 μ m
Numerische Apertur	0.2
Wellenlänge	850 $\pm$ 10nm

Informations et Consignes de Sécurité Relatives à l'Utilisation des Lasers.

Les Spécifications des Modules Laser sont les Suivantes:

	HP 81551MM
Type de Laser	FP-Laser InGaAsP
Classe du Laser	
Conforme au STD IEC 825-1 (EN 60825-1 Europe)	3A
Puissance de Sortie	>-2dBm
Diamètre du Faisceau	50 μ m
Ouverture Numérique	0.2
Longueur d'Onde	850 $\pm$ 10nm

Contents

C. HP 81551MM Specifications

Supplementary Performance Characteristics	C-2
Internal Digital Modulation	C-2
Output Attenuation	C-2
Stability	C-2
Spectral Bandwidth (FWHM)	C-2

D. HP 81551MM Performance Tests

Introduction	D-1
Equipment Required	D-1
Test Record	D-2
Test Failure	D-2
Instrument Specification	D-2
Performance Tests	D-2
Output Power and Stability Tests	D-3
Output Power Test	D-3
Attenuation Function Test	D-4
Modulation Function Test	D-4
Stability Test	D-4

E. Cleaning Procedures

The Cleaning Kit	E-1
Other Cleaning Tools	E-3
Preserving Connectors	E-4
Cleaning Instrument Housings	E-4
Cleaning Procedures	E-5
Cleaning Cable Connectors	E-5
Cleaning Connector Adapters	E-6
Cleaning Connector Interfaces	E-6

Figures

D-1. Performance Test Setup	D-3
---------------------------------------	-----

Tables

C-1. HP 81551MM Specifications	C-1
--	-----

HP 81551MM Specifications

Specifications describe the instrument's warranted performance. Supplementary performance characteristics describe the instrument's non-warranted typical performance.

Because of the modular nature of the instrument, these performance specifications apply only to this module. You should insert these pages into the appropriate section of the manual.

Table C-1. HP 81551MM Specifications

Laser Type	Fabry Perot Laser
Central Wavelength¹	850±10nm
Fiber type	multimode, 50/125μm
Spectral Bandwidth²	<1.5nm rms
Output Power²	>-2dBm
CW-Stability	
Short Term (15min, T = constant)	±0.01dB
Long Term (6h, T = 0°C to 55°C±1K)	±0.06dB
Operating temperature	0°C to +55°C
Dimensions	75mm H, 32mm W, 335mm D (2.8"×1.3"×13.2")
Weight	net 0.7kg (1.5lbs), shipping 1kg (2.2lbs)
Recalibration Period	1 year
¹ Central Wavelength is shown on the display. ² rms: root mean square. ³ Class 3A according to IEC 825-1 (1993), Class 1 according to FDA CFR 21 (1986) ⁴ After a warm-up time of 60 min. with output enabled. If previously stored at the same temperature, 20 min. only.	

Suppelementary Performance Characteristics

Internal Digital Modulation

You can select internal modulation frequencies of 270HZ, 1kHz, or 2kHz. All outputs are pulse shaped, with a duty cycle of 50%.

Output Attenuation

The output can be attenuated from 0 to 6dB, in steps of 0.1dB.

Stability

The value of the long term CW-stability doubles with just one minute warmup time (laser enabled).

Spectral Bandwidth (FWHM)

The spectral bandwidth is, typically, twice the specified RMS value.

HP 81551MM Performance Tests

Introduction

The procedures in this section test the optical performance of the instrument. The complete specifications to which the HP 81551MM is tested are given in Table C-1. All tests can be performed without access to the interior of the instrument. The performance tests refer specifically to tests using the Diamond HMS-10/HP connector.

Equipment Required

Equipment required for the performance test is listed below. Any equipment that satisfies the critical specifications of the equipment given in the list may be substituted for the recommended models.

Instrument/Accessory	Recommended Model
Power Meter Standard	HP 8153A Mainframe with HP 81533A Optical Head Interface Module with HP 81520A Optical Head
Multimeter Mainframe	HP 8153A
Connector Adapter	HP 81000AA
(head)	
Connector Interface	HP 81000AI 2ea (08154-61701)
Multimode Fiber	HP 81501AC
BNC to BNC Cable	8120-1840
Oscilloscope	

Test Record

Results of the performance test may be noted in the Performance Test Record. The Test Record can also be used as a permanent record and may be reproduced without written permission from Hewlett-Packard

Test Failure

If the HP 81551MM fails any performance test, return the instrument to the nearest Hewlett-Packard Sales/Service Office for repair.

Instrument Specification

Specifications are the performance characteristics of the instrument that are certified. These specifications, listed in Table C-1, are the performance standards or limits against which the HP 81551MM can be tested. Appendix C also lists some supplemental characteristics of the HP 81551MM and should be considered as additional information.

Any changes in the specifications due to manufacturing changes, design, or traceability to the National Bureau of Standards will be covered in a manual change supplement or revised manual. The specifications listed in such a change supersede any previously published.

Performance Tests

The performance tests given in this section are separated into Output Power Test and Stability Test. Perform each step in the tests in the order they are given, using the corresponding test equipment.

Note



Make sure that all optical connections in the test setups given in the procedure are dry and clean.

The ambient temperature must be constant ($\pm 2^{\circ}\text{C}$) during the test. The power meter must be zeroed before the measurement.

Output Power and Stability Tests

Specifications:

Optical output power of 50/125 μm fiber: $> -2\text{dBm}$
Stability over 15 minutes at constant temperature: $\pm 0.01\text{dB}$
Stability over 6h and $\pm 2^{\circ}\text{C}$ env. temp. window: $\pm 0.06\text{dB}$

Output Power Test

1. Make sure that cable connectors and detector windows are clean.
2. Turn instruments on, enable the laser output of the HP 81551MM and allow instruments to warm up for at least 20 minutes.
3. On the power meter:
 - a. Set λ to the wavelength displayed for the HP 81551MM source channel.
 - b. Make sure that the CAL parameter on the power meter is set to zero.
 - c. With the connector adapter, on the optical head, covered with a plastic cap, press **(Zero)** to zero the power meter.
4. Connect the equipment as shown in Figure D-1.

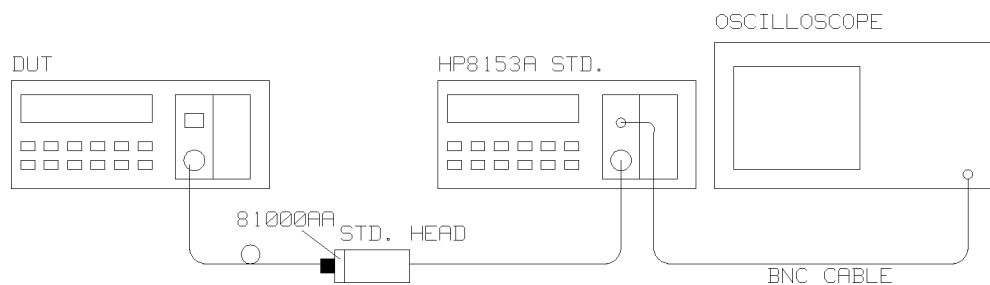


Figure D-1. Performance Test Setup

5. On the HP 8153A with the module under test:

- a. Press **(Param)** until the AUX parameter is selected. Make sure that this parameter is set to CW.
- b. Press **(Param)** until the ATT parameter is selected. Make sure that this parameter is set to zero.

6. Measure the output power and note the result in the Test Record.

Attenuation Function Test

7. On the power meter, press **(Disp→Ref)**. Press **(dB)** to select a display in dB.

8. Using the modify keys on the HP 8153A with the module under test, increase the attenuation and check that the output power changes.

Note the reaction on the Test Record.

9. Set the attenuation to 1.0dB.

Modulation Function Test

10. Using a BNC cable, connect the power meter transducer output to the oscilloscope input and set the oscilloscope as follows: 0.5V/DIV DC coupled, 1ms/DIV.

11. On the power meter, switch the autoranging off and select the 0dBm range.

12. On the HP 8153A with the module under test, press **(Param)** to select the AUX parameter. Monitor the frequency change on the oscilloscope as you set the modulation to 270Hz, 1kHz, and then to 2kHz.

Note the reaction on the Test Record.

Stability Test

1. Enable the HP 81551MM laser output and allow the instruments to warm up for 20 minutes.

2. Select the channel with the source.

- a. Press **(Param)** to select the AUX parameter. Set this parameter to CW.
- b. Press **(Param)** to select the ATT parameter. Set this parameter to zero.

D-4 HP 81551MM Performance Tests

3. On the power meter:
 - a. Cover the input to the sensor with a plastic cap and press **(Zero)** to zero the meter.
 - b. Press **(Param)** to select the λ parameter. Set this parameter to the value displayed for the source.
 - c. Press **(Param)** to select the T parameter. Set this parameter to 1s.
4. Using the HP 81501AC cable, connect the output of the source to the input of the sensor. Make sure that the cable is fixed and that it cannot be moved during the measurement.
5. Select the MENU mode on the power meter.
 - a. Press **(Record)** to select STABILITY.
 - b. Press **(Edit)** and select the T_TOTAL parameter. Set the T_TOTAL parameter to 15 minutes.
 - c. Press **(Edit)** and then **(Exec)** to run the stability application.
6. When the stability test has completed, press **(More)** to select the SHOW application. Press **(Edit)** and then **(Next)**/**(Prev)** to display the DIFF result. Divide this result by 2 to obtain the value for the stability:

$$\frac{DIFF}{2} = Stability (dB)$$

Note the result on the Test Record.

7. Repeat the stability measurement (steps 5 and 6) with T_TOTAL set to 6 hours.

Performance Test for the HP 81551MM

Page 1 of 3

Test Facility:

_____	Report No. _____
_____	Date _____
_____	Customer _____
_____	Tested By _____

Model HP 81551MM Source Module

Serial No. _____ Ambient temperature _____ °C

Options _____ Relative humidity _____ %

Firmware Rev. _____ Line frequency _____ Hz

Special Notes:

Performance Test for the HP 81551MM

Page 2 of 3

Test Equipment Used:

Description	Model No.	Trace No.	Cal. Due Date
1. Lightwave Multimeter (Std.)	HP 8153A	_____	_____
2. Opt. Head Interface Module	HP 81533A	_____	_____
3. Optical Head 850nm	HP 81520A	_____	_____
4. Lightwave Multimeter (DUT)	HP 8153A	_____	_____
5. Connector Interface	HP 81000AI	N/A	N/A
6. Connector Adapter	HP 81000AA	N/A	N/A
7. Multimode Fiber	HP 81501AC	N/A	N/A
8. BNC to BNC Cable	P/N 8120-1840	N/A	N/A
9. Oscilloscope	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
13. _____	_____	_____	_____
14. _____	_____	_____	_____
15. _____	_____	_____	_____
16. _____	_____	_____	_____
17. _____	_____	_____	_____
18. _____	_____	_____	_____

Performance Test for the HP 81551MM

Page 3 of 3

Model HP 81551MM Source Module		No.	Date		
Test No.	Test Description	Minimum Spec.	Result	Maximum Spec.	Measurement Uncertainty
1.	Output Power Test Output Power	-2dBm			0.1dB
2.	Attenuation Function Test Passed (P)/Failed (F)				
3.	Modulation Function Test Passed (P)/Failed (F)				
4.	Stability Tests Stability (15min.)	-0.01dB		+ 0.01dB	
	Stability (6h.)	-0.06dB		+ 0.06dB	

Cleaning Procedures

The Cleaning Kit

A full cleaning kit contains the following items:

Isopropyl alcohol This is usually available from pharmaceutical suppliers or chemists.

If possible, use alcohol supplied for medical purposes, rather than impure alcohol or alcohol with additives.

Caution

Do not use other solvents as some can damage plastic materials and claddings. For example, Acetone dissolves the adhesives used in fiber optic devices.

Warning

Never drink this alcohol as this can lead to blindness or other serious damage to your health.

Cotton-swabs

Use swabs such as Q-tips or other cotton-swabs. These are typically available from local distributors of medical or hygiene products (such as supermarkets or pharmacies).

Note If you are cleaning connector interfaces or adapters, the diameter of the cotton swab is important. Cotton swabs for babies normally have a smaller diameter.

Caution

- Do not use foam swabs, as these can leave filmy deposits on the surface you are cleaning.
- Store your cotton-swabs carefully and never reuse them. Dust and dirt from the air or from previous cleaning, can scratch or dirty your optical device.

Soft-tissues

These are available from most stores and distributors of medical and hygiene products (such as supermarkets or pharmacies).

Use multi-layer tissues made from non-recycled cellulose. These are more absorbent and softer than other types and they do not scratch the surface of your device.

Caution

Store your soft-tissues carefully and never reuse them, as dust and dirt from the air or from previous cleaning can scratch and dirty your optical device.

Pipe-cleaner

This is available from tobacco shops.

Ensure that the bristles of the pipe-cleaner are soft, so that they do not scratch your device during cleaning.

Caution

Store your pipe-cleaners carefully and never reuse them as dust and dirt from the air or from previous cleaning can scratch and dirty your optical device.

Compressed Air

This is available from laboratory suppliers.

It is essential that your compressed air is free of dust, water and oil. Only use clean, dry air. If you do not, it can lead to filmy deposits or scratches.

When using compressed air from a can,

- Hold the can upright. A slant can cause propellant to escape with the compressed air and dirty your optical device.
- Spray the first couple of seconds into the air; as the first stream of compressed air can contain condensation or propellant. Any condensation produces a filmy deposit.

If you are using compressed air from a can, you should select one with a CFC-free propellant, for the sake of the environment.

E-2 Cleaning Procedures

Other Cleaning Tools

To examine devices you also require:

Microscope	Select a microscope with a magnification range of between 50X and 300X. These should be available from photographic stores or laboratory suppliers. Ensure that the light source of the microscope is flexible. This helps you to examine your device closely and from different angles. A microscope allows you to determine the type of dirt on your device and its extent. Then you can choose the correct cleaning procedure and later to examine the results of cleaning. With a microscope you can also determine if your optical device is scratched.
Ultrasonic bath	This is typically available from photographic stores or laboratory suppliers. An ultrasonic bath very gently removes greasy and other stubborn dirt from optical devices. Only use an ultrasonic bath with isopropyl alcohol, as other solvents can damage or dirty your optical device.
Warm water and liquid soap	Use water only if you are sure that your optical device will not corrode or be damaged. Do not use hot water, as this can lead to mechanical stress that can damage your optical device. Ensure that your liquid soap has no abrasive properties or perfume in it, as these can scratch or damage your optical device. Do not use normal washing-up liquid, as it can leave behind an iridescent film.
Premoistened cleaning wipes	These are available from HP. The part number is HP 92193N (80 Wipes per box). These are tissues that are moistened with isopropyl alcohol.
Polymer film	This is typically available from professional photographic stores or laboratory suppliers. Polymer film is very gentle on optical surfaces and is particularly good for cleaning extremely sensitive devices such as mirrors.
Infrared sensor card	This is typically available from laboratory suppliers. With this card you can qualitatively check the uniformity of your emitted laser light, because when the laser light is projected onto the sensor card it becomes visible.
Lens Cleaning Paper	Some lens cleaning papers and cleaning kits available, for example, in photographic stores are not suitable for cleaning fiber optic devices. To be sure, please ask the salesperson or the manufacturer.

Preserving Connectors

Listed below are some hints on how 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 Hewlett-Packard's lightwave instruments and accessories are shipped with either laser shutter caps or dust caps. If you need additional or replacement dust caps, contact your Hewlett-Packard sales 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.

Cleaning Procedures

If you are unsure about the correct cleaning procedure for your device or if you are unsure whether the procedure given here is suitable for your device, check with the manufacturer or sales distributor, or try the procedure on a dummy or test device first.

Cleaning Cable Connectors

Cleaning connectors is difficult as the core diameter of a singlemode fiber is only about 9µm. 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 personnel, 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 projected onto the card and becomes visible as a small circular spot.

- | | |
|------------------------------------|--|
| Preferred Procedure | <ol style="list-style-type: none">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 | <p>Use this procedure particularly when there is greasy dirt on the connector:</p> <ol style="list-style-type: none">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 | <p>The better, more gentle, but more expensive cleaning procedure is to use an ultrasonic bath with isopropyl alcohol.</p> <ol style="list-style-type: none">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. |

Cleaning Connector Adapters

Caution

Some adapters have an anti-reflection coating on the back to reduce back reflection. This coating is extremely sensitive to solvents and mechanical abrasion. Extra care is needed when cleaning these adapters.

Preferred Procedure

1. Clean the adapter 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 adapter:

1. Moisten a new cotton-swab with isopropyl alcohol.
2. Clean the adapter 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.

Cleaning 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

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.