11

Troubleshooting

Introduction

This chapter provides information to help you find defective components in an Agilent laser measurement system when a problem occurs. It can help determine whether the problem source is in the system electronics, environmental sensor, laser head, receiver, or the optics.

Component-level troubleshooting and calibration should be performed by Agilent Technologies technicians only. However, component-level troubleshooting and calibration information is provided for selected assemblies. This chapter is structured as indicated in Table 11-1.

Table 11-1. Chapter content summary

Instrument	Type of Information
Laser Heads	System-level troubleshooting for isolating the fault to the laser head
Agilent 10780C, 10780F, E1708A, or E1709A	System-level troubleshooting for isolating the fault to a receiver
Agilent 107XX Optics	System-level troubleshooting for isolating the fault to the optical assemblies. The Agilent 107XX optics are repairable only by Agilent Technologies.

Additional information is provided in the manuals that are supplied with each instrument.

Troubleshooting Assumptions

The troubleshooting procedures assume that:

1. The system controller is operating properly. Before connecting the system controller to the Agilent electronics, check the controller by:
   a. Booting the unit up and verifying appropriate responses,
   b. Running your own known good programs, and
   c. Executing any controller diagnostics unique to your particular controller.
2. All system controls have been double-checked to verify that they are in the proper positions. This includes the correct setting of all circuit board address and test switches. (See “Preliminary Checks” (or similar information) in the troubleshooting chapter of your electronics manual.)
3. All system cabling is configured correctly and that all cables are making proper electrical connection.
4. The system optics are clean. Refer to Chapter 10, “Maintenance,” in this manual.
5. Power to the system is removed before replacing any units or circuit boards.
6. You adhere to the precautions outlined in “Electrostatic Discharge (ESD)” section of this chapter.
7. The troubleshooting procedures cannot cover all possible malfunctions or combination of malfunctions. However, at the very minimum, these procedures will direct you to the general area of the problem.

WARNING **USE OF CONTROLS, ADJUSTMENTS, OR PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS LASER LIGHT EXPOSURE OR EXPOSURE TO HIGH VOLTAGES.**

Electrostatic Discharge (ESD)

Electronic components and assemblies can be permanently damaged by electrostatic discharge. To avoid damage caused by ESD, follow the following precautions:

1. Ensure that static-sensitive devices or assemblies are serviced at static-safe work stations providing the proper grounding for personnel (e.g., table mat with wrist strap).
2. Ensure that static-sensitive devices or assemblies are stored in static-shielding containers (e.g., antistatic poly bags).
3. Do not wear clothing subject to static charge build-up, such as wool or synthetic materials.
4. Do not handle components or assemblies in carpeted areas, Do not remove the component or assembly from its static protective container until you are ready to install it.
5. Avoid touching component leads or assembly edge connectors with your fingers.

Required Test Equipment

The equipment required to maintain the laser heads and receivers is listed in Table 11-2. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table. Refer to the appropriate electronics manual for a list of test equipment required for electronics maintenance and the calibration of environmental sensors (Agilent 10751C or Agilent 10751D Air Sensor and 10757D, Agilent 10757E, or Agilent 10757F Material Temperature Sensor).

Table 11-2. Recommended test equipment

Instrument Required	Characteristics	Model Number
Laser Power Meter	Range: 1 microwatt to 1 milliwatt Accuracy: ± 10%	Coherent Inc. ® Ultima Labmaster or equivalent
Digital Voltmeter	Range: −15V to +15V ± 0.01 Vdc NOTE: Accurary of ± 0.01 Vdc required for voltage adjustments.	Agilent 34401A
Oscilloscope	Ability to display signals between dc and 100 MHz.	Agilent 54624A
Clip-on DC Milliammeter	DC Current Range: 1mA to 10A (fullscale) Accuracy: ±3% of full scale ±0.15 mA	Agilent 34401A

Troubleshooting Information

The possible system problems that can occur can be divided into the following areas:

- Malfunction of the laser head.
- Malfunction of one or more receivers.
- Malfunction, misalignment, or improper application of the optical devices.
- Malfunction of the system controller or its improper programming.
- Malfunction of the Agilent system electronics.

If one of these areas is suspect as the source of the trouble, refer to the appropriate troubleshooting information and flowcharts (provided in this section) for that particular area.

Laser Head troubleshooting

Agilent 5517A/B/C/D Laser Head

Laser heads are listed here in the same order in which they are listed in Chapter 5, “Laser Heads,” of this manual.

Laser head adjustment procedures are given in the laser head’s own operating and service manual.

The following symptoms indicate problems with the Agilent 5517A, Agilent 5517B, Agilent 5517C, or Agilent 5517D Laser Head. If one or more of these symptoms are observed, use the Troubleshooting Tree, Figure 11-1, to assist in determining if the laser head is actually at fault. Detailed repair procedures are outlined in the laser head’s operating and service manual.

- No laser light being emitted from the laser head exit port.
- Low power output from the laser head.
- LASER ON indicator not lit.
- READY indicator does not illuminate as expected. Normally, the indicator will start to blink on and off within three minutes of applying power to the laser head. This indicates that the laser head is in the process of warming up. When the Agilent 5517A, Agilent 5517B, Agilent 5517C, or Agilent 5517D Laser Head is ready for use, the indicator assumes a steady on condition.
- Absence of reference signal or bad reference signal.
- Agilent 5517B, Agilent 5517C, or Agilent 5517D Laser Head’s **+15V POWER ON** or **-15V POWER ON** indicator is not lit.

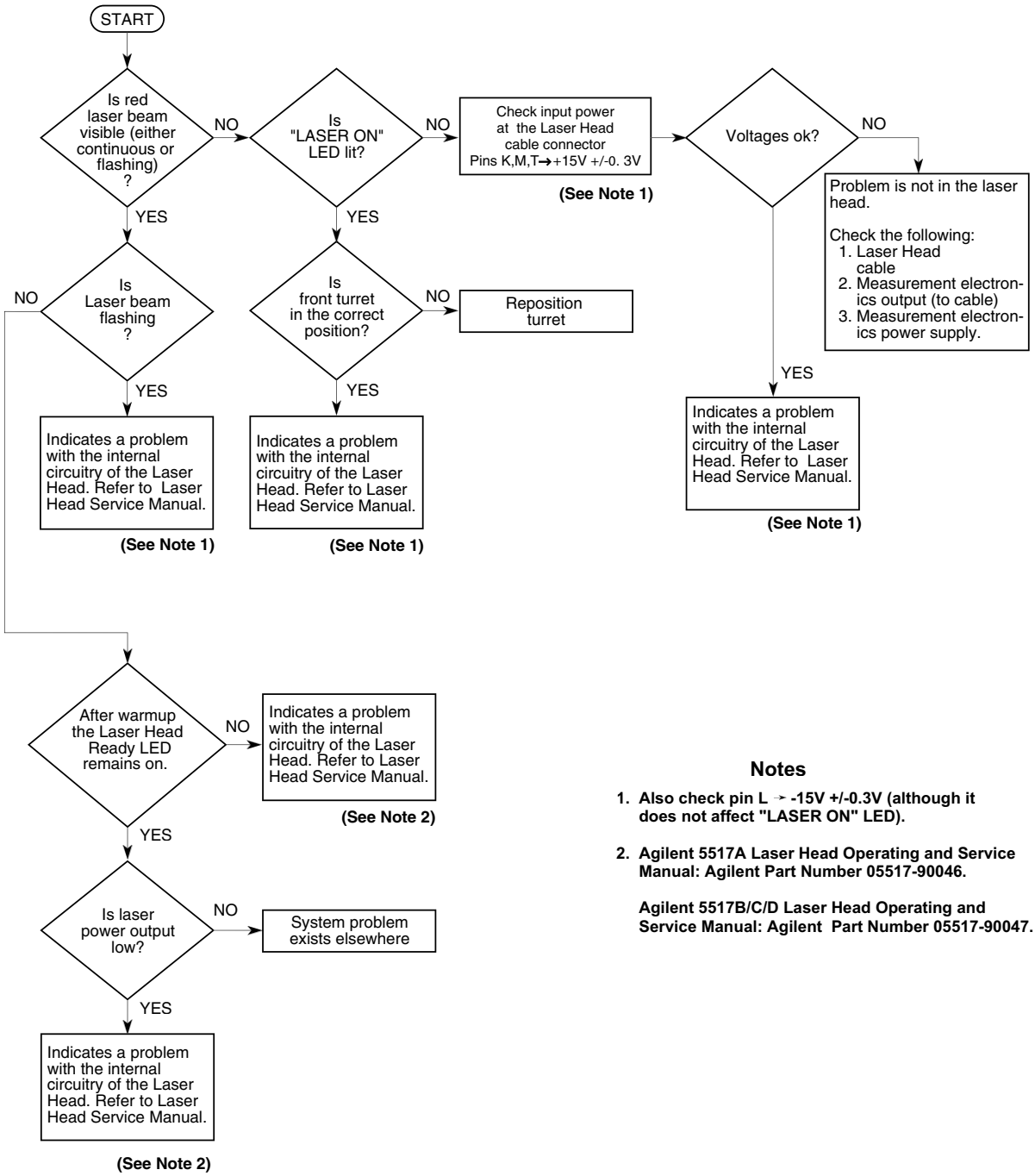

Figure 11-1. Agilent 5517A/B/C/D Laser Head—troubleshooting tree

Agilent 5519A/B Laser Head

See the *Agilent 5519A/B Laser Head Service Manual* for laser head troubleshooting information.

Receiver troubleshooting

Agilent 10780C, 10780F, E1708A, E1709A Receiver

NOTE This section is basically written for troubleshooting the Agilent 10780C/F receiver, but many of the same techniques can be used to troubleshoot the Agilent E1708A or E1709A receiver. For troubleshooting information specific to the Agilent E1708A or E1709A receiver, see their respective operating manuals.

NOTE Allow the laser head sufficient time to complete its tuning cycle prior to determining whether or not the Agilent 10780C, Agilent 10780F, Agilent E1708A, or Agilent E1709A receiver is working properly.

When the Agilent 10780C/F receiver photodetector receives an adequate laser beam signal, the LED indicator illuminates (located on the Receiver's top surface) and the DC voltage at the external beam monitor test point is greater than +0.7. See the "Alignment and Gain Adjustment Procedure" in Chapter 8, "Receivers," of this manual for procedures to adjust this test point voltage. The alignment and gain adjustment procedures for the Agilent E1708A or E1709A receiver can be found in their respective operating manuals.

If the MEASUREMENT SIGNAL ERROR indicator on the Agilent electronics illuminates, the problem may be with one of the system's measurement axis receivers. If a SYSTEM ERROR indicator illuminates and the system is equipped with a Wavelength Tracking Compensation system, the problem could be with the wavelength tracker axis receiver or the overall alignment of the Wavelength Tracking Compensation system components. By sending an error message query to the Agilent electronics via the system controller, the system will respond indicating which axis is generating the error message.

Improperly aligned optical devices in either a measurement or a wavelength tracking axis can also cause a receiver to appear bad. Check for this by either placing the receiver directly in the laser beam path from the laser head, or by reflecting the laser beam onto the receiver's photodetector using a retroreflector. This isolates all other optical devices from the system. Most systems contain more than one axis and, consequently, more than one receiver. If trouble is suspected with one particular receiver, exchange it with another receiver to verify

the suspected malfunction. If you suspect problems with the alignment of a receiver, refer to Chapter 8, “Receivers,” and Chapter 7, “Measurement Optics,” in this manual for the appropriate alignment procedures.

A loose or broken fiber-optic connection at either the remote lens or electronics of the Agilent 10780F Remote Receiver, Agilent E1708A, or Agilent E1709A can also cause the receiver to appear bad.

The receiver LED indicator may remain on even if the beam between the interferometer and the retroreflector is blocked. This can occur occasionally with correct optical alignment if the measurement path is very short and few optical devices are used in the measurement path. If this situation occurs, refer to the receiver's operating and service manual.

The troubleshooting tree of Figure 11-2 will help you determine if the Agilent 10780C Receiver, Agilent 10780F Remote Receiver is faulty. Repair of the Agilent 10780C or Agilent 10780F is outlined in the *Agilent 10780C/F Operating and Service Manual*. Table 11-3 shows the Agilent 10780C/F Receiver signal chart.

Table 11-3. Agilent 10780C or Agilent 10780F Receiver signal chart

Receiver Input Output	Signal Name	
J1(1)	MEAS	
J1(2)	MEAS	
J1(3)	+15V Return RET	
J1(4)	+15V	
Pin	**Wire Color**	**Signal**
1	BLK	MEAS FREQ—
2	WHT	MEAS FREQ
3	WHT/GRA	+15V RETURN
4	WHT/GRA/GRN	+15V
NOTE: A dash (—) following a signal name indicates a negative-true signal.		

The receivers should be inspected at least twice a year, depending on their operating environment. Inspect as follows:

- VISUAL INSPECTION — Inspect the unit for indication of mechanical and electrical defects. Look for signs of overheating, corrosion, accumulations of dust, oil, loose electrical connections, or

broken parts. Also check the Agilent 10780F Remote Receiver for loose fiber-optic connections at both ends of the fiber.

- REPAIR AND CLEANING — Repair any obvious defects; and if necessary, clean the unit with dry, clean compressed air or a vacuum cleaner.

CAUTION

To avoid scratching the lens during cleaning, the following procedure is recommended.

Use a soft camel-hair lens brush or equivalent to remove dust from the optical surfaces. Dampen a few lens cleaning tissues with electronics grade methanol, shake off excessive methanol and wipe across the lens surface once. Use a fresh tissue dampened with methanol for each wipe. Allow the methanol to evaporate.

The ends of the Agilent 10780F, Agilent E1708A, or Agilent E1709A fiber-optic cable may be cleaned with a clean lint free cloth.

Periodically you may wish to verify proper beam alignment. Refer to Chapter 8, “Receivers,” Chapter 4, “System Installation and Alignment,” and Chapter 7, “Measurement Optics,” in this manual for procedures.

Troubleshooting Information

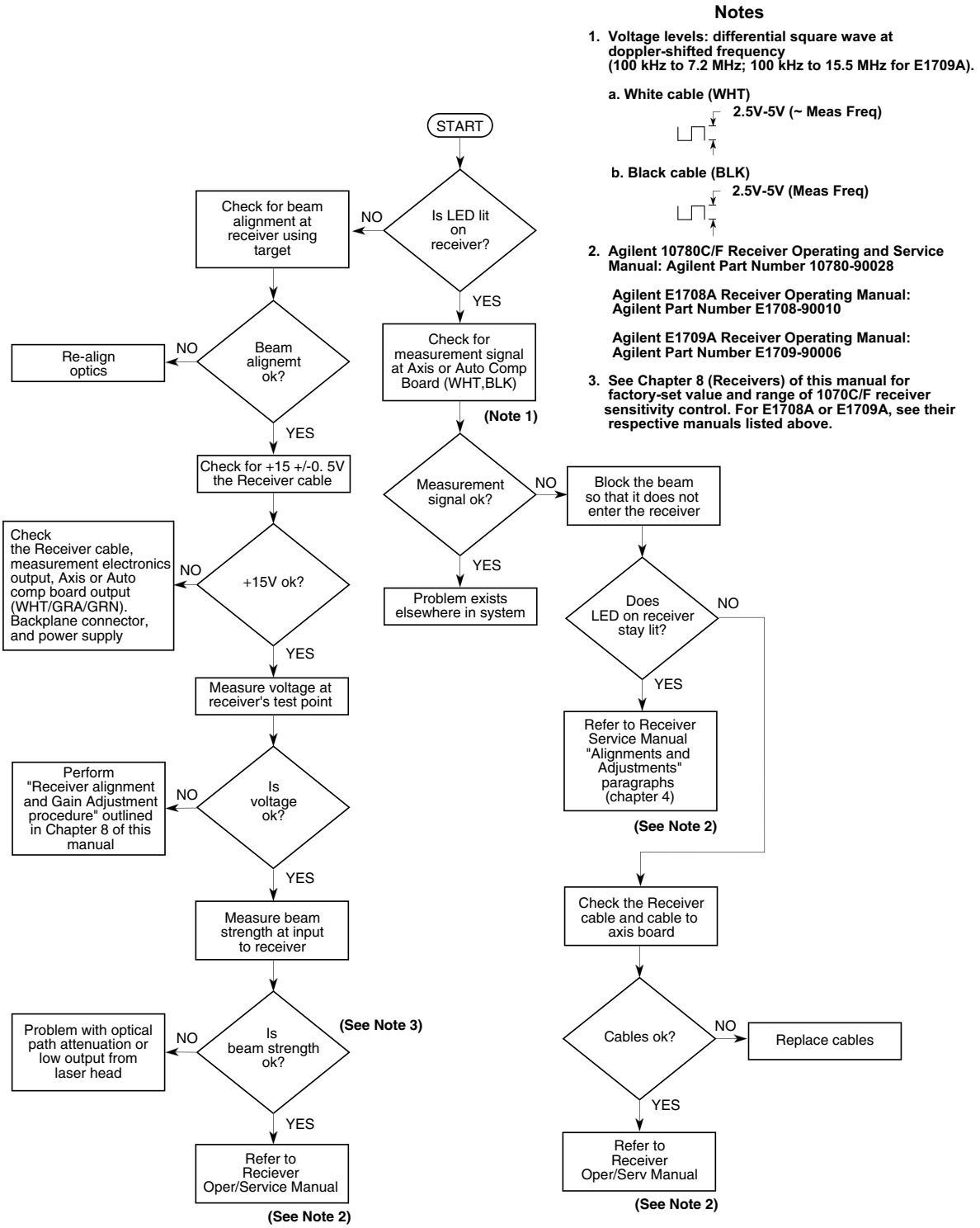

Figure 11-2. Agilent Receiver troubleshooting tree

Agilent 5519A/B Laser Head internal receiver

See the *Agilent 5519A/B Laser Head Service Manual* for internal receiver troubleshooting information.

Optical device troubleshooting

Problems with the optical devices are usually caused by their misalignment. Refer to the alignment procedures in this manual for further information. Air turbulence caused by ventilation equipment or temperature gradients near the laser beam path can also cause measurement problems. If this is suspected, shield the area around the laser beam and optical devices with cardboard tubing, plastic sheet, or other suitable material. Some problems with sporadic counting and drift can be traced to air turbulence around the measurement path. This should be considered as a possibility before troubleshooting other parts of the system.

NOTE

If the problem is traced back to dirty optics, refer to "Procedures for Cleaning Measurement Optics", in Chapter 10, "Maintenance," of this manual, before you try to clean them.

Defective measurement optics should be returned to Agilent Technologies where they will be evaluated for repair. Follow the procedures outlined in Chapter 13, "Packaging for Storage or Shipment" of this manual for packaging methods and procedures.

Procedures for cleaning optics are given in Chapter 10, "Maintenance," of this manual.

Agilent 10717A Wavelength Tracker troubleshooting

Troubleshooting the Agilent 10717A Wavelength Tracker involves proper interpretation of the Agilent laser system electronics front-panel annunciators, system- and board-level self tests, and knowing when the Wavelength Tracker requires realignment to the system optics. The main system problems that could occur include:

- Misalignment of the wavelength tracker, the receiver, the system optics, and system laser source
- Improper programming of system
- Malfunction of the receiver
- Malfunction of the Agilent system electronics (for example, the Agilent Automatic Compensation Board)

Troubleshooting trees (Figures 11-2 and 11-3, respectively) will help you determine if the Agilent receiver or the Agilent 10717A Wavelength Tracker is faulty.

Troubleshooting Information

The front-panel LEDs, combined with the error messages listed in the appropriate electronics manuals, provide assistance with both programming and hardware problems. The SYSTEM ERROR LED illuminates when a problem occurs in the measurement or reference path of the Wavelength Tracker axis or when incorrect programming strings have been sent by the system controller. By sending an error message query to the Agilent electronics via the system controller, the system will respond indicating which board address is generating the error message, and provide a brief description of the error.

The Agilent 10717A Wavelength Tracker is an optical device and is prealigned at the factory. If found defective it should be returned to Agilent Technologies where it will be evaluated for repair. Follow the procedures outlined in Chapter 13, “Packaging for Storage or Shipment,” of this manual for packaging methods and procedures.

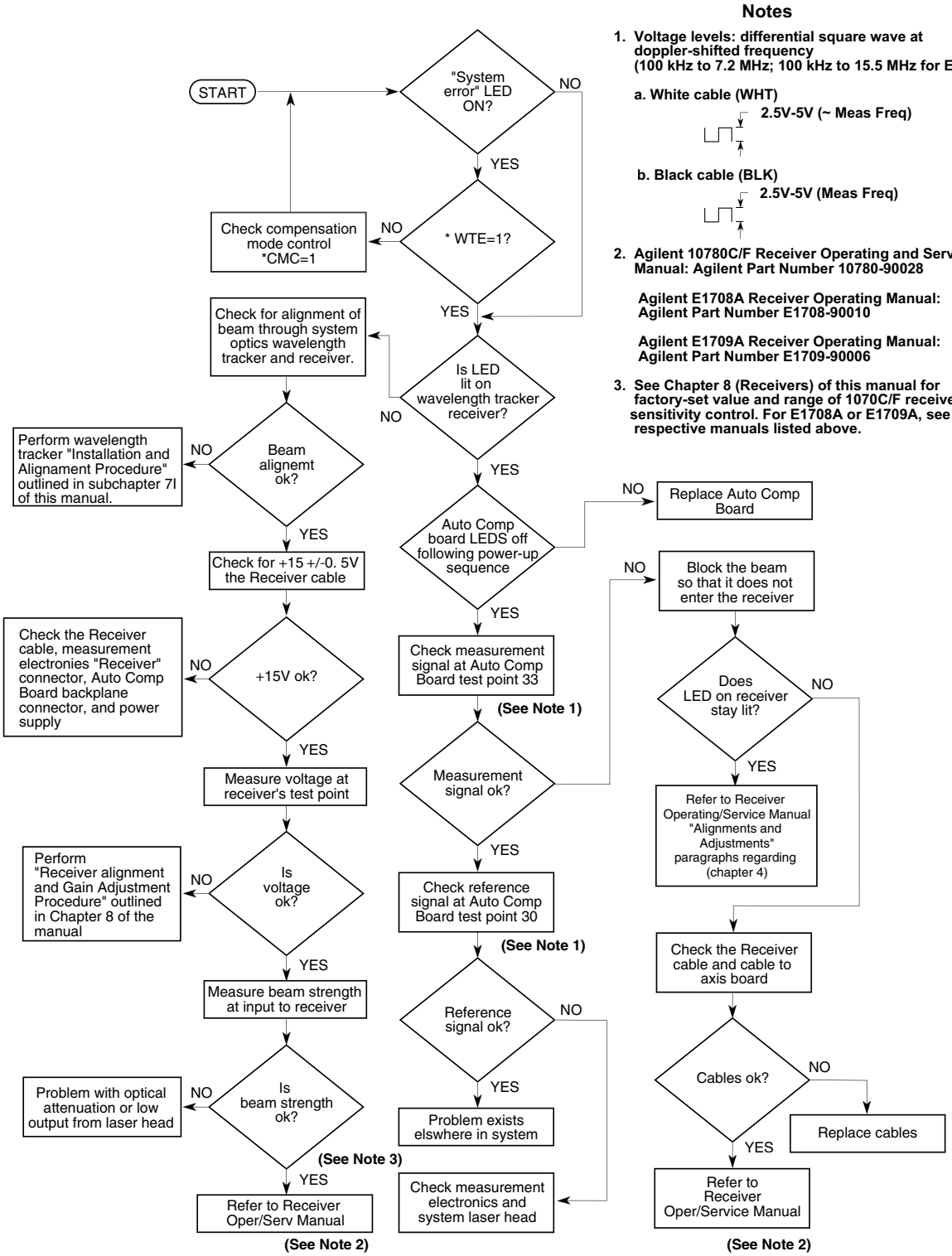

Figure 11-3. Agilent 10717A Wavelength Tracker troubleshooting tree

Before and After Service Product Safety Check

The following safety checks must be performed after any troubleshooting and repair procedures have been completed to ensure the safe operation of the instrument.

WARNING

RESISTANCE CHECKS DESCRIBED BELOW REQUIRE THAT THE POWER CORD BE CONNECTED TO THE INSTRUMENT AND THAT AC POWER BE DISCONNECTED. BE SURE THAT THE POWER CORD IS NOT CONNECTED TO POWER BEFORE PERFORMING ANY SAFETY CHECKS.

1. VISUAL INSPECTION. Visually inspect the interior of the serviced instrument for signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy the cause of any such condition.
2. GROUND CONTINUITY TEST. Plug the power cord into the Agilent electronics. DO NOT CONNECT THE INSTRUMENT TO AC POWER. Using a suitable ohmmeter, check the resistance from the enclosure (chassis) to the ground pin on the power cord. The reading should be less than 1 ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist. The resistance check should be performed from the enclosure to the ground pin of the cord while flexing the interconnect cable.
3. Check any indicated front or rear-panel ground terminals using the above procedures.
4. INSULATION RESISTANCE CHECK. Tie the line and neutral pins of the power cable together. Check resistance from the instrument enclosure (chassis) to line and neutral with the LINE switch ON and the power source disconnected. The minimum acceptable resistance is 2 Megohm. Replace any component that results in a failure.
5. POWER LINE MODULE CHECK. Check line fuse and line voltage selector in the electronics rear-panel power line module to verify that the correct fuse is installed and that the instrument is properly set for the AC source to be applied.

Before and After Service Product Safety Check

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Laser and Optics User's Manual
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This chapter is p/n 05517-90137