8 Performance Verification and Adjustment Software

What You Will Find in This Chapter

This chapter is divided into three sections. The first, "Introduction," is a brief description of performance verification and adjustments. The second, "Getting Started," describes how to begin using the performance verification software and the equipment you will need to complete the tests. The third, "List of Performance Verification Tests," provides a list of the tests supported by the performance verification software.

NOTE For additional information on performance verification or adjustment tests, refer to the onboard help on the *Performance Verification and Adjustment Software*.

Introduction

Instruments with Option 290

Instruments with Option 290, 8590 Series Programming Code Compatibility, installed will not be able to execute or process SCPI commands. Therefore, Option 290 will need to be uninstalled prior to running the performance verification software. To uninstall or reinstall Option 290, refer to “Uninstalling/Installing Option 290” in the 8590 Series Programming Compatibility Guide.

Test Environment

Agilent Test Management Environment is the new high performance, 32 bit, component-based calibration platform from Agilent Technologies, Inc. Agilent Test Management Environment can be expanded by purchasing test packages to test additional Agilent instruments. Agilent Test Management Environment reduces the cost of instrument maintenance by providing quick and accurate automated tests—reducing instrument downtime—and providing a “common look and feel”—reducing operator training.

Agilent Test Management Environment feature highlights:

- Runs on Microsoft ® Windows 95/98 or NT 4.0
- Provides fast automated testing
- Provides easy customizing of test sequences
- Provides ANSI Z540 compliant test reports
- It is Y2K compliant
- Runs from a graphical user interface
- Provides test standard tracking
- Provides administration security to control the test standards used
- Provides comprehensive on-line help

Performance Verification Tests

Performance verification tests are tests designed to provide the highest level of confidence that the instrument being tested conforms to published, factory-set specifications. The tests are supplied in an automated test software package. The automatic execution of the full set of performance tests will take between two and three hours to complete. Performance tests are designed to test an instrument operating within the operational temperature range defined by the instrument specifications. Some repairs require a performance test to be run after the repair.

If the instrument is unable to pass any of the performance tests, adjustment tests or further repairs are needed.

Adjustments

Adjustments, sometimes incorrectly referred to as *calibrations*, are procedures designed to reset various circuit parameters. In addition, some of the adjustments reset or calculate correction values associated with some measurements. The adjustments are supplied in an automated test software package accessory. The software is designed to adjust an instrument operating within the operational temperature range defined by the instrument specifications.

Never perform adjustments as routine maintenance. Adjustments should be performed only after a repair or a performance test failure.

The *Performance Verification and Adjustment Software* is included as part of Option 0BW, service documentation for the Agilent ESA spectrum analyzer products. This software was previously available as the N2717A Performance Verification and Adjustment Software. For ordering information get in touch with your local Agilent sales and service office listed in Table 5-35 on page 238.

Getting Started

NOTE Refer to the onboard help documentation for complete information on using the performance verification and adjustment software.

NOTE For software technical support, refer to “Contacting Agilent Technologies, Inc.” in Chapter 5.

Before You Start

You must do the following *before* starting performance verification:

1. Ensure you have a compatible controller (IBM compatible computer), refer to Table 8-1 on page 337.
2. Install Performance Verification and Adjustment Software on the computer.
3. Ensure you have the proper test equipment, refer to Table 8-1 on page 337, through Table 8-5 on page 343, for a list of test equipment.
4. Switch the unit under test (UUT, the analyzer) on and let it warm up in accordance with warm-up requirements in the instrument specifications.

Software Installation and Configuration

Refer to the instructions on the Performance Verification and Adjustment Software CD-ROM packaging for installation instructions.

After installation, refer to the onboard help instructions for configuring the software for performing tests and adjustments.

Test Equipment

Table 8-1 on page 337, through Table 8-5 on page 343, list the equipment required to run the performance verification tests and adjustments. The tables list the equipment type, critical specifications, and the recommended model number. The “Recommended Model” is the preferred equipment. The critical specifications in this table are the most restrictive specifications for all of the tests.

Not all of the listed test equipment needs to be connected to perform an individual test. To run a test, only the equipment specified for that test needs to be connected.

NOTE The validity of the performance verification and adjustment program measurements depends in part on required test equipment measurement accuracy. Verify proper calibration of test equipment before running tests with this software.

Warm-up Time

Test Equipment Warmup

Allow sufficient warmup time for the test equipment. Refer to individual operating and service manuals for warmup specifications.

UUT Warmup

The UUT must be stored at a constant temperature, within the specified operating temperature range, for a minimum of two hours prior to running the performance verification tests or adjustments. Switch on the instrument and let it warm up in accordance with warm-up requirements in the instrument specifications.

Table 8-1 Required Controller and Accessories

Equipment	Critical Specifications	Recommended Agilent Model Number	Alternative Agilent Model Number
Controller			
Computer	IBM compatible PC Intel Pentium 90 MHz or greater MS Windows 95/98 or NT 4.0 At least 32 MB RAM At least 200 MB of free hard disk space CD-ROM Drive 800x600 Minimum monitor resolution Web browser[a]		
IEEE-488 Interface Card	High-performance GPIB with: Agilent-VISA 1.2[b] or greater or NI-488.2 1.5[c] or greater	82341D	National part number AT-GPIB/TNT
Software	Performance verification and adjustment software for ESA spectrum analyzers	E4401-90416	

a. Microsoft Internet Explorer 4.0 or greater or Netscape 4.0 or greater.
b. Agilent Technologies, Inc. Information on how to obtain the Agilent-VISA is available in the readme file of the software.
c. National Instruments NI-488.2 is available at http://www.ni.com.

Table 8-2 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Agilent Model	Use[a]
Digital Multimeter	Input Resistance: >10 MΩ Accuracy: ±10 mV on 100 V range	3458A	P,A,T
DVM Test Leads	For use with 3458A Digital Multimeter	34118B	T
Universal Counter	Frequency Range: 10 MHz ±10 Hz Time Interval Range: 25 ms to 100 ms Single Trigger Operation Range: +2.5 Vdc to –2.5 Vdc External Reference Input	53132A	P,A,T
Frequency Standard	Frequency: 10 MHz Timebase Accuracy (Aging): $<1 \times 10^{-9}$/day	5071A	P,A
Oscilloscope	Bandwidth: >10 MHz Functions: Area, Vp-p, Pulse Width Vertical Scale Factor of 0.5 V to 5 V/Div	54501A[b] 54820A[c]	P, T

Table 8-2 Recommended Test Equipment (Continued)

Equipment	Critical Specifications for Equipment Substitution	Recommended Agilent Model	Use[a]
Power Meter	Compatible with 8480 series power sensors. dB relative mode. Resolution: 0.01 dB Reference Accuracy: ±1.2% Dual Channel	E4419A	P,A,T
RF Signal Generator	Capable of generating cdmaOne and GSM formats	E4433B, Options UND, IE5, UN5, and UN8	P, T
RF Power Sensor (2 required)	Frequency Range: 100 kHz to 3 GHz Maximum SWR: 1.60 (100 kHz to 300 kHz) 1.20 (300 kHz to 1 MHz) 1.1 (1 MHz to 2.0 GHz) 1.18 (2.0 GHz to 3.0 GHz) Amplitude range: –25 dBm to +10 dBm	8482A	P,A,T
Microwave Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Maximum SWR: 1.15 (50 MHz to 100 MHz) 1.10 (100 MHz to 2 GHz) 1.15 (2 GHz to 12.4 GHz) 1.20 (12.4 GHz to 18 GHz) 1.25 (18 GHz to 26.5 GHz) Amplitude range: –25 dBm to 0 dBm	8485A	P,A,T
75 Ω Power Sensor (Option 1DP)	Frequency Range: 1 MHz to 1500 MHz Maximum SWR: 1.18 (600 kHz to 1500 MHz) Impedance: 75 Ω Amplitude Range: –30 dBm to +20 dBm	8483A	P,A,T
Power Sensor, Low Power	Frequency Range: 50 MHz to 3.0 GHz Amplitude Range: –20 dBm to –70 dBm Maximum SWR: 1.4 (10 MHz to 30 MHz) 1.15 (30 MHz to 3.0 GHz)	8481D	P,A,T
Spectrum Analyzer, Microwave (required for Option 1DN or 1DQ)	Frequency Range: 100 kHz to 7 GHz Relative Amplitude Accuracy: 100 kHz to 3.0 GHz: < ±1.8 dB Frequency Accuracy: < ±10 kHz @ 7 GHz	8563E	P,T
Synthesized Signal Generator	Frequency Range: 100 kHz to 2500 MHz Amplitude Range: –35 to +16 dBm SSB Noise: <–120 dBc/Hz at 20 kHz offset	8663A	P,A

Table 8-2 Recommended Test Equipment (Continued)

Equipment	Critical Specifications for Equipment Substitution	Recommended Agilent Model	Use[a]
Synthesized Sweeper *(2 required for all but E4401B and E4411B)*	Frequency Range: E4407B or E4408B: 10 MHz to 26.5 GHz All others: 10 MHz to 13.2 GHz Frequency Accuracy (CW): ±0.02% Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: –35 to +16 dBm	83630/40/50B 83620/30/40/50B	P,A,T
Function Generator	Frequency Range: 0.1 Hz to 20 MHz Frequency Accuracy: ±0.02% Waveform: Triangle, Square	33120A or 3325B	P,A,T
Attenuator/Switch Driver	Compatible with 8494G and 8496G Programmable step attenuators	11713A	P
Attenuator, 1 dB Step	Attenuation Range: 0 to 11 dB Frequency Range: 4 GHz Connectors: Type-N female Calibrated at 50 MHz with accuracy of 1 to 11 dB attenuation: ±0.010 dB.	8494A/G	P
Attenuator, 10 dB Step	Attenuation Range: 0 to 110 dB Frequency Range: 4 GHz Connectors: Type-N female Calibrated at 50 MHz with accuracy of: 0 to 40 dB attenuation: ±0.020 dB 50 to 100 dB attenuation: ±0.065 dB 110 dB attenuation: ±0.075 dB	8496A/G	P
Attenuator, 20 dB Fixed (Option 1DS)	Nominal attenuation: 20 dB Frequency Range: dc to 3.0 GHz Connectors: Type-N (m) and Type-N (f) Maximum SWR: <1.2 (dc to 3 GHz)	8491A Option 020	P,A
Attenuator, 10 dB Fixed	Nominal attenuation: 10 dB Frequency Range: dc to 12.4 GHz Connectors: Type-N (m) and Type-N (f)	8491A Option 010	P
Attenuator, 6 dB Fixed	Nominal attenuation: 6 dB Frequency Range: dc to 12.4 GHz Connectors: Type-N (m) and Type-N (f) Maximum SWR: <1.15 at 50 MHz	8491A Option 010 and H47	P
Attenuator Interconnect Kit	Mechanically and electrically connects 8494A/G and 8496A/G	11716 Series	P

a. P = Performance Test, A = Adjustment, T = Troubleshooting
b. Required for the N2717A automated performance verification test.
c. Required for the manual performance test.

Table 8-3 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Agilent Model	Use [a]
6 GHz Directional Bridge	Frequency Range: 5 MHz to 3.0 GHz Directivity: >40 dB Coupling factor: 16 dB nominal Insertion Loss: 2 dB maximum	86205A	P
Power Splitter (E4401B/02B/ 03B/04B/05B/11B)	Frequency Range: 9 kHz to 13.2 GHz Insertion Loss: 6 dB nominal Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	11667A	P,A
Power Splitter (E4407B/E4408B)	Frequency Range: 9 kHz to 26.5 GHz Insertion Loss: 6 dB nominal Output Tracking: <0.25 dB (dc to 18 GHz) <0.4 dB (18 to 26.5 GHz) Equivalent Output SWR: <1.22:1	11667B	P,A
Directional Coupler	Frequency Range: 2 GHz to 8 GHz Directivity>20 dB Max.VSWR: 1.35:1 Transmission Arm Loss: < 1 dB nominal Coupled Arm Loss: ~ 16 dB nominal	0955-0098	P
Directional Coupler	Frequency Range: 2 GHz to 15 GHz Directivity>14 dB Max.VSWR: 1.35:1 Transmission Arm Loss: < 1.5 dB nominal Coupled Arm Loss: ~ 10 dB nominal	87300B	P
Termination, 50 Ω (E4401B/02B/ 03B/04B/05B/11B) (2 required for Option 1DN)	Impedance: 50 Ω nominal Connector: Type-N (m)	909A (Option 012)	P,T
Termination, 50 Ω (E4407B/ 08B)	Impedance: 50 Ω nominal Connector: APC 3.5 (f)	909D (Option 011)	P,T
Termination, 50 Ω	Impedance: 50 Ω nominal Connector: BNC (m)	11593A	P,A
Termination, 75 Ω (Option 1DQ and 1DP)	Impedance: 75 Ω nominal *(2 required for Option 1DQ)* *(1 required for Option 1DP)*	909E (Option 201)	P,T
Filter, 50 MHz Low Pass	Cutoff frequency: 50 MHz Rejection at 65 MHz: >40 dB Rejection at 75 MHz: >60 dB	0955-0306	P
Filter, 300 MHz Low Pass	Cutoff frequency: 300 MHz Rejection at >43 MHz: >45 dB	0955-0455	P

Table 8-3 Recommended Accessories (Continued)

Equipment	Critical Specifications for Accessory Substitution	Recommended Agilent Model	Use [a]
Filter, 1 GHz Low Pass	Cutoff frequency: 1 GHz Rejection at 2 GHz: >60 dB	0955-0487	P
Filter, 1.8 GHz Low Pass (2 required) (E4404B/05B/07B/08B)	Cutoff frequency: 1.8 GHz Rejection at >3 GHz: >45 dB	0955-0491	P
Filter, 4.4 GHz Low Pass (2 required) (E4404B/05B/07B/08B)	Cutoff frequency: 4.4 GHz Rejection at >5.5 GHz: >42 dB	9135-0005 or 360D	P

a. P = Performance Test, A = Adjustment, T = Troubleshooting

Table 8-4 Recommended Adapters

Critical Specifications for Adapter Substitution	Recommended Agilent Model	Use [a]
BNC (m) to BNC (m)	1250-0216	P,T
BNC tee (f,m,f)	1250-0781	A,T
Type-N (f) to APC-3.5 (f)	1250-1745	P,A,T
Type-N (f) to BNC (m)	1250-1477	P,T
Type-N (f) to BNC (m), 75 Ω *(2 required for* Option 1DQ) *(1 required for* Option 1DP)	1250-1534	P,A,T
Type-N (m) to BNC (f)*(4 required)*	1250-1476	P,A,T
Type-N (m) to BNC (m) *(2 required)*	1250-1473	P,T
Type-N (m) to BNC (m), 75 Ω (Option 1DP)	1250-1533	P,A,T
Type-N (f) to Type-N (f)	1250-1472	P,T
Type-N (m) to Type-N (m)	1250-1475	P,A,T
Type-N (f) to Type-N (f), 75 Ω (Option 1DP)	1250-1529	P,A,T
Type-N (f), 75 Ω to Type-N (m), 50 Ω (Option 1DP)	1250-0597	P,A,T
Type-N (m) to SMA (m)	1250-1636	P
BNC (m) to SMA (f)	1250-2015	P
50 Ω to 75 Ω Minimum Loss Pad Frequency Range: dc to 1.5 GHz Insertion Loss: 5.7 dB (Option 1DP)	11852B	P,A,T
Type-N (f) to Type-N (f)	1250-0777	P
Type-N (f) to BNC (f), 75 Ω (Option 1DP)	1250-1535	P,A
Type-N (m) to APC-3.5 (f) *(3 required)*	1250-1744	P,A
APC-3.5 (f) to APC-3.5 (f)	1250-1749	P,A
Dual Banana to BNC (f)	1251-2277	P,A,T
Type-N (m) to BNC (f) *(2 required)*	1250-0780	P,A,T

a. P = Performance Test, A = Adjustment, T = Troubleshooting

Table 8-5 Recommended Cables

Critical Specifications for Cable Substitution	Recommended Agilent/HP Model	Use [a]
Frequency Range: dc to 1 GHz Length: >122 cm (48 in) Connectors: BNC (m) (2) *(4 required)*	10503A	P,A,T
Frequency Range: dc to 310 MHz Length: 23 cm (9 in) Connectors: BNC (m) (2)	10502A	P,A,T
BNC, 75 Ω, 30 cm (12 in) (option 1DP)	5062-6452	P,A,T
Type-N, Precision 62 cm (24 in)	11500C	P,A,T
Type-N, Precision 152 cm (60 in) *(2 required)*	11500D	P,A,T
APC-3.5 Cable Frequency: 9 kHz to 26.5 GHz Connectors: APC-3.5 (m) (2) Length: >92 cm (36 in) *(2 required)*	8120-4921	P,A,T
Cable, Test Length: >91 cm (36 in) Connectors: SMB (f) to BNC (m) *(2 required)*	85680-60093	T

a. P = Performance Test, A = Adjustment, T = Troubleshooting

Equipment Connections

GPIB Cables

All test equipment controlled by GPIB should be connected to the internal GPIB connector of the controller (select code 7). If the controller has only one GPIB connector, connect the UUT to it as well. If the controller has dual GPIB connectors, connect the UUT to the second GPIB (typically, select code 8).

Test Setups

Complete detailed test setup illustrations are located in the onboard help supplied with the test software. The program prompts the operator to make appropriate equipment connections.

Failure to Meet Specifications

If the instrument does not meet one or more of the specifications during testing, check the test setup for proper configuration, check the condition of all connectors, and ensure all connections are tight. After these things have been checked and confirmed correct, run the failed tests again. If the results are still unsatisfactory, complete any remaining tests and refer to the troubleshooting information in “Check the Basics” in Chapter 1 to correct the problem.

Calibration Cycle

The performance verification tests should be used to check the instrument against the instrument specifications every twelve months.

The instrument requires periodic verification of performance. Under most conditions of use, you should check the instrument against the instrument specifications every twelve months using the complete set of automated performance verification tests located on the *Performance Verification and Adjustment Software CD-ROM* or perform the manual performance tests in the calibration guide.

When test results show proper operation and calibration, no adjustments are necessary.

List of Performance Verification Tests

Performance verification tests are tests designed to provide the highest level of confidence that the instrument being tested conforms to the published, factory-set specifications. The tests are supplied in an automated test software package. Manual versions of the tests are also provided in the calibration guide. The automatic execution of the full set of performance tests will take between two and three hours to complete. Performance tests are designed to test an instrument operating within the operational temperature range defined by the instrument specifications. Some repairs require a performance test to be run after the repair

The following is a list of the tests included in the performance verification and adjustment software and the calibration guide:

10 MHz Reference Frequency Accuracy

10 MHz Precision Reference Frequency Accuracy, (Opt 1D5)

Frequency Readout Accuracy

Frequency Span Readout Accuracy

Noise Sidebands

Noise Sidebands - Wide Offsets

System Related Sidebands

Residual FM

Sweep Time Accuracy

Scale Fidelity

Input Attenuation Switching Uncertainty at 50 MHz

Reference Level Accuracy

Resolution BW Switching Uncertainty

Absolute Amplitude Accuracy

Overall Amplitude Accuracy

Resolution BW Accuracy

Frequency Response

Other Input Related Spurious Responses

Spurious Responses - TOI

Spurious Responses - SHI

Gain Compression

Displayed Average Noise Level (DANL)

Residual Responses

Fast Time Domain Amplitude Accuracy, Option AYX

Tracking Generator Absolute Amplitude and Vernier Accuracy

Tracking Generator Level Flatness

Tracking Generator Harmonic Spurious Outputs

Tracking Generator Non-Harmonic Spurious Outputs

Tracking Generator LO Feedthrough Amplitude

Gate Delay and Gate Length Accuracy

Gate Mode Additional Amplitude Error

NOTE For additional information on these tests, refer to the onboard help or the equivalent manual performance verification test. The manual performance tests are located in the calibration guide, and provide additional information about the test including the steps required for the manual performance of the test.

List of Adjustments

Adjustments should not be used for calibration. The procedures are designed to reset various circuit parameters. In addition, some of the tests reset or calculate correction values associated with some measurements. The adjustments are supplied in an automated test software application. The software is designed to adjust an instrument operating within the temperature range defined by the instrument specifications.

Never perform adjustments as routine maintenance. Adjustments should be performed only after a repair or after a performance test failure.

The following is a list the adjustments included in adjustment software:

YTF Adjustment

LO Power Adjustment

IF Amplitude Adjustment

IF Input Correction

50 MHz Amplitude Reference Adjustment

10 MHz Reference Adjustment

Tracking Generator ALC Calibration

Tracking Generator Frequency Slope Adjustment

Processor Initialization

RF Assembly Initialization

Flatness Initialization