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Errata

Title & Document Type: 8753D Option 011 Network Analyzer Service Guide

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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www.tm.agilent.com

Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

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Service Guide

HP 8753D Network Analyzer Option 011



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Service Equipment and Analyzer Options

Table of Service Test Equipment

Table 1-1. Required Tools

T-8, T-10, T-15, and T-20 TORX screwdrivers
Flat-blade screwdrivers – small, medium, and large
5/16-inch open-end wrench (for SMA nuts)
3/16, 5/16, and 9/16-inch hex nut drivers
5/16-inch open-end torque wrench (set to 10 in-lb)
2.5 mm hex-key driver
Non-conductive and non-ferrous adjustment tool
Needle-nose pliers
Tweezers
Anti-static work mat with wrist-strap
Floppy Disk 3.5-inch

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Table 1-2. Service Test Equipment

Required Equipment	Critical Specifications	Recommended Model	Use*
Spectrum Analyzer	Frequency Accuracy ±7 Hz	HP 8563E	A, T
Frequency Counter	Frequency: 300 kHz - 3 GHz (6 GHz for Option 006)	HP 5350B	P
Synthesized Sweeper	Maximum spurious input: <−30 dBc Residual FM: <20 kHz	HP 83640A	P
Oscilloscope	Bandwidth: 100 MHz Accuracy: 10%	any	T
Digital Voltmeter	Resolution: 10 mV	any	T
Power Meter (HP-IB)	No substitute	HP 437A or 438A	A, P, T
Power Sensor	Frequency: 300 kHz-3 GHz	HP 8482A	A, P, T
Power Sensor (for Option 006)	Frequency: 3 GHz-6 GHz	HP 8481A	A, P
S-Parameter Test Set	Frequency Range: 3-6 GHz, for Option 006: 3 GHz-6 GHz	HP 85046A[1]/HP 85047A[2]	P
Transmission/Reflection Test Set	Frequency: 300 kHz-3 GHz Directivity: 30 dB	HP 85044A	P
Tool Kit	No substitute	HP part number 08753-60023	T
Photometer		Tektronix J16	A
Photometer Probe		Tektronix J6503	A
Light Occluder		Tektronix 016-0305-00	
CRT Demagnetizer or Bulk Tape Eraser			A
Printer		HP ThinkJet, DeskJet, LaserJet	P
Floppy Disk	3.5-inch	HP 92192A	A
Calibration Kit 7 mm	No substitute	HP 85031B	P
Calibration Kit Type-N	No substitute	HP 85032B	P
Verification Kit 7 mm	No substitute	HP 85029B	P
Test Set		HP 85046B/47B	P (Option 011)

1 For use with HP 8753D Option 011

2 For use with HP 8753D Option 011 and 006.

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Table 1-2 Service Test Equipment (2 of 3)

Required Equipment	Critical Specifications	Recommended Model	Use*
Step Attenuator	110 dB(Calibrated @ 30 MHz)	HP 8496A	P
Attenuators (fixed):	Return loss: ≥32 dB		
3 dB	Type-N	HP 8491A Opt. 003	P
20 dB	Type-N	HP 8491A Opt. 020	A, P, T
10 dB	Type-N	HP 8491A Opt. 010	A, P
30 dB	Type-N	HP 8491A Opt. 030	A, P
RF Cable	Type-N	HP P/N 8120-4721	A
RF Cable Set	12-inch, phase matched	HP 11500B	A
RF Cable Kit	Qty. 3, 50 , Type-N (m), matched	HP 11851B	A, P
RF Cable Set	50 7 mm	HP 85029B	P
RF Cable	24-inch APC-7	HP P/N 8120-4779	P
RF Cable	50 Type-N	HP P/N 8120-4781	P
RF Cable	50 , Type-N (m) to Type-N (m)	HP 11500B	A
RF Cable	50 , 7 mm, 24-inch, matched	HP 11857D	P
HP-IB Cable		HP 10833A/B/C/D	A,P
BNC Cable		HP P/N 8120-1840	A,P
Adapter	Type-N (f) to Type-N (f)	HP P/N 1250-1472	A, P
Adapter	Type-N (m) to Type-N (m)	HP P/N 1250-1475	A, P
Adapter	Type-N (f) to APC-7	HP 11524A	P
Adapter	Type-N (m) to APC-7	HP 11525A	P
Adapter	APC-3.5 (f) to Type-N (f)	HP P/N 1250-1745	P
Adapter	APC-3.5 (m) to APC-7	HP P/N 1250-1746	P
Adapter	Type-N (f) to BNC (m)	HP P/N 1250-0077	P
Adapter	BNC to Alligator Clip	HP P/N 8120-1292	A

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Table 1-2 Service Test Equipment (3 of 3)

Required Equipment	Critical Specifications	Recommended Model	Use*
Power Splitter, 2-Way	Frequency: 300 kHz-6 GHz	HP 11667A Option 001	A,P
Power Splitter, 3-Way	Frequency: 300 kHz-3 GHz Tracking between outputs: ±.25 dB Output SWR: ±1.1 dB	HP 11850C	P, T
Low Pass Filter	>50 dB @ 2.96 Hz and passband that includes 800 MHz	HP P/N 9135-0198	A
Termination	50 , Type-N (m), Return loss ≥30 dB	HP 908A	P
Anti-static Wrist Strap		HP P/N 9300-1367	A, P, T
Anti-static Wrist Strap Cord		HP P/N 9300-0980	A, P, T
Static-control Table Mat and Earth Ground Wire		HP P/N 9300-0797	A, P, T

*
P - Performance Tests
A - Adjustment
T - Troubleshooting

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Principles of Microwave Connector Care

Proper connector care and connection techniques are critical for accurate, repeatable measurements.

Refer to the calibration kit documentation for connector care information. Prior to making connections to the network analyzer, carefully review the information about inspecting, cleaning and gaging connectors.

Having good connector care and connection techniques extends the life of these devices. In addition, you obtain the most accurate measurements.

This type of information is typically located in Chapter 3 of the calibration kit manuals.

For additional connector care instruction, contact your local Hewlett-Packard Sales and Service Office about course numbers HP 85050A+24A and HP 85050A+24D.

See the following table for quick reference tips about connector care.

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Table 1-3. Connector Care Quick Reference

Handling and Storage	
Do	**Do Not**
Keep connectors clean Extend sleeve or connector nut Use plastic end-caps during storage	Touch mating-plane surfaces Set connectors contact-end down
Visual Inspection	
Do	**Do Not**
Inspect all connectors carefully Look for metal particles, scratches, and dents	Use a damaged connector - ever
Connector Cleaning	
Do	**Do Not**
Try compressed air first Use isopropyl alcohol Clean connector threads	Use any abrasives Get liquid into plastic support beads
Gaging Connectors	
Do	**Do Not**
Clean and zero the gage before use Use the correct gage type Use correct end of calibration block Gage all connectors before first use	Use an out-of-spec connector
Making Connections	
Do	**Do Not**
Align connectors carefully Make preliminary connection lightly Turn only the connector nut Use a torque wrench for final connect	Apply bending force to connection Over tighten preliminary connection Twist or screw any connection Tighten past torque wrench “break” point

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Analyzer Options Available

Option 1D5, High Stability Frequency Reference

This option offers ±0.05 ppm temperature stability from 0 to 60 °C (referenced to 25 °C).

Option 002, Harmonic Mode

This option provides measurement of second or third harmonics of the test device's fundamental output signal. Frequency and power sweep are supported in this mode. Harmonic frequencies can be measured up to the maximum frequency of the receiver. However, the fundamental frequency may not be lower than 16 MHz.

Option 006, 6 GHz Operation

This option extends the maximum source and receiver frequency of the analyzer to 6 GHz.

Option 010, Time Domain

This option displays the time domain response of a network by computing the inverse Fourier transform of the frequency domain response. It shows the response of a test device as a function of time or distance. Displaying the reflection coefficient of a network versus time determines the magnitude and location of each discontinuity. Displaying the transmission coefficient of a network versus time determines the characteristics of individual transmission paths. Time domain operation retains all accuracy inherent with the correction that is active in of such devices as SAW filters, SAW delay lines, RF cables, and RF antennas.

Option 1CM, Rack Mount Flange Kit Without Handles

This option is a rack mount kit containing a pair of flanges and the necessary hardware to mount the instrument, with handles detached, in an equipment rack with 482.6 mm (19 inches) horizontal spacing.

Option 1CP, Rack Mount Flange Kit With Handles

This option is a rack mount kit containing a pair of flanges and the necessary hardware to mount the instrument with handles attached in an equipment rack with 482.6 mm (19 inches) spacing.

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Service and Support Options

The analyzer automatically includes a one-year on-site service warranty, where available. If on-site service is not available in your local area, you can purchase the analyzer with a W08 Option, which converts the one year on-site warranty to a three year return to HP warranty. Consult your local HP customer engineer for details.

The following service and support options are available at the time you purchase an HP 8753D Option 011 network analyzer.

Option W31

This option adds two years of on-site repair to the product warranty, providing three years of repair coverage.

Option W51

This option adds four years of on-site repair to the product warranty, providing five years of repair coverage.

Option W32

This option provides three years of return to HP calibration service.

Option W52

This option provides five years of return to HP calibration service.

Option W34

This option provides three years of return to HP Standards Compliant Calibration.

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Option W54

This option provides five years of return to HP Standards Compliant Calibration.

If support was not purchased along with the analyzer, there are many repair and calibration options available from Hewlett-Packard's support organization. These options cover a range of on-site services and agreements with varying response times as well as return to HP agreements and per-incident pricing. Contact your local Hewlett-Packard customer engineer for details.

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2a

Performance Test Record

For Analyzers with a Frequency Range of 300 kHz to 3 GHz

Note See the next "Performance Test Record" section if your analyzer frequency range is from 30 kHz to 6 GHz (Option 006).

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HP 8753D Performance Test Record (1 of 18)

Calibration Lab Address:

Report Number _____

Date _____

_____ Last Calibration Date _____

_____ Customer's Name _____

_____ Performed by _____

Model HP 8753D Option 011

Serial No. _____ Option(s) _____

Firmware Revision _____

Ambient Temperature _____° C Relative Humidity _____%

Test Equipment Used:

Description	Model Number	Trace Number	Cal Due Date
Frequency Counter			
Power Meter			
Power Sensor			
Calibration Kit			
Verification Kit			

Notes/Comments: _____

_____

_____

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HP 8753D Performance Test Record (2 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 1. Source Frequency Range and Accuracy

CW Frequency (MHz)	Lower Limit (MHz)	Measured Value (MHz)	Upper Limit (MHz)	Measurement Uncertainty (MHz)
0.3	0.299 997	_____	0.300 003	± 0.000 000 520
5.0	4.999 950	_____	5.000 050	± 0.000 008 610
16.0	15.999 840	_____	16.000 160	± 0.000 028 220
31.0	30.999 690	_____	31.000 310	± 0.000 053 730
60.999 999	60.999 390	_____	61.000 610	± 0.000 104 800
121.0	120.998 790	_____	121.001 210	± 0.000 206 800
180.0	179.998 200	_____	180.001 800	± 0.000 307 200
310.0	309.995 900	_____	310.003 100	± 0.000 528 300
700.0	699.930 000	_____	700.007 000	± 0.001 191 700
1 300.0	1 299.987	_____	1 300.013	± 0.002 212 300
2 000.0	1 999.980	_____	2 000.020	± 0.003 403 000
3 000.0	2 999.970	_____	3 000.030	± 0.005 104 000

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HP 8753D Performance Test Record (3 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 2. Source Power Range, Linearity, and Accuracy:
– Path Loss Calculations Worksheet –

CW Frequency	Source Output Power Level (dBm)	First Value (dB)	Second Value (dB)	Path Loss (dB)
300 kHz	+10			
20 MHz	+10			
50 MHz	+10			
100 MHz	+10			
200 MHz	+10			
500 MHz	+10			
1 GHz	+10			
2 GHz	+10			
3 GHz	+10			

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Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 2. Source Power Range, Linearity, and Accuracy:
– Power Range and Power Linearity –

Source Power Level (dBm)	Power Offset (dB)	Path Loss (dB)	Measured Value (dB)	Power Linearity (dB)	Spec. (dB)	Meas. Uncer. (dB)
CW Freq. = 300 kHz						
– 5	+15				± 0.25	± 0.02
– 3	+13				± 0.25	± 0.02
– 1	+11				± 0.25	± 0.02
+1	+9				± 0.25	± 0.02
+3	+7				± 0.25	± 0.02
+5	+5				± 0.25	± 0.02
+7	+3				± 0.25	± 0.0
+9	+1				± 0.25	± 0.0
+11	– 1				± 0.25	± 0.0
+13	– 3				± 0.25	± 0.0
+15	– 5				± 0.5	± 0.0
+17	– 7				± 0.5	± 0.17
+20	– 10				± 0.5	± 0.17
CW Freq. = 3 GHz						
– 5	+15				± 0.25	± 0.02
– 3	+13				± 0.25	± 0.02
– 1	+11				± 0.25	± 0.02
+1	+9				± 0.25	± 0.02
+3	+7				± 0.25	± 0.02
+5	+5				± 0.25	± 0.02
+7	+3				± 0.25	± 0.0
+9	+1				± 0.25	± 0.0
+11	– 1				± 0.25	± 0.0
+13	– 3				± 0.25	± 0.0
+15	– 5				± 0.5	± 0.0
+17	– 7				± 0.5	± 0.17
+20	– 10				± 0.5	± 0.17

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HP 8753D Performance Test Record (5 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 2. Source Power Range, Linearity, and Accuracy:
– Power Level Accuracy –

CW Frequency (MHz)	Path Loss (dB)	Calibrated Power Level (dB)	Measured Value (dB)	Power Level Accuracy (dB)	Spec. (dB)	Meas. Uncer. (dB)
Source Output Power Level = +10dBm						
0.300	_____	_____	_____	_____	± 1.0	± 0.33
20.000	_____	_____	_____	_____	± 1.0	± 0.10
50.000	_____	_____	_____	_____	± 1.0	± 0.10
100.000	_____	_____	_____	_____	± 1.0	± 0.11
200.000	_____	_____	_____	_____	± 1.0	± 0.11
500.000	_____	_____	_____	_____	± 1.0	± 0.11
1000.000	_____	_____	_____	_____	± 1.0	± 0.11
2000.000	_____	_____	_____	_____	± 1.0	± 0.20
3000.000	_____	_____	_____	_____	± 1.0	± 0.20

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HP 8753D Performance Test Record (6 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 3. Receiver Minimum R Channel Level

CW Frequency	Specification (dB)	Marker Value (dB)	Measurement Uncertainty (dB)
300 kHz	< – 35	_____	± 1.0
3.29 MHz	< – 35	_____	± 1.0
3.31 MHz	< – 35	_____	± 1.0
15.90 MHz	< – 35	_____	± 1.0
16.10 MHz	< – 35	_____	± 1.0
30.90 MHz	< – 35	_____	± 1.0
31.10 MHz	< – 35	_____	± 1.0
1.6069 GHz	< – 35	_____	± 1.0
1.6071 GHz	< – 35	_____	± 1.0
3.000 GHz	< – 35	_____	± 1.0

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HP 8753D Performance Test Record (7 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 4. Receiver Minimum R Channel Level for External Source Mode

CW Frequency (MHz)	Frac-N VCO Lower Limit (MHz)	Frac-N VCO Upper Limit (MHz)	Measured Value (MHz)	Measurement Uncertainty
10	49.496	50.496	_____	N/A
20	37.620	38.380	_____	N/A
100	49.005	49.995	_____	N/A
1000	36.630	37.370	_____	N/A
3000	58.216	59.392	_____	N/A

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Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 5. Receiver Channel Noise Floor Level

Frequency Range	IF Bandwidth	Specification (dBm)	Calculated Value	Measurement Uncertainty
Receiver Channel A				
300 kHz - 3.0 GHz	3 kHz	– 90	_____	N/A
300 kHz - 3.0 GHz	10 Hz	– 110	_____	N/A
Receiver Channel B				
300 kHz - 3.0 GHz	10 Hz	– 110	_____	N/A
300 kHz - 3.0 GHz	3 kHz	– 90	_____	N/A

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HP 8753D Performance Test Record (9 of 18)
For 300 kHz-3 GHz Analyzers

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▶▶ 7. Receiver Magnitude Frequency Response

CW Frequency	Power Meter Reading	R Input Power	A Input Power	B Input Power	Greatest Difference	Spec. (dB)	Meas. Uncer. (dB)
Example	– 10.0	– 10.14	– 10.09	– 10.10	0.14	± 1	± 0.05
300 kHz						± 1	± 0.14
5 MHz						± 1	± 0.10
16 MHz						± 1	± 0.10
31 MHz						± 1	± 0.10
61 MHz						± 1	± 0.10
121 MHz						± 1	± 0.10
180 MHz						± 1	± 0.10
310 MHz						± 1	± 0.10
700 MHz						± 1	± 0.10
1.5 GHz						± 1	± 0.10
2.0 GHz						± 1	± 0.10
2.5 GHz						± 1	± 0.11
3.0 GHz						± 1	± 0.11

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▶▶ 8. Phase Frequency Response

Frequency Range	Ratio	Specification	Measured Value	Measurement Uncertainty
300 kHz - 3 GHz	A/R	± 3°	_____	± 0.67°
300 kHz - 3 GHz	B/R	± 3°	_____	± 0.67°
300 kHz - 3 GHz	A/B	± 3°	_____	± 0.67°

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▶▶ 9. Receiver Input Crosstalk

Frequency Range	Specification (dB)	Marker Value	Measurement Uncertainty
R into A Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1 dB
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1 dB
R into B Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1 dB
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1 dB
B into A Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1 dB
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1 dB
A into B Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1 dB
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1 dB

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▶▶ 10. Receiver Trace Noise

CW Frequency (GHz)	Ratio	Measured Value	Specification (rms)	Measurement Uncertainty
3	A/R	_____	≤ 0.006 dB	± 0.001 dB
3	B/R	_____	≤ 0.006 dB	± 0.001 dB
3	A/B	_____	≤ 0.006 dB	± 0.001 dB
3	A/B	_____	≤ 0.038°	± 0.01°
3	B/R	_____	≤ 0.038°	± 0.0 °
3	A/R	_____	≤ 0.038°	± 0.01°

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HP 8753D Performance Test Record (13 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 11. Receiver Input Impedance

Frequency Range	B Return Loss (A/R)	A Return Loss (B/R)	R Return Loss (A/B)	Specification (dB)	Measurement Uncertainty (dB)
300 kHz - 2 MHz	_____	_____	_____	≥ 20	± 0.58
2 MHz - 1.3 GHz	_____	_____	_____	≥ 23	± 0.58
1.3 GHz - 3 GHz	_____	_____	_____	≥ 20	± 0.58

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HP 8753D Performance Test Record (14 of 18)
For 300 kHz—3 GHz Analyzers

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▶▶ 12. Receiver Magnitude Dynamic Accuracy

		G	F	|G – F|		
Test Port Input Power	8496A Attn. (dB)	Test Port Measurement (dBm)	Expected Measurement (dBm)	Dynamic Accuracy (Calculated)	Spec. (dB)	Meas. Uncer. (dB)
Channel B						
– 10	0	_____	_____	_____	≤ 0.075	± 0.008
– 20 (Ref)	10	Reference	Reference	Reference	Reference	Reference
– 30	20	_____	_____	_____	≤ 0.050	± 0.008
– 40	30	_____	_____	_____	≤ 0.050	± 0.008
– 50	40	_____	_____	_____	≤ 0.050	± 0.008
– 60	50	_____	_____	_____	≤ 0.058	± 0.017
– 70	60	_____	_____	_____	≤ 0.089	± 0.017
– 80	70	_____	_____	_____	≤ 0.240	± 0.017
– 90	80	_____	_____	_____	≤ 0.680	± 0.017
– 100	90	_____	_____	_____	≤ 1.950	± 0.027
Channel A						
– 10	0	_____	_____	_____	≤ 0.075	± 0.008
– 20 (Ref)	10	Reference	Reference	Reference	Reference	Reference
– 30	20	_____	_____	_____	≤ 0.050	± 0.008
– 40	30	_____	_____	_____	≤ 0.050	± 0.008
– 50	40	_____	_____	_____	≤ 0.050	± 0.008
– 60	50	_____	_____	_____	≤ 0.058	± 0.017
– 70	60	_____	_____	_____	≤ 0.089	± 0.017
– 80	70	_____	_____	_____	≤ 0.240	± 0.017
– 90	80	_____	_____	_____	≤ 0.680	± 0.017
– 100	90	_____	_____	_____	≤ 1.950	± 0.027

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HP 8753D Performance Test Record (15 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 13. Receiver Compression - Magnitude

CW Frequency	Start Power (dBm)	Stop Power (dBm)	Measured Value (dB)	Specification (dB)	Measurement Uncertainty
Channel A					
50 MHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
1 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
2 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
3 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
Channel B					
50 MHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
1 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
2 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
3 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
Channel R					
50 MHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
1 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
2 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB
3 GHz	_____	_____	_____	≤ 0.32 dB	± 0.1 dB

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Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 14. Receiver Compression - Phase

CW Frequency	Start Power (dBm)	Stop Power (dBm)	Measured Value (degrees)	Specification (degrees)	Measurement Uncertainty
Channel A					
50 MHz	_____	_____	_____	≤ 5.2	N/A
1 GHz	_____	_____	_____	≤ 5.2	N/A
2 GHz	_____	_____	_____	≤ 5.2	N/A
3 GHz	_____	_____	_____	≤ 5.2	N/A
Channel B					
50 MHz	_____	_____	_____	≤ 5.2	N/A
1 GHz	_____	_____	_____	≤ 5.2	N/A
2 GHz	_____	_____	_____	≤ 5.2	N/A
3 GHz	_____	_____	_____	≤ 5.2	N/A
Channel R					
50 MHz	_____	_____	_____	≤ 5.2	N/A
1 GHz	_____	_____	_____	≤ 5.2	N/A
2 GHz	_____	_____	_____	≤ 5.2	N/A
3 GHz	_____	_____	_____	≤ 5.2	N/A

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Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 15. Source and Receiver Harmonics

Stop Frequency (GHz)	Harmonic	Specification (dBc)	Measured Value	Measurement Uncertainty (dB)
Source Harmonics				
1.5	2nd	< – 25	_____	± 1
1.0	3rd	< – 25	_____	± 1
Source and Receiver Harmonics				
1.5	A: 2nd	< – 15	_____	± 1
1.0	A: 3rd	< – 30	_____	± 1
1.5	B: 2nd	< – 15	_____	± 1
1.0	B: 3rd	< – 30	_____	± 1
Receiver Harmonics				
1.5	B: 2nd	< – 15	_____	± 1
1.0	B: 3rd	< – 30	_____	± 1
1.5	A: 2nd	< – 15	_____	± 1
1.0	A: 3rd	< – 30	_____	± 1

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HP 8753D Performance Test Record (18 of 18)
For 300 kHz-3 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 Serial Number _____	Report Number _____ Date _____

▶▶ 16. Magnitude Frequency Response

Analyzer Frequency	Ext. Source Freq.	Power Meter Value	Input A Value	Input B Value	Max. Diff. Spec.	Spec. (dB)	Meas. Uncer. (dB)
16 MHz	32 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
16 MHz	48 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
31 MHz	62 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
31 MHz	93 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
61 MHz	122 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
61 MHz	183 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
121 MHz	242 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
121 MHz	363 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
180 MHz	360 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
180 MHz	540 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
310 MHz	620 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
310 MHz	930 MHz	_____	_____	_____	_____	± 1	± 0.17 dB
700 MHz	1.4 GHz	_____	_____	_____	_____	± 1	± 0.17 dB
700 MHz	2.1 GHz	_____	_____	_____	_____	± 1	± 0.17 dB
1 GHz	2 GHz	_____	_____	_____	_____	± 1	± 0.17 dB
1 GHz	3 GHz	_____	_____	_____	_____	± 1	± 0.17 dB
1.5 GHz	3 GHz	_____	_____	_____	_____	± 1	± 0.17 dB

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Contents

2b. Performance Test Record
For Analyzers with a Frequency Range of 30 kHz to 6 GHz 2b-1

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2b

Performance Test Record

For Analyzers with a Frequency Range of 30 kHz to 6 GHz

Note See the previous "Performance Test Record" section if your analyzer frequency range is from 300 kHz to 3 GHz.

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HP 8753D Performance Test Record (1 of 18)

Calibration Lab Address:

Report Number _____

Date _____

_____ Last Calibration Date _____

_____ Customer's Name _____

_____ Performed by _____

Model HP 8753D Option 011 and Option 006

Serial No. _____ Option(s) _____

Firmware Revision _____

Ambient Temperature _____°C Relative Humidity _____%

Test Equipment Used:

Description	Model Number	Trace Number	Cal Due Date
Frequency Counter			
Power Meter			
Power Sensor			
Calibration Kit			
Verification Kit			

Notes/Comments: _____

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HP 8753D Performance Test Record (2 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 1. Source Frequency Range and Accuracy

CW Frequency (MHz)	Lower Limit (MHz)	Measured Value (MHz)	Upper Limit (MHz)	Measurement Uncertainty (MHz)
0.3	0.299 997	_____	0.300 003	± 0.000 000 520
5.0	4.999 950	_____	5.000 050	± 0.000 008 610
16.0	15.999 840	_____	16.000 160	± 0.000 028 220
31.0	30.999 690	_____	31.000 310	± 0.000 053 730
60.999 999	60.999 390	_____	61.000 610	± 0.000 104 800
121.0	120.998 790	_____	121.001 210	± 0.000 206 800
180.0	179.998 200	_____	180.001 800	± 0.000 307 200
310.0	309.995 900	_____	310.003 100	± 0.000 528 300
700.0	699.930 000	_____	700.007 000	± 0.001 191 700
1 300.0	1 299.987	_____	1 300.013	± 0.002 212 300
2 000.0	1 999.980	_____	2 000.020	± 0.003 403 000
3 000.0	2 999.970	_____	3 000.030	± 0.005 104 000
4 000.0	3 999.960	_____	4 000.040	± 0.006 805 000
5 000.0	4 999.950	_____	5 000.050	± 0.008 506 000
6 000.0	5 999.940	_____	6 000.060	± 0.010 207 000

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HP 8753D Performance Test Record (3 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 2. Source Power Range, Linearity, and Accuracy:
– Path Loss Calculations Worksheet –

CW Frequency	Source Output Power Level (dBm)	First Value (dB)	Second Value (dB)	Path Loss (dB)
300 kHz	+10			
20 MHz	+10			
50 MHz	+10			
100 MHz	+10			
200 MHz	+10			
500 MHz	+10			
1 GHz	+10			
2 GHz	+10			
3 GHz	+10			
4 GHz	+10			
5 GHz	+10			
6 GHz	+10			

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Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 2. Source Power Range, Linearity, and Accuracy:
– Power Range and Power Linearity –

Source Power Level (dBm)	Power Offset (dB)	Path Loss (dB)	Measured Value (dB)	Power Linearity (dB)	Spec. (dB)	Meas. Uncer. (dB)
CW Frequency = 300kHz						
– 5	+15				± 0.25	± 0.02
– 3	+13				± 0.25	± 0.02
– 1	+11				± 0.25	± 0.02
+1	+9				± 0.25	± 0.02
+3	+7				± 0.25	± 0.02
+5	+5				± 0.25	± 0.02
+7	+3				± 0.25	± 0.0
+9	+1				± 0.25	± 0.0
+11	– 1				± 0.25	± 0.0
+13	– 3				± 0.25	± 0.0
+15	– 5				± 0.5	± 0.0
+18	– 8				± 0.5	± 0.17
CW Frequency = 3 GHz						
– 5	+15				± 0.25	± 0.02
– 3	+13				± 0.25	± 0.02
– 1	+11				± 0.25	± 0.02
+1	+9				± 0.25	± 0.02
+3	+7				± 0.25	± 0.02
+5	+5				± 0.25	± 0.02

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Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 2. Source Power Range, Linearity, and Accuracy:
– Power Range and Power Linearity –

Source Power Level (dBm)	Power Offset (dB)	Path Loss (dB)	Measured Value (dB)	Power Linearity (dB)	Spec. (dB)	Meas. Uncer. (dB)
+7	+3	_____	_____	_____	± 0.25	± 0.0
+9	+1	_____	_____	_____	± 0.25	± 0.0
+11	– 1	_____	_____	_____	± 0.25	± 0.0
+13	– 3	_____	_____	_____	± 0.25	± 0.0
+15	– 5	_____	_____	_____	± 0.5	± 0.0
+18	– 8	_____	_____	_____	± 0.5	± 0.17
CW Frequency = 6 GHz						
– 5	+15	_____	_____	_____	± 0.25	± 0.02
– 3	+13	_____	_____	_____	± 0.25	± 0.02
– 1	+11	_____	_____	_____	± 0.25	± 0.02
+1	+9	_____	_____	_____	± 0.25	± 0.02
+3	+7	_____	_____	_____	± 0.25	± 0.02
+5	+5	_____	_____	_____	± 0.25	± 0.02
+7	+3	_____	_____	_____	± 0.25	± 0.0
+9	+1	_____	_____	_____	± 0.25	± 0.0
+11	– 1	_____	_____	_____	± 0.25	± 0.0
+13	– 3	_____	_____	_____	± 0.5	± 0.0
+15	– 5	_____	_____	_____	± 0.5	± 0.0
+18	– 8	_____	_____	_____	± 0.5	± 0.17

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Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 2. Source Power Range, Linearity, and Accuracy:
– Power Level Accuracy –

CW Frequency (MHz)	Path Loss (dB)	Calibrated Power Level (dB)	Measured Value (dB)	Power Level Accuracy (dB)	Spec. (dB)	Meas. Uncer. (dB)
Source Output Power Level = +10dBm						
0.300	_____	_____	_____	_____	± 1.0	± 0.33
20.000	_____	_____	_____	_____	± 1.0	± 0.10
50.000	_____	_____	_____	_____	± 1.0	± 0.10
100.000	_____	_____	_____	_____	± 1.0	± 0.11
200.000	_____	_____	_____	_____	± 1.0	± 0.11
500.000	_____	_____	_____	_____	± 1.0	± 0.11
1 000.000	_____	_____	_____	_____	± 1.0	± 0.11
2 000.000	_____	_____	_____	_____	± 1.0	± 0.20
3 000.000	_____	_____	_____	_____	± 1.0	± 0.20
4 000.000	_____	_____	_____	_____	± 1.0	± 0.17
5 000.000	_____	_____	_____	_____	± 1.0	± 0.17
6 000.000	_____	_____	_____	_____	± 1.0	± 0.17

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HP 8753D Performance Test Record (6 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▸▸ 3. Receiver Minimum R Channel Level

CW Frequency	Specification (dB)	Marker Value (dB)	Measurement Uncertainty (dB)
300 kHz	< – 35	_____	± 1.0
3.29 MHz	< – 35	_____	± 1.0
3.31 MHz	< – 35	_____	± 1.0
15.90 MHz	< – 35	_____	± 1.0
16.10 MHz	< – 35	_____	± 1.0
30.90 MHz	< – 35	_____	± 1.0
31.10 MHz	< – 35	_____	± 1.0
1.6069 GHz	< – 35	_____	± 1.0
1.6071 GHz	< – 35	_____	± 1.0
3.000 GHz	< – 35	_____	± 2.0
4.000 GHz	< – 30	_____	± 2.0
5.000 GHz	< – 30	_____	± 2.0
6.000 GHz	< – 30	_____	± 2.0

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Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▸▸ 4. Receiver Minimum R Channel Level for External Source Mode

CW Frequency (MHz)	Frac-N VCO Lower Limit (MHz)	Frac-N VCO Upper Limit (MHz)	Measured Value (MHz)	Measurement Uncertainty
10	49.496	50.496	_____	N/A
20	37.620	38.380	_____	N/A
100	49.005	49.995	_____	N/A
1 000	36.630	37.370	_____	N/A
3 000	58.216	59.392	_____	N/A
4 000	48.181	48.663	_____	N/A
5 000	43.470	43.905	_____	N/A
6 000	52.165	52.687	_____	N/A

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HP 8753D Performance Test Record (8 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 6. Receiver Channel Noise Floor Level

Frequency Range	IF Bandwidth	Specification (dBm)	Calculated Value	Measurement Uncertainty
Receiver Channel A				
300 kHz - 3.0 GHz	3 kHz	– 90	_____	N/A
300 kHz - 3.0 GHz	10 Hz	– 110	_____	N/A
Receiver Channel B				
300 kHz - 3.0 GHz	10 Hz	– 110	_____	N/A
300 kHz - 3.0 GHz	3 kHz	– 90	_____	N/A
Receiver Channel B				
3.0 GHz - 6.0 GHz	3 kHz	– 85	_____	N/A
3.0 GHz - 6.0 GHz	10 Hz	– 105	_____	N/A
Receiver Channel A				
3.0 GHz - 6.0 GHz	10 Hz	– 105	_____	N/A
3.0 GHz - 6.0 GHz	3 kHz	– 85	_____	N/A

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Hewlett-Packard Company
Model HP 8753D Option 011 and Option 006

Report Number _____

Serial Number _____

Date _____

▶▶ 7. Receiver Magnitude Frequency Response

CW Frequency	Power Meter Reading	R Input Power	A Input Power	B Input Power	Greatest Difference	Spec. (dB)	Meas. Uncer. (dB)
Example	– 10.0	– 10.14	– 10.09	– 10.10	0.14	± 1	± 0.05
300 kHz						± 1	± 0.14
5 MHz						± 1	± 0.10
16 MHz						± 1	± 0.10
31 MHz						± 1	± 0.10
61 MHz						± 1	± 0.10
121 MHz						± 1	± 0.10
180 MHz						± 1	± 0.10
310 MHz						± 1	± 0.10
700 MHz						± 1	± 0.10
1.5 GHz						± 1	± 0.10
2.0 GHz						± 1	± 0.10
2.5 GHz						± 1	± 0.11
3.0 GHz						± 1	± 0.11
3.5 GHz						± 2	± 0.11
4.0 GHz						± 2	± 0.11
4.5 GHz						± 2	± 0.14
5.0 GHz						± 2	± 0.14
5.5 GHz						± 2	± 0. 14
6.0 GHz						± 2	± 0. 14

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HP 8753D Performance Test Record (10 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 8. Phase Frequency Response

Frequency Range	Ratio	Specification	Measured Value	Measurement Uncertainty
300 kHz - 3 GHz	A/R	± 3°	_____	± 0.67°
300 kHz - 3 GHz	B/R	± 3°	_____	± 0.67°
300 kHz - 3 GHz	A/B	± 3°	_____	± 0.67°
3 GHz - 6 GHz	A/B	± 10°	_____	± 0.67°
3 GHz - 6 GHz	A/R	± 10°	_____	± 0.67°
3 GHz - 6 GHz	B/R	± 10°	_____	± 0.67°

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Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 9. Receiver Input Crosstalk

Frequency Range	Specification (dB)	Marker Value	Measurement Uncertainty
R into A Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1
3.0 GHz - 4.5 GHz	– 82	_____	± 5.4
4.5 GHz - 6.0 GHz	– 75	_____	± 5.4
R into B Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1
3.0 GHz - 4.5 GHz	– 82	_____	± 5.4
4.5 GHz - 6.0 GHz	– 75	_____	± 5.4
B into A Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1
3.0 GHz - 4.5 GHz	– 82	_____	± 5.4
4.5 GHz - 6.0 GHz	– 75	_____	± 5.4
A into B Crosstalk			
300 kHz - 1.0 GHz	– 100	_____	± 5.1
1.0 GHz - 3.0 GHz	– 90	_____	± 5.1
3.0 GHz - 4.5 GHz	– 82	_____	± 5.4
4.5 GHz - 6.0 GHz	– 75	_____	± 5.4

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HP 8753D Performance Test Record (12 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 10. Receiver Trace Noise

CW Frequency (GHz)	Ratio	Measured Value	Specification (rms)	Measurement Uncertainty
6	A/R	_____	≤ 0.010 dB	± 0.001 DB
6	B/R	_____	≤ 0.010 dB	± 0.001 DB
6	A/B	_____	≤ 0.010 dB	± 0.001 DB
6	A/B	_____	≤ 0.070°	± 0.01°
6	B/R	_____	≤ 0.070°	± 0.01°
6	A/R	_____	≤ 0.070°	± 0.01°

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HP 8753D Performance Test Record (13 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 11. Receiver Input Impedance

Frequency Range	B Return Loss (A/R)	A Return Loss (B/R)	R Return Loss (A/B)	Specification (dB)	Measurement Uncertainty (dB)
300 kHz - 2 MHz	_____	_____	_____	≥ 20	± 0.58
2 MHz - 1.3 GHz	_____	_____	_____	≥ 23	± 0.58
1.3 GHz - 3 GHz	_____	_____	_____	≥ 20	± 0.58

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HP 8753D Performance Test Record (14 of 18)
For 30 kHz—6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 12. Receiver Magnitude Dynamic Accuracy

		G	F	|G – F|		
Test Port Input Power	8496A Attn. (dB)	Test Port Measurement (dBm)	Expected Measurement (dBm)	Dynamic Accuracy (Calculated)	Spec. (dB)	Meas. Uncer. (dB)
Channel B						
– 10	0	_____	_____	_____	≤ 0.075	± 0.008
– 20 (Ref)	10	Reference	Reference	Reference	Reference	Reference
– 30	20	_____	_____	_____	≤ 0.050	± 0.008
– 40	30	_____	_____	_____	≤ 0.050	± 0.008
– 50	40	_____	_____	_____	≤ 0.050	± 0.008
– 60	50	_____	_____	_____	≤ 0.058	± 0.017
– 70	60	_____	_____	_____	≤ 0.089	± 0.017
– 80	70	_____	_____	_____	≤ 0.240	± 0.017
– 90	80	_____	_____	_____	≤ 0.680	± 0.017
– 100	90	_____	_____	_____	≤ 1.950	± 0.027
Channel A						
– 10	0	_____	_____	_____	≤ 0.075	± 0.008
– 20 (Ref)	10	Reference	Reference	Reference	Reference	Reference
– 30	20	_____	_____	_____	≤ 0.050	± 0.008
– 40	30	_____	_____	_____	≤ 0.050	± 0.008
– 50	40	_____	_____	_____	≤ 0.050	± 0.008
– 60	50	_____	_____	_____	≤ 0.058	± 0.017
– 70	60	_____	_____	_____	≤ 0.089	± 0.017
– 80	70	_____	_____	_____	≤ 0.240	± 0.017
– 90	80	_____	_____	_____	≤ 0.680	± 0.017
– 100	90	_____	_____	_____	≤ 1.950	± 0.027

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Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 13. Receiver Compression - Magnitude

CW Frequency	Start Power (dBm)	Stop Power (dBm)	Measured Value (dB)	Specification (dB)	Measurement Uncertainty
Channel A					
50 MHz	_____	_____	_____	≤ 0.32	± 0.1 DB
1 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
2 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
3 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
4 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
5 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
6 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
Channel B					
50 MHz	_____	_____	_____	≤ 0.32	± 0.1 DB
1 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
2 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
3 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
4 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
5 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
6 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
Channel R					
50 MHz	_____	_____	_____	≤ 0.32	± 0.1 DB
1 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
2 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
3 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
4 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
5 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB
6 GHz	_____	_____	_____	≤ 0.32	± 0.1 DB

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HP 8753D Performance Test Record (16 of 18)
For 30 kHz-6 GHz Analyzers

Hewlett-Packard Company Model HP 8753D Option 011 and Option 006 Serial Number _____	Report Number _____ Date _____

▶▶ 14. Receiver Compression - Phase

CW Frequency	Start Power (dBm)	Stop Power (dBm)	Measured Value (degrees)	Specification (degrees)	Measurement Uncertainty
Channel A					
50 MHz	_____	_____	_____	≤ 5.2	N/A
1 GHz	_____	_____	_____	≤ 5.2	N/A
2 GHz	_____	_____	_____	≤ 5.2	N/A
3 GHz	_____	_____	_____	≤ 5.2	N/A
4 GHz	_____	_____	_____	≤ 5.2	N/A
5 GHz	_____	_____	_____	≤ 5.2	N/A
6 GHz	_____	_____	_____	≤ 5.2	N/A
Channel B					
50 MHz	_____	_____	_____	≤ 5.2	N/A
1 GHz	_____	_____	_____	≤ 5.2	N/A
2 GHz	_____	_____	_____	≤ 5.2	N/A
3 GHz	_____	_____	_____	≤ 5.2	N/A
4 GHz	_____	_____	_____	≤ 5.2	N/A
5 GHz	_____	_____	_____	≤ 5.2	N/A
6 GHz	_____	_____	_____	≤ 5.2	N/A
Channel R					
50 MHz	_____	_____	_____	≤ 5.2	N/A
1 GHz	_____	_____	_____	≤ 5.2	N/A
2 GHz	_____	_____	_____	≤ 5.2	N/A
3 GHz	_____	_____	_____	≤ 5.2	N/A
4 GHz	_____	_____	_____	≤ 5.2	N/A
5 GHz	_____	_____	_____	≤ 5.2	N/A
6 GHz	_____	_____	_____	≤ 5.2	N/A

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▶▶ **15. Source and Receiver Harmonics**

Stop Frequency (GHz)	Harmonic	Specification (dBc)	Measured Value	Measurement Uncertainty (dB)
Source Harmonics				
3	2nd	< – 25	_____	± 1
2	3rd	< – 25	_____	± 1
Source and Receiver Harmonics				
3	A: 2nd	< – 15	_____	± 1
2	A: 3rd	< – 30	_____	± 1
3	B: 2nd	< – 15	_____	± 1
2	B: 3rd	< – 30	_____	± 1
Receiver Harmonics				
3	B: 2nd	< – 15	_____	± 1
2	B: 3rd	< – 30	_____	± 1
3	A: 2nd	< – 15	_____	± 1
2	A: 3rd	< – 30	_____	± 1

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Hewlett-Packard Company
Model HP 8753D Option 011 and Option 006

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Date _____

▶▶ 16. Magnitude Frequency Response

Analyzer Frequency	Ext. Source Freq.	Power Meter Value	Input A Value	Input B Value	Max. Diff. Spec.	Spec. (dB)	Meas. Uncer. (dB)
16 MHz	32 MHz					± 1	± 0.07
16 MHz	48 MHz					± 1	± 0.07
31 MHz	62 MHz					± 1	± 0.07
31 MHz	93 MHz					± 1	± 0.07
61 MHz	122 MHz					± 1	± 0.07
61 MHz	183 MHz					± 1	± 0.07
121 MHz	242 MHz					± 1	± 0.07
121 MHz	363 MHz					± 1	± 0.07
180 MHz	360 MHz					± 1	± 0.07
180 MHz	540 MHz					± 1	± 0.07
310 MHz	620 MHz					± 1	± 0.07
310 MHz	930 MHz					± 1	± 0.07
700 MHz	1.4 GHz					± 1	± 0.07
700 MHz	2.1 GHz					± 1	± 0.07
1 GHz	2 GHz					± 1	± 0.07
1 GHz	3 GHz					± 1	± 0.07
1.5 GHz	3 GHz					± 1	± 0.07
2 GHz	4 GHz					± 2	± 0.07
2 GHz	6 GHz					± 2	± 0.22
3 GHz	6 GHz					± 2	± 0.22

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3

Adjustments and Correction Constants

This chapter has the following adjustment procedures:

- A9 CC Jumper Positions
- Source Default Correction Constants (Test 44)
- Source Pretune Default Correction Constants (Test 45)
- Analog Bus Correction Constants (Test 46)
- RF Output Power Correction Constants (Test 47)
- Source Pretune Correction Constants (Test 48)
- Display Intensity Correction Constants (Test 49)
- IF Amplifier Correction Constants (Test 51)
- ADC Offset Correction Constants (Test 52)
- Sampler Magnitude and Phase Correction Constants (Test 53)
- Cavity Oscillator Frequency Correction Constants (Test 54)
- Serial Number Correction Constants (Test 55)
- Option Numbers Correction Constants (Test 56)
- Calibration Kit Default Correction Constants (Test 57)
- Initialize EEPROMs (Test 58)
- EEPROM Backup
- Vertical Position and Focus Adjustments
- Display Degaussing (Demagnetizing)
- Fractional-N Frequency Range Adjustment
- Frequency Accuracy Adjustment
- High/Low Band Transition Adjustment
- Fractional-N Spur Avoidance and FM Sideband Adjustment
- Source Spur Avoidance Tracking Adjustment
- Unprotected Hardware Option Numbers Correction Constants

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Post-Repair Procedures for HP 8753D Option 011

Table 3-1 lists the additional service procedures which you must perform to ensure that the instrument is working correctly, following the replacement of an assembly.

Perform the procedures in the order that they are listed in the table.

Table 3-1. Related Service Procedures

Replaced Assembly	Adjustments Correction Constants (CC)	Verification
A1 Front Panel Keyboard	None	Internal Test 0 Internal Test 23
A2 Front Panel Interface	None	Internal Test 0 Internal Test 23
A3 Source	A9 CC Jumper Positions Source Def CC (Test 44) Analog Bus CC (Test 46) Source Pretune CC (Test 48) RF Output Power CC (Test 47) Cavity Oscillator Frequency CC (Test 54) Source Spur Avoidance Tracking EEPROM Backup Disk	Output Power Spectral Purity (harmonics and mixer spurs) or System Verification
A4/A5/A6 Samplers	A9CC Jumper Positions Sampler Magnitude and Phase CC (Test 53) IF Amplifier CC (Test 51) EEPROM Backup Disk	Minimum R Level (if R sampler replaced) Input Crosstalk Absolute Amplitude Accuracy Frequency Response Input Impedance (replace assembly only) or System Verification
A7 Pulse Generator	A9CC Jumper Positions Sampler Magnitude and Phase CC (Test 53) EEPROM Backup Disk	Frequency Response Frequency Range and Accuracy Spectral Purity (phase noise) or System Verification
A8 Post Regulator	A9CC Jumper Positions Cavity Oscillator Frequency CC (Test 54) Source Spur Avoidance Tracking EEPROM Backup Disk	Internal Test 0 Check A8 test point voltages

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Table 3-1 Related Service Procedures (2 of 3)

Replaced Assembly	Adjustments Correction Constants (CC)	Verification
A9 CPU[1]	A9CC Jumper Positions Serial Number CC (Test 55) Option Number CC (Test 56) Display Intensity and Focus CC (Test 49) Source Def CC (Test 44) Pretune Default CC (Test 45) Analog Bus CC (Test 46) Cal Kit Default (Test 57) Source Pretune CC (Test 48) RF Output Power CC (Test 47) Sampler Magnitude and Phase CC (Test 53) ADC Linearity CC (Test 52) IF Amplifier CC (Test 51) Cavity Oscillator Frequency CC (Test 54) EEPROM Backup Disk	Output Power Absolute Amplitude Accuracy Frequency Response Dynamic Accuracy or System Verification
Firmware Rev 5.20 08753-60185	A9CC Jumper Positions Source Default CC 9 (Test 44) Pretune Default CC (Test 45) Analog Bus CC (Test 46) RF Output Power CC (Test 47) Source Pretune CC (Test 48) Sampler Magnitude and Phase CC (Test 47) EEPROM Backup Disk	Internal Test 0
A10 Digital IF	A9CC Jumper Positions Analog Bus CC (Test 46) Sampler Magnitude and Phase CC (Test 53) ADC Linearity CC (Test 52) IF Amplifier CC (Test 51) EEPROM Backup Disk	Receiver Noise Level Trace Noise Input Crosstalk Absolute Amplitude Accuracy or System Verification
A11 Phase Lock	A9CC Jumper Positions Analog Bus CC (Test 46) Source Pretune CC (Test 48) EEPROM Backup Disk	Minimum R Level Frequency Accuracy

1 If you have an EEPROM backup disk available, you only need to perform the first three tests listed.

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Table 3-1 Related Service Procedures (3 of 3)

Replaced Assembly	Adjustments Correction Constants (CC)	Verification
A12 Reference	A9CC Jumper Positions High/Low Band Transition Frequency Accuracy EEPROM Backup Disk	Frequency Range and Accuracy or System Verification
A13 Fractional-N (Analog)	A9CC Jumper Positions Fractional-N Spur and FM Sideband EEPROM Backup Disk	Spectral Purity (other spurious signals) Frequency Range and Accuracy
A14 Fractional-N (Digital)	A9CC Jumper Positions Fractional-N Frequency Range EEPROM Backup Disk	Frequency Range and Accuracy or System Verification
A15 Preregulator	None	Self-Test
A16 Rear Panel Interface	None	Internal Test 13, Rear Panel
A17 Motherboard	None	Self-Test
A18 Display	Vertical Position and Focus (only if needed)	Observation of Display Tests 66 - 80
A19 Graphics System Processor	None	Observation of Display Tests 59 - 80

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A9 CC Jumper Positions

1. Remove the power line cord from the analyzer.
2. Set the analyzer on its side.
3. Remove the two lower-rear corner bumpers from the bottom of the instrument with the T-10 TORX screwdriver.
4. Loosen the captive screw on the bottom cover's back edge, using a T-15 TORX screwdriver.
5. Slide the cover toward the rear of the instrument.
6. Move the jumper, as shown in Figure 3-1:
   - Move the A9 CC jumper to the ALT position, before you run any of the correction constant adjustment routines. This is the position for altering the analyzer's correction constants.
   - Move the A9 CC jumper to the NRM position, after you have run correction constant adjustment routines. This is the position for normal operating conditions.
7. Reconnect the power line cord and switch on the instrument.

Figure JUMP3 here.

Figure 3-1. Partial Component Location Diagram

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Source Default Correction Constants (Test 44)

Analyzer warm-up time: **30 minutes.**

This internal adjustment routine writes default correction constants for the source power accuracy.

1. Press [PRESET] [SYSTEM] SERVICE MENU TESTS [44] [x1] EXECUTE TEST YES.
2. Observe the analyzer for the results of the adjustment routine:
   - If the analyzer displays `*Source Def  DONE`, you have completed this procedure.
   - If the analyzer displays `*Source Def  FAIL`, refer to "Source Troubleshooting."

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Source Pretune Default Correction Constants (Test 45)

Analyzer warm-up time: **30 minutes.**

This adjustment writes default correction constants for rudimentary phase lock pretuning accuracy.

1. Press [PRESET] [SYSTEM] `SERVICE MENU` `TESTS` [45] [x1] `EXECUTE TEST` `YES`.
2. Observe the analyzer for the results of this adjustment routine:
   - If the analyzer displays `*Pretune Def DONE`, you have completed this procedure.
   - If the analyzer displays `FAIL`, refer to the "Source Troubleshooting" chapter.

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Analog Bus Correction Constant (Test 46)

Analyzer warm-up time: **30 minutes.**

This procedure calibrates the analog bus by using three reference voltages: ground, +0.37 V and +2.5 V. The calibration data is stored as correction constants in EEPROMs.

1. Press (PRESET) (SYSTEM) `SERVICE MENU` `TESTS` (46) (x1) `EXECUTE TEST` `YES`.
2. Observe the analyzer for the results of the adjustment routine:
   - If the analyzer displays `ABUS Cor DONE`, you have completed this procedure.
   - If the analyzer displays `ABUS Cor FAIL`, refer to the "Digital Control Troubleshooting" chapter.

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RF Output Power Correction Constants (Test 47)

Required Equipment and Tools

Power meter	HP 437B or HP 438A
Power sensor	HP 8482A
Power sensor (for Option 006 analyzers)	HP 8481A
Power splitter (2)	HP 11667A Option 001
Attenuator 20 dB	HP 8491A Option 020
HP-IB cable	HP 10833A
RF cable 24-inch	HP 11500B
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up Time: **30 minutes.**

This procedure adjusts several correction constants that can improve the output power level accuracy of the internal source. They are related to the power level, power slope, power slope offset, and the ALC roll-off factors among others.

1. If you just completed "Sampler Magnitude and Phase Correction Constants (Test 53)," continue this procedure with step 8.
2. Press (PRESET) (LOCAL) `SYSTEM CONTROLLER`.
3. Press (LOCAL) `SET ADDRESSES` `ADDRESS: P MTR/HPIB`. The default power meter address is 13. Refer to the power meter manual as required to observe or change its HP-IB address.
4. Press `POWER MTR:438A/437` to toggle between the 438A/437 and 436A power meters. Choose the appropriate model number.

Note If you are using the HP 438A power meter, connect the HP 8482A power sensor to channel A, and the HP 8481A power sensor to channel B.

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Power Sensor Calibration Factor Entry

5. Zero and calibrate the power meter and sensor.
6. Press (SYSTEM) SERVICE MENU TEST OPTIONS LOSS/SENSR LISTS CAL FACTOR SENSOR A to access the calibration factor menu for power sensor A (HP 8482A).
7. Build a table of up to 12 points (12 frequencies with their calibration factors). To enter each point, follow these steps:
   a. Press ADD FREQUENCY.
   b. Input a frequency value and then press the appropriate key: ((G/n), (M/μ), or (k/m)).
   c. Press CAL FACTOR and enter the calibration factor percentage that corresponds to the frequency you entered.

      The cal factor and frequency values are found on the back of the sensor. If you make a mistake, press (←) and re-enter the correct value.
   d. Press DONE to complete the data entry for each point.

Note

The following terms are part of the sensor calibration menu:

SEGMENT	Allows you to select a frequency point.
EDIT	Allows you to edit or change a previously entered value.
DELETE	Allows you to delete a point from the sensor cal factor table.
ADD	Allows you to add a point into the sensor cal factor table.
CLEAR LIST	Allows you to erase the entire sensor cal factor table.
DONE	Allows you to complete the points entry of the sensor cal factor table.

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8. **For Option 006 Instruments Only:** Press CAL FACTOR SENSOR B to create a power sensor calibration table for power sensor B (HP 8481A), using the softkeys mentioned above. Since sensor B is only used for 3 GHz to 6 GHz measurements, you only need to input calibration factors for this frequency range.
9. Preset, zero, and calibrate the power meter and the HP 8482A power sensor.
10. Connect the equipment as shown in Figure 3-2.

Figure SETUPA here.

Figure 3-2. Setup A for the HP 8753D Option 011 RF Output Correction Constants

11. Press MENU CW FREQ 300 k/m.

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12. Record the power meter reading in the first column of Table 3-2.

Table 3-2. Power Meter Readings

Setup A Reading (First Reading)	Setup B Reading (Second Reading)	Power Loss of #2 (Enter in Analyzer)
300 kHz:_____dB	minus_____dB	equals_____dB
50 MHz:_____dB	minus_____dB	equals_____dB
1.5 GHz:_____dB	minus_____dB	equals_____dB
3 GHz:_____dB	minus_____dB	equals_____dB
6 GHz[1]:_____dB	minus_____dB	equals_____dB

1 For Option 006 instruments only.

13. Repeat the previous two steps at 50 MHz, 1.5 GHz, and 3 GHz.
14. **For Option 006 Instruments Only:** Make a measurement at 6 GHz by disconnecting the HP 8482A (sensor A) from the power splitter, and replacing it with the HP 8481A (sensor B).
    - If you are using the HP 438A power meter, the HP 8481A should be connected to the meter's channel B input.
    - If you are using the HP 437B power meter, zero and calibrate the HP 8481A sensor.
15. Reconfigure the equipment as shown in Figure 3-3.
16. **For Option 006 Instruments Only:** Use the HP 8482A (sensor A) in the equipment configuration.
    - If you are using the HP 438A power meter, the HP 8482A should be connected to the meter's channel A input.
    - If you are using the HP 437B power meter, zero and calibrate the HP 8482A sensor.

Figure SETUPB here.

Figure 3-3. Setup B for the HP 8753D Option 011 RF Output Correction Constants

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17. Repeat the measurements at the same frequencies (300 kHz, 50 MHz, 1.5 GHz, 3 GHz) and record the power meter readings in the second column in Table 3-2.
18. **For Option 006 Instruments Only:** Make a measurement at 6 GHz by disconnecting the HP 8482A (sensor A) from the power splitter, and replacing it with the HP 8481A (sensor B).
    - If you are using the HP 438A power meter, the HP 8481A should be connected to the meter's channel B input.
    - If you are using the HP 437B power meter, zero and calibrate the HP 8481A sensor.
19. Subtract the value of each frequency in the second column from the value in the first column, and enter the difference in the third column.
20. Press [SYSTEM] SERVICE MENU TEST OPTIONS LOSS/SENSR LISTS POWER LOSS and enter the power loss data in the same way you entered the calibration factors.

Source Correction Routine

21. Press [PRESET] [SYSTEM] SERVICE MENU TESTS [47] [x1] EXECUTE TEST YES.
22. Connect the equipment as shown in Figure 3-4, using splitter #2 and the power sensor requested by the prompt.

Figure SETUPC here.

Figure 3-4. Setup C for the HP 8753D Option 011 RF Output Correction Constants

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23. Press CONTINUE.

24. Observe the analyzer display for the results of the adjustment routine:

    - If the analyzer shows SOURCE Cor DONE, press (PRESET) and you have completed this procedure.
    - If the analyzer fails this routine, refer to "Source Troubleshooting."

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Source Pretune Correction Constants (Test 48)

Analyzer warm-up time: **30 minutes.**

This procedure generates pretune values for correct phase-locked loop operation.

1. Press [PRESET] [SYSTEM] `SERVICE MENU` `TESTS` [48] [x1] `EXECUTE TEST` `YES`.
2. Observe the analyzer for the results of this adjustment routine:
   - If the analyzer displays `Pretune Cor DONE`, you have completed this procedure.
   - If the analyzer displays `FAIL`, refer to "Source Troubleshooting."

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Display Intensity Correction Constants (Test 49)

Required Equipment and Tools

Photometer	Tektronix J16 photometer
Probe	Tektronix J6503
Light occluder	Tektronix 016-0305-00
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up time: **30 minutes.**
Photometer warm-up time: **30 minutes.**

There are three display intensity adjustments:

- background
- maximum
- operating default

If either the A19 GSP, A9 CPU or A18 display assemblies are replaced, perform a visual inspection of the display. If it appears to need an adjustment, then proceed with the following procedures:

Note This procedure should be performed with a photometer and only by qualified personnel.

1. Set the photometer probe to NORMAL. Press [POWER] on the photometer to switch it on to allow 30 minutes of warm-up time.

Background Adjustment

2. In a dimly lit room (or with the analyzer display shaded from bright lights), press [PRESET] [SYSTEM] SERVICE MENU TESTS [49] [x1].
3. The display should show `Intensity Cor - ND -`.

Note The display could be so far out of adjustment that the annotation would be very difficult to read.

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4. Press `EXECUTE TEST` and `YES` at the prompt to alter the correction constants. Alternating vertical bars of three different intensities will be drawn on the display. Each bar has a number written below it: 0, 1, or 2.
5. Adjust the analyzer front panel knob until the vertical bar labeled "1" is just barely visible against the black border. Vertical bar "0" must not be visible.

Maximum Intensity Adjustment

This adjustment ensures that the light output at the 100% intensity level is equal to, or less than 150 Nits. The level is set using a photometer to measure the output light.

Caution If you operate the display at intensities higher than 150 Nits, you may reduce the life of the display.

---

6. Press the top softkey. The analyzer display should have an all white screen.
7. Zero the photometer according to the manufacturer's instructions.
8. Center the photometer on the analyzer display as shown in Figure 3-5.

Figure INTENSE here.

Figure 3-5. Maximum Intensity Adjustment Setup

Note The intensity levels are read with a display bezel installed. The glass filter transmits 60% of the display light, therefore 90 Nits would be 150 Nits without the bezel installed.

---

9. Adjust the analyzer front panel knob to the maximum (clockwise) position.
   - If the photometer registers greater than 90 Nits (or 150 Nits without the bezel), turn the front panel knob until a reading of no more than 90 Nits, registers on the photometer.

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- If the photometer registers a reading of less than 90 Nits (or 150 Nits without the bezel), and greater than 60 Nits (or 100 without the bezel), proceed to "Operating Default Intensity Adjustment."
- If the photometer registers a reading of less than 60 Nits (or 100 Nits without the bezel), the display is faulty.

Operating Default Intensity Adjustment

This adjustment sets the preset default level of the display intensity. If you switch the power off and on, the analyzer uses this default level to ensure that the display is visible and eliminates concern that the display may not be functioning.

10. Press the top softkey on the analyzer to bring up the next display adjustment mode.
11. Center the photometer on the analyzer display as shown in Figure 3-5.
12. Adjust the analyzer front panel knob until the photometer registers 60 Nits (or 100 Nits without bezel installed).
13. Press the top softkey on the analyzer and observe the display:
    - If `DONE` is displayed on the analyzer, the adjustment is done. This completes the series of three Display Intensity Adjustment Procedures.
    - If `FAIL` is displayed on the analyzer, repeat the three "Display Intensity Correction Constants (Test 49)." If the analyzer still fails the adjustment routine, refer to the "Start Troubleshooting Here" chapter to isolate the problem.

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IF Amplifier Correction Constants (Test 51)

Required Equipment and Tools

Power splitter	HP 11667A Option 001
RF cable (2)	HP 11500B
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up Time: **30 minutes.**

This adjustment routine measures the gain of the IF amplifiers (A and B only) located on the A10 digital IF, to determine the correction constants for absolute amplitude accuracy.

1. Connect the equipment as shown in Figure 3-6, using the analyzer's A input.

Figure IFAMP here.

Figure 3-6. Setup for IF Amplifier Correction Constants

2. Press [PRESET] [SYSTEM] SERVICE MENU TESTS [51] [x1] EXECUTE TEST YES CONTINUE.
3. Connect the equipment as shown in Figure 3-6, using the analyzer's B input.

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4. Press `CONTINUE` and observe the analyzer for the results of the adjustment routine:

   - If `DONE` is displayed, you have completed this procedure.
   - If `FAIL` is displayed, check that the RF cables are connected from the power splitter to R input and A (or B) input. Then repeat this adjustment routine.
   - If the analyzer continues to fail the adjustment routine, refer to the "Digital Control Troubleshooting" chapter.

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ADC Offset Correction Constants (Test 52)

Analyzer warm-up time: **30 minutes.**

These correction constants improve the dynamic accuracy by shifting small signals to the most linear part of the ADC quantizing curve.

1. Press (PRESET) (SYSTEM) SERVICE MENU TESTS (52) (x1) EXECUTE TEST YES.

Note This routine takes about three minutes.

2. Observe the analyzer for the results of the adjustment routine:
   - If the analyzer displays `ADC Ofs Cor DONE`, you have completed this procedure.
   - If the analyzer displays `ADC Ofs Cor FAIL`, refer to the "Digital Control" chapter.

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Sampler Magnitude and Phase Correction Constants (Test 53)

Required Equipment and Tools

Power meter	HP 437B or HP 438A
Power sensor	HP 8482A
Power sensor (for Option 006 analyzers)	HP 8481A
Power splitter	HP 11667A Option 001
RF cable set (2)	HP 11500B
HP-IB cable	HP 10833A
Adapter type-N (m) to type-N (m)	HP P/N 1250-1475
Adapter type-N (f) to type-N (f)	HP P/N 1250-1472
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up time: **30 minutes.**

This adjustment procedure corrects the overall flatness of the microwave components that make up the analyzer receiver and test separation sections. This is necessary for the HP 8753D Option 011 to meet the published test port flatness.

1. If you just completed "Source Correction Constants (Test 47)," continue this procedure with step 8.
2. Press PRESET LOCAL SYSTEM CONTROLLER.
3. Press LOCAL SET ADDRESSES ADDRESS: P MTR/HPIB. The default power meter address is 13. Refer to the power meter manual as required to observe or change its HP-IB address.
4. Press POWER MTR:438A/437 to toggle between the 438A/437 and 436A power meters. Choose the appropriate model number.

Note If you are using the HP 438A power meter, connect the HP 8482A power sensor to channel A, and for Option 006, connect the HP 8481A power sensor to channel B.

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Power Sensor Calibration Factor Entry

5. Press (SYSTEM) SERVICE MENU TEST OPTIONS LOSS/SENSR LISTS CAL FACTOR SENSOR A to access the calibration factor menu for power sensor A (HP 8482A).
6. Build a table of up to twelve points (twelve frequencies with their calibration factors). To enter each point, follow these steps:
   a. Press ADD FREQUENCY.
   b. Input a frequency value and then press the appropriate key: (G/n), (M/μ), or (k/m).
   c. Press CAL FACTOR and enter the calibration factor percentage that corresponds to the frequency you entered.

      The calibration factor and frequency values are found on the back of the sensor. If you make a mistake, press (←) and re-enter the correct value.
   d. Press DONE to complete the data entry for each point.

Note

The following terms are part of the sensor calibration menu :

SEGMENT	Allows you to select a frequency point.
EDIT	Allows you to edit or change a previously entered value.
DELETE	Allows you to delete a point from the sensor cal factor table.
ADD	Allows you to add a point into the sensor cal factor table.
CLEAR LIST	Allows you to erase the entire sensor cal factor table.
DONE	Allows you to complete the points entry of the sensor cal factor table.

7. **For Option 006 Instruments Only:** Press CAL FACTOR SENSOR B to create a power sensor calibration table for power sensor B (HP 8481A), using the softkeys mentioned above. Since sensor B is only used for 3 GHz to 6 GHz measurements, you only need to input calibration factors for this frequency range.
8. Zero and calibrate the power meter and power sensor.

Update Sampler Correction Constants

9. Preset, zero, and calibrate the power meter and HP 8482A (sensor A).
10. Press (SYSTEM) SERVICE MENU TESTS (53) (x1) EXECUTE TEST YES.
11. Connect the equipment as shown in Figure 3-7.

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Figure SAMPR here.

Figure 3-7. Input R Sampler Correction Setup

12. Press `CONTINUE`.

    The analyzer starts the first part of the automatic adjustment. This part will take about seven minutes.

13. **For Option 006 Instruments Only:** After the analyzer has finished the first part of the adjustment, disconnect the HP 8482A (sensor A) from the power splitter, and replace it with the HP 8481A (sensor B) for the 6 GHz measurement.

    - If you are using the HP 438A power meter, the HP 8481A should be connected to the meter's channel B input.
    - If you are using the HP 437B power meter, zero and calibrate the HP 8481A sensor.

14. Press `CONTINUE`.

15. Connect the equipment as shown in Figure 3-8. Use two cables of equal electrical length at the power splitter outputs.

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Figure SAMPA here.

Figure 3-8. Input A Sampler Correction Setup

16. Press `CONTINUE`. The analyzer starts the second part of the automatic adjustment.

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17. Follow the analyzer prompt to move the cable from input A to input B, as shown in Figure 3-9.

Figure SAMPB here.

Figure 3-9. Input B Sampler Correction Setup

18. Press CONTINUE. The analyzer starts the third part of the automatic adjustment.
19. When the analyzer completes the adjustment, observe the display:
    - If the analyzer shows DONE, this procedure is complete.
    - If the analyzer shows FAIL, press PRESET and then repeat this entire procedure ("Sampler Magnitude and Phase Correction Constants"). If the analyzer shows FAIL again, refer to the "Receiver Troubleshooting" chapter.

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Cavity Oscillator Frequency Correction Constants (Test 54)

Required Equipment and Tools

Low pass filter	HP P/N 9135-0198
Power splitter	HP 11667A Option 001
Attenuator 20 dB	HP 8491A Option 020
RF cable set	HP 11851B
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up Time: **30 minutes.**

The nominal frequency of the cavity oscillator is 2.982 GHz, but it varies with temperature. This procedure determines the precise frequency of the cavity oscillator at a particular temperature by identifying a known spur.

Note You should perform this procedure with the recommended filter, or a filter with at least 50 dB of rejection at 2.9 GHz and a passband which includes 800 MHz. The filter makes spur identification substantially faster and more reliable.

With the filter, you need to distinguish between only two spurs, each of which should be 10 dB to 20 dB (3 to 4 divisions) above the trace noise.

Without the filter, you need to distinguish the target spur between four or five spurs, each of which may be 0.002 to 0.010 dB (invisible to 2 divisions) above or below the trace noise.

Perform the first five steps of the procedure at least once for familiarization before trying to select the target spur (especially if you are not using a filter).

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1. Connect the equipment shown in Figure 3-10.

Figure CAVOSC here.

Figure 3-10. Setup for Cavity Oscillator Frequency Correction Constant Routine

2. Press (PRESET) (SYSTEM) SERVICE MENU TESTS (54) (x1) EXECUTE TEST YES.

   During this adjustment routine, you will see several softkeys:

CONTINUE	Sweeps the current frequency span: you may press it repeatedly for additional sweeps of the current frequency span.
NEXT	Sweeps the next frequency span (2 MHz higher).
SELECT	Enters the value of the marker which you have placed on the spur and exits the routine.
ABORT	Exits the routine.

3. Press CONTINUE to sweep the first frequency span three times. Each new span overlaps the previous span by 3 MHz (the center frequency increases by 2 MHz; the span is 5 MHz). Therefore, anything visible on the right half of the screen of one set of sweeps will appear on the left half or center of the screen when you press NEXT.

4. Press NEXT repeatedly. Watch the trace on each sweep and try to spot the target spur. With the filter, the target spur will be one of two obvious spurs. See Figure 3-11). Without the filter (not recommended), the target spur will be one of four or five less distinct spurs as shown in Figure 3-12 and Figure 3-13. When the center frequency increases to 2994.999 MHz, and you have not "selected" the target spur, Cav Osc Cor FAIL will appear on the display.

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Figure TARGET here.

Figure 3-11. Typical Display of Spurs with a Filter

Spur Search Procedure with a Filter

5. Press `EXECUTE TEST` `YES` `CONTINUE` and the other softkeys as required to observe and mark the target spur. The target spur will appear to the right of a second spur, similar to Figure 3-11.
6. Rotate the front panel knob to position the marker on the spur and then press `SELECT`.

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7. Observe the analyzer for the results of this adjustment routine:
   - If the analyzer displays `Cav Osc Cor DONE`, you have completed this procedure.
   - If the analyzer does not display `DONE`, repeat this procedure.
   - If the analyzer continues not to display `DONE`, refer to the "Source Troubleshooting" chapter.

Spur Search Procedure without a Filter

8. Press `EXECUTE TEST` `YES` `CONTINUE` and the other softkeys as required to observe and mark the target spur.

   The target spur will appear in many variations. Often it will be difficult to identify positively; occasionally it will be nearly impossible to identify. Do not hesitate to press `CONTINUE` as many times as necessary to thoroughly inspect the current span.

   The target spur usually appears as one of a group of four evenly spaced spurs as in Figure 3-12. The target spur is on the right most spur (fourth from the left). On any particular sweep, one, any, or all of the spurs may be large, small, visible, invisible, above or below the reference line.

Figure TARGET1 here.

Figure 3-12. Typical Display of Four Spurs without a Filter

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On occasion the largest spur appears as one of a group of five evenly spaced spurs as shown in Figure 3-13. The target spur is again the fourth from the left (not the fifth, right-most spur).

Figure TARGET2 here.

Figure 3-13. Target Spur in Display of Five Spurs

Figure 3-14 shows another variation of the basic four spur pattern: some up, some down, and the target spur itself almost indistinguishable.

Figure TARGET3 here.

Figure 3-14. Target Spur Almost Invisible

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9. Rotate the front panel knob to position the marker on the target spur. Then press SELECT and observe the analyzer for the results of the adjustment routine:
   - If the analyzer displays `Cav Osc Cor DONE`, you have completed this procedure.
   - If the analyzer displays `FAIL`, refer to the "Source Troubleshooting" chapter.

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Serial Number Correction Constant (Test 55)

Analyzer warm-up time: **5 minutes.**

This procedure stores the analyzer serial number in the A9 CPU assembly EEPROMs.

Caution Perform this procedure ONLY if the A9 CPU assembly has been replaced.

1. Record the ten character serial number that is on the analyzer real panel identification label.
2. Press (PRESET) DISPLAY MORE TITLE ERASE TITLE to erase the HP logo.
3. Enter the serial number by rotating the front panel knob to position the arrow below each character of the instrument serial number, and then pressing SELECT LETTER to enter each letter. Enter a total of ten characters: four digits, one letter, and five final digits.

   Press BACKSPACE if you made a mistake.
4. Press DONE when you have finished entering the title.

Caution Mistakes CANNOT be corrected after step 5 is performed, unless you contact the factory for a clear serial number keyword. Then you must perform the "Options Correction Constants" procedure and repeat this procedure.

5. Press (SYSTEM) SERVICE MENU TESTS (55) (x1) EXECUTE TEST YES.

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6. Observe the analyzer for the results of the routine:
   - If the analyzer displays the message `Serial Cor DONE`, you have completed this procedure.
   - If the analyzer does not display `DONE`, then either the serial number entered in steps 3 and 4 did not match the required format or a serial number was already stored. Check the serial number recognized by the analyzer:
     a. Press (PRESET) (SYSTEM) `SERVICE MENU` `FIRMWARE REVISION`.
     b. Look for the serial number displayed on the analyzer screen.
     c. Rerun this adjustment test.
   - If the analyzer continues to fail this adjustment routine, contact your nearest HP Sales and Service office.

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Option Numbers Correction Constant (Test 56)

This procedure stores instrument option(s) information in A9 CPU assembly EEPROMs. You can also use this procedure to remove a serial number or install an option, with the unique as referred to in "Serial Number Correction Constant."

1. Remove the instrument top cover and record the keyword label(s) that are on the display assembly. Note that each keyword is for EACH option installed in the instrument.
   - If the instrument does not have a label, then contact your nearest HP Sales and Service office. Be sure to include the full serial number of the instrument.
2. Press (PRESET) (DISPLAY) `MORE` `TITLE` `ERASE TITLE`.
3. Enter the keyword by rotating the front panel knob to position the arrow below each character of the keyword, and then pressing `SELECT LETTER` to enter each letter.

   Press `BACKSPACE` if you made a mistake.
4. Press `DONE` when you have finished entering the title.

Caution Do not confuse "I" with "1" or "O" with "0" (zero).

5. Press (SYSTEM) `SERVICE MENU` `TESTS` (56) (x1) `EXECUTE TEST` `YES`.
6. Observe the analyzer for the results of the adjustment routine:
   - If the analyzer displays `Option Cor DONE`, you have completed this procedure.
   - If the analyzer has more than one option, repeat steps 2 through 6 to install the remaining option(s).
   - If the analyzer displays `Option Cor FAIL`, check the keyword used in step 3 and make sure it is correct. Pay special attention to the letters "I" or "0", the numbers "1" or "0" (zero). Repeat this entire adjustment test.
   - If the analyzer continues to fail the adjustment routine, contact your nearest HP service office.

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Calibration Kit Default Correction Constants (Test 57)

This internal adjustment test writes default calibration kit definitions (device model coefficients) into EEPROM's.

1. Press (PRESET) (SYSTEM) SERVICE MENU TESTS (57) (x1) EXECUTE TEST YES.
2. Observe the analyzer for the results of the adjustment routine:
   - If the analyzer displays Cal Kit Def DONE, press (PRESET), and you have completed this procedure.
   - If the analyzer does not display DONE, contact your nearest HP Sales and Service office.

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Initialize EEPROMs (Test 58)

This service internal test performs the following functions:

- *destroys* all correction constants and all un-protected options
- initializes certain EEPROM address locations to zeroes
- replaces the display intensity correction constants with default values

Note This routine **WILL NOT** alter the serial number or Options 002, 006 and 010 correction constants.

1. Press (PRESET) (SYSTEM) SERVICE MENU TESTS (58) (x1) EXECUTE TEST YES.
2. Restore the analyzer options in the EEPROMs:
   - If you have the correction constants backed up on a disk, perform these steps:
     a. Place the disk in the analyzer disk drive and press (SAVE/RECALL) SELECT DISK INTERNAL DISK.
     b. Use the front panel knob to highlight the filename that represents your serial number.
     c. Press RETURN RECALL STATE (PRESET).
   - If you don't have the correction constants backed up on a disk, run all the internal service routines in the following order:
     1. Display Intensity Correction Constants (Test 49)
     2. Source Default Correction Constants (Test 44)
     3. Source Pretune Correction Constants (Test 45)
     4. Analog Bus Correction Constants (Test 46)
     5. Source Pretune Correction Constants (Test 48)
     6. Calibration Kit Default Correction Constants (Test 57)
     7. ADC Offset Correction Constants (Test 52)
     8. RF Output Power Correction Constants (Test 47)
     9. Sampler Magnitude and Phase Correction Constants (Test 53)
     10. IF Amplifier Correction Constants (Test 51)
     11. Cavity Oscillator Frequency Correction Constants (Test 54)

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EEPROM Backup Disk Procedure

Required Equipment and Tools

3.5-inch floppy disk	HP 92192A (box of 10)
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

The correction constants, that are unique to your instrument, are stored in EEPROM on the A9 controller assembly. By creating an EEPROM backup disk, you will have a copy of all the correction constant data should you need to replace or repair the A9 assembly.

1. Insert a 3.5-inch disk into the analyzer disk drive.
2. If the disk is not formatted, follow these steps:
   a. Press (SAVE/RECALL) `FILE UTILITIES` `FORMAT DISK`.
   b. Select the format type:
      - To format a LIF disk, select `FORMAT:LIF`.
      - To format a DOS disk, select `FORMAT:DOS`.
   c. Press `FORMAT INT DISK` and answer `YES` at the query.
3. Press (SYSTEM) `SERVICE MENU` `SERVICE MODES` `MORE` `STORE EEPR ON` (SAVE/RECALL) `SELECT DISK` `INTERNAL DISK` `RETURN` `SAVE STATE`.

Note The analyzer creates a default file "FILE0". The filename appears in the upper-left corner of the display. The file type "ISTATE(E)" indicates that the file is an instrument-state with EEPROM backup.

4. Press `FILE UTILITIES` `RENAME FILE` `ERASE TITLE`. Use the front panel knob and the `SELECT LETTER` softkey (or an external keyboard) to rename the file "FILE0" TO "N*12345*" where *12345* represents the last 5 digits of the instrument's serial number. (The first character in the filename must be a letter.) When you are finished renaming the file, press `DONE`.

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5. Write the following information on the disk label:
   - analyzer serial number
   - today's date
   - "EEPROM Backup Disk"

How to Retrieve Correction Constant Data from the EEPROM Backup Disk

1. Insert the "EEPROM Backup Disk" into the analyzer disk drive.
2. Make sure the A9 CC jumper is in the ALTER position.
3. Press (SAVE/RECALL) `SELECT DISK` `INTERNAL DISK`. Use the front panel knob to highlight the file "N12345" where N12345 represents the file name of the EEPROM data for the analyzer. On the factory shipped EEPROM backup disk, the filename is FILE1.
4. Press `RETURN` `RECALL STATE` to down load the correction constants data into the instrument EEPROM's.
5. Perform "Serial Number Correction Constants (Test 55)", and if applicable, "Option Numbers Correction Constant (Test 56)."
6. Press (PRESET) and verify that good data was transferred to EEPROM by performing a simple measurement.
7. Move the A9 CC jumper back to its NORMAL position when you are done working with the instrument.

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Vertical Position and Focus Adjustments

Required Equipment and Tools

Torx screwdriver T-15
Non-conductive flat head screwdriver,-2 inches .....HP P/N 8830-0024
Antistatic wrist strap .....HP P/N 9300-1367
Antistatic wrist strap cord .....HP P/N 9300-0980
Static-control table mat and earth ground wire .....HP P/N 9300-0797

Analyzer warm-up time: **30 minutes.**

Use this procedure to adjust the vertical position and focus of the analyzer color display.

Caution These are the only display adjustments. Any other adjustments to the color display will *void* the warranty.

Vertical Adjustment Procedure

1. Remove the left-rear bumpers and left side panel.

Figure VERT here.

Figure 3-15. Vertical Position and Focus Adjustment Locations

2. Insert the flat head screw driver into the vertical position hole.
3. Adjust the control until the softkey labels are aligned with the softkeys.

Focus Adjustment Procedure

4. Use the screw driver from step 3 to adjust the focus until the display has the most readability.

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Display Degaussing (Demagnetizing)

Required Equipment and Tools

Any CRT demagnetizer or bulk tape eraser
Antistatic wrist strap ..... HP P/N 9300-1367
Antistatic wrist strap cord ..... HP P/N 9300-0980
Static-control table mat and earth ground wire ..... HP P/N 9300-0797

As with all color monitors, the display is very susceptible to external magnetic fields. These fields can originate from many sources, including unshielded motors, metal frame tables, and from the earth itself. The usual symptom is a discoloration or slight dimming of the display usually near the top left corner of the display. If this problem is observed, remove the device causing the magnetic field.

In extreme cases, a total color shift may be observed; for example, a trace that was red may shift to green. This does not indicate a problem with the display; it is characteristic of all color displays.

In countries that use 50 Hz AC power, some 10 Hz jitters may be noticed.

1. If the display becomes magnetized, or if color purity is a problem, cycle the analyzer power several times. Leave the instrument off for at least 15 seconds before turning it on. This will activate the automatic degaussing circuitry in the display.
2. If the display color purity is still a problem, you must use a commercially available demagnetizer such as a CRT demagnetizer or a bulk tape eraser. Follow the manufacturer's instructions keeping in mind of the following:
   - At the first pass, do NOT place the demagnetizer closer than 4 inches (10 cm) from the face of the display while demagnetizing the display.
   - At the second pass, if you did not completely demagnetize the display, move the demagnetizer to a slightly closer distance until the display is demagnetized.

Caution If you apply an excessively strong magnetic field to the display face, you can permanently destroy the display.

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Fractional-N Frequency Range Adjustment

Required Equipment and Tools

TORX screwdriver T-15
Non-metallic adjustment tool ..... HP P/N 8830-0024
Antistatic wrist strap ..... HP P/N 9300-1367
Antistatic wrist strap cord ..... HP P/N 9300-0980
Static-control table mat and earth ground wire ..... HP P/N 9300-0797

Analyzer warm-up time: **30 minutes**

This procedure centers the fractional-N VCO (voltage controlled oscillator) in its tuning range to insure reliable operation of the instrument.

1. Remove the right-rear bumpers and the right side cover, using the torx screwdriver.
2. Press [PRESET] [DISPLAY] DUAL CHAN ON [SYSTEM] SERVICE MENU ANALOG BUS ON [MENU] NUMBER of POINTS [11] [x1] COUPLED CH OFF.
3. Press [START] [36] [M/μ] [STOP] [60.75] [M/μ] [MENU] SWEEP TIME [12.5] [k/m] [MEAS] S PARAMETERS ANALOG IN Aux Input [29] [x1] to observe the "FN VCO Tun" voltage.
4. Press [FORMAT] MORE REAL [SCALE REF] [.6] [x1] REFERENCE VALUE [-7] [x1] to set and scale channel 1. Press [MARKER] to set the marker to the far right of the graticule.
5. Press [CHAN 2] [MENU] CW FREQ [31.0001] [M/μ] SWEEP TIME [12.375] [k/m] [MEAS] S PARAMETERS ANALOG IN Aux Input [29] [x1] to observe the "FN VCO Tun" voltage.
6. Press [FORMAT] MORE REAL [SCALE REF] [.2] [x1] REFERENCE VALUE [6.77] [x1] [MARKER] [6] [k/m] to set channel 2 and its marker.
7. Adjust the "FN VCO ADJ" (see Figure 3-16) with a non-metallic tool so that the channel 1 marker is as many divisions above the reference line as the channel 2 marker is below it. See Figure 3-17.

Figure FNVCO here.

Figure 3-16. Location of the FN VCO Adjustment

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Figure RANGE here.

Figure 3-17. Fractional-N Frequency Range Adjustment Display

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8. To fine-tune this adjustment, press [PRESET] [MENU] CW FREQ [SYSTEM] SERVICE MENU ANALOG BUS ON SERVICE MODES FRACN TUNE ON to set "FRAC N TUNE" to 29.2 MHz.

9. Press [MEAS] S PARAMETERS ANALOG IN Aux Input [29] [x1] [MARKER] [FORMAT] MORE REAL [SCALE REF] REFERENCE VALUE [7] [x1].

10. Observe the analyzer for the results of this adjustment:

    - If the marker value is less than 7, you have completed this procedure.
    - If the marker value is greater than 7, readjust "FN VCO ADJ" to 7. Then perform steps 2 to 10 to confirm that the channel 1 and channel 2 markers are still above and below the reference line respectively.
    - If you cannot adjust the analyzer correctly, replace the A14 board assembly.

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Frequency Accuracy Adjustment

Required Equipment and Tools

Spectrum analyzer	HP 8563E
Power splitter	HP 11667A Option 001
RF cable 24-inch (2)	HP 11500B
Non-metallic adjustment tool	HP P/N 8830-0024
TORX screwdriver T-15	
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up time: **30 minutes.**

This adjustment sets the VCXO (voltage controlled crystal oscillator) frequency to maintain the instrument's frequency accuracy.

1. Remove the upper-rear bumpers and analyzer top cover, using the torx screwdriver.
2. Connect the equipment as shown in Figure 3-18.

Figure FREQACC here.

Figure 3-18. Frequency Accuracy Adjustment Setup

Note Make sure that the spectrum analyzer and network analyzer references are NOT connected.

3. **For Option 1D5 Instruments Only:** Remove the BNC to BNC jumper that is connected between the "EXT REF" and the "10 MHz Precision Reference," as shown in Figure 3-20.
4. Set the spectrum analyzer measurement parameters as follows:

Center Frequency	2.9 GHz (or 5.9 GHz for Option 006)
Frequency Span	50 kHz
Reference Level	+10 dBm

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5. On the HP 8753D Option 011, press (PRESET) (MENU) CW FREQ (2.9) (G/n) (or (5.9) (G/n) for Option 006).
6. No adjustment is required when the spectrum analyzer measures 2.9 GHz ±;5 kHz (or 5.9 GHz ± 5 kHz for Option 006). Otherwise, locate the A12 assembly (red extractors) and adjust the VCXO ADJ for a spectrum analyzer center frequency measurement of ± 5 kHz. See Figure 3-19.
7. Replace the A12 assembly if you are unable to adjust the frequency as specified. Repeat this adjustment test.

Figure VCXO here.

Figure 3-19. Location of the VCXO ADJ Adjustment

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HP 8753D Option 011 with Option 1D5 Only

8. Connect the BNC to BNC jumper between the "EXT REF" and the "10 MHz Precision Reference" as shown in Figure 3-20.
9. Use a flat-head screwdriver to remove the screw that covers the precision frequency adjustment as shown in Figure 3-20. Insert a narrow screwdriver and adjust the precision frequency reference potentiometer for a spectrum analyzer center frequency measurement of ±5 Hz.

Figure OPT1D5 here.

Figure 3-20. High Stability Frequency Adjustment Location

10. Replace the A26 board assembly if you cannot adjust for a center frequency measurement of ±50 Hz.

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High/Low Band Transition Adjustment

Required Equipment and Tools

Non-metallic adjustment tool	HP P/N 8830-0024
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up time: **30 minutes.**

This adjustment centers the VCO (voltage controlled oscillator) of the A12 reference assembly for high and low band operations.

1. Press [PRESET] [SYSTEM] SERVICE MENU ANALOG BUS ON [START] [11] [M/μ] [STOP] [21] [M/μ] to observe part of both the low and high bands on the analog bus.
2. Press [MEAS] S PARAMETERS ANALOG IN Aux Input [22] [x1] [FORMAT] MORE REAL [DISPLAY] DATAMEM DATA-MEMORY to subtract the ground voltage from the next measurement.
3. Press [MEAS] S PARAMETERS ANALOG IN Aux Input [23] [x1] [MARKER] [11] [M/μ].
4. Press [SCALE REF] [.1] [x1] and observe the VCO tuning trace:
   - If the left half of trace = 0 ±1000 mV and right half of trace = 100 to 200 mV higher (one to two divisions), no adjustment is necessary. See Figure 3-21.
   - If the adjustment is necessary, follow these steps:
     a. Remove the upper-rear bumpers and top cover, using a torx screwdriver.
     b. Adjust the VCO tune (see Figure 3-22) to position the left half of the trace to 0 ±125 mV. This is a very sensitive adjustment where the trace could easily go off of the screen.
     c. Adjust the HBLB (see Figure 3-22) to position the right half of the trace 125 to 175 mV (about 1 to 1.5 divisions) higher than the left half.
   - Refer to "Source Troubleshooting" if you cannot perform the adjustment.

Figure HIGHLOW here.

Figure 3-21. High/Low Band Transition Adjustment Trace

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Figure HLADJ here.

Figure 3-22. High/Low Band Adjustment Locations

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Fractional-N Spur Avoidance and FM Sideband Adjustment

Required Equipment and Tools

Spectrum analyzer	HP 8563E
Power splitter	HP 11667A Option 001
Attenuator 10 dB	HP 8491A Option 010
BNC cable	HP P/N 8120-1840
HP-IB cable	HP 10833A/B/C/D
RF cable set	HP 11851B
Non-metallic adjustment tool	HP P/N 8830-0024
TORX screwdriver T-15	
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up time: **30 minutes.**

This adjustment minimizes the spurs caused by the API (analog phase interpolator, on the fractional-N assembly) circuits. It also improves the sideband characteristics.

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1. Connect the equipment as shown in Figure 3-23.
2. Make sure the instruments are set to their default HP-IB addresses:
   HP 8753D Option 011 = 16, Spectrum Analyzer = 18.

Figure FRACSPUR here.

Figure 3-23. Fractional-N Spur Avoidance and FM Sideband Adjustment Setup

3. Set the spectrum analyzer measurement parameters as follows:

Reference Level	0 dBm
Resolution Bandwidth	100 Hz
Center Frequency	676.145105 MHz
Span	2.5 kHz

4. On the HP 8753D Option 011, press (PRESET) (MENU) CW FREQ (676.045105) (M/μ).
5. Remove the upper-rear corner bumpers and the top cover, using a torx screwdriver.
6. Adjust the 100 kHz (R77) for a null (minimum amplitude) on the spectrum analyzer. The minimum signal may, or may not, drop down into the noise floor.

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Figure API here.

Figure 3-24. Location of API and 100 kHz Adjustments

7. On the spectrum analyzer, set the center frequency for 676.051105 MHz.
8. On the HP 8753D Option 011, press (MENU) CW FREQ (676.048105) (M/μ).
9. Adjust the API1 (R35) for a null (minimum amplitude) on the spectrum analyzer.
10. On the spectrum analyzer, set the center frequency for 676.007515 MHz.
11. On the HP 8753D Option 011, press (MENU) CW FREQ (676.004515) (M/μ).
12. Adjust the API2 (R43) for a null (minimum amplitude) on the spectrum analyzer.
13. On the spectrum analyzer, set the center frequency for 676.003450 MHz.
14. On the HP 8753D Option 011, press (MENU) CW FREQ (676.00045) (M/μ).
15. Adjust the API3 (R45) for a null (minimum amplitude) on the spectrum analyzer.
16. On the spectrum analyzer, set the center frequency for 676.003045 MHz.
17. On the HP 8753D Option 011, press (MENU) CW FREQ (676.000045) (M/μ).
18. Adjust the API4 (R47) for a null (minimum amplitude) on the spectrum analyzer.

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In Case of Difficulty

- If this adjustment can not be performed satisfactorily, repeat the entire procedure. Or else replace the A13 board assembly.

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Source Spur Avoidance Tracking Adjustment

Required Equipment and Tools

TORX screwdriver T-15	
BNC alligator clip adapter	HP P/N 8120-1292
BNC to BNC cable	HP P/N 8120-1840
Antistatic wrist strap	HP P/N 9300-1367
Antistatic wrist strap cord	HP P/N 9300-0980
Static-control table mat and earth ground wire	HP P/N 9300-0797

Analyzer warm-up time: **30 minutes.**

This adjustment optimizes tracking between the YO (YIG oscillator) and the cavity oscillator when they are frequency offset to avoid spurs. Optimizing YO-cavity oscillator tracking reduces potential phase-locked loop problems.

1. Remove the upper-rear corner bumpers and top cover, using a torx screwdriver.
2. Mate the adapter to the BNC cable and connect the BNC connector end to AUX INPUT on the analyzer rear panel. Connect the BNC center conductor alligator-clip to A11 TP10 (labeled ERR); the shield clip to A11 TP1 (GND) as shown in Figure 3-25.

Figure A11CAV here.

Figure 3-25. Location of A11 Test Points and A3 CAV ADJ Adjustments

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3. Press PRESET CENTER 400 M/μ SPAN 50 M/μ.
4. Press SYSTEM SERVICE MENU ANALOG BUS ON MEAS S PARAMETERS ANALOG IN Aux Input 11 x1.
5. Press FORMAT MORE REAL SCALE REF 10 k/m MARKERREFERENCE.
6. Observe the phase locked loop error voltage:
   - If "spikes" are not visible on the analyzer display (see Figure 3-26), no adjustment is necessary.
   - If "spikes" are excessive (see Figure 3-26),adjust the CAV ADJ potentiometer on the A3 source bias assembly to eliminate the spikes. See Figure 3-25.
   - If the "spikes" persist, refer to the "Source Troubleshooting" chapter.

Figure SPIKES here.

Figure 3-26. Display of Acceptable versus Excessive Spikes

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Unprotected Hardware Option Numbers Correction Constants

Analyzer warm-up Time: **None.**

This procedure stores the instrument's unprotected option(s) information in A9 CPU assembly EEPROMs.

1. Make sure the A9 CC jumper is in the ALT (ALTER) position.
2. Record the installed options that are printed on the rear panel of the analyzer.
3. Press (SYSTEM) SERVICE MENU PEEK/POKE PEEK/POKE ADDRESS.
4. Refer to the table below for the address of each unprotected hardware option. Enter the address for the specific installed hardware option that needs to be enabled or disabled. Follow the address entry by POKE (−1) (x1).
   - Pressing POKE (−1) (x1) after an entry enables the option.
   - Pressing POKE (0) (x1) after an entry disables the option.

Hardware Options	PEEK/POKE Address
1D5	5243250
011	5243256

5. Repeat steps 3 and 4 for all of the unprotected options that you want to enable.

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6. After you have entered all of the instrument's hardware options, press the following keys:

   SYSTEM SERVICE MENU FIRMWARE REVISION

7. View the analyzer display for the listed options.
8. When you have entered all of the hardware options, return the A9 CC jumper to the NRM (NORMAL) position.
9. Perform the "EEPROM Backup Disk Procedure" located on page 3-42.

In Case of Difficulty

If any of the installed options are missing from the list, return to step 2 and reenter the missing option(s).

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Sequences for Mechanical Adjustments

The network analyzer has the capability of automating tasks through a sequencing function. The following adjustment sequences are available through InterNet.

- Fractional-N Frequency Range Adjustment
- High/Low Band Transition Adjustment
- Fractional-N Spur Avoidance and FM Sideband Adjustment

How to Load Sequences from Disk

1. Place the sequence disk in the analyzer disk drive.
2. Press (LOCAL) SYSTEM CONTROLLER (SEQUENCE) MORE LOAD SEQUENCE FROM DISK READ SEQUENCE FILE TITLES .
3. Select any or all of the following sequence files by pressing:
   - Select LOAD SEQ APIADJ if you want to load the file for the "Fractional-N Spur Avoidance and FM Sideband Adjustment."
   - Select LOAD SEQ HBLBADJ if you want to load the file for the "High/Low Band Transition Adjustment."
   - Select LOAD SEQ FNADJ and LOAD SEQ FNCHK if you want to load the files for the "Fractional-N Frequency Range Adjustment."

How to Set Up the Fractional-N Frequency Range Adjustment

1. Remove the right-rear bumpers and right side cover. This exposes the adjustment location in the sheet metal.
2. Press (PRESET) SEQUENCE X FNADJ (where X is the sequence number).
3. Adjust the "FN VCO TUNE" with a non-metallic tool so that the channel 1 marker is as many divisions above the reference line as the channel 2 marker is below it.
4. Press (PRESET) SEQUENCE X FNCHK (where X is the sequence number).
   - If the marker value is <7, you have completed this procedure.
   - If the marker value is >7, readjust "FN VCO TUNE" to 7. Then repeat steps 2, 3, and 4 to confirm that the channel 1 and channel 2 markers are still above and below the reference line respectively.

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How to Set Up the High/Low Band Transition Adjustments

1. Press (PRESET) `SEQ X HBLBADJ` (where X is the sequence number).
2. Observe the VCO tuning trace:
   - If the left half of trace = 0 ±1000 mV and right half of the trace = 100 to 200 mV higher (one to two divisions), no adjustment is necessary.
   - If the adjustment is necessary, follow these steps:
     a. Remove the upper-rear bumpers and top cover, using a torx screwdriver.
     b. Adjust the VCO tune (A12 C85) to position the left half of the trace to 0 ±125 mV. This is a very sensitive adjustment where the trace could easily go off of the screen.
     c. Adjust the HBLB (A12 R68) to position the right half of the trace 125 to 175 mV (about 1 to 1.5 divisions) higher than the left half.
   - Refer to "Source Troubleshooting" if you cannot perform the adjustment.

How to Set Up the Fractional-N Spur Avoidance and FM Sideband Adjustment

1. Press (PRESET) `SEQUENCE X APIADJ` (where X is the sequence number).
2. Remove the upper-rear corner bumpers and the top cover, using a torx screwdriver.
3. Follow the directions on the analyzer display and make all of the API adjustments.

Sequence Contents

Sequence for the High/Low Band Transition Adjustment

—Sequence HBLBADJ sets the hi-band to low-band switch point.—

```
PRESET
SYSTEM
  SERVICE MENU
    ANALOG BUS ON
START 11 M/u
STOP 21 M/u
MEAS
  ANALOG IN 22 x1 (A12 GND)
DISPLAY
  DATA > MEM
  DATA - MEM
MEAS
  ANALOG IN 23 x1 (VCO TUNE)
MKR 11 M/u
```


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SCALE/REF .1 x1

Sequences for the Fractional-N Frequency Range Adjustment

—Sequence FNADJ sets up A14 (FRAC N Digital) VCO.—

DISPLAY
  DUAL CHAN ON
SYSTEM
  SERVICE MENU
    ANALOG BUS ON
MENU
  NUMBER OF POINTS 11 x1
  COUPLED CHAN OFF
START 36 M/u
STOP 60.75 M/u
MENU
  SWEEP TIME 12.5 k/m
MEAS
  ANALOG IN 29 x1 (FN VCO TUN)
SCALE/REF .6 x1
  REF VALUE -7 x1
MKR
CH 2
MENU
  CW FREQ 31.0001 M/u
  SWEEP TIME 12.375 k/m
MEAS
  ANALOG IN 29 x1 (FN VCO TUN)
SCALE/REF .2 x1
  REF VALUE 6.77 x1
MKR 6 k/m

—Sequence FNCHK checks the VCO adjustment.—

MENU
  CW FREQ 1 G/n
SYSTEM
  SERVICE MENU
    ANALOG BUS ON
    SERVICE MODES
      FRAC N TUNE ON
MEAS
  ANALOG IN 29 x1
MKR
SCALE/REF
  REF VALUE 7 x1

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Sequences for the Fractional-N Avoidance and FM Sideband Adjustment

—Sequence APIADJ sets up the fractional-N API spur adjustments.—

```
TITLE
  S 2.5K
PERIPHERAL HPIB ADDR
  18 x1
TITLE TO PERIPHERAL
WAIT x
  0 x1
TITLE
  AT 0DB
TITLE TO PERIPHERAL
WAIT x
  0 x1
TITLE
  RM 100HZ
TITLE TO PERIPHERAL
WAIT x
  0 x1
TITLE
  CF 676.145105MZ
TITLE TO PERIPHERAL
WAIT x
  0 x1
CW FREQ
  676.045105M/u
TITLE
  ADJ A13 100KHZ
SEQUENCE
PAUSE
TITLE
  CF 676.048105MZ
TITLE TO PERIPHERAL
WAIT x
  0 x1
TITLE
  ADJ A13 API1
SEQUENCE
PAUSE
TITLE
  CF 676.007515MZ
TITLE TO PERIPHERAL
WAIT x
  0 x1
CW FREQ
  676.004515M/u
TITLE
  ADJ A13 API2
SEQUENCE
```


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```
PAUSE
TITLE
  CF 676.003450MZ
TITLE TO PERIPHERAL
WAIT x
  0 x1
CW FREQ
  676.000450M/u
TITLE
  ADJ A13 API3
SEQUENCE
PAUSE
TITLE
  CF 676.003045MZ
TITLE TO PERIPHERAL
WAIT x
0 x1
CW FREQ
  676.000045M/u
TITLE
ADJ A13 API4
```


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4

Start Troubleshooting Here

The information in this chapter helps you:

- Identify the portion of the analyzer that is at fault.
- Locate the specific troubleshooting procedures to identify the assembly or peripheral at fault.

To identify the portion of the analyzer at fault, follow these procedures:

Step 1. Initial Observations

Step 2. Operator's Check

Step 3. HP-IB System Check

Step 4. Faulty Group Isolation

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Assembly Replacement Sequence

The following steps show the sequence to replace an assembly in an HP 8753D Option 011 Network Analyzer.

1. Identify the faulty group. Refer to Chapter 4, "Start Troubleshooting Here." Follow up with the appropriate troubleshooting chapter that identifies the faulty assembly.
2. Order a replacement assembly. Refer to Chapter 13, "Replaceable Parts."
3. Replace the faulty assembly and determine what adjustments are necessary. Refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
4. Perform the necessary adjustments. Refer to Chapter 3, "Adjustments and Correction Constants."
5. Perform the necessary performance tests. Refer to Chapter 2, "System Verification and Performance Tests."

Having Your Analyzer Serviced

The HP 8753D Option 011 has a one year on-site warranty, where available. If the analyzer should fail any of the following checks, call your local HP Sales and Service office. A customer engineer will be dispatched to service your analyzer on-site. If a customer engineer is not available in your area, follow the steps below to send your analyzer back to HP for repair.

1. Choose the nearest HP service center. (A table listing of Hewlett-Packard Sales and Service Offices is provided at the end of this guide.)
2. Include a detailed description of any failed test and any error message.
3. Ship the analyzer, using the original or comparable anti-static packaging materials.

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Step 1. Initial Observations

Initiate the Analyzer Self-Test

1. Disconnect all devices and peripherals from the analyzer (including all test set interconnects).
2. Switch on the analyzer and press PRESET.
3. Watch for the indications shown in Figure 4-1 to determine if the analyzer is operating correctly.

Figure ORDER4 here.

Figure 4-1. Preset Sequence

If the Self-Test Failed

- Check the AC line power to the analyzer.
- Check the fuse (rating listed on rear panel, spare inside holder).
- Check the line voltage setting (use small screwdriver to change).
- If the problem persists, refer to "Step 4. Faulty Group Isolation."

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Step 2. Operator's Check

This procedure verifies with 80% confidence that the analyzer is functioning properly.

Equipment

20 dB attenuator ..... HP 8491A Option 020
RF cable set ..... HP 11851B
Two-way power splitter ..... HP 11667A Option 001

Procedure

1. Switch on the analyzer for a 30 minute warm-up.
2. Press (PRESET) (SYSTEM) SERVICE MENU TESTS (21) (X1). When "TEST 21 R&A Op Check" appears on the analyzer display, press EXECUTE TEST.

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3. At the prompt, connect the equipment as shown in Figure 4-2, with power to inputs R and A. Press CONTINUE as prompted until the analyzer displays PASS or FAIL.

Figure OCS4 here.

Figure 4-2. Operator's Check Setup

4. Press (22) (X1) to access the input R and B operator's check. When the title appears, press EXECUTE TEST. Move the RF cable from input A to B. Press CONTINUE as prompted until the analyzer displays PASS or FAIL.

If the Operator's Check Failed

- Recheck the equipment configuration and connections; if necessary, retest.
- Confirm that the attenuator, splitter and cables meet their published specifications. Visually inspect the connectors. Retest or refer to "Step 4. Faulty Group Isolation" as indicated.

Step 3. HP-IB Systems Check

Check the analyzer's HP-IB functions with a *known working* passive peripheral (such as a plotter, printer, or disk drive).

1. Connect the peripheral to the analyzer using a *good* HP-IB cable.
2. Press (LOCAL) SYSTEM CONTROLLER to enable the analyzer to control the peripheral.
3. Then press SET ADDRESSES and the appropriate softkeys to verify that the device addresses will be recognized by the analyzer. The factory default addresses are:

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Device	HP-IB Address
HP 8753D	16
Plotter port – HP-IB	5
Printer port – HP-IB	1
Disk (external)	0
Controller	21
Power meter – HP-IB	13

Note

You may use other addresses with two provisions:

- Each device must have its own address.
- The address set on each device must match the one recognized by the analyzer (and displayed).

Peripheral addresses are often set with a rear panel switch. Refer to the manual of the peripheral to read or change its address.

If Using a Plotter or Printer

1. Ensure that the plotter or printer is set up correctly:
   - power is on
   - pens and paper loaded
   - pinch wheels are down
   - some plotters need to have P1 and P2 positions set
2. Press (COPY) and then `PLOT` or `PRINT MONOCHROME`.
   - If the result is a copy of the analyzer display, the printing/plotting features are functional in the analyzer. Continue with "Troubleshooting Systems with Multiple Peripherals", "Troubleshooting Systems with Controllers", or the "Step 4. Faulty Group Isolation" section in this chapter.
   - If the result is not a copy of the analyzer display, suspect the HP-IB function of the analyzer. Refer to Chapter 6, "Digital Control Troubleshooting."

If Using an External Disk Drive

1. Select the external disk drive. Press (SAVE/RECALL) `SELECT DISK` `EXTERNAL DISK`.
2. Verify that the address is set correctly. Press (LOCAL) `SET ADDRESSES` `ADDRESS:DISK`.
3. Ensure that the disk drive is set up correctly:
   - power is on
   - an initialized disk in the correct drive
   - correct disk unit number and volume number (press (LOCAL) to access the softkeys that display the numbers; default is 0 for both)

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- with hard disk (Winchester) drives, make sure the configuration switch is properly set (see drive manual)

4. Press START 1 M/ SAVE/RECALL SAVE STATE. Then press PRESET SAVE/RECALL RECALL STATE.

   - If the resultant trace starts at 1 MHz, HP-IB is functional in the analyzer. Continue with "Troubleshooting Systems with Multiple Peripherals", "Troubleshooting Systems with Controllers", or the "Step 4. Faulty Group Isolation" section in this chapter.
   - If the resultant trace does not start at 1 MHz, suspect the HP-IB function of the analyzer. Refer to Chapter 6, "Digital Control Troubleshooting."

Troubleshooting Systems with Multiple Peripherals

Connect any other system peripherals (but not a controller) to the analyzer one at a time and check their functionality. Any problems observed are in the peripherals, cables, or are address problems (see above).

Troubleshooting Systems with Controllers

Passing the preceding checks indicates that the analyzer's peripheral functions are normal. Therefore, if the analyzer has not been operating properly with an external controller, suspect the controller. Check the following:

- Compatibility, must be HP 9000 series 200/300. (See Chapter 1, "Service Equipment and Analyzer Options.")
- HP-IB interface hardware must be installed. (Refer to the manual, *Installing and Maintaining HP Basic/WS 6.2*, that comes with your HP Basic software.)
- Select code. (Refer to the manual, *Installing and Maintaining HP Basic/WS 6.2*, that comes with your HP Basic software.)
- I/O and HP-IB binaries loaded. (Refer to the manual, *Installing and Maintaining HP Basic/WS 6.2*, that comes with your HP Basic software.)
- HP-IB cables. (See "HP-IB Requirements" in the *HP 8753D Network Analyzer User's Guide*.)
- Programming syntax. (Refer to the *HP 8753D Network Analyzer Programmer's Guide*.)

If the analyzer appears to be operating unexpectedly but has not completely failed, go to "Step 4. Faulty Group Isolation."

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Step 4. Faulty Group Isolation

Use the following procedures only if you have read the previous sections in this chapter and you think the problem is in the analyzer. These are simple procedures to verify the four functional groups in sequence, and determine which group is faulty.

The four functional groups are:

- power supplies
- digital control
- source
- receiver

Descriptions of these groups are provided in Chapter 12, "Theory of Operation."

The checks in the following pages must be performed in the order presented. If one of the procedures fails, it is an indication that the problem is in the functional group checked. Go to the troubleshooting information for the indicated group, to isolate the problem to the defective assembly.

Figure 4-3 illustrates the troubleshooting organization.

Figure TO4 here.

Figure 4-3. Troubleshooting Organization

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Power Supply

Check the Rear Panel LEDs

Switch on the analyzer. Notice the condition of the two LEDs on the A15 preregulator at rear of the analyzer. See Figure 4-4.

- The upper (red) LED should be off.
- The lower (green) LED should be on.

Figure REARLED4 here.

Figure 4-4. A15 Preregulator LEDs

Check the A8 Post Regulator LEDs

Remove the analyzer's top cover. Switch on the power. Inspect the green LEDs along the top edge of the A8 post-regulator assembly.

- All green LEDs should be on.
- The fan should be audible.

In case of difficulty, refer to Chapter 5, "Power Supply Troubleshooting."

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Digital Control

Observe the Power Up Sequence

Switch the analyzer power off, then on. The following should take place within a few seconds:

1. On the front panel observe the following:
   - All six amber LEDs illuminate.
   - The amber LEDs go off after a few seconds, except the CH 1 LED. See Figure 4-5.
2. The display should come up bright and focused.
3. Four red LEDs on the A9 CPU board should illuminate. They can be observed through a small opening in the rear panel.

Figure FPPUS4 here.

Figure 4-5. Front Panel Power Up Sequence

Verify Internal Tests Passed

1. Press (PRESET) (SYSTEM) `SERVICE MENU` `TESTS` `INTERNAL TESTS` `EXECUTE TEST`. The display should indicate:

```
TEST

0 ALL INT       PASS
```

   - If your display shows the above message, go to step 2. Otherwise, continue with this step.
   - If phase lock error messages are present, this test may stop without passing or failing. In this case, continue with the next procedure to check the source.

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- If you have unexpected results, or if the analyzer indicates a specific test failure, that internal test (and possibly others) have failed; the analyzer reports the first failure detected. Refer to Chapter 6, "Digital Control Troubleshooting."
- If the analyzer indicates failure but does not identify the test, press ▢ to search for the failed test. Then refer to Chapter 6, "Digital Control Troubleshooting." Likewise, if the response to front panel or HP-IB commands is unexpected, troubleshoot the digital control group.

2. Perform the Analog Bus test. Press RETURN (19) (X1) EXECUTE TEST.
   - If this test fails, refer to Chapter 6, "Digital Control Troubleshooting."
   - If this test passes, continue with the next procedure to check the source.

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Phase Lock Error Messages

The error messages listed below are usually indicative of a source failure or improper instrument configuration. (Ensure that the R channel input is receiving at least −35 dBm power). Continue with this procedure.

- `NO IF FOUND: CHECK R INPUT LEVEL`

  The first IF was not detected during the pretune stage of phase lock.

- `NO PHASE LOCK: CHECK R INPUT LEVEL`

  The first IF was detected at the pretune stage but phase lock could not be acquired thereafter.

- `PHASE LOCK LOST`

  Phase-lock was acquired but then lost.

- `PHASE LOCK CAL FAILED`

  An internal phase lock calibration routine is automatically executed at power-on, when pretune values drift, or when phase lock problems are detected. A problem spoiled a calibration attempt.

- `POSSIBLE FALSE LOCK`

  The analyzer is achieving phase lock but possibly on the wrong harmonic comb tooth.

- `SWEEP TIME TOO FAST`

  The fractional-N and the digital IF circuits have lost synchronization.

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Check Source Output Power

1. Connect the equipment as shown in Figure 4-6.

Figure ESSPC4 here.

Figure 4-6. Equipment Setup for Source Power Check

2. Zero and calibrate the power meter. Press [PRESET] on the analyzer to initialize the instrument.
3. On the analyzer, press [MENU] CW FREQ [300] [k/m] to output a CW 300 kHz signal. The power meter should read approximately 4 dBm. (The frequency response of the power splitter may account for up to ±1 dB difference.)
4. Press [16] [M/] to change the CW frequency to 16 MHz. The power output power should remain approximately 4 dBm throughout the analyzers's frequency range. Repeat this step at 1 and 3 GHz. (For Option 006 include an additional check at 6 GHz.)

If any incorrect power levels are measured, refer to Chapter 7, "Source Troubleshooting."

No Oscilloscope or Power Meter? Try the ABUS

Monitor ABUS node 16.

1. Press [PRESET] [START] [300] [k/m] [STOP] [3] [G/n] [SYSTEM] SERVICE MENU ANALOG BUS ON.
2. [MEAS] S PARAMETERS ANALOG IN Aux Input [16] [X1].
3. [FORMAT] MORE REAL [SCALE REF] AUTOSCALE.

The display should resemble Figure 4-7.

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Figure ABUS4 here.

Figure 4-7. ABUS Node 16: 1V/GHz

If any of the above procedures provide unexpected results, or if error messages are present, refer to Chapter 7, “Source Troubleshooting.”

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Receiver

Observe the R, A, and B Input Traces

1. Connect the equipment as shown in Figure 4-8 below.

Figure REC4 here.

Figure 4-8. Equipment Setup

2. Press [PRESET] [MEAS] R [SCALE REF] AUTO SCALE [MARKER FCTN] MARKERREFERENCE.
3. Observe the measurement trace displayed by the R input. The trace should have about the same flatness as the trace in Figure 4-9.

Note The R trace will be 20 dB lower than the A and B trace due to the attenuator on the R input. The flatness of the trace, however, should resemble that of the A and B input traces.

4. Press [MEAS] A to check the A channel trace. The trace should have about the same flatness as the trace in Figure 4-9.
5. Move the A input cable to the B input and press B to check the B channel trace. The trace should have about the same flatness as the trace in Figure 4-9.

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Figure TMT4 here.

Figure 4-9. Typical Measurement Trace

If the source is working, but the R, A, or B input traces appear to be in error, refer to Chapter 8, "Receiver Troubleshooting."

The following symptoms may also indicate receiver failure.

Receiver Error Messages

- CAUTION: OVERLOAD ON INPUT A; POWER REDUCED
- CAUTION: OVERLOAD ON INPUT B; POWER REDUCED
- CAUTION: OVERLOAD ON INPUT R; POWER REDUCED

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The error messages above indicate that you have exceeded approximately +3 dBm at one of the input ports. The RF output power is automatically switched off. The annotation P appears in the left margin of the display to indicate that the power trip function has been activated. When this occurs, press (MENU) POWER and enter a lower power level. Press POWER TRIP OFF to switch on the power again.

Faulty Data

Any trace data that appears to be below the noise floor of the analyzer (−100 dBm) is indicative of a receiver failure.

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Accessories

If the analyzer has passed all of the above checks but is still making incorrect measurements, suspect the system accessories. Accessories such as RF or interconnect cables, calibration and verification kit devices, adapters, and test sets can all induce system problems.

Reconfigure the system as it is normally used and reconfirm the problem. Continue with Chapter 9, "Accessories Troubleshooting."

Accessories Error Messages

- `POWER PROBE SHUT DOWN!`

  The biasing supplies to a front panel powered device (like a probe or millimeter module) are shut down due to excessive current draw. Troubleshoot the device.

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(oversized art) /08753/90261/egs/sg614d.hpg

Figure 4-10. HP 8753D Option 011 Overall Block Diagram

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5

Power Supply Troubleshooting

Use this procedure only if you have read Chapter 4, "Start Troubleshooting Here." Follow the procedures in the order given, unless:

- an error message appears on the display, refer to "Error Messages" near the end of this chapter.
- the fan is not working, refer to "Fan Troubleshooting" in this chapter.

The power supply group assemblies consist of the following:

- A8 post regulator
- A15 preregulator

All assemblies, however, are related to the power supply group because power is supplied to each assembly.

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Assembly Replacement Sequence

The following steps show the sequence to replace an assembly in an HP 8753D network analyzer.

1. Identify the faulty group. Refer to Chapter 4, "Start Troubleshooting Here." Follow up with the appropriate troubleshooting chapter that identifies the faulty assembly.
2. Order a replacement assembly. Refer to Chapter 13, "Replaceable Parts."
3. Replace the faulty assembly and determine what adjustments are necessary. Refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
4. Perform the necessary adjustments. Refer to Chapter 3, "Adjustments and Correction Constants."
5. Perform the necessary performance tests. Refer to Chapter 2, "System Verification and Performance Tests."

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Simplified Block Diagram

Figure 5-1 shows the power supply group in simplified block diagram form. Refer to the detailed block diagram of the power supply (Figure 5-8) located at the end of this chapter to see voltage lines and specific connector pin numbers.

Figure BLOCK5 here.

Figure 5-1. Power Supply Group Simplified Block Diagram

Start Here

Check the Green LED and Red LED on A15

Switch on the analyzer and look at the rear panel of the analyzer. Check the two power supply diagnostic LEDs on the A15 preregulator casting by looking through the holes located to the left of the line voltage selector switch. See Figure 5-2. During normal operation, the bottom (green) LED is on and the top (red) LED is off. If these LEDs are normal, then A15 is 95% verified. Continue to "Check the Green LEDs on A8."

- If the green LED is not on steadily, refer to "If the Green LED on A15 is not ON Steadily" in this procedure.
- If the red LED is on or flashing, refer to "If the Red LED on A15 is ON" in this procedure.

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Figure LED5 here.

Figure 5-2. Location of A15 Diagnostic LEDs

Check the Green LEDs on A8

Remove the top cover of the analyzer and locate the A8 post regulator; use the location diagram under the top cover if necessary. Check to see if the green LEDs on the top edge of A8 are all on. There are nine green LEDs (one is not visible without removing the PC board stabilizer).

- If all of the green LEDs on the top edge of A8 are on, there is a 95% confidence level that the power supply is verified. To confirm the last 5% uncertainty of the power supply, refer to "Measure the Post Regulator Voltages" (next).
- If any LED on the A8 post regulator is off or flashing, refer to "If the Green LEDs on A8 are not All ON" in this procedure.

Measure the Post Regulator Voltages

Measure the DC voltages on the test points of A8 with a voltmeter. Refer to Figure 5-3 for test point locations and Table 5-1 for supply voltages and limits.

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Figure TPL5 here.

Figure 5-3. A8 Post Regulator Test Point Locations

Table 5-1. A8 Post Regulator Test Point Voltages

TP	Supply	Range
1	+65 V	+64.6 to +65.4
2	AGND	n/a
3	+5 VD	+4.9 to +5.3
4	SDIS	n/a
5	−15 V	−14.4 to −15.6
6	−12.6VPP (probe power)	−12.1 to −12.8
7	+15 V	+14.5 to +15.5
8	+5 VU	+5.05 to +5.35
9	−5.2 V	−5.0 to −5.4
10	+22 V	+21.3 to +22.7
11	+6 V	+5.8 to +6.2

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If the Green LED on A15 is not ON Steadily

If the green LED is not on steadily, the line voltage is not sufficient to power the analyzer.

Check the Line Voltage, Selector Switch, and Fuse

Check the main power line cord, line fuse, line selector switch setting, and actual line voltage to see that they are all correct. Figure 5-4 shows how to remove the line fuse, using a small flat-bladed screwdriver to pry out the fuse holder. Figure 5-2 shows the location of the line voltage selector switch. Use a small flat-bladed screwdriver to select the correct switch position.

If the A15 green LED is still not on steadily, replace A15.

Figure FUSE5 here.

Figure 5-4. Removing the Line Fuse

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If the Red LED on A15 is ON

If the red LED is on or flashing, the power supply is shutting down. Use the following procedures to determine which assembly is causing the problem.

Check the A8 Post Regulator

1. Switch off the analyzer.
2. Disconnect the cable A15W1 from the A8 post regulator. See Figure 5-5.
3. Switch on the analyzer and observe the red LED on A15.
   - If the red LED goes out, the problem is probably the A8 post regulator. Continue to "Verify the A15 Preregulator" to first verify that the inputs to A8 are correct.
   - If the red LED is still on, the problem is probably the A15 preregulator, or one of the assemblies obtaining power from it. Continue with "Check for a Faulty Assembly."

Figure PWRCABL5 here.

Figure 5-5. Power Supply Cable Locations

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Verify the A15 Preregulator

Verify that the A15 preregulator is supplying the correct voltages to the A8 post regulator. Use a voltmeter with a small probe to measure the output voltages of A15W1's plug. Refer to Table 5-2 and Figure 5-6.

- If the voltages are not within tolerance, replace A15.
- If the voltages are within tolerance, A15 is verified. Continue to "Check for a Faulty Assembly."

Table 5-2. Output Voltages

Pin	A15W1P1 (Disconnected) Voltages	A8J2 (Connected) Voltages	A15 Preregulator Mnemonic
1,2	+125 to +100	+68 to +72	+70 V
3,4	+22.4 to +33.6	+17.0 to +18.4	+18 V
5,6	−22.4 to −33.6	−17.0 to −18.4	−18 V
7	N/C	N/C	N/C
8	+9.4 to +14	+7.4 to +8.0	+8 V
9,10	−9.4 to −14	−6.7 to −7.3	−8 V
11	+32 to +48	+24.6 to +26.6	+25 V
12	N/C	N/C	N/C
NOTE: The +5VD supply must be loaded by one or more assemblies at all times, or the other voltages will not be correct. It connects to motherboard connector A17J3 Pin 4.			

Figure PLUG5 here.

Figure 5-6. A15W1 Plug Detail

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Check for a Faulty Assembly

This procedure checks for a faulty assembly that might be shutting down the A15 preregulator via one of the following lines (also refer to Figure 5-1):

- A15W1 connecting to the A8 post regulator
- the +5VCPU line through the motherboard
- the +5VDIG line through the motherboard

Do the following:

1. Switch off the analyzer.
2. Ensure that A15W1 is reconnected to A8. Refer to Figure 5-5.
3. Remove or disconnect the assemblies listed in Table 5-3 one at a time and in the order shown. The assemblies are sorted from most to least accessible. Table 5-3 also lists any associated assemblies that are supplied by the assembly that is being removed. After each assembly is removed or disconnected switch on the analyzer and observe the red LED on A15.

Note

- *Always switch off the analyzer before removing or disconnecting assemblies.*
- When extensive disassembly is required, refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
- Refer to Chapter 13, "Replaceable Parts," to identify specific cables and assemblies that are not shown in this chapter.

- If the red LED goes out, the particular assembly (or one receiving power from it) that allows it to go out is faulty.
- If the red LED is still on after you have checked all of the assemblies listed in Table 5-3, continue to "Check the Operating Temperature."

Table 5-3. Recommended Order for Removal/Disconnection

Assembly To Remove	Removal or Disconnection Method	Other Assemblies that Receive Power from the Removed Assembly
1. A19 Graphics Processor	Disconnect W14	A18 Display
2. A14 Frac N Digital	Remove from Card Cage	None
3. A9 CPU	Disconnect W36	A20 Disk Drive
4. A16 Rear Panel Interface	Disconnect W27	None
5. A2 Front Panel Interface	Disconnect W17	A1 Front Panel Keyboard

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Check the Operating Temperature

The temperature sensing circuitry inside the A15 preregulator may be shutting down the supply. Make sure the temperature of the open air operating environment does not exceed 55° C (131° F), and that the analyzer fan is operating.

- If the fan does not seem to be operating correctly, refer to "Fan Troubleshooting" at the end of this procedure.
- If there does not appear to be a temperature problem, it is likely that A15 is faulty.

Inspect the Motherboard

If the red LED is still on after replacement or repair of A15, switch off the analyzer and inspect the motherboard for solder bridges, and other noticeable defects. Use an ohmmeter to check for shorts. The +5VD, +5VCPU, or +5VDSENSE lines may be bad. Refer to the block diagram (Figure 5-8) at the end of this chapter and troubleshoot these suspected power supply lines on the A17 motherboard.

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If the Green LEDs on A8 are not All ON

The green LEDs along the top edge of the A8 post regulator are normally on.

Flashing LEDs on A8 indicate that the shutdown circuitry on the A8 post regulator is protecting power supplies from overcurrent conditions by repeatedly shutting them down. This may be caused by supply loading on A8 or on any other assembly in the analyzer.

Remove A8, Maintain A15W1 Cable Connection

1. Switch off the analyzer.
2. Remove A8 from its motherboard connector, but keep the A15W1 cable connected to A8.
3. Remove the display power cable W14. See Figure 5-5.
4. Short A8TP2 (AGND) (see Figure 5-3) to chassis ground with a clip lead.
5. Switch on the analyzer and observe the green LEDs on A8.
   - If any green LEDs other than +5VD are still off or flashing, continue to "Check the A8 Fuses and Voltages."
   - If all LEDs are now on steadily except for the +5VD LED, the A15 preregulator and A8 post regulator are working properly and the trouble is excessive loading somewhere after the motherboard connections at A8. Continue to "Remove the Assemblies."

Check the A8 Fuses and Voltages

Check the fuses along the top edge of A8. If any A8 fuse has burned out, replace it. If it burns out again when power is applied to the analyzer, A8 or A15 is faulty. Determine which assembly has failed as follows:

1. Remove the A15W1 cable at A8. See Figure 5-5.
2. Measure the voltages at A15W1P1 (see Figure 5-6) with a voltmeter having a small probe.
3. Compare the measured voltages with those in Table 5-2.
   - If the voltages are within tolerance, replace A8.
   - If the voltages are not within tolerance, replace A15.
4. If the green LEDs are now on, the A15 preregulator and A8 post regulator are working properly and the trouble is excessive loading somewhere after the motherboard connections at A8. Continue to "Remove the Assemblies."

Remove the Assemblies

1. Switch off the analyzer.
2. Install A8. Remove the jumper from A8TP2 (AGND) to chassis ground.
3. Remove or disconnect all the assemblies listed below. See Figure 5-5. *Always switch off the analyzer before removing or disconnecting an assembly.*

   A10 digital IF
   A11 phase lock
   A12 reference
   A13 fractional-N analog

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A14 fractional-N digital
A19 graphics processor (disconnect W14, A18W1, and W20)

4. Switch on the analyzer and observe the green LEDs on A8.
   - If any of the green LEDs are off or flashing, it is not likely that any of the assemblies listed above is causing the problem. Continue to "Briefly Disable the Shutdown Circuitry."
   - If all green LEDs are now on, one or more of the above assemblies may be faulty. Continue to next step.
5. Switch off the analyzer.
6. Reconnect W14 and W20 to A19.
7. Switch on the analyzer and observe the LEDs.
   - If the LEDs are off or blinking, replace the A19 assembly.
   - If the LEDs are still on, continue to next step.
8. Switch off the analyzer.
9. Reconnect A18W1 to the A19 assembly.
10. Switch on the analyzer and observe the LEDs.
    - If the LEDs are off, replace the A18 display.
    - If the LEDs are still on, continue with the next step.
11. Switch off the analyzer.
12. Reinstall each assembly one at a time. Switch on the analyzer after each assembly is installed. The assembly that causes the green LEDs to go off or flash could be faulty.

Note It is possible, however, that this condition is caused by the A8 post regulator not supplying enough current. To check this, reinstall the assemblies in a different order to change the loading. If the same assembly appears to be faulty, replace that assembly. If a different assembly appears faulty, A8 is most likely faulty (unless both of the other assemblies are faulty).

Briefly Disable the Shutdown Circuitry

In this step, you shutdown the protective circuitry is disabled for a short time, and the supplies are forced on (including shorted supplies) with a 100% duty cycle.

Caution Damage to components or to circuit traces may occur if A8TP4 (SDIS) is shorted to chassis ground for more than a few seconds while supplies are shorted.

1. Connect A8TP4 (SDIS) to chassis ground with a jumper wire.
2. Switch on the analyzer and note the signal mnemonics and test points of any LEDs that are off. *Immediately remove the jumper wire.*
3. Refer to the block diagram (Figure 5-8) at the end of this chapter and do the following:
   - Note the mnemonics of any additional signals that may connect to any A8 test point that showed a fault in the previous step.

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- Cross reference all assemblies that use the power supplies whose A8 LEDs went out when A8TP4 (SDIS) was connected to chassis ground.

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- Make a list of these assemblies.
- Delete the following assemblies from your list as they have already been verified earlier in this section.

  A10 digital IF
  A11 phase lock
  A12 reference
  A13 fractional-N analog
  A14 fractional-N digital
  A18 display
  A19 graphics processor

4. Switch off the analyzer.
5. Of those assemblies that are left on the list, remove or disconnect them from the analyzer one at a time. Table 5-4 shows the best order in which to remove them, sorting them from most to least accessible. Table 5-4 also lists any associated assemblies that are supplied by the assembly that is being removed. After each assembly is removed or disconnected switch on the analyzer and observe the LEDs.

Note

- *Always switch off the analyzer before removing or disconnecting assemblies.*
- When extensive disassembly is required, refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
- Refer to Chapter 13, "Replaceable Parts," to identify specific cables and assemblies that are not shown in this chapter.

- If all the LEDs light, the assembly (or one receiving power from it) that allows them to light is faulty.
- If the LEDs are still not on steadily, continue to "Inspect the Motherboard."

Table 5-4. Recommended Order for Removal/Disconnection

Assembly To Remove	Removal or Disconnection Method	Other Assemblies that Receive Power from the Removed Assembly
1. A3 Source	Remove from Card Cage	None
2. A7 Pulse Generator	Remove from Card Cage	None
3. A4 R Sampler	Remove from Card Cage	None
4. A5 A Sampler	Remove from Card Cage	None
5. A6 B Sampler	Remove from Card Cage	None
6. A9 CPU	Disconnect W35 and W36	A20 Disk Drive
7. A2 Front Panel Interface	Disconnect W17	A1 Front Panel Keyboard
8. A16 Rear Panel Interface	Disconnect W27	None

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Inspect the Motherboard

Inspect the A17 motherboard for solder bridges and shorted traces. In particular, inspect the traces that carry the supplies whose LEDs faulted when A8TP4 (SDIS) was grounded earlier.

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Error Messages

Three error messages are associated with the power supplies functional group. They are shown here.

- `POWER SUPPLY SHUT DOWN!`

  One or more supplies on the A8 post regulator assembly is shut down due to one of the following conditions: overcurrent, overvoltage, or undervoltage. Refer to "If the Red LED on A15 is ON" earlier in this procedure.

- `POWER SUPPLY HOT`

  The temperature sensors on the A8 post regulator assembly detect an overtemperature condition. The regulated power supplies on A8 have been shut down.

  Check the temperature of the operating environment; it should not be greater than +55 °C (131 °F). The fan should be operating and there should be at least 15 cm (6 in) spacing behind and all around the analyzer to allow for proper ventilation.

- `PROBE POWER SHUT DOWN!`

  The front panel RF probe biasing supplies are shut down due to excessive current draw. These supplies are +15VPP and −12.6VPP, both supplied by the A8 post regulator. +15VPP is derived from the +15 V supply. −12.6VPP is derived from the −12.6 V supply.

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Refer to Figure 5-7 and carefully measure the power supply voltages at the front panel RF probe connectors.

Figure PROBE5 here.

Figure 5-7. Front Panel Probe Power Connector Voltages

1. If the correct voltages are present, troubleshoot the probe.
2. If the voltages are not present, check the +15 V and −12.6 V green LEDs on A8.
   - If the LEDs are on, there is an open between the A8 assembly and the front panel probe power connectors. Put A8 onto an extender board and measure the voltages at the following pins:

A8P2 pins 6 and 36	−12.6 V
A8P2 pins 4 and 34	+15 V

   - If the LEDs are off, continue with "Check the Fuses and Isolate A8."

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Check the Fuses and Isolate A8

Check the fuses associated with each of these supplies near the A8 test points. If these fuses keep burning out, a short exists. Try isolating A8 by removing it from the motherboard connector, but keeping the cable A15W1 connected to A8J2. Connect a jumper wire from A8TP2 to chassis ground.

- If either the +15 V or −12.6 V fuse blows, or the associated green LEDs do not light, replace A8.
- If the +15 V and −12.6 V green LEDs light, troubleshoot for a short between the motherboard connector pins XA8P2 pins 6 and 36 (−12.6 V) and the front panel probe power connectors. Also check between motherboard connector pins XA8P2 pins 4 and 34 (+15 V) and the front panel probe power connectors.

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Fan Troubleshooting

Fan Speeds

The fan speed varies depending upon temperature. It is normal for the fan to be at high speed when the analyzer is just switched on, and then change to low speed when the analyzer is cooled.

Check the Fan Voltages

If the fan is dead, refer to the A8 post regulator block diagram (Figure 5-8) at the end of this chapter. The fan is driven by the +18 V and −18 V supplies coming from the A15 preregulator. Neither of these supplies is fused.

The −18 V supply is regulated on A8 in the fan drive block, and remains constant at approximately −14 V. It connects to the A17 motherboard via pin 32 of the A8P1 connector.

The +18 V supply is regulated on A8 but changes the voltage to the fan, depending on airflow and temperature information. Its voltage ranges from approximately −1.0 V to +14.7 V, and connects to the A17 motherboard via pin 31 of the A8P1 connector.

Measure the voltages of these supplies while using an extender board to allow access to the PC board connector, A8P1.

Short A8TP3 to Ground

If there is no voltage at A8P1 pins 31 and 32, switch off the analyzer. Remove A8 from its motherboard connector (or extender board) but keep the cable A15W1 connected to A8 (see Figure 5-5). Connect a jumper wire between A8TP3 and chassis ground. Switch on the analyzer.

- If all the green LEDs on the top edge of A8 light (except +5 VD), replace the fan.
- If other green LEDs on A8 do not light, refer to "If the Green LEDs on A8 are not All ON" earlier in this procedure.

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Intermittent Problems

PRESET states that appear spontaneously (without pressing PRESET) typically signal a power supply or A9 CPU problem. Since the A9 CPU assembly is the easiest to substitute, do so. If the problem ceases, replace the A9. If the problem continues, replace the A15 preregulator assembly.

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(oversized art) /08753/90261/egs/sg629d.hpg

Figure 5-8. Power Supply Block Diagram

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7

Source Troubleshooting

Use this procedure only if you have read Chapter 4, “Start Troubleshooting Here.” This chapter is divided into two troubleshooting procedures for the following problems:

- Incorrect power levels: Perform the “Power” troubleshooting checks.
- Phase lock error: Perform the “Phase Lock Error” troubleshooting checks.

The source group assemblies consist of the following:

- A3 source
- A4 sampler/mixer
- A7 pulse generator
- A11 phase lock
- A12 reference
- A13 fractional-N (analog)
- A14 fractional-N (digital)

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Assembly Replacement Sequence

The following steps show the sequence to replace an assembly in an HP 8753D Network Analyzer.

1. Identify the faulty group. Refer to Chapter 4, "Start Troubleshooting Here." Follow up with the appropriate troubleshooting chapter that identifies the faulty assembly.
2. Order a replacement assembly. Refer to Chapter 13, "Replaceable Parts."
3. Replace the faulty assembly and determine what adjustments are necessary. Refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
4. Perform the necessary adjustments. Refer to Chapter 3, "Adjustments and Correction Constants."
5. Perform the necessary performance tests. Refer to Chapter 2, "System Verification and Performance Tests."

Before You Start Troubleshooting

Make sure all of the assemblies are firmly seated. Also make sure that input R has a signal of at least −35 dBm (about 0.01 Vp-p into 50 ohms) at all times to maintain phase lock.

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Power

If the analyzer output power levels are incorrect but no phase lock error is present, perform the following checks in the order given:

1. Source Default Correction Constants (Test 44)

To run this test, press [PRESET] [SYSTEM] SERVICE MENU TESTS [44] [X1] EXECUTE TEST. When complete, DONE should appear on the analyzer display. Use a power meter to verify that source power can be controlled and that the power level is approximately correct. If the source passes these checks, proceed with step 2. However, if FAIL appears on the analyzer display, or if the analyzer fails the checks, replace the source.

2. RF Output Power Correction Constants (Test 47)

Follow the instructions for this procedure given in Chapter 3, "Adjustments and Correction Constants." The procedure is complete when "DONE" appears on the analyzer display. Use a power meter to verify that power levels are now correct. If power levels are not correct, or if the analyzer fails the routine, proceed with step 3.

3. Sampler Magnitude and Phase Correction Constants (Test 53)

Follow the instructions for this procedure given in Chapter 3, "Adjustments and Correction Constants." The procedure is complete when "DONE" appears on the analyzer display. Next, repeat step 2. If the analyzer fails the routine in step 2, replace the source.

If the analyzer fails the routine in step 3, replace the source.

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Phase Lock Error

Figure PLE7 here.

Figure 7-1. Basic Phase Lock Error Troubleshooting Equipment Setup

Troubleshooting tools include the assembly location diagram and phase lock diagnostic tools. The assembly location diagram is on the underside of the instrument top cover. The diagram shows major assembly locations and RF cable connections. The phase lock diagnostic tools are explained in the "Source Group Troubleshooting Appendix" and should be used to troubleshoot phase lock problems. The equipment setup shown in Figure 7-1 can be used throughout this chapter.

Phase Lock Loop Error Message Check

Phase lock error messages may appear as a result of incorrect pretune correction constants. To check this possibility, perform the pretune correction constants routine.

The four phase lock error messages, listed below, are described in the "Source Group Troubleshooting Appendix" at the end of this chapter.

- `NO IF FOUND: CHECK R INPUT LEVEL`
- `NO PHASE LOCK: CHECK R INPUT LEVEL`
- `PHASE LOCK CAL FAILED`
- `PHASE LOCK LOST`

1. Connect the power splitter, RF cable and attenuator to inputs A and R as shown in Figure 7-1.
2. Make sure the A9 CC Jumper is in the ALTER position.
   a. Remove the power line cord from the analyzer.
   b. Set the analyzer on its side.
   c. Remove the two corner bumpers from the bottom of the instrument with a T-15 TORX screwdriver.

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d. Loosen the captive screw on the bottom cover's back edge.

e. Slide the cover toward the rear of the instrument.

f. Move the jumper to the ALT position as shown in Figure 7-2.

g. Replace the bottom cover, corner bumpers, and power cord.

Figure JUMP7 here.

Figure 7-2. Jumper Positions on the A9 CPU

3. Switch on the analyzer and press [PRESET] [SYSTEM] SERVICE MENU TESTS [46] [X1] EXECUTE TEST to generate new analog bus correction constants. Then press [PRESET] [SYSTEM] SERVICE MENU TESTS [45] [X1] EXECUTE TEST to generate default pretune correction constants.

   Press [PRESET] [SYSTEM] SERVICE MENU TESTS [48] [X1] EXECUTE TEST YES to generate new pretune correction constants.

Note Always press [PRESET] before and after performing an adjustment test.

---

4. Press [PRESET] and observe the analyzer display:

   - No error message: restore the A9 CC jumper to the NRM position. Then refer to "Post-Repair Procedures" in Chapter 14 to verify operation.
   - Error message visible: continue with "A4 Sampler/Mixer Check."

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A4 Sampler/Mixer Check

The A4, A5, and A6 (R, A and B) sampler/mixers are identical. Any sampler can be used to phase lock the source. To eliminate the possibility of a bad R sampler, follow this procedure:

1. Connect the power splitter, RF cable and attenuator to inputs A (or B) and R as shown in Figure 7-1.
2. Remove the W8 cable (A11J1 to A4) from the R-channel sampler (A4) and connect it to either the A-channel sampler (A5) or the B-channel sampler (A6), depending on which one you selected in step 1. Refer to Figure 7-3.

Figure SAMMIX7 here.

Figure 7-3. Sampler/Mixer to Phase Lock Cable Connection Diagram

3. If you connected W8 to:
   - **A5**, press (MEAS) A/R
   - **A6**, press (MEAS) B/R
4. Ignore the displayed trace, but check for phase lock error messages. If the phase lock problem persists, the R-channel sampler is *not* the problem.

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A3 Source and A11 Phase Lock Check

This procedure checks the source and part of the phase lock assembly. It opens the phase-locked loop and exercises the source by varying the source output frequency with the A11 pretune DAC.

Note If the analyzer failed internal test 48, default pretune correction constants were stored which may result in a constant offset of several MHz. Regardless, continue with this procedure.

Note Use a spectrum analyzer for problems above 100 MHz.

1. Connect the oscilloscope or spectrum analyzer as shown in Figure 7-1. (Set the oscilloscope input impedance to 50 ohms.)
2. Press (PRESET) (SYSTEM) `SERVICE MENU` `SERVICE MODES` `SRC ADJUST MENU` `SRC TUNE ON` `SRC TUNE FREQ` to activate the source tune (SRC TUNE) service mode.
3. Use the front panel knob or front panel keys to set the pretune frequency to 300 kHz, 30 MHz, and 40 MHz. Verify the signal frequency on the oscilloscope.

Note In SRC TUNE mode, the source output frequency changes in 1 to 2 MHz increments and should be 1 to 6 MHz above the indicated output frequency.

4. Check for the frequencies indicated by Table 7-1.

Table 7-1. Output Frequency in SRC Tune Mode

Setting	Observed Frequency
300 kHz	1.3 to 6.3 MHz
30 MHz	31 to 36 MHz
40 MHz	41 to 46 MHz

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5. The signal observed on an oscilloscope should be as solid as the signal in Figure 7-4.

Figure WAVE7 here.

Figure 7-4. Waveform Integrity in SRC Tune Mode

6. The signal observed on the spectrum analyzer will appear jittery as in Figure 7-5 (b), not solid as in Figure 7-5 (a). This is because in SRC TUNE mode the output is not phase locked.

Figure PLCOMP7 here.

Figure 7-5. Phase Locked Output Compared to Open Loop Output in SRC Tune Mode

7. Press (MENU) POWER to vary the power and check for corresponding level changes on the test instrument. (A power change of 20 dB will change the voltage observed on the oscilloscope by a factor of ten.)
8. Note the results of the frequency and power changes:
   - If the frequency and power output changes are correct, skip ahead to "A12 Reference Check" located in this chapter.

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- If the frequency changes are not correct, continue with "YO Coilk Drive Check with Analog Bus."
- If the power output changes are not correct, check analog bus node 3.

  a. Press (SYSTEM) SERVICE MENU ANALOG BUS ON (MEAS) S PARAMETERS ANALOG IN Aux Input (FORMAT) MORE REAL (3) (X1).

  b. Press (MARKER) (2) (G/n). The marker should read approximately 434 mU.

  c. Press (MARKER) (4) (G/n). The marker should read approximately 646 mU.

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Note If the analog bus is not functional, perform the "YO Drive Coil Check with Oscilloscope" test.

1. Press (PRESET) (SYSTEM) SERVICE MENU ANALOG BUS ON SERVICE MODES SOURCE PLL OFF (MEAS) S PARAMETERS ANALOG IN Aux Input COUNTER: ANALOG BUS.
2. Then press (16) (X1) (FORMAT) MORE REAL (SCALE REF) AUTOSCALE. This keystroke sequence lets you check the pretune DAC and the A11 output to the YO coil drive by monitoring the 1 V/GHz signal at analog bus node 16.
3. Compare the waveform to Figure 7-6. If the waveform is incorrect, the A11 phase lock assembly is faulty.

Figure ABN7 here.

Figure 7-6. 1V/GHz at Analog Bus Node 16 with Source PLL Off.

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Note Use the large extender board for easy access to the voltage points. The extender board is included with the HP 8753 Tool Kit. See Chapter 13, "Replaceable Parts," for part numbers and ordering information.

1. Connect oscilloscope probes to A11P1-1 and A11P1-2. The YO coil drive signal is actually two signals whose voltage difference drives the coil.
2. Press PRESET SYSTEM SERVICE MENU SERVICE MODES SOURCE PLL OFF to operate the analyzer in a swept open loop mode.
3. Monitor the two YO coil drive lines. In source tune mode the voltage difference should vary from approximately 3.5 to 5.0 volts as shown in Figure 7-7.
   - If the voltages are not correct, replace the faulty A11 assembly.
   - If the output signals from the A11 assembly are correct, replace the faulty A3 source assembly.
   - If neither the A11, nor the A3 assembly is faulty, continue with the next check.

Figure VDIFF7 here.

Figure 7-7. YO– and YO+ Coil Drive Voltage Differences with SOURCE PLL OFF

A12 Reference Check

The signals are evaluated with pass/fail checks. The most efficient way to check the A12 frequency reference signals is to use the analog bus while referring to Table 7-2.

Alternatively, you can use an oscilloscope, while referring to Table 7-3 and Figure 7-8 through Figure 7-14. If any of the observed signals differ from the figures, there is a 90% probability that the A12 assembly is faulty. Either consider the A12 assembly defective or perform the "A12 Digital Control Signals Check."

Both of these procedures are described below.

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Analog Bus Method

1. Press [PRESET] [SYSTEM] SERVICE MENU ANALOG BUS ON [MEAS] S PARAMETERS ANALOG IN Aux Input ANALOG BUS to switch on the analog bus and its counter.
2. Press [21] [X1] to count the frequency of the 100 kHz signal.
3. Press [MENU] CW FREQ [500] [k/m]. Verify that the counter reading (displayed on the analyzer next to cnt:) matches the corresponding 100 kHz value for the CW frequency. (Refer to Table 7-2.)
4. Verify the remaining CW frequencies, comparing the counter reading with the value in Table 7-2:
   - Press [2] [M/].
   - Press [50] [M/].

Table 7-2. Analog Bus Check of Reference Frequencies

CW Frequency	Analog Bus Node 21 100 kHz	Analog Bus Node 24 2nd LO	Analog Bus Node 25 PLREF
500 kHz	0.100 MHz	0.504 MHz	0.500 MHz
2 MHz	0.100 MHz	2.007 MHz	2.000 MHz
50 MHz	0.100 MHz	0.996 MHz	1.000 MHz

NOTE: The counter should indicate the frequencies listed in this table to within ±0.1%. Accuracy may vary with gate time and signal strength.

5. Press [24] [X1] to count the frequency of the 2nd LO signal.
6. Press [MENU] CW FREQ [500] [k/m]. Verify that the counter reading matches the corresponding 2nd LO value for the CW frequency. (Refer to Table 7-2.)
7. Verify the remaining CW frequencies, comparing the counter reading with the value in Table 7-2:
   - Press [2] [M/].
   - Press [50] [M/].
8. Press [25] [X1] to count the frequency of the PLREF signal.
9. Press [MENU] CW FREQ [500] [k/m]. Verify that the counter reading matches the corresponding PLREF value for the CW frequency. (Refer to Table 7-2.)
10. Verify the remaining CW frequencies, comparing the counter reading with the value in Table 7-2:
    - Press [2] [M/].
    - Press [50] [M/].
11. Check the results.
    - If all the counter readings match the frequencies listed in Table 7-2, skip ahead to"A13/A14 Fractional-N Check."

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- If the counter readings are incorrect at the 500 kHz and 2 MHz settings only, go to "FN LO at A12 Check."
- If all the counter readings are incorrect at all three CW frequencies, the counter may be faulty. Perform the "Oscilloscope Method" check of the signals described below. (If the signals are good, either the A10 or A14 assemblies could be faulty.)

Oscilloscope Method

You need not use the oscilloscope method unless the analog bus is non-functional or any of the signals fail the specifications listed in Table 7-2.

If the analog bus is non-functional or the previous check has revealed questionable signals, observe the signal(s) with an oscilloscope. Table 7-3 identifies a convenient test point and a plot for the five signals listed.

Table 7-3. A12 Reference Frequencies

Mnemonic	Signal Description	Location	See Figure	Analyzer Setting
FN100kHzREF	100 kHz Reference	A13TP5	Figure 7-8	any
REF	Phase Lock Reference	A11TP1 Pin 9	Figure 7-9	≥16 MHz CW
REF	Phase Lock Reference	A11TP1 Pin 9	Figure 7-10	5 MHz CW
FN LO*	Fractional-N LO	A14J2	Figure 7-11	10 MHz CW
4 MHz REF	4 MHz Reference	A12TP9	Figure 7-12	any
2ND LO+/–	Second LO	A12P1-2,4	Figure 7-13	≥16 MHz CW
2ND LO+/–	Second LO	A12P1-2,4	Figure 7-14	14 MHz CW

* Not an A12 signal, but required for A12 lowband operation.

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100 kHz Pulses

The 100 kHz pulses are very narrow and typically 1.5 V in amplitude. You may have to increase the oscilloscope intensity to see these pulses. (See Figure 7-8.)

Figure SHARP7 here.

Figure 7-8. Sharp 100 kHz Pulses at A13TP5 (any frequency)

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PLREF Waveforms

REF Signal At A11TP1 Pin 9. REF is the buffered PLREF+ signal. The 1st IF is phase locked to this signal. Use an oscilloscope to observe the signal at the frequencies noted in Figure 7-9 and Figure 7-10.

High Band REF Signal. In high band the REF signal is a constant 1 MHz square wave as indicated by Figure 7-9.

Figure HBSIG7 here.

Figure 7-9. High Band REF Signal ($\geq$16 MHz CW)

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Low Band REF Signal. In low band this signal follows the frequency of the RF output signal. Figure 7-10 illustrates a 5 MHz CW signal.

Figure REFSIG7 here.

Figure 7-10. REF Signal at A11TP9 (5 MHz CW)

- If REF looks good, skip ahead to "4 MHz Reference Signal."
- If REF is bad in low band, continue with "FN LO at A12 Check."

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FN LO at A12 Check

1. Use an oscilloscope to observe the FN LO from A14 at the cable end of A14J2. Press (PRESET) (SYSTEM) SERVICE MENU SERVICE MODES FRACN TUNE ON to switch on the fractional-N service mode.
2. Use the front panel knob to vary the frequency from 30 to 60 MHz. The signal should appear similar to Figure 7-11. The display will indicate 10 to 60.8 MHz.
   a. If the FN LO signal is good, the A12 assembly is faulty.
   b. If the FN LO signal is not good, skip ahead to "A13/A14 Fractional-N Check."

Figure LOWAVE7 here.

Figure 7-11. Typical FN LO Waveform at A12J1

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4 MHz Reference Signal

This reference signal is used to control the receiver. If faulty, this signal can cause apparent source problems because the CPU uses receiver data to control the source. At A12TP9 it should appear similar to Figure 7-12.

Figure REFS7 here.

Figure 7-12. 4 MHz Reference Signal at A12TP9 (Preset)

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2ND LO Waveforms

The 2nd LO signals appear different in phase and shape at different frequencies. Refer to Table 7-3 for convenient test points.

90 Degree Phase Offset of 2nd LO Signals in High Band. In high band, the 2nd LO is 996 kHz. As indicated by Figure 7-13, the 2nd LO actually consists of two signals 90 degrees out of phase.

Figure PHASEO7 here.

Figure 7-13. 90 Degree Phase Offset of High Band 2nd LO Signals (≥16 MHz CW)

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In-Phase 2nd LO Signals in Low Band. The 2nd LO signals in low band, as shown in Figure 7-14, are not phase shifted. In low band these signals track the RF output with a 4 kHz offset.

Figure INPHAS7 here.

Figure 7-14. In-Phase Low Band 2nd LO Signals (14 MHz CW)

If any of the signals of Table 7-2 are incorrect, the probability is 90% that the A12 assembly is faulty. Either consider the A12 assembly faulty or perform the "A12 Digital Control Signals Check" described below.

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A12 Digital Control Signals Check

Several digital control signals must be functional for the A12 assembly to operate properly. Check the control lines listed in Table 7-4 with the oscilloscope in the high input impedance setting.

Table 7-4. A12-Related Digital Control Signals

Mnemonic	Signal Description	Location	See Figure	Analyzer Setting
L ENREF	L=Reference Enable	A12P2-16	Figure 7-15	Preset
L HB	L=High Band	A12P2-32	Figure 7-16	Preset
L LB	L=Low Band	A12P1-23	Figure 7-16	Preset

L ENREF Line. This is a TTL signal. To observe it, trigger on the negative edge. In preset state, the signal should show activity similar to Figure 7-15.

Figure ENREF7 here.

Figure 7-15. L ENREF Line at A12P2-16 (Preset)

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L HB and L LB Lines. These complementary signals toggle when the instrument switches from low band to high band as illustrated by Figure 7-16.

Figure COMPSIG7 here.

Figure 7-16. Complementary L HB and L LB Signals (Preset)

If all of the digital signals appeared good, the A12 assembly is faulty.

A13/A14 Fractional-N Check

Use the analog bus or an oscilloscope to check the A14 VCO's ability to sweep from 30 MHz to 60 MHz. The faster analog bus method should suffice unless problems are detected.

Fractional-N Check with Analog Bus

1. Press (PRESET) (SYSTEM) SERVICE MENU ANALOG BUS ON (MEAS) S PARAMETERS ANALOG IN Aux Input FRAC N to switch on the analog bus and the fractional-N counter.
2. Then press (MENU) (CW FREQ) to set the analyzer to CW mode.
3. Set the instrument as indicated in Table 7-5 and see whether the VCO generates the frequencies listed.

Table 7-5. VCO Range Check Frequencies

Instrument Setting	Counter Reading
31 MHz	30 ±0.030 MHz
60.999999 MHz	60 ±0.060 MHz

4. Check the counter reading at the frequencies indicated.
   - If the readings are within the limits specified, the probability is greater than 90% that the fractional-N assemblies are functional. Either skip ahead to the "A7 Pulse Generator Check," or perform the more conclusive "A14 VCO Range Check with Oscilloscope" described below.

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- If the readings fail the specified limits, perform the "A14 VCO Exercise."

A14 VCO Range Check with Oscilloscope

1. Remove the W9 HI OUT cable (A14J1 to A7) from the A7 assembly and connect it to an oscilloscope set for 50 ohm input impedance. Switch on the analyzer.
2. Press PRESET SYSTEM SERVICE MENU SERVICE MODES FRACN TUNE ON to activate the FRACN TUNE service mode. See Chapter 10, "Service Key Menus and Error Messages," for more information on the FRACN TUNE mode.
3. Vary the fractional-N VCO frequency with the front panel knob and check the signal with the oscilloscope. The waveform should resemble Figure 7-17, Figure 7-18, and Figure 7-19.

   If the fractional-N output signals are correct, continue source troubleshooting by skipping ahead to "A7 Pulse Generator Check."

Figure HO107 here.

Figure 7-17. 10 MHz HI OUT Waveform from A14J1

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Figure HO257 here.

Figure 7-18. 25 MHz HI OUT Waveform from A14J1

Figure HO607 here.

Figure 7-19. 60 MHz HI OUT Waveform from A14J1

A14 VCO Exercise

The nominal tuning voltage range of the VCO is +10 to −5 volts. When the analyzer is in operation, this voltage is supplied by the A13 assembly. This procedure substitutes a power supply for the A13 assembly to check the frequency range of the A14 VCO.

1. Switch off the analyzer and remove the A13 assembly.
2. Put the A14 assembly on an extender board and switch on the instrument.
3. Prepare to monitor the VCO frequency, either by:
   - Activating the analog bus and setting the internal counter to the FRACN node, or

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- Connecting an oscilloscope to A14J2 (labeled LO OUT) and looking for waveforms similar to Figure 7-20.

Figure LOWAV27 here.

Figure 7-20. LO OUT Waveform at A14J2

4. Vary the voltage at A14TP14 from +10 to −5 volts either by:
   - Connecting an appropriate external power supply to A14TP14, or
   - First jumping the +15 V internal power supply from A8TP8 to A14TP14 and then jumping the −5.2 V supply from A8TP10 to A14TP14.
5. Confirm that the VCO frequency changes from approximately 30 MHz or less to 60 MHz or more.
6. If this procedure produces unexpected results, the A14 assembly is faulty.
7. If this procedure produces the expected results, continue with the "A14 Divide-by-N Circuit Check."

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Note The A13 assembly should still be out of the instrument and the A14 assembly on an extender board.

1. Ground A14TP14 and confirm (as in the A14 VCO Exercise) that the VCO oscillates at approximately 50 to 55 MHz.
2. Put the analyzer in CW mode (to avoid relock transitions) and activate the FRACN TUNE service mode.
3. Connect an oscilloscope to A14J3 and observe the output.
4. With the FRACN TUNE service feature, vary the frequency from 30 MHz to 60.8 MHz.
5. The period of the observed signal should vary from 5.5 μs to 11 μs.
   - If this procedure produces unexpected results, the A14 assembly is faulty.
   - If this procedure produces the expected results, perform the "A14-to-A13 Digital Control Signals Check."
6. Remember to replace the A13 assembly.

A14-to-A13 Digital Control Signals Check.

The A14 assembly generates a TTL cycle start (CST) signal every 10 microseconds. If the VCO is oscillating and the CST signal is not detectable at A14TP3, the A14 assembly is non-functional.

Use the CST signal as an external trigger for the oscilloscope and monitor the signals in Table 7-6. Since these TTL signals are generated by A14 to control A13, check them at A13 first. Place A13 on the large extender board. The signals should look similar to Figure 7-21. If these signals are good, the A13 assembly is defective.

Table 7-6. A14-to-A13 Digital Control Signal Locations

Mnemonic	A13 Location	A14 Location
CST	none	TP3
L FNHOLD	P2-2	P2-2
FNBIAS	P2-5	P2-5
API1	P2-32	P2-32
API2	P2-3	P2-3
API3	P2-34	P2-34
API4	P2-4	P2-4
API5	P2-35	P2-35
NLATCH	P1-28	P1-58

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Figure DCS7 here.

Figure 7-21. A14 Generated Digital Control Signals

H MB Line. This signal is active during the 16 MHz to 31 MHz sweep. The upper trace of Figure 7-22 shows relative inactivity of this signal during preset condition. The lower trace shows its status during a 16 MHz to 31 MHz sweep with inactivity during retrace only.

Figure MBS7 here.

Figure 7-22. H MB Signal at A14P1-5 (Preset and 16 MHz to 31 MHz Sweep)

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A7 Pulse Generator Check

The pulse generator affects phase lock in high band only. It can be checked with either a spectrum analyzer or an oscilloscope.

A7 Pulse Generator Check with Spectrum Analyzer

1. Remove the A7-to-A6 SMB cable (W7) from the A7 pulse generator assembly. Set the analyzer to generate a 16 MHz CW signal. Connect the spectrum analyzer to the A7 output connector and observe the signal. The A7 comb should resemble the spectral display in Figure 7-23.

Figure PGO7 here.

Figure 7-23. Pulse Generator Output

2. If the analyzer malfunction relates to a particular frequency or range, look more closely at the comb tooth there. Adjust the spectrum analyzer span and bandwidth as required. Even at 3 GHz, the comb should look as clean as Figure 7-24. For Option 006 instruments at 6 GHz the comb tooth level should be approximately −46 dBm.

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Figure COMB7 here.

Figure 7-24. High Quality Comb Tooth at 3 GHz

3. If the signal at the A7 output is good, check the A7-to-A4 cable.
4. If the signal is not as clean as Figure 7-24, observe the HI OUT input signal to the A7 assembly.
   - On the network analyzer, press SYSTEM SERVICE MENU SERVICE MODES PLL AUTO OFF. Otherwise do not readjust the instrument. Remove the A14-to-A7 SMB cable (W9) from the A7 pulse generator assembly.(CW 16 MHz)
   - Set the spectrum analyzer to a center frequency of 45 MHz and a span of 30 MHz. Connect it to the A14-to-A7 cable still attached to the A14 assembly. Narrow the span and bandwidth to observe the signal closely.
5. If the HI OUT signal is as clean as Figure 7-25, the A7 assembly is faulty.

   Otherwise, check the A14-to-A7 cable or recheck the A13/A14 fractional-N as described ahead.

Rechecking the A13/A14 Fractional-N

Some phase lock problems may result from phase noise problems in the fractional-N loop. To troubleshoot this unusual failure mode, do the following:

1. Set the network analyzer at 60 MHz in the FRACN TUNE mode.
2. Use a spectrum analyzer, to examine the HI OUT signal from the A14 assembly. The signal should appear as clean as Figure 7-25. The comb shape may vary from pulse generator to pulse generator.

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Figure STABHO7 here.

Figure 7-25. Stable HI OUT Signal in FRACN TUNE Mode

A7 Pulse Generator Check with Oscilloscope

Perform this check if a spectrum analyzer is not available.

1. Remove the A4-to-A11 SMB cable from the A4 (R) sampler/mixer output. Connect the oscilloscope to the A4 output (1st IF).
2. Activate the FRACN TUNE service mode and tune the fractional-N to 50 MHz. Press (SYSTEM) SERVICE MENU SERVICE MODES FRACN TUNE ON (50) (M/).
3. Activate the SRC TUNE service mode of the analyzer and tune the source to 50 MHz. Press SRC TUNE ON SRC TUNE FREQ (50) (M/).
4. Set the SRC TUNE frequency to those listed in Table 7-7 and observe the 1st IF waveforms. They should appear similar to Figure 7-26.
   - If the signals observed are proper, continue with "A11 Phase Lock Check."
   - If the signals observed are questionable, use a spectrum analyzer to perform the preceding "A7 Pulse Generator Check with Spectrum Analyzer."

Table 7-7. 1st IF Waveform Settings

SRC TUNE	FRACN	Harmonic	1st IF
50 MHz	50 MHz	1	1 to 6 MHz
250 MHz	50 MHz	5	1 to 6 MHz
2550 MHz	50 MHz	51	1 to 6 MHz

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Figure IFWAVE7 here.

Figure 7-26. Typical 1st IF Waveform in FRACN TUNE/SRC TUNE Mode

A11 Phase Lock Check

At this point, the A11 phase lock assembly appears to be faulty (its inputs should have been verified already). Nevertheless, you may elect to use the phase lock diagnostic routines or check the relevant signals at the assembly itself for confirmation.

Note If external source mode is the only operating mode with phase lock problems, replace the A11 phase lock assembly.

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Phase Lock Check with PLL DIAG

Refer to "Phase Lock Diagnostic Tools" in "Source Group Troubleshooting Appendix" at the end of this chapter for an explanation of the error messages and the diagnostic routines. Follow the steps there to determine in which state the phase lock is lost.

- If `NO IF FOUND` is displayed, confirm that the analog bus is functional and perform the "Source Pretune Correction Constants (Test 48)" as outlined in Chapter 3, "Adjustments and Correction Constants."
- If phase lock is lost in the ACQUIRE state, the A11 assembly is faulty.
- If phase lock is lost in the TRACK state, troubleshoot source phase lock loop components other than the A11 assembly.

Phase Lock Check by Signal Examination

To confirm that the A11 assembly is receiving the signals required for its proper operation, perform the following steps:

1. Place the A11 assembly on the large extender board.
2. Switch on the analyzer and press (PRESET).
3. Check for the signals listed in Table 7-8.

Table 7-8. A11 Input Signals

Mnemonic	I/O	Access	See Figure	Notes
FM COIL –	O	A11P1-3,33	Figure 7-27	Aids YO COIL in setting YIG. Press (PRESET) (MENU) NUMBER OF POINTS (3) (x1) to observe this signal.
REF	I	A11TP9	Figure 7-9, Figure 7-10	Observe both low band and high band CW frequencies.
YO COIL +	O	A11P1-2,32	Figure 7-7	Use SOURCE PLL OFF.
YO COIL –	O	A11P1-1,31	Figure 7-7	
1ST IF	I	A11 PL IF IN	Figure 7-26	Check for 1 MHz with tee a A11 jack (not at cable end) in high band.

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Figure FMCOIL7 here.

Figure 7-27. FM Coil – Plot with 3 Point Sweep

4. If any of the input signals are not proper, refer to the overall block diagram in Chapter 4, "Start Troubleshooting Here," as an aid to trouble shooting the problem to its source.
5. If any of the output signals are not proper, the A11 assembly is faulty.

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Source Group Troubleshooting Appendix

Troubleshooting Source Problems with the Analog Bus

The analog bus can perform a variety of fast checks. However, it too is subject to failure and thus should be tested prior to use. You should have done this in Chapter 4, "Start Troubleshooting Here."

To use the analog bus to check any one of the nodes, press (PRESET) (SYSTEM) SERVICE MENU ANALOG BUS IN. Then press (MEAS) S PARAMETERS ANALOG IN Aux Input and enter the analog bus node number followed by (X1). Refer to "Analog Bus" in Chapter 10, "Service Key Menus and Error Messages," for additional information.

Phase Lock Diagnostic Tools

- error messages
- diagnostic routines

Phase Lock Error Messages

All phase lock error messages can result from improper front panel connections.

NO IF FOUND: CHECK R INPUT LEVEL means no IF was detected during pretune: a source problem. Perform the "A4 Sampler/Mixer Check."

NO PHASE LOCK: CHECK R INPUT LEVEL means the IF was not acquired after pretune: a source problem. Perform the "A4 Sampler/Mixer Check," earlier in this chapter.

PHASE LOCK CAL FAILED means that a calculation of pretune values was not successful: a source or receiver failure. Perform the "Source Pretune Correction Constants" routine as outlined in Chapter 3, "Adjustments and Correction Constants." If the analyzer fails that routine, perform the
"A4 Sampler/Mixer Check."

PHASE LOCK LOST means that phase lock was lost or interrupted before the band sweep ended: a source problem. Refer to "Phase Lock Diagnostic Routines" next to access the phase lock loop diagnostic service routine. Then troubleshoot the problem by following the procedures in this chapter.

Phase Lock Diagnostic Routines

Perform the following steps to determine at what frequencies and bands the phase lock problem occurs.

1. Press (PRESET) (SYSTEM) SERVICE MENU SERVICE MODES PLL AUTO OFF to switch off the automatic phase-locked loop. Normally, when the phase-locked loop detects lock problems, it automatically aborts the sweep and attempts to recalibrate the pretune cycle. Switching off PLL AUTO defeats this routine.
2. Press PLL DIAG ON to switch on the phase-locked loop diagnostic service mode. In this mode, the phase lock cycle and subsweep number are displayed on the analyzer display. (See "Service Modes Menu" in Chapter 10, "Service Key Menus and Error Messages," for more information.)

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3. Press PLL PAUSE to pause the phase lock sequence and determine where the source is trying to tune when lock is lost.

Refer to "Source Theory Overview" in Chapter 12, "Theory of Operation," for additional information regarding band related problems. Then use the procedures in this chapter to check source functions at specific frequencies.

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8

Receiver Troubleshooting

Use this procedure only if you have read Chapter 4, "Start Troubleshooting Here." Follow the procedures in the order given, unless instructed otherwise.

The receiver group assemblies consist of the following:

- A4/5/6 sampler/mixer assemblies
- A10 digital IF assembly

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Assembly Replacement Sequence

The following steps show the sequence to replace an assembly in an HP 8753D Network Analyzer.

1. Identify the faulty group. Refer to Chapter 4, "Start Troubleshooting Here." Follow up with the appropriate troubleshooting chapter that identifies the faulty assembly.
2. Order a replacement assembly. Refer to Chapter 13, "Replaceable Parts."
3. Replace the faulty assembly and determine what adjustments are necessary. Refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
4. Perform the necessary adjustments. Refer to Chapter 3, "Adjustments and Correction Constants."
5. Perform the necessary performance tests. Refer to Chapter 2, "System Verification and Performance Tests."

Receiver Failure Error Messages

The error messages which indicate receiver group problems may be caused by the instrument itself or by external devices or connections. Remember that RF OUT must be connected to input R to maintain phase lock (unless internal cables are moved). The following three error messages share the same description.

- CAUTION: OVERLOAD ON INPUT A, POWER REDUCED
- CAUTION: OVERLOAD ON INPUT B, POWER REDUCED
- CAUTION: OVERLOAD ON INPUT R, POWER REDUCED

If any of the above error messages appear, you have exceeded approximately +3 dBm at one of the input ports. The RF output power is automatically turned off. The annotation P appears in the left margin of the display to indicate that the power trip function has been activated. To reset the analyzer's power and regain control of the power level, do the following:

1. Remove any devices under test which may have contributed excess power to the input.
2. Connect the equipment as shown in Figure 8-1.
3. Press (MENU) POWER (0) (X1) POWER TRIP OFF to return the power level to the preset state.
   - If the power trip indicator (P) does not reappear, reconfigure the test setup to keep input power levels at 0 dBm or below.
   - If P reappears, continue with "Check the R, A, and B inputs."

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Check the R, A, and B inputs

Good inputs produce traces similar to Figure 8-2 in terms of flatness. To examine each input trace, do the following:

1. Connect the equipment as shown in Figure 8-1. (The thru cable is HP part number 8120-4781.)

Figure SETUP8 here.

Figure 8-1. Equipment Setup

2. Check the flatness of the input R trace by comparing it with the trace in Figure 8-2.

Note The R trace will be 20 dB lower than the A and B trace due to the attenuator on the R input. The flatness of the trace, however, should resemble that of the A and B input traces.

Press PRESET MEAS R SCALE REF AUTO SCALE.

3. Check the flatness of the input A trace by comparing it with the trace in Figure 8-2.

   Press MEAS A.

4. Check the flatness of the input B trace by comparing it with the trace in Figure 8-2.

   Move the A input cable to the B input and press B.

   - If none of the input traces resembles Figure 8-2, continue with "Troubleshooting When All Inputs Look Bad."
   - If at least one input trace resembles Figure 8-2, continue with "Troubleshooting When One or More Inputs Look Good."

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Figure GOOD8 here.

Figure 8-2. Typical Good Trace

Troubleshooting When All Inputs Look Bad

Run Internal Tests 18 and 17

1. Press [PRESET] [SYSTEM] SERVICE MENU TESTS [18] [X1] EXECUTE TEST to run the ADC offset.
2. Then, when the analyzer finishes test 18, press [17] [X1] EXECUTE TEST to run the ADC linearity test.

If either of these tests FAIL, the A10 assembly is probably faulty. This can be confirmed by checking the 4 MHz signal and substituting the A10 assembly or checking the signals listed in Table 8-1.

Check 2nd LO

Check the 2nd LO signal. Refer to the "A12 Reference Check" section of Chapter 7, "Source Troubleshooting" for analog bus and oscilloscope checks of the 2nd LO and waveform illustrations.

- If the analyzer passes the checks, continue to "Check the 4 MHz REF Signal."
- If the analyzer fails the checks, perform the high/low band transition adjustment. If the adjustment fails, or brings no improvement, replace A12.

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Check the 4 MHz REF Signal

1. Connect a cable from the RF OUT to input R.
2. Press [PRESET].
3. Use an oscilloscope to observe the 4 MHz reference signal at A10P2-6.
   - If the signal does not resemble Figure 8-3, troubleshoot the signal source (A12P2-36) and path.
   - If the signal is good, the probability is greater than 90% that the A10 assembly is faulty. For confirmation, perform "Check A10 by Substitution or Signal Examination."

Figure WAVE8 here.

Figure 8-3. 4 MHz REF Waveform

Check A10 by Substitution or Signal Examination

If the 4 MHz REF signal is good at the A10 digital IF assembly, check the A10 assembly by one of the following methods:

- Substitute another A10 assembly or
- Check the signal/control lines required for its operation. The pins and signal sources of those lines are identified in Table 8-1. It is possible that the A9 assembly may not be providing the necessary signals. These signal checks allow you to determine which assembly is faulty. Some of the waveforms are illustrated by Figure 8-4 and Figure 8-5.

If the substitute assembly shows no improvement or if all of the input signals are valid, continue with "Check the 4 kHz Signal." Otherwise troubleshoot the suspect signal(s) or consider the A10 assembly faulty.

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Table 8-1. Signals Required for A10 Assembly Operation

Mnemonic	Description	A10 Location	Signal Source	See Figure
DIFD0	Digital IF data 0 (LSB)	P2-27	A9P2-27	*
DIFD1	Digital IF data 1	P2-57	A9P2-57	*
DIFD2	Digital IF data 2	P2-28	A9P2-28	*
DIFD3	Digital IF data 3	P2-58	A9P2-58	*
DIFD4	Digital IF data 4	P2-29	A9P2-29	*
DIFD5	Digital IF data 5	P2-59	A9P2-59	*
DIFD6	Digital IF data 6	P2-30	A9P2-30	*
DIFD7	Digital IF data 7 (MSB)	P2-60	A9P2-60	*
L DIFEN0	Digital IF enable 0	P2-34	A9P2-34	*
L DIFEN1	Digital IF enable 1	P2-5	A9P2-5	*
L DIFEN2	Digital IF enable 2	P2-35	A9P2-35	*
DIFCC	Digital IF conversion comp.	P2-33	A10P2-33	Figure 8-4
DIFCLK	Digital IF serial clock	P2-4	A10P2-4	Figure 8-4
DIF DATA	Digital IF serial data out	P2-3	A10P2-3	Figure 8-4
L ENDIF	L=enable digital IF	P2-17	A9P2-17	Figure 8-5
L INTCOP	L=interrupt, DSP	P2-2	A10P2-2	Figure 8-5
*Check for TTL activity.				

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Figure DATAL8 here.

Figure 8-4. Digital Data Lines Observed Using L INTCOP as Trigger

Figure CNTRL8 here.

Figure 8-5. Digital Control Lines Observed Using L INTCOP as Trigger

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Troubleshooting When One or More Inputs Look Good

Since at least one input is good, all of the common receiver circuitry beyond the multiplexer is functional. Only the status of the individual sampler/mixers and their individual signal paths is undetermined.

Check the 4 kHz Signal

1. Connect a cable from the RF OUT to input R.
2. Press (PRESET) (MENU) CW FREQ .
3. Use an oscilloscope to check the 4 kHz output of the sampler/mixer in question at the A10 assembly. The input and output access pins are listed in Table 8-2. The signal should resemble the waveform of Figure 8-6.
   - If the signal is good, continue with "Check the Trace with the Sampler Correction Constants Off."
   - If the signal is bad, skip ahead to "Check 1st LO Signal at Sampler/Mixer."

Table 8-2. 2nd IF (4 kHz) Signal Locations

Mnemonic	Description	A10 Location	Signal Source
IFR	4 kHz	A10P1-1, 31	A4P1-6
IFA	4 kHz	A10P1-4, 34	A5P1-6
IFB	4 kHz	A10P1-7, 37	A6P1-6

Figure IFWAVE8 here.

Figure 8-6. 2nd IF (4 kHz) Waveform

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Check the Trace with the Sampler Correction Constants Off

1. Press [PRESET] [MEAS] [A] [SCALE REF] AUTO SCALE.
2. The trace is currently being displayed with the sampler correction constants on and should resemble Figure 8-7a.
3. Press [SYSTEM] SERVICE MENU SERVICE MODES MORE SAMPLER COR OFF.
4. The trace is now being displayed with sampler correction constants off and should have worsened to resemble Figure 8-7b.
5. Press [SAMPLER COR ON]. The trace should improve and resemble Figure 8-7a again.

Note When the correction constants are switched off, an absolute offset and bandswitch points may be evident.

If the trace shows no improvement when the sampler correction constants are toggled from off to on, perform the "Sampler Magnitude and Phase Correction Constants (Test 53)" adjustment described in Chapter 3, "Adjustments and Correction Constants." If the trace remains bad after this adjustment, the A10 assembly is defective.

Figure TRACE8 here.

Figure 8-7. Typical Trace with Sampler Correction On and Off

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Check 1st LO Signal at Sampler/Mixer

If the 4 kHz signal is bad at the sampler/mixer assembly, check the 1st LO signal where it enters the sampler/mixer assembly in question.

- If the 1st LO is faulty, check the 1st LO signal at its output connector on the A7 assembly to determine if the failure is in the cable or the assembly.
- If the 1st LO is good, continue with "Check 2nd LO Signal at Sampler/Mixer."

Check 2nd LO Signal at Sampler/Mixer

Check the 2nd LO signal at the pins identified in Table 8-3. Refer to the "A12 Reference Check" in Chapter 7, "Source Troubleshooting," for analog bus and oscilloscope checks of the 2nd LO and waveform illustrations. Table 8-3 identifies the signal location at the samplers and the A12 assembly.

Table 8-3. 2nd LO Locations

Mnemonic	Description	Sampler Location	Signal Source
2nd LO 1	2nd LO (0 degrees)	A4/5/6 P1-11	A12P1-2, 32
2nd LO 2	2nd LO (−90 degrees)	A4/5/6 P1-4	A12P1-4, 34

If the 2nd LO is good at the sampler/mixer, the sampler/mixer assembly is faulty. Otherwise, troubleshoot the A12 assembly and associated signal path.

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9

Accessories Troubleshooting

Use this procedure only if you have read Chapter 4, “Start Troubleshooting Here.” Follow the procedures in the order given, unless instructed otherwise.

Measurement failures can be divided into two categories:

- Failures which don’t affect the normal functioning of the analyzer but render incorrect measurement data.
- Failures which impede the normal functioning of the analyzer or prohibit the use of a feature.

This chapter addresses the first category of failures which are usually caused by the following:

- operator errors
- faulty calibration devices or connectors
- bad cables or adapters
- improper calibration techniques
- RF cabling problems within the test set

These failures are checked using the following procedures:

- “Inspect the Accessories”
- “Inspect the Error Terms”
- “Test Set Troubleshooting”

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Assembly Replacement Sequence

The following steps show the sequence to replace an assembly in an HP 8753D Network Analyzer.

1. Identify the faulty group. Refer to Chapter 4, "Start Troubleshooting Here." Follow up with the appropriate troubleshooting chapter that identifies the faulty assembly.
2. Order a replacement assembly. Refer to Chapter 13, "Replaceable Parts."
3. Replace the faulty assembly and determine what adjustments are necessary. Refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
4. Perform the necessary adjustments. Refer to Chapter 3, "Adjustments and Correction Constants."
5. Perform the necessary performance tests. Refer to Chapter 2, "System Verification and Performance Tests."

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Inspect the Accessories

Inspect the System's Connectors and Calibration Devices

1. Check for damaged mating interfaces and loose connector bulkheads on the analyzer's front panel connectors.
2. Check the test set and power splitter connectors for defects as well.
3. Inspect the calibration kit devices for bent or broken center conductors and other physical damage. Refer to the calibration kit operating and service manual for information on gaging and inspecting the device connectors.

   If any calibration device is obviously damaged or out of mechanical tolerance, replace the device.

Switch Repeatability

Calibration does not compensate for the repeatability of the mechanical transfer switch in the S-parameter test sets, so the switch can be a source of error. However, most switch failures are not subtle: no action.

Connect the test set to the analyzer. Press (PRESET) (MEAS) `Refl: REV S22 (B/R)` and then `Refl: FWD S11 (A/R)`. Listen for the sound of the switch.

- No sound: confirm that the test set has a solid-state (noiseless) switch, then refer to "Test Set Troubleshooting" to locate the problem.
- Audible sound: continue with this section unless a subtle failure is suspected. To troubleshoot subtle failures, refer to the test set manual.

Inspect the Error Terms

Error terms are a measure of a "system": a network analyzer, calibration kit, and any cables used. As required, refer to Chapter 11, "Error Terms" for the following:

- The specific measurement calibration procedure used to generate the error terms.
- The routines required to extract error terms from the instrument.
- Typical error term data.

Use Table 9-1 to cross-reference error term data to system faults.

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Table 9-1. Components Related to Specific Error Terms

Component	Directivity	Source Match	Reflection Tracking	Isolation	Load Match	Transmission Tracking
Calibration Kit						
load	X					
open/short	X	X				
Test Set						
connectors	X	X	X	X	X	X
bridge	X	X	X	X	X	X
bias tee		X	X	X	X	X
transfer switch	X	X	X	X	X	
step attenuator		X	X		X	X
power splitter		X	X		X	X
Analyzer						
sampler			X	X		X
A10 digital IF				X		
External cables					X	X

If you detect problems using error term analysis, use the following approach to isolate the fault:

- Check the cable by examining the load match and transmission tracking terms. If those terms are incorrect, go to "Cable Test."
- Verify the calibration kit devices:

  Loads: If the directivity error term looks good, the load and the test port are good. If directivity looks bad, connect the same load on the other test port and measure its directivity. If the second port looks bad, as if the problem had shifted with the load, replace the load. If the second port looks good, as if the load had not been the problem, troubleshoot the first port.

  Shorts and opens: If the source match and reflection tracking terms look good, the shorts and the opens are good. If these terms look bad while the rest of the terms look good, proceed to "Verify Shorts and Opens."

Cable Test

The load match error term is a good indicator of cable problems. You can further verify a faulty cable by measuring the reflection of the cable. Perform an S11 1-port calibration directly at port 1 (no cables). Then connect the suspect cable to port 1 and terminate the open end in 50 ohms.

Figure 9-1 shows the return loss trace of a good (left side) and faulty cable. Note that the important characteristic of a cable trace is its level (the good cable trace is much lower) not its regularity. Refer to the cable manual for return loss specifications.

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Figure LOSS9 here.

Figure 9-1. Typical Return Loss Traces of Good and Poor Cables

Verify Shorts and Opens

Substitute a known good short and open of the same connector type and sex as the short and open in question. If the devices are not from one of the standard calibration kits, refer to the *HP 8753D Network Analyzer User's Guide* for information on how to use the MODIFY CAL KIT function. Set aside the short and open that are causing the problem.

1. Perform an S11 1-port calibration using the good short and open. Then press FORMAT SMITH CHART to view the devices in Smith chart format.

2. Connect the good short to port 1. Press SCALE REF ELECTRICAL DELAY and turn the front panel knob to enter enough electrical delay so that the trace appears as a dot at the left side of the circle (see Figure 9-2a, left).

   Replace the good short with the questionable short at port 1. The trace of the questionable short should appear very similar to the known good short.

3. Connect the good open to port 1. Press SCALE REF ELECTRICAL DELAY and turn the front panel knob to enter enough electrical delay so that the trace appears as a dot at the right side of the circle (see Figure 9-2b, right).

   Replace the good open with the questionable open at port 1. The trace of the questionable open should appear very similar to the known good open.

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Figure SMITH9 here.

Figure 9-2. Typical Smith Chart Traces of Good Short (a) and Open (b)

Test Set Troubleshooting

Test set problems are of three varieties: RF problems, power problems and control problems. The HP 85044A/B can only experience RF problems as it is not powered or controlled by the analyzer.

To troubleshoot:

- The HP 85044A/B: refer to its manual.
- S-parameter test set RF problems: refer to their manuals.
- S-parameter power or control problems: continue with "Troubleshooting Power Problems in S-Parameter Test Sets" (power problems can affect control).

Troubleshooting Power Problems in S-Parameter Test Sets

HP 8753D Option 011 with HP 85047A or 85046A/B

Do *not* connect the test set to the analyzer to perform these checks.

1. Move the A9 CC Jumper to the ALTER position:
   - Remove the power line cord from the analyzer.
   - Set the analyzer on its side.
   - Remove the two corner bumpers from the bottom of the instrument with a T-15 TORX screwdriver.
   - Loosen the captive screw on the bottom cover's back edge.
   - Slide the cover toward the rear of the instrument.

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- Move the jumper to the ALT position as shown in Figure 9-3.
- Replace the bottom cover, corner bumpers, and power cord.

Figure JUMP9 here.

Figure 9-3. Jumper Positions on the A9 CPU

2. Press [PRESET] [SYSTEM] SERVICE MENU PEEK/POKE ADDRESS [1314412] [X1].
3. "POKE" the address for the appropriate test set:
   - HP 85047A: Press POKE [5] [X1] [PRESET].
   - HP 85046A/B: Press POKE [1] [X1] [PRESET].
4. Measure the DC voltage at pin 14 (see Figure 9-4) of the analyzer rear panel test set interconnect connector.

Figure INTER9 here.

Figure 9-4. Analyzer Rear Panel Test Set Interconnect Connector Pins

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- If the voltage is between 21.3 V and 22.7 V, the supply is good. Proceed with either of the following:
  a. Refer to the test set manual to troubleshoot the test set and its interconnect cable (especially if the test set LEDs don't light).
  b. Continue with "Troubleshooting Control Problems in S-Parameter Test Sets."
- If the voltage is not as stated above, refer to Chapter 5, "Power Supply Troubleshooting."

5. Be certain to press POKE 0 X1 PRESET after all troubleshooting and return the A9 CC jumper to "normal" position.

Troubleshooting Control Problems in S-Parameter Test Sets

The analyzer controls the test set attenuator, the transfer switch (for forward and reverse measurements), and, in the case of the HP 85047A, bypasses the frequency doubler. The associated test set interconnect connector pins are shown in Figure 9-4; refer to it as needed.

Note Before continuing with these procedures, be sure the A9 CC jumper is set to "alter" and the value for the appropriate test set has been "POKEd".

Attenuation Control Voltages. Voltage levels on the pins identified in Table 9-2 control test set attenuation. Press MENU POWER ATTENUATOR PORT 1 and enter the attenuation values listed below. After each entry, check the pins (see Figure 9-4) for the indicated voltages.

Table 9-2. Attenuation Voltage Matrix

Attenuation	HP 85046A/B			HP 85047A			
	PIN 11	PIN 22	PIN 23	PIN 8	PIN 11	PIN 22	PIN 23
0	+5	+5	+5	+5	+5	+5	+5
10	+5	0	+5	+5	+5	0	+5
20	+5	+5	0	+5	+5	+5	0
30	+5	0	0	+5	+5	0	0
40	0	+5	+5	+5	0	+5	+5
50	0	0	+5	+5	0	0	+5
60	0	+5	0	+5	0	+5	0
70	0	0	0	+5	0	0	0

- Proper voltages: refer to the test set manual to continue troubleshooting. For HP 85047A systems, first see HP 85047A Note, above, to reset the analyzer.
- Wrong voltages: replace the A16 rear panel assembly of the analyzer.

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Measurement Control Signals. Voltage levels on the pins identified in Table 9-3 control measurement direction (forward or reverse) and the doubler off function. Press (MEAS) S PARAMETERS and enter the measurements listed below. After each entry, check the pins (see Figure 9-4) for the indicated voltages. In similar fashion, change the frequency range to 6 GHz or 3 GHz by pressing (SYSTEM) FREQ RANGE 3GHz6GHz and check the pins for the indicated voltages.

Table 9-3. Measurement Voltage Matrix

	HP 85046A/B	HP 85047A		
	Pin 8	Pin 8	Pin 22	Pin 23
Refl: FWD S11 (A/R)	+5	0	–	+5
Trans: FWD S21 (B/R)	+5	0	–	+5
Trans: REV S12 (B/R)	0	0	–	0
Refl: REV S22 (A/R)	0	0	–	0
Doubler OFF	–	0	+5	–

- Proper voltages: refer to the test set manual to continue troubleshooting. For HP 85047A systems, first see HP 85047A Note, above, to reset the analyzer.
- Wrong voltages: replace the A16 rear panel assembly of the analyzer.

Remote Trigger. Monitor pin 24 with an oscilloscope. Press (PRESET): +5 V should be present during PRESET. After PRESET a negative-going pulse to zero volts, about 200 nanoseconds long, should be visible. The pulse should be present at the beginning of each sweep. To increase pulse visibility, decrease number of points to 3 and decrease sweep time to 50 milliseconds on the analyzer.

- Proper pulse: troubleshoot the test set by referring to its manual. For HP 85047A systems, first see HP 85047A Note, above, to reset the analyzer.
- Incorrect pulse: replace the analyzer A16 rear panel assembly.

Sweep Delay. This signal delays the start of the analyzer's sweep to allow for test set switch settling time. It also distinguishes, by encoding, the HP 85047A from the 85046A/B test sets. See the test set manual for more detail. For HP 85047A systems, first see HP 85047A Note, above, to reset the analyzer.

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10

Service Key Menus and Error Messages

Service Key Menus

These menus allow you to perform the following service functions:

- test
- verify
- adjust
- control
- troubleshoot

The menus are divided into two groups:

1. Internal Diagnostics
2. Service Features

When applicable, the HP-IB mnemonic is written in parentheses following the key. See HP-IB Service Mnemonic Definitions at the end of this section.

Error Messages

The displayed messages that pertain to service functions are also listed in this chapter to help you:

- Understand the message.
- Solve the problem.

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Service Key Menus - Internal Diagnostics

The internal diagnostics menus are shown in Figure 10-1 and described in the following paragraphs. The following keys access the internal diagnostics menus:

- TESTS
- TEST OPTIONS
- SELF-DIAGNOSE

Figure INTDIAG here.

Figure 10-1. Internal Diagnostics Menus

Note Throughout this service guide, these conventions are observed:

- (HARDKEYS) are labeled front panel keys.
- SOFTKEYS display defined keys (in the menus).
- (HP-IB COMMANDS) When applicable, follow the keystroke in parentheses.

Tests Menu

To access this menu, press (SYSTEM) SERVICE MENU TESTS.

TESTS (TEST [D]) Accesses a menu that allows you to select or execute the service tests. The default is set to internal test 1.

Note Descriptions of tests in each of the categories are given under the heading *Test Descriptions* in the following pages.

The tests are divided by function into the following categories:

- Internal Tests (1—20)
- External Tests (21—26)
- System Verification Tests (27—43)

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- Adjustment Tests (44—57)
- Display Tests (59—65)

To access the first test in each category, press the category softkey. To access the other tests, use the numeric keypad, step keys or front panel knob. The test number, name, and status abbreviation will be displayed in the active entry area of the display.

Table 10-1 shows the test status abbreviation that appears on the display, its definition, and the equivalent HP-IB code. The HP-IB command to output the test status of the most recently executed test is OUTPTESS. For more information, refer to "HP-IB Service Mnemonic Definitions" located at the end of this chapter.

Table 10-1. Test Status Terms

Display Abbreviation	Definition	HP-IB Code
PASS	PASS	0
FAIL	FAIL	1
-IP-	IN PROGRESS	2
(NA)	NOT AVAILABLE	3
-ND-	NOT DONE	4
DONE	DONE	5

`EXECUTE TEST` (EXET) Runs the selected test and may display these softkeys:

`CONTINUE` (TESR1) Continues the selected test.

`YES` (TESR2) Alters correction constants during adjustment tests.

`NEXT` (TESR4) Displays the next choice.

`SELECT` (TESR6) Chooses the option indicated.

`ABORT` (TESR8) Terminates the test and returns to the tests menu.

`INTERNAL TESTS` Evaluates the analyzer's internal operation. These tests are completely internal and do not require external connections or user interaction.

`EXTERNAL TESTS` Evaluates the analyzer's external operation. These additional tests require some user interaction (such as keystrokes).

`SYS VER TESTS` Verifies the analyzer system operation by examining the contents of the measurement calibration arrays. The procedure is in the "System Verification and Performance Tests" chapter. Information about the calibration arrays is provided in the "Error Terms" chapter.

`ADJUSTMENT TESTS` Generates and stores the correction constants. For more information, refer to the "Adjustments" chapter.

`DISPLAY TESTS` Checks for correct operation of the GSP board.

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Test Options Menu

To access this menu, press (SYSTEM) SERVICE MENU TEST OPTIONS.

TEST OPTIONS	Accesses softkeys that affect the way tests (routines) run, or supply necessary additional data.
CONTINUE TEST (TESR1)	Resumes the test from where it was stopped.
REPEAT on OFF (TO2)	Toggles the repeat function on and off. When the function is ON, the selected test will run 10,000 times unless you press any key to stop it. The analyzer shows the current number of passes and fails.
RECORD on OFF (TO1)	Toggles the record function on and off. When the function is ON, certain test results are sent to a printer via HP-IB. This is especially useful for correction constants. The instrument must be in system controller mode or pass control mode to print. (Refer to the "Printing, Plotting, and Saving Measurement Results" chapter in the *HP 8753D User's Guide*.)
LIMITS[NORM/SPCL]	Selects either NORMal or SPeCiaL (tighter) limits for the Operator's Check. The SPCL limits are useful for a guard band.
POWER LOSS on OFF	Activates power loss function.
LOSS/SENSR LISTS	Accesses the power loss/sensor lists menu: USE SENSOR A/B Selects the A or B power sensor calibration factor list for use in power meter calibration measurements. CAL FACTOR SENSOR A (CALFSENA) Accesses the Edit List menu to allow modification of the calibration data table for power sensor A. CAL FACTOR SENSOR B (CALFSENB) Accesses the Edit List menu to allow modification of the calibration data table for power sensor B. POWER LOSS (POWLLIST) Accesses the Edit List menu to allow modification of the external power loss data table that corrects coupled-arm power loss when a directional coupler samples the RF output.

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Edit List Menu

To access this menu, press (SYSTEM) SERVICE MENU TEST OPTIONS LOSS/SENSR LISTS and then press one of the following: CAL FACTOR SENSOR A or CAL FACTOR SENSOR B or POWER LOSS.

SEGMENT	Selects a segment (frequency point) to be edited, deleted from, or added to the current data table. Works with the entry controls.
EDIT (SEDI[D])	Allows modification of frequency, cal factor and loss values previously entered in the current data table.
DELETE (SDEL)	Deletes frequency, cal factor and loss values previously entered in the current data table.
ADD (SADD)	Adds new frequency, cal factor and loss values to the current data table up to a maximum of 12 segments (frequency points, PTS).
CLEAR LIST (CLEL)	Deletes the entire current data table (or list) when YES is pressed. Press NO to avoid deletion.
DONE (EDITDONE)	Returns to the previous menu.

Self Diagnose Softkey

You can access the self diagnosis function by pressing, (SYSTEM) SERVICE MENU SELF DIAGNOSE. This function examines, in order, the pass/fail status of all internal tests and displays NO FAILURE FOUND if no tests have failed.

If a failure is detected, the routine displays the assembly or assemblies most probably faulty and assigns a failure probability factor to each assembly.

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Test Descriptions

The analyzer has up to 80 routines that test, verify, and adjust the instrument. This section describes those tests.

Internal Tests

This group of tests runs without external connections or operator interaction. All return a `PASS` or `FAIL` condition. All of these tests run on power-up and PRESET except as noted.

0 **ALL INT.** Runs only when selected. It consists of internal tests 3-11, 13-16, and 20. Use the front panel knob to scroll through the tests and see which failed. If all pass, the test displays a PASS status. Each test in the subset retains its own test status.

1 **PRESET.** Runs the following subset of internal tests: first,the ROM/RAM tests 2, 3, and 4; then tests 5 through 11, 14, 15, and 16. If any of these tests fail, this test returns a FAIL status. Use the front panel knob to scroll through the tests and see which failed. If all pass, this test displays a PASS status. Each test in the subset retains its own test status. This same subset is available over HP-IB as "TST?". It is not performed upon remote preset.

2 **ROM.** Part of the ROM/RAM tests and cannot be run separately. Refer to the "Digital Control Troubleshooting" chapter for more information.

3 **CMOS RAM.** Verifies the A9 CPU CMOS (long-term) memory with a non-destructive write/read pattern. A destructive version that writes over stored data is shown in Table 10-2.

4 **Main DRAM.** Verifies the A9 CPU main memory (DRAM) with a non-destructive write/read test pattern. A destructive version is shown in Table 10-2. These tests, internal tests 2 through 4, are normally run at preset and power-on (see NORMAL, below). However, a jumper on the A9 CPU assembly, illustrated in Figure 10-2, can be set in one of five positions with the following results:

Table 10-2. Descriptions of Jumper Positions

Jumper Position	Position No	Result
ALTER	1	With the jumper in this right position, correction constants can be altered, (updated) during adjustment procedures. The altered correction constants are stored in EEPROM, replacing previously stored correction constants.
CMOS	2	This destructive version of the CMOS RAM test (internal test 3) continuously writes over information stored there.
DRAM	3	This destructive version of the main DRAM test (internal test 4) continuously writes over information stored there.
SKIP	4	For factory use only.
NORMAL	5	The left position is the normal operation position.

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Figure JUMPLOC here.

Figure 10-2. Jumper Positions on the A9 CPU

Jumper positions 1 to 5 run right to left.

For additional information, see "Internal Tests" (near the front of this section) and the "Digital Control Troubleshooting" chapter.

5 **DSP Wr/Rd.** Verifies the ability of the main processor and the DSP (digital signal processor), both on the A9 CPU assembly, to communicate with each other through DRAM. This also verifies that programs can be loaded to the DSP, and that most of the main RAM access circuits operate correctly.

6 **DSP RAM.** Verifies the A9 CPU RAM associated with the digital signal processor by using a write/read pattern.

7 **DSP ALU.** Verifies the A9 CPU high-speed math processing portions of the digital signal processor.

8 **DSP Intrpt.** Tests the ability of the A9 CPU digital signal processor to respond to interrupts from the A10 digital IF ADC.

9 **DIF Control.** Tests the ability of the A9 CPU main processor to write/read to the control latches on the A10 digital IF.

10 **DIF Counter.** Tests the ability of the A9 CPU main processor to write/read to the triple divider on the A10 CPU. It tests the A9 CPU data buffers and A10 digital IF, the 4 MHz clock from the A12 reference.

11 **DSP Control.** Tests the ability of the A9 CPU digital signal processor to write to the control latches on the A10 digital IF. Feedback is verified by the main processor. It primarily tests the A10 digital IF, but failures may be caused by the A9 CPU.

12 **Fr Pan Wr/Rd.** Tests the ability of the A9 CPU main processor to write/read to the front panel processor. It tests the A2 front panel interface and processor,and A9 CPU data buffering and address decoding. (See also tests 23 and 24 below.) This runs only when selected.

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13 **Rear Panel.** Tests the ability of the A9 CPU main processor to write/read to the rear panel control elements. It tests the A16 rear panel, and A9 CPU data buffering and address decoding. (It does not test the HP-IB interface; for that see the *HP-IB Programming Guide*.) This runs only when selected or with ALL INTERNAL.

14 **Post Reg.** Polls the status register of the A8 post-regulator, and flags these conditions: heat sink too hot, inadequate air flow, or post-regulated supply shutdown.

15 **Frac N Cont.** Tests the ability of the A9 CPU main processor to write/read to the control element on the A14 fractional-N (digital) assembly. The control element must be functioning, and the fractional-N VCO must be oscillating (although not necessarily phase-locked) to pass.

16 **Sweep Trig.** Tests the sweep trigger (L SWP) line from the A14 fractional-N to the A10 digital IF. The receiver with the sweep synchronizes L SWP.

17 **ADC Lin.** Tests the linearity of the A10 digital IF ADC using the built-in ramp generator. The test generates a histogram of the ADC linearity, where each data point represents the relative "width" of a particular ADC code. Ideally, all codes have the same width; different widths correspond to non-linearities.

18 **ADC Ofs.** This runs only when selected. It tests the ability of the offset DAC, on the A10 digital IF, to apply a bias offset to the IF signals before the ADC input. This runs only when selected.

19 **ABUS Test.** Tests analog bus accuracy, by measuring several analog bus reference voltages (all nodes from the A10 digital IF). This runs only when selected.

20 **FN Count.** Uses the internal counter to count the A14 fractional-N VCO frequency (120 to 240 MHz) and the divided fractional-N frequency (100 kHz). It requires the 100 kHz signal from A12 and the counter gate signal from A10 to pass.

External Tests

These tests require either external equipment and connections or operator interaction of some kind to run. Tests 30 and 60 are comprehensive front panel checks, more complete than test 12, that checks the front panel keys and knob entry.

21 **Port 1 Op Chk.** Part of the "Operator's Check" procedure, located in the "Start Troubleshooting" chapter. The procedure requires the external connection of a short to PORT 1.

22 **Port 2 Op Chk.** Same as 21, but tests PORT 2.

23 **Fr Pan Seq.** Tests the front panel knob entry and all A1 front panel keys, as well as the front panel microprocessor on the A2 assembly. It prompts the user to rotate the front panel knob, then press each key in an ordered sequence. It continues to the next prompt only if the current prompt is correctly satisfied.

24 **Fr Pan Diag.** Similar to 23 above, but the user rotates the front panel knob or presses the keys in any order. This test displays the command the instrument received.

25 **ADC Hist.** Factory use only.

26 **Source Ex.** Factory use only.

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System Verification Tests

These tests apply mainly to system-level, error-corrected verification and troubleshooting. Tests 27 to 31 are associated with the system verification procedure, documented in the "System Verification and Performance Tests" chapter. Tests 32 to 43 facilitate examining the calibration coefficient arrays (error terms) resulting from a measurement calibration; refer to the "Error Terms" chapter for details.

27 **Sys Ver Init.** Recalls the initialization state for system verification from disk, in preparation for a measurement calibration. It must be done before 28, 29, 30 or 31 are performed.

28 **Ver Dev 1.** Recalls verification limits from disk for verification device #1 in all applicable S-parameter measurements. It performs pass/fail limit testing of the current measurement.

29 **Ver Dev 2.** Same as 27 above for device #2.

30 **Ver Dev 3.** Same as 27 above for device #3.

31 **Ver Dev 4.** Same as 27 above for device #4.

32-43 **Cal Coef 1-12.** Copies error term data from a measurement calibration array to display memory. A measurement calibration must be complete and active. The definition of calibration arrays depends on the current calibration type. After execution, the memory is automatically displayed. Refer to the "Error Term" chapter for details.

Adjustment Tests

The tests without asterisks are used in the procedures located in the "Adjustments" chapter of this manual, except as noted.

44 ***Source Def.** Writes default correction constants for rudimentary source power accuracy. Use this test before running test 47, below.

45 ***Pretune Def.** Writes default correction constants for rudimentary phase lock pretuning accuracy. Use this test before running test 48, below.

46 **ABUS Cor.** Measures three fixed voltages on the ABUS, and generates new correction constants for ABUS amplitude accuracy in both high resolution and low resolution modes. Use this test before running test 48, below.

47 **Source Cor.** Measures source output power accuracy, flatness, and linearity against an external power meter via HP-IB to generate new correction constants. Run tests 44, 45, 46, and 48 first.

48 **Pretune Cor.** Generates source pretune values for proper phase-locked loop operation. Run tests 44, 45, and 46 first.

49 **Intensity Cor.** Stores the current values of the intensity adjustments, under DISPLAY, for recall of display intensity values at power-on.

50 **Disp 2 Ex.** Not used in "Adjustments." Writes the "secondary test pattern" to the display for adjustments. Press PRESET to exit this routine.

51 **IF Step Cor.** Measures the gain of the IF amplifiers (A and B only) located on the A10 digital IF, to determine the correction constants for absolute amplitude accuracy.

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It provides smooth dynamic accuracy and absolute amplitude accuracy in the −30 dBm input power region.

52 **ADC Ofs Cor.** Measures the A10 Digital IF ADC linearity characteristics, using an internal ramp generator, and stores values for the optimal operating region. During measurement, IF signals are centered in the optimal region to improve low-level dynamic accuracy.

53 **Sampler Cor.** Measures the absolute amplitude response of the R sampler against an external power meter via HP-IB, then compares A and B, (magnitude and phase), against R. It improves the R input accuracy and A/B/R tracking.

54 **Cav Osc Cor.** Calculates the frequency of the cavity oscillator and the instrument temperature for effective spur avoidance.

55 **Serial Cor.** Stores the serial number (input by the user in the Display Title menu) in EEPROM. This routine will not overwrite an existing serial number.

56 **Option Cor.** Stores the option keyword (required for Option 002, 006, 010 or any combination).

57 **Cal Kit Def.** Not used.

58 **Init EEPROM.** This test initializes the EEPROM.

Display Tests

These tests do not return a PASS/FAIL condition. All six amber front panel LEDs will turn off if the test passes. The display will be blank; press (PRESET) to exit the test. If any of the six LEDs remain on, the test has failed.

59 **Disp/cpu com.** Checks to confirm that the CPU can communicate with the A19 GSP board. The CPU writes all zeros, all ones, and then a walking 1 pattern to the GSP and reads them back. If the test fails, the CPU repeats the walking 1 pattern until (PRESET) is pressed.

60 **DRAM cell.** Tests the DRAM on A19 by writing a test pattern to the DRAM and then verifying that it can be read back.

61 **Main VRAM.** Tests the VRAM by writing all zeros to one location in each bank and then writing all ones to one location in each bank. Finally a walking one pattern is written to one location in each bank.

62 **VRAM bank.** Tests all the cells in each of the 4 VRAM banks.

63 **VRAM/video.** Verifies that the GSP is able to successfully perform both write and read shift register transfers. It also checks the video signals LHSYNC, LVSYNC, and LBLANK to verify that they are active and toggling.

64 **RGB outputs.** Confirms that the analog video signals are correct and it verifies their functionality.

65 **Inten DAC.** Verifies that the intensity DAC can be set both low and high.

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Test Patterns

Test patterns are used in the factory for display adjustments, diagnostics, and troubleshooting, but they are not used for field service. Test patterns are executed by entering the test number (66 through 80), then pressing `EXECUTE TEST CONTINUE`. The test pattern will be displayed and the softkey labels blanked. To exit the test pattern and return the softkey labels, press softkey 8 (bottom softkey). The following is a description of the test patterns.

66 **Test pat 1.** Displays an all white screen for verifying the light output of the A18 display and checks for color purity. In this, and other solid test patterns, an extremely thin full-screen horizontal line will be seen about 1/4 screen height from the bottom. This condition is characteristic of the display and does not indicate any problem.

67-69 **Test Pat 2-4.** Displays a red, green, and blue pattern for verifying the color purity of the display and also the ability to independently control each gun color. If the purity of the displayed test pattern is a problem, it usually indicates that the face of the display needs to be de-gaussed (de-magnetized). If purity is bad, cycling the power a few times may cure the problem. If this does not work, a commercially available de-magnetizer must be used.

70 **Test Pat 5.** Displays a 16-step gray scale for verifying that the palette chip on the A19 GSP board can produce 16 different amplitudes of color (in this case, white). This pattern is also very useful when using an oscilloscope for troubleshooting. The staircase pattern it produces will quickly show missing or stuck data bits.

71 **Test Pat 6.** Displays a 3-step gray scale pattern for adjusting the background level (or 0 step) so that the first bar is not visible, and the second bar is just barely visible. This pattern consists of the first three gray scale bars of the 16-step gray scale.

72 **Test Pat 7.** Displays a convergence pattern for measuring the accuracy of the color convergence. It is mainly for use by the factory, since convergence cannot be adjusted in the field.

73-74 **Test Pat 8-9.** Displays crosshatch and inverse crosshatch patterns for testing color convergence, linearity, alignment, and high voltage regulation, in the factory only. No field adjustments are possible.

75 **Test Pat 10.** Displays an H pattern for checking the focus of the display. Under normal conditions, this should never need to be adjusted. However, it is possible to adjust it by accessing the focus control adjustment at the left rear of the display. See the “Adjustments” chapter.

76 **Test Pat 11.** Verifies the functionality of the pixel stretching circuit of the A19 GSP board. Under normal conditions, this pattern should appear all white. If a failure occurs in the pixel stretching circuit, the pattern will consist of 16 alternating white and gray vertical stripes. Suspect problems with the STRETCH line and LFIRSTPIX.

77 **Test Pat 12.** Displays a repeating gray scale for troubleshooting, using an oscilloscope. It is similar to the 16 step gray scale but is repeated 32 times across the screen. Each of the 3 outputs of the video palette will then show 32 ramps (instead of one staircase) between each horizontal sync pulse. This pattern is used to troubleshoot the pixel processing circuit of the A19 GSP board.

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78 **Test Pat 13.** Displays a color rainbow pattern for showing the ability of the A19 GSP board to display 15 colors plus white. The numbers written below each bar indicate the tint number used to produce that bar (0 & 100=pure red, 33=pure green, 67=pure blue).

79 **Test Pat 14.** Displays a character set for showing the user all the different types and sizes of characters available. Three sets of characters are drawn in each of the three character sizes. 125 characters of each size are displayed. Characters 0 and 3 cannot be drawn and several others are really control characters (such as carriage return and line feed).

80 **Test Pat 15.** Displays a bandwidth pattern for verifying the bandwidth of the display. It consists of multiple alternating white and black vertical stripes. Each stripe should be clearly visible. A limited bandwidth would smear these lines together. This adjustment can be performed in the factory only.

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Service Key Menus - Service Features

The service feature menus are shown in Figure 10-3 and described in the following paragraphs. The following keys access the service feature menus:

- SERVICE MODES
- ANALOG BUS on OFF
- PEEK/POKE
- FIRMWARE REVISION

Figure SERVFEAT here.

Figure 10-3. Service Feature Menus

Service Modes Menu

To access this menu, press (SYSTEM) SERVICE MENU SERVICE MODES.

SERVICE MODES	Allows you to control and monitor various circuits for troubleshooting.
FRACN TUNE on OFF (SM1)	Tests the A13 and A14 fractional-N circuits. It allows you to directly control and monitor the output frequency of the fractional-N synthesizer (10 MHz to 60 MHz). Set the instrument to CW sweep mode and then set FRACN TUNE ON. Change frequencies with the front panel keys or knob. The output of the A14 assembly can be checked at A14J1 HI OUT (in high band) or A14J2 LO OUT (in low band) with an oscilloscope, a frequency counter, or a spectrum analyzer. Signal jumps and changes in shape at 20 MHz and 30 MHz when tuning up in frequency, and at 29.2 MHz and 15 MHz when tuning down, are due to switching of the digital divider. This mode can be used with the SRC TUNE mode as described in "Source Troubleshooting" chapter.

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`SRC ADJUST MENU` Accesses the functions that allow you to adjust the source:

- `SRC TUNE on OFF` Tests the pretune functions of the phase lock and source assemblies. Use the entry controls to set RF OUT to any frequency from 300 KHz to 3 GHz. When in this mode:
  1. Set analyzer to CW frequency before pressing `SRC TUNE ON`.
  2. RF OUT is 1 MHz to 6 MHz above indicated (entered) frequency.
  3. Instrument does not attempt to phase lock.
  4. Residual FM increases.
- `SRC TUNE FREQ`
- `ALC ON off` Toggles the automatic leveling control (ALC) on and off.
- `MAIN PWR DAC`
- `SLOPE DAC`
- `SRC ADJUST DACS`
- `HB FLTR SW on OFF`

`SOURCE PLL ON off` (SM3) With this mode switched OFF, the source stays in the pretune mode and does not attempt to complete the phase lock sequence. Also, all phase lock error messages are disabled. The fractional-N circuits and the receiver operate normally. Therefore, the instrument sweeps, but the source is being driven by the pretune DAC in a stair-stepped fashion.

`PLL AUTO ON off` (SM4) Automatically attempts to determine new pretune values when the instrument encounters phase lock problems (e.g. "harmonic skip"). With `PLL AUTO OFF` the frequencies and voltages are not changing as they are when they are attempting to determine new pretune values, so troubleshooting the phase-locked loop circuits is more convenient.

`PLL DIAG on OFF` (SM5) Displays a phase lock sequence at the beginning of each band. This sequence normally occurs very rapidly, making it difficult to troubleshoot phase lock problems. Switching this mode ON slows the process down, allowing you to inspect the steps of the phase lock sequence (pretune, acquire, and track) by pausing at each step. The steps are indicated on the display, along with the channel (C1 or C2) and band number (B1 through B13).

This mode can be used with PLL PAUSE to halt the process at any step. It can also be used with the analog bus counter.

`PLL PAUSE` Used only with PLL DIAG mode. `CONT` indicates that it will continuously cycle through all steps of the phase lock sequence. `PAUSE` holds it at any step of interest. This mode is useful for troubleshooting phase-locked loop problems.

`MORE` Accesses the service modes more menu listed below.

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Service Modes More Menu

To access this menu, press (SYSTEM) SERVICE MENU SERVICE MODES MORE.

SAMPLER COR ON off (SM6)	Toggles the sampler correction ON, for normal operation, or OFF, for diagnosis or adjustment purposes.
IF GAIN AUTO	Normal operating condition and works in conjunction with IF GAIN ON and OFF. The A10 assembly includes a switchable attenuator section and an amplifier that amplifies low-level 4 kHz IF signals (for A and B inputs only). This mode allows the A10 IF section to automatically determine if the attenuator should be switched in or out. The switch occurs when the A or B input signal is approximately −30 dBm.
IF GAIN ON	Locks out the A10 IF attenuator sections for checking the A10 IF gain amplifier circuits, regardless of the amplitude of the A or B IF signal. Switches out both the A and B attenuation circuits; they cannot be switched independently. Be aware that input signal levels above −30 dBm at the sampler input will saturate the ADC and cause measurement errors.
IF GAIN OFF	Switches in both of the A10 IF attenuators for checking the A10 IF gain amplifier circuits. Small input signals will appear noisy, and raise the apparent noise floor of the instrument.
SPUR TEST on OFF (SM7)	For factory use only.
STORE EEPR on OFF	Allows you to store the correction constants that reside in non-volatile memory (EEPROM) onto a disk. Correction constants improve instrument performance by compensating for specific operating variations due to hardware limitations (refer to the "Adjustments" chapter). Having this information on disk is useful as a backup, in case the constants are lost (due to a CPU board failure). Without a disk backup the correction constants can be regenerated manually, although the procedures are more time consuming.
SPUR AVOID ON off (SM8)	Offsets the frequency of both the A3 YIG oscillator and the A3 cavity oscillator to avoid spurs which cannot otherwise be filtered out. SPUR AVOID OFF allows examination of these spurs for service.
ANALOG BUS on OFF (ANAB)	Enables and disables the analog bus, described below. Use it with the analog in menu, described in the following pages:

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Analog Bus

To access the analog bus, press (SYSTEM) SERVICE MENU ANALOG BUS ON.

Description of the Analog Bus

The analog bus is a single multiplexed line that networks 31 nodes within the instrument. It can be controlled from the front panel, or through HP-IB, to make voltage and frequency measurements just like a voltmeter, oscilloscope, or frequency counter. The next few paragraphs provide general information about the structure and operation of the analog bus. See "Analog Bus Nodes," below, for a description of each individual node. Refer to the "Overall Block Diagram," in the "Start Troubleshooting" chapter, to see where the nodes are located in the instrument.

The analog bus consists of a source section and a receiver section. The source can be the following:

- any one of the 31 nodes described in "Analog Bus Nodes"
- the A14 fractional-N VCO
- the A14 fractional-N VCO divided down to 100 kHz

The receiver portion can be the following:

- the main ADC
- the frequency counter

When analog bus traces are displayed, frequency is the x-axis. For a linear x-axis in time, switch to CW time mode (or sweep a single band).

The Main ADC

The main ADC is located on the A10 digital IF assembly and makes voltage measurements in two ranges. See "RESOLUTION," under "Analog In Menu."

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The Frequency Counter

The frequency counter is located on the A14 assembly and can count one of three sources:

- selected analog bus node
- A14 fractional-N VCO (FRAC N)
- A14 fractional-N VCO divided down to 100 kHz (DIV FRAC N) (frequency range is 100 kHz to 16 MHz)

The counts are triggered by the phase lock cycle; one each at pretune, acquire, and track for each bandswitch. (The service mode, SOURCE PLL, must be ON for the counter to be updated at each bandswitch.) The counter works in swept modes or in CW mode. It can be used in conjunction with SERVICE MODES for troubleshooting phase lock and source problems.

To read the counter over HP-IB, use the command OUTPCNTR.

Notes

- The display and marker units (U) correspond to volts.
- Nodes 17 (1st IF) and 24 (2nd LO) are unreliable above 1 MHz.
- About 0.750 MHz is a typical counter reading with no AC signal present.
- Anything occurring during bandswitches is not visible.
- Fast-moving waveforms may be sensitive to sweep time.
- The analog bus input impedance is about 50K ohms.
- Waveforms up to approximately 200 Hz can be reproduced.

Analog In Menu

Select this menu to monitor voltage and frequency nodes, using the analog bus and internal counter, as explained below. To switch on the analog bus and access the analog in menu, press:

(SYSTEM) SERVICE MENU ANALOG BUS ON (MEAS) ANALOG IN

The RESOLUTION [LOW] key toggles between low and high resolution.

Resolution	Maximum Signal	Minimum Signal
LOW	+0.5 V	−0.5 V
HIGH	+10 V	−10 V

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`AUX OUT on OFF` Allows you to monitor the analog bus nodes (except nodes 1, 2, 3, 4, 9, 10, 12) with external equipment (oscilloscope, voltmeter, etc.). To do this, connect the equipment to the AUX INPUT BNC connector on the rear panel, and press `AUX OUT`, until `ON` is highlighted.

Caution To prevent damage to the analyzer, first connect the signal to the rear panel AUX INPUT, and then switch the function ON.

`COUNTER: OFF` Switches the internal counter off and removes the counter display from the display. The counter can be switched on with one of the next three keys. (Note: Using the counter slows the sweep.) The counter bandwidth is 16 MHz unless otherwise noted for a specific node.

Note OUTPCNTR is the HP-IB command to output the counter's frequency data.

`ANALOG BUS` switches the counter to monitor the analog bus.

`FRAC N` switches the counter to monitor the A14 fractional-N VCO frequency at the node shown on the "Overall Block Diagram," in the "Start Troubleshooting" chapter.

`DIV FRAC N` switches the counter to monitor the A14 fractional-N VCO frequency after it has been divided down to 100 kHz for phase locking the VCO.

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Analog Bus Nodes

The following paragraphs describe the 31 analog bus nodes. The nodes are listed in numerical order and are grouped by assembly. Refer to the "Overall Block Diagram" for node locations.

A3 Source

To observe six of the eight A3 analog bus nodes (not node 5 or 8), perform Step A3 to set up a power sweep on the analog bus. Then follow the node specific instructions.

Step A3.
Press:
PRESET
SYSTEM SERVICE MENU ANALOG BUS ON
MEAS ANALOG IN
FORMAT MORE REAL
MENU CW FREQ 3 G/n SWEEP TYPE MENU POWER SWEEP
START -15 x1
STOP 10 x1

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Node 1 Mn Pwr DAC (main power DAC)

Perform step A3, above, to set up a power sweep on the analog bus. Then press MEAS ANALOG IN 1 x1 SCALE REF AUTO SCALE.

Node 1 detects the RF power from the cavity oscillator into the level modulator. Flat line segments indicate ALC saturation and should not occur between −15 dBm and +10 dBm. A flat line at about 0 V indicates the cavity oscillator is not outputting any power.

Figure NODE1 here.

Figure 10-4. Analog Bus Node 1

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Node 2 **Src 1V/GHz (source 1 volt per GHz)**

Perform step A3, above, to set up a power sweep on the analog bus. Then press (MEAS) ANALOG IN (2) (x1) (SCALE REF) AUTO SCALE.

Node 2 detects the RF power out of the level modulator. Flat line segments indicate ALC saturation and should not occur between −15 dBm and +10 dBm. In Figure 10-5, the flat part is in the last (right side) division. A flat line at about 0 V indicates the cavity oscillator is not outputting any power.

Figure NODE2 here.

Figure 10-5. Analog Bus Node 2

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Node 3 Amp Id (amplifier input detector)

Perform step A3, above, to set up a power sweep on the analog bus. Then press (MEAS) ANALOG IN (3) (x1) (SCALE REF) AUTO SCALE.

Node 3 detects the power out of the mixer and into the amplifier. Typically the trace is flat at 0 V up to about 10 dBm, the response limit of the analog bus detector.

Figure NODE3 here.

Figure 10-6. Analog Bus Node 3

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Node 4 Det (detects RF OUT power level)

Perform step A3, above, to set up a power sweep on the analog bus. Then press (MEAS) ANALOG IN (4) (x1) (SCALE REF) AUTO SCALE.

Node 4 detects power that is coupled and detected from the RF OUT arm to the ALC loop. Note that the voltage exponentially follows the power level inversely. Flat segments indicate ALC saturation and should not occur between −15 dBm and +10 dBm.

Figure NODE4 here.

Figure 10-7. Analog Bus Node 4

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Node 5 Temp (temperature sensor)

This node registers the temperature of the cavity oscillator which must be known for effective spur avoidance. The sensitivity is 10 mV per degree Kelvin. The oscillator changes frequency slightly as its temperature changes. This sensor indicates the temperature so that the frequency can be predicted.

Node 6 Integ (ALC leveling integrator output)

Perform step A3, above, to set up a power sweep on the analog bus. Then press MEAS ANALOG IN 6 x1 SCALE REF AUTO SCALE.

Node 6 displays the output of the summing circuit in the ALC loop. Absolute voltage level variations are normal. Flat segments indicate ALC saturation and should not occur between −15 dBm and +10 dBm.

Figure NODE6 here.

Figure 10-8. Analog Bus Node 6

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Node 7 Log (log amplifier output detector)

Perform step A3, above, to set up a power sweep on the analog bus. Then press (MEAS) ANALOG IN (7) (x1) (SCALE REF) AUTO SCALE.

Node 7 displays the output of a logger circuit in the ALC loop. The trace should be a linear ramp. Absolute voltage level variations are normal. Flat segments indicate ALC saturation and should not occur between −15 dBm and +10 dBm.

The proper waveform at node 7 indicates that the circuits in the A3 source ALC loop are normal and the source is leveled.

Figure NODE7 here.

Figure 10-9. Analog Bus Node 7

Node 8 A3 Gnd (ground)

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To observe the A10 analog bus nodes perform step A10, below. Then follow the node-specific instructions.

Step A10.
Press:
PRESET
MEAS ANALOG IN
MARKER
SYSTEM SERVICE MENU ANALOG BUS ON
FORMAT MORE REAL

Node 9 +0.37 V (+0.37 V reference)

Perform step A10, above, and then press MEAS ANALOG IN RESOLUTION [HIGH] 9 x1.

Check for a flat line at approximately +0.37V. This is used as the voltage reference in the "Analog Bus Correction Constants" adjustment procedure. The voltage level should be the same in high and low resolution; the absolute level is not critical.

Node 10 +2.50 V (+2.50 V reference)

Perform step A10, above, and then press MEAS ANALOG IN RESOLUTION [LOW] 10 x1 SCALE REF 1 x1.

Check for a flat line at approximately +2.5 V. This voltage is used in the "Analog Bus Correction Constants" adjustment as a reference for calibrating the analog bus low resolution circuitry.

Node 11 Aux Input (rear panel input)

Perform step A10, above, and then press MEAS ANALOG IN 1 1 x1.

This selects the rear panel AUX INPUT to drive the analog bus for voltage and frequency measurements. It can be used to look at test points within the instrument, using the analyzer's display as an oscilloscope. Connect the test point of interest to the rear panel AUX INPUT BNC connector.

This feature can be useful if an oscilloscope is not available. Also, it can be used for testing voltage-controlled devices by connecting the driving voltage of the device under test to the AUX IN connector. Look at the driving voltage on one display channel, while displaying the S-parameter response of the test device on the other display channel.

With AUX OUT switched ON, you can examine the analyzer's analog bus nodes with external equipment (see AUX OUT on OFF under the "Analog Bus Menu" heading). For HP-IB considerations, see "HP-IB Service Mnemonic Definitions," located later in this chapter.

Node 12 A10 Gnd (ground reference)

This node is used in the "Analog Bus Correction Constants" adjustment as a reference for calibrating the analog bus low and high resolution circuitry.

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A11 Phase Lock

To observe the A11 analog bus nodes perform step A11, below. Then follow the node-specific instructions.

Step A11.
Press:
(PRESET)
(MEAS) ANALOG IN
(MARKER)
(SYSTEM) SERVICE MENU ANALOG BUS ON
(FORMAT) MORE REAL

Node 13 VCO Tune 2 (not used)

Node 14 Vbb Ref (ECL reference voltage level)

Perform step A11, above, and then press (MEAS) ANALOG IN (14) (x1) (SCALE REF) (.3) (x1) REFERENCE VALUE (-1.29) (x1)

The trace should be within 0.3 V (one division) of the reference value. Vbb Ref is used to compensate for ECL voltage drift.

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Node 15 Pretune (open-loop source pretune voltage)

Perform step A11, above, and then press (MEAS) ANALOG IN (15) (x1) (SCALE REF) AUTOSCALE.

This node displays the source pretune signal and should look like a stair-stepped ramp. Each step corresponds to the start of a band. Disregard the error message CAUTION: POSSIBLE FALSE LOCK.

Figure NODE15 here.

Figure 10-10. Analog Bus Node 15

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Node 16 1V/GHz (source oscillator tuning voltage)

Perform step A11, above, and then press (MEAS) ANALOG IN (16) (x1) (SCALE REF) AUTOSCALE.

This node displays the tuning voltage ramp used to tune the source oscillator. You should see a voltage ramp like the one shown in Figure 10-11. If this waveform is correct, you can be confident that the A11 phase lock assembly, the A3 source assembly, the A13/A14 fractional-N assemblies, and the A7 pulse generator are working correctly and the instrument is phase locked. If you see anything else, refer to the "Source Troubleshooting" chapter.

Figure NODE16 here.

Figure 10-11. Analog Bus Node 16

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Node 17 1st IF (IF used for phase lock)

Perform step A11, above, and then press (MEAS) ANALOG IN (17) (x1) COUNTER: ANALOG BUS (MENU) CW FREQ .

Vary the frequency and compare the results to the table below.

Entered Frequency	Counter Reading
0.3 to 15.999 MHz	same as entered
16 MHz to 3 GHz	1 MHz

This node displays the IF frequency (see node17) as it enters the A11 phase lock assembly via the A7 ALC assembly. This signal comes from the R sampler output and is used to phase lock the source.

Figure NODE17 here.

Figure 10-12. Counter Readout Location

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Node 18 IF Det 2N (IF on A11 phase lock after 3 MHz filter)

Perform step A11, above, and then press [MEAS] ANALOG IN [18] [x1] [STOP] [20] [M/μ] [SCALE REF] AUTOSCALE.

This node detects the IF within the low pass filter/limiter. The filter is used during the track and sweep sequences but never in band 1 (3.3 to 16 MHz). The low level (about −1.7 V) means IF is in the passband of the filter. This node can be used with the FRAC N TUNE and SRC TUNE service modes.

Figure NODE18 here.

Figure 10-13. Analog Bus Node 18

Node 19 IF Det 2W (IF after 16 MHz filter)

Perform step A11, above, and then press [MEAS] ANALOG IN [19] [x1] [MENU] [STOP] [20] [x1] [SCALE REF] [.2] [x1] REFERENCE VALUE [-1.2] [x1].

This node detects IF after the 16 MHz filter/limiter. The filter is used during pretune and acquire, but not in band 1. Normal state is a flat line at about −1.7 V.

Node 20 IF Det 1 (IF after 30 MHz filter)

Perform step A11, above and then press [MEAS] ANALOG IN [20] [x1] [SCALE REF] [1] [x1].

The trace should be a flat line across the entire frequency band at least 0.5 V greater than Vbb (node 14). The correct trace indicates the presence of IF after the first 30 MHz filter/limiter.

A12 Reference

To observe the A12 analog bus nodes perform step A12, below. Then follow the node-specific instructions.

Step A12.
Press:
[PRESET]
[MEAS] ANALOG IN
[MARKER]
[SYSTEM] SERVICE MENU ANALOG BUS ON
[FORMAT] MORE REAL

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Node 21 100 kHz (100 kHz reference frequency)

Perform step A12, above, and then press (MEAS) ANALOG IN (21) (x1) COUNTER: ANALOG BUS. This node counts the A12 100 kHz reference signal that is used on A13 (the fractional-N analog assembly) as a reference frequency for the phase detector.

Node 22 A12 Gnd 1 (ground)

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Node 23 VCO Tune (A12 VCO tuning voltage)

Perform Step A12, above, and then press (MEAS) ANALOG IN (23) (x1) (STOP) (20) (M/μ) (MARKER FCTN) (SCALE REF) AUTO SCALE.

The trace should show a voltage step as shown in Figure 10-14. If not, refer to the High/Low Band Transition Adjustment.

Figure NODE23 here.

Figure 10-14. Analog Bus Node 23

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Node 24 2nd LO

Perform step A12, above, and then press (MEAS) ANALOG IN (24) (x1) COUNTER: ANALOG BUS (MENU) CW FREQ.

This node counts the 2nd LO used by the sampler/mixer assemblies to produce the 2nd IF of 4 kHz. As you vary the frequency, the counter reading should change to values very close to those indicated below:

Frequency Entered	Counter Reading
0.3 to 1 MHz	frequency entered +4 kHz
1 to 16 MHz	not accurate
16 to 3,000 MHz	996 kHz

Node 25 PL Ref (phase lock reference)

Perform step A12, above, and then press (MEAS) ANALOG IN (25) (x1) COUNTER: ANALOG BUS (MENU) CW FREQ.

This node counts the reference signal used by the phase comparator circuit on the A11 phase lock assembly. As you vary the frequency, the counter reading should change as indicated below:

Frequency Entered	Counter Reading
0.3 to 1 MHz	frequency entered
1 to 16 MHz	not accurate
16 to 3,000 MHz	1 MHz

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Node 26 Ext Ref (rear panel external reference input)

Perform step A12, above, and then press [MEAS] ANALOG IN [26] [x1].

The voltage level of this node indicates whether an external reference timebase is being used:

- No external reference: about −0.9 V
- With external reference: about −0.6 V

Node 27 VCXO Tune (40 MHz VCXO tuning voltage)

Perform step A12, above, and then press [MEAS] ANALOG IN [27] [x1] [MARKER FCTN] MARKER REFERENCE.

This node displays the voltage used to fine tune the A12 reference VCXO to 40 MHz. You should see a flat line at some voltage level (the actual voltage level varies from instrument to instrument). Anything other than a flat line indicates that the VCXO is tuning to different frequencies. Refer to the "Frequency Accuracy" adjustment procedure.

Node 28 A12 Gnd 2 (Ground reference)

A14 Fractional-N (Digital)

To observe the A14 analog bus nodes perform step A14, below. Then follow the node-specific instructions.

Step A14.
Press:
[PRESET]
[MEAS] ANALOG IN
[SYSTEM] SERVICE MENU ANALOG BUS ON
[FORMAT] MORE REAL

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Node 29 FN VCO Tun (A14 FN VCO tuning voltage)

Perform step A14, above, and then press MEAS ANALOG IN 29 x1 SCALE REF AUTOSCALE.

Observe the A14 FN VCO tuning voltage. If the A13 and A14 assemblies are functioning correctly and the VCO is phase locked, the trace should look like Figure 10-15. Any other waveform indicates that the FN VCO is not phase locked. The vertical lines in the trace indicate the band crossings. (The counter can also be enabled to count the VCO frequency in CW mode.)

Figure NODE29 here.

Figure 10-15. Analog Bus Node 29

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Node 30 FN VCO Det (A14 VCO detector)

Perform step A14, above, and then press (MEAS) ANALOG IN (30) (x1) RESOLUTION [HIGH] (SCALE REF) (50) (k/m).

See whether the FN VCO is oscillating. The trace should resemble Figure 10-16.

Figure NODE30 here.

Figure 10-16. Analog Bus Node 30

Node 31 Count Gate (analog bus counter gate)

Perform step A14, above, and then press (MEAS) ANALOG IN (31) (x1) (SCALE REF) (2) (x1).

You should see a flat line at +5 V. The counter gate activity occurs during bandswitches, and therefore is not visible on the analog bus. To view the bandswitch activity, look at this node on an oscilloscope, using AUX OUT ON. Refer to AUX OUT on OFF under the Analog Bus Menu heading.

PEEK/POKE Menu

To access this menu, press (SYSTEM) SERVICE MENU PEEK/POKE.

PEEK/POKE	Accesses different memory locations to view or change the contents. The keys are described below.

Caution The PEEK/POKE capability is intended for service use only.

PEEK/POKE ADDRESS (PEEL[D])	Accesses any memory address and shows it in the active entry area of the display. Use the front panel knob, entry keys, or step keys to enter the memory address of interest.
PEEK (PEEK)	Displays the data at the accessed memory address.
POKE (POKE[D])	Allows you to change the data at the memory address accessed by the PEEK/POKE ADDRESS softkey. Use the front panel knob, entry keys, or step keys to change the data. The A9CC jumper must be in the "ALTER" position in order to poke.

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RESET MEMORY

Resets or clears the memory where instrument states are stored. To do this, press RESET MEMORY (PRESET).

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Firmware Revision Softkey

Press (SYSTEM) SERVICE MENU FIRMWARE REVISION to display the current firmware revision information. The number and implementation date appear in the active entry area of the display as shown in Figure 10-17 below. The installed options are also displayed. Another way to display the firmware revision information is to cycle the line power.

Figure FIRM here.

Figure 10-17. Location of Firmware Revision Information on Display

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HP-IB Service Mnemonic Definitions

All service routine keystrokes can be made through HP-IB in one of the following approaches:

- sending equivalent remote HP-IB commands. (Mnemonics have been documented previously with the corresponding keystroke.)
- invoking the System Menu (MENUSYST) and using the analyzer mnemonic (SOFTn), where "n" represents the softkey number. (Softkeys are numbered 1 to 8 from top to bottom.)

An HP-IB overview is provided in the "Compatible Peripherals" chapter in the *User's Guide*. HP-IB programming information is also provided in the *Programming Guide*.

Invoking Tests Remotely

Many tests require a response to the displayed prompts. Since bit 1 of the Event Status Register B is set (bit 1 = service routine waiting) any time a service routine prompts the user for an expected response, you can send an appropriate response using one of the following techniques:

- Read event status register B to reset the bit.
- Enable bit 1 to interrupt (ESNB[D]). See "Status Reporting" in the Programming Guide.
- Respond to the prompt with a TESRn command (see Tests Menu, at the beginning of this chapter).

Symbol Conventions

[ ]	An optional operand
D	A numerical operand
< >	A necessary appendage
|	An either/or choice in appendages

Analog Bus Codes

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ANAI[D]	Measures and displays the analog input. The preset state input to the analog bus is the rear panel AUX IN. The other 30 nodes may be selected with D only if the ABUS is enabled (ANABon).
OUTPCNTR	Outputs the counter's frequency data.
OUTPERRO	Reads any prompt message sent to the error queue by a service routine.
OUTPTESS	Outputs the integer status of the test most recently executed. Status codes are those listed under "TST?".
TST?	Executes the power-on self test (internal test 1) and outputs an integer test status. Status codes are as follows: 0 =pass 1 =fail 2 =in progress 3 =not available 4 =not done 5 =done

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Error Messages

This section contains an alphabetical list of the error messages that pertain to servicing the analyzer. The information in the list includes explanations of the displayed messages and suggestion to help solve the problem.

Note The error messages that pertain to measurement applications are included in the *HP 8753D Option 011 Network Analyzer User's Guide*.

`BATTERY FAILED. STATE MEMORY CLEARED`

Error Number 183 — The battery protection of the non-volatile CMOS memory has failed. The CMOS memory has been cleared. See Chapter 14 for battery replacement instructions. Refer to Chapter 12 of the *HP 8753D Network Analyzer User's Guide* for more information about the CMOS memory.

`BATTERY LOW! STORE SAVE REGS TO DISK`

Error Number 184 — The battery protection of the non-volatile CMOS memory is in danger of failing. If this occurs, all of the instrument state registers stored in CMOS memory will be lost. Save these states to a disk and see Chapter 14 for battery replacement instructions. Refer to Chapter 12 of the *HP 8753D Network Analyzer User's Guide* for more information about the CMOS memory.

`CALIBRATION ABORTED`

Error Number 74 — You have changed the active channel during a calibration so the calibration in progress was terminated. Make sure the appropriate channel is active and restart the calibration.

`CALIBRATION REQUIRED`

Error Number 63 — A calibration set could not be found that matched the current stimulus state or measurement parameter. You will have to perform a new calibration.

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CORRECTION CONSTANTS NOT STORED

Error Number 3 — A store operation to the EEPROM was not successful. You must change the position of the jumper on the A9 CPU assembly. Refer to the "A9 CC Jumper Position Procedure" in the "Adjustments and Correction Constants" chapter.

CORRECTION TURNED OFF

Error Number 66 — Critical parameters in your current instrument state do not match the parameters for the calibration set, therefore correction has been turned off. The critical instrument state parameters are sweep type, start frequency, frequency span, and number of points.

CURRENT PARAMETER NOT IN CAL SET

Error Number 64 — Correction is not valid for your selected measurement parameter. Either change the measurement parameters or perform a new calibration.

DEADLOCK

Error Number 111 — A fatal firmware error occurred before instrument preset completed. Call your local Hewlett-Packard sales and service office.

DEVICE: not on, not connect, wrong addrs

Error Number 119 — The device at the selected address cannot be accessed by the analyzer. Verify that the device is switched on, and check the HP-IB connection between the analyzer and the device. Ensure that the device address recognized by the analyzer matches the HP-IB address set on the device itself.

DISK HARDWARE PROBLEM

Error Number 39 — The disk drive is not responding correctly. Refer to the disk drive operating manual.

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DISK MESSAGE LENGTH ERROR

Error Number 190: The analyzer and the external disk drive aren't communicating properly. Check the HP-IB connection and then try substituting another disk drive to isolate the problem instrument.

DISK: not on, not connected, wrong addrs

Error Number 38: The disk cannot be accessed by the analyzer. Verify power to the disk drive, and check the HP-IB connection between the analyzer and the disk drive. Ensure that the disk drive address recognized by the analyzer matches the HP-IB address set on the disk drive itself.

DISK READ/WRITE ERROR

Error Number 189: There may be a problem with your disk. Try a new floppy disk. If a new floppy disk does not eliminate the error, suspect hardware problems.

EXCEEDED 7 STANDARDS PER CLASS

Error Number 72: When modifying calibration kits, you can define a maximum of seven standards for any class.

INITIALIZATION FAILED

Error Number 47: The disk initialization failed, probably because the disk is damaged.

INSUFFICIENT MEMORY

Error Number 51: Your last front panel or HP-IB request could not be implemented due to insufficient memory space. In some cases, this is a fatal error from which you can escape only by presetting the instrument.

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MORE SLIDES NEEDED

Error Number 71	When you use a sliding load (in a user-defined calibration kit), you must set at least three slide positions to complete the calibration.

NO CALIBRATION CURRENTLY IN PROGRESS

Error Number 69	The `RESUME CAL SEQUENCE` softkey is not valid unless a calibration is already in progress. Start a new calibration.

NOT ENOUGH SPACE ON DISK FOR STORE

Error Number 44	The store operation will overflow the available disk space. Insert a new disk or purge files to create free disk space.

NO FILE(S) FOUND ON DISK

Error Number 45	No files of the type created by an analyzer store operation were found on the disk. If you requested a specific file title, that file was not found on the disk.

NO IF FOUND: CHECK R INPUT LEVEL

Error Number 5	The first IF signal was not detected during pretune. Check the front panel R channel jumper. If there is no visible problem with the jumper, refer to Chapter 7, "Source Troubleshooting."

NO PHASE LOCK: CHECK R INPUT LEVEL

Error Number 7	The first IF signal was detected at pretune, but phase lock could not be acquired. Refer to Chapter 7, "Source Troubleshooting."

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NO SPACE FOR NEW CAL. CLEAR REGISTERS

Error Number 70

You cannot store a calibration set due to insufficient memory. You can free more memory by clearing a saved instrument state from an internal register (which may also delete an associated calibration set, if all the instrument states using the calibration kit have been deleted). You can store the saved instrument state and calibration set to a disk before clearing them. After deleting the instrument states, press PRESET to run the memory packer.

NOT ALLOWED DURING POWER METER CAL

Error Number 198

When the analyzer is performing a power meter calibration, the HP-IB bus is unavailable for other functions such as printing or plotting.

OVERLOAD ON INPUT A, POWER REDUCED

Error Number 58

See error number 57.

OVERLOAD ON INPUT B, POWER REDUCED

Error Number 59

See error number 57.

OVERLOAD ON INPUT R, POWER REDUCED

Error Number 57

You have exceeded approximately +14 dBm at one of the test ports. The RF output power is automatically reduced to −85 dBm. The annotation P appears in the left margin of the display to indicate that the power trip function has been activated. When this occurs, reset the power to a lower level, then toggle the SOURCE PWR on OFF softkey to switch on the power again.

PARALLEL PORT NOT AVAILABLE FOR GPIO

Error Number 165

You have defined the parallel port as COPY for sequencing in the HP-IB menu. To access the parallel port for general purpose I/O (GPIO), set the selection to [GPIO].

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PARALLEL PORT NOT AVAILABLE FOR COPY

Error Number 167

You have defined the parallel port as general purpose I/O (GPIO) for sequencing. The definition was made under the (LOCAL) key menus. To access the parallel port for copy, set the selection to `PARALLEL [COPY]`.

PHASE LOCK CAL FAILED

Error Number 4

An internal phase lock calibration routine is automatically executed at power-on, preset, and any time a loss of phase lock is detected. This message indicates that phase lock calibration was initiated and the first IF detected, but a problem prevented the calibration from completing successfully. Refer to Chapter 3 and execute pretune correction test 48.

This message may appear if you connect a mixer between the RF output and R input before turning on frequency offset mode. Ignore it: it will go away when you turn on frequency offset. This message may also appear if you turn on frequency offset mode before you define the offset.

PHASE LOCK LOST

Error Number 8

Phase lock was acquired but then lost. Refer to Chapter 7, "Source Troubleshooting."

POSSIBLE FALSE LOCK

Error Number 6

Phase lock has been achieved, but the source may be phase locked to the wrong harmonic of the synthesizer. Perform the source pretune correction routine documented in the "Adjustments and Correction Constants" chapter.

POWER UNLEVELED

Error Number 179

There is either a hardware failure in the source or you have attempted to set the power level too high. Check to see if the power level you set is within specifications. If it is, refer to Chapter 7, "Source Troubleshooting." You will only receive this message over the HP-IB. On the analyzer, `P?` is displayed.

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`POW MET INVALID`

Error Number 116	The power meter indicates an out-of-range condition. Check the test setup.

`POW MET NOT SETTLED`

Error Number 118	Sequential power meter readings are not consistent. Verify that the equipment is set up correctly. If so, preset the instrument and restart the operation.

`POW MET: not on, not connected, wrong addrs`

Error Number 117	The power meter cannot be accessed by the analyzer. Verify that the power meter address and model number set in the analyzer match the address and model number of the actual power meter.

`POWER SUPPLY HOT!`

Error Number 21	The temperature sensors on the A8 post-regulator assembly have detected an over-temperature condition. The power supplies regulated on the post-regulator have been shut down.

`POWER SUPPLY SHUT DOWN!`

Error Number 22	One or more supplies on the A8 post-regulator assembly have been shut down due to an over-current, over-voltage, or under-voltage condition.

`PRINTER: error`

Error Number 175	The parallel port printer is malfunctioning. The analyzer cannot complete the copy function.

`PRINTER: not handshaking`

Error Number 177	The printer at the parallel port is not responding.

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PRINTER: not on, not connected, wrong addrs

Error Number 24	The printer does not respond to control. Verify power to the printer, and check the HP-IB connection between the analyzer and the printer. Ensure that the printer address recognized by the analyzer matches the HP-IB address set on the printer itself.

PROBE POWER SHUT DOWN!

Error Number 23	The analyzer biasing supplies to the HP 85024A external probe are shut down due to excessive current. Troubleshoot the probe, and refer to Chapter 5, "Power Supply Troubleshooting."

SAVE FAILED. INSUFFICIENT MEMORY

Error Number 151	You cannot store an instrument state in an internal register due to insufficient memory. Increase the available memory by clearing one or more save/recall registers and pressing (PRESET), or by storing files to a disk.

SELF TEST #n FAILED

Service Error Number 112	Internal test #n has failed. Several internal test routines are executed at instrument preset. The analyzer reports the first failure detected. Refer to the internal tests and the self-diagnose feature descriptions earlier in this chapter.

SLIDES ABORTED (MEMORY REALLOCATION)

Error Number 73	You cannot perform sliding load measurements due to insufficient memory. Reduce memory usage by clearing save/recall registers, then repeat the sliding load measurements.

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SOURCE POWER TRIPPED, RESET UNDER POWER MENU

Information Message

You have exceeded the maximum power level at one of the inputs and power has been automatically reduced. The annotation P indicates that power trip has been activated. When this occurs, reset the power and then press (MENU) POWER SOURCE PWR on OFF, to switch on the power. This message follows error numbers 57, 58, and 59.

SYSTEM IS NOT IN REMOTE

Error Number 52

The analyzer is in local mode. In this mode, the analyzer will not respond to HP-IB commands with front panel key equivalents. It will, however, respond to commands that have no such equivalents, such as status requests.

TEST ABORTED

Error Number 113

You have prematurely stopped a service test.

SWEEP MODE CHANGED TO CW TIME SWEEP

Error Number 187

If you select external source auto or manual instrument mode and you do not also select CW mode, the analyzer is automatically switched to CW.

TROUBLE! CHECK SETUP AND START OVER

Service Error Number 115

Your equipment setup for the adjustment procedure in progress is not correct. Check the setup diagram and instructions in the "Adjustments and Correction Constants" chapter. Start the procedure again.

WRONG DISK FORMAT, INITIALIZE DISK

Error Number 77

You have attempted to store, load, or read file titles, but your disk format does not conform to the Logical Interchange Format (LIF). You must initialize the disk before reading or writing to it.

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11

Error Terms

The analyzer generates and stores factors in internal arrays when a measurement error-correction (measurement calibration) is performed. These factors are known by the following terms:

- error terms
- E-terms
- measurement calibration coefficients

The analyzer creates error terms by measuring well-defined calibration devices over the frequency range of interest and comparing the measured data with the ideal model for the devices. The differences represent systematic (repeatable) errors of the analyzer system. The resulting calibration coefficients are good representations of the systematic error sources. for details on the various levels of error-correction, refer to the "Optimizing Measurement Results" chapter of the *HP 8753D Option 011 Network Analyzer User's Guide*. Fore details on the theory of error-correction, refer to the "Application and Operation Concepts" chapter of the *HP 8753D Option 011 Network Analyzer User's Guide*.

Error Terms Can Also Serve a Diagnostic Purpose

Specific parts of the analyzer and its accessories directly contribute to the magnitude and shape of the error terms. Since we know this correlation and we know what typical error terms look like, we can examine error terms to monitor system performance (preventive maintenance) or to identify faulty components in the system (troubleshooting).

- **Preventive Maintenance.** A stable, repeatable system should generate repeatable error terms over long time intervals, for example, six months. If you make a hardcopy record (print or plot) of the error terms, you can periodically compare current error terms with the record. A sudden shift in error terms reflects a sudden shift in systematic errors, and may indicate the need for further troubleshooting. A long-term trend often reflects drift, connector and cable wear, or gradual degradation, indicating the need for further investigation and preventive maintenance. Yet, the system may still conform to specifications. The cure is often as simple as cleaning and gaging connectors or inspecting cables.
- **Troubleshooting.** If a subtle failure or mild performance problem is suspected, the magnitude of the error terms should be compared against values generated previously with the same instrument and calibration kit. This comparison will produce the most precise view of the problem.

  However, if previously generated values are not available, compare the current values to the typical values listed in Table 11-2, and shown graphically on the plots in this chapter. If the magnitude exceeds its limit, inspect the corresponding system component. If the condition causes system verification to fail, replace the component.

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Consider the following while troubleshooting:

1. All parts of the system, including cables and calibration devices, can contribute to systematic errors and impact the error terms.
2. Connectors must be clean, gaged, and within specification for error term analysis to be meaningful.
3. Avoid unnecessary bending and flexing of the cables following measurement calibration, minimizing cable instability errors.
4. Use good connection techniques during the measurement calibration. The connector interface must be repeatable. Refer to the "Principles of Microwave Connector Care" section in the "Service Equipment and Analyzer Options" chapter for information on connection techniques and on cleaning and gaging connectors.
5. Use error term analysis to troubleshoot minor, subtle performance problems. Refer to the "Start Troubleshooting Here" chapter if a blatant failure or gross measurement error is evident.
6. It is often worthwhile to perform the procedure twice (using two distinct measurement calibrations) to establish the degree of repeatability. If the results do not seem repeatable, check all connectors and cables.

Full Two-Port Error-Correction Procedure

Note This is the most accurate error-correction procedure. Since the analyzer takes both forward and reverse sweeps, this procedure takes more time than the other correction procedures.

1. Set any measurement parameters that you want for the device measurement: power, format, number of points, IF bandwidth.
2. To access the measurement correction menus, press:

   CAL

3. Assuming that your calibration kit is the m default, press:

   `CAL KIT 7 MM RETURN`

4. To select the correction type, press:

   `CALIBRATE MENU FULL 2-PORT REFLECTION`

5. Connect a shielded open circuit to PORT 1.

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Figure FULLCAL here.

Figure 11-1. Standard Connections for Full Two-Port Error-Correction

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6. To measure the standard, when the displayed trace has settled, press:

   FORWARD: OPEN

   The analyzer underlines the OPEN softkey after it measures the standard.

7. Disconnect the open, and connect a short circuit to PORT 1.
8. To measure the device, when the displayed trace has settled, press:

   FORWARD: SHORT

   The analyzer underlines the SHORT softkey after it measures the standard.

9. Disconnect the short, and connect an impedance-matched load to PORT 1.
10. To measure the standard, when the displayed trace has settled, press:

    FORWARD: LOAD

    The analyzer underlines the LOAD softkey after it measures the standard.

11. Repeat the open-short-load measurements descried above, but connect the devices in turn to PORT 2, and use the REVERSE: OPEN, REVERSE: SHORT, and REVERSE: LOAD softkeys.
12. To compute the reflection correction coefficients, press:

    STANDARDS DONE

13. To start the transmission portion of the correction, press: TRANSMISSION
14. Press ISOLATION and select from the following two options:

    - If you will be measuring devices with a dynamic range less than 90 dB, press:

      OMIT ISOLATION

    - If you will be measuring devices with a dynamic range greater than 90 dB, follow these steps:

      a. Connect impedance-matched loads to PORT 1 and PORT 2.

Note If you will be measuring highly reflective devices, such as filters, use the test device, connected to the reference plane and terminated with a load, for the isolation standard.

---

      b. Activate at least four times more averages than desired during the device measurement.

      c. Press (CAL) RESUME CAL SEQUENCE ISOLATION FWD ISOL'N ISOL'N STD REV ISOL'N ISOL'N STD ISOLATION DONE.

      d. Return the averaging to the original state of the measurement, and press (CAL) RESUME CAL SEQUENCE.

15. Make a "thru" connection between PORT 1 and PORT 2, as shown in Figure 11-1.

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16. To measure the standard, when the trace has settled, press: `TRANSMISSION` `DO BOTH FWD + REV`

17. To compute the error coefficients, press:

    `DONE 2-PORT CAL`

    The analyzer displays the corrected measurement trace. The analyzer also shows the notation `Cor` at the left of the screen, indicating that error-correction is on.

Note You can save or store the measurement correction to use for later measurements. Use the menus under SAVE/RECALL, or refer to "Printing, Plotting, and Saving Measurement Results" located in the *HP 8753D Option 011 Network Analyzer User's Guide* for procedures.

18. This completes the full two-port correction procedure. You can connect and measure your device under test.

Table 11-1. Calibration Coefficient Terms and Tests

Calibration Coefficient	Calibration Type				Test Number
	Response	Response and Isolation*	1-port	2-port	
1	E_R or E_T	E_X (E_D)	E_D	E_{DF}	32
2		E_T (E_R)	E_S	E_{SF}	33
3			E_R	E_{RF}	34
4				E_{XF}	35
5				E_{LF}	36
6				E_{TF}	37
7				E_{DR}	38
8				E_{SR}	39
9				E_{RR}	40
10				E_{XR}	41
11				E_{LR}	42
12				E_{TR}	43

NOTES:

Meaning of first subscript: D=directivity; S=source match; R=reflection tracking; X=crosstalk; L=load match; T=transmission tracking.

Meaning of second subscript: F=forward; R=reverse.

* Response and Isolation cal yields: E_X or E_T if a transmission parameter (S_{21}, S_{12}) or E_D or E_R if a reflection parameter (S_{11}, S_{22})

One-path, 2-port cal duplicates arrays 1 to 6 in arrays 7 to 12.

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Error Term Inspection

Note If the correction is not active, press (CAL) CORRECTION ON.

1. Press (SYSTEM) SERVICE MENU TESTS (32) (x1) EXECUTE TEST.

   The analyzer copies the first calibration measurement trace for the selected error term into memory and then displays it. Table 11-2 lists the test numbers.

2. Press (SCALE REF) and adjust the scale and reference to study the error term trace.
3. Press (MARKER FCTN) and use the marker functions to determine the error term magnitude.
4. Compare the displayed measurement trace to the trace shown in the following "Error Term descriptions" section, and to previously measured data. If data is not available from previous measurements, refer to the typical uncorrected performance specifications listed in Table 11-2.
5. Make a hardcopy of the measurement results:
   a. Connect a printing or plotting peripheral to the analyzer.
   b. Press (LOCAL) SYSTEM CONTROLLER SET ADDRESSES and select the appropriate peripheral to verify that the HP-IB address is set correctly on the analyzer.
   c. Press (SAVE/RECALL) and then choose either PRINT MONOCHROME or PLOT.
   d. Press (DISPLAY) MORE TITLE and title each data trace so that you can identify it later.

   For detailed information on creating hardcopies, refer to "Printing, Plotting, and Saving Measurement Results" in the *HP 8753D Option 011 Network Analyzer User's Guide*.

If Error Terms Seem Worse than Typical Values

1. Perform a system verification to verify that the system still conforms to specifications.
2. If system verification fails, refer to "Start Troubleshooting Here."

Uncorrected Performance

The following table shows typical performance without error-correction. RF cables are not used except as noted. Related error terms should be within these values.

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Table 11-2.
Uncorrected System Performance of HP 8753D (50Ω) with 7 mm Test Ports

	Frequency Range			
	30 kHz to 300 kHz*	300 kHz to 1.3 GHz	1.3 GHz to 3 GHz	3 GHz to 6 GHz
Directivity	20 dB	35 dB	30 dB	25 dB
Source Match	18 dB	16 dB	16 dB	14 dB
Load Match	20 dB	18 dB	16 dB	14 dB
Reflection Tracking	±2.0 dB	±1.5 dB	±1.5 dB	±2.5 dB
Transmission Tracking	±2.0 dB	±1.5 dB	±1.5 dB	±2.5 dB
Crosstalk	100 dB	100 dB	100 dB	90 dB

*Typical
15 dB, 30 kHz to 50 kHz
10 dB, 30 kHz to 50 kHz

Error Term Descriptions

The error term descriptions in this section include the following information:

- significance of each error term
- typical results following a full 2-port error-correction
- guidelines to interpret each error term

The same description applies to both the forward (F) and reverse (R) terms.

Directivity (EDF and EDR)

Description

Directivity is a measure of any detected power that is reflected when a load is attached to the test port. These are the uncorrected forward and reverse directivity error terms of the system. The directivity error of the test port is determined by measuring the reflection (S11, S22) of the load during the error-correction procedure.

Significant System Components

- load used in the error-correction (calibration)
- test port connectors
- test port cables

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Affected Measurements

Low reflection device measurements are most affected by directivity errors.

Figure EDFEDR here.

Figure 11-2. Typical EDF/EDR without and with Cables

Source Match (ESF and ESR)

Description

Source match is a measure of test port connector match, as well as the match between all components from the source to the test port. These are the forward and reverse uncorrected source match terms of the driven port.

Significant System Components

- load calibration kit device
- open calibration kit device
- short calibration kit device
- bridge
- test port connectors
- bias tees
- step attenuator
- transfer switch
- test port cables

Affected Measurements

Reflection and transmission measurements of highly reflective devices are most affected by source match errors.

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Figure ESFESR here.

Figure 11-3. Typical ESF/ESR without and with Cables

Reflection Tracking (ERF and ERR)

Description

Reflection tracking is the difference between the frequency response of the reference path (R path) and the frequency response of the reflection test path (A or B input path).

Significant System Components

- open calibration kit device
- short calibration kit device
- R signal path if large variation in both ERF and ERR
- A or B input paths if only one term is affected

Affected Measurements

All reflection measurements (high or low return loss) are affected by the reflection tracking errors.

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Figure ERFERR here.

Figure 11-4. Typical ERF/ERR Without and With Cables

Isolation (Crosstalk, EXF and EXR)

Description

Isolation is a measure of the leakage between the test ports and the signal paths. The isolation error terms are characterized by measuring transmission (S21, S12) with loads attached to both ports during the error-correction procedure. Since these terms are low in magnitude, they are usually noisy (not very repeatable). The error term magnitude changes dramatically with IF bandwidth: a 10 Hz IF bandwidth must be used in order to lower the noise floor beyond the crosstalk specification. Using averaging will also reduce the peak-to-peak noise in this error term.

Significant System Components

- sampler crosstalk

Affected Measurements

Transmission measurements, (primarily where the measured signal level is very low), are affected by isolation errors. For example, transmission measurements where the insertion loss of the device under test is large.

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Figure EXFEXR here.

Figure 11-5. Typical EXF/EXR with 10 Hz Bandwidth and with 3 kHz Bandwidth

Load Match (ELF and ELR)

Description

Load match is a measure of the impedance match of the test port that terminates the output of a 2-port device. Load match error terms are characterized by measuring the reflection (S11, S22) responses of a "thru" configuration during the calibration procedure.

Significant System Components

- "thru" cable
- cable connectors
- test port connectors

Affected Measurements

All transmission and reflection measurements of a low insertion loss two-port devices are most affected by load match errors. Transmission measurements of lossy devices are also affected.

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Figure ELFELR here.

Figure 11-6. Typical ELF/ELR

Transmission Tracking (ETF and ETR)

Description

Transmission tracking is the difference between the frequency response of the reference path (including R input) and the transmission test path (including A or B input) while measuring transmission. The response of the test port cables is included. These terms are characterized by measuring the transmission (S21, S12) of the "thru" configuration during the error-correction procedure.

Significant System Components

- R signal path (if both ETF and ETR and bad)
- A or B input paths
- "thru" cable

Affected Measurements

All transmission measurements are affected by transmission tracking errors.

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Figure ETFETR here.

Figure 11-7. Typical ETF/ETR

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12

Theory of Operation

This chapter is divided into two major sections:

- "How the HP 8753D Option 011 Works" gives a general description of the HP 8753D Network Analyzer's operation.
- "A Close Look at the Analyzer's Functional Groups" provides more detailed operating theory for each of the analyzer's functional groups.

How the HP 8753D Option 011 Works

Network analyzers measure the reflection and transmission characteristics of devices and networks. A network analyzer test system consists of the following:

- source
- signal-separation devices
- receiver
- display

The analyzer applies a signal that is either transmitted through the device under test, or reflected from its input, and then compares it with the incident signal generated by the swept RF source. The signals are then applied to a receiver for measurement, signal processing, and display.

The HP 8753D Option 011 vector network analyzer integrates a high resolution synthesized RF source and a dual channel three-input receiver to measure and display magnitude, phase, and group delay of transmitted and reflected power. The HP 8753D Option 010 has the additional capability of transforming measured data from the frequency domain to the time domain. Figure 12-1 is a simplified block diagram of the network analyzer system. A detailed block diagram of the analyzer is located at the end of Chapter 4, "Start Troubleshooting Here."

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Figure SIMBLK12 here.

Figure 12-1. Simplified Block Diagram of the Network Analyzer System

The Built-In Synthesized Source

The analyzer's built-in synthesized source produces a swept RF signal in the range of 300 kHz to 3.0 GHz. The HP 8753D Option 006 is able to generate signals from 30 kHz to 6 GHz. The RF output power is leveled by an internal ALC (automatic leveling control) circuit. To achieve frequency accuracy and phase measuring capability, the analyzer is phase locked to a highly stable crystal oscillator.

For this purpose, a portion of the transmitted signal is routed to the R channel input of the receiver, where it is sampled by the phase detection loop and fed back to the source.

Test Sets

Signal separation for the HP 8753D Option 011 network analyzer can be accomplished using any one of the following accessories:

- HP 85044A/B Transmission/Reflection Test Set
- HP 85046A/B S-Parameter Test Set
- HP 85047A S-Parameter Test Set
- HP Made Special Option Transmission/Reflection or S-Parameter Test Set
- HP 86205A/86207A RF Bridge
- HP 11667A Two-Way Power Splitter and HP 86205A RF Bridge

Signal separation devices are needed to separate the incident signal from the transmitted/reflected signal. The incident signal, which comes from the analyzer's source RF output, is applied to the R channel receiver input. Meanwhile, the transmitted/reflected signal is applied to the A or B channel receiver input via a test port coupler (in a test set) or an RF bridge.

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The HP 85046A/B and HP 85047A S-parameter test sets contain the hardware required to make simultaneous transmission and reflection measurements in both the forward and reverse directions. An RF path switch in the test set allows reverse measurements to be made without changing the connections to the device under test.

Test Set Step Attenuator

The 70 dB step attenuator contained in the test set is used to adjust the power level to the DUT without changing the level of the incident power in the reference path. The attenuator in the HP 85046A/B or HP 85047A test set is controlled from the front panel of the analyzer using the `ATTENUATOR PORT 1` or `ATTENUATOR PORT 2` softkeys located in the power menu.

The Receiver Block

The receiver block contains three sampler/mixers for the R, A, and B inputs. The signals are sampled, and down-converted to produce a 4 kHz IF (intermediate frequency). A multiplexer sequentially directs each of the three IF signals to the ADC (analog to digital converter) where it is converted from an analog to a digital signal to be measured and processed for viewing on the display. Both amplitude and phase information are measured simultaneously, regardless of what is displayed on the analyzer.

The Microprocessor

A microprocessor takes the raw data and performs all the required error correction, trace math, formatting, scaling, averaging, and marker operations, according to the instructions from the front panel or over HP-IB. The formatted data is then displayed.

Required Peripheral Equipment

In addition to the analyzer and the test set, a system requires calibration standards for vector accuracy enhancement, and cables for interconnections.

A Close Look at the Analyzer's Functional Groups

The operation of the analyzer is most logically described in five functional groups. Each group consists of several major assemblies, and performs a distinct function in the instrument. Some assemblies are related to more than one group, and in fact all the groups are to some extent interrelated and affect each other's performance.

Power Supply. The power supply functional group consists of the A8 post regulator and the A15 preregulator. It supplies power to the other assemblies in the instrument.

Digital Control. The digital control group consists of the A1 front panel and A2 front panel processor, the A9 CPU, the A16 rear panel, the A18 display and the A19 graphics system processor (GSP). The A10 digital IF assembly is also related to this group. These assemblies combine to provide digital control for the analyzer and an HP 85047A or 85046A/B S-parameter test set if used.

Source. The source group consists of the A3 source, A7 pulse generator, A11 phase lock, A12 reference, A13 fractional-N (analog), and A14 fractional-N (digital) assemblies. The A4

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sampler is also related since it is part of the source phase lock loop. The source supplies a phase-locked RF signal to the device under test.

Signal Separation. The signal separation group divides the source signal into a reference path and a test path, and provides connections to the device under test. To accomplish this, one of several external test sets must be connected to the analyzer.

Receiver. The receiver group consists of the A4/A5/A6 sampler/mixers and the A10 digital IF. The A12 reference assembly and the A9 CPU are also related. The receiver measures and processes input signals for display.

The following pages describe the operation of each of the functional groups.

Power Supply Theory

The power supply functional group consists of the A15 preregulator and the A8 post regulator. These two assemblies comprise a switching power supply that provides regulated DC voltages to power all assemblies in the analyzer. The A15 preregulator is enclosed in a casting at the rear of the instrument behind the display. It is connected to the A8 post regulator by a wire bus A15W1. Figure 12-2 is a simplified block diagram of the power supply group.

Figure PSBLK12 here.

Figure 12-2. Power Supply Functional Group, Simplified Block Diagram

A15 Preregulator

The A15 preregulator steps down and rectifies the line voltage. It provides a fully regulated +5 V digital supply, and several preregulated voltages that go to the A8 post regulator assembly for additional regulation.

The A15 preregulator assembly includes the line power module, a 60 kHz switching preregulator, and overvoltage protection for the +5 V digital supply. It provides LEDs, visible from the rear of the instrument, to indicate either normal or shutdown status.

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Line Power Module

The line power module includes the line power switch, voltage selector switch, and main fuse. The line power switch is activated from the front panel. The voltage selector switch, accessible at the rear panel, adapts the analyzer to local line voltages of approximately 115 V or 230 V (with 350 VA maximum). The main fuse, which protects the input side of the preregulator against drawing too much line current, is also accessible at the rear panel. Refer to the *HP 8753D Network Analyzer Installation and Quick Start Guide* for line voltage tolerances and other power considerations.

Preregulated Voltages

The switching preregulator converts the line voltage to several DC voltages. The regulated +5 V digital supply goes directly to the motherboard. The following partially regulated voltages are routed through A15W1 to the A8 post regulator for final regulation:

+70 V +25 V +18 V −18 V +8 V −8 V

Regulated +5 V Digital Supply

The +5VD supply is regulated by the control circuitry in the A15 preregulator. It goes directly to the motherboard, and from there to all assemblies requiring a low noise digital supply. A +5 V sense line returns from the motherboard to the A15 preregulator. The +5VCPU is derived from the +5VD in the A8 post regulator and goes directly to the A19 graphics system processor.

In order for the preregulator to function, the +5 V digital supply must be loaded by one or more assemblies, and the +5 V sense line must be working. If not, the other preregulated voltages will not be correct.

Shutdown Indications: the Green LED and Red LED

The green LED is on in normal operation. It is off when line power is not connected, not switched on, or set too low, or if the line fuse has blown.

The red LED, which is off in normal operation, lights to indicate a fault in the +5 V supply. This may be an over/under line voltage, over line current, or overtemperature condition. Refer to the troubleshooting chapters for more information.

A8 Post Regulator

The A8 post regulator filters and regulates the DC voltages received from the A15 preregulator. It provides fusing and shutdown circuitry for individual voltage supplies. It distributes regulated constant voltages to individual assemblies throughout the instrument. It includes the overtemperature shutdown circuit, the variable fan speed circuit, and the air flow detector. Nine green LEDs provide status indications for the individual voltage supplies.

Refer to the Power Supply Block Diagram located at the end of Chapter 5, “Power Supply Troubleshooting,” to see the voltages provided by the A8 post regulator.

Voltage Indications: the Green LEDs

The nine green LEDs along the top edge of the A8 assembly are on in normal operation, to indicate the correct voltage is present in each supply. If they are off or flashing, a problem is

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indicated. The troubleshooting procedures later in this chapter detail the steps to trace the cause of the problem.

Shutdown Circuit

The shutdown circuit is triggered by overcurrent, overvoltage, undervoltage, or overtemperature. It protects the instrument by causing the regulated voltage supplies to be shut down. It also sends status messages to the A9 CPU to trigger warning messages on the analyzer display. The voltages that are not shut down are the +5VD and +5VCPU digital supplies from the preregulator, the fan supplies, the probe power supplies, and the display supplies. The shutdown circuit can be disabled momentarily for troubleshooting purposes by using a jumper to connect the SDIS line (A8TP4) to ground.

Variable Fan Circuit and Air Flow Detector

The fan power is derived directly from the +18 V and −18 V supplies from the A15 preregulator. The fan is not fused, so that it will continue to provide airflow and cooling when the instrument is otherwise disabled. If overheating occurs, the main instrument supplies are shut down and the fan runs at full speed. An overtemperature status message is sent to the A9 CPU to initiate a warning message on the analyzer display. The fan also runs at full speed if the air flow detector senses a low output of air from the fan. (Full speed is normal at initial power on.)

Display Power

The A8 assembly supplies voltages to the display through a wire cable. The A8 supplies +5VCPU and +65 V to the A19 GSP, then the +65 V is routed to the display. They are not connected to the protective shutdown circuitry so that the A18 display assemblies can operate during troubleshooting when other supplies do not work.

Probe Power

The +18 V and −18 V supplies are post regulated to +15 V and −12.6 V to provide a power source at the front panel for an external RF probe or milli-meter modules.

Digital Control Theory

The digital control functional group consists of the following assemblies:

- A1 front panel
- A2 front panel processor
- A9 CPU
- A10 digital IF
- A16 rear panel
- A18 display
- A19 GSP

These assemblies combine to provide digital control for the entire analyzer and HP 85047A and 85046A/B S-parameter test set. They provide math processing functions, as well

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as communications between the analyzer and an external controller and/or peripherals. Figure 12-3 is a simplified block diagram of the digital control functional group.

Figure DIBLK12 here.

Figure 12-3. Digital Control Group, Simplified Block Diagram

A1 Front Panel

The A1 front panel assembly provides user interface with the analyzer. It includes the keyboard for local user inputs, and the front panel LEDs that indicate instrument status. The RPG (rotary pulse generator) is not electrically connected to the front panel, but provides user inputs directly to the front panel processor.

A2 Front Panel Processor

The A2 front panel processor detects and decodes user inputs from the front panel and the RPG, and transmits them to the CPU. It has the capability to interrupt the CPU to provide information updates. It controls the front panel LEDs that provide status information to the user.

A9 CPU/A10 Digital IF

The A9 CPU assembly contains the main CPU (central processing unit), the digital signal processor, memory storage, and interconnect port interfaces. The main CPU is the master controller for the analyzer, including the other dedicated microprocessors. The memory includes EEPROM, RAM, EPROM, and ROM.

Data from the receiver is serially clocked into the A9 CPU assembly from the A10 digital IF. The data taking sequence is triggered either from the A14 fractional-N assembly, externally from the rear panel, or by software on the A9 assembly.

Main CPU

The main CPU is a 16-bit microprocessor that maintains digital control over the entire instrument through the instrument bus. The main CPU receives external control information from the front panel or HP-IB, and performs processing and formatting operations on the raw

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data in the main RAM. It controls the digital signal processor, the front panel processor, the display processor, and the interconnect port interfaces. In addition, when the analyzer is in the system controller mode, the main CPU controls peripheral devices through the peripheral port interfaces.

The main CPU has a dedicated EPROM that contains the operating system for instrument control. Front panel settings are stored in CMOS RAM, with a battery providing at least 5 years of backup storage when external power is off.

Main RAM

The main RAM (random access memory) is shared memory for the CPU and the digital signal processor. It stores the raw data received from the digital signal processor, while additional calculations are performed on it by the CPU. The CPU reads the resulting formatted data from the main RAM and converts it to GSP commands. It writes these commands to the GSP for output to the analyzer display.

EEPROM

EEPROM (electrically-erasable programmable read only memory) contains factory set correction constants unique to each instrument. These constants correct for hardware variations to maintain the highest measurement accuracy. The correction constants can be updated by executing the routines in Chapter 3, "Adjustments and Correction Constants."

Digital Signal Processor

The digital signal processor receives the digitized data from the A10 digital IF. It computes discrete Fourier transforms to extract the complex phase and magnitude data from the 4 kHz IF signal. The resulting raw data is written into the main RAM.

A18 Display

The A18 display is a 7.5 inch raster scan CRT with associated drive circuitry. It receives a +65 V power supply from the A19 GSP, along with digital TTL horizontal and vertical sync signals, and red, green, and blue (RGB) video signals. Automatic degaussing is performed whenever the instrument is switched on to minimize the magnetization of the CRT.

A19 GSP

The A19 graphics system processor provides an interface between the A9 CPU and the A18 display. The CPU (A9) converts the formatted data to GSP commands and writes it to the GSP. The GSP processes the data to obtain the necessary video signals and sends the signals to the A18 display. It also produces RGB output signals which are sent to the A16 rear panel. The assembly receives two power supply voltages: +5VCPU, which is used for processing, and +65 V, which is passed on to A18 but not used on A19.

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A16 Rear Panel

The A16 rear panel includes the following interfaces:

TEST SET I/O INTERCONNECT. This allows you to connect an HP 8753D Option 011 analyzer to an HP 85046A/B or 85047A S-parameter test set using the interconnect cable supplied with the test set. The S-parameter test set is then fully controlled by the analyzer.

This interface also provides control signals and power to operate duplexer test adapters.

EXT REF. This allows for a frequency reference signal input that can phase lock the analyzer to an external frequency standard for increased frequency accuracy.

The analyzer automatically enables the external frequency reference feature when a signal is connected to this input. When the signal is removed, the analyzer automatically switches back to its internal frequency reference.

10 MHZ PRECISION REFERENCE. (Option 1D5) This output is connected to the EXT REF (described above) to improve the frequency accuracy of the analyzer.

AUX INPUT. This allows for a dc or ac voltage input from an external signal source, such as a detector or function generator, which you can then measure, using the S-parameter menu. (You can also use this connector as an analog output in service routines.)

EXT AM. This allows for an external analog signal input that is applied to the ALC circuitry of the analyzer's source. This input analog signal amplitude modulates the RF output signal.

EXT TRIG. This allows connection of an external negative TTL-compatible signal that will trigger a measurement sweep. The trigger can be set to external through softkey functions.

TEST SEQ. This outputs a TTL signal that can be programmed in a test sequence to be high or low, or pulse (10 seconds) high or low at the end of a sweep for a robotic part handler interface.

LIMIT TEST. This outputs a TTL signal of the limit test results as follows:

Pass: TTL high

Fail: TTL low

Source Theory Overview

The source produces a highly stable and accurate RF output signal by phase locking a YIG oscillator to a harmonic of the synthesized VCO (voltage controlled oscillator). The source output produces a CW or swept signal between 300 kHz and 3 GHz (or 30 kHz and 6 GHz for Option 006). The source has a maximum leveled power of +20 dBm (or +18 dBm for Option 006) and a minimum power of −5 dBm.

The full frequency range of the source is produced in 14 subsweeps, one in super low band, two in low band and eleven in high band. The high band frequencies (16 MHz to 3 GHz) or (16 MHz to 6 GHz for Option 006) are achieved by harmonic mixing, with a different harmonic number for each subsweep. The low band frequencies (300 kHz to 16 MHz) are down-converted by fundamental mixing. The super low band frequencies (10 kHz to 300 kHz) are sent directly from the A12 reference board to the output of the A3 source assembly. This

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band is not phased locked nor does it use the ALC. It is the basic amplified output of the fractional-N synthesizer.

The source functional group consists of the individual assemblies described below.

A14/A13 Fractional-N

These two assemblies comprise the synthesizer. The 30 to 60 MHz VCO in the A14 assembly generates the stable LO frequencies for fundamental and harmonic mixing.

A12 Reference

This assembly provides stable reference frequencies to the rest of the instrument by dividing down the output of a 40 MHz crystal oscillator. In low band operation, the output of the fractional-N synthesizer is mixed down in the A12 reference assembly. (The 2nd LO signal from the A12 assembly is explained in Receiver Theory.) The A12 is also the origin of the super low band portion of the 8753D source.

A7 Pulse Generator

A step recovery diode in the pulse generator produces a comb of harmonic multiples of the VCO output. These harmonics provide the high band LO (local oscillator) input to the samplers. In low band and super low band the operation the pulse generator is turned off.

A11 Phase Lock

This assembly compares the first IF (derived from the source output in the A4 sampler) to a stable reference, and generates an error voltage that is integrated into the drive for the A3 source assembly.

A3 Source

This assembly includes a 3.0 to 6.8 GHz YIG oscillator and a 3.8 GHz cavity oscillator. The outputs of these oscillators are mixed to produce the RF output signal. In Option 006 (30 kHz to 6 GHz) the frequencies 3.0 to 6.0 GHz are no longer a mixed product, but are the direct output of the YIG Oscillator. The signal tracks the stable output of the synthesizer. The ALC (automatic leveling control) circuitry is also in the A3 assembly.

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Source Super Low Band Operation

The Super Low Band Frequency Range is 10 kHz to 300 kHz. These frequencies are generated by the A12 Reference Board. They are the amplified output of the fractional-N synthesizer. This output is not phase locked and is not subject to ALC control. Refer to Table 12-1.

Table 12-1. Super Low Band Subsweep Frequencies

Fractional-N (MHz)	1st IF (MHz)	RF Output (MHz)
40.0 to 43.3	0.010 to 0.300	0.010 to 0.300

Source Low Band Operation

The low band frequency range is 300 kHz to 16 MHz. These frequencies are generated by locking the A3 source to a reference signal. The reference signal is synthesized by mixing down the fundamental output of the fractional-N VCO with a 40 MHz crystal reference signal. Low band operation differs from high band in these respects: The reference frequency for the A11 phase lock is not a fixed 1 MHz signal, but varies with the frequency of the fractional-N VCO signal. The sampler diodes are biased on to pass the signal through to the mixer. The 1st IF signal from the A4 sampler is not fixed but is identical to the RF output signal from the A3 source and sweeps with it. The following steps outline the low band sweep sequence, illustrated in Figure 12-4.

1. **A signal (FN LO) is generated by the fractional-N VCO.** The VCO in the A14 Fractional-N assembly generates a CW or swept signal that is 4O MHz greater than the start frequency. The signal is divided down to 1OO kHz and phase locked in the A13 assembly, as in high band operation.
2. **The fractional-N VCO signal is mixed with 40 MHz to produce a reference signal.** The signal (FN LO) from the Fractional-N VCO goes to the A12 reference assembly, where it is mixed with the 4O MHz VCXO (voltage controlled crystal oscillator). The resulting signal is the reference to the phase comparator in the A11 assembly.
3. **The A3 source is pretuned. The signal (RF OUT) is fed to the A4 sampler.** The pretuned DAC in the A11 phase lock assembly sets the A3 source to a frequency 1 to 6 MHz above the start frequency. This signal (RF OUT) goes to the A4 R input sampler/mixer assembly. (The source RF output *must* be connected externally to the R input connector in the Option 011.)
4. **The signal from the source is fed back (1st IF) to the phase comparator.** The source RF OUT signal passes directly through the sampler in the A4 assembly, because the sampler is biased on. The signal (1st IF) is fed back unaltered to the phase comparator in the A11 phase lock assembly. The other input to the phase comparator is the heterodyned reference signal from the A12 assembly. Any frequency difference between these two signals produces a proportional error voltage.
5. **A tuning signal (YO DRIVE) tunes the source and phase lock is achieved.** The error voltage is used to drive the A3 source YIG oscillator to bring the YIG closer to the reference frequency. The loop process continues until the source frequency and the reference frequency are the same, and phase lock is achieved.

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6. **A synthesized sub sweep is generated. The source tracks the synthesizer.** When lock is achieved at the start frequency, the synthesizer starts to sweep. This changes the phase lock reference frequency, and causes the source to track at a difference frequency 40 MHz below the synthesizer.

Figure LBBLK12 here.

Figure 12-4. Low Band Operation of the Source

The full low band is produced in two sub sweeps, to allow addition IF filtering below 3 MHz . At the transition between subsweeps, the source is pretuned and then relocks. Table 12-2 lists the low band subsweep frequencies at the fractional-N VCO and the RF output.

Table 12-2. Low Band Subsweep Frequencies

Fractional-N (MHz)	1st IF (MHz)	RF Output (MHz)
40.3 to 43.3	0.3 to 3.3	0.3 to 3.3
43.3 to 56.0	3.3 to 16.0	3.3 to 16.0

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Source High Band Operation

The high band frequency range is 16 MHz to 3.O GHz or 16 MHz to 6.0 GHz with Option 006. These frequencies are generated in subsweeps by phase-locking the A3 source signal to harmonic multiples of the fractional-N VCO. The high band subsweep sequence, illustrated in Figure 12-5, follows these steps:

1. **A signal (HI OUT) is generated by the fractional-N VCO.** The VCO in the A14 fractional-N assembly generates a CW or swept signal in the range of 30 to 60 MHz. This signal is synthesized and phase locked to a 100 kHz reference signal from the A12 reference assembly. The signal from the fractional-N VCO is divided by 1 or 2, and goes to the pulse generator.
2. **A comb of harmonics (1st LO) is produced in the A7 pulse generator.** The divided down signal from the fractional-N VCO drives a step recovery diode (SRD) in the A7 pulse generator assembly. The SRD multiplies the fundamental signal from the fractional-N into a comb of harmonic frequencies. The harmonics are used as the 1st LO (local oscillator) signal to the samplers. One of the harmonic signals is 1 MHz below the start signal set from the front panel.
3. **The A3 source is pretuned. The source RF OUT is fed to the A4 sampler.** The pretune DAC in the A11 phase lock assembly sets the A3 source to a first approximation frequency (1 to 6 MHz higher than the start frequency). This signal (RF OUT) goes to the A4 R input sampler/mixer assembly.
4. **The synthesizer signal and the source signal are combined by the sampler. A difference frequency is generated.** In the A4 sampler, the 1st LO signal from the pulse generator is combined with the RF OUT signal. The IF (intermediate frequency) produced is a first approximation of 1 MHz. This signal (1st IF) is routed back to the A11 phase lock assembly.

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5. **The difference frequency (1st IF) from the A4 sampler is compared to a reference.** The 1st IF feedback signal from the A4 is filtered and applied to a phase comparator circuit in the A11 phase lock assembly. The other input to the phase comparator is a crystal controlled 1 MHz signal from the A12 reference assembly. Any frequency difference between these two signals produces a proportional error voltage.

6. **A tuning signal (YO DRIVE) tunes the source and phase lock is achieved.** The error voltage is used to drive the A3 source YIG oscillator, in order to bring it closer to the required frequency. The loop process continues until the 1st IF feedback signal to the phase comparator is equal to the 1 MHz reference signal, and phase lock is achieved.

7. **A synthesized subsweep is generated by A13/A14. The A3 source tracks the synthesizer.** When the source is phase locked to the synthesizer at the start frequency, the synthesizer starts to sweep. The phase locked loop forces the source to track the synthesizer, maintaining a constant 1 MHz 1st IF signal .

   The full high band sweep is generated in a series of subsweeps, by phase locking the A3 source signal to harmonic multiples of the fractional-N VCO. The 16 to 31 MHz subsweep is produced by a one half harmonic, using the divide-by-2 circuit on the A14 assembly. At the transitions between subsweeps, the source is pretuned and then relocks. Table 12-3 lists the high band subsweep frequencies from the fractional-N VCO and the RF output.

Figure HBBLK12 here.

Figure 12-5. High Band Operation of the Source

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Table 12-3. High Band Subsweep Frequencies

Fractional-N (MHz)	Harmonic	RF Output (MHz)
30 to 60	1/2	16 to 31
30 to 60	1	31 to 61
30 to 60	2	61 to 121
40 to 59	3	121 to 178
35.4 to 59.2	5	178 to 296
32.8 to 59.4	9	296 to 536
35.7 to 59.5	15	536 to 893
33.0 to 59.5	27	893 to 1607
31.5 to 58.8	51	1607 to 3000
Option 006		
37.0 to 59.6	83	3000 to 4950
49.0 to 59.4	101	4950 to 6000

Source Operation in other Modes/Features

Besides the normal network analyzer mode, the HP 8753D Option 011 has extra modes and features to make additional types of measurements. The following describes the key differences in how the analyzer operates to achieve these new measurements.

Frequency Offset

The analyzer can measure frequency-translating devices with the frequency offset feature.

The receiver operates normally. However, the source is pretuned to a different frequency by an offset entered by the user. The device under test will translate this frequency back to the frequency the receiver expects. Otherwise, phase locking and source operation occur as usual.

Harmonic Analysis (Option 002)

The analyzer can measure the 2nd or 3rd harmonic of the fundamental source frequency, on a swept or CW basis, with the harmonic analysis feature (optional).

To make this measurement, the reference frequency (normally 1 MHz) from the A12 reference assembly to the A11 phase lock assembly is divided by 1, 2, or 3. See Figure 12-6.

The fractional-N assemblies are also tuned so that the correct harmonic (comb tooth) of the 1st LO is 0.500 or 0.333 MHz below the source frequency instead of the usual 1.000 MHz. The analyzer pretunes the A3 source normally, then phase locks the 1st IF to the new reference frequency to sweep the fundamental source frequency in the usual way. The key difference is that the 1st IF (output from the R sampler) due to the fundamental and used for phase locking is now 0.500 or 0.333 MHz instead of 1.000 MHz.

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Since the chosen VCO harmonic and the source differ by 0.500 or 0.333 MHz, then another VCO harmonic, 2 or 3 times higher in frequency, will be exactly 1.000 MHz away from the 2nd or 3rd harmonic of the source frequency. The samplers, then, will also down-convert these harmonics to yield the desired components in the 1st IF at 1.000 MHz. Narrow bandpass filters in the receiver eliminate all but the 1.000 MHz signals; these pass through to be processed and displayed.

Figure HARBLK12 here.

Figure 12-6. Harmonic Analysis

External Source Mode

In external source mode, the analyzer phase locks its receiver to an external signal source. This source must be CW (not swept), but it does not need to be synthesized. The user must enter the source frequency into the analyzer. (The analyzer's internal source output is not used.)

To accomplish this, the phase lock loop is reconnected so that the tuning voltage from the A11 phase lock assembly controls the VCO of the A14 fractional-N assembly and not the A3 source. See Figure 12-7. The VCO's output still drives the 1st LO of the samplers and down-converts the RF signal supplied by the external source. The resulting 1st IF is fed back to the A11 phase lock assembly, compared to the 1.000 MHz reference, and used to generate a tuning voltage as usual. However, the tuning voltage controls the VCO to lock on to the external source, keeping the 1st IF at exactly 1.000 MHz.

The analyzer normally goes through a pretune-acquire-track sequence to achieve phase lock. In external source mode, the fractional-N VCO pretunes as a closed-loop synthesizer referenced to the 100 kHz signal from the A12 reference assembly. Then, to acquire or track, a switch causes the VCO to be tuned by the A11 phase lock assembly instead. (Refer to the Overall Block Diagram at the end of Chapter 4, "Start Troubleshooting Here.")

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Figure EXBLK12 here.

Figure 12-7. External Source Mode

Tuned Receiver Mode

In tuned receiver mode, the analyzer is a synthesized, swept, narrow-band receiver only. The external signal source must be synthesized and reference-locked to the analyzer.

To achieve this, the analyzer's source and phase lock circuits are completely unused. See Figure 12-8. The fractional-N synthesizer is tuned so that one of its harmonics (1st LO) down-converts the RF input to the samplers. (In contrast to external source mode, the analyzer does not phase lock at all. However, the 1st LO is synthesized.)

The analyzer can function as a swept tuned receiver, similar to a spectrum analyzer, but the samplers create spurious signals at certain frequencies, which limit the accuracy of such measurements.

Figure TRBLK12 here.

Figure 12-8. Tuned Receiver Mode

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Signal Separation

External Test Sets

The HP 85047A S-parameter test set contains a switched frequency doubler to double the HP 8753C source frequency. A portion of the RF signal is coupled to the analyzer R input for reference. (For an HP 8753D Option 011 combined with Option 006, the frequency doubler is bypassed since the analyzer's source is capable of generating a swept RF signal up to 6 GHz.) The remaining signal is routed through a 70 dB programmable step attenuator to the directional couplers for reflection and transmission measurements. The couplers allow detection of the signal from 300 kHz to 6 GHz. These couplers provide low insertion loss between the RF input and the test ports. Two bias tees supply external biasing for active devices. An HP 8753D Option 006/011 is required for use with the HP 85047A test set. Figure 12-9a shows a simplified block diagram of the HP 85047A.

The HP 85046A/B S-parameter test set contains a power splitter to divert a portion of the incident signal to the R input of the analyzer for reference. The remainder of the incident signal is routed through a switch to one of two directional bridges at the measurement ports. The RF path switch is controlled by the analyzer to enable switching between forward and reverse measurements. A 70 dB step attenuator in the test set, also controlled from the analyzer, adjusts the power level to the DUT without changing the level of the incident power in the reference path. Two bias tees are included, for external biasing of active devices connected to the test ports. Figure 12-9b shows a simplified block diagram of the HP 85046A/B.

The HP 85044A/B transmission/reflection test set contains a power splitter to divert a portion of the incident signal to the R input of the analyzer. The remainder of the incident signal is routed through a directional bridge to the measurement port. The test set includes a manually controlled 70 dB step attenuator, and a bias tee for external biasing of active devices connected to the test port. A simplified block diagram of the HP 85044A/B is shown in Figure 12-9c.

An HP 11850C/D or 11667A power splitter can be used instead of a test set for transmission measurements only.

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Figure TSBLK12 here.

Figure 12-9. Simplified Block Diagrams of the Test Sets

Receiver Theory

The receiver functional group consists of the following assemblies:

- A4 sampler/mixer
- A5 sampler/mixer
- A6 sampler/mixer
- A10 digital IF

These assemblies combine with the A9 CPU (described in Digital Control Theory) to measure and process input signals into digital information for display on the analyzer. Figure 12-10 is a simplified block diagram of the receiver functional group. The A12 reference assembly is also included in the illustration to show how the 2nd LO signal is derived.

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Figure RFGBLK12 here.

Figure 12-10. Receiver Functional Group, Simplified Block Diagram

A4/A5/A6 Sampler/Mixer

The A4, A5, and A6 sampler/mixers all down-convert the RF input signals to fixed 4 kHz 2nd IF signals with amplitude and phase corresponding to the RF input.

The Sampler Circuit in High Band

In high band operation, the sampling rate of the samplers is controlled by the 1st LO from the A7 pulse generator assembly. The 1st LO is a comb of harmonics produced by a step recovery diode driven by the fractional-N VCO fundamental signal. One of the harmonic signals is 1 MHz below the start frequency set at the front panel. The 1st LO is combined in the samplers with the RF input signal from the source. In the Option 006, samplers are additionally capable of recognizing RF input signals from 3 to 6 GHz. The mixing products are filtered, so that the only remaining response is the difference between the source frequency and the harmonic 1 MHz below it. This fixed 1 MHz signal is the 1st IF. Part of the 1st IF signal from the R sampler is fed back to the A11 phase lock assembly (the RF output *must* be connected externally to the R input connector for phase-locked operation).

The Sampler Circuit in Low Band or Super Low Band

In low band or super low band (Option 011 combined with Option 006) the sampler diodes are biased continuously on, so that the RF input signal passes through them unchanged. Thus the 1st IF is identical to the RF output signal from the source (300 kHz to 16 MHz for lowband; 10 to 300 kHz for super lowband), and sweeps with it. Part of the 1st IF signal from the R sampler is fed back to the A11 phase lock assembly.

(Refer to “Source Theory Overview” for information on high band and low band operation of the source.)

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The 2nd LO Signal

The 2nd LO is obtained from the A12 reference assembly. In high band, the 2nd LO is fixed at 996 kHz. This is produced by feeding the 39.84 MHz output of a phase-locked oscillator in the A12 assembly through a divide-by-40 circuit.

In low band, the 2nd LO is a variable frequency produced by mixing the output of the fractional-N VCO with a fixed 39.996 MHz signal in the A12 assembly. The 2nd LO covers the range of 0.304 to 16.004 MHz (0.014 to 16.004 MHz if Option 011 is combined with Option 006) in two subsweeps that correspond with the source subsweeps. These subsweeps are 0.304 to 3.304 MHz and 3.304 to 16.004 MHz.

The Mixer Circuit

The 1st IF and the 2nd LO are combined in the mixer circuit. The resulting difference frequency (the 2nd IF) is a constant 4 kHz in both bands, as Table 12-4 shows.

Table 12-4. Mixer Frequencies

Band	1st IF	2nd LO	2nd IF
Super Low*	0.010 to 0.300 MHz	0.014 to 0.304 MHz	4.0 kHz
Low	0.300 to 16.0 MHz	0.304 to 16.004 MHz	4.0 kHz
High	1.000 MHz	0.996 MHz	4.0 kHz

* This band is present on the HP 8753D Option 011 *only* when it is combined with the Option 006.

A10 Digital IF

The three 4 kHz 2nd IF signals from the sampler/mixer assemblies are input to the A10 digital IF assembly. These signals are sampled at a 16 kHz rate. A fourth input is the analog bus, which can monitor either an external input at the rear panel AUX IN connector, or one of 31 internal nodes. A multiplexer sequentially directs each of the signals to the ADC (analog-to-digital converter). Here they are converted to digital form and sent to the A9 CPU assembly for processing. Refer to "Digital Control Theory" for more information on signal processing.

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14

Assembly Replacement and Post-Repair Procedures

This chapter contains procedures for removing and replacing the major assemblies of the HP 8753D Option 011 Network Analyzer. A table showing the corresponding post-repair procedures for each replaced assembly is located at the end of this chapter.

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Replacing an assembly

The following steps show the sequence to replace an assembly in an HP 8753D Option 011 Network Analyzer.

1. Identify the faulty group. Refer to Chapter 4, "Start Troubleshooting Here." Follow up with the appropriate troubleshooting chapter that identifies the faulty assembly.
2. Order a replacement assembly. Refer to Chapter 13, "Replaceable Parts."
3. Replace the faulty assembly and determine what adjustments are necessary. Refer to Chapter 14, "Assembly Replacement and Post-Repair Procedures."
4. Perform the necessary adjustments. Refer to Chapter 3, "Adjustments and Correction Constants."
5. Perform the necessary performance tests. Refer to Chapter 2, "System Verification and Performance Tests."

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

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

Warning **The power cord is connected to internal capacitors that may remain live for 10 seconds after disconnecting the plug from its power supply.**

Caution Many of the assemblies in this instrument are very susceptible to damage from ESD (electrostatic discharge). Perform the following procedures only at a static-safe workstation and wear a grounding strap.

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Procedures described in this chapter

The following pages describe assembly replacement procedures for the HP 8753D Option 011 assemblies listed below:

- Line Fuse
- Covers
- Front Panel Assembly
- Rear Panel Assembly
- Type-N Connector Assembly
- **A1** Keyboard
- **A2** Front Panel Interface
- **A3** Source Assembly
- **A4, A5, A6** Samplers and **A7** Pulse Generator
- **A8, A10, A11, A12, A13, A14** Card Cage Boards
- **A9** CPU Board
- **A9BT1** Battery
- **A15** Preregulator
- **A16** Rear Panel Interface
- **A17** Motherboard Assembly
- **A18** Display
- **A19** Graphics Processor
- **A20** Disk Drive
- **A26** High Stability Frequency Reference (Option 1D5)
- **B1** Fan

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Line Fuse

Tools Required

- small slot screwdriver

Removal

Warning **For continued protection against fire hazard, replace fuse only with same type and rating (3 A 250 V F). The use of other fuses or materials is prohibited.**

1. Disconnect the power cord.
2. Use a small slot screwdriver to pry open the fuse holder.
3. Replace the blown fuse with a 3 A 250 V F fuse (HP part number 2110-0708).

Replacement

- Simply replace the fuse holder.

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Covers

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- T-20 TORX screwdriver

Removing the top cover

1. Remove both upper rear feet (item 1) by loosening the attaching screws (item 2).
2. Loosen the top cover screw (item 3).
3. Slide cover off.

Removing the side covers

1. Remove the top cover.
2. Remove the lower rear foot (item 4) that corresponds to the side cover you want to remove by loosening the attaching screw (item 5).
3. Remove the handle assembly (item 6) by loosening the attaching screws (item 7).
4. Slide cover off.

Removing the bottom cover

1. Remove both lower rear feet (item 4) by loosening the attaching screws (item 5).
2. Loosen the bottom cover screw (item 8).
3. Slide cover off.

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Front Panel Assembly

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- small slot screwdriver
- ESD (electrostatic discharge) grounding wrist strap
- 5/16-inch open-end torque wrench (set to 10 in-lb)

Removal

1. Disconnect the power cord.
2. Remove the bezel's softkey cover (item 1) by sliding your fingernail under the left edge, near the top or bottom of the cover. Pry the softkey cover away from the bezel. If you use another tool, take care not to scratch the glass.
3. Remove the two screws (item 2) exposed by the previous step. The bezel (item 3) is now free from the frame. Remove it.
4. Remove the trim strip (item 4) from the top edge of the front frame by prying under the strip with a small slot screwdriver.
5. Remove the two screws (item 5) from the top edge of the frame.
6. Remove the left-side trim strip (item 6) from the front frame to expose four screws. Remove the bottom screw (item 7).

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7. Remove both front feet (item 8).
8. Remove the four screws (item 9) from the bottom edge of the frame.
9. Slide the front panel over the four Type-N connectors (item 10).
10. Disconnect the ribbon cable (W17) from the front panel by pressing down and out on the connector locks. The front panel is now free from the instrument.

Replacement

- Reverse the order of the removal procedure.

Note When reconnecting semi-rigid cables, it is recommended that the connections be torqued to 10 in-lb.

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Rear Panel Assembly

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord and remove the top and bottom covers (refer to "Covers" in this chapter).
2. Remove six screws (item 1) from the rear frame: two from the top edge and four from the bottom edge.
3. Remove the screw from the pc board stabilizer (item 2) and remove the stabilizer.
4. Lift the reference board (A12) from its motherboard connector and disconnect W13 from A12J3.
5. Remove the six screws (item 3), next to the preregulator, from the rear panel as shown.
6. Remove the four screws (item 4), surrounding the connector interfaces, from the rear panel as shown.

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7. Pull the rear panel away from the frame. Disconnect the ribbon cable (W27) from the motherboard connector (A17J6), pressing down and out on the connector locks. The rear panel is now connected only by three flexible cables (W21, W22, and W23).
8. Remove the bracket (item 5) that secures the graphics board (A19), removing the two screws that attach it to the rear frame. *The preregulator is now sitting loosely in the instrument*. Gently press the top of the graphics board (A19) towards the display (A18) then lift up. Disconnect the three flexible cables (W21, W22, and W23) from the graphics board (A19). The rear panel is now detached.

Replacement

- Reverse the order of the removal procedure.

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Type-N Connector Assembly

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- small slot screwdriver
- ESD (electrostatic discharge) grounding wrist strap
- 5/16-inch open-end torque wrench (set to 10 in-lb)

Removal

1. Disconnect the power cord and remove the top cover (refer to “Covers” in this chapter).
2. Remove the front panel (refer to “Front Panel Assembly” in this chapter).
3. Remove the source bracket (item 1).
4. Disconnect the semi-rigid cables (W1, W2, W3, and W4) from the source and the samplers.
5. Remove the two screws (item 2) that secure the bracket (item 3) holding the semi-rigid cables against the card cage assembly. Remove the bracket.
6. Remove the right-side trim strip (item 4) from the front frame. Remove the screw (item 5) that secures the right end of the Type-N connector bracket.

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7. Remove the three screws (item 6) from the bottom edge of the front frame that secure the connector bracket. Remove the connector assembly (item 7).

Replacement

- Reverse the order of the removal procedure.

Note When reconnecting semi-rigid cables, it is recommended that the connections be torqued to 10 in-lb.

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A1 Keyboard

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- small slot screwdriver
- ESD (electrostatic discharge) grounding wrist strap
- 5/16-inch open-end torque wrench (set to 10 in-lb)

Removal

1. Remove the front panel interface board (refer to "A2 Front Panel Interface" in this chapter).
2. Remove the eight screws (item 2) that attach the front panel keyboard assembly (A1) to the front panel. Detach the keyboard assembly.

Replacement

- Reverse the order of the removal procedure.

Note

When reinstalling the keyboard assembly (A1), place the eight screws in the holes plated with a circular pattern. (The other four holes secure the interface board (A2).)

Initially, you should install all eight screws loosely. Then you can go back and tighten each one. This will ensure that the board is correctly aligned.

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A2 Front Panel Interface

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- small slot screwdriver
- ESD (electrostatic discharge) grounding wrist strap
- 5/16-inch open-end torque wrench (set to 10 in-lb)

Removal

1. Remove the front panel (refer to "Front Panel Assembly" in this chapter).
2. Disconnect W18, W19, and RPG1W1 from the interface board (A2).
3. Disconnect A1W1 from the interface board (A2), inserting the blade of a small slot screwdriver into the slots on the sides of the ribbon cable connector. Gently pry upward on either side of the connector until the ribbon cable is detached.
4. Remove the four screws (item 1) from the corners of the interface board (A2). Remove the board.

Replacement

- Reverse the order of the removal procedure.

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A3 Source Assembly

Tools Required

- T-15 TORX screwdriver
- 5/16-inch open-end torque wrench (set to 10 in-lb)
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord and remove the top cover (refer to "Covers" in this chapter).
2. Remove the source bracket (item 1).
3. Disconnect the semi-rigid cable (W1) from the source assembly (A3). If you have Option 006, remove the flexible cable (W26) from the source as well.
4. Lift the two retention clips (item 2) at the front and rear of the source assembly (A3) to an upright position.
5. The source is seated in a motherboard edge connector. Hold the loose semi-rigid cable (W1) to the right and lift up on the source bracket handle (item 3) to remove the source assembly from the instrument.

Replacement

1. Slide the edges of the sheet metal partition (item 4) into the guides at the front and back of the source compartment. Press down on the module to ensure that it is well seated in the motherboard connector.
2. Push down the retention clips. Reconnect the semi-rigid cable (W1) to the source assembly. If you have Option 006, reconnect the flexible cable (W26) to the source as well.

Note When reconnecting semi-rigid cables, it is recommended that the connections be torqued to 10 in-lb.

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A4, A5, A6 Samplers and A7 Pulse Generator

Tools Required

- T-10 TORX screwdriver
- 5/16-inch open-end torque wrench (set to 10 in-lb)
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord and remove the top cover (refer to "Covers" in this chapter).
2. To remove the R sampler (A4), you must remove the source bracket (item 1).
3. Disconnect all cables from the top of the sampler (A4/A5/A6) or pulse generator (A7).
4. Remove the screws from the top of the assembly. Extract the assembly from the slot.

Note

- If you are removing the pulse generator (A7), the grounding clip, which rests on top of the assembly, will become loose once the four screws are removed. Be sure to replace the grounding clip when reinstalling the pulse generator assembly.
- If you're removing more than one sampler, be careful not to mix them. The R sampler (A4) is different from the A and B samplers (A5 and A6).

Replacement

- Reverse the order of the removal procedure.

Note

- When reconnecting semi-rigid cables, it is recommended that the connections be torqued to 10 in-lb.
- Be sure to route W8 and W9 as shown. No excess wire should be hanging in the A11 and A14 board slots. Routing the wires in this manner will reduce noise and crosstalk.

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A8, A10, A11, A12, A13, A14 Card Cage Boards

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord and remove the top cover (refer to "Covers" in this chapter).
2. Remove the screw from the pc board stabilizer (item 1) and remove the stabilizer.
3. Lift the two extractors (item 2) located at each end of the board. Lift the board from the card cage slot, just enough to disconnect any flexible cables that may be connected to it.
4. Remove the board from the card cage slot.

Replacement

- Reverse the order of the removal procedure.

Note Be sure to route W8 and W9 as shown. No excess wire should be hanging in the A11 and A14 board slots. Routing the wires in this manner will reduce noise and crosstalk in the instrument.

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A9 CPU Board

Tools Required

- T-10 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord.
2. Remove the four screws (item 1) on the rear panel.
3. Remove the bottom cover (refer to “Covers” in this chapter).
4. Remove the screw (item 2) that secures the CPU board (A9) to the deck. Slide the board towards the front of the instrument so that it disconnects from the three standoffs (item 3).
5. Disconnect the four ribbon cables (W37, W20, W35, and W36) from the CPU board (A9).
6. Lift the board off of the standoffs.

Replacement

- Reverse the order of the removal procedure.

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A9BT1 Battery

Tools Required

- T-10 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap
- soldering iron with associated soldering tools

Removal

1. Remove the A9 CPU board (refer to "A9 CPU Board" in this chapter).
2. Unsolder and remove A9BT1 from the A9 CPU board.

Warning **Battery A9BT1 contains lithium. Do not incinerate or puncture this battery. Dispose of the discharged battery in a safe manner.**

Replacement

1. Make sure the new battery is inserted into the A9 board with the correct polarity.
2. Solder the battery into place.
3. Replace the A9 CPU board (refer to "A9 CPU Board" in this chapter).

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A15 Preregulator

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Remove the rear panel (refer to "Rear Panel Assembly" in this chapter).
2. Disconnect the wire bundle (A15W1) from A8J2 and A17J3.
3. Remove the preregulator (A15) from the frame.

Replacement

- Reverse the order of the removal procedure.

Note

- When reinstalling the preregulator (A15), make sure the three grommets (item 1) on A15W1 are seated in the two slots (item 2) on the back side of the preregulator and the slot (item 3) in the card cage wall.
- After reinstalling the preregulator (A15), be sure to set the line voltage selector to the appropriate setting, 115 V or 230 V.

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A16 Rear Panel Interface

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- 3/16-inch hex-nut driver
- 9/16-inch hex-nut driver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Remove the rear panel (refer to "Rear Panel Assembly" in this chapter).
2. If you have Option 1D5, disconnect W30 from the rear panel interface board (A16).
3. Remove the hex nuts and washers from the BNC connectors (item 5) as shown.
4. Remove the two hex screws and washers that attach the test set-I/O interconnect (item 6). Remove the rear panel board (A16).

Replacement

- Reverse the order of the removal procedure.

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A17 Motherboard Assembly

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- T-20 TORX screwdriver
- small slot screwdriver
- 2.5 mm hex-key driver
- 5/16-inch open-end torque wrench (set to 10 in-lb)
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord and remove the top, bottom, and side covers (refer to "Covers" in this chapter).
2. Remove the front panel assembly (refer to "Front Panel Assembly" in this chapter).
3. Remove the rear panel assembly (refer to "Rear Panel Assembly" in this chapter).
4. Remove the preregulator (refer to "A15 Preregulator" in this chapter).
5. Remove the fan (refer to "B1 Fan" in this chapter).
6. Remove the graphics processor (refer to "A19 Graphics Processor" in this chapter).
7. Remove the Type-N connector assembly (refer to "Type-N Connector Assembly" in this chapter).
8. Remove the disk drive deck (refer to "A20 Disk Drive" in this chapter).
9. Remove the CPU board (refer to "A9 CPU Board" in this chapter).
10. Remove the memory deck (item 1) by removing three screws (item 2) from the bottom corner struts of the motherboard/card cage assembly. There are two screws on the right side and one on the left side.

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11. Remove the display (refer to "A18 Display" in this chapter).
12. Remove the source assembly (refer to "A3 Source Assembly" in this chapter).
13. Remove the samplers and pulse generator (refer to "A4, A5, A6 Samplers and A7 Pulse Generator" in this chapter).
14. Remove the card cage boards (refer to "A8, A10, A11, A12, A13, A14 Card Cage Boards" in this chapter).
15. Remove the bezel support (item 3) by removing the three screws (item 4) from the left side of the front frame.
16. Remove the actuator assembly (item 5) and insulator strip (item 6) by unhooking the spring (item 7) and removing the screw (item 8) that secures them to the display housing.
17. Remove the front frame (item 9) and rear frame (item 10) by removing the attaching screws (item 11). At this point, only the motherboard/card cage assembly should remain. This whole assembly is replaceable.

Replacement

- Reverse the order of the removal procedure.

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A18 Display

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord.
2. Remove the bezel's softkey cover (item 1) by sliding your fingernail under the left edge, near the top or bottom of the cover. Pry the softkey cover away from the bezel. If you use another tool, take care not to scratch the glass.
3. Remove the two screws (item 2) exposed by the previous step. The bezel (item 3) is now free from the frame. Remove it.
4. Remove the top cover (refer to "Covers" in this chapter).
5. Disconnect the ribbon cable (A18W1) from the graphics processor board (A19).
6. Remove the four screws (item 4) on the top of the display housing.
7. Slide the display (A18) out of the instrument, pushing on the back of the display assembly. There is an opening at the rear of the display housing where you can reach in with a couple of fingers to push the display.

Replacement

1. Remove the bottom shield that is attached to the replacement display. Install the bottom shield on the old display assembly before you return it for repair.
2. Ensure the ribbon cable (A18W1) is connected to the display so you can retrieve it through the opening in the rear of the display housing when you reinstall the display.
3. Reverse the order of the removal procedure with the exception that the four screws (item 4) should not be tightened until after you have reinstalled the bezel assembly and pushed the display forward in the display housing so that it is firmly pressing against the bezel assembly.

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A19 Graphics Processor

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord and remove the top cover (refer to “Covers” in this chapter).
2. Remove the clip (item 1) that secures the graphics processor board (A19), removing the two screws that attach it to the rear frame. Gently press the top of the graphics processor board (A19) towards the display (A18), then lift up.
3. Disconnect the two ribbon cables (A18W1 and W20) and the wire bundle (W14) from the graphics processor board (A19).
4. Disconnect the three flexible cables (W21, W22, and W23) from the graphics processor board (A19). Remove the board.

Replacement

- Reverse the order of the removal procedure.

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A20 Disk Drive

Tools Required

- T-8 TORX screwdriver
- T-10 TORX screwdriver
- T-15 TORX screwdriver
- small slot screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Disconnect the power cord and remove the bottom cover (refer to "Covers" in this chapter).
2. Remove the front panel (refer to "Front Panel Assembly" in this chapter).
3. Turn the instrument upside-down and disconnect the ribbon cable, W37, from the CPU board (A9J15).
4. Remove the two screws (item 1) that secure the disk drive deck to the bottom edge of the front frame.
5. Slide the disk drive deck out of the instrument.
6. Remove the four screws that secure the disk drive (A20) to the deck. Remove the drive from the deck.

Replacement

- Reverse the order of the removal procedure.

Note When replacing the disk drive deck, ensure that the two tabs (item 2) at the rear of the deck slide into the slots (item 3) of the CPU board deck.

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A26 High Stability Frequency Reference (Option 1D5)

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- 9/16-inch hex-nut driver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Remove the rear panel (refer to "Rear Panel Assembly" in this chapter).
2. Disconnect W30 from the high stability frequency reference board (A26).
3. Remove the BNC connector nut and washer from the "10 MHz PRECISION REFERENCE" connector (item 1) on the rear panel.
4. Remove the screw (item 2) that secures the high stability frequency reference board (A26) to the bracket.
5. Slide the board out of the bracket. Be careful not to lose the plastic spacer washer (item 3) that is on the BNC connector as the board is being removed.

Replacement

- Reverse the order of the removal procedure.

Note Before reinserting the high stability frequency reference board (A26) into the bracket, be sure the plastic spacer washer (item 3) is on the BNC connector.

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B1 Fan

Tools Required

- 2.5 mm hex-key driver
- T-10 TORX screwdriver
- T-15 TORX screwdriver
- ESD (electrostatic discharge) grounding wrist strap

Removal

1. Remove the rear panel (refer to "Rear Panel Assembly" in this chapter).
2. Disconnect the fan harness (B1W1) from the motherboard (A17J5).
3. Remove the four screws and washers (item 1) that secure the fan (B1).

Replacement

- Reverse the order of the removal procedure.

Note The fan should be installed so that the direction of the air flow is away from the instrument. There is an arrow on the fan chassis indicating the air flow direction.

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Post-Repair Procedures for HP 8753D Option 011

Table 14-1 lists the additional service procedures which you must perform to ensure that the instrument is working correctly, following the replacement of an assembly.

Perform the procedures in the order that they are listed in the table.

Table 14-1. Related Service Procedures

Replaced Assembly	Adjustments Correction Constants (CC)	Verification
A1 Front Panel Keyboard	None	Internal Test 0 Internal Test 23
A2 Front Panel Interface	None	Internal Test 0 Internal Test 23
A3 Source	A9 CC Jumper Positions Source Def CC (Test 44) Analog Bus CC (Test 46) Source Pretune CC (Test 48) RF Output Power CC (Test 47) Cavity Oscillator Frequency CC (Test 54) Source Spur Avoidance Tracking EEPROM Backup Disk	Output Power Spectral Purity (harmonics and mixer spurs) or On-Site Verification
A4/A5/A6 Samplers	A9CC Jumper Positions Sampler Magnitude and Phase CC (Test 53) IF Amplifier CC (Test 51) EEPROM Backup Disk	Minimum R Level (if R sampler replaced) Input Crosstalk Absolute Amplitude Accuracy Frequency Response Input Impedance (replace assembly only) or On-Site Verification
A7 Pulse Generator	A9CC Jumper Positions Sampler Magnitude and Phase CC (Test 53) EEPROM Backup Disk	Frequency Response Frequency Range and Accuracy Spectral Purity (phase noise) or On-Site Verification
A8 Post Regulator	A9CC Jumper Positions Cavity Oscillator Frequency CC (Test 54) Source Spur Avoidance Tracking EEPROM Backup Disk	Internal Test 0 Check A8 test point voltages

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Table 14-1 Related Service Procedures (2 of 3)

Replaced Assembly	Adjustments Correction Constants (CC)	Verification
A9 CPU[1]	A9CC Jumper Positions Serial Number CC (Test 55) Option Number CC (Test 56) Display Intensity and Focus CC (Test 49) Source Def CC (Test 44) Pretune Default CC (Test 45) Analog Bus CC (Test 46) Cal Kit Default (Test 57) Source Pretune CC (Test 48) RF Output Power CC (Test 47) Sampler Magnitude and Phase CC (Test 53) ADC Linearity CC (Test 52) IF Amplifier CC (Test 51) Cavity Oscillator Frequency CC (Test 54) EEPROM Backup Disk	Output Power Absolute Amplitude Accuracy Frequency Response Dynamic Accuracy or On-Site Verification
Firmware Rev 5.20 08753-60185	A9CC Jumper Positions Source Default CC 9 (Test 44) Pretune Default CC (Test 45) Analog Bus CC (Test 46) RF Output Power CC (Test 47) Source Pretune CC (Test 48) Sampler Magnitude and Phase CC (Test 47) EEPROM Backup Disk	Internal Test 0
A10 Digital IF	A9CC Jumper Positions Analog Bus CC (Test 46) Sampler Magnitude and Phase CC (Test 53) ADC Linearity CC (Test 52) IF Amplifier CC (Test 51) EEPROM Backup Disk	Receiver Noise Level Trace Noise Input Crosstalk Absolute Amplitude Accuracy or

1 If you have an EEPROM backup disk available, you only need to perform the first three tests listed.

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Table 14-1 Related Service Procedures (3 of 3)

Replaced Assembly	Adjustments Correction Constants (CC)	Verification On-Site Verification
A11 Phase Lock	A9CC Jumper Positions Analog Bus CC (Test 46) Source Pretune CC (Test 48) EEPROM Backup Disk	Minimum R Level Frequency Accuracy or On-Site Verification
A12 Reference	A9CC Jumper Positions High/Low Band Transition Frequency Accuracy EEPROM Backup Disk	Frequency Range and Accuracy
A13 Fractional-N (Analog)	A9CC Jumper Positions Fractional-N Spur and FM Sideband EEPROM Backup Disk	Spectral Purity (other spurious signals) Frequency Range and Accuracy
A14 Fractional-N (Digital)	A9CC Jumper Positions Fractional-N Frequency Range EEPROM Backup Disk	Frequency Range and Accuracy or On-Site Verification
A15 Preregulator	None	Self-Test
A16 Rear Panel Interface	None	Internal Test 13, Rear Panel
A17 Motherboard	None	Self-Test
A18 Display	Vertical Position and Focus (only if needed)	Observation of Display Tests 66 - 80
A19 Graphics System Processor	None	Observation of Display Tests 59 - 80

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Safety and Licensing

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Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

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Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

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Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

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Shipment for Service

If you are sending the instrument to Hewlett-Packard for service, ship the analyzer to the nearest HP service center for repair, including a description of any failed test and any error message. Ship the analyzer, using the original or comparable anti-static packaging materials. A listing of Hewlett-Packard sales and service offices is provided in Table 15-1.

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Safety Symbols

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

Caution	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the instrument. Do not proceed beyond a caution note until the indicated conditions are fully understood and met.

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

Instrument Markings

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

"CE" The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)

"ISM1-A" This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

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

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General Safety Considerations

Safety Earth Ground

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

Before Applying Power

Caution Make sure that the analyzer line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed.

Caution If this product is to be energized via an autotransformer make sure the common terminal is connected to the neutral (grounded side of the mains supply).

Servicing

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

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

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

Warning **Adjustments described in this document may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.**

Warning **The power cord is connected to internal capacitors that may remain live for 10 seconds after disconnecting the plug from its power supply.**

Warning **For continued protection against fire hazard replace line fuse only with same type and rating (F 3 A/250 V). The use of other fuses or material is prohibited.**

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