Calibration Guide

Agilent Technologies ESA Spectrum Analyzers

This manual provides documentation for the following instruments:

Agilent ESA-E Series
E4401B (9 kHz - 1.5 GHz)
E4402B (9 kHz - 3.0 GHz)
E4404B (9 kHz - 6.7 GHz)
E4405B (9 kHz - 13.2 GHz)
E4407B (9 kHz - 26.5 GHz)

and

Agilent ESA-L Series
E4411B (9 kHz - 1.5 GHz)
E4403B (9 kHz - 6.7 GHz)
E4408B (9 kHz - 26.5 GHz)

Agilent Technologies

Manufacturing Part Number: E4401-90177
Supersedes E4401-90132

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WARNING **This is a Safety Class 1 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 protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

CAUTION *Caution* denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING **This is a Safety Class 1 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 of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

CAUTION Always use the three-prong ac power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

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Where to Find the Latest Information

Documentation is updated periodically. For the latest information about Agilent ESA Spectrum Analyzers, including firmware upgrades and application information, please visit the following Internet URL: http//www.agilent.com/go/esa.

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1 Calibrating

Calibration

This chapter identifies the performance test procedures which test the electrical performance of the analyzer.

Allow the analyzer to warm up in accordance with the temperature stability specifications before performing the tests in this chapter.

None of the test procedures involve removing the cover of the analyzer.

Calibration verifies that the analyzer performance is within all specifications. It is time consuming and requires extensive test equipment. Calibration consists of *all* the performance tests. For a complete listing of the performance tests, see the performance verification tests table for your specific analyzer.

Calibration Cycle

The performance tests in chapter 2 should be used to check the analyzer against its specifications once every year. Specifications are listed in this calibration guide.

Performance Verification Test Tables

The tables on the following pages list the performance tests in Chapter 2, “Performance Verification Tests”, required for each model number. Perform all the tests marked with a dot in the “Std” (standard) column. If any options are installed in the analyzer, also perform all tests marked with a dot in the appropriate option column.

Table 1-1 Agilent E4401B Performance Verification Tests

Performance Test Name	Calibration for Instrument Option:						
	Std[a]	1DN	1DQ	1DS	1D5	1D6	AYX
1. 10 MHz Reference Output Accuracy[b]	•						
2. 10 MHz Precision Frequency Reference Output Accuracy					•		
3. Frequency Readout and Marker Frequency Count Accuracy	•						
5. Frequency Span Readout Accuracy	•						
7. Noise Sidebands	•						
8. System Related Sidebands	•						
9. Residual FM	•						
10. Sweep Time Accuracy	•						
11. Display Scale Fidelity	•						
12. Input Attenuation Switching Uncertainty	•						
13. Reference Level Accuracy	•						
15. Resolution Bandwidth Switching Uncertainty	•						
16. Absolute Amplitude Accuracy (Reference Settings)	•						
18. Overall Absolute Amplitude Accuracy	•						
20. Resolution Bandwidth Accuracy	•						
21. Frequency Response	•						
24. Frequency Response (Preamp On)				•			
27. Other Input Related Spurious Responses	•						
29. Spurious Responses	•						
32. Gain Compression	•						
34. Displayed Average Noise Level	•						
38. Residual Responses	•						
39. Fast Time Domain Amplitude Accuracy							•
40. Tracking Generator Absolute Amplitude and Vernier Accuracy		•	•				
42. Tracking Generator Level Flatness		•	•				
44. Tracking Generator Harmonic Spurious Outputs		•	•				
46. Tracking Generator Non-Harmonic Spurious Outputs		•	•				
49. Gate Delay Accuracy and Gate Length Accuracy						•	
50. Gate Mode Amplitude Error						•	

a. Perform these tests for all E4401B analyzers.
b. Perform this test only on analyzers not equipped with Option 1D5.

Table 1-2 Agilent E4402B Performance Verification Tests

Performance Test Name	Calibration for Instrument Option:								
	Std[a]	1DN	1DS	1D5	1D6	AYX	BAC	BAH	B7E
1. 10 MHz Reference Output Accuracy[b]	•								
2. 10 MHz Precision Frequency Reference Output Accuracy				•					
3. Frequency Readout and Marker Frequency Count Accuracy	•								
6. Frequency Span Readout Accuracy	•								
7. Noise Sidebands	•								
8. System Related Sidebands	•								
9. Residual FM	•								
10. Sweep Time Accuracy	•								
11. Display Scale Fidelity	•								
12. Input Attenuation Switching Uncertainty	•								
14. Reference Level Accuracy	•								
15. Resolution Bandwidth Switching Uncertainty	•								
17. Absolute Amplitude Accuracy (Reference Settings)	•								
19. Overall Absolute Amplitude Accuracy	•								
20. Resolution Bandwidth Accuracy	•								
22. Frequency Response	•								
25. Frequency Response (Preamp On)			•						
28. Other Input Related Spurious Responses	•								
30. Spurious Responses	•								
32. Gain Compression	•								
35. Displayed Average Noise Level	•								
38. Residual Responses	•								
39. Fast Time Domain Amplitude Accuracy						•			
41. Tracking Generator Absolute Amplitude and Vernier Accuracy		•							
43. Tracking Generator Level Flatness		•							
45. Tracking Generator Harmonic Spurious Outputs		•							
47. Tracking Generator Non-Harmonic Spurious Outputs		•							
48. Tracking Generator L.O. Feedthrough Amplitude		•							
49. Gate Delay Accuracy and Gate Length Accuracy					•				
50. Gate Mode Amplitude Error					•				
53. Comms Frequency Response							•	•	
55. cdmaOne Modulation Accuracy (Rho)[c]									•

Table 1-2 Agilent E4402B Performance Verification Tests

Performance Test Name	Calibration for Instrument Option:								
	Std[a]	1DN	1DS	1D5	1D6	AYX	BAC	BAH	B7E
56. cdmaOne Modulation Accuracy - EVM (error vector magnitude)[c]									•
57. cdmaOne Code Domain Power[c]									•
58. GSM Phase and Frequency[d]									•
59. Comms Absolute Accuracy (Options BAC or BAH)							•	•	

a. Perform these tests for all E4402B analyzers.
b. Perform this test only on analyzers not equipped with Option 1D5.
c. Perform this test only on instruments having option BAC, cdmaOne Measurement Personality.
d. Perform this test only on instruments having option BAH, GSM Measurement Personality.

Table 1-3 Agilent E4403B Performance Verification Tests

Performance Test Name		Calibration for Instrument Option:	
		Std[a]	1DN
1.	10 MHz Reference Output Accuracy	•	
3.	Frequency Readout and Marker Frequency Count Accuracy	•	
6.	Frequency Span Readout Accuracy	•	
7.	Noise Sidebands	•	
8.	System Related Sidebands	•	
9.	Residual FM	•	
10.	Sweep Time Accuracy	•	
11.	Display Scale Fidelity	•	
12.	Input Attenuation Switching Uncertainty	•	
14.	Reference Level Accuracy	•	
15.	Resolution Bandwidth Switching Uncertainty	•	
17.	Absolute Amplitude Accuracy (Reference Settings)	•	
19.	Overall Absolute Amplitude Accuracy	•	
20.	Resolution Bandwidth Accuracy	•	
22.	Frequency Response	•	
28.	Other Input Related Spurious Responses	•	
30.	Spurious Responses	•	
32.	Gain Compression	•	
35.	Displayed Average Noise Level	•	
38.	Residual Responses	•	
41.	Tracking Generator Absolute Amplitude and Vernier Accuracy		•
43.	Tracking Generator Level Flatness		•
45.	Tracking Generator Harmonic Spurious Outputs		•
47.	Tracking Generator Non-Harmonic Spurious Outputs		•
48.	Tracking Generator L.O. Feedthrough Amplitude		•

a. Perform these tests on all E4403B analyzers.

Table 1-4 Agilent E4404B Performance Verification Tests

	Performance Test Name	Calibration for Instrument Option:								
		Std[a]	1DN	1DS	1D5	1D6	AYX	BAC	BAH	B7E
1.	10 MHz Reference Output Accuracy[b]	•								
2.	10 MHz Precision Frequency Reference Output Accuracy				•					
4.	Frequency Readout and Marker Frequency Count Accuracy	•								
6.	Frequency Span Readout Accuracy	•								
7.	Noise Sidebands	•								
8.	System Related Sidebands	•								
9.	Residual FM	•								
10.	Sweep Time Accuracy	•								
11.	Display Scale Fidelity	•								
12.	Input Attenuation Switching Uncertainty	•								
14.	Reference Level Accuracy	•								
15.	Resolution Bandwidth Switching Uncertainty	•								
17.	Absolute Amplitude Accuracy (Reference Settings)	•								
19.	Overall Absolute Amplitude Accuracy	•								
20.	Resolution Bandwidth Accuracy	•								
23.	Frequency Response	•								
26.	Frequency Response (Preamp On)			•						
28.	Other Input Related Spurious Responses	•								
31.	Spurious Responses	•								
33.	Gain Compression	•								
36.	Displayed Average Noise Level	•								
38.	Residual Responses	•								
39.	Fast Time Domain Amplitude Accuracy						•			
41.	Tracking Generator Absolute Amplitude and Vernier Accuracy		•							
43.	Tracking Generator Level Flatness		•							
45.	Tracking Generator Harmonic Spurious Outputs		•							
47.	Tracking Generator Non-Harmonic Spurious Outputs		•							
48.	Tracking Generator L.O. Feedthrough Amplitude		•							
49.	Gate Delay Accuracy and Gate Length Accuracy					•				
50.	Gate Mode Amplitude Error					•				
53.	Comms Frequency Response							•	•	
55.	cdmaOne Modulation Accuracy (Rho)[c]									•
56.	cdmaOne Modulation Accuracy - EVM (error vector magnitude)[c]									•

Table 1-4 Agilent E4404B Performance Verification Tests

Performance Test Name	Calibration for Instrument Option:								
	Std[a]	1DN	1DS	1D5	1D6	AYX	BAC	BAH	B7E
57. cdmaOne Code Domain Power[c]									•
58. GSM Phase and Frequency[d]									•
59. Comms Absolute Accuracy (Options BAC or BAH)							•	•	

a. Perform these tests on all Agilent E4404B analyzers.
b. Perform this test only on analyzers not equipped with Option 1D5.
c. Perform this test only on instruments having option BAC, cdmaOne Measurement Personality.
d. Perform this test only on instruments having option BAH, GSM Measurement Personality.

Table 1-5 Agilent E4405B Performance Verification Tests

	Performance Test Name	Calibration for Instrument Option:								
		Std[a]	1DN	1DS	1D5	1D6	AYX	BAC	BAH	B7E
1.	10 MHz Reference Output Accuracy[b]	•								
2.	10 MHz Precision Frequency Reference Output Accuracy				•					
4.	Frequency Readout and Marker Frequency Count Accuracy	•								
6.	Frequency Span Readout Accuracy	•								
7.	Noise Sidebands	•								
8.	System Related Sidebands	•								
9.	Residual FM	•								
10.	Sweep Time Accuracy	•								
11.	Display Scale Fidelity	•								
12.	Input Attenuation Switching Uncertainty	•								
14.	Reference Level Accuracy	•								
15.	Resolution Bandwidth Switching Uncertainty	•								
17.	Absolute Amplitude Accuracy (Reference Settings)	•								
19.	Overall Absolute Amplitude Accuracy	•								
20.	Resolution Bandwidth Accuracy	•								
23.	Frequency Response	•								
26.	Frequency Response (Preamp On)			•						
28.	Other Input Related Spurious Responses	•								
31.	Spurious Responses	•								
33.	Gain Compression	•								
36.	Displayed Average Noise Level	•								
38.	Residual Responses	•								
39.	Fast Time Domain Amplitude Accuracy						•			
41.	Tracking Generator Absolute Amplitude and Vernier Accuracy		•							
43.	Tracking Generator Level Flatness		•							
45.	Tracking Generator Harmonic Spurious Outputs		•							
47.	Tracking Generator Non-Harmonic Spurious Outputs		•							
48.	Tracking Generator L.O. Feedthrough Amplitude		•							
49.	Gate Delay Accuracy and Gate Length Accuracy					•				
50.	Gate Mode Amplitude Error					•				
53.	Comms Frequency Response							•	•	
55.	cdmaOne Modulation Accuracy (Rho)[c]									•

Table 1-5 Agilent E4405B Performance Verification Tests

Performance Test Name	Calibration for Instrument Option:								
	Std[a]	1DN	1DS	1D5	1D6	AYX	BAC	BAH	B7E
56. cdmaOne Modulation Accuracy - EVM (error vector magnitude)[c]									•
57. cdmaOne Code Domain Power[c]									•
58. GSM Phase and Frequency[d]									•
59. Comms Absolute Accuracy (Options BAC or BAH)							•	•	

a. Perform these tests on all E4405B analyzers.
b. Perform this test only if the analyzer is not equipped with Option 1D5.
c. Perform this test only on instruments having option BAC, cdmaOne Measurement Personality.
d. Perform this test only on instruments having option BAH, GSM Measurement Personality.

Table 1-6 Agilent E4407B Performance Verification Tests

Performance Test Name		Calibration for Instrument Option:									
		Std[a]	1DN	1DS	1D5	1D6	AYX	AYZ	BAC	BAH	B7E
1.	10 MHz Reference Output Accuracy[b]	•									
2.	10 MHz Precision Frequency Reference Output Accuracy				•						
4.	Frequency Readout and Marker Frequency Count Accuracy	•									
6.	Frequency Span Readout Accuracy	•									
7.	Noise Sidebands	•									
8.	System Related Sidebands	•									
9.	Residual FM	•									
10.	Sweep Time Accuracy	•									
11.	Display Scale Fidelity	•									
12.	Input Attenuation Switching Uncertainty	•									
14.	Reference Level Accuracy	•									
15.	Resolution Bandwidth Switching Uncertainty	•									
17.	Absolute Amplitude Accuracy (Reference Settings)	•									
19.	Overall Absolute Amplitude Accuracy	•									
20.	Resolution Bandwidth Accuracy	•									
23.	Frequency Response	•									
26.	Frequency Response (Preamp On)			•							
28.	Other Input Related Spurious Responses	•									
31.	Spurious Responses	•									
33.	Gain Compression	•									
37.	Displayed Average Noise Level	•									
38.	Residual Responses	•									
39.	Fast Time Domain Amplitude Accuracy						•				
41.	Tracking Generator Absolute Amplitude and Vernier Accuracy		•								
43.	Tracking Generator Level Flatness		•								
45.	Tracking Generator Harmonic Spurious Outputs		•								
47.	Tracking Generator Non-Harmonic Spurious Outputs		•								
48.	Tracking Generator L.O. Feedthrough Amplitude		•								
49.	Gate Delay Accuracy and Gate Length Accuracy					•					
50.	Gate Mode Amplitude Error					•					
52.	IF Input Accuracy							•			
53.	Comms Frequency Response								•	•	

Table 1-6 Agilent E4407B Performance Verification Tests

Performance Test Name	Calibration for Instrument Option:									
	Std[a]	1DN	1DS	1D5	1D6	AYX	AYZ	BAC	BAH	B7E
55. cdmaOne Modulation Accuracy (Rho)[c]										•
56. cdmaOne Modulation Accuracy - EVM (error vector magnitude)[d]										•
58. GSM Phase and Frequency[d]										•
59. Comms Absolute Accuracy (Options BAC or BAH)								•	•	

a. Perform these tests on all E4407B analyzers.
b. Perform this test only on analyzers not equipped with Option 1D5.
c. Perform this test only on instruments having option BAC, cdmaOne Measurement Personality.
d. Perform this test only on instruments having option BAH, GSM Measurement Personality.

Table 1-7 Agilent E4408B Performance Verification Tests

Performance Test Name		Calibration for Instrument Option:	
		Std[a]	1DN
1.	10 MHz Reference Output Accuracy	•	
4.	Frequency Readout and Marker Frequency Count Accuracy	•	
6.	Frequency Span Readout Accuracy	•	
7.	Noise Sidebands	•	
8.	System Related Sidebands	•	
9.	Residual FM	•	
10.	Sweep Time Accuracy	•	
11.	Display Scale Fidelity	•	
12.	Input Attenuation Switching Uncertainty	•	
14.	Reference Level Accuracy	•	
15.	Resolution Bandwidth Switching Uncertainty	•	
17.	Absolute Amplitude Accuracy (Reference Settings)	•	
19.	Overall Absolute Amplitude Accuracy	•	
20.	Resolution Bandwidth Accuracy	•	
23.	Frequency Response	•	
28.	Other Input Related Spurious Responses	•	
31.	Spurious Responses	•	
33.	Gain Compression	•	
37.	Displayed Average Noise Level	•	
38.	Residual Responses	•	
41.	Tracking Generator Absolute Amplitude and Vernier Accuracy		•
43.	Tracking Generator Level Flatness		•
45.	Tracking Generator Harmonic Spurious Outputs		•
47.	Tracking Generator Non-Harmonic Spurious Outputs		•
48.	Tracking Generator L.O. Feedthrough Amplitude		•

a. Perform these tests on all E4408B analyzers.

Table 1-8 Agilent E4411B Performance Verification Tests

Performance Test Name		Calibration for Instrument Option:		
		Std[a]	1DN	1DQ
1.	10 MHz Reference Output Accuracy	•		
3.	Frequency Readout and Marker Frequency Count Accuracy	•		
5.	Frequency Span Readout Accuracy	•		
7.	Noise Sidebands	•		
8.	System Related Sidebands	•		
9.	Residual FM	•		
10.	Sweep Time Accuracy	•		
11.	Display Scale Fidelity	•		
12.	Input Attenuation Switching Uncertainty	•		
13.	Reference Level Accuracy	•		
15.	Resolution Bandwidth Switching Uncertainty	•		
16.	Absolute Amplitude Accuracy (Reference Settings)	•		
18.	Overall Absolute Amplitude Accuracy	•		
20.	Resolution Bandwidth Accuracy	•		
21.	Frequency Response	•		
27.	Other Input Related Spurious Responses	•		
29.	Spurious Responses	•		
32.	Gain Compression	•		
34.	Displayed Average Noise Level	•		
38.	Residual Responses	•		
40.	Tracking Generator Absolute Amplitude and Vernier Accuracy		•	•
42.	Tracking Generator Level Flatness		•	•
44.	Tracking Generator Harmonic Spurious Outputs		•	•
46.	Tracking Generator Non-Harmonic Spurious Outputs		•	•

a. Perform these tests on all E4411B analyzers.

Before You Start

This brief procedure should be performed before starting the performance verification tests:

1. Switch the analyzer on and let it warm up for five minutes.
2. If the analyzer is an Agilent E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B, connect a cable from AMPTD REF OUT to the 50 Ω Input.
3. Press **System**, **Alignments**, **Align Now**, **All**, and wait for the auto alignments to finish.
4. Read the remainder of this section before you start any of the tests, and make a copy of the Performance Verification Test Record described below in "Recording the test results."

Recording the test results

Performance verification test records, for each analyzer, are provided in the chapter following the tests.

Each test result is identified as a *TR Entry* in the performance tests and on the performance verification test record. We recommend that you make a copy of the performance verification test record, record the test results on the copy, and keep the copy for your calibration test record. This record could prove valuable in tracking gradual changes in test results over long periods of time.

Performing Self-Alignment

Perform a complete self-alignment at least once per day, or if the analyzer fails a verification test. To perform a self-alignment, press **System**, **Alignment**, **Align Now**, **All**. The instrument must be up to operating temperature in order for this test to be valid. If the analyzer continuously fails one or more specifications, complete any remaining tests and record all test results on a copy of the test record. Then refer to Chapter 4 , “If You Have a Problem” for instructions on how to solve the problem.

Periodic verification of operation

The analyzer requires periodic verification of operation. Under most conditions of use, you should test the analyzer at least once a year with the complete set of performance verification tests.

Test equipment you will need

The following tables list the recommended test equipment for the performance tests. The tables also list recommended equipment for the analyzer adjustment procedures which are located in the *Agilent ESA Spectrum Analyzers Assembly-Level Repair Service Guide*. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Table 1-9 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [a]
Digital Multimeter	Input Resistance ≥10 megohms Accuracy: 10 mV on 100 V range	HP/Agilent 3458A	P,A,T
DVM Test Leads	For use with HP/Agilent 3458A Digital Multimeter	HP/Agilent 34118B	T
Universal Counter	Frequency Range: 10 MHz 100 Hz Time Interval Range: 25 ms to 100 ms Single Operation Range: 2.5 Vdc to –2.5 Vdc External Reference Input	HP/Agilent 53132A	P,A,T
Frequency Standard	Frequency: 10 MHz Timebase Accuracy (Aging): $<1\times10^{-9}$/day	HP/Agilent 5071A	P,A
Oscilloscope	Bandwidth: dc to 100 MHz Vertical Scale Factor of 0.5 V to 5 V/Div Two channels Minimum Timebase Setting: <100 ns Digitizing display with pulse width and time interval measurement functions Delta –T measurement accuracy in 200 ns / div: <450 ps	HP/Agilent 54820A	T

Table 1-9 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [a]
Power Meter	Compatible with HP/Agilent 8480 series power sensors. dB relative mode. Resolution: 0.01 dB Reference Accuracy: 1.2%	HP/Agilent E4419A	P,A,T
RF Power Sensor (2 required)	Frequency Range: 100 kHz to 3 GHz Maximum SWR: 1.60 (100 kHz to 300 kHz) 1.20 (300 kHz to 1 MHz) 1.1 (1 MHz to 2.0 GHz) 1.18 (2.0 GHz to 3.0 GHz) Amplitude range: –25 dBm to 10 dBm	HP/Agilent 8482A	P,A,T
Microwave Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Maximum SWR: 1.15 (50 MHz to 100 MHz) 1.10 (100 MHz to 2 GHz) 1.15 (2 GHz to 12.4 GHz) 1.20 (12.4 GHz to 18 GHz) 1.25 (18 GHz to 26.5 GHz) Amplitude range: –25 dBm to 0 dBm	HP/Agilent 8485A	P,A,T
Power Sensor, 75 Ω (Option 1DP)	Frequency Range: 1 MHz to 1500 MHz Maximum SWR: 1.18 (600 kHz to 1500 MHz) Impedance: 75 Ω Amplitude Range: –30 dBm to 20 dBm	HP/Agilent 8483A	P,A,T
Power Sensor, Low Power	Frequency Range: 50 MHz to 3.0 GHz Amplitude Range: –20 dBm to –70 dBm Maximum SWR: 1.4 (10 MHz to 30 MHz) 1.15 (30 MHz to 3.0 GHz)	HP/Agilent 8481D	P,A,T
Synthesized Signal Generator	Frequency Range: 100 kHz to 1500 MHz Amplitude Range: –35 to 16 dBm SSB Noise: <–120 dBc/Hz at 20 kHz offset	HP/Agilent 8663A	P,A

Table 1-9 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [a]
Spectrum Analyzer, Microwave	Frequency Range: 100 kHz to 7 GHz Relative Amplitude Accuracy: 100 kHz to 3.0 GHz: <1.8 dB Frequency Accuracy: <10 kHz at 7 GHz	HP/Agilent 8563E	P,T
Synthesized Sweeper (2 required)	Frequency Range: E4407B or E4408B: 10 MHz to 26.5 GHz All others: 10 MHz to 13.2 GHz Frequency Accuracy (CW): 0.02% Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: –40 to 16 dBm	HP/Agilent 83630/40/50B or HP/Agilent 83620/30/B 40/50B	P,A,T
Function Generator	Frequency Range: 0.1 Hz to 15 MHz Frequency Accuracy: 0.02% Waveform: Triangle, Square, Sine	HP/Agilent 33120A or HP/Agilent 3325B	P,A,T
Attenuator/Switch Driver	Compatible with HP/Agilent 8494G and 8496G Programmable step attenuators	HP/Agilent 11713A	P
Attenuator, 1 dB Step	Attenuation Range: 0 to 11 dB Frequency Range: 4 GHz Connectors: Type-N female Calibrated at 50 MHz with accuracy of 1 to 11 dB attenuation: 0.010 dB.	HP/Agilent 8494A/G	P
Attenuator, 10 dB Step	Attenuation Range: 0 to 110 dB Frequency Range: 4 GHz Connectors: Type-N female Calibrated at 50 MHz with accuracy of: 0 to 40 dB attenuation: 0.020 dB 50 to 100 dB attenuation: 0.065 dB 110 dB attenuation: 0.075 dB	HP/Agilent 8496A/G	P
Attenuator, 10 dB Fixed	Nominal attenuation: 10 dB Frequency Range: dc to 3 GHz Connectors: Type-N(m) and Type-N(f)	HP/Agilent 8491A Option 010	P

Table 1-9 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [a]
Attenuator, 6 dB Fixed	Nominal attenuation: 6 dB Frequency Range: 50 MHz ±1 MHz VSWR: <1.1: 1 at 50 MHz	HP/Agilent 8491A Option 006	P
Attenuator, 20 dB Fixed	Nominal attenuation: 20 dB Frequency Range: 100 kHz to 3 GHz VSWR: <1.2: 1 at ≤3 GHz	HP/Agilent 8491A Option 020	P
Attenuator Interconnect Kit	Mechanically and electrically connects HP/Agilent 8494A/G and HP/Agilent 8496A/G	HP/Agilent 11716 Series	

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

Table 1-10 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use [a]
Directional Bridge	Frequency Range: 5 MHz to 3 GHz Directivity: >40 dB Coupling factor: 16 dB nominal Insertion Loss: 2 dB maximum	HP/Agilent 86205A	P
Power Splitter (for E4401B/ 02B/03B/11B)	Frequency Range: 9 kHz to 13.2 GHz Insertion Loss: 6 dB nominal Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	HP/Agilent 11667A	P,A
Power Splitter (for E4404B/ 05B/07B/08B)	Frequency Range: 9 kHz to 26.5 GHz Insertion Loss: 6 dB nominal Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	HP/Agilent 11667B	
Directional Coupler (for E4404B/05B/ 07B/08B)	Frequency Range: 2 GHz to 15 GHz Directivity: >16 dB Max.VSWR: 1.35:1 Transmission Arm Loss: <1.5 dB (nominal) Coupled Arm Loss: ~ 10 dB (nominal)	HP/Agilent 87300B	
Termination, 50 Ω (2 required for Option 1DN)	Impedance: 50 Ω nominal Connector: Type-N (m)	HP/Agilent 909A	P,T
Termination, 50 Ω	Impedance: 50 Ω (nominal) Connector: BNC (m)	HP/Agilent 11593A	P,A
Termination, 75 Ω (Option 1DQ, 1DP)	Impedance: 75 Ω (nominal) (2 required for Option 1DQ) (1 required for Option 1DP)	HP/Agilent 909E Option 201	P,T

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

Table 1-11 Recommended Adapters

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

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

Table 1-12 Recommended Cables

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

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

2 Performance Verification Tests

These tests verify the electrical performance of the analyzer. Allow the analyzer to warm up in accordance with the temperature stability specifications before performing the tests.

Tests included in this section:

Calibration

To perform calibration:

1. Run all performance verification tests listed in column 1 of Table 2-1.
2. If any of the performance verification tests fail, perform the appropriate calibration adjustments listed in column 2 of Table 2-1 which corresponds to the failure.
3. Repeat all of the performance verification tests listed in column 1 of Table 2-1 if any calibration adjustments were made in step 2. This will confirm that there is no interaction between adjustments which could negatively impact analyzer performance.

Table 2-1 lists the performance verification tests and adjustments needed for calibration. The performance tests are located in the following pages of this chapter. Adjustment information is located in the service guide.

Table 2-1 Calibration Requirements

Test #	Column 1 Performance Verification Tests	Column 2 Calibration Adjustments
1.	10 MHz Reference Output Accuracy	10 MHz Frequency Reference Adjustment
2.	10 MHz High-Stability Frequency Reference Output Accuracy	10 MHz Frequency Reference Adjustment
3.	Frequency Readout and Marker Frequency Accuracy	None
4.	Frequency Readout and Marker Frequency Accuracy	None
5.	Frequency Span Readout Accuracy	None
6.	Frequency Span Readout Accuracy	None
7.	Noise Sidebands	IF Amplitude
8.	System-related Sidebands	IF Amplitude
9.	Residual FM	None
10.	Sweep Time Accuracy	None
11.	Display Scale Fidelity	IF Amplitude
12.	Input Attenuation Switching Uncertainty	50 MHz Amplitude Reference
13.	Reference Level Accuracy	IF Amplitude
14.	Reference Level Accuracy	IF Amplitude
15.	Resolution BW Switching Uncertainty	IF Amplitude
16.	Absolute Amplitude Accuracy (Reference Settings)	None
17.	Absolute Amplitude Accuracy (Reference Settings)	None
18.	Overall Absolute Amplitude Accuracy	Frequency Response Adjustment
19.	Overall Absolute Amplitude Accuracy	None
20.	Resolution Bandwidth Accuracy	IF Amplitude
21.	Frequency Response	Frequency Response
22.	Frequency Response	Frequency Response
23.	Frequency Response	Frequency Response
24.	Frequency Response (Preamp On)	Frequency Response

Table 2-1 Calibration Requirements

Test #	Column 1 Performance Verification Tests	Column 2 Calibration Adjustments
25.	Frequency Response (Preamp On)	Frequency Response
26.	Frequency Response (Preamp On)	Frequency Response
27.	Other Input-Related Spurious Responses	None
28.	Other Input-Related Spurious Responses	None
29.	Spurious Responses	None
30.	Spurious Responses	None
31.	Spurious Responses	None
32.	Gain Compression	None
33.	Gain Compression	None
34.	Displayed Average Noise Level	Frequency Response
35.	Displayed Average Noise Level	Frequency Response
36.	Displayed Average Noise Level	Frequency Response
37.	Displayed Average Noise Level	Frequency Response
38.	Residual Responses	None
39.	Fast Time Domain Amplitude Accuracy	None
40.	Tracking Generator Absolute Amplitude and Vernier Accuracy	Tracking Generator ALC and Tracking Generator Frequency Slope
41.	Tracking Generator Absolute Amplitude and Vernier Accuracy	Tracking Generator ALC and Tracking Generator Frequency Slope
42.	Tracking Generator Level Flatness	Tracking Generator ALC and Tracking Generator Frequency Slope
43.	Tracking Generator Level Flatness	Tracking Generator ALC and Tracking Generator Frequency Slope
44.	Tracking Generator Harmonic Spurious Outputs	None
45.	Tracking Generator Harmonic Spurious Outputs	None
46.	Tracking Generator Non-Harmonic Spurious Outputs	None
47.	Tracking Generator Non-Harmonic Spurious Outputs	None

Table 2-1 Calibration Requirements

Test #	Column 1 Performance Verification Tests	Column 2 Calibration Adjustments
48.	Tracking Generator L.O. Feedthrough Amplitude	LO Power
49.	Gate Delay Accuracy and Gate Length Accuracy	None
50.	Gate Mode Amplitude Error	None
51.	First LO OUTPUT Amplitude Accuracy	LO Power
52.	IF INPUT Accuracy	IF INPUT Correction

Manual use of HP/Agilent 8494G and HP/Agilent 8496G Attenuators with the HP/Agilent 11713A

When using the programmable versions of the 1 dB and 10 dB step attenuator (HP/Agilent 8494G and HP/Agilent 8496G), the HP/Agilent 11713A Attenuator/ Switch Driver must be used to control the attenuators. The HP/Agilent 8494G 1 dB step attenuator should be connected as Attenuator X and the HP/Agilent 8496G 10 dB step attenuator should be connected as Attenuator Y.

Use Table 2-2 to determine which of the Attenuator X and Attenuator Y settings are use to set the step attenuators to the desired value. In the columns labeled Attenuator X and Attenuator Y, a “1” indicates that section is on (the LED in the button will be lit), while a “0” indicates that section is off. For example, if the 1 dB step attenuator should be set to 2 dB and the 10 dB step attenuator should be set to 60 dB, sections 2, 6, and 7 should be on (lit) and all other sections should be off.

Table 2-2 HP/Agilent 11713A Settings for HP/Agilent 8494G and HP/Agilent 8496G

1 dB Step Atten (dB)	Attenuator X				10 dB Step Atten (dB)	Attenuator Y			
	1	2	3	4		5	6	7	8
0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	10	1	0	0	0
2	0	1	0	0	20	0	1	0	0
3	1	1	0	0	30	1	1	0	0
4	0	0	1	0	40	0	0	1	0
5	1	0	1	0	50	1	0	1	0

Table 2-2 HP/Agilent 11713A Settings for HP/Agilent 8494G and HP/Agilent 8496G

1 dB Step Atten (dB)	Attenuator X				10 dB Step Atten (dB)	Attenuator Y			
	1	2	3	4		5	6	7	8
6	0	1	1	0	60	0	1	1	0
7	1	1	1	0	70	1	1	1	0
8	0	0	1	1	80	0	0	1	1
9	1	0	1	1	90	1	0	1	1
10	0	1	1	1	100	0	1	1	1
11	1	1	1	1	110	1	1	1	1

1. 10 MHz Reference Accuracy

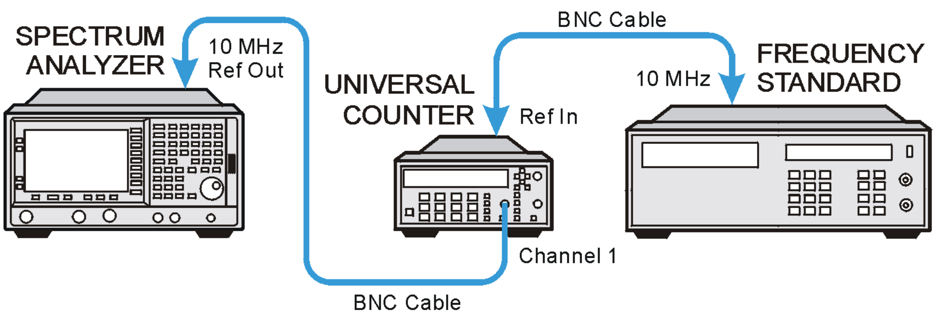
The sensibility is measured by changing the settings of the digital-to-analog converter (DAC), which controls the frequency of the timebase. The difference in frequency for each DAC step is calculated and compared to the specification.

The related adjustment for this performance verification test is the “10 MHz Reference Frequency Adjustment.”

Equipment Required

Universal counter (Instructions are for HP/Agilent 53132A. For HP/Agilent 5316B, refer to its user documentation.)
Frequency standard
Cable, BNC, 122-cm (48-in) (*2 required*)

Figure 2-1 10 MHz Reference Test Setup



Procedure

1. Connect the equipment as shown in Figure 2-1. The frequency standard provides the reference for the universal counter.
2. Check that the analyzer is not in external reference mode. If `Ext Ref` appears on the screen, the analyzer is in external reference mode. If the analyzer is in external reference mode, disconnect the external reference.
3. Ensure that the analyzer has been on and in internal frequency mode for at least five minutes before proceeding.
4. Set the universal counter controls as follows:
   a. Press **Gate & ExtArm**
   b. Press any one of the arrow keys until `TIME` is displayed.

c. Press **Gate & ExtArm** again. Using the arrow keys, set the time to 10 s.

d. Press **Enter**.

e. On Channel 1, press **50 Ω/1 MΩ** until the LED is lit.

f. On Channel 1, press **x10 Attenuator** until the LEd is extinguished.

g. On Channel 1, press **AC/DC** until the LED next to DC is extinguished.

h. On Channel 1, press **100 kHz Filter** until the LED is extinguished.

i. On Channel 1, press **Trigger/Sensitivity** until `Auto Trig` is displayed.

j. Use the arrow keys to toggle to off.

k. Press **Freq & Ratio**.

5. Wait for the universal counter reading to stabilize. Record the universal counter reading in Table 2-3 as Counter Reading 1 with 0.1 Hz resolution.

6. Set the analyzer by pressing the following keys:

   System, **Alignments**, **Timebase**, **Fine**

7. Record the number in the active function block of the analyzer in Table 2-3 as Timebase Fine.

8. Press the ↑ (up arrow) key on the analyzer.

9. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in Table 2-3 as Counter Reading 2 with 0.1 Hz resolution.

10. Press the ↓ (down arrow) key on the analyzer 2 times.

11. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in Table 2-3 as Counter Reading 3 with 0.1 Hz resolution.

12. Press **Preset** on the analyzer to return the DAC settings to their initial values. Press the **Factory Preset** softkey, if it is displayed.

13. Subtract Counter Reading 1 from Counter Reading 2 and record the difference in Table 2-3 as the Positive Frequency Change.

$$\text{Positive Frequency Change} = \text{Counter Reading 2} - \text{Counter Reading 1}$$

14. Subtract Counter Reading 3 from Counter Reading 1 and record the difference in Table 2-3 as the Positive Frequency Change.

$$\text{Negative Frequency Change} = \text{Counter Reading 1} - \text{Counter Reading 3}$$

15. Of the Positive Frequency Change and negative frequency change values recorded in Table 2-3, record the largest value in Table 2-3 as the maximum frequency change.

16. Divide the maximum frequency change by two and record the result as the settability.

Table 2-3 10 MHz Reference Accuracy Worksheet

Description	Measurement
Counter Reading 1	___________ Hz
Timebase Fine DAC	___________ Hz
Counter Reading 2	___________ Hz
Counter Reading 3	___________ Hz
Positive Frequency Change	___________ Hz
Negative Frequency Change	___________ Hz
Maximum Frequency Change	___________ Hz
Settability	___________ Hz

2. 10 MHz High-Stability Frequency Reference Accuracy: Agilent E4401B, E4402B, E4404B, E4405B, and E4407B (Option 1D5)

This test applies only to analyzers equipped with the high-stability frequency reference, Option 1D5. If your analyzer does not have Option 1D5, perform the "10 MHz Reference Output Accuracy" test instead.

This test measures the warmup characteristics of the 10 MHz reference oscillator. The ability of the 10 MHz oscillator to meet its warmup characteristics gives a high level of confidence that it will also meet its yearly aging specification.

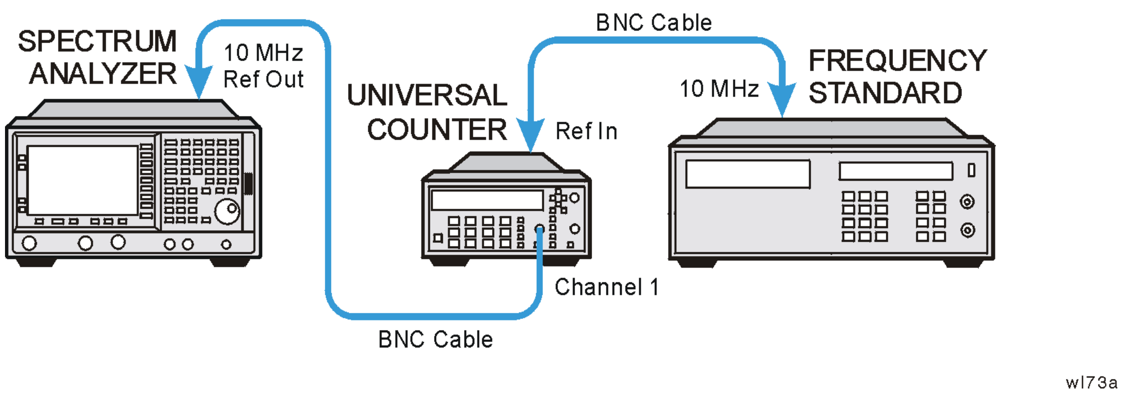
The universal counter is connected to the 10 MHz REF OUT. After the analyzer has been allowed to cool for at least 60 minutes, the analyzer is powered on. A frequency measurement is made five minutes after power is applied and the frequency is recorded. Another frequency measurement is made 10 minutes later (15 minutes after power is applied) and the frequency is recorded. A final frequency measurement is made 60 minutes after power is applied. The difference between each of the first two frequency measurements and the last frequency measurement is calculated and recorded.

The related adjustment for this performance verification test is the "10 MHz Reference Frequency Adjustment."

Equipment Required

Universal counter (Instructions are for HP/Agilent 53132A. For HP/Agilent 5316B, refer to its user documentation.)
Frequency standard
Cable, BNC, 122-cm (48-in) (*2 required*)

Figure 2-2 Frequency Reference Test Setup



Procedure

The analyzer must have been allowed to sit with the power off for at least 60 minutes before performing this procedure. This adequately simulates a cold start.

1. Allow the analyzer to sit with the power off for at least 60 minutes before proceeding.
2. Switch the power to the analyzer on. Record the Power On Time below.

   Power On Time___________

3. Connect the equipment as shown in Figure 2-2. The frequency standard provides the reference for the universal counter. Disconnect any cable to the 10 MHz REF INPUT of the analyzer.
4. Check that the analyzer is not in external reference mode. `Ext Ref` will appear on the display if the analyzer is in external reference mode. If the analyzer is in external reference mode, disconnect the external reference.
5. Set the universal counter controls as follows:
   a. Press **Gate & ExtArm**
   b. Press any one of the arrow keys until `TIME` is displayed.
   c. Press **Gate & ExtArm** again. Using the arrow keys, set the `TIME` to 10s.
   d. Press **Enter**
   e. On Channel 1, press **50 Ω/1 MΩ** to light the LED next to 50 Ω.
   f. On Channel 1, press **AC/DC** to extinguish the LED next to DC.
   g. On Channel 1, press **x10 Attenuator** to extinguish the LED next to x10 Attenuator.
   h. On Channel 1, press **100 kHz Filter** to extinguish the LED next to 100 kHz Filter.
   i. On Channel 1, press **Trigger/Sensitivity** until `Auto Trig` is displayed.
   j. Use the arrows keys to toggle to off.
   k. Press **Freq & Ratio**
6. Proceed with the next step 5 minutes after the Power On Time noted in step 2.
7. Wait for the universal counter reading to make at least two readings. Record the universal counter reading in Table 2-3 as Counter Reading 1 with 0.001 Hz resolution.

8. Proceed with next step 15 minutes after the Power On Time noted in step 2.

9. Wait for the universal counter reading to make at least two readings. Record the universal counter reading in Table 2-3 as Counter Reading 2 with 0.001 Hz resolution.

10. Proceed with next step 60 minutes after the Power On Time noted in step 2.

11. Wait for the universal counter reading to make at least two readings. Record the universal counter reading in Table 2-3 as Counter Reading 3 with 0.001 Hz resolution.

12. Calculate the 5 Minute Warm-up Error (in ppm) by subtracting Counter Reading 3 from Counter Reading 1 and dividing the result by 10.

$$\text{5 Minute Warm-up Error} = (\text{Counter Reading 1} - \text{Counter Reading 3})/10$$

NOTE Dividing the frequency by 10 is equivalent to dividing the difference first by 10 MHz (to normalize the difference to the reference frequency) and then multiplying by 1 x 10^6 to convert the result to parts-per-million (ppm).

13. Record the 5 Minute Warm-up Error (in ppm) in the performance verification test record as TR Entry 1.

14. Calculate the 15 Minute Warm-up Error (in ppm) by subtracting Counter Reading 3 from Counter Reading 2 and dividing the result by 10.

$$\text{15 Minute Warm-up Error} = (\text{Counter Reading 2} - \text{Counter Reading 3})/10$$

15. Record the 15 Minute Warm-up Error in the performance verification test record as TR Entry 2.

Table 2-4 10 MHz Reference Accuracy Worksheet

Description	Measurement
Counter Reading 1	___________ Hz
Counter Reading 2	___________ Hz
Counter Reading 3	___________ Hz

3. Frequency Readout and Marker Frequency Count Accuracy: Agilent E4401B, E4402B, E4403B, and E4411B

The frequency readout accuracy of the analyzer is tested with an input signal of known frequency. By using the same frequency standard for the analyzer and the synthesized sweeper, the frequency reference error is eliminated.

There is no related adjustment for this performance test.

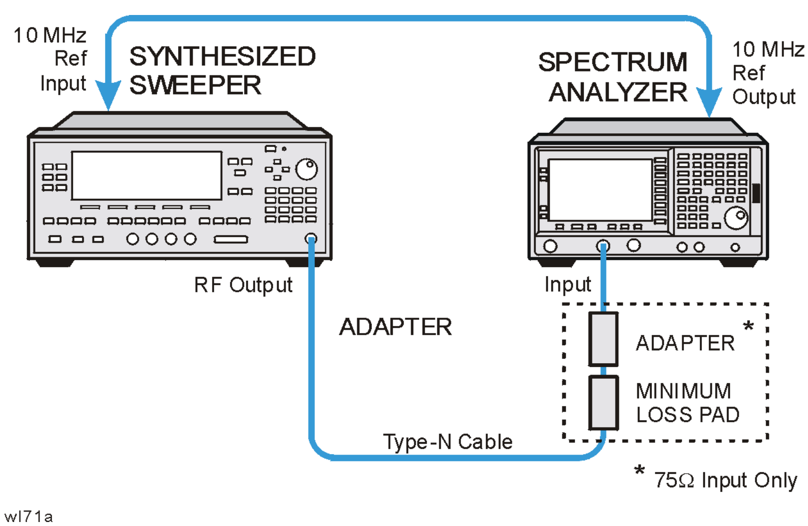
Equipment Required

Synthesized sweeper
Adapter, Type N (f) to APC 3.5 (m)
Cable, Type N, 183 cm (72 in)
Cable, BNC, 122 cm (48 in)

Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

Figure 2-3 Frequency Readout and Marker Frequency Accuracy Test Setup



Procedure

This performance test consists of two parts:

"Part 1: Frequency Readout Accuracy"
"Part 2: Marker Count Accuracy"

Perform "Part 1: Frequency Readout Accuracy" before "Part 2: Marker Count Accuracy".

Part 1: Frequency Readout Accuracy

1. Connect the equipment as shown in Figure 2-3. Remember to connect the 10 MHz REF OUT of the analyzer to the 10 MHz REF INPUT of the synthesized sweeper.

CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or the input connector will be damaged.

2. Perform the following steps to set up the equipment:

   a. Press **INSTRUMENT PRESET** on the synthesized sweeper, then set the controls as follows:

      CW, **1.490 GHz** (*E4401B and E4411B*)
      CW, **1.5 GHz** (*E4402B and E4403B*)
      POWER LEVEL, **–10 dBm**

   b. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

      Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
      FREQUENCY, **1.5 GHz**
      SPAN, 20 MHz

3. Press **Peak Search** (or **Search**) on the analyzer to measure the frequency readout accuracy.

4. Record the marker frequency reading in the performance verification test record.

5. Repeat step 3 and step 4 above for the remaining spans listed in Table 2-5.

Table 2-5 Frequency Readout Accuracy

Analyzer Span (MHz)	TR Entry, Actual Marker Frequency
20	**1**)
10	**2**)
1	**3**)

Part 2: Marker Count Accuracy

Perform "Part 1: Frequency Readout Accuracy" before performing this procedure.

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer to measure the marker count accuracy by pressing the following keys:

   FREQUENCY, **1.490 GHz** (*E4401B and E4411B*)
   FREQUENCY, **1.5 GHz** (*E4402B and E4403B*)
   SPAN, **10 MHz**
   BW/Avg, **Resolution BW**, **100 kHz** (Man)
   Freq Count, Marker Count (On)
   Resolution (Man)**, 1 Hz**

2. Press **Peak Search** (or **Search**), then wait for a count be taken (it may take several seconds).
3. Record the Cntr1 frequency reading as TR Entry 4 of the performance verification test record.
4. On the analyzer, press **SPAN, 1 MHz**.
5. Press **Peak Search** (or **Search**), then wait for a count be taken (it may take several seconds).
6. Record the Cntr1 frequency reading as TR Entry 5 of the performance verification test record.

4. Frequency Readout and Marker Frequency Count Accuracy: Agilent E4404B, E4405B, E4407B, and E4408B

The frequency readout accuracy of the analyzer is tested with an input signal of known frequency. By using the same frequency standard for the analyzer and the synthesized sweeper, the frequency reference error is eliminated.

There is no related adjustment for this performance test.

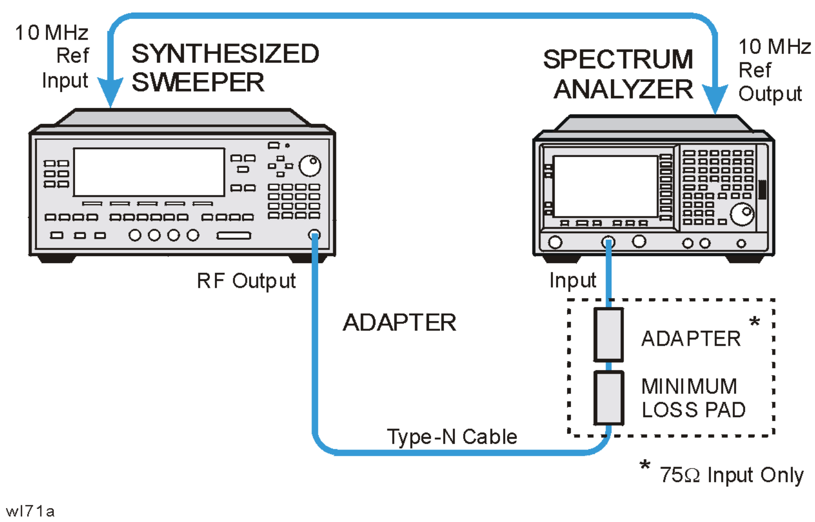
Equipment Required

Synthesized sweeper
Adapter, Type N (m) to APC 3.5 (f)
Adapter, APC 3.5 (f) to APC 3.5 (f)
Cable, APC 3.5, 91 cm (36 in)
Cable, BNC, 122 cm (48 in)

Additional Equipment for Option BAB

Adapter, APC 3.5 (f) to APC 3.5 (f)

Figure 2-4 Frequency Readout and Marker Count Accuracy Test Setup



Procedure

This performance verification test consists of two parts:

"Part 1: Frequency Readout Accuracy"
"Part 2: Marker Count Accuracy"

Perform “Part 1: Frequency Readout Accuracy” before “Part 2: Marker Count Accuracy”.

Part 1: Frequency Readout Accuracy

1. Connect the equipment as shown in Figure 2-4. Remember to connect the 10 MHz REF OUT of the analyzer to the 10 MHz REF INPUT of the synthesized sweeper.

   Option BAB only: Use the APC 3.5 adapter to connect the cable to the analyzer input.

2. Perform the following steps to set up the equipment:

   a. Press **INSTRUMENT PRESET** on the synthesized sweeper, then set the controls as follows:

      CW, **1.5 GHz**
      POWER LEVEL, **–10 dBm**

   b. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

      Sweep, Points, 401, **Enter** *(Firmware revision A.04.00 and later)*
      FREQUENCY, 1.5 MHz
      SPAN, 20 MHz

3. Press **Peak Search** (or **Search**) on the analyzer to measure the frequency readout accuracy.

4. Record the Mkr1 frequency reading in the performance verification test record as indicated in Table 2-6.

5. Change to the next analyzer span setting listed in Table 2-6.

6. Repeat step 3 through step 5 for each analyzer frequency and span setting and synthesized sweeper CW frequency setting listed in Table 2-6 for the analyzer being tested.

Table 2-6 Frequency Readout Accuracy

Synthesized Sweeper CW Frequency (MHz)	Analyzer Span (MHz)	Analyzer Center Frequency (GHz)	TR Entry Frequency (GHz)
1500	20	1.5	**1)**
1500	10	1.5	**2)**
1500	1	1.5	**3)**
4000	20	4.0	**4)**
4000	10	4.0	**5)**

Table 2-6 Frequency Readout Accuracy

Synthesized Sweeper CW Frequency (MHz)	Analyzer Span (MHz)	Analyzer Center Frequency (GHz)	TR Entry Frequency (GHz)
4000	1	4.0	**6)**
Stop here for E4404B.			
9000	20	9.0	**7)**
9000	10	9.0	**8)**
9000	1	9.0	**9)**
Stop here for E4405B.			
16000	20	16.0	**10)**
16000	10	16.0	**11)**
16000	1	16.0	**12)**
21000	20	21.0	**13)**
21000	10	21.0	**14)**
21000	1	21.0	**15)**

Part 2: Marker Count Accuracy

Perform "Part 1: Frequency Readout Accuracy" before performing this procedure.

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer to measure the marker count accuracy by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **1.5 GHz**
   SPAN, **20 MHz**
   BW/Avg, **Resolution BW**, **100 kHz** (Man)
   Freq Count, Marker Count (On)
   Resolution (Man)

2. Press **Peak Search** (or **Search**), then wait for a count be taken (it may take several seconds).

3. Record the Cntr1 frequency reading in the performance verification test record as indicated in Table 2-7.

4. Repeat step 2 and step 3 for each analyzer center frequency and span setting and synthesized sweeper CW frequency setting listed in Table 2-7 for the analyzer being tested.

Performance verification test “Frequency Readout Accuracy and Marker Count Accuracy” is now complete.

Table 2-7 Marker Count Accuracy

Synthesized Sweeper CW Frequency	Analyzer Center Frequency	Analyzer Span	Cntr 1 Frequency
MHz	**GHz**	**MHz**	**TR Entry**
1500	1.5	20	**16**)
1500	1.5	1	**17**)
4000	4.0	20	**18**)
4000	4.0	1	**19**)
Stop here for E4404B.			
9000	9.0	20	**20**)
9000	9.0	1	**21**)
Stop here for E4405B.			
16000	16.0	20	**22**)
16000	16.0	1	**23**)
21000	21.0	20	**24**)
21000	21.0	1	**25**)

5. Frequency Span Readout Accuracy: Agilent E4401B and Agilent E4411B

For testing each frequency span, two synthesized sources are used to provide two precisely-spaced signals. The analyzer marker functions are used to measure this frequency difference.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper
Synthesized signal generator
Power splitter
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (f) to APC 3.5 (f)
Cable, Type-N, 152-cm (60-in) *(2 required)*
Cable, BNC, 122-cm (48-in)

Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Procedure

Full Span Frequency Span Readout Accuracy

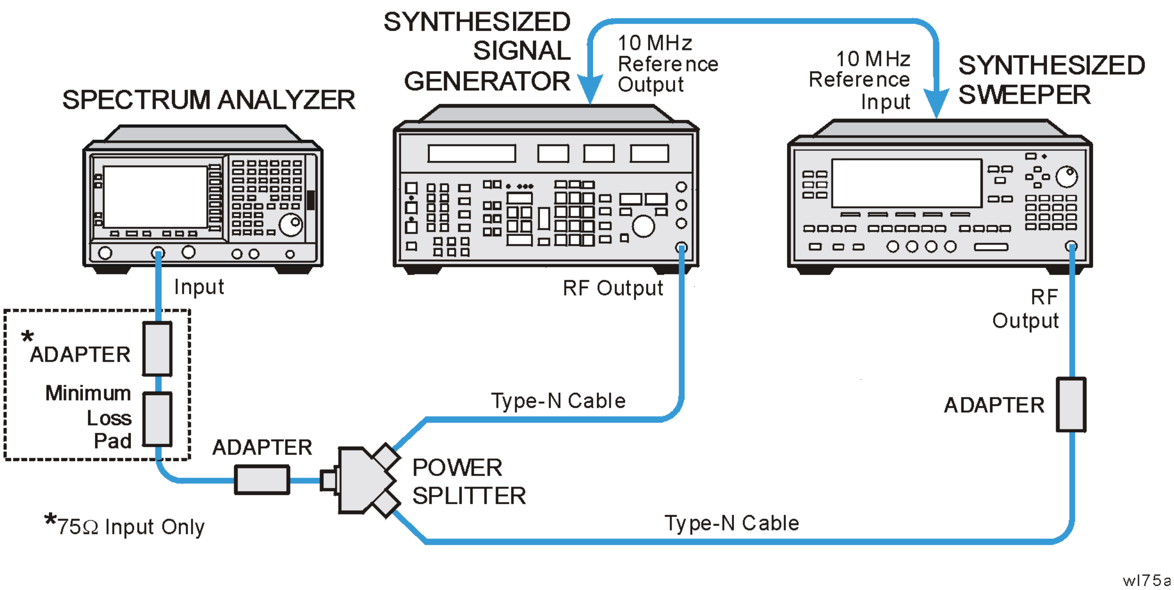
1. Connect the equipment as shown in Figure 2-5. Note that the power splitter is used as a combiner. The synthesized signal generator provides the frequency reference for the synthesized sweeper.
2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.
3. Press **PRESET** on the synthesized sweeper and set the controls as follows:

   CW, **1350 MHz**
   POWER LEVEL, **–5 dBm**

4. On the synthesized signal generator, set the controls as follows:

   FREQUENCY, 150 MHz
   AMPLITUDE, **0 dBm**

Figure 2-5 Frequency Span Readout Accuracy Test Setup



5. Adjust the analyzer center frequency, if necessary, to place the lower frequency on the second vertical graticule line (one division from the left-most graticule line).

6. On the analyzer, press **Single**. Wait for the completion of a new sweep, then press the following keys:

   Peak Search (or **Search**)
   Marker, Delta
   Next Peak

   The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).

7. If necessary, continue pressing **Next Peak** until the active marker is on the right-most signal (1350 MHz).

8. Record the ΔMkr1 frequency reading as TR Entry 1 of the performance verification test record.

100 kHz and 100 MHz Frequency Span Readout Accuracy

1. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, **10 MHz**
   Stop Freq, **110 MHz**
   Sweep, Sweep (Cont)

2. On the synthesized sweeper set the controls as follows:

   CW, **100 MHz**
   POWER LEVEL, **–5 dBm**

3. Set the synthesized signal generator controls as follows:

   FREQUENCY, **20 MHz**
   AMPLITUDE, **0 dBm**

4. Adjust the analyzer center frequency to center the two signals on the display.

5. On the analyzer, press **Single**. Wait for the completion of a new sweep, then press the following keys:

   Peak Search (or **Search**)
   Marker, Delta
   Next Peak

   The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).

6. If necessary, continue pressing **Next Peak** until the active marker is on the right-most signal (100 MHz). Record the ΔMkr1 frequency reading in the performance test record as TR Entry 2.

7. Press **Marker**, **More, Marker All Off** on the analyzer.

8. Change to the next equipment settings listed in Table 2-8.

9. On the analyzer, press **Single**. Wait for the completion of a newsweep, then press the following keys:

   Peak Search (or **Search**)
   Marker, Delta
   Next Peak

10. If necessary, continue pressing **Next Peak** until the marker delta is on the right-most signal. Record the ΔMkr1 frequency reading in the performance test record.

11. Repeat step 7 through step 10 for the remaining analyzer span settings listed in Table 2-8.

Table 2-8 Frequency Span Readout Accuracy

Analyzer Start Frequency (MHz)	Analyzer Stop Frequency (MHz)	Synthesized Signal Generator Frequency (MHz)	Synthesized Sweeper Frequency (MHz)	TR Entry	Analyzer Span (MHz)
0	1500	150	1350	**1**)	1500
10	110	20	100	**2**)	100
10	10.1	10.01	10.09	**3**)	0.1
800	900	810	890	**4**)	100
800	800.1	800.01	800.09	**5**)	0.1
1400	1500	1410	1490	**6**)	100
1499	1499.1	1499.01	1499.09	**7**)	0.1

6. Frequency Span Readout Accuracy: Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B

For testing each frequency span, two synthesized sources are used to provide two precisely-spaced signals. The analyzer marker functions are used to measure this frequency difference.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper
Synthesized signal generator
Power splitter
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (f) to APC 3.5 (f)
Cable, Type-N, 152-cm (60-in) *(2 required)*
Cable, BNC, 122-cm (48-in)

Additional Equipment for Option BAB

Adapter, Type-N (m), to APC 3.5 (f)

Procedure

Full Span Frequency Span Readout Accuracy

1. Connect the equipment as shown in Figure 2-5. Note that the power splitter is used as a combiner. The synthesized signal generator provides the frequency reference for the synthesized sweeper.
2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **Stop Freq**, **3 GHz**

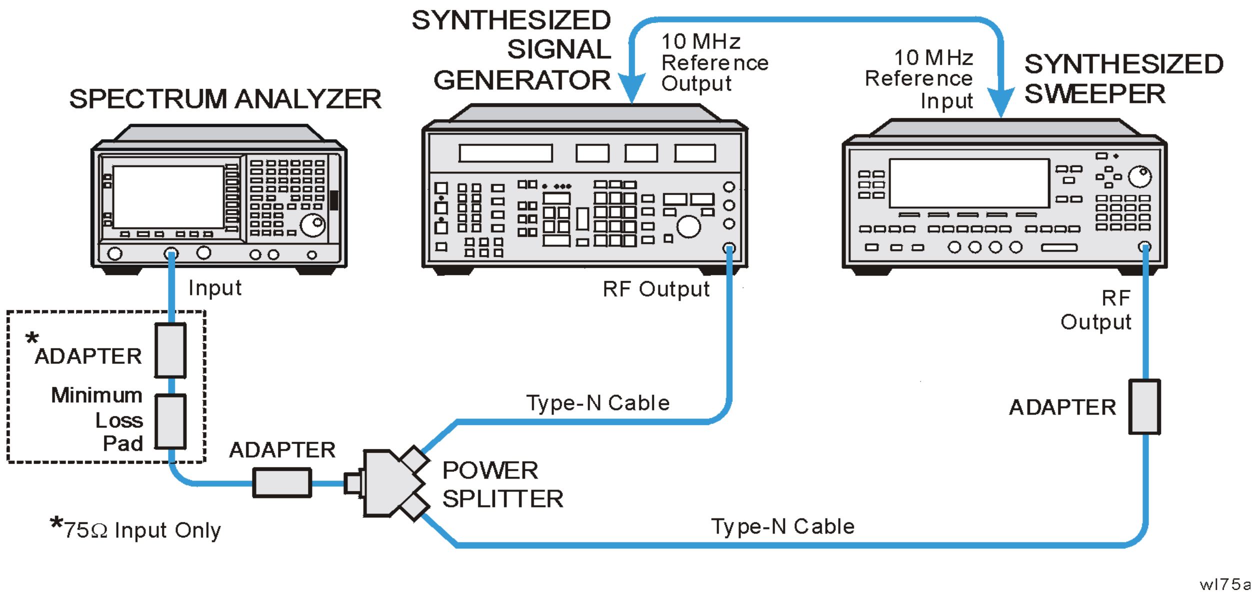
3. Press **PRESET** on the synthesized sweeper and set the controls as follows:

   CW, **2700 MHz**
   POWER LEVEL, **–5 dBm**

4. On the synthesized signal generator, set the controls as follows:

   FREQUENCY, 300 MHz
   AMPLITUDE, **0 dBm**

Figure 2-6 Frequency Span Readout Accuracy Test Setup



5. Adjust the analyzer center frequency, if necessary, to place the lower frequency on the second vertical graticule line (one division from the left-most graticule line).
6. On the analyzer, press **Single**. Wait for the completion of a new sweep, then press the following keys:

   Peak Search (or **Search**)
   Marker, Delta
   Next Peak

NOTE The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).

7. If necessary, continue pressing **Next Peak** until the active marker is on the right-most signal (2700 MHz).
8. Record the ΔMkr1 frequency reading as TR Entry 1 of the performance verification test record.

100 kHz and 100 MHz Frequency Span Readout Accuracy

1. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, **10 MHz**
   Stop Freq, **110 MHz**
   Sweep, Sweep (Cont)

2. On the synthesized sweeper set the controls as follows:

   CW, **100 MHz**
   POWER LEVEL, **–5 dBm**

3. Set the synthesized signal generator controls as follows:

   FREQUENCY, **20 MHz**
   AMPLITUDE, **0 dBm**

4. Adjust the analyzer center frequency to center the two signals on the display.

5. On the analyzer, press **Single**. Wait for the completion of a new sweep, then press the following keys:

   Peak Search (or **Search**)
   Marker, Delta
   Next Peak

   The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).

6. If necessary, continue pressing **Next Peak** until the active marker is on the right-most signal (100 MHz). Record the ΔMkr1 frequency reading in the performance test record as TR Entry 2.

7. Press **Marker**, **More, Marker Off** on the analyzer.

8. Change to the next equipment settings listed in Table 2-9.

9. On the analyzer, press **Single.** Wait for the completion of a new sweep, then press the following keys:

   Peak Search (or **Search**)
   Marker, Delta
   Next Peak

10. If necessary, continue pressing **Next Peak** until the marker delta is on the right-most signal. Record the ΔMkr1 frequency reading in the performance test record.

11. Repeat step 7 through step 10 for the remaining analyzer span settings listed in Table 2-9.

Table 2-9 Frequency Span Readout Accuracy

Analyzer Start Frequency (MHz)	Analyzer Stop Frequency (MHz)	Synthesized Signal Generator Frequency (MHz)	Synthesized Sweeper Frequency (MHz)	TR Entry	Analyzer Span (MHz)
0	3000	300	2700	**1)**	3000
10	110	20	100	**2)**	100
10	10.1	10.01	10.09	**3)**	0.1
800	900	810	890	**4)**	100
800	800.1	800.01	800.09	**5)**	0.1
1400	1500	1410	1490	**6)**	100
1499	1499.1	1499.01	1499.09	**7)**	0.1

7. Noise Sidebands

A 1 GHz CW signal is applied to the input of the analyzer. The marker functions are used to measure the amplitude of the carrier and the noise level at 10 kHz, 20 kHz, 30 kHz, and 100 kHz above and below the carrier.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized signal generator
Cable, Type-N, 152-cm (60-in)

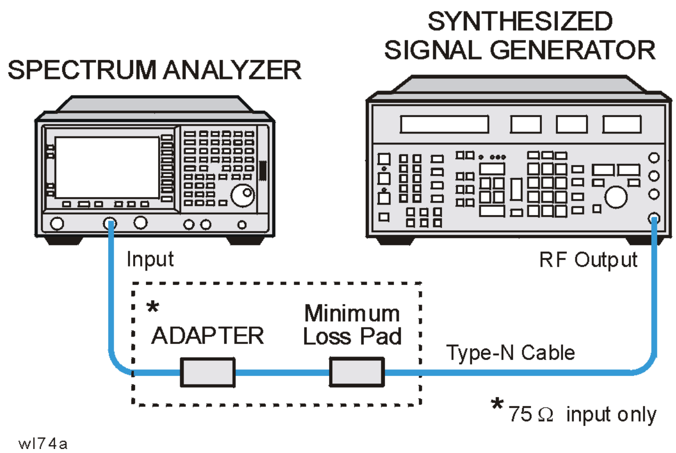
Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f), to APC 3.5 (f)

Figure 2-7 Noise Sidebands Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or the connectors will be damaged.

Procedure

This performance test consists of four parts:

Part 1: Noise Sideband Suppression at 10 kHz
Part 2: Noise Sideband Suppression at 20 kHz
Part 3: Noise Sideband Suppression at 30 kHz
Part 4: Noise Sideband Suppression at 100 kHz

Perform part 1 before performing parts 2-4 of this procedure.

A worksheet is provided at the end of this procedure for calculating the noise sideband suppression.

Part 1: Noise Sideband Suppression at 10 kHz

1. Perform the following steps to set up the equipment:

   a. Set the synthesized signal generator controls as follows:

      FREQUENCY, **1000 MHz**
      AMPLITUDE, **0 dBm** (50 Ω Input only)
      AMPLITUDE, **to 6 dBm** (75 Ω Input only)
      AM OFF
      FM OFF

   b. Connect the equipment as shown in Figure 2-7.

   c. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

      Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
      FREQUENCY, **1 GHz**
      SPAN, **10 MHz**
      AMPLITUDE, **Attenuation 10 dB** (Man)
      AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**

2. Press the following analyzer keys to measure the carrier amplitude:

   Peak Search (or **Search**)
   FREQUENCY, **Signal Track** (On)
   SPAN, **50 kHz**
   BW/Avg, **1 kHz**
   Video BW, **30 Hz** (Man)
   FREQUENCY, **Signal Track** (Off)
   Sweep, Sweep Time, 5 sec
   Single

   Wait for the completion of a sweep, then press **Peak Search** (or **Search**).

3. Press the following analyzer keys to measure the noise sideband level at 10 kHz:

   Marker, **Delta**
   More, **Function**, **Marker Noise** (or **Noise**)
   AMPLITUDE, –10 dBm
   FREQUENCY, CF Step, 10 kHz
   Center Freq, ↑
   SPAN, Zero Span
   Single

   Record the marker delta amplitude reading in Table 2-10 as the Noise Sideband Level at 10 kHz.

4. Press the following analyzer keys to measure the noise sideband level at –10 kHz:

   FREQUENCY, ↓**,** ↓
   Single

   Record the marker amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at –10 kHz.

5. Record the more positive value, either Noise Sideband Level at 10 kHz or Noise Sideband Level at –10 kHz from the Noise Sideband Worksheet as TR Entry 1 in the performance verification test record.

6. Press **FREQUENCY,** ↑

Part 2: Noise Sideband Suppression at 20 kHz

1. Press the following analyzer keys to measure the noise sideband level at 20 kHz:

   FREQUENCY, CF Step, 20 kHz
   Center Freq, ↑
   Single

   Record the marker amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at 20 kHz.

2. Press the following analyzer keys to measure the noise sideband level at –20 kHz:

   FREQUENCY, ↓**,** ↓
   Single

   Record the marker amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at –20 kHz.

3. Record the more positive value, either Noise Sideband Level at 20 kHz or Noise Sideband Level at –20 kHz from the Noise Sideband Worksheet as TR Entry 2 in the performance verification test record.

4. Press **FREQUENCY,** ↑

Part 3: Noise Sideband Suppression at 30 kHz

1. Press the following analyzer keys to measure the noise sideband level at 30 kHz:

   FREQUENCY, CF Step, 30 kHz
   Center Freq, ↑
   Single

   Record the marker amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at 30 kHz.

2. Press the following analyzer keys to measure the noise sideband level at –30 kHz:

   FREQUENCY, ↓, ↓
   Single

   Record the marker amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at –30 kHz.

3. Record the more positive value, either Noise Sideband Level at 30 kHz or Noise Sideband Level at –30 kHz from the Noise Sideband Worksheet as TR Entry 3 in the performance verification test record.

4. Press **FREQUENCY, ↑**

Part 4: Noise Sideband Suppression at 100 kHz

1. Press the following analyzer keys to measure the noise sideband level at 100 kHz:

   FREQUENCY, CF Step, 98 kHz
   Center Freq, ↑
   Single

   Record the marker amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at 100 kHz.

2. Press the following analyzer keys to measure the noise sideband level at –100 kHz:

   FREQUENCY, ↓, ↓
   Single

NOTE A spur may exist at 100 kHz offset from the carrier. Measuring at ±98 kHz offset from the carrier will yield a noise sideband level worse than the reading at ±100 kHz offset.

   Record the marker amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at –100 kHz.

3. Record the more positive value; either Noise Sideband Level at 100 kHz or Noise Sideband Level at –100 kHz from the Noise Sideband Worksheet as TR Entry 4 in the performance test verification record.

Table 2-10 Noise Sideband Worksheet

Description	Measurement
Noise Sideband Level at 10 kHz	dBc/Hz
Noise Sideband Level at –10 kHz	dBc/Hz
Noise Sideband Level at 20 kHz	dBc/Hz
Noise Sideband Level at –20 kHz	dBc/Hz
Noise Sideband Level at 30 kHz	dBc/Hz
Noise Sideband Level at –30 kHz	dBc/Hz
Noise Sideband Level at 100 kHz	dBc/Hz
Noise Sideband Level at –100 kHz	dBc/Hz

8. System-related Sidebands

A 500 MHz CW signal is applied to the input of the analyzer. The marker functions are used to measure the amplitude of the carrier and the amplitude of any system-related sidebands more than 30 kHz away from the carrier. System-related sidebands are any internally generated sidebands related to the line, power supply or local oscillator.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized signal generator
Cable, Type-N, 152-cm (60-in)

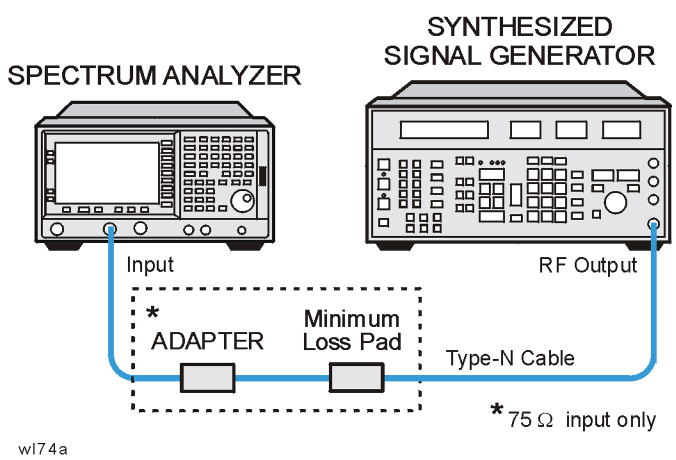
Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f), to APC 3.5 (f)

Figure 2-8 System-related Sidebands Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or the connectors will be damaged.

Procedure

1. Perform the following steps to set up the equipment:

   a. Set the synthesized signal generator controls as follows:

      FREQUENCY, **500 MHz**
      AMPLITUDE, **0 dBm** *(50 Ω Input only)*
      AMPLITUDE, **6 dBm** (75 Ω *Input only)*
      AM Off
      FM Off

   b. Connect the equipment as shown in Figure 2-8.

   c. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

      Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
      FREQUENCY, **500 MHz**
      SPAN, **10 MHz**

2. Set the analyzer to measure the system-related sideband above the signal by performing the following steps:

   a. Press the following keys:

      Peak Search (or **Search**)
      FREQUENCY, **Signal Track** (On)
      SPAN, **200 kHz**
      BW/Avg, **1 kHz**
      Video BW, **30 Hz** (Man)

      Allow the analyzer to take two complete sweeps. Then press the following keys:

      FREQUENCY, **Signal Track** (Off)
      CF Step, **130 kHz** (Man)

   b. Press **Single** and wait for the completion of the sweep. Press **Peak Search** (or **Search**), then **Marker, Delta**.

   c. Press the following keys:

      FREQUENCY
      ↑(step-up key)

3. Measure the system-related sideband above the signal by pressing **Single** on the analyzer. Wait for the completion of a new sweep, then press **Peak Search** (or **Search**).

4. Record the marker delta amplitude as TR Entry 1 of the performance verification test record.

5. Set the analyzer to measure the system-related sideband below the signal by pressing the following keys:

   FREQUENCY
   ↓ (step-down key)
   ↓ (step-down key)

6. Measure the system-related sideband below the signal by pressing **Single**. Wait for the completion of a new sweep, then press **Peak Search** (or **Search**).

   Record the marker delta amplitude as TR Entry 2 of the performance verification test record.

9. Residual FM

This test measures the inherent short-term instability of the analyzer LO system. With the analyzer in zero span, a stable signal is applied to the input and slope detected on the linear portion of the IF bandwidth filter skirt. Any instability in the LO transfers to the IF signal in the mixing process. The test determines the slope of the IF filter in Hz/dB and then measures the signal amplitude variation caused by the residual FM. Multiplying these two values yields the residual FM in Hz.

Since the 10 Hz resolution bandwidth filter is digitally implemented, its slope is well known. The measured amplitude variation is simply multiplied by the known slope to yield the residual FM in a 10 Hz Res BW.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized signal generator
Cable, Type-N, 152-cm (60-in)

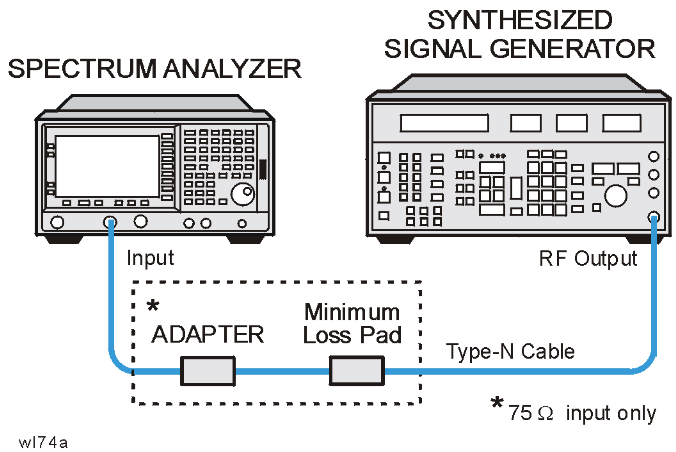
Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f), to APC 3.5 (f)

Figure 2-9 Residual FM Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or the connectors will be damaged.

Procedure

This performance test consists of two parts:

"Part 1: Residual FM"
"Part 2: Residual FM for Option 1DR and 1D5"

Perform "Part 2: Residual FM for Option 1DR," and 1D5 in addition to Part 1, only if your analyzer is equipped with Option 1DR or 1D5.

Part 1: Residual FM

Determining the IF Filter Slope

1. Connect the equipment as shown in Figure 2-9.
2. Set the synthesized signal generator controls as follows:

   FREQUENCY, **1000 MHz**
   AMPLITUDE, **–10 dBm** (50 Ω *Input only)*
   AMPLITUDE, **–4 dBm** (75 Ω *Input only)*
   AM OFF
   FM OFF

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **Center Freq, 1 GHz**
   SPAN, **1 MHz**
   AMPLITUDE, **Ref Level**, **–9 dBm** (50 Ω *Input only)*
   AMPLITUDE, **39.8 dBmV** (75 Ω *Input only)*
   Scale/Div, **2 dB**
   BW/Avg, **Resolution BW**, **1 kHz**

4. On the analyzer, press the following keys:

   Peak Search (or **Search**)
   SPAN, **Span Zoom**, **5 kHz**

   Wait for the Span 5kHz message to appear, then press:

   Peak Search (or **Search**), **More**, **Marker** → **Ref Lvl**, **Marker**, **Off**

5. On the analyzer, press the following keys:

   Single (Wait for the sweep to finish)
   Peak Search (or **Search**)
   Meas Tools, **Delta**

6. On the analyzer, rotate RPG knob counterclockwise until the ΔMkr1 amplitude reads –8 dB ±0.3 dB.

7. Press **Delta**, then rotate the knob counterclockwise until the ΔMkr1 reads –4 dB ±0.3 dB.

   If you have difficulty achieving the ±0.3 dB setting, then make the following analyzer settings:

   Sweep, **Sweep** (Cont)
   SPAN, **2 kHz**
   BW/Avg, **Video BW**, **30 Hz** (Man)
   Repeat step 5 through step 7.

8. Divide the ΔMkr1 frequency in Hertz by the ΔMkr1 amplitude in dB to obtain the slope of the resolution bandwidth filter. For example, if the ΔMkr1 frequency is 275 Hz and the ΔMkr1 amplitude is 3.92 dB, the slope would be equal to 94.2 Hz/dB. Record the result below:

   Slope ___________ Hz/ dB

Measuring the Residual FM

9. On the analyzer, press:

   Marker, **Off**
   Peak Search (or **Search**)
   Meas Tools
   Delta

10. Rotate the RPG knob counterclockwise until the ΔMkr1 amplitude reads –10 dB ±0.3 dB.

11. On the analyzer, press the following keys:

   Marker, **Normal**
   Marker →, **Mkr** → **CF**
   Single
   BW/Avg, **Video BW** (Man), **1 kHz**
   SPAN, **Zero Span**
   Sweep, **Sweep Time**
   100 ms, **Single**

   The displayed trace should be about five divisions below the reference level. If it is not, press **Sweep**, **Sweep** (Cont), **FREQUENCY**, and use the RPG knob to place the displayed trace about five divisions below the reference level. Press **Single**.

12. On the analyzer, press **Peak Search** (or **Search**), **Pk-Pk Search**. Read the ΔMkr1 amplitude, take its absolute value, and record the result as the Deviation.

   Deviation ___________ dB

13. Calculate the Residual FM by multiplying the Slope recorded in step 8 by the Deviation recorded in step 12.

    Record this value as TR Entry 1 (Residual FM (1 kHz Res BW) in the performance verification test record.

Part 2: Residual FM for Option 1DR and 1D5

Perform this additional procedure only if Option 1DR and Option 1D5 are present. Perform "Part 1: Residual FM" before performing this procedure.

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **Center Freq**, **1 GHz**
   SPAN, **1 MHz**
   AMPLITUDE, **Ref Level**, **–9 dBm** (50 Ω *Input only)*
   AMPLITUDE, **Ref Level, 39.8 dBmV** (75 Ω *Input only)*
   Scale/Div, **2 dB**

2. On the analyzer press the following keys:

   Peak Search (or **Search**)
   SPAN, **Span Zoom**, **5 kHz**

   Wait for the "Span 5 kHz" message to appear. Press the following keys:

   BW/Avg, Resolution BW, 10 Hz (Man)
   SPAN, **100 Hz**

3. On the analyzer, press the following keys:

   Peak Search (or **Search**)
   More, Mkr → **Ref Lvl**
   Marker, **Off**
   Peak Search (or **Search**)
   Meas Tools
   Delta

4. On the analyzer, rotate the RPG knob counterclockwise until the ΔMkr1 amplitude reads –10 dB ±0.3 dB.

5. On the analyzer, press the following keys:

   Marker, **Normal**
   Marker →, **Mkr → CF**
   Single
   BW/Avg, **Video BW**, **10 Hz** (Man)
   SPAN, **Zero Span**
   Sweep, **Sweep Time, 20 ms**
   Single

   The displayed trace should be about five divisions below the reference level. If it is not, press **Sweep**, **Sweep** (Cont), **FREQUENCY**, and use the RPG knob to place the displayed trace about five divisions below the reference level. Press **Single**.

6. On the analyzer, press **Peak Search** (or **Search**), **Pk-Pk Search**. Read the ΔMkr1 amplitude, take its absolute value, and record the result as the Deviation.

   Deviation ____________ dB

7. Calculate the Residual FM by multiplying the deviation recorded in step 6 by 0.426 Hz/dB. This is the slope of the 10 Hz Res BW filter at 10 dB below the peak of the filter.

   Record this value as TR Entry 2 (Residual FM (10 Hz RBW)) in the performance verification test record.

10. Sweep Time Accuracy

This test uses a function generator to amplitude-modulate a 500 MHz CW signal from another signal generator. The analyzer demodulates this signal in zero span to display the response in the time domain. The marker Δ function on the analyzer is used to read out the sweep time accuracy.

If the analyzer is equipped with Option AYX, also perform "Fast Time Domain Amplitude Accuracy" in addition to this procedure.

There are no related adjustment procedures for this performance test.

Equipment Required

Function generator
Synthesized signal generator
Cable, Type-N, 152-cm (60-in)
Cable, BNC, 120-cm (48-in)

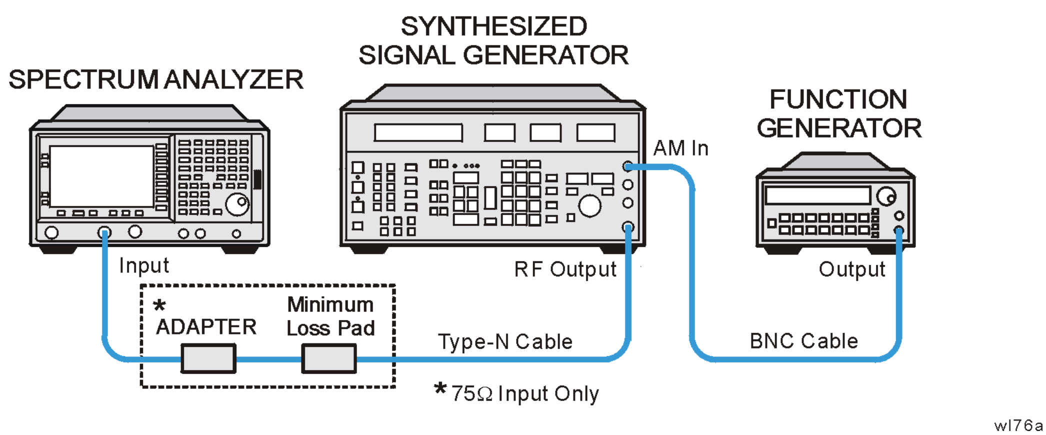
Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f), to APC 3.5 (f)

Figure 2-10 Sweep Time Accuracy Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or the connectors will be damaged.

Procedure

1. Set the synthesized signal generator to output a 500 MHz, –10 dBm, CW signal. Set the AM and FM controls to off.

   75 Ω *Input only: Set output level to –4 dBm.*

2. Set the function generator to output a 2 kHz, 1.14 Vp-p triangle waveform signal.
3. Connect the equipment as shown in Figure 2-10.
4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   Center Frequency, **500 MHz**
   SPAN, 10 MHz
   SPAN, **Span Zoom**, **50 kHz**

5. Wait for the `Span 50 kHz` message to appear. Set **Signal Track** (Off).
6. Set the span to 0 Hz and set the analyzer as follows:

   BW/Avg, Resolution BW, 3 MHz
   Sweep, Sweep Time, 5 ms
   AMPLITUDE, Scale Type (Lin)
   Peak Search (or **Search**)
   More, **Search Parameters**
   Peak Excursion, **3 dB**

7. Adjust the synthesized signal generator amplitude as necessary for a mid-screen display (marker amplitude should read approximately 110 mV).
8. Set the synthesized signal generator modulation source to EXT DC. Set AM ON at 90% modulation.
9. On the analyzer, press **Trig** then **Video**. Set the video trigger level to 110 mV (mid-screen).
10. On the analyzer, press **Single**. After the completion of the sweep, press **Peak Search** (or **Search**), **0s**, **Meas Tools**, **Next Pk Right**. This is the marked signal.
11. Press **Marker, Delta**, then **Peak Search** (or **Search**) and press **Next Pk Right** eight times so the delta marker is on the eighth signal peak from the marked signal.

12.Read the ΔMkr1 time. Calculate the sweeptime accuracy as follows:

$$\text{Sweep Time Accuracy} = 100 \times \frac{\Delta\text{Mkr1} - (0.8 \times \text{Sweep Time})}{\text{Sweep Time}}$$

NOTE The sweep time accuracy is defined as a percentage of the indicated sweep time, not of the indicated signal separation. Therefore, it is appropriate to divide the difference between the ΔMkr1 reading and the nominal signal separation by the sweep time, rather than dividing by the nominal signal separation.

13.Record the calculated sweeptime accuracy in Table 2-11.

14.If the analyzer is not equipped with Option AYX, fast time domain sweeps, repeat step 10 through step 13 only for sweeptime settings between 5 ms and 10 s as indicated in Table 2-11. For each sweeptime setting, set the function generator to the frequency indicated in Table 2-11.

15.If the analyzer is equipped with Option AYX, fast time domain sweeps, Option B7D, DSP, or Fast ADC, repeat step 10 through step 13 for all sweeptime settings as indicated in Table 2-11. For each sweeptime setting, set the function generator to the frequency indicated in Table 2-11.

Table 2-11 Sweep Time Accuracy

Analyzer Sweep Time Setting	Synthesizer Function Generator Frequency	Δ Mkr 1 Reading	Sweep Time Accuracy (%)	TR Entry
5 ms	2.0 kHz			**1)**
20 ms	500.0 Hz			**2)**
100 ms	100.0 Hz			**3)**
1 s	10.0 Hz			**4)**
10 s	1.0 Hz			**5)**
The following entries only apply to analyzers equipped with Option AYX or B7D.				
1 ms	10.0 kHz			**6)**
500 µs	20.0 kHz			**7)**
100 µs	100.0 kHz			**8)**

11. Display Scale Fidelity

A 50 MHz CW signal is applied to the input of the analyzer through two calibrated step attenuators. The attenuators are the amplitude reference standard. The source is adjusted for a response at the reference level. The attenuators are then set to achieve a nominal amplitude below the reference level. The analyzer amplitude marker is compared to the actual total attenuation to determine the scale fidelity error.

The test is performed in both log and linear amplitude scales.

The related adjustment for this performance test is “IF Amplitude.”

Equipment Required

Synthesized signal generator
1 dB step attenuator
10 dB step attenuator
Attenuator switch driver (if programmable step attenuators are used)
Cable, Type-N 152-cm (60-in)
Cable, BNC 122-cm (48-in) (*2 required*)
Attenuator interconnect kit
Adapter, Type-N (m) to BNC (f) (*2 required*)

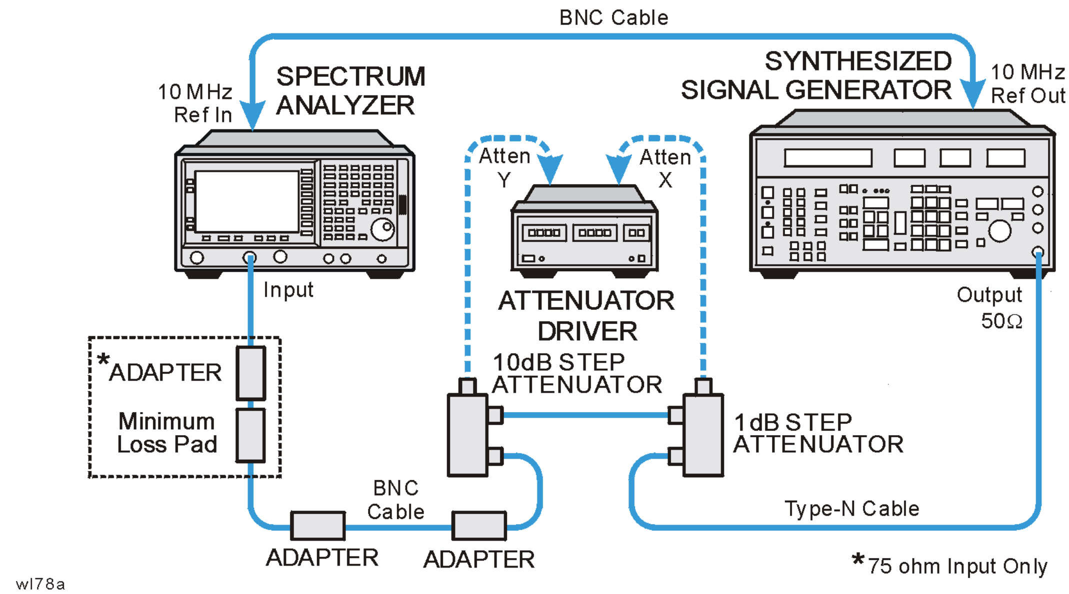
Additional Equipment for 75 Ω Input

50 Ω to 75 Ω minimum loss pad
Adapter, Type-N (f), to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f), to APC 3.5 (f)

Figure 2-11 Scale Fidelity Test Setup



CAUTION Use only 75 Ω cables, connectors, and adapters on instruments with 75 Ω connectors, or the connectors will be damaged.

Procedure

Calculate the Actual Attenuation Errors

1. From the calibration data supplied with the 10 dB step attenuator, enter into column 4 of Table 2-12 and Table 2-13 the actual attenuation for the corresponding nominal attenuation settings.

   If the calibration data does not indicate an actual attenuation value for the 0 dB setting, enter 0 dB.

NOTE The HP/Agilent 8496G programmable attenuator has four attenuator sections consisting of 10 dB, 20 dB, and 40 dB attenuators. If using the HP/Agilent 8496G programmable attenuator, enter the calibration data for the section three, 40 dB step, rather than the section four, 40 dB step.

2. From the calibration data supplied with the 1 dB step attenuator, enter into column 5 of Table 2-12 and Table 2-13 the actual attenuation for the corresponding nominal attenuation settings.

   If the calibration data does not indicate an actual attenuation value for the 0 dB setting, enter 0 dB.

NOTE The HP/Agilent 8494G programmable attenuator has four attenuator sections consisting of 1 dB, 2 dB, 4 dB, and 4 dB attenuators. If using the HP/Agilent 8494G programmable attenuator, enter the calibration data for the section three, 4 dB step, rather than the section four, 4 dB step.

3. For each row in Table 2-12 and Table 2-13, add the 10 dB and the 1 dB Step Attenuator Actual Attenuation values (columns 4 and 5) and place the results into the Total Actual Attenuation (column 6).

$$\text{Total Actual Attenuation} = \text{1 dB Step Attenuator Actual Attenuation} + \text{10 dB Step Attenuator Actual Attenuation}$$

Example for –36 dB from REF LVL setting:

$$\text{1 dB Step Attenuator Actual Attenuation (6 dB)} = 5.998 \text{ dB}$$

$$\text{10dB Step Attenuator Actual Attenuation (30 dB)} = 30.012 \text{ dB}$$

$$\text{Total Actual Attenuation} = 5.998\text{dB} + 30.012 \text{ dB} = 36.010 \text{ dB}$$

4. Enter the total actual attenuation (0 dB from the reference level) below:

Total actual attenuation (0 dB from Ref Level) = __________ dB

Section 1: Log Display Scale Fidelity, Analog Bandwidths

Setup for Log Scale Measurement

1. Connect the equipment as indicated in Figure 2-11.
2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   System, Alignments, Auto Align, Off
   FREQUENCY, 50 MHz
   SPAN, 45 kHz
   BW/Avg, 3 kHz
   BW/Avg, Video BW, 1 kHz

3. **Preset** the synthesized signal generator, then press **Blue Key, Special, 0.0**. Press the following keys:

   FREQUENCY, 50 MHz
   AMPLITUDE, –3 dBm (*50 Ω Input only*)
   AMPLITUDE, 4 dBm (*75 Ω Input only*)

4. Set the 1 dB step attenuator to 0 dB.

5. Set the 10 dB step attenuator to 0 dB.
6. Press **Peak Search** (or **Search**) on the analyzer.
7. Adjust the synthesized signal generator amplitude until the analyzer marker amplitude reads 0 dBm ±0.1 dB.

   75 Ω Input: Adjust the synthesized signal generator amplitude until the analyzer marker reads 48.75 dBmV ±0.1 dB.

NOTE Do not adjust the synthesized signal generator amplitude after the reference is established.

8. On the analyzer, press **Marker**, **Delta**.

Measure the Cumulative Log Fidelity

1. Perform step 2 to step 4 for each measurement value in Table 2-12.
2. Set the 1 dB and 10 dB step attenuators as indicated in column 2 and column 3 of Table 2-12 for the ϖαριουσ dB from REF LVL settings.

   For settings of –64 dB and lower, press the following keys:

   BW/Avg, Average (On)
   5, Enter
3. Press **Peak Search** (or **Search**) on the analyzer and record the ΔMkr reading in column 7 of Table 2-12.
4. Calculate the Cumulative Log Fidelity Error (CLFE) as follows, and record the result in the performance verification test record as indicated in column 8 of Table 2-12:

$$\text{CLFE} = \text{Total Actual Attenuation} + \text{Mkr}\Delta\text{ Reading} - \text{Total Actual Atten (0 dB from Ref Level)}$$

Table 2-12 Cumulative and Incremental Log Scale Fidelity Worksheet, Analog Resolution Bandwidths Measured at 3 kHz

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
dB from REF LVL (dB)	10 dB Step Atten Nominal Attenu-ation (dB)	1 dB Step Atten Nominal Attenu-ation (dB)	10 dB Step Atten Actual Attenu-ation (dB)	1 dB Step Atten Actual Attenu-ation (dB)	Total Actual Attenu-ation (dB)	Mkr Δ Reading (dB)	TR Entry – CLFE (dB)	TR Entry – ILFE (dB)
0 (Ref)	0	0				0 (Ref)	0 (Ref)	NA
–4	0	4					1) ______	22)_____
–8	0	8					2) ______	23)_____
–12	10	2					3) ______	24)_____
–16	10	6					4) ______	25)_____
–20	20	0					5) ______	26)_____
–24	20	4					6) ______	27)_____
–28	20	8					7) ______	28)_____
–32	30	2					8) ______	29)_____
–36	30	6					9) ______	30)_____
–40	40	0					10)_____	31)_____
–44	40	4					11)_____	32)_____
–48	40	8					12)_____	33)_____
–52	50	2					13)_____	34)_____
–56	50	6					14)_____	35)_____
–60	60	0					15)_____	36)_____
–64	60	4					16)_____	37)_____
–68	60	8					17)_____	38)_____
–72	70	2					18)_____	39)_____
–76	70	6					19)_____	40)_____
–80	80	0					20)_____	41)_____
–84	80	4					21)_____	NA

Calculate Incremental Log Fidelity

1. Calculate the Incremental Log Fidelity Error (ILFE) for dB from REF LVL settings of –4 dB to –80 dB using the current and previous Cumulative Log Fidelity Errors (CLFEs):

$$\text{ILFE} = \text{CLFE(current)} - \text{CLFE(previous)}$$

   Example Calculation for ILFE at –20 dB from REFLVL setting:

$$\text{Previous CLFE}(-16\text{ dB from REF LVL}) = -0.07\text{ dB}$$

$$\text{Current CLFE}(-20\text{ dB from REF LVL}) = 0.02\text{ dB}$$

$$\text{ILFE}(-20\text{ dB}) = 0.02\text{ dB} - (-0.07\text{ dB}) = 0.09\text{ dB}$$

2. Record the result in the performance verification test record as indicated in column 9 of Table 2-12.

Section 2: Log Display Scale Fidelity, Digital Bandwidths

This section is for analyzers with Option 1DR (narrow resolution bandwidths) only.

Setup for Log Scale Measurement

1. Set the following parameters on the analyzer:

   SPAN, 150 Hz
   BW/Avg, 10 Hz
   BW/Avg, Video BW, 3 Hz

2. Press **Peak Search** (or **Search**) on the analyzer.
3. Adjust the amplitude of the synthesized signal generator until the analyzer marker amplitude reads 0 dBm ±0.1 dB.

   75 Ω Input only: Adjust the amplitude of the synthesized signal generator until the analyzer marker amplitude reads 48.75 dBmV ±0.1 dB.

4. Set the 1 dB and the 10 dB step attenuators to 0 dB.

NOTE Do not adjust the synthesized signal generator amplitude after the reference is established.

5. On the analyzer, press **Marker**, **Delta**.

Measure the Cumulative Log Fidelity

1. Perform step 2 to step 4 for each measurement value in Table 2-13.
2. Set the 1 dB and 10 dB step attenuators as indicated in Table 2-13 for the various dB from REF LVL settings.

   For settings of –84 dB and lower, press the following keys:

   BW/Avg, Average (On)
   5, Enter
3. Press **Peak Search** (or **Search**) on the analyzer and record the ΔMkr reading in column 7 of Table 2-13.
4. Calculate the Cumulative Log Fidelity Error (CLFE) as follows and record the result in the performance verification test record as indicated in column 8 of Table 2-13:

$$\text{CLFE} = \text{Total Actual Attenuation} + \text{Mkr}\nabla\text{Reading} - \text{Total Actual Atten}(0\text{ dB from Ref Level})$$

Table 2-13 Cumulative and Incremental Log Scale Fidelity Worksheet, Option 1DR Narrow Resolution Bandwidths Measured at 10 Hz

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
dB from REF LVL (dB)	10 dB Step Atten Nominal Attenu-ation (dB)	1 dB Step Atten Nominal Attenu-ation (dB)	10 dB Step Atten Actual Attenu-ation (dB)	1 dB Step Atten Actual Attenu-ation (dB)	Total Actual Attenu-ation (dB)	Mkr Δ Reading (dB)	TR Entry – CLFE (dB)	TR Entry – ILFE (dB)
0 (Ref)	0	0				0 (Ref)	0 (Ref)	NA
–4	0	4					43)_____	68)_____
–8	0	8					44)_____	69)_____
–12	10	2					45)_____	70)_____
–16	10	6					46)_____	71)_____
–20	20	0					47)_____	72)_____
–24	20	4					48)_____	73)_____
–28	20	8					49)_____	74)_____
–32	30	2					50)_____	75)_____
–36	30	6					51)_____	76)_____
–40	40	0					52)_____	77)_____
–44	40	4					53)_____	78)_____
–48	40	8					54)_____	79)_____

Table 2-13 Cumulative and Incremental Log Scale Fidelity Worksheet, Option 1DR Narrow Resolution Bandwidths Measured at 10 Hz

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
dB from REF LVL (dB)	**10 dB Step Atten Nominal Attenu-ation (dB)**	**1 dB Step Atten Nominal Attenu-ation (dB)**	**10 dB Step Atten Actual Attenu-ation (dB)**	**1 dB Step Atten Actual Attenu-ation (dB)**	**Total Actual Attenu-ation (dB)**	**Mkr Δ Reading (dB)**	**TR Entry – CLFE (dB)**	**TR Entry – ILFE (dB)**
–52	50	2					**55)_____**	**80)_____**
–56	50	6					**56)_____**	**81)_____**
–60	60	0					**57)_____**	**82)_____**
–64	60	4					**58)_____**	**83)_____**
–68	60	8					**59)_____**	**84)_____**
–72	70	2					**60)_____**	**85)_____**
–76	70	6					**61)_____**	**86)_____**
–80	80	0					**62)_____**	**87)_____**
–84	80	4					**63)_____**	**NA**
–88	80	8					**64)_____**	**NA**
–92	90	2					**65)_____**	**NA**
–96	90	4					**66)_____**	**NA**
–98	90	6					**67)_____**	**NA**

Calculate incremental log fidelity:

Calculate the Incremental Log Fidelity Error (ILFE) for dB from REF LVL settings of –4 dB to –80 dB using the current and previous Cumulative Log Fidelity Errors (CLFEs):

$$\text{ILFE} = \text{CLFE}(\text{current}) - \text{CLFE}(\text{previous})$$

Record the result in the performance verification test record as indicated in column 9 of Table 2-13.

Section 3: Linear Display Scale Fidelity, Analog Bandwidths

Setup for linear scale measurement:

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   System, Alignments, Auto Align, Off
   FREQUENCY, 50 MHz
   SPAN, 10 kHz
   BW/Avg, 3 kHz
   AMPLITUDE, Scale Type (Lin)
   Input/Output (or **Input**), Input Z Corr (50) (*75 Ω Input only*)

2. Preset the synthesized signal generator, by pressing **Blue Key, Special, 0, 0**. Press the following keys:

   FREQUENCY, 50 MHz
   AMPLITUDE, –3 dBm (*50 Ω Input only*)
   AMPLITUDE, 4 dBm (*75 Ω Input only*)

3. Set the 1 dB step attenuator to 0 dB.
4. Set the 10 dB step attenuator to 0 dB.
5. Press **Peak Search** (or **Search**) on the analyzer.
6. Adjust the synthesized signal generator amplitude until the analyzer marker amplitude reads 223.6 mV ±4 mV.

NOTE Do not adjust the amplitude of the synthesized signal generator after the reference is established.

Calculate ideal marker amplitude:

7. Considering Total Actual Attenuation at the 0 dB from REF LVL setting to be ATref, and the Total Actual Attenuation at any other dB from REF LVL setting to be ATmeas, calculate the Ideal Mkr Reading, in millivolts, as follows, and enter the result in column 7 of Table 2-14.

$$\text{Ideal Mkr Reading(mV)} = 1000\sqrt{0.05 \times 10^{(-\text{ATmeas} + \text{ATref})/10}}$$

   For example, if ATref = 0.012 dB and ATmeas = 7.982, the Ideal Mkr Reading for the –8 dB from Ref Level setting would be:

$$\text{Ideal Mkr Reading(mV)} = 1000\sqrt{0.05 \times 10^{(-7.982 + 0.012)/10}} = 89.3\ \text{mV}$$

Measure linear fidelity:

8. Perform step 9 to step 11 for each measurement value in Table 2-14.

9. Set the 1 dB and 10 dB step attenuators as indicated in column 2 and column 3 of Table 2-14 for the dB from REF LVL settings.

10. Press **Peak Search** (or **Search**) on the analyzer and record the Mkr Δ amplitude reading as the actual Mkr reading in column 8 of Table 2-14.

11. Calculate the Linear Fidelity Error (LFE) as a percentage of reference level (RL), and record the result in the performance verification test record as indicated in column 9 of Table 2-14.

$$\mathrm{LFE}(\%\ \mathrm{of\ RL}) = 100 \times \frac{\mathrm{Actual\ Mkr\ Reading} - \mathrm{Ideal\ Mkr\ Reading}}{223.6\ \mathrm{mV}}$$

Example calculation for LFE(% of RL):

$$\mathrm{Actual\ Mkr\ Reading} = 85.0\ \mathrm{mV}$$

$$\mathrm{Ideal\ Mkr\ Reading} = 89.3\ \mathrm{mV}$$

$$\mathrm{LFE}(\%\mathrm{of\ RL}) = 100 \times \frac{85.0 - 89.3}{223.6}$$

$$\mathrm{LFE}(\%\mathrm{of\ RL}) = 1.92\%\ \mathrm{of\ RL}$$

Table 2-14 Linear Scale Fidelity Worksheet, Analog Resolution Bandwidths Measured at 3 kHz

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
dB from REF LVL (dB)	**10 dB Step Atten Nominal Attenu-ation (dB)**	**1 dB Step Atten Nominal Attenu-ation (dB)**	**10 dB Step Atten Actual Attenu-ation (dB)**	**1 dB Step Atten Actual Attenu-ation (dB)**	**Total Actual Attenu-ation (dB)**	**Ideal Mkr Reading (mV)**	**Actual Mkr Reading (mV)**	**TR Entry – LFE (% of RL)**
0 (Ref)	0	0				0 (Ref)	0 (Ref)	0 (Ref)
–4	0	4						**89)**_____
–8	0	8						**90)**_____
–12	10	2						**91)**_____
–16	10	6						**92)**_____
–20	20	0						**93)**_____

Section 4: Linear Display Scale Fidelity, Digital Bandwidths

This section is for analyzers with Option 1DR (narrow resolution bandwidths) only.

Setup for linear scale measurement:

1. Set the following parameters on the analyzer:

   SPAN, 100, Hz
   BW/Avg, 10 Hz
   Video BW, 1 Hz

2. Press **Peak Search** (or **Search**) on the analyzer.
3. Set the 1 dB and 10 dB step attenuators to 0 dB.
4. Adjust the synthesized signal generator amplitude until the analyzer marker amplitude reads 223.6 mV ±4mV.

NOTE Do not adjust the synthesized signal generator amplitude after the reference is established.

Calculate ideal marker amplitude:

5. Considering Total Actual Attenuation at the 0 dB from REF LVL setting to be ATref and the Total Actual Attenuation at any other dB from REF LVL setting to be ATmeas, calculate the Ideal Mkr Reading, in millivolts, as follows and enter the result in column 7 of Table 2-15.

$$\text{Ideal Mkr Reading(mV)} = 1000\sqrt{0.05 \times 10^{(-\text{ATmeas} + \text{ATref})/10}}$$

Measure linear fidelity:

6. Perform step 7 to step 9 for each measurement value in Table 2-15.
7. Set the 1 dB and 10 dB step attenuators as indicated in Table 2-15 for the dB from REF LVL settings.
8. Press **Peak Search** (or **Search**) on the analyzer and record the Mkr Δ amplitude reading as the actual Mkr reading in column 8 of Table 2-15.
9. Calculate the Linear Fidelity Error (LFE) as a percentage of reference level (RL), and record the result in the performance verification test record as indicated in column 9 of Table 2-15.

$$\text{LFE(\%of RL)} = 100 \times \frac{\text{Actual Mkr Reading} - \text{Ideal Mkr Reading}}{223.6\text{ mV}}$$

Table 2-15 Linear Scale Fidelity Worksheet, Option 1DR Narrow Resolution Bandwidths Measured at 10 Hz

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
dB from REF LVL (dB)	10 dB Step Atten Nominal Attenu-ation (dB)	1 dB Step Atten Nominal Attenu-ation (dB)	10 dB Step Atten Actual Attenu-ation (dB)	1 dB Step Atten Actual Attenu-ation (dB)	Total Actual Attenu-ation (dB)	Ideal Mkr Reading (mV)	Actual Mkr Reading (mV)	TR Entry – LFE (% of RL)
0 (Ref)	0	0				0 (Ref)	0 (Ref)	0 (Ref)
–4	0	4						94)_____
–8	0	8						95)_____
–12	10	2						96)_____
–16	10	6						97)_____
–20	20	0						98)_____

10. If the analyzer has a 75Ω Input press:

Input/Output (or **Input**)
Input Z Corr (75)

Zero Span Log Fidelity, Digital Bandwidths

This section is for analyzers with Option 1DR (narrow resolution bandwidths) only.

Setup for zero span measurements

11. Set the 1 dB step attenuator to 11 dB and the 10 dB step attenuator to 110 dB.
12. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

    System, Alignments
    Align Now, All *(wait for the alignment sequence to complete)*

13. Set the 1 dB and 10 dB step attenuators to 0 dB.
14. Set the following parameters on the analyzer:

    FREQUENCY, 50 MHz
    SPAN, 100 Hz
    BW/Avg, 10 Hz

15. Press **Peak Search** (or **Search**), Marker –>, and Marker –> CF on the analyzer.
16. Press **SPAN, Zero Span** on the analyzer

17. Adjust the synthesized signal generator amplitude until the analyzer marker amplitude reads 0 dBm ± 0.1 dB.

    75 Ω Input: Adjust the synthesized signal generator amplitude until the analyzer marker amplitude reads 48.75 dBmV ± 0.1 dB.

NOTE Do not adjust the synthesized signal generator amplitude after the reference is established.

18. On the analyzer press **Marker, Delta**.

Measure the Cumulative Log Fidelity

19. On the analyzer, press **Single, BW/Avg, Average, 5, Enter**.
20. Perform step 22 to step 25 for each measurement value in Table 2-16.
21. Set the 1 dB and 10 dB step attenuators as indicated in column 2 and column 3 of Table 2-16 for the various dB from REF LVL settings.
22. Press **Single** and wait for “VAvg 5” to be displayed to the right of the graticule area.
23. Record the DMkr1 amplitude reading in column 7 of Table 2-16.
24. Calculate the Cumulative Log Fidelity Error (CLFE) as follows, and record the result in the performance verification test record as indicated in column 8 of Table 2-16.

    CLFE = Total Actual Attenuation + DMkr Reading – Total Actual Atten (0 dB from Ref Level)

Table 2-16 Zero Span Cumulative Log Fidelity Worksheet, Opt 1DR Narrow Resolution Bandwidths, (measured at 10 Hz)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
dB from REF LVL (dB)	10 dB Step Atten Nominal Attenu-ation (dB)	1 dB Step Atten Nominal Attenu-ation (dB)	10 dB Step Atten Actual Attenu-ation (dB)	1 dB Step Atten Actual Attenu-ation (dB)	Total Actual Attenu-ation (dB)	ΔMkr Reading (dB)	TR Entry-CLFE (dB)
0 (Ref)	0	0				0 (Ref)	0 (Ref)
–4	0	4					**97)____**
–8	0	8					**98)____**
–12	10	2					**99)____**
–16	10	6					**100)____**
–20	20	0					**101)____**
–24	20	4					**102)____**
–28	20	8					**103)____**
–32	30	2					**104)____**
–36	30	6					**105)____**
–40	40	0					**106)____**
–44	40	4					**107)____**
–48	40	8					**108)____**
–52	50	2					**109)____**
–56	50	6					**110)____**
–60	60	0					**111)____**
–64	60	4					**112)____**
–68	60	8					**113)____**
–70	70	0					**114)____**

Post Test Instrument Restoration

25.On the analyzer, press the following keys:

Preset
System, Alignments, Auto Align, All

12. Input Attenuation Switching Uncertainty

A 50 MHz CW signal is applied to the input of the analyzer through two calibrated step attenuators. The attenuators are the amplitude reference standard. The source is adjusted for a response at the reference level. The internal attenuators are then varied between settings and the external attenuators are changed accordingly to maintain the same input level at the mixer. The analyzer marker functions are used to measure the amplitude differences. The actual attenuation values of the step attenuators are used to correct the marker amplitude readings yielding the input attenuation switching error.

The related adjustment for this performance test is “Frequency Response.”

Equipment Required

Synthesized signal generator
1 dB step attenuator
10 dB step attenuator
Attenuator switch driver (if programmable step attenuators are used)
10 dB fixed attenuator
Cable, Type-N 152-cm (60-in)
Cable, BNC 122-cm (48-in) (*2 required*)
Attenuator interconnect kit
Adapter, Type-N (m) to BNC (f) (*2 required*)

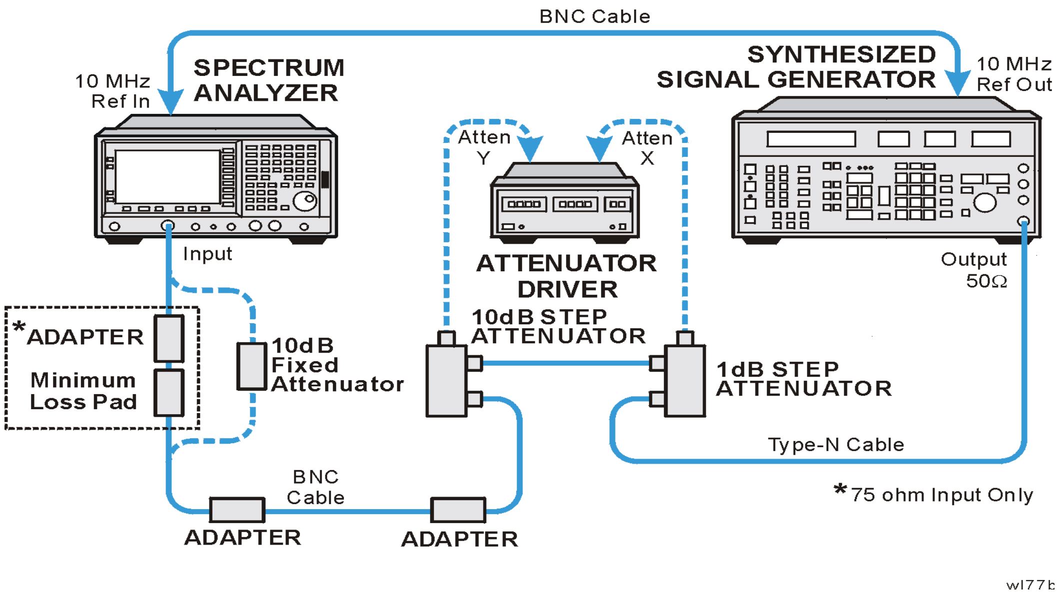
Additional Equipment for 75 Ω Input

50 Ω to 75 Ω minimum loss pad
Adapter, Type-N (f), to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f), to APC 3.5 (f)

Figure 2-12 Input Attenuator Switching Uncertainty Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or the connectors will be damaged.

Procedure

Calculate Actual Attenuation Values

1. From the calibration data supplied with the 1 dB step attenuator, enter into column 2 of Table 2-17 the actual attenuation for the corresponding nominal attenuation settings. If the calibration data does not indicate an actual attenuation value for the 0 dB setting, enter 0 dB.

NOTE The HP/Agilent 8494G programmable attenuator has four attenuator sections consisting of 1 dB, 2 dB, 4 dB, and 4 dB attenuators. If using the HP/Agilent 8494G programmable attenuator, enter the calibration data for the section three 4 dB step rather than the section four 4 dB step.

2. From the calibration data supplied with the 10 dB step attenuator, enter into column 4 of Table 2-17 the actual attenuation for the corresponding nominal attenuation settings. If the calibration data does not indicate an actual attenuation value for the 0 dB setting, enter 0 dB.

NOTE The HP/Agilent 8496G programmable attenuator has four attenuator sections consisting of 10 dB, 20 dB, 40 dB, and 40 dB attenuators. If using the HP/Agilent 8496G programmable attenuator, enter the calibration data for the section three 40 dB step rather than the section four 40 dB step.

3. For each Total Nominal Attenuation setting indicated in Table 2-17, calculate the Total Actual Attenuation from the actual attenuation columns for the 1 dB and the 10 dB step attenuators and enter the result in Table 2-17.

$$\text{Total Actual Attenuation} = \text{1 dB Step Attenuator Actual Attenuation} + \text{10 dB Step Attenuator Actual Attenuation}$$

Example for 35 dB total nominal attenuation setting:

$$\text{1dB Step Attenuator Actual Attenuation (5 dB)} = 5.021\text{ dB}$$

$$\text{10 dB Step Attenuator Actual Attenuation (30 dB)} = 29.981\text{ dB}$$

$$\text{Total Actual Attenuation} = 5.998\text{ dB} + 30.012\text{ dB} = 35.002\text{ dB}$$

Table 2-17 Actual Attenuation Worksheet

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
1 dB step Attenuator Nominal Attenuation (dB)	**1 dB step Attenuator Actual Attenuation (dB)**	**10 dB step Attenuator Nominal Attenuation (dB)**	**10 dB step Attenuator Actual Attenuation (dB)**	**Total Nominal Atten-uation (dB)**	**Total Actual Atten-uation (dB)**
0		0		0	
5		0		5	
0		10		10	
5		10		15	
0		20		20	
5		20		25	
0		30		30	
5		30		35	
0		40		40	
5		40		45	
0		50		50	
5		50		55	
0		60		60	
5		60		65	

4. For each attenuation error value in column 4 of Table 2-18, calculate the attenuation errors by subtracting the difference between the Table 2-17 Total Actual Attenuation and Total Nominal Attenuation from the difference between the Total Actual Attenuation and Total Nominal Attenuation at 55 dB. Note that the total nominal attenuations listed in Table 2-18 are in a different order than those listed in Table 2-17.

AttenErr = (ActAtten(55 dB) - 55 dB) - (ActAtten(X dB) - NomAtten(X dB))

Where:

AttenErr = Attenuator Error between the X dB and 55 dB settings

ActAtten(55 dB) = Actual Attenuation of the 55 dB setting

ActAtten(X dB) = Actual Attenuation of the X dB setting

NomAtten(X dB) = Nominal Attenuation of the X dB setting

Example of attenuation error calculation for 35 dB nominal attenuation:

ActAtten (55 dB) = 55.15 dB
ActAtten (35 dB) = 35.002 dB
NomAtten (35 dB) = 35 dB

AttenErr = (55.15 – 55) – (35.002 – 35)
AttenErr = 0.15 – 0.002
AttenErr = 0.148 dB

Setup for Switching Uncertainty Measurement

5. Connect the equipment as indicated in Figure 2-12. The 10 dB fixed attenuator (or minimum loss pad for 75 Ω input analyzers) should be connected directly to the input connector of the analyzer.

6. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off**. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   SPAN, **100 kHz**
   AMPLITUDE, –55 dBm (*50 Ω Input only*)
   AMPLITUDE, –6.2 dBmV (*75 Ω Input only*)
   AMPLITUDE, Attenuation, 10 dB
   AMPLITUDE, Scale/Div, 2 dB
   BW/Avg, **30 kHz**
   BW/Avg, **Video BW**, **100 Hz**

7. Preset the synthesized signal generator (**Blue Key, Special, 0, 0**) and set the controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **10 dBm** (*50 Ω Input only*)
   AMPLITUDE, **6 dBm** (*75 Ω Input only*)

8. Set the 1 dB step attenuator to 5 dB attenuation. Set the 10 dB step attenuator to 50 dB. Refer to the HP/Agilent 11713A attenuator switch driver manual for information on manually controlling a programmable step attenuator.

9. Press **Peak Search** (or **Search**) on the analyzer.

10. Adjust the amplitude of the synthesized signal generator until the marker amplitude of the analyzer reads –57 dBm ± 0.1 dB.

    75 Ω *Input only: Adjust the amplitude of the synthesized signal generator until the marker of the analyzer reads –8.2 dBmV ± 0.1 dB.*

NOTE Do not adjust the amplitude of the synthesized signal generator after the reference is established.

11. On the analyzer, press **Peak Search** (or **Search**), **Marker**, **Delta**.

Table 2-18 Input Attenuation Switching Uncertainty Worksheet

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Analyzer Internal Attenu-ation Setting	**Analyzer Reference Level Setting 50 Ω Input/ 75 Ω Input**	**Total Nominal Attenu-ation Setting**	**Attenu-ation Error (dB)**	**Ideal Marker Delta Reading**	**Marker Delta Reading (dB)**	**TR Entry – Switching Error (dB)**
10 dB	–55 dBm / –6.2 dBmV	55 dB	0	0 dB	0	Ref
0 dB	–65 dBm / –16.2 dBmV	65 dB		–10 dB		**1)**
5 dB	–60 dBm / –11.2 dBmV	60 dB		–5 dB		**2)**
15 dB	–50 dBm / –1.2 dBmV	50 dB		5 dB		**3)**
20 dB	–45 dBm / 3.8 dBmV	45 dB		10 dB		**4)**
25 dB	–40 dBm / 8.8 dBmV	40 dB		15 dB		**5)**
30 dB	–35 dBm / 13.8 dBmV	35 dB		20 dB		**6)**
35 dB	–30 dBm / 18.8 dBmV	30 dB		25 dB		**7)**
40 dB	–25 dBm / 23.8 dBmV	25 dB		30 dB		**8)**
45 dB	–20 dBm / 28.8 dBmV	20 dB		35 dB		**9)**
50 dB	–15 dBm / 33.8 dBmV	15 dB		40 dB		**10)**
55 dB	–10 dBm / 38.8 dBmV	10 dB		45 dB		**11)**
60 dB	–5 dBm / 43.8 dBmV	5 dB		50 dB		**12)**
65 dB[a]	0 dBm / 48.8 dBmV	0 dB		55 dB		**13)**

a. Does not apply to E4401B or E4411B.

Measure Switching Uncertainty

Perform step 12 to step 15 for each measurement value in Table 2-18.

12. Set the 1 dB and 10 dB step attenuators to the Total Nominal Attenuation setting value as indicated in column 3 of Table 2-18 for the various analyzer attenuation settings for each measurement. Table 2-17 may be used as a reference for setting the step attenuators to achieve the desired total nominal attenuation.

13. Similarly, set the corresponding analyzer attenuation and reference level settings as indicated in column 1 and column 2 of Table 2-18.

14. Press **Single**, then **Peak Search** (or **Search**) and record the marker amplitude reading as the Marker Delta Reading in column 6 of Table 2-18.

15. Calculate the Switching Error (Table 2-18, column 7) by subtracting the Ideal Marker Delta Reading and the Attenuation Error from the Marker Delta Reading. Record the result in the performance verification test record.

$$\text{Switching Error} = \text{Marker Delta Reading} - \text{Ideal Marker Delta Reading} - \text{Attenuattion Error}$$

Example for 25 dB analyzer internal attenuation setting:

$$\text{Marker Delta Reading} = 14.790\text{ dB}$$

$$\text{Ideal Marker Delta Reading} = 15\text{ dB}$$

$$\text{Attenuation Error} = -0.148\text{ dB}$$

$$\text{Switching Error} = 14.790 - 15 - (-0.148) = -0.062\text{ dB}$$

Post-test Instrument Restoration

16. On the analyzer, press **Preset, System, Alignments, Auto Align, All**.

13. Reference Level Accuracy: Agilent E4401B and Agilent E4411B

A 50 MHz CW signal is applied to the 50 Ω input of the analyzer through two step attenuators. The amplitude of the source is decreased in 10 dB steps and the analyzer marker functions are used to measure the amplitude difference between steps. The external attenuator is used as the reference standard. The test is performed in both log and linear amplitude scales.

It is only necessary to test reference levels as low as –90 dBm (with 10 dB internal attenuation) since lower reference levels are a function of the analyzer microprocessor manipulating the trace data. There is no error associated with the trace data manipulation.

The related adjustment for this performance test is “IF Amplitude.”

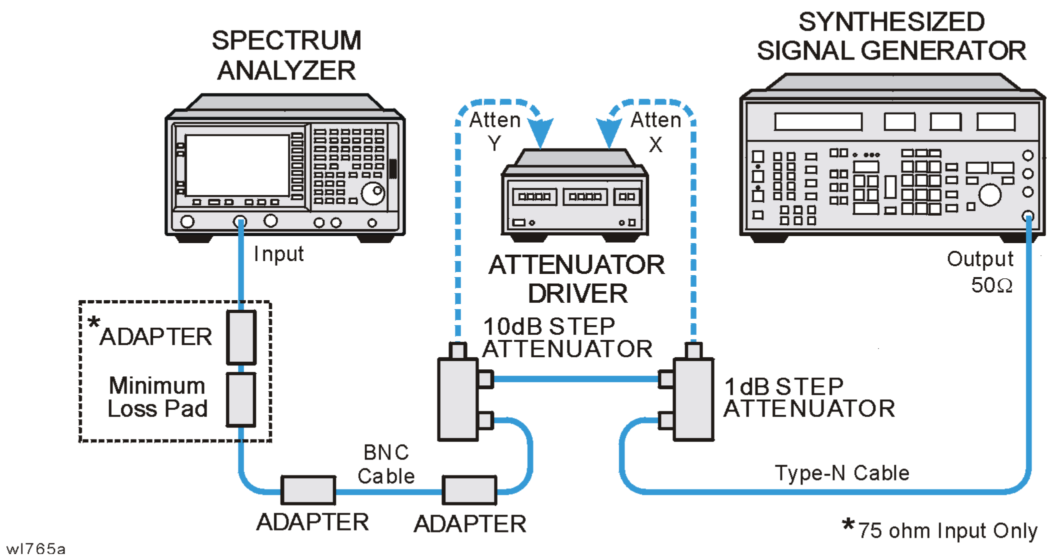
Equipment Required

Synthesized signal generator
1 dB step attenuator
10 dB step attenuator
Attenuator switch driver (if programmable step attenuators are used)
Cable, Type-N 152-cm (60-in)
Cable, BNC 122-cm (48-in) (*2 required*)
Attenuator interconnect kit
Adapter, Type-N (m) to BNC (f) (*2 required*)

Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Figure 2-13 Reference Level Accuracy Test Setup



Procedure

Calculate the Actual Attenuation Errors

1. From the calibration data supplied with the 10 dB step attenuator, enter into column 2 of Table 2-19 and Table 2-20 the actual attenuation for the corresponding nominal attenuation settings. If no calibration data is supplied for 0 dB, enter zero.

NOTE The HP/Agilent 8496G programmable attenuator has four attenuator sections consisting of 10 dB, 20 dB, 40 dB and 40 dB attenuators. If using the HP/Agilent 8496G programmable attenuator, enter the calibration data for the section three 40 dB step rather than the section four 40 dB step.

2. Calculate the reference attenuation error by subtracting 20 dB from the actual attenuation for the 20 dB setting, and enter below.

$$\text{Reference Attenuator Error} = \text{Actual Attenuation}(20\text{ dB}) - 20\text{ dB}$$

Reference Attenuator Error ____________ dB

3. To calculate the Attenuation Error at other nominal attenuator settings, subtract the Attenuation Error at the other settings from the Reference Attenuator Error and enter the result in column 3 of Table 2-19 and Table 2-20.

$$\text{Attenuator Error (X dB)} = (\text{Actual Attenuation}(\text{X dB}) - \text{Nominal Attenuation (X dB)}) - \text{Reference Attenuation Error}$$

Example for 50 dB attenuator setting:

$$\text{Actual Attenuation (50 dB)} = 50.08\ \text{dB}$$

$$\text{Actual Attenuation (20 dB)} = 19.85\ \text{dB}$$

$$\text{Reference Attenuation Error} = 19.85\ \text{dB} - 20\ \text{dB} = -0.15\ \text{dB}$$

$$\text{Attenuation Error (50 dB)} = (50.08\ \text{dB} - 50\text{dB}) - (-0.15)\ \text{dB}$$

$$= 0.23\ \text{dB}$$

Log Scale, Analog Bandwidths

1. Set the synthesized signal generator controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **2 dBm**

2. Connect the equipment as shown in Figure 2-13. Set the 10 dB step attenuator to 20 dB attenuation and the 1 dB step attenuator to 5 dB attenuation.

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off**. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   AMPLITUDE, **–25 dBm** (*50 Ω Input only*)
   AMPLITUDE, **26.75 dBmV** (*75 Ω Input only*)
   Attenuation, **10 dB** (Man)
   Scale/Div, **1 dB**
   SPAN, **50 kHz**
   BW/Avg, 3 kHz
   Video BW, 30 Hz

4. Set the 1 dB step attenuator to place the signal peak 1 to 3 dB (1 to 3 divisions) below the reference level.

5. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

6. Set the 10 dB step attenuator and analyzer reference level according to column 1 and column 4 of Table 2-19. At each setting, do the following:

   a. Press **Single** on the analyzer.

   b. Press **Peak Search** (or **Search**).

c. Record the marker delta amplitude reading in column 5 of Table 2-19.

d. Add the actual attenuation error to the analyzer marker delta amplitude and enter the result as the TR entry in the performance test record.

The following is an example for –35 dBm reference level:

$$\text{Analyzer marker } \Delta \text{ amplitude} = +0.17\text{ dB}$$

$$\text{Attenuation Error }(30\text{ dB}) = (-0.07)\text{ dB}$$

$$\text{Test Record Entry} = 0.17\text{ dB} + (-0.07)\text{ dB} = 0.10\text{ dB}$$

Table 2-19 Log Scale, Analog Bandwidths

Column 1	Column 2	Column 3	Column 4		Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	**10 dB Attenuator Actual Attenuation (dB)**	**Attenuation Error (dB)**	**Analyzer Reference Level[a]**		**Analyzer Marker Delta Amplitude (dB)**	**TR Entry**
			(dBm)	**(dBmV)**		
20		0 (Ref)	–25	23.75	0 (Ref)	(Ref)
10			–15	33.75		**1)**
0			–5	43.75		**2)**
30			–35	13.75		**3)**
40			–45	3.75		**4)**
50			–55	–6.25		**5)**
60			–65	–16.25		**6)**
70			–75	–26.25		**7)**

a. Use the dBm column values for analyzers with a 50 Ω input and the dBmV column for analyzers with a 75 Ω input.

Log Scale, Digital Bandwidths, Option 1DR

NOTE If the analyzer is not equipped with Option 1DR (narrow resolution bandwidths), skip to the next section (Linear Scale, Analog Bandwidths).

1. On the analyzer, press the following keys:

   SPAN, 150 Hz
   BW/Avg, 10 Hz
   Video BW, 1 Hz

2. Set the 1 dB step attenuator to place the signal peak 1 to 3 dB (1 to 3 divisions) below the reference level.
3. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

4. Set the 10 dB step attenuator and analyzer reference level according to column 1 and column 4 of Table 2-20. At each setting, do the following:
   a. Press **Single** on the analyzer.
   b. Press **Peak Search** (or **Search**).
   c. Record the Marker Delta Amplitude reading in column 5 of Table 2-20.
   d. Add the Actual Attenuation Error to the Analyzer Marker Delta Amplitude and enter the result as the TR Entry in the performance test record.

Table 2-20 Log Mode, Digital Bandwidths Worksheet, Option 1DR

Column 1	Column 2	Column 3	Column 4		Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	10 dB Attenuator Actual Attenuation (dB)	Attenuation Error (dB)	Analyzer Reference Level[a] (dBm)	(dBmV)	Analyzer Marker Delta Amplitude (dB)	TR Entry
20		0 (Ref)	–25	23.75	0 (Ref)	(Ref)
10			–15	33.75		**8)**
0			–5	43.75		**9)**
30			–35	13.75		**10)**
40			–45	3.75		**11)**
50			–55	–6.25		**12)**
60			–65	–16.25		**13)**
70			–75	–26.25		**14)**

a. Use the dBm column values for analyzers with a 50 Ω input and the dBmV column for analyzers with a 75 Ω input.

Linear Scale, Analog Bandwidths

1. Set the 10 dB step attenuator to 20 dB attenuation.
2. Set the 1 dB step attenuator to 5 dB attenuation.
3. Set the analyzer by pressing the following keys:

   AMPLITUDE, **–25 dBm** (*50 Ω input only*)
   AMPLITUDE, **26.76 dBmV** (*75 Ω input only*)
   AMPLITUDE, Scale Type (Lin)
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm** (*50 Ω input only*)
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBmV** (*75 Ω input only*)
   SPAN, **50 kHz**
   BW/Avg, 3 kHz
   Video BW, 30 Hz
   Sweep, Sweep Cont
   Marker, Off

4. Set the 1 dB step attenuator to place the signal peak one to three divisions below the reference level.

5. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

6. Set the 10 dB step attenuator and analyzer reference level according to column 1 and column 4 of Table 2-21. At each setting, do the following:

   a. Press **Single** on the analyzer.

   b. Press **Peak Search** (or **Search**).

   c. Record the marker delta amplitude reading in column 5 of Table 2-21.

   d. Add the Attenuation Error to the Analyzer Marker Delta Amplitude and enter the result in the performance test record.

Table 2-21 Linear Mode, Analog Bandwidths Worksheet

Column 1	Column 2	Column 3	Column 4		Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	10 dB Attenuator Actual Attenuation (dB)	Attenuation Error (dB)	Analyzer Reference Level[a] (dBm)	(dBmV)	Analyzer Marker Delta Amplitude (dB)	TR Entry
20		0 (Ref)	–25	23.75	0 (Ref)	(Ref)
10			–15	33.75		**15)**
0			–5	43.75		**16)**
30			–35	13.75		**17)**
40			–45	3.75		**18)**
50			–55	–6.25		**19)**
60			–65	–16.25		**20)**
70			–75	–26.25		**21)**

a. Use the dBm column values for analyzers with a 50 Ω input and the dBmV column for analyzers with a 75 Ω input.

Linear Scale, Digital Bandwidths, Option 1DR

NOTE If the analyzer is not equipped with Option 1DR (narrow resolution bandwidths), skip to the next section (Post-Test Instrument Restoration).

1. On the analyzer, press the following keys:

   SPAN, 150 Hz
   BW/Avg, 10 Hz
   Video BW, 1 Hz

2. Set the 1 dB step attenuator to place the signal peak 1 to 3 divisions below the reference level.

3. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

4. Set the 10 dB step attenuator and analyzer reference level according to Table 2-22. At each setting, do the following:

   a. Press **Single** on the analyzer.

   b. Press **Peak Search** (or **Search**).

   c. Record the marker delta amplitude reading in column 5 of Table 2-22.

   d. Add the actual attenuation error to the Analyzer Marker Delta Amplitude and enter the result as the TR Entry in the performance test record.

Table 2-22 Linear Mode, Digital Bandwidths, Option 1DR

Column 1	Column 2	Column 3	Column 4		Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	10 dB Attenuator Actual Attenuation (dB)	Attenuation Error (dB)	Analyzer Reference Level[a] (dBm)	(dBmV)	Analyzer Marker Delta Amplitude (dB)	TR Entry
20		0 (Ref)	–25	23.75	0 (Ref)	(Ref)
10			–15	33.75		**22)**
0			–5	43.75		**23)**
30			–35	13.75		**24)**
40			–45	3.75		**25)**
50			–55	–6.25		**26)**

Table 2-22 Linear Mode, Digital Bandwidths, Option 1DR

Column 1	Column 2	Column 3	Column 4		Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	10 dB Attenuator Actual Attenuation (dB)	Attenuation Error (dB)	Analyzer Reference Level[a] (dBm)	(dBmV)	Analyzer Marker Delta Amplitude (dB)	TR Entry
60			–65	–16.25		**27)**
70			–75	–26.25		**28)**

a. Use the dBm column values for analyzers with a 50 Ω input and the dBmV column for analyzers with a 75 Ω input.

Post-test Instrument Restoration

To restore the default settings on the analyzer, press **Preset, System, Alignments, Auto Align, All**.

14. Reference Level Accuracy: Agilent E4402B, E4403B, E4404B, E4407B, and E4408B.

A 50 MHz CW signal is applied to the 50 Ω Input of the analyzer through two step attenuators. The amplitude of the source is decreased in 10 dB steps and the analyzer marker functions are used to measure the amplitude difference between steps. The external attenuator is used as the reference standard. The test is performed in both log and linear amplitude scales.

It is only necessary to test reference levels as low as –90 dBm (with 10 dB internal attenuation) since lower reference levels are a function of the analyzer microprocessor manipulating the trace data. There is no error associated with the trace data manipulation.

The related adjustment for this performance test is “IF Amplitude.”

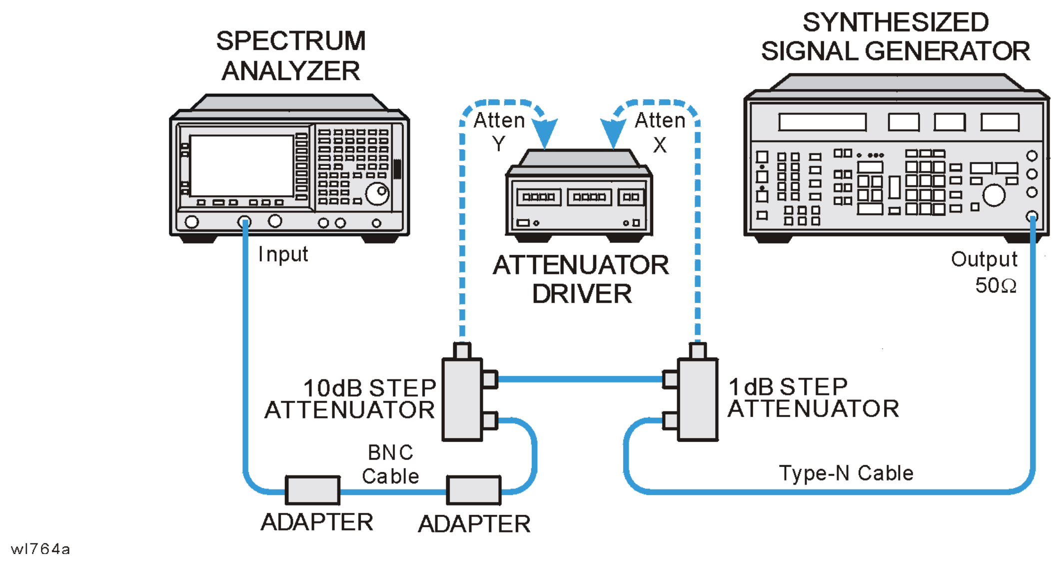
Equipment Required

Synthesized signal generator
1 dB step attenuator
10 dB step attenuator
Attenuator switch driver (if programmable step attenuators are used)
Cable, Type-N 152-cm (60-in)
Cable, BNC 122-cm (48-in) (*2 required*)
Attenuator interconnect kit
Adapter, Type-N (m) to BNC (f) (*2 required*)

Additional Equipment for Option BAB

Adapter, Type-N (f) to APC 3.5 (f)

Figure 2-14 Reference Level Accuracy Test Setup



Procedure

Calculate the Actual Attenuation Errors

1. From the calibration data supplied with the 10 dB step attenuator, enter into column 2 of Table 2-23 and Table 2-24 the actual attenuation for the corresponding nominal attenuation settings. If no calibration data is supplied for 0 dB, enter zero.

NOTE The HP/Agilent 8496G programmable attenuator has four attenuator sections consisting of 10 dB, 20 dB, 40 dB and 40 dB attenuators. If using the HP/Agilent 8496G programmable attenuator, enter the calibration data for the section three 40 dB step rather than the section four 40 dB step.

2. Calculate the reference attenuation error by subtracting 20 dB from the actual attenuation for the 20 dB setting, and enter below.

$$\text{Reference Attenuator Error} = \text{Actual Attenuation}(20\text{ dB}) - 20\text{ dB}$$

Reference Attenuator Error ___________ dB

3. To calculate the attenuation error at other nominal attenuator settings, subtract the attenuation error at the other settings from the reference attenuator error and enter the result in column 3 of Table 2-23 and Table 2-24.

$$\text{Atten Error (X dB)} = (\text{Actual Attenuation}(X\text{ dB}) - \text{Nominal Attenuation }(X\text{ dB})) - \text{Reference Attenuation Error}$$

Example for 50 dB attenuator setting:

$$\text{Actual Attenuation (50 dB)} = 50.08\text{ dB}$$

$$\text{Actual Attenuation (20 dB)} = 19.85\text{ dB}$$

$$\text{Reference Attenuation Error} = 19.85\text{ dB} - 20\text{ dB} = -0.15\text{ dB}$$

$$\text{Attenuation Error (50 dB)} = (50.08\text{ dB} - 50\text{dB}) - (-0.15)\text{ dB}$$

$$= 0.23\text{ dB}$$

Log Scale, Analog Bandwidths

1. Set the synthesized signal generator controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **2 dBm**

2. Connect the equipment as shown in Figure 2-14. Set the 10 dB step attenuator to 20 dB attenuation and the 1 dB step attenuator to 5 dB attenuation.

3. Press **Preset** on the analyzer. Press the Factory Preset softkey, if it is displayed. Press **System, Alignments, Auto Align, Off**. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   AMPLITUDE, **–20 dBm**
   Attenuation, **10 dB**
   Scale/Div, **1 dB**
   SPAN, **50 kHz**
   BW/Avg, 3 kHz
   Video BW, 30 Hz

4. Set the 1 dB step attenuator to place the signal peak 1 to 3 divisions below the reference level.

5. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

6. Set the 10 dB step attenuator and analyzer reference level according to Table 2-23. At each setting, do the following:

   a. Press **Single** on the analyzer.

   b. Press **Peak Search** (or **Search**).

   c. Record the marker delta amplitude reading in column 5 of Table 2-23.

d. Add the actual attenuation error to the analyzer marker delta amplitude and enter the result as the TR Entry in the performance test record.

Example, for –35 dBm reference level:

$$\text{Analyzer marker } \Delta \text{ amplitude} = 0.17 \text{ dB}$$

$$\text{Attenuation Error } (30 \text{ dB}) = (-0.07) \text{ dB}$$

$$\text{Test Record Entry} = 0.17 \text{ dB} + (-0.07) \text{ dB} = 0.10 \text{ dB}$$

Table 2-23 Log Mode, Analog Bandwidths Worksheet

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	**10 dB Attenuator Actual Attenuation (dB)**	**Attenuation Error (dB)**	**Analyzer Reference Level (dBm)**	**Analyzer Marker Delta Amplitude (dB)**	**TR Entry**
20		0 (Ref)	–20	0 (Ref)	(Ref)
10			–10		**1)**
0			0		**2)**
30			–30		**3)**
40			–40		**4)**
50			–50		**5)**
60			–60		**6)**
70			–70		**7)**
80			–80		**8)**

Log Scale, Digital Bandwidths, Option 1DR

NOTE If the analyzer is not equipped with Option 1DR (narrow resolution bandwidths), skip to the next section (Linear Scale, Analog Bandwidths).

7. On the analyzer, press the following keys:

   SPAN, 150 Hz
   BW/Avg, 10 Hz
   Video BW, 1 Hz

8. Set the 1 dB step attenuator to set the signal peak 1 to 3 divisions below the reference level.

9. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

10. Set the 10 dB step attenuator and analyzer reference level according to Table 2-24. At each setting, do the following:

    a. Press **Single** on the analyzer.

    b. Press **Peak Search** (or **Search**).

    c. Record the marker delta amplitude reading in column 5 of Table 2-24.

    d. Add the actual attenuation error to the analyzer marker delta amplitude and enter the result as the TR Entry in the performance test record.

Table 2-24 Log Mode, Digital Bandwidths Worksheet, Option 1DR

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	**10 dB Attenuator Actual Attenuation, (dB)**	**Attenuation Error (dB)**	**Analyzer Reference Level (dBm)**	**Analyzer Marker Delta Amplitude (dB)**	**TR Entry**
20		0 (Ref)	−20	0 (Ref)	(Ref)
10			−10		**9)**
0			0		**10)**
30			−30		**11)**
40			−40		**12)**
50			−50		**13)**
60			−60		**14)**
70			−70		**15)**
80			−80		**16)**

Linear Scale, Analog Bandwidths

1. Set the 10 dB step attenuator to 20 dB attenuation.
2. Set the 1 dB step attenuator to 5 dB attenuation.
3. Set the analyzer by pressing the following keys:

   AMPLITUDE, **–20 dBm**
   AMPLITUDE, Scale Type (Lin)
   AMPLITUDE, **More 1 of 2**, **Y Axis Units** (or **Amptd Units**), **dBm**
   SPAN, **50 kHz**
   BW/Avg, 3 kHz
   Video BW, 30 Hz
   Sweep, Sweep Cont
   Marker, Off

4. Set the 1 dB step attenuator to place the signal peak 1 to 3 divisions below the reference level.
5. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

6. Set the 10 dB step attenuator and analyzer reference level according to Table 2-25, column 1 and column 4. At each setting, do the following:
   a. Press **Single** on the analyzer.
   b. Press **Peak Search** (or **Search**).
   c. Record the marker delta amplitude reading in column 5 of Table 2-25.
   d. Add the attenuation error to the Analyzer Marker Delta Amplitude and enter the result as the TR Entry in the performance test record.

Table 2-25 Linear Mode, Analog Bandwidths Worksheet

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	**10 dB Attenuator Actual Attenuation (dB)**	**Attenuation Error (dB)**	**Analyzer Reference Level (dBm)**	**Analyzer Marker Delta Amplitude (dB)**	**TR Entry**
20		0 (Ref)	–20	0 (Ref)	(Ref)
10			–10		**17)**
0			0		**18)**
30			–30		**19)**
40			–40		**20)**
50			–50		**21)**
60			–60		**22)**
70			–70		**23)**
80			–80		**24)**

Linear Scale, Digital Bandwidths, Option 1DR

NOTE If the analyzer is not equipped with Option 1DR (narrow resolution bandwidths), skip to the next section (Post-Test Instrument Restoration).

1. On the analyzer, press the following keys:

   SPAN, 150 Hz
   BW/Avg, 10 Hz
   Video BW, 1 Hz

2. Set the 1 dB step attenuator to place the signal peak 1 to 3 divisions below the reference level.
3. On the analyzer, press the following keys:

   Single
   Peak Search (or **Search**)
   Marker, **Delta**

4. Set the 10 dB step attenuator and analyzer reference level according to Table 2-26. At each setting, do the following:
   a. Press **Single** on the analyzer.
   b. Press **Peak Search** (or **Search**).

c. Record the marker delta amplitude reading in column 5 of Table 2-26.

d. Add the actual attenuation error to the analyzer marker delta amplitude and enter the result as the TR Entry in the performance test record.

Table 2-26 Linear Mode, Digital Bandwidths Worksheet, Option 1DR

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
10 dB Attenuator Nominal Attenuation (dB)	**10 dB Attenuator Actual Attenuation (dB)**	**Attenuation Error (dB)**	**Analyzer Reference Level (dBm)**	**Analyzer Marker Delta Amplitude (dB)**	**TR Entry**
20		0 (Ref)	−20	0 (Ref)	(Ref)
10			−10		**25)**
0			0		**26)**
30			−30		**27)**
40			−40		**28)**
50			−50		**29)**
60			−60		**30)**
70			−70		**31)**
80			−80		**32)**

Post-test Instrument Restoration

To restore the default settings on the analyzer, press **Preset, System, Alignments, Auto Align, All**.

15. Resolution Bandwidth Switching Uncertainty

To measure the resolution bandwidth switching uncertainty an amplitude reference is taken with the resolution bandwidth set to 3 kHz using the marker delta function. The resolution bandwidth is changed to settings between 5 MHz and 10 Hz and the amplitude variation is measured at each setting and compared to the specification. The span is changed as necessary to maintain approximately the same aspect ratio.

The related adjustment for this performance test is “IF Amplitude.”

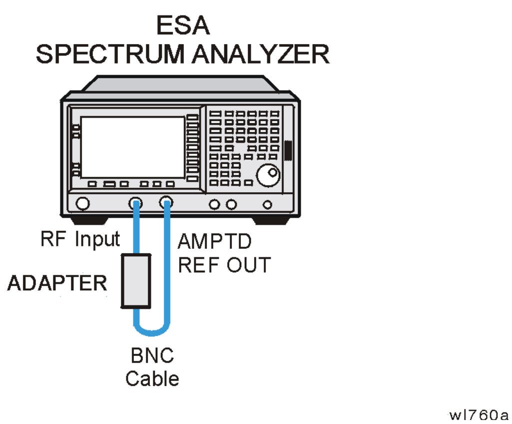
Equipment Required for E4402B, E4403B, E4404B, E4405B, E4407B and E4408B

Adapter, Type-N (m) to BNC (f)
BNC Cable

Additional Equipment for Option BAB

Adapter, Type-N (f) to APC 3.5 (f)

Figure 2-15 Resolution Bandwidth Switching Test Setup



Procedure

1. On the E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B connect a BNC cable from the AMPTD REF OUT to the 50 Ω Input using adapters as necessary. Refer to Figure 2-15.

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer controls by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   Input/Output (or **Input**), **Amptd Ref** (On) (*E4411B, E4401B*)
   Input/Output (or **Input**), **Amptd Ref Out** (On) (*E4402B, E4403B, E4404B, E4405B, E4407, E4408B*)
   FREQUENCY, **50 MHz**
   SPAN, **5 kHz**
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, **–25 dBm** (*E4411B, E4401B*)
   AMPLITUDE, **–19 dBm** *(E4402B/03B/04B/05B/07B/08B)*
   AMPLITUDE, Scale/Div, **1 dB**
   BW/Avg, **1 kHz**
   BW/Avg, Video BW, **1 kHz**

3. Press **AMPLITUDE** and use the RPG to adjust the reference level until the signal appears five divisions below the reference level, then press the following keys:

   Peak Search (or **Search**)
   Marker→, Mkr →CF
   Marker, Delta

4. Set the analyzer span and resolution bandwidth according to Table 2-27.

5. Press **Peak Search** (or **Search**), **Marker→, Mkr →CF, Peak Search** (or **Search**) then record the marker delta amplitude reading in the performance verification test record as indicated in Table 2-27.

6. Repeat step 4 and step 5 for each of the remaining resolution bandwidth and span settings listed in Table 2-27.

Table 2-27 Resolution Bandwidth Switching Uncertainty

Analyzer		Marker Delta Amplitude Reading
RES BW Setting	**SPAN Setting**	**TR Entry**
1 kHz	5 kHz	0 (Ref)
3 kHz	10 kHz	**1)**
9 kHz[a]	50 kHz	**2)**
10 kHz	50 kHz	**3)**
30 kHz	100 kHz	**4)**
100 kHz	500 kHz	**5)**
120 kHz[a]	500 kHz	**6)**

Table 2-27 Resolution Bandwidth Switching Uncertainty

Analyzer		Marker Delta Amplitude Reading
RES BW Setting	**SPAN Setting**	**TR Entry**
300 kHz	1 MHz	**7)**
1 MHz	5 MHz	**8)**
3 MHz	10 MHz	**9)**
5 MHz	25 MHz	**10)**

a. These Res BW Settings must be entered from the keypad; they can not be accessed from the step keys or RPG.

7. If you are testing a analyzer equipped with Option 1DR, continue with step 8. If the analyzer is not equipped with Option 1DR, stop here.

8. Set the resolution bandwidth and span according to Table 2-28.

9. Press **Peak Search** (or **Search**), **Marker→, Mkr →CF, Peak Search** (or **Search**) then record the Marker Delta Amplitude Reading in the performance verification test record as indicated in Table 2-28.

10. Repeat step 8 and step 9 for each of the remaining resolution bandwidth and span settings listed in Table 2-28.

Table 2-28 Resolution Bandwidth Switching Uncertainty for Option 1DR

Analyzer		Marker Delta Amplitude Reading
RES BW Setting	**SPAN Setting**	**TR Entry**
300 Hz	1 kHz	**11)**
200 Hz[a]	1 kHz	**12)**
100 Hz	500 Hz	**13)**
30 Hz	100 Hz	**14)**
10 Hz	50 Hz	**15)**

a. These Res BW Settings must be entered from the keypad; they can not be accessed from the step keys or RPG.

16. Absolute Amplitude Accuracy (Reference Settings): Agilent E4401B and E4411B

Absolute Amplitude Accuracy

The level of a 50 MHz signal is measured with a power meter. A complete auto alignment is performed. The 50 MHz signal is then measured with the analyzer. The difference between the power meter and analyzer readings is calculated.

Equipment Required

Synthesized signal generator
Measuring receiver
Power sensor, low power
Cable, Type-N, 152-cm (60-in)
Adapter, Type-N (f) to Type-N (f)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Adapter, mechanical, Type-N (f), 75 Ω to Type-N (m) 50 Ω
Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Procedure

This performance test consists of two parts:

Part 1. Absolute Amplitude Accuracy, Preamp Off

Part 2. Absolute Amplitude Accuracy, Preamp On (Option 1DS)

Part 1 should be performed on all ESA Spectrum Analyzers. Part 2 should be performed only on ESA-E Series Spectrum Analyzers equipped with Option 1DS, Preamplifier.

Part 1. Absolute Amplitude Accuracy, Preamp Off

1. On the synthesized signal generator set the controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **–27 dBm** (50 Ω *Input only)*
   AMPLITUDE, **–18 dBm** (75 Ω *Input only*)
   RF ON
   AM OFF
   FM OFF

2. Calibrate the power meter and low-power power sensor.

   75 Ω *Input: Calibrate the power meter and 75* Ω power sensor.

3. Connect the signal generator output to the low-power power sensor through the Type-N cable, using an adapter.

   75 Ω *Input: Connect the signal generator output to the 75* Ω *power sensor through the Type-N cable using the minimum loss pad and other adapters as necessary.*

4. Adjust the signal generator power level for a power meter reading of –25 dBm.

   75 Ω *Input: Adjust the power level of the signal generator for a power meter reading of –24 dBm. Allow the power sensor adequate time to settle; the 75* Ω *power sensor is being used on its lowest range.*

   Record the power meter reading here.

   Power Meter Reading ____________ dBm

5. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   System, Alignments, Align Now, All (wait for alignment to finish)
   System, Alignments, Auto Align (Off)
   FREQUENCY, Center Freq, 50 MHz
   SPAN, **2 kHz**
   BW/Avg, **Resolution BW** (Man), **1 kHz**
   Video BW (Man), **1 kHz**

6. Press **AMPLITUDE**, –**25 dBm**, **Attenuation** (Man), **10 dB**, **Scale Type** (Log).

   75 Ω *Input: Set the reference level to 28.75 dBmV.*

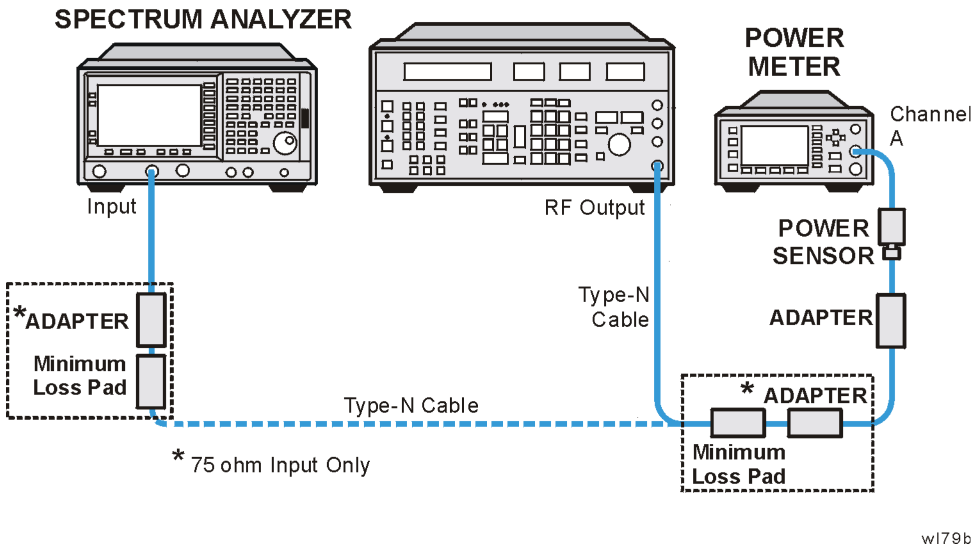
7. On the analyzer, press the following:

   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **Volts**
   Det/Demod, **Detector**, **Sample**, **Return**

8. Disconnect the power sensor from the Type-N cable. Connect the Type-N cable to the analyzer 50 Ω input.

   75 Ω *Input: Connect the Type-N cable to the analyzer 75* Ω *input using a minimum loss adapter.*

Figure 2-16 Absolute Amplitude Accuracy Test Setup



9. Press **Peak Search** (or **Search**).

10. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2/0.05))$$

$$75\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2/0.075))$$

Marker Amptd (dBm) ___________ dBm

11. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 10. Record the difference as TR Entry 1 in the performance verification test record.

$$\text{Absolute Amplitude Accuracy (Log)} = \text{Marker Amptd (dBm)} - \text{Power Meter Reading (dBm)}$$

12. On the analyzer, press the following:

AMPLITUDE, **Scale Type** (Lin)
Peak Search (or **Search**)

13. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2/0.05))$$

$$75\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2/0.075))$$

Marker Amptd (dBm) ___________ dBm

14. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 13. Record the difference, Absolute Amplitude Accuracy (Lin), as TR Entry 2 in the performance verification test record.

Absolute Amplitude Accuracy (Lin) = Marker Amptd (dBm) – Power Meter Reading (dBm)

15. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System**, **Alignments**, **Auto Align**, **All**.

16. If the analyzer is equipped with Option 1DS, preamplifier, proceed to Part 2: Absolute Amplitude Accuracy, Preamp On.

Part 2. Absolute Amplitude Accuracy, Preamp On (Option 1DS)

1. On the synthesized signal generator set the controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **–30 dBm** (50 Ω *Input only)*
   AMPLITUDE, **–24 dBm** (75 Ω *Input only*)
   RF ON
   AM OFF
   FM OFF

2. Calibrate the power meter and low-power power sensor.

   75 Ω *Input: Calibrate the measuring receiver and 75* Ω power sensor.

3. Connect the signal generator output to the power sensor through the Type-N cable, using an adapter.

   75 Ω *Input: Connect the signal generator output to the 75* Ω *power sensor through the Type-N cable using the minimum loss pad and other adapters as necessary.*

4. Adjust the signal generator power level for a power meter reading of –30 dBm.

   75 Ω *Input: Adjust the power level of the signal generator for a power meter reading of –30 dBm. Allow the power sensor adequate time to settle; the 75* Ω *power sensor is being used on its lowest range.*

   Record the power meter reading here:

   Power Meter Reading ___________ dBm

5. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   System, Alignments, Align Now, All (wait for alignment to finish)
   Done, **Auto Align, Off**.
   FREQUENCY, Center Freq, 50 MHz
   SPAN, **2 kHz**
   BW/Avg, **Resolution BW Auto Man**, **1 kHz**
   Video BW Auto Man 1 kHz

6. Press **AMPLITUDE –30 dBm, Atten** (Man) **0 dB**, **Scale Type** (Log).

   75 Ω *Input: Set the reference level to 18.75 dBmV.*

7. Press **AMPLITUDE, More, Int Preamp** (On).

8. Press **AMPLITUDE**, **More**, **Y Axis Units** (or **Amptd Units**), **Volts**, **Det/Demod**, **Detector**, **Sample**, **Return**.

9. Disconnect the power sensor from the Type-N cable. Connect the Type-N cable to the analyzer 50 Ω input.

   75 Ω *Input: Connect the Type-N cable to the analyzer 75* Ω *input using a minimum loss adapter.*

10. Press **Peak Search** (or **Search**).

11. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2 / 0.05))$$

$$75\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2 / 0.075))$$

   Marker Amptd (dBm) ____________ dBm

12. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 11. Record the difference, Absolute Amplitude Accuracy (Log), as TR Entry 3 in the performance verification test record.

$$\text{Absolute Amplitude Accuracy (Log)} = \text{Marker Amptd (dBm)} - \text{Power Meter Reading (dBm)}$$

13. On the analyzer, press the following keys:

   AMPLITUDE, **Scale Type** (Lin)
   Peak Search (or **Search**)

14. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2 / 0.05))$$

$$75\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2 / 0.075))$$

Marker Amptd (dBm) ___________ dBm

15. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 14. Record the difference, Absolute Amplitude Accuracy (Lin), as TR Entry 4 in the performance verification test record.

$$\text{Absolute Amplitude Accuracy (Lin)} = \text{Marker Amptd (dBm)} - \text{Power Meter Reading (dBm)}$$

16. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System**, **Alignments**, **Auto Align**, **All**.

17. Absolute Amplitude Accuracy (Reference Settings): Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B

Absolute Amplitude Accuracy

The level of a 50 MHz signal is measured with a power meter. A complete auto alignment is performed. The 50 MHz signal is then measured with the analyzer. The difference between the power meter and analyzer readings is calculated.

Equipment Required

Synthesized signal generator
Measuring receiver
RF power sensor
Low-power power sensor *(Option 1DS only)*
Cable, Type-N, 152-cm (60-in)
Adapter, Type-N (f) to Type-N (f)

Additional Equipment for Option BAB

Adapter, Type-N (f) to APC 3.5 (f)

Procedure

This performance test consists of two parts:

Part 1. Absolute Amplitude Accuracy, Preamp Off

Part 2. Absolute Amplitude Accuracy, Preamp On (Option 1DS)

Part 1 should be performed on all ESA Series Spectrum Analyzers. Part 2 should be performed only on ESA-E Series Spectrum Analyzers equipped with Option 1DS, Preamplifier.

Part 1. Absolute Amplitude Accuracy, Preamp Off

1. On the synthesized signal generator set the controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **–20 dBm**
   RF ON
   AM OFF
   FM OFF

2. Calibrate the power meter and RF power sensor.

3. Connect the signal generator output to the power sensor through the Type-N cable, using an adapter.

4. Adjust the signal generator power level for a power meter reading of –20 dBm.

   Record the power meter reading here:

   Power Meter Reading ____________ dBm

5. On the analyzer, connect the AMPTD REF OUT to the 50 Ω Input using a BNC Cable and adapter as shown in Figure 2-17.

6. Press the following **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

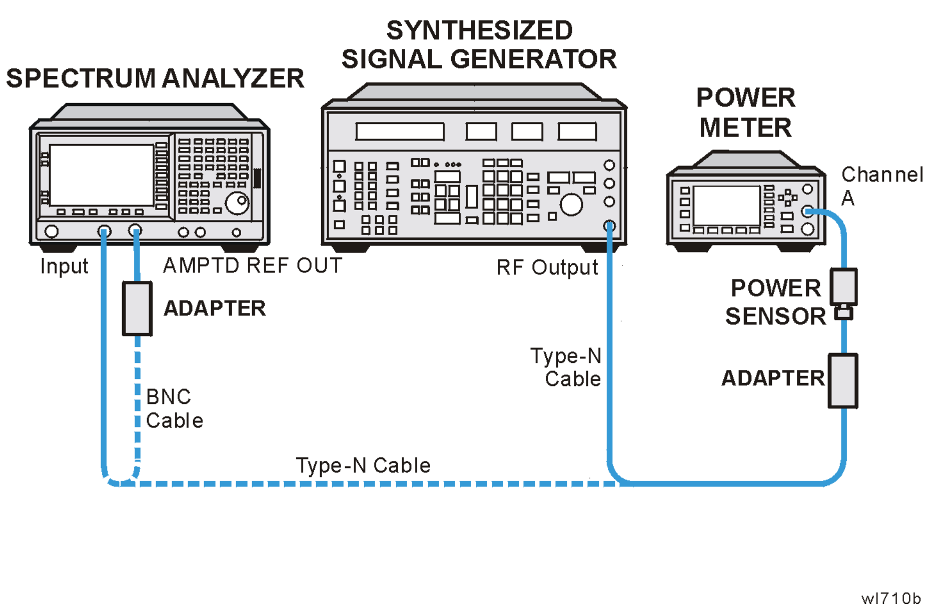
   System, **Alignments**
   Align Now, **All** (wait for alignment to finish)
   Return, **Auto Align**, **Off**
   FREQUENCY, Center Freq, 50 MHz
   SPAN, **2 kHz**
   BW/Avg, **Resolution BW Auto Man**, **1 kHz**
   Video BW Auto Man 1 kHz
   Sweep, **Points**, **401**, **Enter** *(Firmware revision A.04.00 and later)*

7. Press **AMPLITUDE –20 dBm, Atten Auto Man 10 dB**, **Scale Type** (Log).

8. Press **AMPLITUDE**, **More**, **Y Axis Units** (or **Amptd Units**), **Volts**, **Det/Demod**, **Detector**, **Sample**, **Return**.

9. Disconnect the power sensor from the Type-N cable. Connect the Type-N cable to the analyzer 50 Ω input.

Figure 2-17 Absolute Amplitude Accuracy Test Setup



10. Press **Peak Search** (or **Search**).

11. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2 / 0.05))$$

Marker Amptd (dBm) ___________ dBm

12. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 11. Record the difference, Absolute Amplitude Accuracy (Log), as TR Entry 1 in the performance verification test record.

$$\text{Absolute Amplitude Accuracy (Log)} = \text{Marker Amptd (dBm)} - \text{Power Meter Reading (dBm)}$$

13. On the analyzer, press the following keys:

AMPLITUDE, **Scale Type** (Lin)
Peak Search (or **Search**)

14. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2 / 0.05))$$

Marker Amptd (dBm) ___________ dBm

15. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 14. Record the difference, Absolute Amplitude Accuracy (Lin), as TR Entry 2 in the performance verification test record.

$$\text{Absolute Amplitude Accuracy (Lin)} = \text{Marker Amptd (dBm)} - \text{Power Meter Reading (dBm)}$$

16. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System**, **Alignments**, **Auto Align**, **All**.

17. If the analyzer is equipped with Option 1DS, preamplifier, proceed to Part 2: Absolute Amplitude Accuracy, Preamp On.

Part 2. Absolute Amplitude Accuracy, Preamp On (Option 1DS)

1. On the synthesized signal generator set the controls as follows:

FREQUENCY, **50 MHz**
AMPLITUDE, **–30 dBm**
RF ON
AM OFF
FM OFF

2. Calibrate the power meter and low-power power sensor.

3. Connect the signal generator output to the power sensor through the Type-N cable, using an adapter.

4. Adjust the signal generator power level for a power meter reading of –30 dBm.

   Record the power meter reading here:

   Power Meter Reading ____________ dBm

5. On the analyzer, connect the AMPTD REF OUT to the 50 Ω INPUT using a BNC Cable and adapter as shown in Figure 2-17.

6. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   System, Alignments, Align Now, All (wait for alignment to finish)
   System, Alignments, Auto Align (Off)
   FREQUENCY, Center Freq, 50 MHz
   SPAN, **2 kHz**
   BW/Avg, **Resolution BW** (Man), **1 kHz**
   Video BW (Man), **1 kHz**

7. Press **AMPLITUDE –30 dBm, Attenuation** (Man) **0 dB**, **Scale Type** (Log).

8. Press **AMPLITUDE, More**, **Internal Preamp** (On).

9. On the analyzer, press the following:

   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **Volts**
   Det/Demod, Detector, Sample, Return

10. Disconnect the power sensor from the Type-N cable. Connect the Type-N cable to the analyzer 50 Ω input.

11. Press **Peak Search** (or **Search**).

12. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega \text{ Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2/0.05))$$

   Marker Amptd (dBm)____________ dBm

13. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 12. Record the difference, Absolute Amplitude Accuracy (Log), as TR Entry 3 in the performance verification test record.

$$\text{Absolute Amplitude Accuracy (Log)} = \text{Marker Amptd (dBm)} - \text{Power Meter Reading (dBm)}$$

14. On the analyzer, press the following:

   AMPLITUDE, **Scale Type** (Lin)
   Peak Search (or **Search**)

15. Convert the marker amplitude reading from volts to dBm using the following equation:

$$50\Omega\ \text{Input Marker Amptd (dBm)} = 10 \times \log(\text{Mkr}(V^2 / 0.05))$$

Marker Amptd (dBm) ___________ dBm

16. Subtract the power meter reading noted in step 4 from the Marker Amptd recorded in step 15. Record the difference, Absolute Amplitude Accuracy (LIN), as TR Entry 1 in the performance verification test record.

$$\text{Absolute Amplitude Accuracy (Lin)} = \text{Marker Amptd (dBm)} - \text{Power Meter Reading (dBm)}$$

17. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System**, **Alignments**, **Auto Align**, **All**.

18. Overall Amplitude Accuracy: Agilent E4401B and E4411B

This test measures the absolute amplitude of the analyzer at 50 MHz. A synthesized signal generator and attenuators are used as the signal source to the analyzer. A power meter is used to measure this signal source with the attenuators set to 0 dB. The value measured is recorded as the source amplitude. The attenuators are used to adjust the signal levels applied to the analyzer between the initial signal amplitude (set with the power meter) and –50 dBm. The amplitude measured by the analyzer is compared to the actual signal level and the amplitude error is calculated.

There are no related adjustments for this performance test.

Equipment Required

Synthesized signal generator
10 dB step attenuator
1 dB step attenuator
Attenuator interconnection kit
Attenuator driver (if programmable step attenuators are used)
6 dB fixed attenuator
Power meter
Power sensor
Cable, Type-N, 62-cm (24 in.) (m) (2 *required*)
Cable, BNC
Adapter, Type-N (f) to Type-N (f)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Pad, minimum loss
Adapter, mechanical, Type-N (f), 75 Ω to Type-N (m) 50 Ω
Adapter, Type-N (f), to BNC (m), 75 Ω
Adapter, Type-N (f) to Type-N (f), 75 Ω

Procedure

Measuring 0 dBm Reference Level

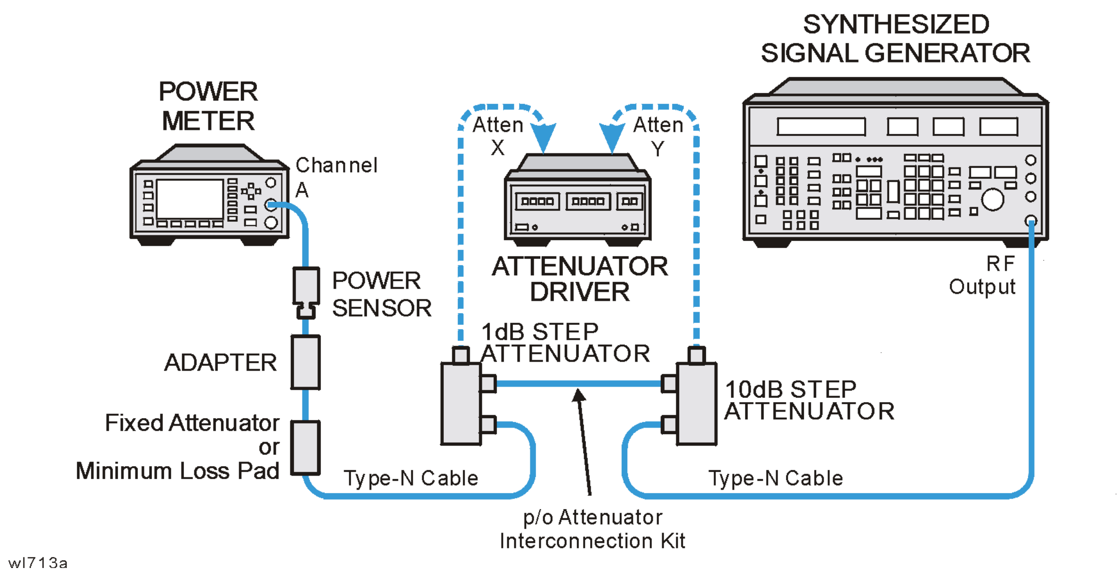
1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.

2. Perform a complete self-alignment and set Auto Align Off. Press **System, Alignments, Align Now, All**, and wait for the alignment routine to finish. Then, press **Return, Auto Align, Off**.

3. Zero and calibrate the power meter and power sensor connected to Channel A of the power meter.

   75 Ω Inputs: Zero and calibrate the power meter and 75 Ω power sensor connected to Channel A of the power meter.

Figure 2-18 Measure Source Test Setup



4. Connect the equipment as shown in Figure 2-18. The power sensor should connect directly to the 6 dB fixed attenuator using an adapter.

   75 Ω Inputs: Use the minimum loss pad in place of the 6 dB fixed attenuator and a 75 Ω Type-N (f) to Type-N (f) adapter.

5. Preset the synthesized signal generator. Manually press **Blue Key, Special, 0, 0**. Set the signal generator as follows:

   FREQUENCY, 50 MHz
   AMPLITUDE, 6 dBm

6. Set the 10 dB and 1 dB step attenuators to 0 dB.

7. From the metrology data for the step attenuators at 50 MHz, obtain the actual attenuation for the 0 dB setting of each attenuator (in some cases, this might be zero by definition). Add the two actual attenuations to obtain the 0 dB reference attenuation.

$$\text{RefAtten}_{0dB} = 10\text{ dB Actual}_{0dB} + 1\text{ dB Actual}_{0dB}$$

   For example, if the actual attenuation for the 10 dB step attenuator is 0.03 dB, 10 dB Actual_{0dB} is 0.03 dB. If the actual attenuation for the 1 dB step attenuator is 0.02 dB, 1 dB Actual_{0dB} is 0.02 dB. In this case RefAtten_{0dB} is 0.05 dB.

8. Retrieve metrology data for the step attenuators at 50 MHz. Enter the actual attenuation values for each attenuator setting as indicated in Table 2-29. If using a programmable attenuator, the section three 40 dB step should be used for the 40 dB setting on the 10 dB step attenuator. Similarly, the section three 4 dB step should be used for the 4 dB setting on the 1 dB step attenuator.

Table 2-29 Amplitude Accuracy Worksheet, 0 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy TR Entry
Setting	**Actual**	**Setting**	**Actual**	**Setting**	**Actual**			
0 dB		0 dB		0 dB		0 dBm		**1)**
0 dB		10 dB		10 dB		–10 dBm		**2)**
0 dB		20 dB		20 dB		–20 dBm		**3)**
0 dB		30 dB		30 dB		–30 dBm		**4)**
0 dB		40 dB		40 dB		–40 dBm		**5)**
0 dB		50 dB		50 dB		–50 dBm		**6)**

9. Calculate the actual total attenuation by adding the actual attenuation for the 1 dB step attenuator to the actual attenuation for the 10 dB step attenuator for each total attenuation setting listed in Table 2-29.

NOTE The external attenuators and cables are now part of the “source.”

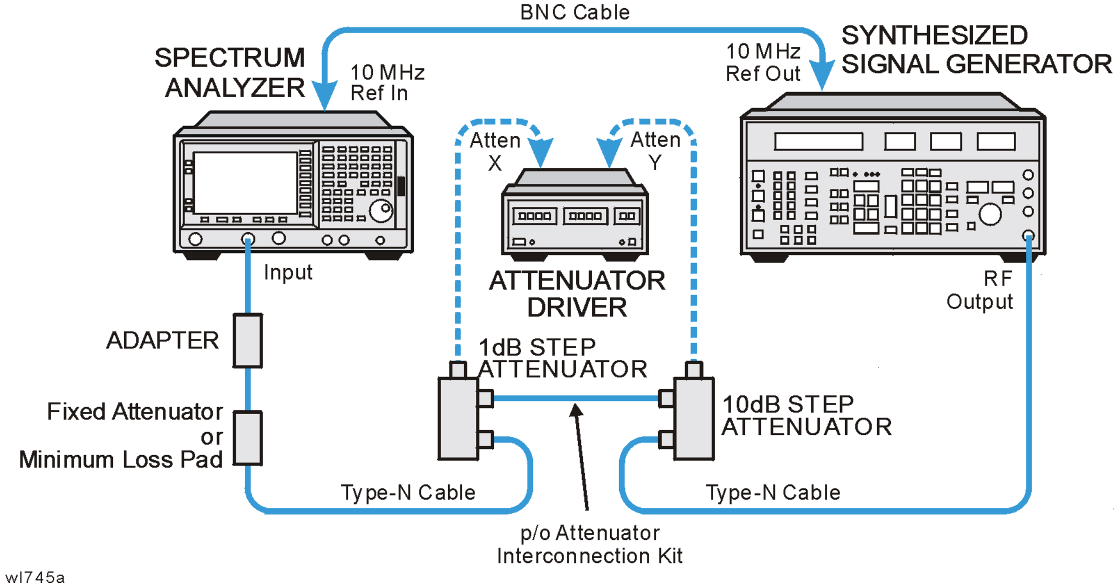
10. Adjust the signal generator amplitude for a power meter reading of 0 dBm ±0.2 dB. Record the power meter reading here:

$Amptd_{0dBm}$ = _______ dBm

11. Connect the equipment as indicated in Figure 2-19. The fixed attenuator must connect directly to the analyzer input.

75 Ω Inputs: The minimum loss pad should be connected to the analyzer input using a Type N (f) to BNC (m) 75 Ω adapter.

Figure 2-19 Amplitude Accuracy Test Setup



12. Set the analyzer as follows:

FREQUENCY, Center Freq, 50 MHz
SPAN, 6 kHz
BW/Avg, Resolution BW, 1 kHz
AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
AMPLITUDE, Ref Level, 0 dBm
Attenuation, **10 dB** (Man)

13. Perform the following steps for each of the nominal amplitude values listed in Table 2-29:

a. Set the 1 dB step attenuator as indicated in Table 2-29.
b. Set the 10 dB step attenuator as indicated in Table 2-29.
c. Press **Single** and wait for the sweep to finish.
d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-29.
f. If the nominal amplitude is 0 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - \text{Amptd0dBm}$$

g. If the amplitude is less than 0 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

h. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-29.

Measuring –20 dBm Reference Level

1. Press **AMPLITUDE, Ref Level, –20 dBm**.
2. Copy the actual total attenuation values from Table 2-29 into the actual total attenuation column in Table 2-30. Not all values in Table 2-29 will be required in Table 2-30.

Table 2-30 Amplitude Accuracy Worksheet, –20 dBm Reference Level

1 dB Step Attenuator	10 dB Step Attenuator	Total Attenuation		Nominal Amplitude	Measured Amplitude	Amplitude Accuracy
Setting	Actual	Setting	Actual			(TR Entry)
0 dB	20 dB	20 dB		–20 dB		**7)**
0 dB	30 dB	30 dB		–30 dB		**8)**
0 dB	40 dB	40 dB		–40 dB		**9)**
0 dB	50 dB	50 dB		–50 dB		**10)**

3. Perform the following steps for each of the nominal amplitude values listed in Table 2-30:
   a. Set the 1 dB step attenuator as indicated in Table 2-30.
   b. Set the 10 dB step attenuator as indicated in Table 2-30.
   c. Press **Single** and wait for the sweep to finish.
   d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
   e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-30.
   f. Calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

   g. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-30.

Measuring –40 dBm Reference Level

1. Press **AMPLITUDE, Ref Level, –40 dBm**.
2. Copy the actual total attenuation values from Table 2-30 into the actual total attenuation column in Table 2-31. Not all values in Table 2-30 will be required in Table 2-31.

Table 2-31 Amplitude Accuracy Worksheet, –40 dBm Reference Level

1 dB Step Attenuator	10 dB Step Attenuator	Total Attenuation		Nominal Amplitude	Measured Amplitude	Amplitude Accuracy
Setting	Actual	Setting	Actual			(TR Entry)
0 dB	40 dB	40 dB		–40 dB		**11)**
0 dB	50 dB	50 dB		–50 dB		**12)**

3. Perform the following steps for each of the nominal amplitude values listed in Table 2-31:

   a. Set the 1 dB step attenuator as indicated in Table 2-31.
   b. Set the 10 dB step attenuator as indicated in Table 2-31.
   c. Press **Single** and wait for the sweep to finish.
   d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
   e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-31.
   f. Calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

   g. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-31.

Measuring –50 dBm Reference Level

1. Press **AMPLITUDE, Ref Level, –50 dBm**.

2. Copy the actual total attenuation values from Table 2-31 into the actual total attenuation column in Table 2-32. Not all values in Table 2-31 will be required in Table 2-32.

Table 2-32 Amplitude Accuracy Worksheet, –50 dBm Reference Level

1 dB Step Attenuator	10 dB Step Attenuator	Total Attenuation		Nominal Amplitude	Measured Amplitude	Amplitude Accuracy
Setting	Actual	Setting	Actual			(TR Entry)
0 dB	50 dB	50 dB		–50 dB		**13)**

3. Perform the following steps for each of the nominal amplitude values listed in Table 2-32:

   a. Set the 1 dB step attenuator as indicated in Table 2-32.
   b. Set the 10 dB step attenuator as indicated in Table 2-32.
   c. Press **Single** and wait for the sweep to finish.

d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-32.
f. Calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

g. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-32.

19. Overall Amplitude Accuracy: Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B

This test measures the absolute amplitude of the analyzer at 50 MHz. A synthesized signal generator and attenuators are used as the signal source to the analyzer. A power meter is used to measure this signal source with the attenuators set to 0 dB. The value measured is recorded as the source amplitude. The attenuators are used to adjust the signal levels applied to the analyzer from the initial signal amplitude (set with the power meter) and –50 dBm. The amplitude measured by the analyzer is compared to the actual signal level and the amplitude error is calculated.

There are no related adjustments for this performance test.

Equipment Required

Synthesized signal generator
10 dB step attenuator
1 dB step attenuator
Attenuator interconnection kit
Attenuator driver (if programmable step attenuators are used)
6 dB fixed attenuator
Power meter
Power sensor
Cable, Type-N, 62 cm (24 in.) (m) (2 *required*)
Cable, BNC
Adapter, Type-N (f) to Type-N (f)

Additional Equipment for Option BAB

Adapter, Type N (f) to APC 3.5 (f)

Procedure

Measuring 0 dBm Reference Level

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.

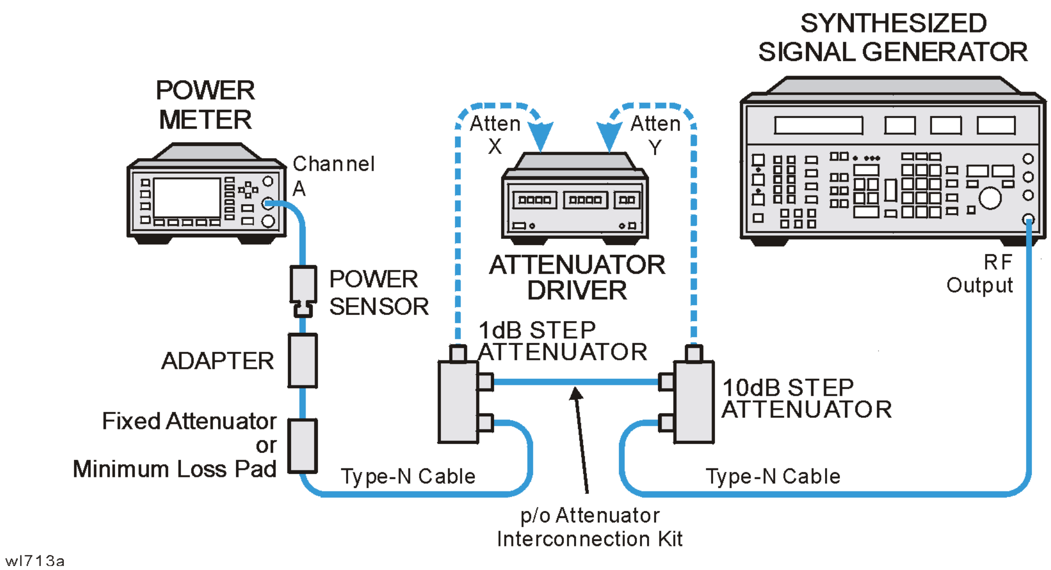
2. Connect a BNC cable from AMPTD REF OUT to the 50 Ω Input connector using a Type N (m) to BNC (f) adapter.

3. Perform a complete self-alignment and set Auto Align Off. Press **System, Alignments, Align Now, All**, and wait for the alignment routine to finish. Then, press **Return, Auto Align, Off**.

4. Zero and calibrate the power meter and power sensor connected to Channel A of the power meter.

5. Connect the equipment as shown in Figure 2-20. The power sensor should connect directly to the 6 dB fixed attenuator using an adapter.

Figure 2-20 Measure Source Test Setup



6. **Preset** the synthesized signal generator. Manually press **Blue Key, Special, 0, 0**. Set the signal generator as follows:

   FREQUENCY, 50 MHz
   AMPLITUDE, 6 dBm

7. Set the 10 dB and 1 dB step attenuators to 0 dB.

8. From the metrology data for the step attenuators at 50 MHz, obtain the actual attenuation for the 0 dB setting of each attenuator (in some cases, this might be zero by definition). Add the two actual attenuations to obtain the 0 dB reference attenuation.

$$\text{RefAtten}_{0\text{dB}} = 10\text{ dB Actual}_{0\text{dB}} + 1\text{ dB Actual}_{0\text{dB}}$$

   For example, if the actual attenuation for the 10 dB step attenuator is 0.03 dB, 10 dB $\text{Actual}_{0\text{dB}}$ is 0.03 dB. If the actual attenuation for the 1 dB step attenuator is 0.02 dB, 1 dB $\text{Actual}_{0\text{dB}}$ is 0.02 dB. In this case $\text{RefAtten}_{0\text{dB}}$ is 0.05 dB.

9. Retrieve metrology data for the step attenuators at 50 MHz. Enter the actual attenuation values for each attenuator setting as indicated in Table 2-33. If using a programmable attenuator, the section three 40 dB step should be used for the 40 dB setting on the 10 dB step attenuator. Similarly, the section three 4 dB step should be used for the 4 dB setting on the 1 dB step attenuator.

Table 2-33 Amplitude Accuracy Worksheet, 0 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			(TR Entry)
0 dB		0 dB		0 dB		0 dBm		**1)**
0 dB		10 dB		10 dB		–10 dBm		**2)**
0 dB		20 dB		20 dB		–20 dBm		**3)**
0 dB		30 dB		30 dB		–30 dBm		**4)**
0 dB		40 dB		40 dB		–40 dBm		**5)**
0 dB		50 dB		50 dB		–50 dBm		**6)**

10. Calculate the actual total attenuation by adding the actual attenuation for the 1 dB step attenuator to the actual attenuation for the 10 dB step attenuator for each total attenuation setting listed in Table 2-33.

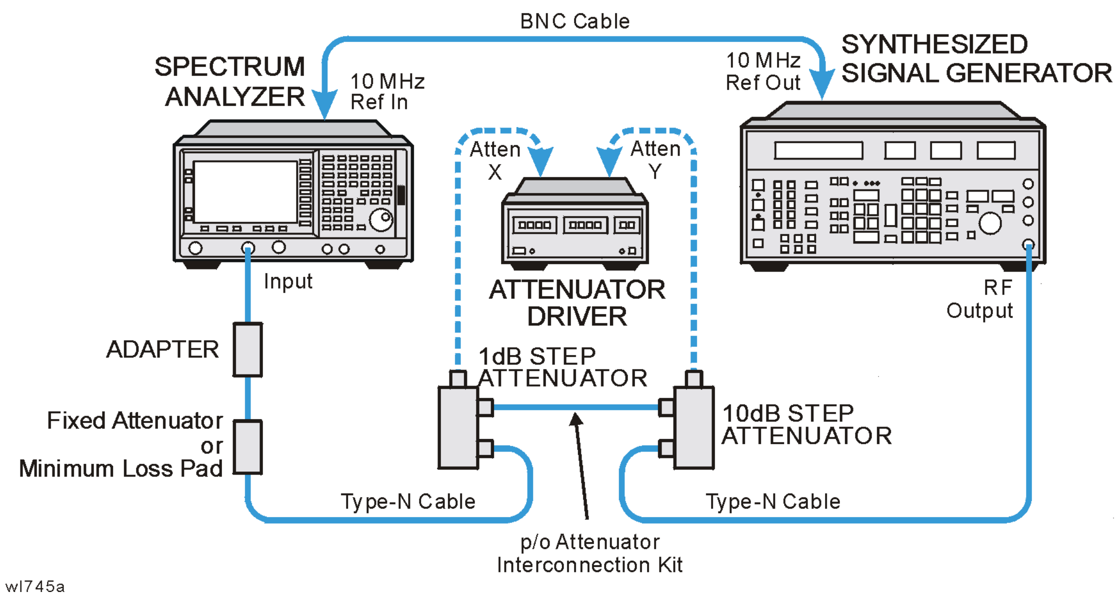
NOTE The external attenuators and cables are now part of the "source."

11. Adjust the signal generator amplitude for a power meter reading of 0 dBm ±0.2 dB. Record the power meter reading here:

    $Amptd_{0dBm}$ = _______ dBm

12. Connect the equipment as indicated in Table 2-33. The fixed attenuator must connect directly to the analyzer input.

Figure 2-21 Amplitude Accuracy Test Setup



13. Set the analyzer as follows:

FREQUENCY, Center Freq, 50 MHz
SPAN, 6 kHz
BW/Avg, Resolution BW, 1 kHz
AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
AMPLITUDE, Ref Level, 0 dBm
Attenuation, 10 dB (Man)

14. Perform the following steps for each of the nominal amplitude values listed in Table 2-33:

a. Set the 1 dB step attenuator as indicated in Table 2-33.
b. Set the 10 dB step attenuator as indicated in Table 2-33.
c. Press **Single** and wait for the sweep to finish.
d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-33.
f. If the nominal amplitude is 0 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - \text{Amptd}_{0\text{dBm}}$$

g. If the amplitude is less than 0 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0\text{dBm}} - \text{ActualTotalAtten} + \text{RefAtten}_{0\text{dB}})$$

h. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-33.

Measuring –20 dBm Reference Level

1. Press **AMPLITUDE, Ref Level, –20 dBm**.
2. Copy the actual total attenuation values from Table 2-33 into the actual total attenuation column in Table 2-34. Not all values in Table 2-33 will be required in Table 2-34.

Table 2-34 Amplitude Accuracy Worksheet, –20 dBm Reference Level

1 dB Step Attenuator	10 dB Step Attenuator	Total Attenuation		Nominal Amplitude	Measured Amplitude	Amplitude Accuracy
Setting	Actual	Setting	Actual			(TR Entry)
0 dB	20 dB	20 dB		–20 dB		**7)**
0 dB	30 dB	30 dB		–30 dB		**8)**
0 dB	40 dB	40 dB		–40 dB		**9)**
0 dB	50 dB	50 dB		–50 dB		**10)**

3. Perform the following steps for each of the nominal amplitude values listed in Table 2-34:

   a. Set the 1 dB step attenuator as indicated in Table 2-34.
   b. Set the 10 dB step attenuator as indicated in Table 2-34.
   c. Press **Single** and wait for the sweep to finish.
   d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
   e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-34.
   f. Calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

   g. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-34.

Measuring –40 dBm Reference Level

1. Press **AMPLITUDE, Ref Level, –40 dBm**.

2. Copy the actual total attenuation values from Table 2-34 into the actual total attenuation column in Table 2-35. Not all values in Table 2-34 will be required in Table 2-35.

Table 2-35 Amplitude Accuracy Worksheet, –40 dBm Reference Level

1 dB Step Attenuator	10 dB Step Attenuator	Total Attenuation		Nominal Amplitude	Measured Amplitude	Amplitude Accuracy
Setting	Actual	Setting	Actual			(TR Entry)
0 dB	40 dB	40 dB		–40 dB		**11)**
0 dB	50 dB	50 dB		–50 dB		**12)**

3. Perform the following steps for each of the nominal amplitude values listed in Table 2-35:

   a. Set the 1 dB step attenuator as indicated in Table 2-35.
   b. Set the 10 dB step attenuator as indicated in Table 2-35.
   c. Press **Single** and wait for the sweep to finish.
   d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
   e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-35.
   f. Calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

   g. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-35.

Measuring –50 dBm Reference Level

1. Press **AMPLITUDE, Ref Level, –50 dBm**.
2. Copy the actual total attenuation values from Table 2-34 into the actual total attenuation column in Table 2-36. Not all values in Table 2-34 will be required in Table 2-36.

Table 2-36 Amplitude Accuracy Worksheet, –50 dBm Reference Level

1 dB Step Attenuator	10 dB Step Attenuator	Total Attenuation		Nominal Amplitude	Measured Amplitude	Amplitude Accuracy
Setting	Actual	Setting	Actual			(TR Entry)
0 dB	50 dB	50 dB		–50 dB		**13)**

3. Perform the following steps for each of the nominal amplitude values listed in Table 2-36:

   a. Set the 1 dB step attenuator as indicated in Table 2-36.
   b. Set the 10 dB step attenuator as indicated in Table 2-36.
   c. Press **Single** and wait for the sweep to finish.
   d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
   e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-36.
   f. Calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd0dBm} - \text{ActualTotalAtten} + \text{RefAtten0dB})$$

   g. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-36.

20. Resolution Bandwidth Accuracy

The output of a synthesized signal generator is connected to the Input of the analyzer, characterized through a 1 dB step attenuator set to 3 dB. The amplitude of the synthesized signal generator is set to a reference amplitude 5 dB below the top of the screen. A marker reference is set and the attenuator is set to 0 dB.

The markers of the analyzer are then used to measure the 3 dB bandwidth. The first marker is set on the left filter skirt so that the marker delta amplitude is 1 dB plus the attenuator error for the 3 dB setting. The second marker is similarly set on the right filter skirt. The frequency difference between the two markers is the 3 dB bandwidth.

Resolution bandwidth settings ≤300 Hz (Option 1DR) are not measured. These bandwidths are digitally derived; therefore, their accuracy is verified by design.

The related adjustment for this performance test is “IF Amplitude.”

Equipment Required

Synthesized signal generator
Cable, BNC, 122-cm (48-in)
Cable, Type-N, 152-cm (60-in) (*2 required*)
1 dB step attenuator
Attenuator/switch driver (if programmable step attenuators are used)

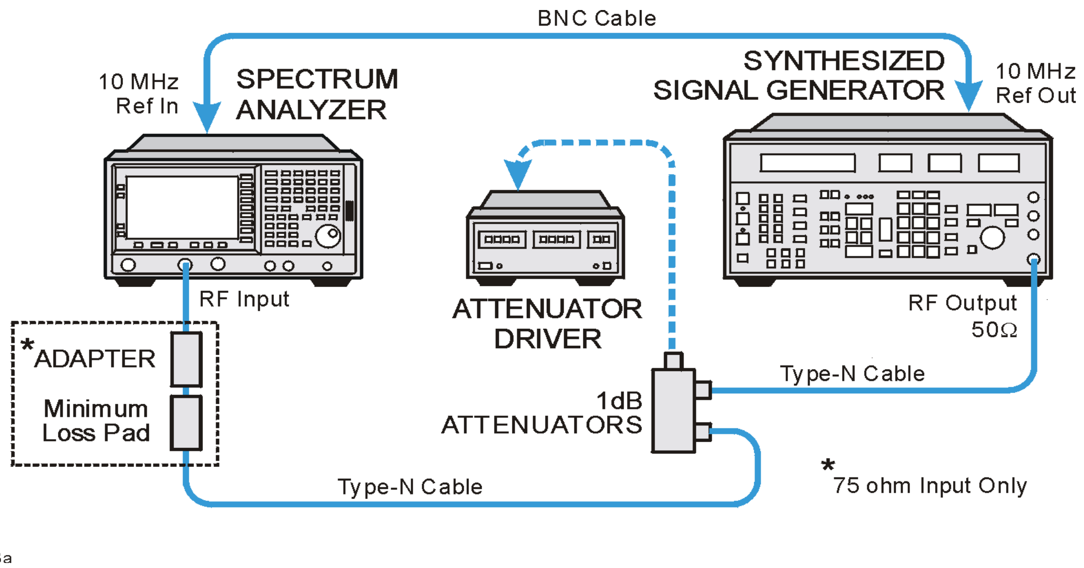
Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f), to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f), to APC 3.5 (f)

Figure 2-22 Resolution Bandwidth Accuracy Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or the connectors will be damaged.

Procedure

1. Connect the equipment as shown in Figure 2-22.
2. On the synthesized signal generator, press **Blue Key, Special, 0, 0** and set the controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **0 dBm** (50 Ω *Input only)*
   AMPLITUDE, **6 dBm** (75 Ω *Input only)*

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off**. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   SPAN, **7.5 MHz**
   AMPLITUDE, **Scale/Div 1 dB**
   AMPLITUDE, **Y Axis Units** (or **Amptd Units**), **dBm**
   BW/Avg, **5 MHz**
   BW/Avg, Video BW, 30 Hz

4. Set the 1 dB step attenuator to 3 dB.

5. Note the error of the external 1 dB step attenuator at 3 dB and 6 dB below using its calibration records.

   Attenuator Error (3 dB) __________ dB

   Attenuator Error (6 dB) __________ dB

3 dB Resolution Bandwidth Accuracy

6. Press **Peak Search** (or **Search**), **Meas Tools, Mkr→ CF** on the analyzer.
7. Adjust the amplitude of the synthesized signal generator for a marker amplitude reading of –5 dBm ±0.2 dB.
8. Press **Peak Search** (or **Search**), **Marker**, **Delta** on the analyzer.
9. Set the attenuator to 0 dB.
10. On the analyzer, press **Marker**. Lower the marker frequency by adjusting the knob until the marker delta amplitude is 0 dB plus the attenuator error (3 dB) noted in step 5 to a tolerance of ±0.05 dB.
11. Record the marker frequency readout in column 3 of Table 2-37.
12. Using the analyzer knob, raise the marker frequency so that the marker delta amplitude is maximum. Continue increasing the marker frequency until the marker reads 0.0 dB plus the attenuator error (3 dB) noted in step 5 to a tolerance of ±0.05 dB.
13. Record the marker frequency readout in column 4 of Table 2-37.
14. Set the attenuator to 3 dB.
15. Press **Marker**, **Normal** on the analyzer.
16. Repeat step 6 through step 15 for each of the analyzer Res BW and Analyzer Span settings listed in Table 2-37.
17. Subtract the Lower Marker Frequency from the Upper Marker Frequency. Record the difference as the 3 dB Bandwidth, in the performance verification test record as indicated in Table 2-37.

    3 db Bandwidth = Upper Marker Frequency – Lower Marker Frequency

Table 2-37 3 dB Resolution Bandwidth Accuracy

Column 1	Column 2	Column 3	Column 4	Column 5
Analyzer Res BW	**Analyzer Span**	**Lower Marker Frequency**	**Upper Marker Frequency**	**TR Entry 3 dB Bandwidth**
5 MHz	7.5 MHz			**1)**
3 MHz	4.5 MHz			**2)**
1 MHz	1.5 MHz			**3)**
300 kHz	450 kHz			**4)**
100 kHz	150 kHz			**5)**
30 kHz	45 kHz			**6)**
10 kHz	15 kHz			**7)**
3 kHz	4.5 kHz			**8)**
1 kHz	1.5 kHz			**9)**

6 dB Resolution Bandwidth Accuracy

18. Set the analyzer Res BW to 120 kHz and the analyzer Span to 180 kHz as shown in Table 2-38.
19. On the analyzer, press **Peak Search** (or **Search**), **Meas Tools, Mkr→ CF**.
20. Set the external 1 dB step attenuator to 6 dB and adjust the amplitude of the synthesized signal generator for a marker amplitude reading of –7 dBm ±0.2 dB.
21. Press **Peak Search** (or **Search**), **Marker**, **Delta** on the analyzer.
22. Set the attenuator to 0 dB.
23. On the analyzer, press **Marker**. Lower the marker frequency by adjusting the knob until the marker delta amplitude is 0 dB plus the attenuator error (6 dB) noted in step 5 to tolerance of ±0.05 dB.
24. Record the marker frequency readout in column 3 of Table 2-38.
25. Using the analyzer knob, raise the marker frequency so that the marker delta amplitude is maximum. Continue increasing the marker frequency until the marker reads 0.0 dB plus the attenuator error (6 dB) noted in step 5 to a tolerance of ± 0.05 dB.
26. Record the marker frequency readout in column 4 of Table 2-38.
27. Set the attenuator to 6 dB.
28. Press **Marker**, **Normal** on the analyzer.

29. Repeat step 19 through step 28 for each of the Analyzer Res BW and Analyzer Span settings listed in Table 2-38.

30. Subtract the Lower Marker Frequency from the Upper Marker Frequency. Record the difference as the 6 dB bandwidth, in the performance verification test record as indicated in Table 2-38.

$$6\text{ dB Bandwidth} = \text{Upper Marker Frequency} - \text{Lower Marker Frequency}$$

Table 2-38 6 dB Resolution Bandwidth Accuracy

Column 1	Column 2	Column 3	Column 4	Column 5
Analyzer Res BW	**Analyzer Span**	**Lower Marker Frequency**	**Upper Marker Frequency**	**TR Entry 3 dB Bandwidth**
120 kHz	180 kHz			**10)**
9 kHz	13.5 kHz			**11)**

Post-test Instrument Restoration

31. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press System, **Alignments, Auto Align, All**.

21. Frequency Response: Agilent E4401B and E4411B

This test measures the amplitude error of the analyzer as a function of frequency. To measure frequencies of 100 kHz and above, the output of a source is fed through a power splitter to a power sensor and the analyzer. The power level of the source is adjusted at 50 MHz to place the displayed signal at the center horizontal graticule line of the analyzer. The power meter is then set to measure dB relative to the power at 50 MHz. At each new source frequency and analyzer center frequency, the power level of the source is adjusted to place the signal at the center horizontal graticule line. The power meter displays the inverse of the frequency response relative to 50 MHz.

To measure frequencies below 100 kHz, a digital voltmeter (DVM) with a 50 Ω load replaces the power sensor and a function generator is used as the source.

For improved amplitude accuracy below 3 GHz, the power splitter is characterized using a specially-calibrated power sensor (the “reference” sensor) connected to one power splitter output port. The other power splitter output port connects to the “buried” sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the analyzer.

This procedure does not test frequency response with the optional preamplifier (Option 1DS) turned on. If the analyzer is equipped with Option 1DS, also perform the “Frequency Response, Preamp On” procedure.

The related adjustment for this performance test is “Frequency Response.”

Analyzers with 75 Ω inputs are tested only down to 1 MHz.

Equipment Required

Synthesized signal generator
Function generator
Power meter
RF power sensor, (*2 required*)
RF Power splitter
Digital multimeter
Adapter, APC 3.5 (f) to APC 3.5 (f)
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to BNC (f)
Dual banana plug to BNC (f)

BNC Tee (BNC f,m,f)
Cable, BNC, 120-cm (48-in) (*2 required*)
Cable, Type-N, 183-cm (72-in)
Cable, APC 3.5
Termination, 50 Ω, BNC (m)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Adapter, mechanical, Type-N (f) 75 Ω to Type-N (m) 50 Ω
Adapter, Type-N (m) to BNC (m), 75 Ω

CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or damage to the connectors will occur.

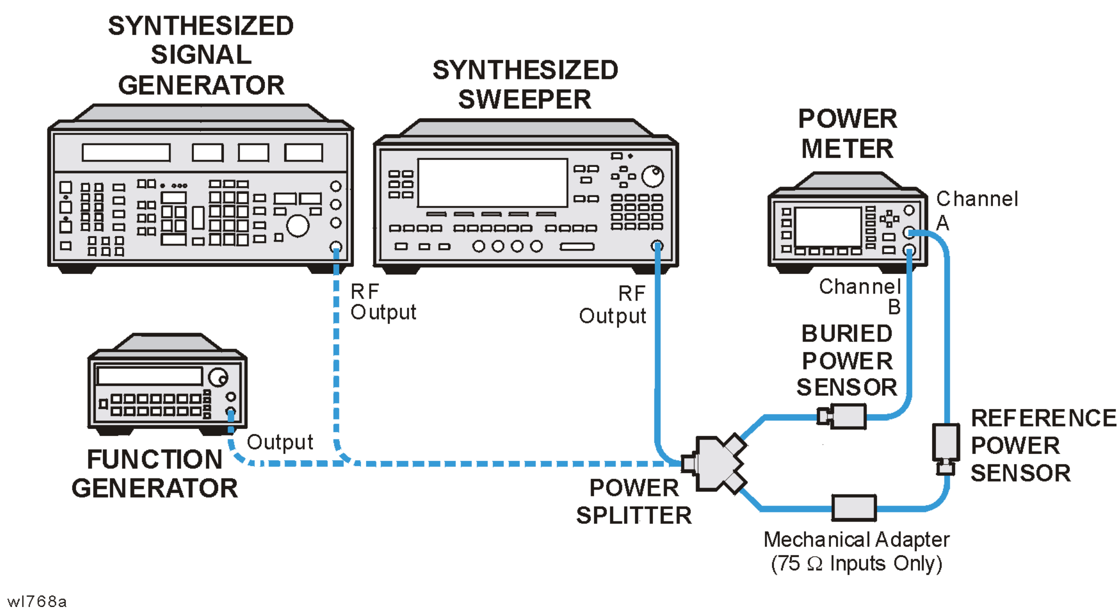
Procedure

Source/Splitter Characterization

1. Refer to Figure 2-23. Connect one of the HP/Agilent 8482A power sensors to Channel A of the power meter. This will be the “reference” sensor. Connect the other HP/Agilent 8482A power sensor to Channel B of the power meter. This will be the “buried” sensor.

   75 Ω Inputs, Option 1DP: Connect the HP/Agilent 8483A power sensor to Channel A of the power meter. This will be the “reference” sensor.

Figure 2-23 Source/Splitter Characterization Setup



2. Zero and calibrate both power sensors.
3. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for 100 kHz.

   75 Ω Inputs, Option 1DP: Use the calibration factor of the reference sensor for 1 MHz.

4. On the power meter, set the Channel B calibration factor to 100%. Do not change this calibration factor during this test.
5. Connect the equipment as shown in Figure 2-23. Use the synthesized signal generator as the source.

   75 Ω Inputs, Option 1DP: Connect the reference sensor to the power splitter using the mechanical adapter.

6. Set the source frequency to 100 kHz and amplitude to –4 dBm.

   75 Ω Inputs, Option 1DP: Set the source frequency to 1 MHz.

7. Adjust the source amplitude to obtain a Channel A power meter reading of –10 dBm ±0.01 dB.
8. Record the source amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-39.
9. Tune the source to the next frequency in Table 2-39.
10. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for the current source frequency.
11. Adjust the source amplitude to obtain a Channel A power meter reading of –10 dBm ±0.01 dB.
12. Record the source amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-39.
13. Repeat step 9 through step 12 for each frequency in Table 2-39.
14. For each entry in Table 2-39, calculate the Splitter Tracking Error as follows:

$$\text{Splitter Tracking Error} = \text{Channel A Power} - \text{Channel B Power}$$

   For example, if Channel A Power is –10.05 dBm and Channel B Power is –10.23 dBm, the Splitter Tracking Error is 0.18 dB.

Table 2-39 Source/splitter characterization

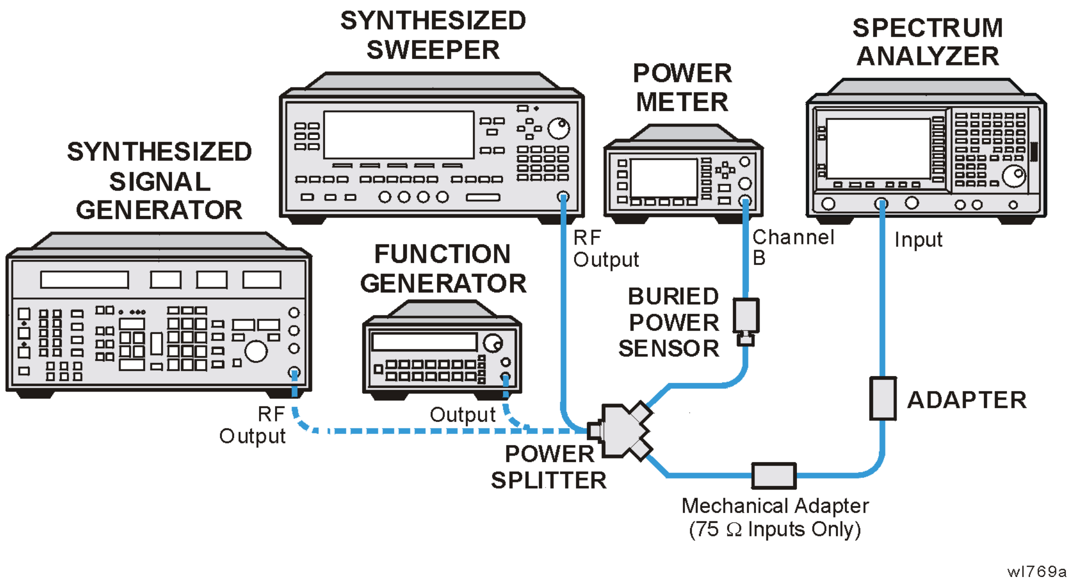
Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
100 kHz[a]				
500 kHz[a]				
1 MHz				
5 MHz				
10 MHz				
20 MHz				
50 MHz				
75 MHz				
175 MHz				
275 MHz				
375 MHz				
475 MHz				
575 MHz				
675 MHz				
775 MHz				
875 MHz				
975 MHz				
1075 MHz				
1175 MHz				
1275 MHz				
1375 MHz				
1500 MHz				

a. These values do not apply to analyzers with 75 Ω inputs (Option 1DP).

Measuring Frequency Response, 100 kHz to 1.5 GHz

1. Remove the reference sensor (Channel A sensor) from the power splitter. Connect the power splitter to the analyzer 50 Ω Input using an adapter. Do not use a cable. Refer to Figure 2-24.

Figure 2-24 Frequency Response Test Setup, 100 kHz to 1.5 GHz



75 Ω inputs, Option 1DP: Connect the power splitter to the analyzer 75 Ω Input using a mechanical adapter and a 75 Ω, Type-N(m) to BNC(m) adapter.

2. Set the source frequency to 100 kHz:

   75 Ω inputs, Option 1DP: Set the source frequency to 1 MHz.

3. Set the source amplitude to the value corresponding to the source power setting in Table 2-40 for the current source frequency (100 kHz or 1 MHz).

4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 100 kHz (*50 Ω Input*)
   FREQUENCY, Center Freq, 1 MHz (*75 Ω Input*)
   CF Step, 100 MHz
   SPAN, 20 kHz
   AMPLITUDE, More, Int Preamp (Off) (*Option 1DS only*)
   AMPLITUDE, More, Y Axis Units (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, –5 dBm
   Attenuation, 10 dB (Man)
   Scale/Div, 1 dB
   BW/Avg, Resolution BW, 3 kHz (Man)
   Video BW, 3 kHz (Man)

5. Adjust the source AMPLITUDE to obtain the Channel B power meter reading recorded in Table 2-39 ±0.1 dB.
6. Record the current Channel B power reading in Table 2-40 as the Current Channel B reading.
7. On the analyzer, press **Single** then **Peak Search** (or **Search**).
8. Record the Mkr1 amplitude reading in Table 2-40.
9. Set the source to the next frequency listed in Table 2-40.
10. Set the analyzer center frequency to the next frequency listed in Table 2-40.
11. Adjust the source AMPLITUDE to obtain the Channel B power meter reading recorded in Table 2-39 ±0.1 dB for the current frequency.
12. Record the current Channel B power meter reading in Table 2-40 as the Current Channel B Reading.
13. On the analyzer, press **Single** then **Peak Search** (or **Search**).
14. Record the Mkr1 amplitude reading in Table 2-40.
15. Repeat step 9 through step 14 for each frequency in Table 2-40.
16. Copy the splitter tracking errors from Table 2-39 into Table 2-40.
17. Calculate the Flatness Error for each frequency in Table 2-40 as follows:

$$\text{Flatness Error} = \text{Mkr1 Amptd} - \text{Current Channel B} - \text{Splitter Tracking Error}$$

For example, if Mkr1 Amptd is –10.32 dBm, Current Channel B is –10.2 and Splitter Tracking Error is 0.18 dB, Flatness Error would be –0.30 dB.

18. Record the Flatness Error for 50 MHz below as the 50 MHz Ref Amptd:

    50 MHz Ref Amptd __________

19. Calculate the Flatness Relative to 50 MHz for each frequency in Table 2-40 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd}$$

For example, if Flatness Error is –0.30 dB and 50 MHz Ref Amptd is 0.15 dB, Flatness Relative to 50 MHz would be –0.45 dB.

Table 2-40 Frequency response worksheet, 100 kHz to 1.5 GHz

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
100 kHz[a]					
500 kHz[a]					
1 MHz					
5 MHz					
10 MHz					
20 MHz					
50 MHz					
75 MHz					
175 MHz					
275 MHz					
375 MHz					
475 MHz					
575 MHz					
675 MHz					
775 MHz					
875 MHz					
975 MHz					
1075 MHz					
1175 MHz					
1275 MHz					
1375 MHz					
1500 MHz					

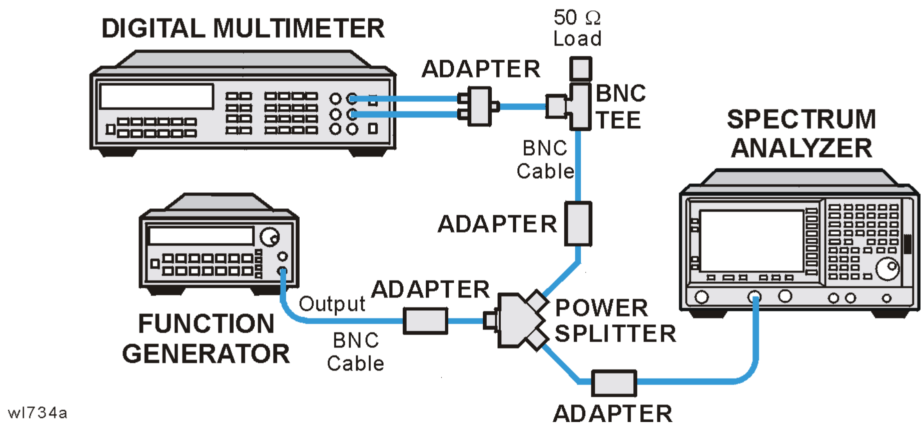
a. These values do not apply to analyzers with 75 Ω inputs (Option 1DP).

Measuring Frequency Response, ≤100 kHz

If the analyzer has Option 1DP, skip to the Test Results section.

1. Connect the equipment as shown in Figure 2-25.

Figure 2-25 Frequency Response Test Setup, ≤100 kHz



2. Set the function generator controls as follows:

   FREQUENCY, **100 kHz**
   AMPLITUDE, **–4 dBm**

3. Set the DVM as follows:

Function	Synchronous AC Volts
Math	dBm
RES Register	50 Ω
Front/Rear Terminals	Front
Range	Auto

4. On the analyzer, press **FREQUENCY**, **100 kHz**.
5. Adjust the function generator amplitude until the DVM reading is –10 dBm ±0.1 dB.
6. Record the actual DVM reading in Table 2-41 as the DVM amplitude reading.
7. On the analyzer, press **Peak Search** (or **Search**), **Marker, Delta**.
8. Set the analyzer center frequency to the next frequency listed in Table 2-41.

9. Set the function generator frequency to the next frequency listed in Table 2-41.

10. On the analyzer, press **Peak Search** (or **Search**).

11. Adjust the function generator amplitude until the ΔMkr1 amplitude reads 0 dB ±0.05 dB.

12. Record the DVM reading in Table 2-41 as the DVM amplitude reading.

13. Repeat step 8 through step 12 for each frequency in Table 2-41.

14. For each of the frequencies in Table 2-41, subtract the DVM amplitude from the DVM Amplitude at 100 kHz recorded in step 6. Record the result as the Response Relative to 100 kHz in Table 2-41.

15. From Table 2-40, note the Flatness Relative to 50 MHz for the 100 kHz frequency. Record this below as the 100 kHz error relative to 50 MHz:

    100 kHz Error Relative to 50 MHz __________ dB

16. Add the 100 kHz error relative to 50 MHz that was recorded in step 15 above to each of the Response Relative to 100 kHz entries in Table 2-41. Record the results as the Response Relative to 50 MHz in Table 2-41.

Table 2-41 Frequency response worksheet, ≤100 kHz

Frequency	DVM Amplitude	Response Relative to 100 kHz	Response Relative to 50 MHz
100 kHz		0 dB (Ref)	
75 kHz			
50 kHz			
20 kHz			
9 kHz			

Test Results

1. Enter the most positive number from the Flatness Relative to 50 MHz column of Table 2-40:

    ____________ dB

2. Enter the most positive number from the Response Relative to 50 MHz column of Table 2-41:

    ____________ dB

75 Ω inputs, Option 1DP: The frequency range below 100 kHz was not tested; no entry from Table 2-41 is necessary.

3. Record the more positive of numbers from step 1 and step 2 in Table 2-42 as the maximum response for Band 0.

4. Enter the most negative number from the Flatness Relative to 50 MHz column of Table 2-40:

   ____________ dB

5. Enter the most negative number from the response relative to 50 MHz column of Table 2-41:

   ____________ dB

   75 Ω inputs, Option 1DP: The frequency range below 100 kHz was not tested; no entry from Table 2-41 is necessary.

6. Record the more negative of numbers from step 4 and step 5 in Table 2-42 as the minimum response for Band 0.

7. Subtract the minimum response for Band 0 from the maximum response for Band 0 and record the result as the Peak-to-Peak response for Band 0 in Table 2-42.

Table 2-42 Frequency Response Results

Band	Maximum Response		Minimum Response		Peak-to-Peak Response	
	dBm	TR Entry	dBm	TR Entry	dBm	TR Entry
0		1)		2)		3)

22. Frequency Response, Agilent E4402B and E4403B

This test measures the amplitude error of the analyzer as a function of frequency. To measure frequencies of 100 kHz and above, the output of a source is fed through a power splitter to a power sensor and the analyzer. The power level of the source is adjusted at 50 MHz to place the displayed signal at the center horizontal graticule line of the analyzer. The power meter is then set to measure dB relative to the power at 50 MHz. At each new source frequency and analyzer center frequency, the power level of the source is adjusted to place the signal at the center horizontal graticule line. The power meter displays the inverse of the frequency response relative to 50 MHz.

NOTE To measure frequencies below 100 kHz, a DVM with a 50Ω load replaces the power sensor and a function generator is used as the source.

For improved amplitude accuracy below 3 GHz, the power splitter is characterized using a specially-calibrated power sensor (the "reference" sensor) connected to one power splitter output port. The other power splitter output port connects to the "buried" sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the analyzer.

This procedure does not test frequency response with the optional preamplifier (Option 1DS) turned on. If the analyzer is equipped with Option 1DS, also perform the "Frequency Response, Preamp On" procedure.

The related adjustment for this performance test is "Frequency Response."

Equipment Required

Synthesized sweeper
Function generator
Power meter
RF power sensor (*2 required*)
RF Power splitter
Digital multimeter
Adapter, APC 3.5 (f) to APC 3.5 (f)
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to BNC (f)
Dual banana plug to BNC (f)
BNC Tee (BNC f,m,f)
Cable, BNC, 122-cm (48-in) (*2 required*)
Cable, Type-N, 183-cm (72-in)

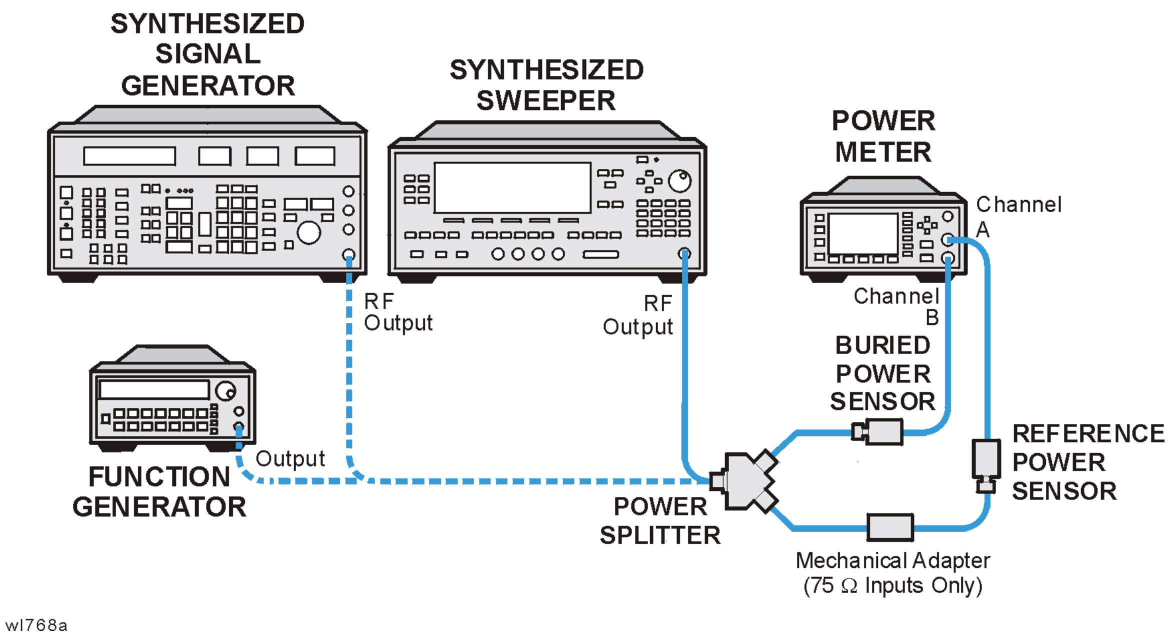
Cable, APC 3.5
Termination, 50 Ω, BNC (m)

Procedure

Source/Splitter Characterization

1. Connect one of the HP/Agilent 8482A power sensors to Channel A of the power meter. This will be the “reference” sensor. Connect the other HP/Agilent 8482A power sensor to Channel B of the power meter. This will be the “buried” sensor. Refer to Figure 2-26.

Figure 2-26 Source/Splitter Characterization Setup



2. Zero and calibrate both power sensors.
3. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for 100 kHz.
4. On the power meter, set the Channel B calibration factor to 100%. Do not change this calibration factor during this test.
5. Connect the equipment as shown in Figure 2-26. Use the function generator as the source.
6. Set the function generator frequency to 100 kHz and amplitude to –4 dBm.
7. Adjust the function generator amplitude to obtain a Channel A power meter reading of –10 dBm ±0.01 dB.

8. Record the function generator amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-43.
9. Tune the source to the next frequency in Table 2-43.
10. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for the current source frequency.
11. Adjust the source amplitude to obtain a Channel A power meter reading of –10 dBm ±0.01 dB.
12. Record the source amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-43.
13. Repeat step 9 through step 12 for frequencies up to 10 MHz.
14. Replace the function generator with the synthesized sweeper.
15. Set the synthesized sweeper CW frequency to 10 MHz and the amplitude to –4 dBm.
16. Adjust the synthesized sweeper power level to obtain a Channel A power meter reading of –10 dBm ±0.1 dB.
17. Record the synthesized sweeper power level and both the Channel A and Channel B power meter readings in Table 2-43.
18. Repeat step 9 through step 12 for each remaining frequency in Table 2-43.
19. For each entry in Table 2-43, calculate the Splitter Tracking Error as follows:

    Splitter Tracking Error = Channel A Power – Channel B Power

    For example, if Channel A Power is –10.05 dBm and Channel B Power is –10.23 dBm, the Splitter Tracking Error is 0.18 dB.

Table 2-43 Source/Splitter Characterization

Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
100 kHz				
500 kHz				
1 MHz				
5 MHz				
10 MHz[a]				
10 MHz[b]				
20 MHz				0 dB (Ref)

Table 2-43 Source/Splitter Characterization

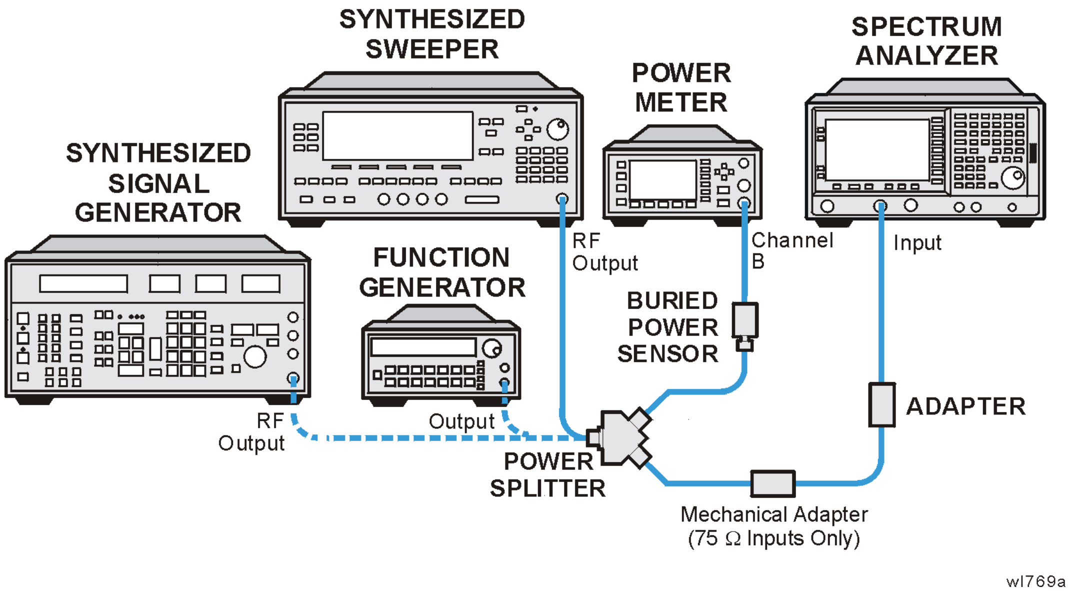
Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
50 MHz				
75 MHz				
175 MHz				
275 MHz				
375 MHz				
475 MHz				
575 MHz				
675 MHz				
775 MHz				
875 MHz				
975 MHz				
1075 MHz				
1175 MHz				
1275 MHz				
1375 MHz				
1500 MHz				
1525 MHz				
1725 MHz				
1925 MHz				
2125 MHz				
2325 MHz				
2525 MHz				
2725 MHz				
2925 MHz				
3000 MHz				

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Measuring Frequency Response, 100 kHz to 3.0 GHz

1. Remove the reference sensor (Channel A sensor) from the power splitter. Connect the power splitter to the 50 Ω Input of the analyzer using an adapter. Do not use a cable. Refer to Figure 2-27.

Figure 2-27 Frequency Response Test Setup, 100 kHz to 3.0 GHz



2. Set the source frequency at 10 MHz.
3. Set the source power level to the value corresponding to the source power setting in Table 2-43 for the current source frequency (10 MHz).
4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed.Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 10 MHz
   CF Step, 100 MHz
   SPAN, 20 kHz
   AMPLITUDE, More, Int Preamp, Off (*Option 1DS only*)
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, –5 dBm
   Attenuation, 10 dB (Man)
   Scale/Div, 1 dB
   BW/Avg, Resolution BW, 3 kHz (Man)
   Video BW, 3 kHz (Man)

5. Adjust the source power level to obtain the Channel B power meter reading recorded in Table 1 ±0.1 dB.
6. Record the current Channel B power reading in Table 2-44 as the Current Channel B Reading.

7. On the analyzer, press **Single** then **Peak Search** (or **Search**).
8. Record the Mkr1 amplitude reading in Table 2-44.
9. Set the source to the next frequency listed in Table 2-44.
10. Set the analyzer center frequency to the next frequency listed in Table 2-44.
11. Adjust the source power level to obtain the Channel B power meter reading recorded in Table 2-44 ±0.1 dB for the current frequency.
12. Record the current Channel B power reading in Table 2-44 as the current Channel B reading.
13. On the analyzer, press **Single** then **Peak Search** (or **Search**).
14. Record the Mkr1 amplitude reading in Table 2-44.
15. Repeat step 9 through step 14 for frequencies up to 3.0 GHz in Table 2-44.
16. Replace the synthesized sweeper with a function generator.
17. Set the function generator amplitude to –4 dBm.
18. Set the function generator frequency to 100 kHz.
19. On the analyzer, press **FREQUENCY**, **Center Freq**, **100 kHz**.
20. Adjust the function generator amplitude to obtain the Channel B power meter reading recorded in Table 2-43 ±0.1 dB for 100 kHz.
21. Record the current Channel B power reading in Table 2-44 as the current Channel B reading.
22. On the analyzer, press **Single** then **Peak Search** (or **Search**).
23. Record the analyzer Mkr1 Amplitude Reading in Table 2-44 as Mkr1 Amplitude.
24. Repeat step 18 through step 23 for frequencies between 100 kHz and 10 MHz.
25. Copy the Splitter Tracking Errors from Table 2-43 into Table 2-44.
26. Calculate the Flatness Error for each frequency in Table 2-44 as follows:

$$\text{Flatness Error} = \text{Mkr1 Amptd} - \text{Current Channel B} - \text{Splitter Tracking Error}$$

For example, if Mkr1 Amptd is –10.32 dBm, Current Channel B is –10.2 and Splitter Tracking Error is 0.18 dB, Flatness Error would be –0.30 dB.

27. Record the Flatness Error for 50 MHz below as the 50 MHz Ref Amptd:

    50 MHz Ref Amptd: __________

28. Calculate the setup change error (error due to changing the test setup from using a synthesized sweeper to using a function generator) as follows:

    a. Record the Flatness Error from Table 2-44 at 10 MHz using the function generator as $FlatError_{FG}$:

       $FlatError_{FG}$=__________ dB

    b. Record the Flatness Error from Table 2-44 at 10 MHz using the synthesized sweeper as $FlatError_{SS}$:

       $FlatError_{SS}$=__________ dB

    c. Subtract $FlatError_{FG}$ from $FlatError_{SS}$ and record the result as the Setup Change Error:

$$\text{Setup Change Error} = \text{FlatError}_{FG} - \text{FlatError}_{SS}$$

       Setup Change Error =__________ dB

29. For frequencies less than 10 MHz calculate the Flatness Relative to 50 MHz for each frequency in Table 2-44 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd} - \text{Setup Change Error}$$

    For example, if Flatness Error is –30.0 dB, 50 MHz Ref Amptd is 0.15 dB and Setup Change Error is –0.19 dB, Flatness Relative to 50 MHz would be –0.26 dB.

30. For frequencies 10 MHz and above, calculate the Flatness Relative to 50 MHz for each frequency in Table 2-44 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd}$$

    For example, if Flatness Error is –0.30 dB and 50 MHz Ref Amptd is 0.15 dB, Flatness Relative to 50 MHz would be –0.45 dB.

Table 2-44 Frequency Response Worksheet, 100 kHz to 3.0 GHz

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
100 kHz					
500 kHz					
1 MHz					
5 MHz					
10 MHz[a]					
10 MHz[b]					
20 MHz					
50 MHz					0 dB (Ref)
75 MHz					
175 MHz					
275 MHz					
375 MHz					
475 MHz					
575 MHz					
675 MHz					
775 MHz					
875 MHz					
975 MHz					
1075 MHz					
1175 MHz					
1275 MHz					
1375 MHz					
1525 MHz					
1525 MHz					
1725 MHz					
1925 MHz					
2125 MHz					
2325 MHz					

Table 2-44 Frequency Response Worksheet, 100 kHz to 3.0 GHz

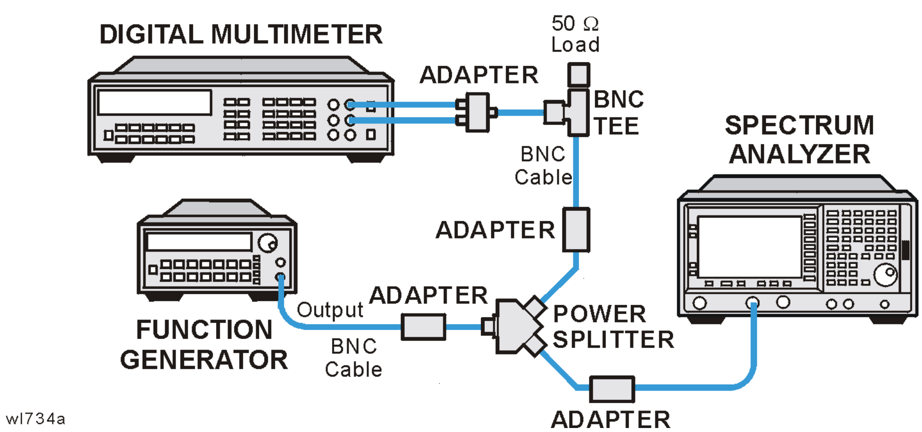
Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
2525 MHz					
2725 MHz					
2925 MHz					
3000 MHz					

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Measuring Frequency Response, ≤100 kHz

1. Connect the equipment as shown in Figure 2-28.

Figure 2-28 Frequency Response Test Setup, ≤100 kHz



2. Set the function generator controls as follows:

   FREQUENCY, **100 kHz**
   AMPLITUDE, **–4 dBm**
   Amptd Increment, **0.05 dB**

3. Set the DVM as follows:

Function	Synchronous AC Volts
Math	dBm
RES Register	50 Ω
Front/Rear Terminals	Front
Range	Auto

4. On the analyzer, press **FREQUENCY**, **100 kHz**.
5. Adjust the function generator amplitude until the DVM reading is –10 dBm ±0.1 dB.
6. Record the actual DVM reading in Table 2-45 as the DVM Amplitude reading.
7. On the analyzer, press **Peak Search** (or **Search**), **Marker, Delta**.
8. Set the analyzer center frequency to the next frequency listed in Table 2-45.
9. Set the function generator frequency to the next frequency listed in Table 2-45.
10. On the analyzer, press **Peak Search** (or **Search**).
11. Adjust the function generator amplitude until the ΔMkr1 amplitude reads 0 dB ±0.05 dB.
12. Record the DVM reading in Table 2-45 as the DVM Amplitude reading.
13. Repeat step 8 through step 12 for each frequency setting listed in Table 2-45.
14. For each of the frequencies in Table 2-45, subtract the DVM amplitude from the DVM amplitude at 100 kHz recorded in step 6. Record the result as the response relative to 100 kHz in Table 2-45.
15. From Table 2-44, note the Flatness Relative to 50 MHz for the 100 kHz frequency. Record this below as the 100 kHz Error Relative to 50 MHz:

    100 kHz Error Relative to 50 MHz =__________ dB

16. Add the 100 kHz error relative to 50 MHz that was recorded in step 15 above to each of the response relative to 100 kHz entries in Table 2-45. Record the results as the response relative to 50 MHz in Table 2-45.

Table 2-45 Frequency Response Worksheet, ≤100 kHz

Frequency	DVM Amplitude	Response Relative to 100 kHz	Response Relative to 50 MHz
100 kHz		0 dB (Ref)	
75 kHz			
50 kHz			
20 kHz			
9 kHz			

Test Results

Perform the following steps to verify the frequency response of the analyzer.

1. Enter the most positive number from the Flatness Relative to 50 MHz column of Table 2-44:

   ___________ dB

2. Enter the most positive number from the response relative to 50 MHz column of Table 2-45:

   ___________ dB

3. Record the more positive of numbers from step 1 and step 2 in Table 2-46 as the maximum response for Band 0.
4. Enter the most negative number from the Flatness Relative to 50 MHz column of Table 2-44:

   ___________ dB

5. Enter the most negative number from the response relative to 50 MHz column of Table 2-45:

   ___________ dB

6. Record the most negative of numbers from step 4 and step 5 in Table 2-46 as the minimum response for Band 0.
7. Subtract the minimum response for Band 0 from the maximum response for Band 0 and record the result as the Peak-to-Peak response for Band 0 in Table 2-46.

Table 2-46 Frequency Response Results

Band	Maximum Response		Minimum Response		Peak-to-peak Response	
	dBm	TR Entry	dBm	TR Entry	dBm	TR Entry
0		1)		2)		3)

23. Frequency Response, Agilent E4404B, E4405B, E4407B, and E4408B

This test measures the amplitude error of the analyzer as a function of frequency. To measure frequencies of 100 kHz and above, the output of a source is fed through a power splitter to a power sensor and the analyzer. The power level of the source is adjusted at 50 MHz to place the displayed signal at the center horizontal graticule line of the analyzer. The power meter is then set to measure dB relative to the power at 50 MHz. At each new source frequency and analyzer center frequency, the power level of the source is adjusted to place the signal at the center horizontal graticule line. The power meter displays the inverse of the frequency response relative to 50 MHz.

NOTE To measure frequencies below 100 kHz, a DVM with a 50Ω load replaces the power sensor and a function generator is used as the source.

For improved amplitude accuracy below 3 GHz, the power splitter is characterized using a specially-calibrated power sensor (the “reference” sensor) connected to one power splitter output port. The other power splitter output port connects to the “buried” sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the analyzer.

This procedure does not test frequency response with the optional preamplifier (Option 1DS) turned on. If the analyzer is equipped with Option 1DS, also perform the “Frequency Response, Preamp On” procedure.

The related adjustment for this performance test is “Frequency Response.”

Equipment Required

Synthesized sweeper
Function generator
Power meter
RF Power sensor (*2 required*)
Microwave power sensor
Microwave power splitter
Digital multimeter
Adapter, APC 3.5 (f) to APC 3.5 (f)
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to BNC (f)
Dual banana plug to BNC (f)
BNC Tee (BNC f,m,f)
Cable, BNC, 122-cm (48-in) (*2 required*)

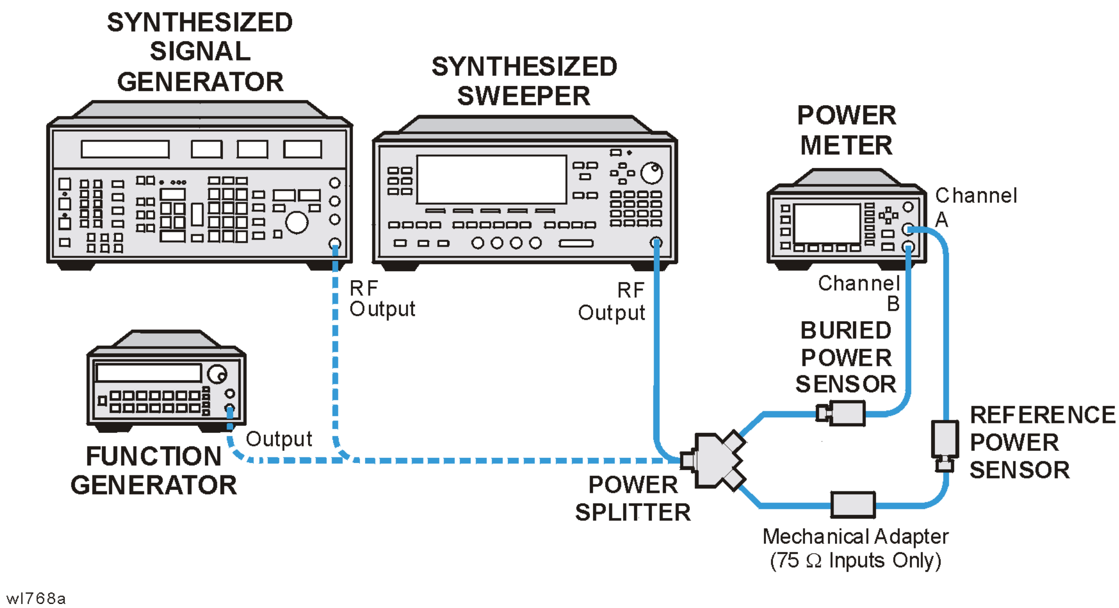
Cable, Type-N, 183-cm (72-in)
Cable, APC 3.5
Termination, 50 Ω, BNC (m)

Procedure

Part 1: Source/splitter characterization

1. Connect the HP/Agilent 8482A to Channel A of the power meter. This will be the “reference” sensor. Connect the other HP/Agilent 8482A to Channel B of the power meter. This will be the “buried” sensor. Refer to Figure 2-29.

Figure 2-29 Source/splitter characterization setup



2. Zero and calibrate both power sensors.
3. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for 100 kHz.
4. On the power meter, set the Channel B calibration factor to 100%. Do not change this calibration factor during this test.
5. Connect the equipment as shown in Figure 2-29. Use the function generator as the source.
6. Set the source frequency to 100 kHz and amplitude to –4 dBm.
7. Adjust the source amplitude to obtain a Channel A power meter reading of –10 dBm ±0.01 dB.

8. Record the source amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-47.

9. Tune the source to the next frequency in Table 2-47.

10. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for the current source frequency.

11. Adjust the source amplitude to obtain a Channel A power meter reading of –10 dBm ±0.01 dB.

12. Record the source amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-47.

13. Repeat step 9 through step 12 for frequencies up to 10 MHz.

14. Replace the function generator with the synthesized sweeper.

15. Set the synthesized sweeper CW frequency to 10 MHz and the amplitude to –4 dBm.

16. Adjust the synthesized sweeper power level to obtain a Channel A power meter reading of –10 dBm ±0.1 dB.

17. Record the synthesized sweeper power level and both the Channel A and Channel B power meter readings in Table 2-47.

18. Repeat step 9 through step 12 for each remaining frequency in Table 2-47.

19. For each entry in Table 2-47, calculate the splitter tracking error as follows:

$$\text{Splitter Tracking Error} = \text{Channel A Power} - \text{Channel B Power}$$

For example, if Channel A Power is –10.05 dBm and Channel B Power is –10.23 dBm, the Splitter Tracking Error is 0.18 dB.

Table 2-47 Source/splitter characterization

Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
100 kHz				
500 kHz				
1 MHz				
5 MHz				
10 MHz[a]				

Table 2-47 Source/splitter characterization

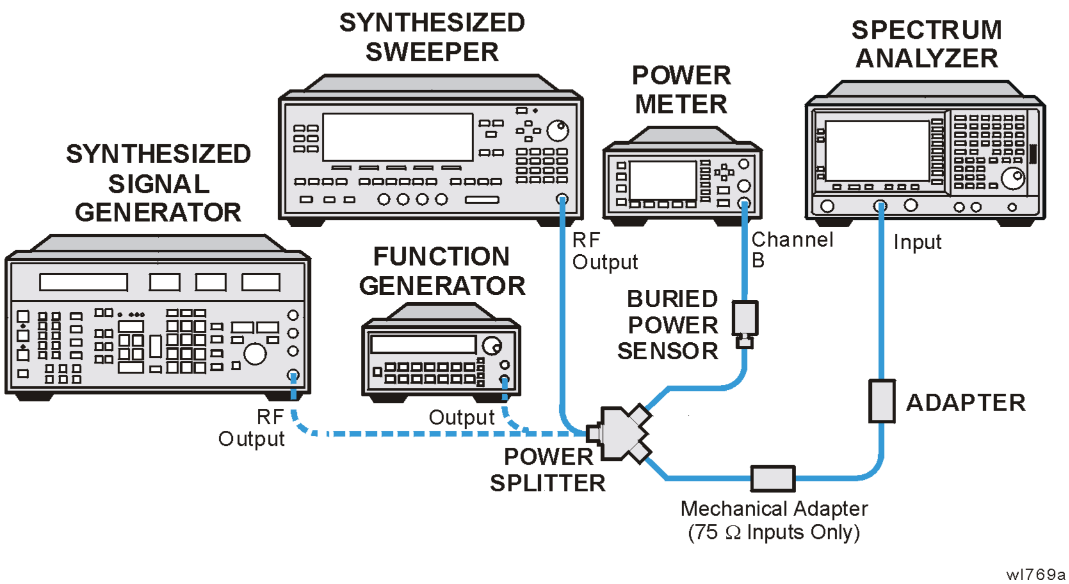
Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
10 MHz[b]				
20 MHz				
50 MHz				
75 MHz				
175 MHz				
275 MHz				
375 MHz				
475 MHz				
575 MHz				
675 MHz				
775 MHz				
875 MHz				
975 MHz				
1075 MHz				
1175 MHz				
1275 MHz				
1375 MHz				
1500 MHz				
1525 MHz				
1725 MHz				
1925 MHz				
2125 MHz				
2325 MHz				
2525 MHz				
2725 MHz				
2925 MHz				
3000 MHz				

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Measuring Frequency Response, 100 kHz to 3.0 GHz

1. Remove the reference sensor (Channel A sensor) from the power splitter. Connect the power splitter to the analyzer 50 Ω Input using an adapter. Do not use a cable. Refer to Figure 2-30.

Figure 2-30 Frequency response test setup, 100 kHz to 3.0 GHz



2. Set the source frequency at 10 MHz.

3. Set the source power level to the value corresponding to the source power setting in Table 2-48 for the current source frequency (10 MHz).

4. Adjust the source power level to obtain the Channel B power meter reading recorded in Table 2-47 ±0.1 dB.

5. Adjust the synthesized signal generator amplitude for a marker amplitude reading of –14 dBm ±0.10 dB.

6. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 10 MHz
   CF Step, 100 MHz
   SPAN, 20 kHz
   Input/Output (or **Input**), **Coupling** (DC) *(E4404B and E4405B)*
   AMPLITUDE, More, Int Preamp, (Off) *(Option 1DS only)*
   AMPLITUDE, Ref Level, –5 dBm
   Attenuation, 10 dB (Man)
   Scale/Div, 1 dB
   BW/Avg, Resolution BW, 3 kHz (Man)
   Video BW, 3 kHz (Man)

7. Record the current Channel B power reading in Table 2-48 as the current Channel B reading.
8. On the analyzer, press **Single**.
9. On the analyzer, press **Peak Search** (or **Search**).
10. Record the Mkr1 amplitude reading in Table 2-48.
11. Set the source to the next frequency listed in Table 2-48.
12. Set the analyzer center frequency to the next frequency listed in Table 2-48.
13. Adjust the source power level to obtain the Channel B power meter reading recorded in Table 2-47 ±0.1 dB for the current frequency.
14. Record the current Channel B power reading in Table 2-48 as the current Channel B reading.
15. On the analyzer, press Single then **Peak Search** (or **Search**).
16. Record the Mkr1 amplitude reading in Table 2-48.
17. Repeat step 9 through step 14 for each frequency in Table 2-48.
18. Replace the synthesized sweeper with a function generator.
19. Set the function generator amplitude to –4 dBm.
20. Set the function generator frequency to 100 kHz.
21. Set the analyzer center frequency to 100 kHz.
22. Adjust the function generator amplitude to obtain the Channel B power meter reading recorded in Table 2-47 ±0.1 dB for 100 kHz.
23. Record the current Channel B power reading in Table 2-48 as the current Channel B reading.
24. On the analyzer, press **Single** then **Peak Search** (or **Search**).
25. Record the analyzer Mkr1 Amplitude Reading in Table 2-48 as Mkr1 amplitude.
26. Repeat step 18 through step 23 for frequencies between 100 kHz and 10 MHz.
27. Copy the splitter tracking errors from Table 2-47 into Table 2-48.
28. Calculate the Flatness Error for each frequency in Table 2-48 as follows:

$$\text{Flatness Error} = \text{Mkr1 Amptd} - \text{Current Channel B} - \text{Splitter Tracking Error}$$

For example, if Mkr1 Amptd is –10.32 dBm, Current Channel B is –10.2 and Splitter Tracking Error is 0.18 dB, Flatness Error would be –0.30 dB.

29. Record the Flatness Error for 50 MHz below as the 50 MHz Ref Amptd:

50 MHz Ref Amptd: __________

30. Calculate the setup change error (error due to changing the test setup from using a synthesized sweeper to using a function generator) as follows:

a. Record the Flatness Error from Table 2-48 at 10 MHz using the function generator as $FlatError_{FG}$:

$FlatError_{FG}$=__________ dB

b. Record the Flatness Error from Table 2-48 at 10 MHz using the synthesized sweeper as $FlatError_{SS}$:

$FlatError_{SS}$=__________ dB

c. Subtract $FlatError_{FG}$ from $FlatError_{SS}$ and record the result as the setup change error:

$$\text{Setup Change Error} = \text{FlatErrorFG} - \text{FlatErrorSS}$$

Setup Change Error =__________ dB

31. Calculate the Flatness Relative to 50 MHz for each frequency in Table 2-48 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd} - \text{Setup Change Error}$$

For example, if Flatness Error is –30.0 dB, 50 MHz Ref Amptd is 0.15 dB and Setup Change Error is –0.19 dB, Flatness Relative to 50 MHz would be –0.26 dB.

Table 2-48 Frequency response worksheet, 100 kHz to 3.0 GHz

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
100 kHz					
500 kHz					
1 MHz					
5 MHz					
10 MHz[a]					
10 MHz[b]					
20 MHz					

Table 2-48 Frequency response worksheet, 100 kHz to 3.0 GHz

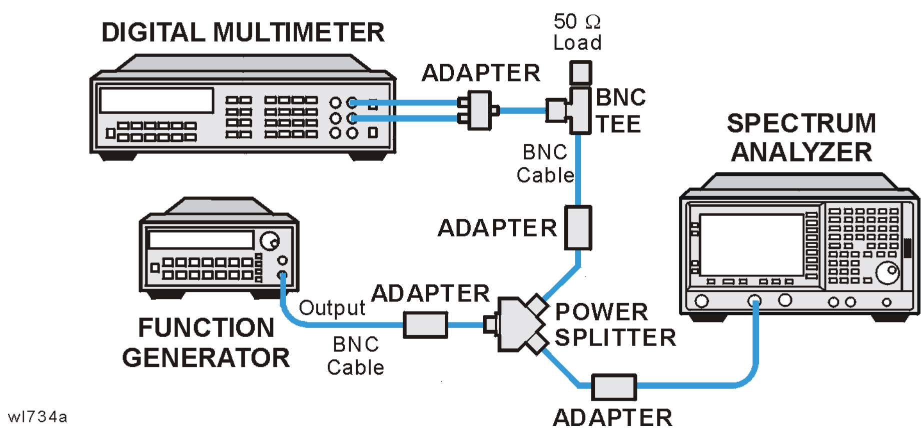
Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
50 MHz					0 dB (Ref)
75 MHz					
175 MHz					
275 MHz					
375 MHz					
475 MHz					
575 MHz					
675 MHz					
775 MHz					
875 MHz					
975 MHz					
1075 MHz					
1175 MHz					
1275 MHz					
1375 MHz					
1525 MHz					
1525 MHz					
1725 MHz					
1925 MHz					
2125 MHz					
2325 MHz					
2525 MHz					
2725 MHz					
2925 MHz					
3000 MHz					

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Measuring Frequency Response, ≤100 kHz

1. Connect the equipment as shown in Figure 2-31.

Figure 2-31 Frequency Response Test Setup, ≤100 kHz



2. Set the frequency synthesizer controls as follows:

   FREQUENCY, **100 kHz**
   AMPLITUDE, **–4 dBm**
   Amptd Increment, **0.05 dB**

3. Set the DVM as follows:

Function	Synchronous AC Volts
Math	dBm
RES Register	50 Ω
Front/Rear Terminals	Front
Range	Auto

4. On the analyzer, press the following keys:

   FREQUENCY, **100 kHz**

5. Adjust the function generator amplitude until the DVM reading is –10 dBm ±0.1 dB.

6. Record the actual DVM reading in Table 2-49 as the DVM amplitude reading.

7. On the analyzer, press **Peak Search** (or **Search**), **Marker, Delta.**

8. Set the analyzer center frequency to the next frequency listed in Table 2-49.

9. Set the function generator frequency to the next frequency listed in Table 2-49.

10. On the analyzer, press **Peak Search** (or **Search**).

11. Adjust the function generator amplitude until the ΔMkr1 amplitude reads 0 dB ±0.05 dB.

12. Record the DVM reading in Table 2-49 as the DVM amplitude reading.

13. Repeat step 8 through step 12 for each frequency setting listed in Table 2-49.

14. For each of the frequencies in Table 2-49, subtract the DVM amplitude from the DVM amplitude at 100 kHz (recorded in step 6). Record the result as the response relative to 100 kHz in Table 2-49.

15. From Table 2-48, note the Flatness Relative to 50 MHz for the 100 kHz frequency. Record this below as the 100 kHz error relative to 50 MHz:

    100 kHz Error Relative to 50 MHz __________ dB

16. Add the 100 kHz error relative to 50 MHz that was recorded in step 15 above to each of the response relative to 100 kHz entries in Table 2-49. Record the results as the Response Relative to 50 MHz in Table 2-49.

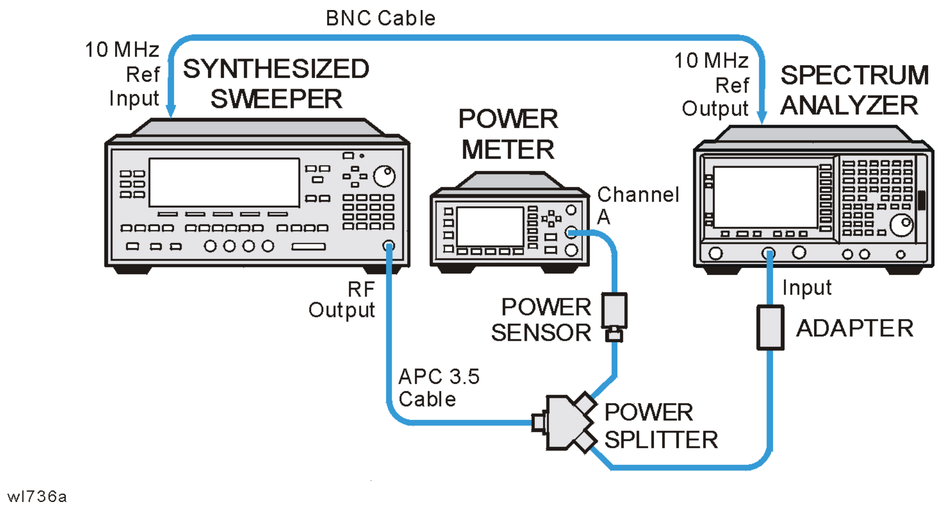
Table 2-49 Frequency response worksheet, ≤100 kHz

Frequency	DVM Amplitude	Response Relative to 100 kHz	Response Relative to 50 MHz
100 kHz		0 dB (Ref)	
75 kHz			
50 kHz			
20 kHz			
9 kHz			

Measuring Frequency Response, >3 GHz

1. Replace the Channel B power sensor with the microwave power sensor. Zero and calibrate the power sensor and power meter in log mode. Enter the 50 MHz calibration factor of the power sensor into the power meter.
2. Connect the equipment as shown in Figure 2-32.

Figure 2-32 Frequency Response Test Setup, >3 GHz



3. On the analyzer, press **FREQUENCY, 50 MHz, CF Step 200 MHz**.
4. Set the synthesized sweeper CW frequency to 50 MHz and FREQ STEP to 200 MHz.
5. Adjust the synthesized sweeper power level for a power meter reading of –10 dBm ±0.05 dB.
6. On the analyzer, press **Peak Search** (or **Search**).
7. On the analyzer, press **Marker, Delta**.
8. Activate the dB relative mode on the power meter. Power meter readings will now read out relative to the power meter reading at 50 MHz.
9. Set the synthesized sweeper CW frequency to the next frequency listed in Table 2-50.
10. Enter the appropriate power sensor calibration factor into the power meter.
11. On the analyzer, press **Peak Search** (or **Search**), **Amplitude**, **Presel Center**.

12.Adjust the synthesized sweeper power level until the analyzer ΔMkr1 amplitude reading is 0 dB ±0.05 dB.

13.Record the negative of the power meter reading in Table 2-50 as the Flatness Relative to 50 MHz.

14.Repeat step 9 through step 13 for frequencies up to 6.7 GHz in Table 2-50. On the analyzer, pressing **FREQUENCY,** ↑ will allow you to step through most of the frequencies. Similarly, on the synthesized sweeper, pressing **CW,** ↑ will allow you to step through most of the frequencies.

If using the E4404B, proceed to “Test Results”.

15.Set the analyzer center frequency by manually pressing **FREQUENCY, CF Step, 400 MHz**.

16.Set the synthesized sweeper FREQ STEP to 400 MHz.

17.Repeat step 9 through step 13 for frequencies up to 13.2 GHz in Table 2-50.

If using the E4404B or E4405B, proceed to “Test Results.”

18.Repeat step 9 through step 13 for the remaining frequencies in Table 2-50.

Table 2-50 Frequency response worksheet, >3 GHz

Frequency, GHz	Flatness Relative to 50 MHz (dB)
3.05 GHz	
3.1 GHz	
3.3 GHz	
3.5 GHz	
3.7 GHz	
3.9 GHz	
4.1 GHz	
4.3 GHz	
4.5 GHz	
4.7 GHz	
4.9 GHz	
5.1 GHz	
5.3 GHz	

Table 2-50 Frequency response worksheet, >3 GHz

Frequency, GHz	Flatness Relative to 50 MHz (dB)
5.5 GHz	
5.7 GHz	
5.9 GHz	
6.3 GHz	
6.5 GHz	
6.7 GHz	
6.8 GHz	
7.0 GHz	
7.4 GHz	
7.8 GHz	
8.2 GHz	
8.6 GHz	
9.0 GHz	
9.4 GHz	
9.8 GHz	
10.2 GHz	
11.0 GHz	
11.4 GHz	
11.8 GHz	
12.2 GHz	
12.6 GHz	
12.8 GHz	
13.2 GHz	
End of procedure for E4405B	
13.3 GHz	
13.7 GHz	
14.1 GHz	
14.5 GHz	

Table 2-50 Frequency response worksheet, >3 GHz

Frequency, GHz	Flatness Relative to 50 MHz (dB)
14.9 GHz	
15.3 GHz	
15.7 GHz	
16.1 GHz	
16.5 GHz	
16.9 GHz	
17.3 GHz	
17.7 GHz	
18.1 GHz	
18.5 GHz	
18.9 GHz	
19.3 GHz	
19.7 GHz	
20.1 GHz	
20.5 GHz	
20.9 GHz	
21.3 GHz	
21.7 GHz	
22.1 GHz	
22.5 GHz	
22.9 GHz	
23.3 GHz	
23.7 GHz	
24.1 GHz	
24.5 GHz	
24.9 GHz	
25.1 GHz	

Table 2-50 Frequency response worksheet, >3 GHz

Frequency, GHz	Flatness Relative to 50 MHz (dB)
25.3 GHz	
25.7 GHz	
26.1 GHz	
26.5 GHz	

Test Results

Perform the following steps to verify the frequency response of the analyzer:

1. Enter the most positive number from the Flatness Relative to 50 MHz column of Table 2-48:

   ____________ dB

2. Enter the most positive number from the response relative to 50 MHz column of Table 2-49:

   ____________ dB

3. Record the more positive of numbers from step 1 and step 2 as the maximum response for Band 0 in Table 2-51.
4. Enter the most negative number from the Flatness Relative to 50 MHz column of Table 2-48:

   ____________ dB

5. Enter the most negative number from the response relative to 50 MHz column of Table 2-49:

   ____________ dB

6. Record the more negative of numbers from step 4 and step 5 as the minimum response for Band 0 in Table 2-51.
7. Subtract the minimum response for Band 0 from the maximum response for Band 0 and record the result as the Peak-to-Peak response to Band 0 in Table 2-51.
8. Record the most positive number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 3.05 GHz to 6.7 GHz as the maximum response for Band 1 in Table 2-51.
9. Record the most negative number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 3.05 GHz to 6.7 GHz as the maximum response for Band 1 in Table 2-51.

10. Subtract the minimum response for Band 1 from the maximum response for Band 1 and record the result as the Peak-to-Peak response to Band 1 in Table 2-51.

End of procedure for E4404B.

11. Record the most positive number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 6.8 GHz to 13.2 GHz as the maximum response for Band 2 in Table 2-51.

12. Record the most negative number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 6.8 GHz to 13.2 GHz as the maximum response for Band 2 in Table 2-51.

13. Subtract the minimum response for Band 2 from the maximum response for Band 2 and record the result as the Peak-to-Peak response to Band 2 in Table 2-51.

End of procedure for E4405B.

14. Record the most positive number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 13.3 GHz to 24.9 GHz as the maximum response for Band 3 in Table 2-51.

15. Record the most negative number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 13.3 GHz to 24.9 GHz as the maximum response for Band 3 in Table 2-51.

16. Subtract the minimum response for Band 3 from the maximum response for Band 3 and record the result as the Peak-to-Peak response to Band 3 in Table 2-51.

17. Record the most positive number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 25.1 GHz to 26.5 GHz as the maximum response for Band 4 in Table 2-51.

18. Record the most negative number from the Flatness Relative to 50 MHz column of Table 2-50 for frequencies from 25.1 GHz to 26.5 GHz as the maximum response for Band 4 in Table 2-51.

19. Subtract the minimum response for Band 4 from the maximum response for Band 4 and record the result as the Peak-to-Peak response to Band 4 in Table 2-51.

Table 2-51 Frequency Response Results

Band	Maximum Response		Minimum Response		Peak-to-peak Response	
	dBm	TR Entry	dBm	TR Entry	dBm	TR Entry
0		1)		2)		3)
1		4)		5)		6)
2		7)		8)		9)
3		10)		11)		12)
4		13)		14)		15)

24. Frequency Response (Preamp On): Agilent E4401B

This test measures the amplitude error of the analyzer as a function of frequency. The output of a source is fed through a power splitter to a power sensor and the analyzer. The power level of the source is adjusted at 50 MHz to place the displayed signal at approximately –32 dBm. At each new source frequency and analyzer center frequency, the power level of the source is adjusted to place the signal at approximately –32 dBm.

For improved amplitude accuracy the power splitter is characterized using a specially-calibrated power sensor (the “reference” sensor) connected to one power splitter output port. The other power splitter output port connects to the “buried” sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the analyzer.

Analyzers with 75 Ω inputs are tested only down to 1 MHz.

This procedure only tests frequency response with the optional preamplifier (Option 1DS) turned on. Perform the “Frequency Response” procedure to test all other frequency response specifications.

The related adjustment for this performance test is “Frequency Response.”

Equipment Required

Synthesized signal generator
Power meter
RF power sensor (*2 required for 50 Ω inputs*)
20 dB fixed attenuator
Power splitter
Cable, Type-N (m), 183 cm
Cable, BNC, 120 cm
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to BNC (f)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Adapter, Type-N (m) 50 Ω to Type-N (f) 75 Ω, mechanical
Adapter, Type-N (m) to BNC (m), 75 Ω

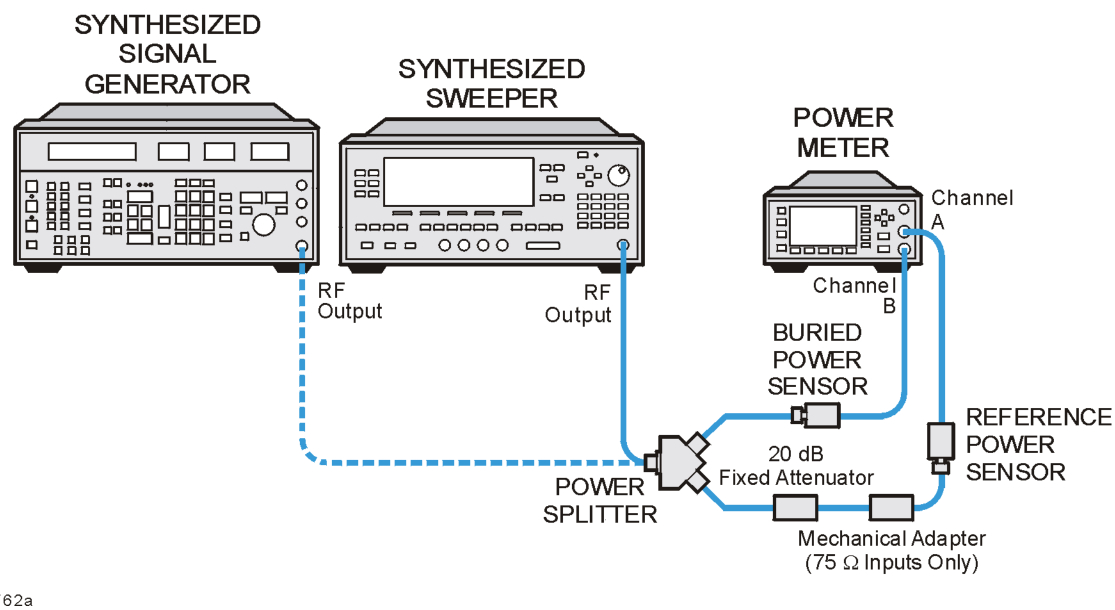
Procedure

Source/Splitter Characterization

1. Connect one RF power sensor to Channel A of the power meter. This will be the “reference” sensor. Connect the other RF power sensor to Channel B of the power meter. This will be the “buried” sensor. Refer to Figure 2-33.

   75 Ω inputs: Connect the 75 Ω power sensor to Channel A of the power meter. This will be the “reference” sensor.

Figure 2-33 Source/Splitter Characterization Setup



CAUTION	Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or damage to the connectors will occur.

2. Zero and calibrate both power sensors.
3. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor at 100 kHz.

   75 Ω inputs: Set the Channel A calibration factor to the calibration factor of the reference sensor at 1 MHz.

4. On the power meter, set the Channel B calibration factor to 100%. Do not change this calibration factor during this test.
5. Connect the equipment as shown in Figure 2-33. Use the synthesized signal generator as the source. Note that the reference sensor connects to the 20 dB fixed attenuator.

75 Ω inputs: Connect the reference sensor to the power splitter using the mechanical adapter.

6. Set the source frequency to 100 kHz and amplitude to 6 dBm.

   75 Ω inputs: Set the source frequency to 1 MHz and amplitude to 6 dBm.

7. Adjust the source amplitude to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.

8. Record the Channel A and Channel B power meter readings in Table 2-52.

9. Tune the source to the next frequency in Table 2-52.

10. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for the current source frequency.

11. Adjust the source amplitude to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.

12. Record the Channel A and Channel B power meter readings in Table 2-52.

13. Repeat step 9 through step 12 for each frequency in Table 2-52.

14. For each entry in Table 2-52, calculate the Splitter Tracking Error as follows:

    $$\text{Splitter Tracking Error} = \text{Channel A Power} - \text{Channel B Power}$$

    For example, if Channel A Power is –20.3 dBm and Channel B power is –0.23 dBm, the splitter tracking error is –20.07 dB.

Table 2-52 Source/Splitter Characterization

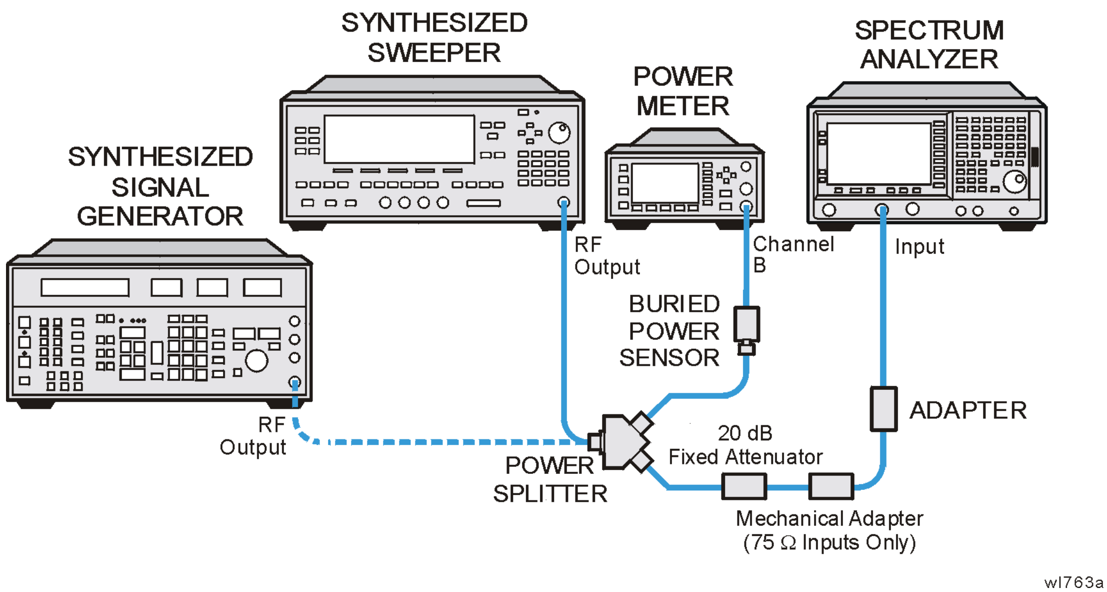
Frequency	Power Meter Reading		Splitter Tracking Error
	Channel A	Channel B	
100 kHz[a]			
500 kHz[a]			
1 MHz			
5 MHz			
10 MHz			
20 MHz			
50 MHz			
75 MHz			
175 MHz			
275 MHz			
375 MHz			
475 MHz			
575 MHz			
675 MHz			
775 MHz			
875 MHz			
975 MHz			
1075 MHz			
1175 MHz			
1275 MHz			
1375 MHz			
1500 MHz			

a. These values do not apply to analyzers with 75 Ω inputs (Option 1DP).

Measuring Frequency Response, Preamp On

1. Remove the reference sensor (Channel A sensor) from the 20 dB fixed attenuator. Connect the 20 dB fixed attenuator to the analyzer 50 Ω Input using an adapter. Do not use a cable. Refer to Figure 2-34.

Figure 2-34 Frequency Response Test Setup, Preamp On



75 Ω inputs: Connect the 20 dB fixed attenuator to the analyzer 75 Ω Input using a mechanical adapter and a 75 Ω, Type-N(m) to BNC(m) adapter.

2. Set the source frequency to 100 kHz:

   75 Ω inputs: Set the source frequency to 1 MHz.

3. Set the source amplitude to –6 dBm.

4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 100 kHz (*50 Ω Input*)
   FREQUENCY, Center Freq, 1 MHz (*75 Ω Input*)
   CF Step, 100 MHz
   SPAN, 20 kHz
   AMPLITUDE, More, Int Preamp (On)
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, –30 dBm
   Attenuation, **0 dB** (Man)
   Scale/Div, 2 dB
   BW/Avg, **Resolution BW**, **3 kHz** (Man)
   Video BW, 3 kHz (Man)

5. On the analyzer, press **Peak Search** (or **Search**).
6. Adjust the source amplitude to obtain a marker amplitude reading on the analyzer of –32.00 dBm ±0.2 dB.
7. Record the current Channel B power reading in Table 2-53 as the Current Channel B reading.
8. Record the Mkr1 amplitude reading in Table 2-53.
9. Set the source to the next frequency listed in Table 2-53.
10. Set the analyzer center frequency to the next frequency listed in Table 2-53.
11. On the analyzer, press **Peak Search** (or **Search**).
12. Adjust the source amplitude to obtain a marker amplitude reading on the analyzer of –32.00 dBm ±0.2 dB.
13. Record the current Channel B power reading in Table 2-53 as the Current Channel B reading.
14. Record the Mkr1 amplitude reading in Table 2-53 as Mkr1 Amptd.
15. Repeat step 9 through step 14 for each frequency in Table 2-53.
16. Copy the splitter tracking errors from Table 2-52 into Table 2-53.
17. Calculate the Flatness Error for each frequency in Table 2-53 as follows:

$$\text{Flatness Error} = \text{Mkr1 Amptd} - \text{Current Channel B} - \text{Splitter Tracking Error}$$

For example, if Mkr1 Amptd is –33.32 dBm, Current Channel B is –12.4 dBm, and Splitter Tracking Error is –20.07 dB, Flatness Error would be –0.85 dB.

18. Record the Flatness Error for 50 MHz below as the 50 MHz Ref Amptd:

50 MHz Ref Amptd __________

19. Calculate the Flatness Relative to 50 MHz for each frequency in Table 2-53 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd}$$

For example, if Flatness Error is –0.30 dB and 50 MHz Ref Amptd is 0.15 dB, Flatness Relative to 50 MHz would be –0.45 dB.

Table 2-53 Frequency Response Worksheet, Preamp On

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
100 kHz[a]					
500 kHz[a]					
1 MHz					
5 MHz					
10 MHz					
20 MHz					
50 MHz					0 dB (Ref)
75 MHz					
175 MHz					
275 MHz					
375 MHz					
475 MHz					
575 MHz					
675 MHz					
775 MHz					
875 MHz					
975 MHz					
1075 MHz					
1175 MHz					
1275 MHz					
1375 MHz					
1500 MHz					

a. These values do not apply to analyzers with 75 Ω inputs (Option 1DP).

Test Results

1. Record the most positive number from the Flatness Relative to 50 MHz column of Table 2-53 as the Maximum Response in Table 2-54 and as TR Entry 1 in the performance verification test record.
2. Record the most negative number from the Flatness Relative to 50 MHz column of Table 2-53 as the Minimum Response in Table 2-54 and as TR Entry 2 in the performance verification test record.
3. Subtract the Minimum Response value in Table 2-54 from the Maximum Response value in Table 2-54 and record the result as the Peak-to-Peak Response in Table 2-54 and as TR Entry 3 in the performance verification test record.

Table 2-54 Frequency Response Results

Maximum Response		Minimum Response		Peak-to-peak Response	
dBm	TR Entry	dBm	TR Entry	dBm	TR Entry
	1)		2)		3)

25. Frequency Response (Preamp On): Agilent E4402B

This test measures the amplitude error of the analyzer as a function of frequency. The output of a source is fed through a power splitter to a power sensor and the analyzer. The power level of the source is adjusted at 50 MHz to place the displayed signal at approximately –32 dBm. At each new source frequency and analyzer center frequency, the power level of the source is adjusted to place the signal at approximately –32 dBm.

For improved amplitude accuracy the power splitter is characterized using a specially-calibrated power sensor (the “reference” sensor) connected to one power splitter output port. The other power splitter output port connects to the “buried” sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the analyzer.

This procedure only tests frequency response with the optional preamplifier (Option 1DS) turned on. Perform the “Frequency Response” procedure to test all other frequency response specifications.

The related adjustment for this performance test is “Frequency Response.”

Equipment Required

Function generator
Synthesized sweeper
Power meter
RF power sensor (*2 required*)
20 dB fixed attenuator
Power splitter
Cable, Type-N (m), 183 cm
Cable, BNC, 120 cm
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to BNC (f)

Procedure

Source/Splitter Characterization

1. Connect one RF power sensor to Channel A of the power meter. This will be the “reference” sensor. Connect the other RF power sensor to Channel B of the power meter. This will be the “buried” sensor.

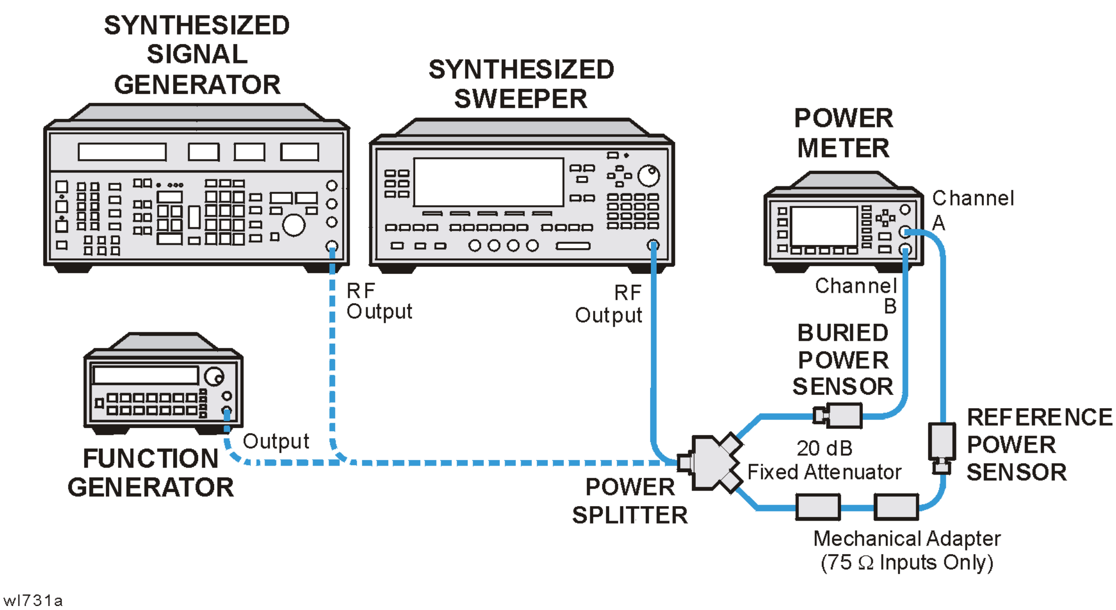
2. Zero and calibrate both power sensors.

3. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor at 1 MHz.

4. On the power meter, set the Channel B calibration factor to 100%. Do not change this calibration factor during this test.

5. Connect the equipment as shown in Figure 2-35. Use the function generator as the source. Note that the reference sensor connects to the 20 dB fixed attenuator.

Figure 2-35 Source/Splitter Characterization Setup



6. Set the function generator frequency to 1 MHz and amplitude to 450 mV rms (approximately 6 dBm).

7. Adjust the source amplitude to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.

8. Record the Channel A and Channel B power meter readings in Table 2-55.

9. Tune the source to the next frequency in Table 2-55.

10. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for the current source frequency.

11. Adjust the source amplitude to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.

12. Record the Channel A and Channel B power meter readings in Table 2-55.

13. Repeat step 9 through step 12 for frequencies up to 10 MHz.

14.Replace the function generator with the synthesized sweeper.

15.Set the synthesized sweeper CW frequency to 10 MHz and the amplitude to 6 dBm.

16.Adjust the synthesized sweeper power level to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.

17.Record the synthesized sweeper power level and both the Channel A and Channel B power meter readings in Table 2-55.

18.Repeat step 9 through step 12 for each remaining frequency in Table 2-55.

19.For each entry in Table 2-55, calculate the Splitter Tracking Error as follows:

$$\text{Splitter Tracking Error} = \text{Channel A Power} - \text{Channel B Power}$$

For example, if Channel A Power is –20.3 dBm and Channel B power is –0.23 dBm, the splitter tracking error is –20.07 dB.

Table 2-55 Source/Splitter Characterization

Frequency	Power Meter Reading		Splitter Tracking Error
	Channel A	Channel B	
1 MHz			
5 MHz			
10 MHz[a]			
10 MHz[b]			
20 MHz			
50 MHz			
75 MHz			
175 MHz			
275 MHz			
375 MHz			
475 MHz			
575 MHz			
675 MHz			
775 MHz			
875 MHz			
975 MHz			

Table 2-55 Source/Splitter Characterization

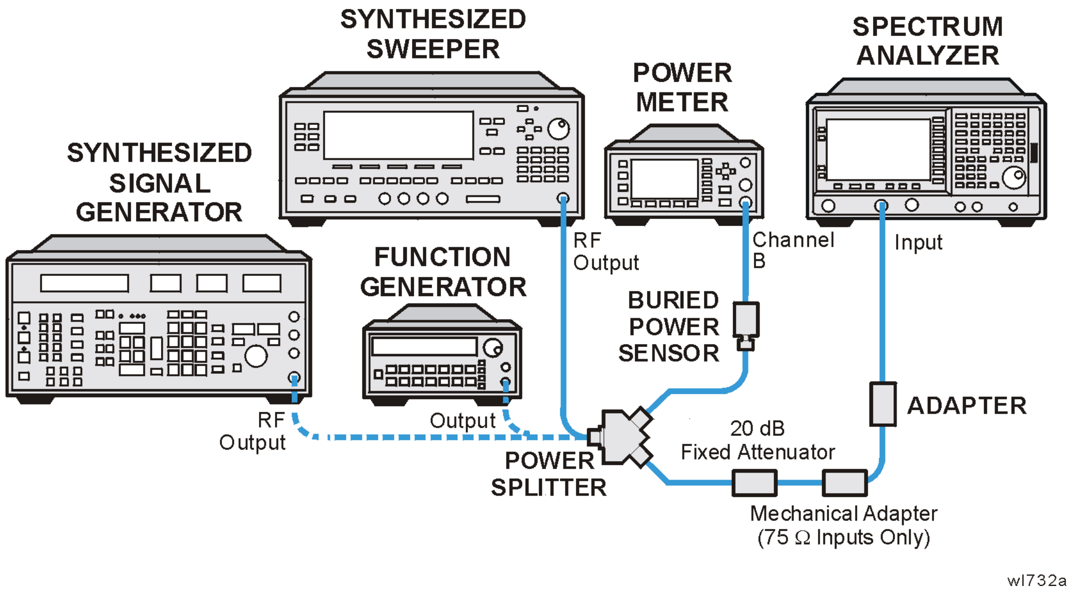
Frequency	Power Meter Reading		Splitter Tracking Error
	Channel A	Channel B	
1075 MHz			
1175 MHz			
1275 MHz			
1375 MHz			
1500 MHz			
1525 MHz			
1725 MHz			
1925 MHz			
2125 MHz			
2325 MHz			
2525 MHz			
2725 MHz			
2925 MHz			
3000 MHz			

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Measuring Frequency Response, Preamp On

1. Remove the reference sensor (Channel A sensor) from the 20 dB fixed attenuator. Connect the 20 dB fixed attenuator to the 50 Ω Input of the analyzer using an adapter. Do not use a cable. Refer to Figure 2-36.
2. Set the source frequency at 10 MHz.
3. Set the source power level to –6 dBm.

Figure 2-36 Frequency Response Test Setup, Preamp On



4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 10 MHz
   CF Step, 100 MHz
   SPAN, 20 kHz
   AMPLITUDE, More, Int Preamp, On
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, –30 dBm
   Attenuation, **0 dB** (Man)
   Scale/Div, 2 dB
   BW/Avg, **Resolution BW**, **3 kHz** (Man)
   Video BW, **3 kHz** (Man)

5. On the analyzer, press **Peak Search** (or **Search**).

6. Adjust the source power level to obtain a marker amplitude reading on the analyzer of –32.00 dBm ±0.2 dB.

7. Record the current Channel B power reading in Table 2-56 as the Current Channel B Reading.

8. Record the Mkr1 amplitude reading in Table 2-56.

9. Set the source to the next frequency listed in Table 2-56.

10. Set the analyzer center frequency to the next frequency listed in Table 2-56.

11. On the analyzer, press **Peak Search** (or **Search**).

12. Adjust the source power level to obtain a marker amplitude reading on the analyzer of –32.00 dBm ±0.2 dB.

13. Record the current Channel B power reading in Table 2-56 as the current Channel B reading.

14. Record the Mkr1 amplitude reading in Table 2-56.

15. Repeat step 9 through step 14 for frequencies up to 3.0 GHz in Table 2-56.

16. Replace the synthesized sweeper with a function generator.

17. Set the function generator amplitude to 112 mV rms (–6 dBm or –12 dBm plus nominal power splitter insertion loss).

18. Set the function generator frequency to 1 MHz.

19. Set the analyzer center frequency to 1 MHz.

20. On the analyzer, press **Peak Search** (or **Search**).

21. Adjust the function generator amplitude to obtain a marker amplitude reading of –32.00 dBm ±0.2 dB.

22. Record the current Channel B power reading in Table 2-56 as the current Channel B reading.

23. Record the analyzer Mkr1 amplitude reading in Table 2-56 as Mkr1 amplitude.

24. Repeat step 18 through step 23 for frequencies between 100 kHz and 10 MHz.

25. Copy the Splitter Tracking Error values from Table 2-55 into Table 2-56.

26. Calculate the Flatness Error for each frequency in Table 2-56 as follows:

$$\text{Flatness Error} = \text{Mkr1 Amptd} - \text{Current Channel B} - \text{Splitter Tracking Error}$$

For example, if Mkr1 Amptd is –33.32 dBm, Current Channel B is –12.4 dBm, and Splitter Tracking Error is –20.07 dB, Flatness Error would be –0.85 dB.

27. Record the Flatness Error for 50 MHz below as the 50 MHz Ref Amptd:

50 MHz Ref Amptd: __________ dB

28. Calculate the Setup Change Error (error due to changing the test setup from using a synthesized sweeper to using a function generator) as follows:

a. Record the Flatness Error from Table 2-56 at 10 MHz using the function generator as FlatError_{FG}:

FlatError_{FG}=__________ dB

b. Record the Flatness Error from Table 2-56 at 10 MHz using the synthesized sweeper as $FlatError_{SS}$:

$FlatError_{SS}$=__________ dB

c. Subtract $FlatError_{FG}$ from $FlatError_{SS}$ and record the result as the Setup Change Error:

$$\text{Setup Change Error} = FlatError_{FG} - FlatError_{SS}$$

Setup Change Error =__________ dB

29. For frequencies less than 10 MHz calculate the Flatness Relative to 50 MHz for each frequency in Table 2-56 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd} - \text{Setup Change Error}$$

For example, if Flatness Error is –0.30 dB, 50 MHz Ref Amptd is 0.15 dB, and Setup Change Error is –0.19 dB, Flatness Relative to 50 MHz would be –0.26 dB.

30. For frequencies 10 MHz and above, calculate the Flatness Relative to 50 MHz for each frequency in Table 2-56 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd}$$

For example, if Flatness Error is –0.30 dB and 50 MHz Ref Amptd is 0.15 dB, Flatness Relative to 50 MHz would be –0.45 dB.

Table 2-56 Frequency Response Worksheet, Preamp On

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
1 MHz					
5 MHz					
10 MHz[a]					
10 MHz[b]					
20 MHz					
50 MHz					0 dB (Ref)
75 MHz					
175 MHz					
275 MHz					
375 MHz					
475 MHz					

Table 2-56 Frequency Response Worksheet, Preamp On

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
575 MHz					
675 MHz					
775 MHz					
875 MHz					
975 MHz					
1075 MHz					
1175 MHz					
1275 MHz					
1375 MHz					
1525 MHz					
1525 MHz					
1725 MHz					
1925 MHz					
2125 MHz					
2325 MHz					
2525 MHz					
2725 MHz					
2925 MHz					
3000 MHz					

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Test Results

1. Record the most positive number from the Flatness Relative to 50 MHz column of Table 2-56 as the Maximum Response in Table 2-57 and as TR Entry 1 in the performance verification test record.
2. Record the most negative number from the Flatness Relative to 50 MHz column of Table 2-56 as the Minimum Response in Table 2-57 and as TR Entry 2 in the performance verification test record.

3. Subtract the Minimum Response value in Table 2-57 from the Maximum Response value in Table 2-57 and record the result as the Peak-to-Peak Response in Table 2-57 and as TR Entry 3 in the performance verification test record.

Table 2-57 Frequency Response Results

Maximum Response		Minimum Response		Peak-to-peak Response	
dBm	TR Entry	dBm	TR Entry	dBm	TR Entry
	1)		2)		3)

26. Frequency Response (Preamp On): Agilent E4404B, E4405B, and E4407B

This test measures the amplitude error of the analyzer as a function of frequency. The output of a source is fed through a power splitter to a power sensor and the analyzer. The power level of the source is adjusted at 50 MHz to place the displayed signal at approximately –32 dBm. At each new source frequency and analyzer center frequency, the power level of the source is adjusted to place the signal at approximately –32 dBm.

For improved amplitude accuracy the power splitter is characterized using a specially-calibrated power sensor (the “reference” sensor) connected to one power splitter output port. The other power splitter output port connects to the “buried” sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the analyzer.

This procedure only tests frequency response with the optional preamplifier (Option 1DS) turned on. Perform the “Frequency Response” procedure to test all other frequency response specifications.

The related adjustment for this performance test is “Frequency Response.”

Equipment Required

Function generator
Synthesized sweeper
Power meter
RF power sensor (*2 required*)
20 dB fixed attenuator
Power splitter
Cable, Type-N (m), 183 cm
Cable, BNC, 120 cm
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to BNC (f)

Additional Equipment for Option BAB

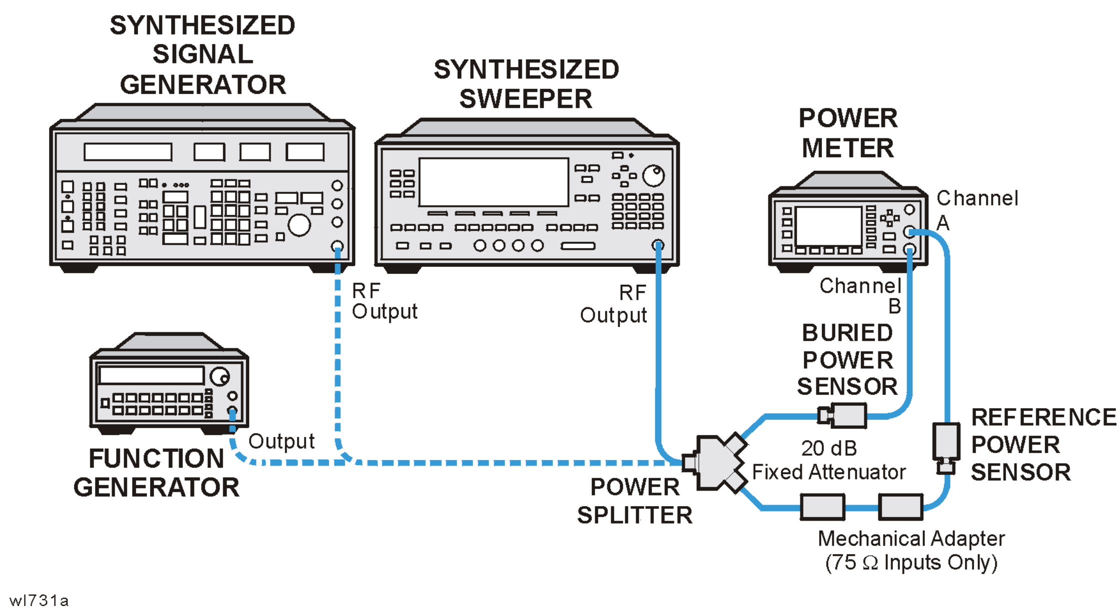
Adapter, Type-N (m) to APC 3.5 (f)

Procedure

Source/Splitter Characterization

1. Connect one RF power sensor to Channel A of the power meter. This will be the “reference” sensor. Connect the other RF power sensor to Channel B of the power meter. This will be the “buried” sensor.
2. Zero and calibrate both power sensors.
3. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor at 1 MHz.
4. On the power meter, set the Channel B calibration factor to 100%. Do not change this calibration factor during this test.
5. Connect the equipment as shown in Figure 2-37. Use the function generator as the source. Note that the reference sensor connects to the 20 dB fixed attenuator.

Figure 2-37 Source/Splitter Characterization Setup



6. Set the function generator frequency to 1 MHz and amplitude to 446 mV rms (approximately 6 dBm).
7. Adjust the source amplitude to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.
8. Record the Channel A and Channel B power meter readings in Table 2-58.
9. Tune the source to the next frequency in Table 2-58.

10.On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for the current source frequency.

11.Adjust the source amplitude to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.

12.Record the Channel A and Channel B power meter readings in Table 2-58.

13.Repeat step 9 through step 12 for frequencies up to 10 MHz.

14.Replace the function generator with the synthesized sweeper.

15.Set the synthesized sweeper CW frequency to 10 MHz and the amplitude to 6 dBm.

16.Adjust the synthesized sweeper power level to obtain a Channel A power meter reading of –20 dBm ±0.1 dB.

17.Record the synthesized sweeper power level and both the Channel A and Channel B power meter readings in Table 2-58.

18.Repeat step 9 through step 12 for each remaining frequency in Table 2-58.

19.For each entry in Table 2-58, calculate the Splitter Tracking Error as follows:

$$\text{Splitter Tracking Error} = \text{Channel A Power} - \text{Channel B Power}$$

For example, if Channel A Power is –20.3 dBm and Channel B power is –0.23 dBm, the splitter tracking error is –20.07 dB.

Table 2-58 Source/Splitter Characterization

Frequency	Power Meter Reading		Splitter Tracking Error
	Channel A	Channel B	
1 MHz			
5 MHz			
10 MHz[a]			
10 MHz[b]			
20 MHz			
50 MHz			
75 MHz			
175 MHz			

Table 2-58 Source/Splitter Characterization

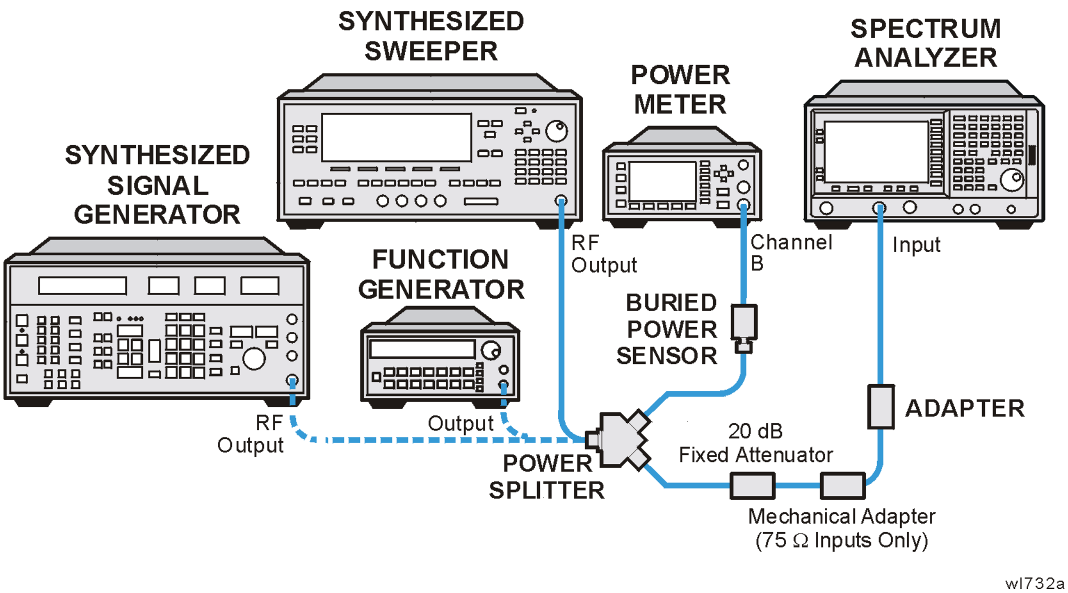
Frequency	Power Meter Reading		Splitter Tracking Error
	Channel A	Channel B	
275 MHz			
375 MHz			
475 MHz			
575 MHz			
675 MHz			
775 MHz			
875 MHz			
975 MHz			
1075 MHz			
1175 MHz			
1275 MHz			
1375 MHz			
1500 MHz			
1525 MHz			
1725 MHz			
1925 MHz			
2125 MHz			
2325 MHz			
2525 MHz			
2725 MHz			
2925 MHz			
3000 MHz			

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Measuring Frequency Response, Preamp On

1. Remove the reference sensor (Channel A sensor) from the 20 dB fixed attenuator. Connect the 20 dB fixed attenuator to the 50 Ω Input of the analyzer using an adapter. Do not use a cable. Refer to Figure 2-27.

Figure 2-38 Frequency Response Test Setup, Preamp On



2. Set the source frequency at 10 MHz.

3. Set the source power level to –6 dBm.

4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 10 MHz
   CF Step, 100 MHz
   SPAN, 20 kHz
   Input/Output (or **Input**), **Coupling**, (DC) *(E4404B and E4405B)*
   AMPLITUDE, More, Int Preamp, On
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, –30 dBm
   Attenuation, **0 dB** (Man)
   Scale/Div, 2 dB
   BW/Avg, **Resolution BW**, **3 kHz** (Man)
   Video BW, 3 kHz (Man)

5. On the analyzer, press **Peak Search** (or **Search**).

6. Adjust the source power level to obtain a marker amplitude reading on the analyzer of –32.00 dBm ±0.2 dB.

7. Record the current Channel B power reading in Table 2-59 as the Current Channel B Reading.
8. Record the Mkr1 amplitude reading in Table 2-59.
9. Set the source to the next frequency listed in Table 2-59.
10. Set the analyzer center frequency to the next frequency listed in Table 2-59.
11. On the analyzer, press **Peak Search** (or **Search**).
12. Adjust the source power level to obtain a marker amplitude reading on the analyzer of –32.00 dBm ±0.2 dB.
13. Record the current Channel B power reading in Table 2-59 as the current Channel B reading.
14. Record the Mkr1 amplitude reading in Table 2-59.
15. Repeat step 9 through step 14 for frequencies up to 3.0 GHz in Table 2-59.
16. Replace the synthesized sweeper with a function generator.
17. Set the function generator amplitude to 112 mV rms (–6 dBm or –12 dBm plus nominal power splitter insertion loss).
18. Set the function generator frequency to 1 MHz.
19. Set the analyzer center frequency to 1 MHz.
20. On the analyzer, press **Peak Search** (or **Search**).
21. Adjust the function generator amplitude to obtain a marker amplitude reading of –32.00 dBm ±0.2 dB.
22. Record the current Channel B power reading in Table 2-59 as the current Channel B reading.
23. Record the analyzer Mkr1 amplitude reading in Table 2-59 as Mkr1 amplitude.
24. Repeat step 18 through step 23 for frequencies between 100 kHz and 10 MHz.
25. Copy the Splitter Tracking Error values from Table 2-58 into Table 2-59.
26. Calculate the Flatness Error for each frequency in Table 2-59 as follows:

$$\text{Flatness Error} = \text{Mkr1 Amptd} - \text{Current Channel B} - \text{Splitter Tracking Error}$$

For example, if Mkr1 Amptd is –33.32 dBm, Current Channel B is –12.4 dBm, and Splitter Tracking Error is –20.07 dB, Flatness Error would be –0.85 dB.

27. Record the Flatness Error for 50 MHz below as the 50 MHz Ref Amptd:

    50 MHz Ref Amptd: __________

28. Calculate the Setup Change Error (error due to changing the test setup from using a synthesized sweeper to using a function generator) as follows:

    a. Record the Flatness Error from Table 2-59 at 10 MHz using the function generator as $FlatError_{FG}$:

       $FlatError_{FG}$=__________ dB

    b. Record the Flatness Error from Table 2-59 at 10 MHz using the synthesized sweeper as $FlatError_{SS}$:

       $FlatError_{SS}$=__________ dB

    c. Subtract $FlatError_{FG}$ from $FlatError_{SS}$ and record the result as the Setup Change Error:

$$\text{Setup Change Error} = \text{FlatError}_{FG} - \text{FlatError}_{SS}$$

       Setup Change Error =__________ dB

29. For frequencies less than 10 MHz calculate the Flatness Relative to 50 MHz for each frequency in Table 2-59 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd} - \text{Setup Change Error}$$

    For example, if Flatness Error is –0.30 dB, 50 MHz Ref Amptd is 0.15 dB, and Setup Change Error is –0.19 dB, Flatness Relative to 50 MHz would be –0.26 dB.

30. For frequencies 10 MHz and above, calculate the Flatness Relative to 50 MHz for each frequency in Table 2-59 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd}$$

    For example, if Flatness Error is –0.30 dB and 50 MHz Ref Amptd is 0.15 dB, Flatness Relative to 50 MHz would be –0.45 dB.

Table 2-59 Frequency Response Worksheet, Preamp On

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
1 MHz					
5 MHz					
10 MHz[a]					
10 MHz[b]					
20 MHz					
50 MHz					0 dB (Ref)
75 MHz					
175 MHz					
275 MHz					
375 MHz					
475 MHz					
575 MHz					
675 MHz					
775 MHz					
875 MHz					
975 MHz					
1075 MHz					
1175 MHz					
1275 MHz					
1375 MHz					
1525 MHz					
1525 MHz					
1725 MHz					
1925 MHz					
2125 MHz					
2325 MHz					
2525 MHz					
2725 MHz					

Table 2-59 Frequency Response Worksheet, Preamp On

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
2925 MHz					
3000 MHz					

a. This entry is for data taken with the function generator as source.
b. This entry is for data taken with the synthesized sweeper as source.

Test Results

1. Record the most positive number from the Flatness Relative to 50 MHz column of Table 2-59 as the Maximum Response in Table 2-60 and as TR Entry 1 in the performance verification test record.
2. Record the most negative number from the Flatness Relative to 50 MHz column of Table 2-59 as the Minimum Response in Table 2-60 and as TR Entry 2 in the performance verification test record.
3. Subtract the Minimum Response value in Table 2-60 from the Maximum Response value in Table 2-60 and record the result as the Peak-to-Peak Response in Table 2-60 and as TR Entry 3 in the performance verification test record.

Table 2-60 Frequency Response Results

Maximum Response		Minimum Response		Peak-to-peak Response	
dBm	TR Entry	dBm	TR Entry	dBm	TR Entry
	1)		2)		3)

27. Other Input-Related Spurious Responses: Agilent E4401B and E4411B

This test measures the ability of the analyzer to reject image and multiple responses. A synthesized source and the analyzer are set to the same frequency and the amplitude of the source is set to –20 dBm. A marker amplitude reference is set on the analyzer. The source is then tuned to several different frequencies which should generate image and multiple responses. At each source frequency, the source amplitude is set to –20 dBm and the amplitude of the response, if any, is measured using the analyzer marker functions.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized signal generator
Power meter
RF power sensor
Adapter, Type-N (f) to APC 3.5 (f)
Adapter, Type-N (f) to Type-N (f)
Cable, Type-N, 152-cm (60-in)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Adapter, Type-N (f), to BNC (m), 75 Ω
Adapter, BNC (m), to BNC (m), 75 Ω
Pad, minimum loss

Procedure

1. Zero and calibrate the power meter and RF power sensor in log mode (power reads out in dBm), as described in the power meter operation manual. Enter the 500 MHz calibration factor of the power sensor into the power meter.

   75 Ω *Input only: Use a 75* Ω *power sensor.*

2. Press **Preset** on the synthesized sweeper and set the controls as follows:

   CW, **542.8 MHz**
   POWER LEVEL, **–10 dBm**

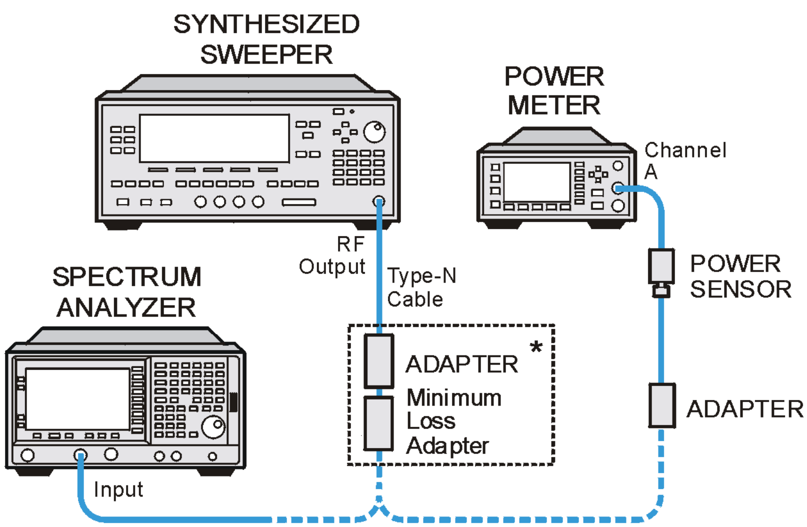
3. Connect the equipment as shown in Figure 2-39 with the output of the synthesized sweeper connected to the power sensor using an adapter between the cable and the power sensor.

75 Ω *Input only: Use the minimum loss pad and 75* Ω *adapters to connect to the 75* Ω *power sensor.*

4. Adjust the power level of the synthesized sweeper for a –10 dBm ±0.1 dB reading on the power meter.

5. On the synthesized sweeper, press **SAVE**, **1**.

Figure 2-39 Other Input Related Spurious Responses Power Setting Setup



6. Set the CW frequency on the synthesized sweeper to 510.7 MHz.

7. Adjust the synthesized sweeper power level for a –10 dBm ±0.1 dB reading on the power meter.

8. On the synthesized sweeper, press **SAVE 2**.

9. Enter the 1 GHz calibration factor for the power sensor into the power meter.

10. Set the CW frequency on the synthesized sweeper to 1310.7 MHz.

11. Adjust the synthesized sweeper power level for a –10 dBm ±0.1 dB reading on the power meter.

12. On the synthesized sweeper, press **SAVE 3.**

13. Enter the 100 MHz calibration factor of the power sensor into the power meter.

14. Set the CW frequency of the synthesized sweeper to 100 MHz.

15. Adjust the synthesized sweeper power level for a –10 dBm ±0.1 dB reading on the power meter.

16. On the synthesized sweeper, press **SAVE 4.**

Table 2-61 Other Input-Related Spurious Responses Worksheet

Synthesized Sweeper CW Frequency			TR Entry (Mkr Δ)
Save Register	CW	Power Level	
1	542.8 MHz[a]	542.8 MHz	**1)**
2	510.7 MHz[b]	510.7 MHz	**2)**
3	1310.7 MHz[b]	1310.7 MHz	**3)**
4	100 MHz	1310.7 MHz	N/A

a. Image response
b. Multiple response

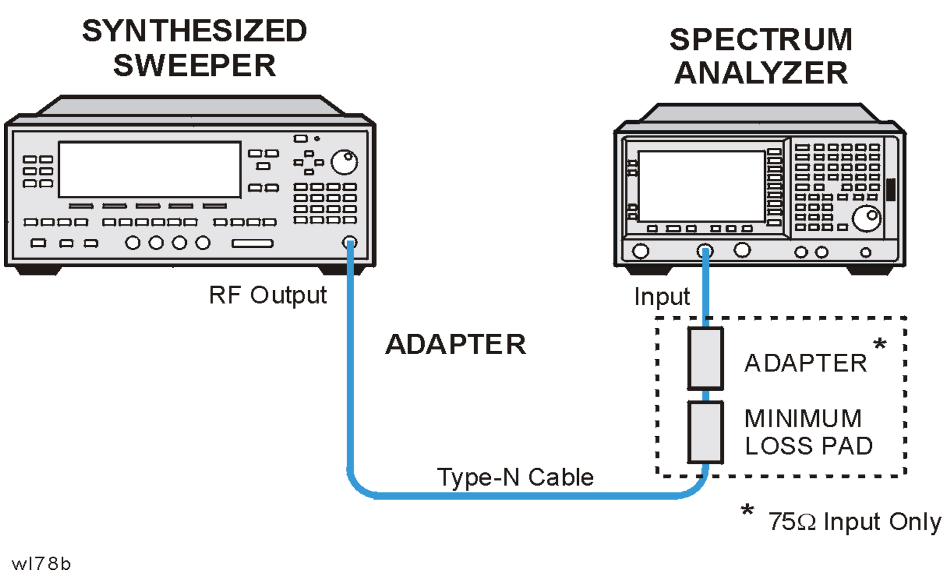
17. Set the CW frequency on the synthesized sweeper to 500 MHz.

18. Adjust the power level of the synthesized sweeper for a –10 dBm ±0.1 dB reading on the power meter.

19. Connect the synthesized sweeper to the Input of the analyzer using the appropriate cable and adapters. See Figure 2-40.

    75 Ω *Input only: Use the minimum loss pad and a 75 Ω adapter as shown in* Figure 2-40.

Figure 2-40 Other Input Related Spurious Responses Measurement Setup



20. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

    Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
    FREQUENCY, **Center Freq, 500 MHz**
    SPAN, **200 kHz**
    AMPLITUDE, **Attenuation**, **10 dB** (Man)
    Peak Search (or **Search**), **Meas Tools, Mkr** → **Ref Lvl**
    Peak Search (or **Search**), **Meas Tools**, **Delta**
    Single

21. On the synthesized sweeper, press **RECALL**, **1**.

22. On the analyzer, press **Single** and wait for the completion of a new sweep.

23. On the analyzer, press **Peak Search** (or **Search**)**,** and record the ΔMkr1 amplitude in the performance verification test record as indicated in Table 2-61.

24. On the synthesized sweeper, press **RECALL**, **2**.

25. On the analyzer, press **Single** and wait for the completion of a new sweep.

26. On the analyzer, press **Peak Search** (or **Search**)**,** record the ΔMkr1 amplitude in the performance verification test record as indicated in Table 2-61.

27. On the synthesized sweeper, press **RECALL, 4.**

28. On the analyzer press the following keys:

    FREQUENCY, 100 MHz
    AMPLITUDE, –5 dBm *(50 Ω Input)*
    AMPLITUDE, 48.75 dBmV *(75 Ω Input)*
    Marker, Normal
    Sweep, Sweep (Cont)
    Peak Search (or **Search**), **Meas Tools, Mkr** → **Ref Lvl**
    Peak Search (or **Search**), **Meas Tools**, **Delta**
    Single

29. On the synthesized sweeper, press **RECALL 3** for a CW frequency of 1310.7 MHz.

30. Press **Single** on the analyzer and wait for a completion of a new sweep.

31. On the analyzer, press **Peak Search** (or **Search**) and record the ΔMkr1 amplitude in the performance test record as indicated in Table 2-61.

28. Other Input-Related Spurious Responses: Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B

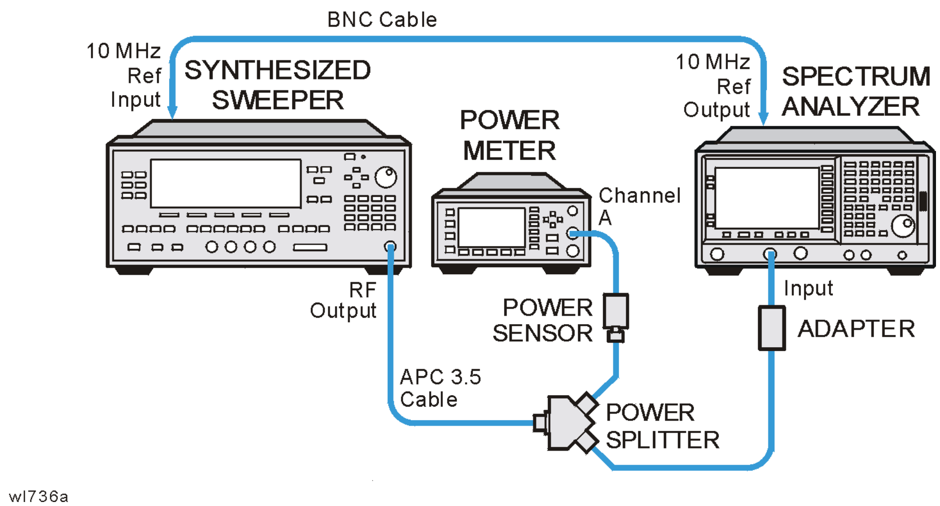
This test measures the ability of the analyzer to reject image, multiple, and out-of-band responses. A synthesized source and the analyzer are set to the same frequency and the amplitude of the source is set to –10 dBm and –20 dBm. A marker amplitude reference is set on the analyzer for each source amplitude setting. The source is then tuned to several different frequencies which should generate image, multiple, and out-of-band responses. At each source frequency, the source amplitude is set to the appropriate amplitude and the amplitude of the response, if any, is measured using the analyzer marker functions.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper
Power meter
RF power sensor, (*E4402B, E4403B*)
Microwave power sensor (*E4404B, E4405B, E4407B, E4408B*)
RF power splitter (*E4402B, E4403B*)
Microwave power splitter (*E4404B, E4405B, E4407B, E4408B*)
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to APC 3.5 (m)
Adapter, APC 3.5 (f) to APC 3.5 (f)
Cable, APC 3.5, 91 cm (36 in)

Figure 2-41 Other Input-Related Spurious Responses Test Setup



Procedure

Band 0

1. Zero and calibrate the power meter and power sensor in log mode (power reads out in dBm), as described in the power meter operation manual. Enter the power sensor 2 GHz calibration factor into the power meter.

2. Preset the synthesized sweeper and set the controls as follows:

   CW, **2000 MHz**
   POWER LEVEL, **–4 dBm**

3. Connect the equipment as shown in Figure 2-41. The analyzer provides the 10 MHz reference for the synthesized sweeper.

4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 2 GHz
   SPAN, 200 kHz
   AMPLITUDE, Ref Level –10 dBm
   AMPLITUDE, Attenuation 0 dBm (Man)

5. Adjust the synthesized sweeper power level for a –10 dBm ±0.1 dB reading on the power meter.

6. On the analyzer, press **Single**, and wait for the sweep to finish. Then press following keys:

   Marker, **Select Marker** (1)
   Peak Search (or **Search**)
   Meas Tools
   Delta

   The signal peak might be slightly above the reference level, but the marker function can still make an accurate measurement.

7. Adjust the synthesized sweeper power level for a –20 dBm ±0.1 dB reading on the power meter.

8. On the analyzer, press **Single**, and wait for the sweep to finish. Press following keys:

   Marker, **Select Marker** (2)
   Peak Search (or **Search**)
   Meas Tools
   Delta

9. On the analyzer, press **AMPLITUDE**, **Ref Level**, **–30 dBm**.

10. Repeat step a through step h using the data in Table 2-62 for Band 0.

a. Set the synthesized sweeper to the listed CW frequency.

Do not set the synthesized sweeper to frequencies outside the frequency range of the analyzer.

b. Enter the appropriate power sensor calibration factor into the power meter.

c. Adjust the synthesized sweeper power level until the power meter reading is equal to the Mixer Level in Table 2-62, ±0.1 dB.

d. On the analyzer, press **Single** and wait for the completion of a new sweep. Then, press **Peak Search** (or **Search**).

e. If the Mixer Level in Table 2-62 is –20 dBm, press **Marker**, **Select Marker** (2).

f. If the Mixer Level in Table 2-62 is –10 dBm, press **Marker**, **Select Marker** (1).

g. On the analyzer, press **Peak Search** (or **Search**).

h. Record the ΔMkr amplitude reading in Table 2-62.

11.On the analyzer, press the following keys:

Marker, **More**, **Marker All Off**
Auto Couple
SPAN, **1 MHz**
AMPLITUDE, **Ref Level**, **–10 dBm**
AMPLITUDE, **Attenuation**, **0 dB**
Sweep, **Sweep** (Cont)

NOTE End of procedure for E4402B and E4403B.

Band 1

12.On the analyzer, press the following keys:

FREQUENCY
Center Freq, 4 GHz

13.On the synthesized sweeper, press **CW**, **4 GHz**.

14.Enter the power sensor 4 GHz calibration factor into the power meter.

15.On the analyzer, press the following keys:

Marker, **More**, **Marker All Off**
Amplitude, Presel Center

16.Repeat step 5 through step 11 for the synthesized sweeper CW frequencies listed in Table 2-62 for Band 1.

NOTE End of procedure for E4404B.

Band 2

17. On the analyzer, press the following keys:

FREQUENCY, Center Freq, 9 GHz

18. On the synthesized sweeper, press **CW**, **9 GHz**.

19. Enter the power sensor 9 GHz calibration factor into the power meter.

20. On the analyzer press the following keys:

AMPLITUDE, **Presel Center**
Marker, **More**, **Marker All Off**

21. Repeat step 5 through step 11 for the synthesized sweeper CW frequencies listed in Table 2-62 for Band 2.

NOTE End of procedure for E4405B.

Band 3

22. On the analyzer, press the following keys:

FREQUENCY
Center Freq, 15 GHz

23. On the synthesized sweeper, press: **CW**, **15 GHz**.

24. Enter the power sensor 15 GHz calibration factor into the power meter.

25. On the analyzer press the following keys:

AMPLITUDE, **Presel Center**
Marker, **More**, **Marker All Off**

26. Repeat step 5 through step 11 for the synthesized sweeper CW frequencies listed in Table 2-62 for Band 3 for the 15 GHz analyzer center frequency.

Band 4

27. On the analyzer, press:

FREQUENCY, Center Freq, 21 GHz

28. On the synthesized sweeper, press: **CW**, **21 GHz**.

29. Enter the power sensor 21 GHz calibration factor into the power meter.

30. On the analyzer, press **AMPLITUDE, Presel Center**.

31.On the analyzer, press the following:

Marker, More, Marker All Off

32.Repeat step 5 through step 11 for the synthesized sweeper CW frequencies listed in Table 2-62 for Band 4 for the 21 GHz analyzer center frequency.

Table 2-62 Other Input-Related Spurious Responses

Band	Analyzer Center Frequency (GHz)	Synthesized Sweeper CW Frequency (MHz)	Mixer Level (dBm)	ΔMkr1 or ΔMkr2 Amplitude
0	2.0	2042.8[a]	–20	
	2.0	2642.8[a]	–20	
	2.0	1820.8[b]	–20	
	2.0	278.5[c]	–20	
Note: The following data applies only to the E4404B, E4405B, E4407B and E4408B				
0	2.0	5600.0[c]	–10	
	2.0	6242.8[b]	–10	
1	4.0	4042.8[a]	–20	
	4.0	4642.8[a]	–20	
	4.0	3742.9[b]	–20	
	4.0	2242.8[c]	–10	
Note: The following data applies only to the E4405B, E4407B and E4408B				
2	9.0	9042.8[a]	–20	
	9.0	9642.8[a]	–20	
	9.0	4982.1[b]	–20	
	9.0	9342.8[c]	–10	
Note: The following data applies only to the E4407B and E4408B				
3	15.0	15042.8[a]	–20	
	15.0	15642.8[a]	–20	

Table 2-62 Other Input-Related Spurious Responses

Band	Analyzer Center Frequency (GHz)	Synthesized Sweeper CW Frequency (MHz)	Mixer Level (dBm)	ΔMkr1 or ΔMkr2 Amplitude
	15.0	18830.35[b]	–20	
	15.0	4151.75[c]	–10	
4	21.0	21042.8[a]	–20	
	21.0	21642.8[a]	–20	
	21.0	21342.8[b]	–20	
	21.0	5008.95[c]	–10	

a. Image response
b. Multiple response
c. Out-of-band response

29. Spurious Responses: Agilent E4401B and E4411B

This test is performed in two parts. Part 1 measures third order intermodulation distortion. Part 2 measures second harmonic distortion.

To test second harmonic distortion, a low pass filter is used to filter the source output, ensuring that harmonics read by the analyzer are internally generated and not coming from the source. To measure the distortion products, the power at the mixer is set 25 dB higher than specified.

For example, the specification states that with –40 dBm at the input mixer, the distortion products should be suppressed by >75 dBc, the equivalent second harmonic intercept (SHI) is >35 dBm (–40 dBm + 75 dBc). Measuring with –15 dBm at the mixer and verifying the distortion products suppressed by >50 dBc also ensures the SHI is >35 dBm (–15 dBm + 50 dBc).

For third order intermodulation distortion, two signals are combined in a directional bridge to provide isolation. These two signals are applied to the analyzer input. The power level of the two signals is several dB higher than specified, so the distortion products should be suppressed by less than the amount specified. In this manner, the equivalent third order intercept (TOI) is measured.

For example, the specification states that with two –30 dBm signals at the input mixer, the distortion products should be suppressed by >80 dBc, which yields a third order intercept of >10 dBm (–30 dBm + (80 dBc/2)). Measuring with –20 dBm at the mixer and verifying the distortion products are suppressed by >60 dBc, the equivalent TOI is also >10 dBm (–20 dBm + (60 dBc/2)).

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized signal generator
Synthesized sweeper
Power meter, dual channel
RF power sensor
Power splitter
Directional bridge
50 MHz low pass filter
Cable, BNC, 120-cm
Cable, APC 3.5, 91-cm *(2 required)*
Adapter, Type-N (m) to APC 3.5 (f) *(3 required)*
Adapter, Type-N (m) to SMA (m)

Adapter, Type-N (m) to BNC (f)
Adapter, Type-N (m) to Type-N (m)
Adapter, SMA (f) to BNC (m)
Adapter, APC 3.5 (f) to APC 3.5 (f)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Adapter, mechanical, Type-N (m) 50 Ω, to Type-N (m), 75 Ω
Adapter, Type-N (m), to BNC (m), 75 Ω

Procedure

This performance test consists of two parts:

Part 1: Third Order Intermodulation Distortion

Part 2: Second Harmonic Distortion

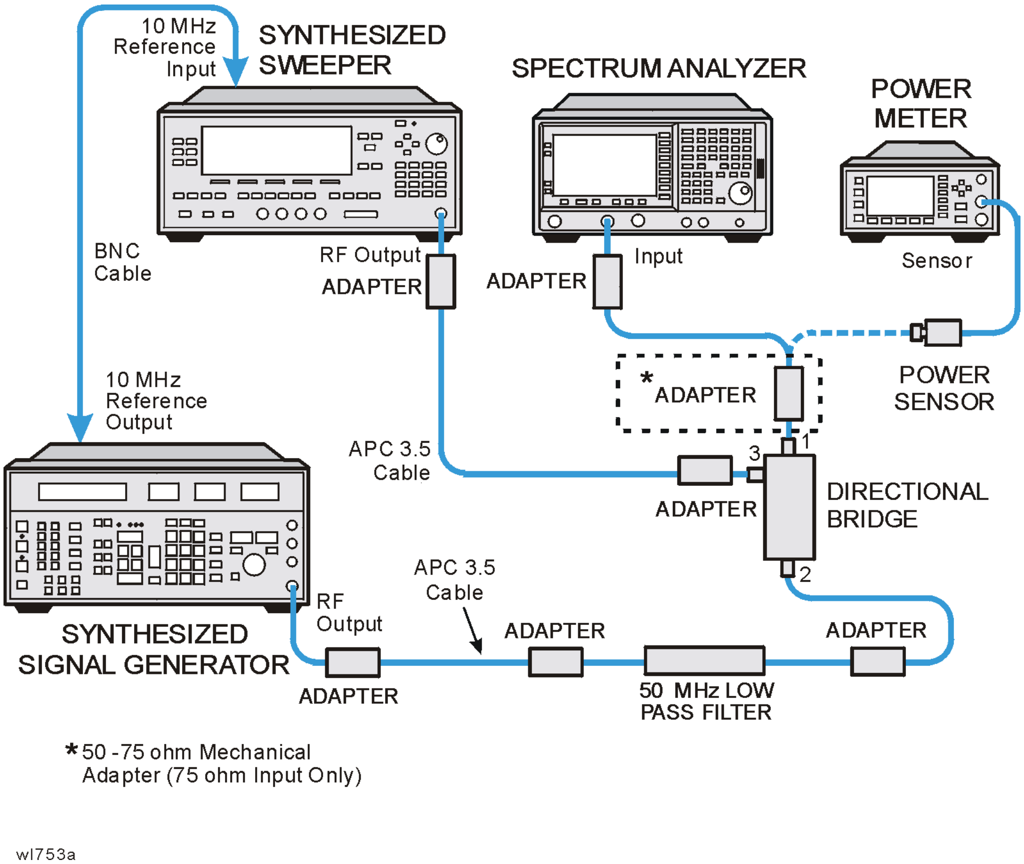
Perform Part 1 before Part 2.

Part 1: Third Order Intermodulation Distortion

1. Zero and calibrate the power meter and RF power sensor in log mode (power reads out in dBm), as described in the power meter operation manual.

   75 Ω *Input only: Use a* 75 Ω *power sensor*.

Figure 2-42 Third Order Intermodulation Distortion Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or damage to the connectors will occur.

2. Connect the equipment as shown in Figure 2-42 with the output of the directional bridge connected to the power sensor.

   75 Ω Input only: Use the 75 Ω power sensor with the 50 Ω to 75 Ω mechanical adapter.

Table 2-63 Test Equipment Settings for

TOI Test	F1 (MHz)	F2 (MHz)	Low Pass Filter (MHz)
1	50.0	50.05	50
Option 1DR	50.0	50.05	50

3. Perform step 4 through step 29 using the information and entries from Table 2-63. Then continue on with step 30 through step 38.

4. Press **Blue Key, Special, 0, 0** on the signal generator. Set the frequency to the F1 value for TOI Test 1 in Table 2-63. Set the amplitude to –10 dBm.

5. Press **PRESET** on the synthesized sweeper. Set the CW frequency of the synthesized sweeper to the F2 value for TOI Test 1 in Table 2-63. Then press the following:

   POWER LEVEL, **4 dBm**
   RF Off

6. Enter the power sensor calibration factor for the signal generator frequency into the power meter.

7. Adjust the amplitude of the signal generator until the power meter reads –12 dBm ±0.1 dB.

   75 Ω Input only: *The power measured at the output of the 50 Ω directional bridge by the 75 Ω power sensor is the equivalent power "seen" by the 75 Ω analyzer.*

8. Disconnect the power sensor from the directional bridge. Connect the directional bridge directly to the analyzer input using an adapter (do not use a cable).

   75 Ω Input only: Use a 50 Ω to 75 Ω mechanical adapter and a 75 Ω Type-N(m) to BNC(m) adapter.

CAUTION Support the directional bridge and low pass filter to minimize stress on the analyzer input connector.

9. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off.** Set the analyzer center frequency to the F1 value for TOI Test 1 in Table 2-63. Then, set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, CF Step, **50 kHz** (Man)
   SPAN, **20 kHz**
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, **–5 dBm** (50 Ω *Input only*)
   AMPLITUDE, Ref Level, **–10 dBm** (*75* Ω *Input only*)
   AMPLITUDE, Attenuation, 5 dB (Man) (50 Ω *Input only*)
   AMPLITUDE, Attenuation, 0 dB(Man) (*75* Ω *Input only*)
   BW/Avg, 1 kHz (Man)
   BW/Avg, Video BW, 300 Hz (Man)
   Peak Search (or **Search**), **More**, **Search Param**, **Peak Excursn**, **3 dB**

10. On the analyzer, press the following keys:

   Peak Search (or **Search**)
   Meas Tools
   Mkr → **CF**, **Delta**

11. On the analyzer, press **FREQUENCY**, ↑.

12. If the resolution bandwidth is ≥1kHz, press **SPAN**, **4 kHz**.

13. On the synthesized sweeper, set the RF On.

14. On the analyzer, press **Peak Search** (or **Search**).

15. On the synthesized sweeper, adjust the power level until the ΔMkr1 amplitude reads 0 dB ±0.05 dB.

16. On the analyzer, press: **FREQUENCY**, ↓, ↓. The center frequency should now be lower than the signal generator frequency by the CF Step value.

17. Set the analyzer reference level to –15 dBm.

    75 Ω *Input only: Set the reference level to –20 dBm.*

18. On the analyzer, press **BW/Avg**, **Average**, **20**, and wait for "`Vavg 20`" to appear along the left side of the display.

19. On the analyzer, press **Peak Search** (or **Search**) and record the marker amplitude reading in Table 2-64 as the Lower Distortion Amplitude.

20. On the analyzer, press **BW/Avg**, **Average Off.**

21. On the analyzer, increment the center frequency by three times the CF Step value. Press **FREQUENCY**, ↑, ↑, ↑. The center frequency should now be one CF Step value above the synthesized sweeper frequency.

22. Set the synthesized signal generator frequency to F2 as indicated in Table 2-63.

23. Set the synthesized sweeper CW frequency to F1 as indicated in Table 2-63.

24. On the analyzer, press **BW/Avg**, **Average**, **20**, and wait for `Vavg 20` to appear along the left side of the display.

25. On the analyzer, press **Peak Search** (or **Search**) and record the marker amplitude reading in Table 2-64 as the Upper Distortion Amplitude.

26. On the analyzer, press **BW/Avg**, **Average Off**.

27. Of the Lower Distortion Amplitude and Upper Distortion Amplitudes recorded in Table 2-64, enter the most positive value as the Worst Distortion Amplitude in Table 2-64. For example, if the Upper Distortion Amplitude is –62 dBc and the Lower Distortion Amplitude is –63 dBc, enter –62 dBc as the Worst Distortion Amplitude.

28. If the analyzer has a 50 Ω input, enter –17 dBm as the Mixer Level in Table 2-64 (–12 dBm input power – 5 dB input attenuation). If the analyzer has a 75 Ω input, enter
36.75 dBmV as the Mixer Level in Table 2-64 (–12 dBm = 36.75 dBmV).

29. Calculate the equivalent TOI by subtracting one half of the Worst Distortion Amplitude (in dB) from the Mixer Level (in dBm or dBmV). Enter the result in Table 2-64 as the Calculated TOI. For example, if the Worst Distortion Amplitude is –62 dBc and the Mixer Level is –17 dBm, the Calculated TOI would be:

Table 2-64 Third Order Intermodulation Distortion Worksheet

TOI Test	Lower Distortion Amplitude	Upper Distortion Amplitude	Worst Distortion Amplitude	Mixer Level	Calculated TOI
1					
Option 1DR					

$$\text{TOI} = -17\text{ dBm} - (-62\text{ dB}/2) = -17\text{ dBm} + 31\text{ dB} = 14\text{ dBm}$$

30. If the analyzer is equipped with Option 1DR, Narrow Resolution Bandwidth, perform step 31 through step 36. Otherwise, continue with step 37.

31. Set synthesized signal generator frequency to the F1 value used in TOI Test 1 of Table 2-63.

32. Set synthesized sweeper CW frequency to the F2 value used in TOI Test 1 of Table 2-63.

33. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off.** Set the analyzer to the F1 value for TOI Test Option 1DR in Table 2-63. Then set the analyzer by pressing the following keys:

FREQUENCY, CF Step, **50 kHz** (Man)
SPAN, **20 kHz**
AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
AMPLITUDE, Ref Level, **–5 dBm** (50 Ω *Input only*)
AMPLITUDE, Ref Level, **–10 dBm** (*75* Ω *Input only*)
AMPLITUDE, Attenuation, 5 dB (Man) (50 Ω *Input only*)
AMPLITUDE, Attenuation, 0 dB (Man) (*75* Ω *Input only*)
BW/Avg, 1 kHz (Man)
BW/Avg, Video BW, 300 Hz (Man)
Peak Search (or **Search**), **More**
Search Param, **Peak Excursn**, **3 dB**

34.On the analyzer, press the following keys:

Peak Search (or **Search**)
Meas Tools
Mkr → CF

35.Set the analyzer as follows:

SPAN, 500 Hz
BW/Avg, Resolution BW, 30 Hz
BW/Avg, Video BW, 10 Hz

36.Repeat step 10 through step 29. This is the TOI test for Option 1DR.

37.On the analyzer, press **System, Alignments, Auto Align, On.**

38.Part 1: Third Order Intermodulation Distortion is complete. Proceed to Part 2: Second Harmonic Distortion.

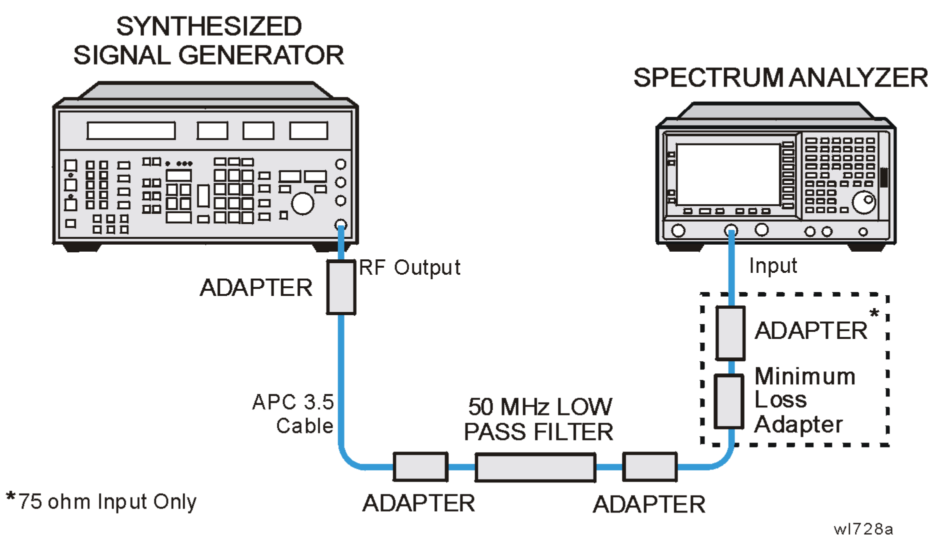
Part 2: Second Harmonic Distortion

1. Set the synthesized signal generator controls as follows:

FREQUENCY, **40 MHz**
AMPLITUDE, **–10 dBm** (50 Ω *Input only)*
AMPLITUDE, **–4.3 dBm** (75 Ω *Input only*)

2. Connect the equipment as shown in Figure 2-43.

Figure 2-43 Second Harmonic Distortion Test Setup



75 Ω Input only: Connect the minimum loss adapter between the LPF and INPUT 75 Ω.

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   FREQUENCY, **40 MHz**
   SPAN, **1 MHz**
   AMPLITUDE, **–10 dBm** (50 Ω *Input only*)
   AMPLITUDE, **44 dBmV** (75 Ω *Input only*)
   Attenuation Auto Man 10 dB
   BW/Avg, **30 kHz**

4. Adjust the synthesized signal generator amplitude to place the peak of the signal at the reference level.

5. Set the analyzer control as follows:

   SPAN, 50 kHz
   BW/Avg, **1 kHz**
   Video BW Auto Man, **100 Hz**

6. Wait for two sweeps to finish, then press the following analyzer keys:

   Peak Search (or **Search**)
   Mkr →, **Mkr** → **CF Step**
   Marker, **Delta**
   FREQUENCY, ↑

7. Press **Peak Search** (or **Search**). The ΔMkr1 amplitude reading is the second harmonic suppression.

8. If the analyzer has a 50 Ω input, calculate the second harmonic intercept (SHI) using the second harmonic suppression value read in step 7 as follows:

   $$\text{SHI} = -20\text{ dBm} - \text{Second Harmonic Suppression}$$

   For example, if the second harmonic suppression is –62 dB, the SHI would be 42 dBm:

   $$42\text{ dBm} = -20\text{ dBm} - (-62\text{ dB})$$

9. If the analyzer has a 75 Ω input, calculate the second harmonic intercept (SHI) using the second harmonic suppression value read in step 7 as follows:

   $$\text{SHI} = 34\text{ dBmV} - \text{Second Harmonic Suppression}$$

   For example, if the second harmonic suppression is –65 dB, the SHI would be 99 dBmV:

   $$99\text{ dBmV} = 34\text{ dBmV} - (-65\text{ dB})$$

30. Spurious Responses: Agilent E4402B and E4403B

This test is performed in two parts. Part 1 measures third order intermodulation distortion; Part 2 measures second harmonic distortion.

To test second harmonic distortion, a low pass filter is used to filter the source output, ensuring that harmonics read by the analyzer are internally generated and not coming from the source. To measure the distortion products, the power at the mixer is set 25 dB higher than specified.

For example, the specification states that with –30 dBm at the input mixer, the distortion products should be suppressed by >75 dBc, the equivalent second harmonic intercept (SHI) is >45 dBm (–30 dBm + 75 dBc). Measuring with –15 dBm at the mixer and verifying the distortion products suppressed by >60 dBc also ensures the SHI is >45 dBm (–15 dBm + 60 dBc).

For third order intermodulation distortion, two signals are combined in a directional bridge to provide isolation. These two signals are applied to the analyzer input. The power level of the two signals is several dB higher than specified, so the distortion products should be suppressed by less than the amount specified. In this manner, the equivalent third order intercept (TOI) is measured.

For example, the specification states that with two –30 dBm signals at the input mixer, the distortion products should be suppressed by >82 dBc, which yields a third order intercept of >11 dBm (–30 dBm + (82 dBc/2)). Measuring with –20 dBm at the mixer and verifying the distortion products are suppressed by >62 dBc, the equivalent TOI is also >11 dBm (–20 dBm + (62 dBc/2)).

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized signal generator
Synthesized sweeper
Power meter, dual channel
RF power sensor
Power splitter
Directional bridge
300 MHz low pass filter
Cable, APC 3.5, 91-cm (2 required)
Cable, BNC, 120-cm
Adapter, Type-N (m) to APC 3.5 (f) *(3 required)*
Adapter, Type-N (m) to SMA (m)

Adapter, Type-N (m) to BNC (f)
Adapter, Type-N (m) to Type-N (m)
Adapter, SMA (f) to BNC (m)
Adapter, APC 3.5 (f) to APC 3.5 (f)

Procedure

This performance test consists of two parts:

Part 1: Third Order Intermodulation Distortion

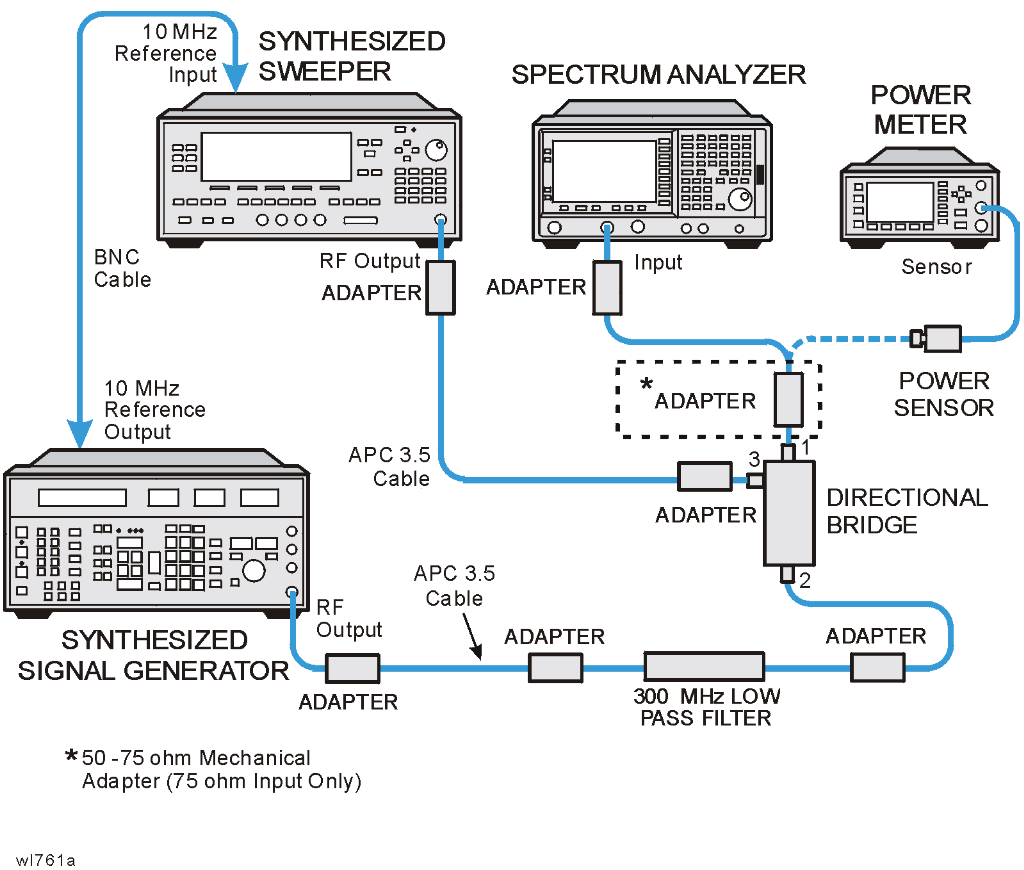
Part 2: Second Harmonic Distortion

Perform Part 1 before Part 2.

Part 1: Third Order Intermodulation Distortion

1. Zero and calibrate the power meter and RF power sensor in log mode (power reads out in dBm), as described in the power meter operation manual.

Figure 2-44 Third Order Intermodulation Distortion Test Setup



2. Connect the equipment as shown in Figure 2-44 with the output of the directional bridge connected to the power sensor.

3. Perform step 4 through step 29 using the information and entries from Table 2-65. Then continue on with step 30 through step 38.

Table 2-65 Test Equipment Settings for TOI

TOI Test	F1 (MHz)	F2 (MHz)	Low Pass Filter (MHz)
1	300.0	300.05	300
Option 1DR	300.0	300.05	300

4. Press **Blue Key, Special, 0, 0** on the signal generator. Set the frequency to F1 in Table 2-65 for TOI Test 1. Set the amplitude to –10 dBm.

5. Press **PRESET** on the synthesized sweeper, and set the frequency to F2 in Table 2-65 for TOI Test 1. Set the synthesized sweeper controls as follows:

   POWER LEVEL, **4 dBm**
   RF Off

6. Enter the power sensor calibration factor for the signal generator frequency into the power meter.

7. Adjust the amplitude of the signal generator until the power meter reads –12 dBm ±0.1 dB.

8. Disconnect the power sensor from the directional bridge. Connect the directional bridge directly to the analyzer input using an adapter (do not use a cable).

CAUTION Support the directional bridge and low pass filter to minimize stress on the analyzer input connector.

9. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off.** Set the analyzer center frequency to the F1 value for TOI Test 1 in Table 2-65. Then, set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, CF Step, **50 kHz** (Man)
   SPAN, **20 kHz**
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, **–5 dBm**
   AMPLITUDE, Attenuation, 5 dB (Man)
   BW/Avg, 1 kHz (Man)
   BW/Avg, Video BW, 300 Hz (Man)
   Peak Search (or **Search**), **More**
   Search Param, **Peak Excursn, 3 dB**

10.On the analyzer, press the following keys:

Peak Search (or **Search**)
Meas Tools
Mkr → CF
Delta

11.On the analyzer, press: **FREQUENCY**, ↑.

12.If the resolution bandwidth is ≥1 kHz, press: **SPAN**, **4 kHz**.

13.On the synthesized sweeper, set the RF on.

14. On the analyzer, press **Peak Search** (or **Search**).

15.On the synthesized sweeper, adjust the power level until the ΔMkr1 amplitude reads 0 dB ±0.05 dB.

16.On the analyzer, press **FREQUENCY**, ↓, ↓. The center frequency should now be lower than the signal generator frequency by the CF Step value.

17.Set the analyzer reference level to –15 dBm.

18.On the analyzer, press: **BW/Avg**, **Average**, **20**, and wait for "`Vavg 20`" to appear along the left side of the display.

19.On the analyzer, press **Peak Search** (or **Search**) and record the marker amplitude reading in Table 2-66 as the Lower Distortion Amplitude.

20.On the analyzer, press: **BW/Avg**, **Average Off**.

21.On the analyzer, press **FREQUENCY**, ↑, ↑, ↑. The center frequency should now be one CF Step value above the synthesized sweeper frequency.

22.Set the synthesized signal generator frequency to F2 as indicated in Table 2-65.

23.Set the synthesized sweep CW frequency to F1 as indicated in Table 2-65.

24.On the analyzer, press **BW/Avg**, **Average**, **20**, and wait for "`Vavg 20`" to appear along the left side of the display.

25.On the analyzer, press **Peak Search** (or **Search**) and record the marker amplitude reading in Table 2-66 as the Upper Distortion Amplitude.

26.On the analyzer, press **BW/Avg**, **Average Off**.

27.Of the Lower Distortion Amplitude and Upper Distortion Amplitudes recorded in Table 2-66, enter the most positive value as the Worst Distortion Amplitude in Table 2-66. For example, if the Upper Distortion Amplitude is –62 dBc and the Lower Distortion Amplitude is –63 dBc, enter –62 dBc as the Worst Distortion Amplitude.

28. Enter –17 dBm as the Mixer Level in Table 2-66 (–12 dBm input power –5 dB input attenuation).

29. Calculate the equivalent TOI by subtracting one half of the Worst Distortion Amplitude (in dB) from the Mixer Level (in dBm). Enter the result in Table 2-66 as the Calculated TOI. For example, if the Worst Distortion Amplitude is –62 dBc and the Mixer Level is –17 dBm, the Calculated TOI would be:

$$\text{TOI} = -17\text{ dBm} - (-62\text{ dB}/2) = -17\text{ dBm} + 31\text{ dBm} = +14\text{ dBm}$$

Table 2-66 Third Order Intermodulation Distortion Worksheet

TOI Test	Lower Distortion Amplitude	Upper Distortion Amplitude	Worst Distortion Amplitude	Mixer Level	Calculated TOI
1					
Option 1DR					

30. If the analyzer is equipped with Option 1DR, Narrow Resolution Bandwidth, perform step 31 through step 36. Otherwise, continue with step 37.

31. Set synthesized signal generator frequency to F1 as indicated in Table 2-65 for TOI Test 1.

32. Set synthesized sweeper CW frequency to F2 as indicated in Table 2-65 for TOI Test 1.

33. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off.** Set the analyzer center frequency to the F1 value for TOI Test Option 1DR in Table 2-65. Then, set the analyzer by pressing the following keys:

    FREQUENCY, CF Step, **50 kHz** (Man)
    SPAN, **20 kHz**
    AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
    AMPLITUDE, Ref Level, **–5 dBm**
    AMPLITUDE, Attenuation, 5 dB (Man)
    BW/Avg, 1 kHz (Man)
    BW/Avg, Video BW, 300 Hz (Man)
    Peak Search (or **Search**), **More**,
    Search Param, **Peak Excursn**, **3 dB**

34. On the analyzer, press the following keys:

    Peak Search (or **Search**)
    Meas Tools
    Mkr → **CF**

35. Set the analyzer as follows:

SPAN, **500 Hz**
BW/Avg, Resolution BW, 30 Hz
Video BW, 10 Hz

36. Repeat step 10 through step 29. This is the TOI test for Option 1DR.

37. On the analyzer, press **System, Alignments, Auto Align, On.**

38. Part 1: Third Order Intermodulation Distortion is complete. Proceed to Part 2: Second Harmonic Distortion.

Part 2: Second Harmonic Distortion

1. Zero and calibrate the power meter and RF power sensor. Enter the power sensor 300 MHz calibration factor into the power meter.

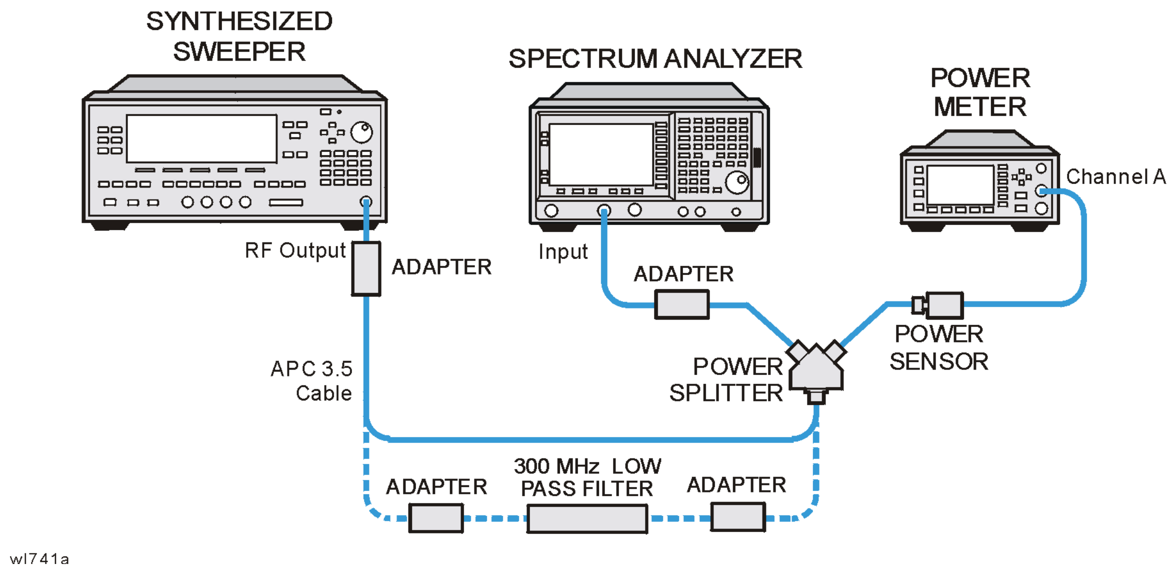
Measuring the 300 MHz Frequency Response Error

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

FREQUENCY, 300 MHz
SPAN, **10 MHz**

3. Connect the equipment as shown in Figure 2-45, with the output of the synthesized sweeper connected to the power splitter input and the power splitter outputs connected to the analyzer and power sensor.

Figure 2-45 Second Harmonic Distortion Test Setup



4. Preset the synthesized sweeper and set the controls as follows:

   CW, 300 MHz
   POWER LEVEL, **0 dBm**

5. On the analyzer, press **Peak Search** (or **Search**), **Marker, Delta**.
6. Record the power meter reading at 300 MHz in Table 2-67.
7. Set the synthesized sweeper CW to 600 MHz.
8. On the analyzer, press **FREQUENCY, 600 MHz**, then **Peak Search** (or **Search**).
9. Adjust the synthesized sweeper power level until the ΔMkr1 amplitude reads 0 dB ±0.10 dB.
10. Enter the power sensor 600 MHz calibration factor into the power meter.
11. Record the power meter reading at 600 MHz in Table 2-67.
12. Subtract the power meter reading at 600 MHz from the power meter reading at 300 MHz. Record this difference as the 300 MHz Frequency Response Error in Table 2-67. For example, if the power meter reading at 600 MHz is –6.45 dBm and the power meter reading at 300 MHz is –7.05 dBm, the 300 MHz Frequency Response Error would be –0.60 dB:

$$-0.60 \text{ dB} = -7.05 \text{ dBm} - (-6.45 \text{ dBm})$$

Table 2-67 Second Harmonic Distortion Worksheet

Description	Measurement
Power Meter Reading at 300 MHz	_______________ dBm
Power Meter Reading at 600 MHz	_______________ dBm
300 MHz Frequency Response Error (FRE)	_______________ dB

Measuring the 300 MHz Second Harmonic Distortion

1. Connect the equipment as shown in Figure 2-45 using the 300 MHz Low Pass Filter.
2. On the synthesized sweeper, press:

   CW, **300 MHz**
   POWER LEVEL, **–10 dBm**

3. Enter the power sensor 300 MHz calibration factor into the power meter.

4. On the analyzer, press the following:

   FREQUENCY, 300 MHz
   SPAN, **100 kHz**
   AMPLITUDE, Ref Level, **–10 dBm**
   AMPLITUDE, Attenuation, 10 dB (Man)
   BW/Avg, Resolution BW 1 kHz (Man)
   Video BW, 1 kHz (Man)
   Markers, Off

5. Adjust the synthesized sweeper power level until the power meter reading is –10 dBm ±0.2 dB.

6. On the analyzer, press the following:

   Peak Search (or **Search**), Marker, Delta
   FREQUENCY, **600 MHz**
   BW/Avg, 10

   Wait for the "`Vavg 10`" to appear along the left side of the display.

7. On the analyzer, press **Peak Search** (or **Search**). The ΔMkr1 amplitude is the second harmonic suppression.

8. Calculate the 300 MHz Second Harmonic Intercept (SHI) using the second harmonic suppression value read in step 7 and the 300 MHz Frequency Response Error (FRE) from Table 2-67 as follows:

$$300\text{ MHz SHI} = -20\text{ dBm} - \text{Second Harmonic Suppression} + 300\text{ MHz FRE}$$

   For example, if the second harmonic suppression is –59 dB, and the 300 MHz FRE is –0.60 dB, the SHI would be 38.4 dBm:

$$38.4\text{ dBm} = -20\text{ dBm} - (-59\text{ dB}) + (-0.60\text{ dB})$$

9. On the synthesized sweeper, press **Marker**, **Off**.

31. Spurious Responses: Agilent E4404B, E4405B, E4407B, and E4408B

This test is performed in two parts. Part 1 measures third order intermodulation distortion. Part 2 measures second harmonic distortion.

To test second harmonic distortion, a low pass filter is used to filter the source output, ensuring that harmonics read by the analyzer are internally generated and not coming from the source. To measure the distortion products, the power at the mixer is set 25 dB higher than specified.

A power meter, power sensor, and power splitter are used to characterize the frequency response of the analyzer so this uncertainty can be eliminated.

For example, the specification states that with –30 dBm at the input mixer, the distortion products should be suppressed by >75 dBc, the equivalent second harmonic intercept (SHI) is >45 dBm (–30 dBm + 75 dBc). Measuring with –15 dBm at the mixer and verifying the distortion products suppressed by >60 dBc also ensures the SHI is >45 dBm (–15 dBm + 60 dBc).

For third order intermodulation distortion, two signals are combined in a directional bridge or directional coupler to provide isolation. These two signals are applied to the analyzer input. The power level of the two signals is several dB higher than specified, so the distortion products should be suppressed by less than the amount specified. In this manner, the equivalent third order intercept (TOI) is measured.

For example, the specification states that with two –30 dBm signals at the input mixer, the distortion products should be suppressed by >75 dBc, which yields a third order intercept of >7.5 dBm (–30 dBm + (75 dBc/2)). Measuring with –20 dBm at the mixer and verifying the distortion products are suppressed by >55 dBc, the equivalent TOI is also >7.5 dBm (–20 dBm + (55 dBc/2)).

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper (2 required)
Power meter, dual channel
Microwave power sensor
Microwave power splitter
Directional bridge
Directional coupler
300 MHz low pass filter
1 GHz low pass filter

1.8 GHz low pass filter *(2 required)*
4.4 GHz low pass filter *(2 required)*
Cable, BNC, 120-cm (48-in)
Cable, APC 3.5, 91-cm (48-in) *(2 required)*
Adapter, Type-N (m) to APC 3.5 (f) *(3 required)*
Adapter, Type-N (m) to SMA (m)
Adapter, Type-N (m) to BNC (f)
Adapter, Type-N (m) to Type-N (m)
Adapter, SMA (f) to BNC (m)
Adapter, APC 3.5 (f) to APC 3.5 (f)

Procedure

This performance test consists of two parts:

Part 1: Third Order Intermodulation Distortion

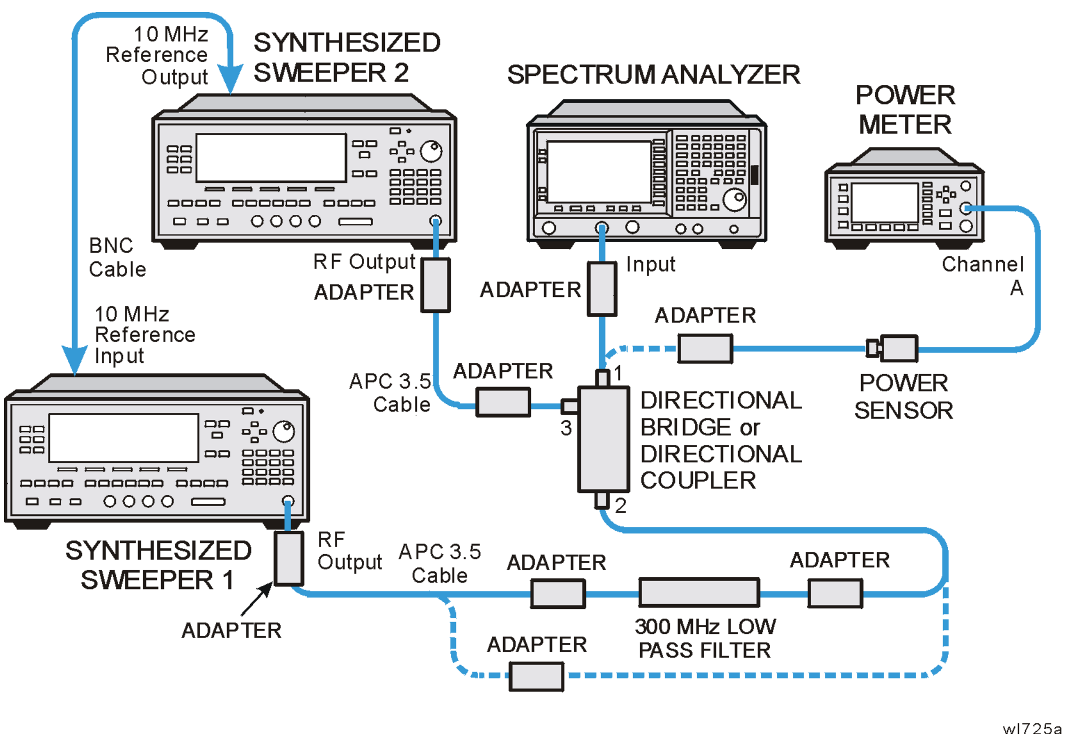
Part 2: Second Harmonic Distortion

Perform Part 1 before Part 2.

Part 1: Third Order Intermodulation Distortion

1. Zero and calibrate the power meter and microwave power sensor in log mode (power reads out in dBm), as described in the power meter operation manual.

Figure 2-46 Third Order Intermodulation Distortion Test Setup



2. Connect the equipment as shown in Figure 2-46 using the 300 MHz low pass filter with the output of the directional bridge connected to the power sensor.

3. Perform step 4 through step 29 using the information and entries from Table 2-68. Then continue on with step 31 through step 43.

Table 2-68 Test Equipment Settings for TOI

TOI Test	F1 (MHz)	F2 (MHz)	Low Pass Filter (MHz)	Bridge or Coupler	Presel Center
1	300.0	300.05	300	Bridge	No
Option 1DR	300.0	300.05	300	Bridge	No
2	5000.0	5000.05	None	Coupler	Yes
3	8000.0	8000.05	None	Coupler	Yes

4. Press **PRESET** on synthesized sweeper 1. Set the CW frequency to F1 as indicated in Table 2-68, and set the power level to –10 dBm.

5. Press **PRESET** on synthesized sweeper 2. Set the CW frequency to F2 as indicated in Table 2-68, and set the controls as follows:

   POWER LEVEL, **4 dBm**
   RF Off

6. Enter the power sensor calibration factor for F1 into the power meter.

7. Adjust the power level of synthesized sweeper 1 until the power meter reads –12 dBm ±0.1 dB.

8. Disconnect the power sensor from the directional bridge (or directional coupler). Connect the directional bridge (or directional coupler) directly to the analyzer input using an adapter (do not use a cable).

CAUTION Support the directional bridge (or directional coupler) and low pass filter to minimize stress on the analyzer input connector.

9. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off.** Set the analyzer to the F1 value for TOI Test 1 in Table 2-68. Then set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, CF Step, **50 kHz** (Man)
   SPAN, **20 kHz**
   AMPLITUDE, Ref Level, **–5 dBm**
   AMPLITUDE, Attenuation, 5 dB (Man)

BW/Avg, 1 kHz (Man)
BW/Avg, Video BW, 300 Hz (Man)
Peak Search (or **Search**), **More**
Search Param, **Peak Excursn**, **3 dB**

10.On the analyzer, press the following keys:

Peak Search (or **Search**)
Meas Tools
Mkr → CF
Delta

11.On the analyzer, Press **FREQUENCY**, ↑. The center frequency should now be equal to synthesized sweeper 2 frequency.

12.If the resolution bandwidth is ≥1 kHz, press **SPAN**, **4 kHz**.

13.On the synthesized sweeper 2, set the RF On.

14.On the analyzer, press **Peak Search** (or **Search**).

15.Adjust the power level of synthesized sweeper 2 until the ΔMkr1 amplitude reads 0 dB ±0.05 dB.

16.On the analyzer, press **FREQUENCY**, ↓, ↓. The center frequency should now be lower than synthesized sweeper 1 by the CF Step value.

17.Set the analyzer reference level to –15 dBm.

18.On the analyzer, press **BW/Avg**, **Average**, **20**, and wait for "Vavg 20" to appear along the left side of the display.

19.On the analyzer, press **Peak Search** (or **Search**) and record the marker amplitude reading in Table 2-69 as the Lower Distortion Amplitude.

20.On the analyzer, press **BW/Avg**, **Average Off**.

21.On the analyzer, press **FREQUENCY**, ↑, ↑, ↑. The center frequency should now be one CF Step value above synthesized sweeper 2 frequency.

22.Set synthesized sweeper 1 CW to F2 as indicated in Table 2-68.

23.Set synthesized sweeper 2 CW to F1 as indicated in Table 2-68.

24.On the analyzer, press **BW/Avg**, **Average**, **20**, and wait for "Vavg 20" to appear along the left side of the display.

25.On the analyzer, press **Peak Search** (or **Search**) and record the marker amplitude reading in Table 2-69 as the Upper Distortion Amplitude.

26.On the analyzer, press **BW/Avg**, **Average Off**.

27. Of the Lower Distortion Amplitude and Upper Distortion Amplitudes recorded in Table 2-69, enter the most positive value as the Worst Distortion Amplitude in Table 2-69. For example, if the Upper Distortion Amplitude is –62 dBc and the Lower Distortion Amplitude is –63 dBc, enter –62 dBc as the Worst Distortion Amplitude.

28. Enter –17 dBm as the Mixer Level in Table 2-69 (–12 dBm input power – 5 dB input attenuation).

29. Calculate the equivalent TOI by subtracting one half of the Worst Distortion Amplitude (in dB) from the Mixer Level (in dBm). Enter the result in Table 2-69 as the Calculated TOI. For example, if the Worst Distortion Amplitude is –62 dBc and the Mixer Level is –17 dBm, the Calculated TOI would be:

$$\text{TOI} = -17\text{ dBm} - (-62\text{ dB}/2) = -17\text{ dBm} + 31\text{ dBm} = +14\text{ dBm}$$

30. Record the Calculated TOI in the performance verification test record as specified in Table 2-69.

Table 2-69 Third Order Intermodulation Distortion Worksheet

TOI Test	Lower Distortion Amplitude	Upper Distortion Amplitude	Worst Distortion Amplitude	Mixer Level	Calculated TOI (TR Entry)
1					**1)**
Option 1DR					**2)**
2					**3)**
3					**4)**

31. If the analyzer is equipped with Option 1DR, Narrow Resolution Bandwidth, perform step 32 through step 36. Otherwise, continue with step 37.

32. Set synthesized sweeper 1 CW frequency to F1 as indicated in TOI Test 1 of Table 2-68.

33. Set synthesized sweeper 2 CW frequency to F2 as indicated in TOI Test 1 of Table 2-68.

34. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System, Alignments, Auto Align, Off.** Set the analyzer center frequency to the F1 value for TOI Test Option 1DR in Table 2-68. Then, set the analyzer by pressing the following keys:

FREQUENCY, CF Step, **50 kHz** (Man)
SPAN, **20 kHz**
AMPLITUDE, Ref Level, **–5 dBm**

AMPLITUDE, Attenuation, 5 dB (Man)
BW/Avg, 1 kHz (Man)
BW/Avg, Video BW, 300 Hz (Man)
Peak Search (or **Search**), **More**
Search Param, **Peak Excursn**, **3 dB**

35. On the analyzer, press the following keys:

Peak Search (or **Search**)
Meas Tools
Mkr → CF
SPAN, 500 Hz
BW/Avg, Resolution BW, 30 Hz
BW/Avg, Video BW, 10 Hz

36. Repeat step 9 through step 26. This is the TOI test for Option 1DR.

37. Replace the directional bridge with the directional coupler. The cable from synthesized sweeper 1 should be connected directly to the input of the directional coupler; no low pass filter is required when testing frequencies >3 GHz. See Figure 2-46.

38. Connect the output of the directional coupler to the power sensor.

39. Repeat step 4 through step 29 using information and entries for TOI Test 2 in Table 2-68 and Table 2-69.

40. Connect the output of the directional bridge to the power sensor.

41. Repeat step 4 through step 29 using information and entries for TOI Test 3 in Table 2-68 and Table 2-69.

42. On the analyzer, press **System, Alignments, Auto Align, All**.

43. Part 1: Third Order Intermodulation Distortion is complete. Proceed to Part 2: Second Harmonic Distortion.

Part 2: Second Harmonic Distortion

1. Zero and calibrate the power meter and microwave power sensor. Enter the power sensor 300 MHz calibration factor into the power meter.

Measuring the Noise Level at 6.2 GHz

2. Remove any cables or adapters from the analyzer Input.

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

FREQUENCY, 6.2 GHz
SPAN, **0 Hz**
AMPLITUDE, Ref Level, **–40 dBm**
AMPLITUDE, Attenuation, 10 dB
BW/Ave, Resolution BW 1 kHz

Video BW, 30 Hz
Sweep, Sweep time, 5 s

4. Wait until “VAvg 10” is displayed along the left side of the display.

5. Press **Peak Search** (or **Search**) and record the marker amplitude reading as the 6.2 GHz Noise Level in Table 2-70.

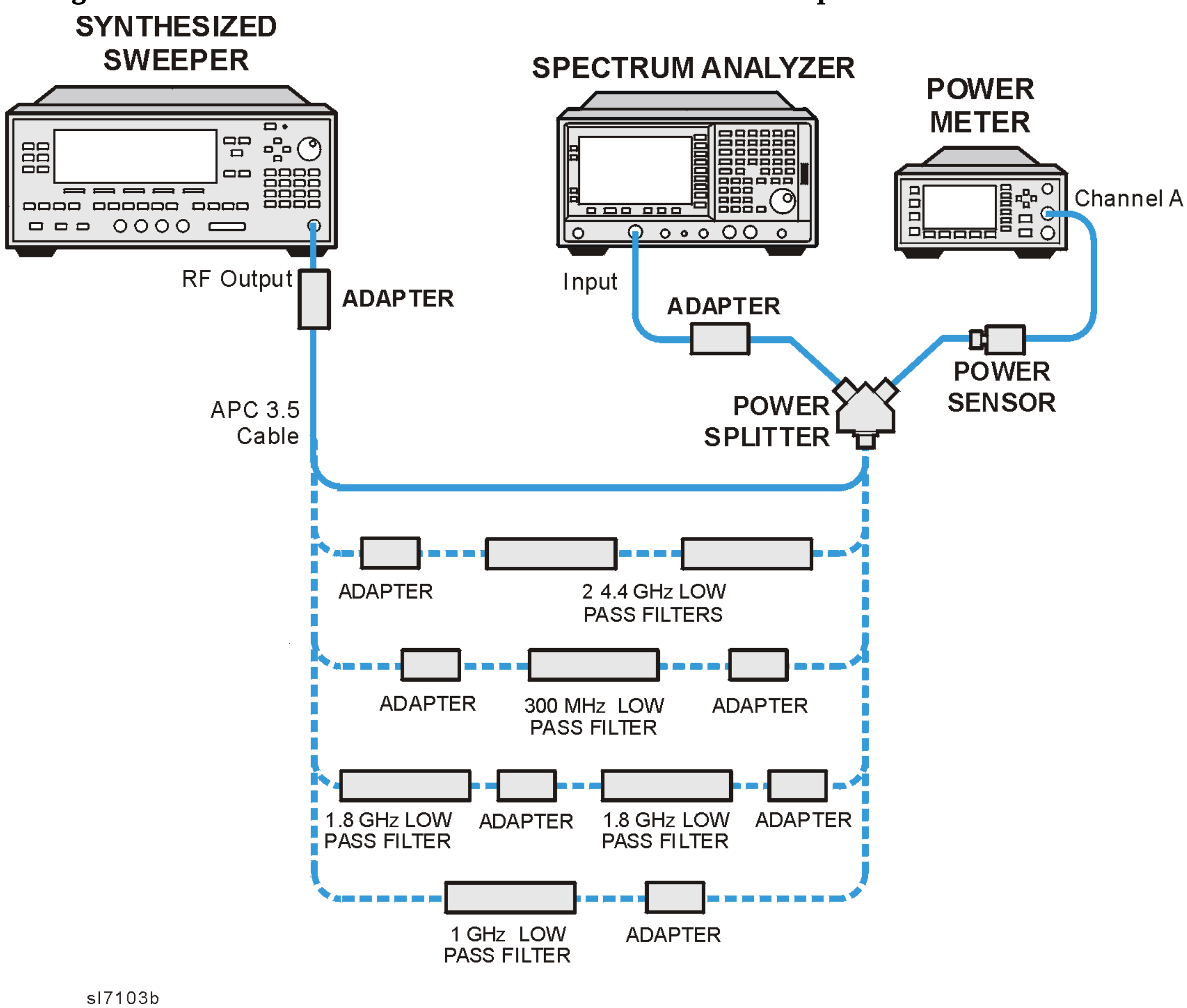
Measuring 300 MHz Frequency Response Error

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   FREQUENCY, 300 MHz
   SPAN, 10 MHz

2. Connect the equipment as shown in Figure 2-47, with the output of the synthesized sweeper connected to the power splitter input and the power splitter outputs connected to the analyzer and power sensor.

Figure 2-47 Second Harmonic Distortion Test Setup



3. Preset the synthesized sweeper and set the controls as follows:

   CW, 300 MHz
   POWER LEVEL, **0 dBm**

4. On the analyzer, press **Peak Search** (or **Search**), **Marker, Delta**.
5. Record the power meter reading at 300 MHz in Table 2-70.
6. Set the synthesized sweeper CW to 600 MHz.
7. On the analyzer, press **FREQUENCY, 600 MHz**, then **Peak Search** (or **Search**).
8. Adjust the synthesized sweeper power level until the ΔMkr1 amplitude reads 0 dB ±0.10 dB.
9. Enter the power sensor 600 MHz calibration factor into the power meter.
10. Record the power meter reading at 600 MHz in Table 2-70.
11. Subtract the power meter reading at 600 MHz from the power meter reading at 300 MHz. Record this difference as the 300 MHz Frequency Response Error in Table 2-70. For example, if the power meter reading at 600 MHz is –6.45 dBm and the power meter reading at 300 MHz is –7.05 dBm, the 300 MHz Frequency Response Error would be –0.60 dB:

$$-0.60\text{ dB} = -7.05\text{ dBm} - (-6.45\text{ dBm})$$

Measuring 900 MHz Frequency Response Error

12. On the synthesized sweeper, press the following:

    CW, 900 MHz
    POWER LEVEL, **0 dBm**

13. On the analyzer, press **FREQUENCY, 900 MHz**.
14. Enter the power sensor 1 GHz calibration factor into the power meter.
15. On the analyzer, press

    Marker, Off
    Peak Search (or **Search**).
    Marker, Delta

16. Record the power meter reading in Table 2-70 as the 900 MHz power meter reading.
17. On the synthesized sweeper, press **CW**, **1.8 GHz**.

18. On the analyzer, press the following:

    FREQUENCY, 1.8 GHz
    Peak Search (or **Search**)
    AMPLITUDE
    Presel Center

19. On the analyzer, press **Peak Search** (or **Search**).

20. Adjust the synthesized sweeper power level until the ΔMkr1 amplitude reads 0 dB ±0.1 dB.

21. Enter the power sensor 2 GHz calibration factor into the power meter.

22. Record the power meter reading in Table 2-70 as the 1.8 GHz power meter reading.

23. On the analyzer, press **Marker, Off**.

24. Subtract the power meter reading at 1.8 GHz from the power meter reading at 900 MHz. Record this difference as the 900 MHz Frequency Response Error in Table 2-70. For example, if the power meter reading at 1.8 GHz is –6.35 dBm and the power meter reading at 900 MHz is –7.05 dBm, the 900 MHz Frequency Response Error would be –0.7 dB:

$$-0.70\ \text{dB} = -7.05\ \text{dBm} - (-6.35\ \text{dBm})$$

Measuring 1.55 GHz Frequency Response Error

1. On the synthesized sweeper, press the following:

    CW, 1.55 GHz
    POWER LEVEL, **0 dBm**

2. On the analyzer, press **FREQUENCY, 1.55 GHz**.

3. Enter the power sensor 2 GHz calibration factor into the power meter.

4. On the analyzer, press the following:

    Marker, **Off**
    Peak Search (or **Search**)
    AMPLITUDE
    Presel Center

5. On the analyzer, press **Peak Search** (or **Search**), **Marker, Delta**.

6. Record the power meter reading in Table 2-70 as the 1.55 GHz power meter reading.

7. On the synthesized sweeper, press **CW**, **3.1 GHz**.

8. On the analyzer, press **FREQUENCY, 3.1 GHz**.

9. On the analyzer, press the following:

   Peak Search (or **Search**)
   AMPLITUDE
   Presel Center

10. On the analyzer, press **Peak Search** (or **Search**).

11. Adjust the synthesized sweeper power level until the ΔMkr1 amplitude reads 0 dB ±0.1 dB.

12. Enter the power sensor 3 GHz calibration factor into the power meter.

13. Record the power meter reading in Table 2-70 as the 3.1 GHz power meter reading.

14. On the analyzer, press **Marker, Off**.

15. Subtract the power meter reading at 3.1 GHz from the power meter reading at 1.55 GHz. Record this difference as the 1.55 GHz Frequency Response Error in Table 2-70. For example, if the power meter reading at 3.1 GHz is –6.05 dBm and the power meter reading at 1.55 GHz is –7.35 dBm, the 3.1 GHz Frequency Response Error would be –1.2 dB:

$$-1.2 \text{ dB} = -7.35 \text{ dBm} - (-6.15 \text{ dBm})$$

Measuring 3.1 GHz Frequency Response Error

1. On the synthesized sweeper, press the following:

   CW, 3.1 GHz
   POWER LEVEL, **0 dBm**

2. On the analyzer, press **FREQUENCY, 3.1 GHz**.

3. Enter the power sensor 3 GHz calibration factor into the power meter.

4. On the analyzer, press the following:

   Marker, **Off**
   Peak Search (or **Search**)
   AMPLITUDE
   Presel Center

5. On the analyzer, press **Peak Search** (or **Search**), **Marker, Delta**.

6. Record the power meter reading in Table 2-70 as the 3.1 GHz power meter reading.

7. On the synthesized sweeper, press **CW**, **6.2 GHz**.

8. On the analyzer, press the following:

   FREQUENCY, 6.2 GHz
   Peak Search (or **Search**)
   AMPLITUDE
   Presel Center

9. On the analyzer, press **Peak Search** (or **Search**).

10. Adjust the synthesized sweeper power level until the ΔMkr1 amplitude reads 0 dB ±0.1 dB.

11. Enter the power sensor 6 GHz calibration factor into the power meter.

12. Record the power meter reading in Table 2-70 as the 6.2 GHz power meter reading.

13. On the analyzer, press **Marker, Off**.

14. Subtract the power meter reading at 6.2 GHz from the power meter reading at 3.1 GHz. Record this difference as the 3.1 GHz Frequency Response Error in Table 2-70. For example, if the power meter reading at 6.2 GHz is –6.05 dBm and the power meter reading at 3.1 GHz is –7.25 dBm, the 3.1 GHz Frequency Response Error would be –1.2 dB:

$$-1.2 \text{ dB} = -7.25 \text{ dBm} - (-6.05 \text{ dBm})$$

Table 2-70 Second Harmonic Distortion Worksheet

Description	Measurement
6.2 GHz Noise Level	______________ dBm
Power Meter Reading at 300 MHz	______________ dBm
Power Meter Reading at 600 MHz	______________ dBm
300 MHz Frequency Response Error (FRE)	______________ dB
Power Meter Reading at 900 MHz	______________ dBm
Power Meter Reading at 1.8 GHz	______________ dBm
900 MHz Frequency Response Error (FRE)	______________ dB
Power Meter Reading at 1.55 GHz	______________ dBm
Power Meter Reading at 3.1 GHz	______________ dBm
1.55 GHz Frequency Response Error (FRE)	______________ dB
Power Meter Reading at 3.1 GHz	______________ dBm
Power Meter Reading at 6.2 GHz	______________ dBm
3.1 GHz Frequency Response Error (FRE)	______________ dB

Measuring 300 MHz Second Harmonic Distortion

1. Connect the equipment as shown in Figure 2-47 using the 300 MHz Low Pass Filter.

2. On the synthesized sweeper, press the following:

   CW, **300 MHz**
   POWER LEVEL, **–10 dBm**

3. Enter the power sensor 300 MHz calibration factor into the power meter.

4. On the analyzer, press the following:

   FREQUENCY, 300 MHz
   SPAN, **100 kHz**
   AMPLITUDE, Ref Level, **–10 dBm**
   AMPLITUDE, Attenuation, 10 dB (Man)
   BW/Avg, Resolution BW 1 kHz (Man)
   Video BW, 1 kHz (Man)
   Markers, Off

5. Adjust the synthesized sweeper power level until the power meter reading is –10 dBm ±0.2 dB.

6. On the analyzer, press the following:

   Peak Search (or **Search**), Marker, Delta
   FREQUENCY, **600 MHz**
   BW/Avg, 10

   Wait for the "`VAvg 10`" to appear along the left side of the display.

7. On the analyzer, press **Peak Search** (or **Search**). The ΔMkr1 amplitude is the second harmonic suppression.

8. Calculate the 300 MHz Second Harmonic Intercept (SHI) using the second harmonic suppression value read in step 7 and the 300 MHz Frequency Response Error (FRE) from Table 2-70 as follows:

$$300\text{ MHz SHI} = -20\text{ dBm} - \text{Second Harmonic Suppression} + 300\text{ MHz FRE}$$

   For example, if the second harmonic suppression is –59 dB, and the 300 MHz FRE is –0.60 dB, the SHI would be 38.4 dBm:

$$38.4\text{ dBm} = -20\text{ dBm} - (-59\text{ dB}) + (-0.60\text{ dB})$$

9. Record the 300 MHz SHI as TR Entry 5 in the performance verification test record.

Measuring 900 MHz Second Harmonic Distortion

1. Replace the 300 MHz low pass filter with the 1 GHz low pass filters as shown in Figure 2-47.

2. On the synthesized sweeper, press the following:

   CW, **900 MHz**
   POWER LEVEL, **–10 dBm**

3. Enter the power sensor 1 GHz calibration factor into the power meter.

4. On the analyzer, press **FREQUENCY, Center Freq, 900 MHz**.

5. On the analyzer, press **Peak Search** (or **Search**).

6. Adjust the synthesized sweeper power level until the power meter reading is –10 dBm ±0.1 dB.

7. On the analyzer, press the following:

   Peak Search (or **Search**)
   Marker, **Delta**
   FREQUENCY, **Center Freq**, **1.8 GHz**

8. On the analyzer, press the following:

   AMPLITUDE, Ref Level, **–20 dBm**
   Video BW, 30 Hz (Man)

9. On the analyzer, press **BW/Avg, Average**, **10 Hz**. Wait until "`VAvg 10`" is displayed along the left side of the display.

10. On the analyzer, press **Peak Search** (or **Search**). The ΔMkr1 amplitude reading is the second harmonic suppression.

11. Calculate the 900 MHz Second Harmonic Intercept (SHI) using the second harmonic suppression value read in step 10 and the 300 MHz Frequency Response Error (FRE) from Table 2-70 as follows:

$$\text{900 MHz SHI} = -20\text{ dBm} - \text{Second Harmonic Suppression} + \text{900 GHz FRE}$$

For example, if the second harmonic suppression is –73 dB, and the 900 MHz FRE is 0.70 dB, the SHI would be 52.3 dBm:

$$52.3\text{ dBm} = -20\text{ dBm} - (-73\text{ dB}) + (-0.70\text{ dB})$$

12. Record the 900 MHz SHI as TR Entry 6 in the performance verification test record.

Measuring 1.55 GHz Second Harmonic Distortion

1. Replace the 1.GHz low pass filter with the two 1.8 GHz low pass filters as shown in Figure 2-47. Two filters are necessary to reduce the second harmonics from the source to less than –100 dBc.
2. On the synthesized sweeper, press the following:

   CW, **1.55 GHz**
   POWER LEVEL, **6 dBm**

3. Enter the power sensor 2 GHz calibration factor into the power meter.
4. On the analyzer, press the following:

   FREQUENCY, 1.55 GHz
   AMPLITUDE, Ref Level, **0 dBm**
   AMPLITUDE, Attenuation, 10 dB (Man)
   Peak Search (or **Search**).

5. Adjust the synthesized sweeper power level until the power meter reading is 0 dBm ±0.1 dB.
6. On the analyzer, press the following:

   Peak Search (or **Search**)
   Marker, **Delta**
   FREQUENCY, **Center Freq**, **3.1 GHz**

7. Remove the 1.8 GHz low pass filters and connect the synthesized sweeper output directly to the power splitter input. See Figure 2-47.
8. On the analyzer, press the following:

   Peak Search (or **Search**)
   AMPLITUDE
   Presel Center

9. Reinstall the filters between the synthesized sweeper and the power splitter.
10. On the analyzer, press the following:

    AMPLITUDE, Ref Level, **–40 dBm**
    Video BW, 30 Hz (Man)

11. On the analyzer, press **BW/Avg, Average**, **10 Hz**. Wait until "`VAvg 10`" is displayed along the left side of the display.
12. On the analyzer, press **Peak Search** (or **Search**). The ΔMkr1 amplitude reading is the second harmonic suppression.
13. Calculate the 1.55 GHz Second Harmonic Intercept (SHI) using the second harmonic suppression value read in step 12 and the 300 MHz Frequency Response Error (FRE) from Table 2-70 as follows:

1.55 GHz SHI = –10 dBm – Second Harmonic Suppression + 1.55 GHz FRE

For example, if the second harmonic suppression is –93 dB, and the 1.55 GHz FRE is –1.05 dB, the SHI would be 81.95 dBm:

81.95 dBm = –10 dBm–(–93 dB) + (–1.05 dB)

14. Record the 1.55 GHz SHI as TR Entry 7 in the performance verification test record.

Measuring 3.1 GHz Second Harmonic Distortion

1. Replace the 300 MHz low pass filter with the two 4.4 GHz low pass filters as shown in Figure 2-47. Two filters are necessary to reduce the second harmonics from the source to less than –110 dBc.
2. On the synthesized sweeper, press the following:

   CW, **3.1 GHz**
   POWER LEVEL, **6 dBm**

3. Enter the power sensor 3 GHz calibration factor into the power meter.
4. On the analyzer, press the following:

   FREQUENCY, 3.1 GHz
   AMPLITUDE, Ref Level, **0 dBm**
   AMPLITUDE, Attenuation, 10 dB (Man)

5. On the analyzer, press the following:

   Peak Search (or **Search**)
   AMPLITUDE
   Presel Center

6. Adjust the synthesized sweeper power level until the power meter reading is 0 dBm ±0.1 dB.
7. On the analyzer, press the following:

   Peak Search (or **Search**)
   Marker
   Delta

8. On the analyzer, press the following:

   FREQUENCY
   Center Freq, 6.2 GHz

9. Remove the 4.4 GHz low pass filters and connect the synthesized sweeper output directly to the power splitter input. See Figure 2-47.

10. On the analyzer, press the following:

    Peak Search (or **Search**)
    AMPLITUDE
    Presel Center

11. Reinstall the filters between the synthesized sweeper and the power splitter.

12. On the analyzer, press the following:

    AMPLITUDE, Ref Level, **–40 dBm**
    Video BW, 30 Hz (Man)

13. On the analyzer, press **BW/Avg, Average**, **10 Hz**. Wait until “VAvg 10” is displayed along the left side of the display.

14. On the analyzer, press **Peak Search** (or **Search**). The ΔMkr1 amplitude reading is the second harmonic suppression.

15. If the marker does not appear to be on a signal, do the following:

    a. Press **Marker, Select Marker (2)**

    b. Compare the Mkr2 and the 6.2 GHz Noise Level recorded in Table 2-70.

    c. If the difference between Mkr2 and the 6.2 GHz Noise Level recorded in Table 2-70 is less than 2 dB, check the box on the performance verification test record that the 3.1 GHz SHI test was noise limited.

16. If the measurement is not noise limited, calculate the 3.1 GHz Second Harmonic Intercept (SHI) using the second harmonic suppression value read in step 14 and the 3.1 GHz Frequency Response Error (FRE) from Table 2-70 as follows:

3.1 GHz SHI = –10 dBm – Second Harmonic Suppression + 3.1 GHz FRE

For example, if the second harmonic suppression is –103 dB, and the 3.1 GHz FRE is –1.20 dB, the SHI would be 91.8 dBm:

91.8 dBm = –10 dBm–(–103 dB) + (–1.20 dB)

17. Record the 3.1 GHz SHI as TR Entry 8 in the performance verification test record.

32. Gain Compression: Agilent E4401B, E4402B, E4403B, and E4411B

This test verifies the ability of the analyzer to measure relatively low-amplitude signals in the presence of higher-amplitude signals. Gain compression is measured by applying two signals, separated by a defined amount in frequency. The higher-amplitude signal is set to yield the specified total power at the input mixer (the power at the input mixer is defined as the input power level minus the input attenuation). The lower-amplitude signal is set at least 35 dB below the higher-amplitude signal, such that its power does not significantly add to the total power. The higher-amplitude signal is turned off and the lower-amplitude signal level is measured. This is the uncompressed amplitude.

The higher-amplitude signal is turned on and the amplitude of the lower-amplitude signal is again measured. This is the compressed amplitude. The difference between the uncompressed and compressed amplitude is the measured gain compression.

There are no adjustments related to this performance test.

Equipment Required

Synthesized sweeper
Synthesized signal generator
Power meter, dual channel
RF power sensor
Directional bridge
Cable, BNC, 120-cm (48-in)
Cable, APC 3.5 (m) (*2 required*)
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to APC 3.5 (f) (3 *required*)
Adapter, Type-N (m) to SMA (m)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Adapter, Type-N (m), to BNC (m), 75 Ω
Adapter, mechanical, Type-N (m), 50 Ω to Type-N (f), 75 Ω

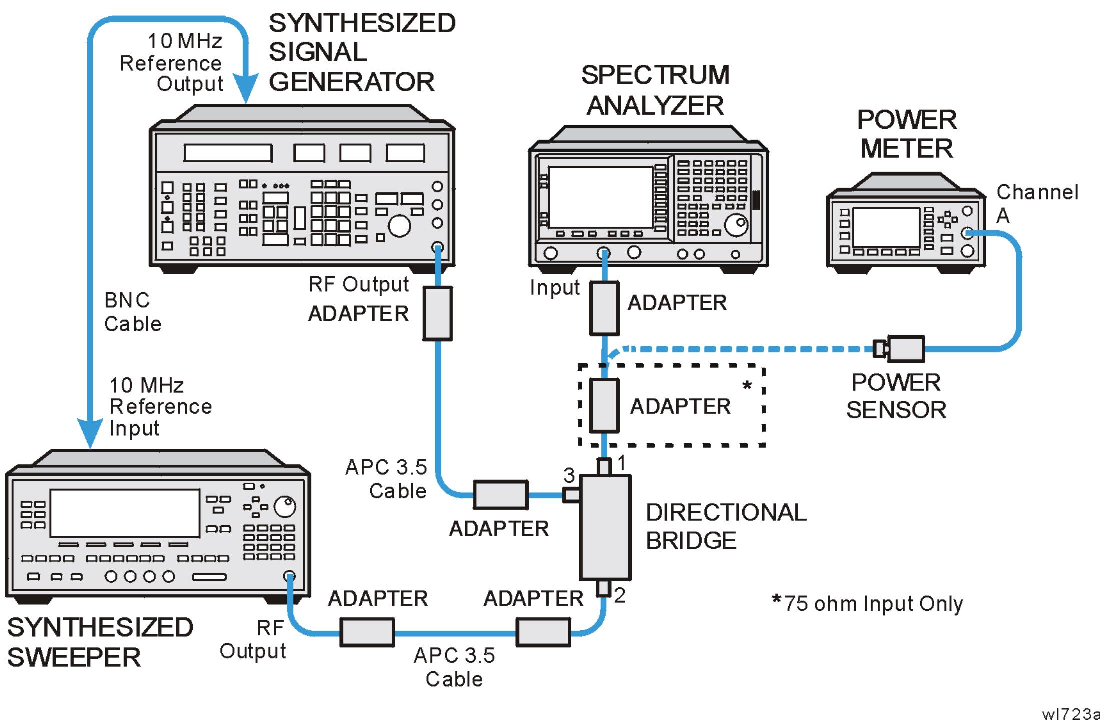
Procedure

1. Zero and calibrate the power meter and power sensor combination in log mode (power reads out in dBm) as described in the power meter operation manual.

2. Connect the equipment as shown in Figure 2-48, with port 1 of the directional bridge connected to the power sensor.

   75 Ω Input only: Use the 75 Ω power sensor with the mechanical adapter. The power measured at the output of the 50 Ω directional bridge by the 75 Ω power sensor is the equivalent power “seen” by the 75 Ω analyzer.

Figure 2-48 Gain Compression Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or damage to the connectors will occur.

3. Set the synthesized signal generator controls as follows:

   FREQUENCY, **50 MHz**
   AMPLITUDE, **–100 dBm**

4. On the synthesized sweeper press **INSTRUMENT PRESET**, then set the controls as follows:

   CW, **53 MHz**
   POWER LEVEL, **–3 dBm**

5. Enter the power sensor calibration factor for the synthesizer frequency into the power meter.

6. Adjust the synthesized sweeper power level setting until the power meter reading is the same as indicated in Table 2-71.

7. Record the actual synthesized sweeper power level setting in Table 2-71 for each frequency indicated.

Table 2-71 Source Frequency and Amplitude Settings

Synthesized Signal Generator		Synthesized Sweeper		
Frequency (GHz)	Amplitude (dBm)	CW Frequency (MHz)	Desired Power Level (dBm)	Actual Power Level (dBm)
0.05	–40	53	0.0	
0.05	–40	50.004	0.0	
1.40	–40	1403	0.0	
2.50[a]	–40[a]	2503[a]	0.0[a]	

a. E4402B and E4403B only.

Table 2-72 Analyzer Settings

Test Frequency	Analyzer							TR Entry
(MHz)	Center Freq (GHz)	Span (kHz)	RBW (kHz)	VBW (kHz)	Ref Lvl (dBm)	Scale (dB)	Atten (dB)	
53	0.05	150	30	0.300	–10.0	10	0.0	**1)**
50.004[a]	0.05[a]	1.0[a]	0.030[a]	0.030[a]	–10.0[a]	10[a]	0.0[a]	**2)**
1403	1.40	150	30	0.300	–10.0	10	0.0	**3)**
2503[b]	2.50[b]	150[b]	30[b]	0.300[b]	–10.0[b]	10[b]	0.0[b]	**4)**

a. Option 1DR only.
b. E4402B and E4403B only.

8. Repeat step 3 through step 7 for each of the settings listed in Table 2-71.

9. Disconnect the power sensor from the directional bridge and connect the directional bridge to the input of the analyzer using an adapter. Do not use a cable.

   75 Ω *Input only: Use a 75* Ω *adapter, Type-N (m) to BNC (m) and a mechanical adapter, Type-N (m) 50* Ω to *Type-N (f) 75* Ω

10. Set the synthesized sweeper amplitude Off.

11. Set the synthesized signal generator amplitude to –24 dBm.

12. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System**, **Alignments**, **Auto Align**, **Off**. Set the analyzer by pressing the following keys:

    Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
    FREQUENCY, **Center Freq, 50 MHz** (*or as indicated in* Table 2-72)
    SPAN, **150 kHz** (*or as indicated in* Table 2-72)
    AMPLITUDE, **More 1 of 2**, **Y Axis Units** (or **Amptd Units**), **dBm**
    AMPLITUDE, **Ref Level, –10 dBm, Attenuation 0 dB**
    AMPLITUDE, **Scale/Div**, **10 dB**
    BW/Avg, **Resolution BW**, **30 kHz** (*or as indicated in* Table 2-72)
    BW/Avg, **Video BW**, **300 Hz** (*or as indicated in* Table 2-72)

13. On the synthesized sweeper, set the appropriate power level to the setting recorded in Table 2-71. Then set RF to Off.

    75 Ω *Input only: Adjust the power level for a 2.0 dBm reading.*

14. On the analyzer, press **Peak Search** (or **Search**).

15. Adjust the amplitude of the synthesized signal generator to achieve a marker amplitude reading within 0.5 dB of the value indicated in Table 2-71. The marker amplitude is the uncompressed amplitude.

16. On the analyzer, press the following keys:

    Peak Search (or **Search**)
    Marker
    Delta

17. On the synthesized sweeper, set RF to On. The amplitude should be the same as recorded in Table 2-71.

18. On the analyzer, press **Peak Search** (or **Search**). This is the compressed amplitude. The ΔMkr1 amplitude is the measured gain compression.

19. Record the measured gain compression in the performance test record as the TR Entry listed in Table 2-72.

20. Repeat step 6 through step 19 for each set of settings in Table 2-71 and Table 2-72.

33. Gain Compression: Agilent E4404B, E4405B, E4407B, and E4408B

This test verifies the ability of the analyzer to measure relatively low-amplitude signals in the presence of higher-amplitude signals. Gain compression is measured by applying two signals, separated by a defined amount in frequency. The higher-amplitude signal is set to yield the specified total power at the input mixer (the power at the input mixer is defined as the input power level minus the input attenuation). The lower-amplitude signal is set at least 35 dB below the higher-amplitude signal, such that its power does not significantly add to the total power. The higher-amplitude signal is turned off and the lower-amplitude signal level is measured. This is the uncompressed amplitude.

The higher-amplitude signal is turned on and the amplitude of the lower-amplitude signal is again measured. This is the compressed amplitude. The difference between the uncompressed and compressed amplitude is the measured gain compression.

There are no adjustments related to this performance test.

Equipment Required

Synthesized sweeper (*2 required*)
Power meter, dual channel
Microwave power sensor
Directional bridge
Directional coupler
Cable, BNC, 120-cm (48-in)
Cable, APC 3.5 (m) (*2 required*)
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to APC 3.5 (f) (3 *required*)
Adapter, Type-N (m) to SMA (m)

Additional Equipment for Option BAB

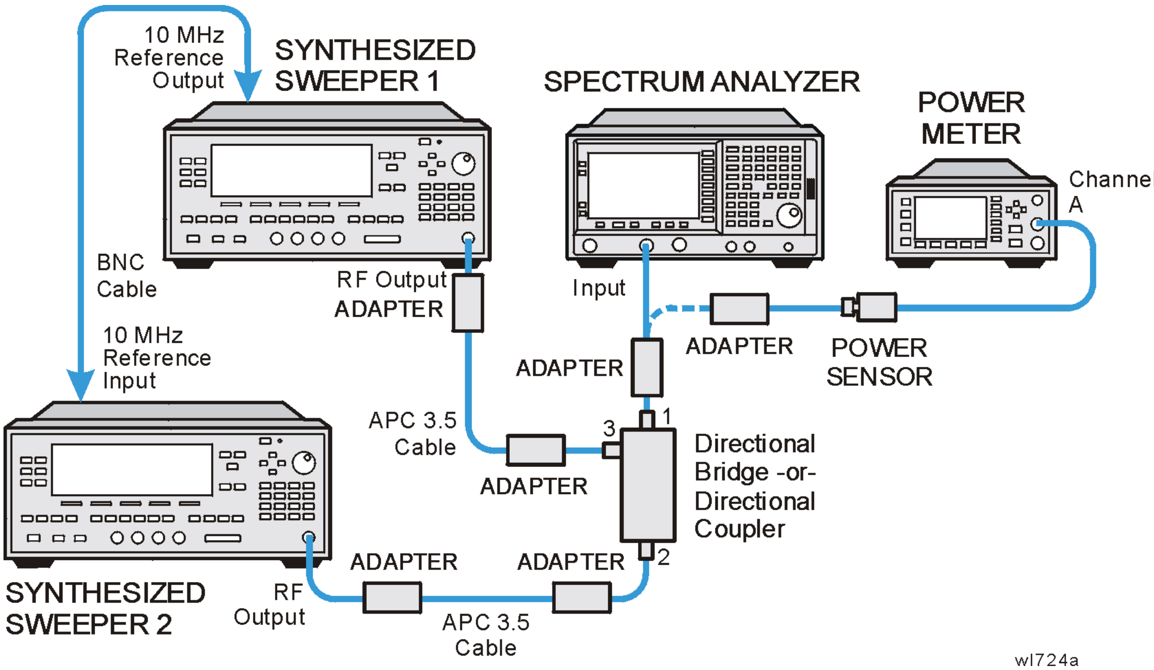
Adapter, Type-N (m), to APC 3.5 (f)

Procedure

1. Zero and calibrate the power meter and power sensor combination in log mode (power reads out in dBm) as described in the power meter operation manual.

2. Connect the equipment as shown in Figure 2-49, with the load port of the directional bridge connected to the power sensor. The directional bridge should be used for measurements of frequencies less than or equal to 2.5 GHz. Use the directional coupler for higher frequency measurements.

Figure 2-49 Gain Compression Test Setup



3. On the synthesized sweeper 1 press **PRESET**, then set the controls as follows:

   CW, **50 MHz**
   POWER LEVEL, **–100 dBm**

4. On the synthesized sweeper 2 press **PRESET**, then set the controls as follows:

   CW, **53 MHz**
   POWER LEVEL, **–3 dBm**

5. Enter the power sensor calibration factor for the synthesized sweeper 2 frequency into the power meter.

6. Adjust the synthesized sweeper 2 power level setting until the power meter reading is the same as indicated in Table 2-74.

7. Record the actual synthesized sweeper 2 power level setting in Table 2-74 for each frequency indicated.

Table 2-73 Source Frequency and Amplitude Settings

First Synthesized Sweeper		Second Synthesized Sweeper		
CW Frequency (MHz)	Power Level (dBm)	CW Frequency (MHz)	Desired Power Level (dBm)	Actual Power Level (dBm)
50	–40	53	–5.0	
50	–40	50.004	–5.0	
1400	–40	1403	0.0	
2500	–40	2503	0.0	
4400	–40	4403	0.0	
7600[b]	–40	7603	0.0	
14000[b]	–40	14003	0.0	

Table 2-74 Analyzer Settings

Test Frequency	Analyzer							TR Entry
(MHz)	Center Freq (GHz)	Span (kHz)	RBW (kHz)	VBW (kHz)	Ref Lvl (dBm)	Scale (dB)	Atten (dB)	
53	0.05	150	30	0.300	–10.0	10	0.0	**1)**
50.004[a]	0.05[a]	1.0[a]	0.030[a]	0.030[a]	–10.0[a]	10[a]	0.0[a]	**2)**
1403	1.40	150	30	0.300	–10.0	10	0.0	**3)**
2503	2.50	150	30	0.300	–10.0	10	0.0	**4)**
4403	4.40	150	30	0.300	–10.0	10	0.0	**5)**
7603[b]	7.60	150	30	0.300	–10.0	10	0.0	**6)**
14003[b]	14.0	150	30	0.300	–10.0	10	0.0	**7)**

a. Option 1DR only.
b. E4405B, E4407B and E4408B only.

8. Repeat step 3 through step 7 for each of the settings listed in Table . Use the directional bridge in place of the coupler for frequencies less than or equal to 2503 MHz.
9. Disconnect the power sensor from the directional bridge and connect the directional bridge to the input of the analyzer using an adapter. Do not use a cable.

10. Set the synthesized sweeper 2 power level to Off.

11. Set the synthesized sweeper 1 power level to –24 dBm.

12. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Press **System**, **Alignments**, **Auto Align**, **Off**. Set the analyzer by pressing the following keys:

    Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
    FREQUENCY, **Center Freq, 50 MHz** (*or as indicated in* Table 2-74)
    SPAN, **150 kHz** (*or as indicated in* Table 2-74)
    AMPLITUDE, **Ref Level, –10 dBm, Attenuation 0 dB**
    AMPLITUDE, **Scale/Div**, **10 dB**
    BW/Avg, **Resolution BW**, **30 kHz** (*or as indicated in* Table 2-74)
    BW/Avg, **Video BW**, **300 Hz** (*or as indicated in* Table 2-74)

13. On the synthesized sweeper 2, set the appropriate power level to the setting recorded in Table 2-73. Then set RF to Off.

14. On the analyzer, press **Peak Search** (or **Search**).

15. Adjust the power level of the synthesized sweeper 1 to achieve a marker amplitude reading within 0.5 dB of the value indicated in Table 2-73. The marker amplitude is the uncompressed amplitude.

16. On the analyzer, press the following keys:

    Peak Search (or **Search**)
    Marker
    Delta

17. On the synthesized sweeper 2, set RF to On. The amplitude should be the same as recorded in Table 2-73.

18. On the analyzer, press **Peak Search** (or **Search**). This is the compressed amplitude. The ΔMkr1 amplitude is the measured gain compression.

19. Record the measured gain compression in the performance test record as the TR Entries indicated in Table 2-74.

20. Repeat step 10 through step 19 for each set of settings in Table 2-73 and Table 2-74 for frequencies less than or equal to 2503 MHz.

21. Replace the directional bridge with the directional coupler.

22. Repeat step 10 through step 19 for the remaining frequencies in Table 2-73.

34. Displayed Average Noise Level: Agilent E4401B and E4411B

This performance test measures the Displayed Average Noise Level (DANL) within the frequency range specified. The analyzer input is terminated in its characteristic impedance. If the analyzer is also equipped with a tracking generator (Option 1DN or 1DQ), the tracking generator is also terminated in its characteristic impedance and set for maximum leveled output power.

The test tunes the analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in a narrow span.

To reduce measurement uncertainty due to input attenuator switching and resolution bandwidth switching, a reference level offset is added. The 50 MHz alignment signal is used as the amplitude reference for determining the amount of offset required. The offset is removed at the end of the test by pressing instrument preset.

For analyzers equipped with narrow resolution bandwidths (Option 1DR), DANL is also tested in the 10 Hz resolution bandwidth setting.

The related adjustment for this procedure is “Frequency Response.”

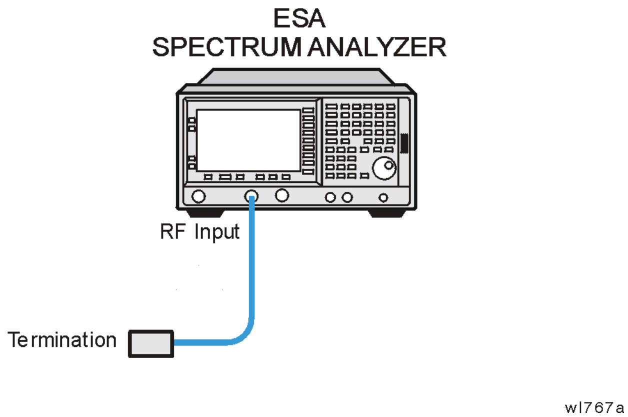
Equipment Required

Termination, 50 Ω, Type-N (m) (*2 required for Options 1DN or 1DQ*)

Additional Equipment for 75 Ω Input

Termination, 75 Ω, Type-N (m) (*2 required for Option 1DQ*)
Adapter, Type-N (f), to BNC (m), 75 Ω

Figure 2-50 Displayed Average Noise Level Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or damage to the connectors will occur.

Procedure

1. Set up the analyzers as shown in Figure 2-50.
2. On the analyzer, press **Preset**. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, **Points**, **401**, **Enter** *(Firmware revision A.04.00 and later)*
   Input/Output (or **Input**), **Amptd Ref Out** (On)
   FREQUENCY, **50 MHz**
   SPAN, **2 kHz**
   AMPLITUDE, –25 dBm (*50 Ω Input only*)
   AMPLITUDE, 28.75 dBmV (75 Ω *Input only*)
   AMPLITUDE, Attenuation, **10 dB**
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 1 kHz
   Det/Demod, Detector, Sample, Return

3. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the Ref Amptd reading below.

   Ref Amptd ____________ dB

4. On the analyzer, press the following keys:

   AMPLITUDE, Attenuation, 0 dB
   SPAN, 20 kHz
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 30 Hz

5. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(1 kHz RBW).

   Meas Amptd(1 kHz RBW)____________ dB

6. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 5 from the Ref Amptd in step 3. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(1 kHz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(1 kHz RBW)}$$

   Ref Lvl Offst(1 kHz RBW)____________ dB

7. If the analyzer is not equipped with Option 1DR, proceed to step 11.

8. On the analyzer, press the following keys:

   AMPLITUDE, Attenuation, 0 dB
   SPAN, 500 Hz
   BW/Avg, Resolution BW, 10 Hz
   BW/Avg, Video BW, 1 Hz

9. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(10 Hz RBW).

   Meas Amptd(10 Hz RBW)____________ dB

10. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 9 from the Ref Amptd in step 3. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(10 Hz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(10 Hz RBW)}$$

   Ref Lvl Offst(10 Hz RBW)____________ dB

11. On the analyzer, press **Input, Amptd Ref** (Off). Then press **AMPLITUDE, More, Ref Lvl Offst**, and enter the value recorded in step 6.

12. Connect the 50 Ω termination to the analyzer input as shown in Figure 2-50.

75 Ω Input only: Connect the 75 Ω termination to the analyzer Input 75 Ω using an adapter.

13. If the analyzer is equipped with Option 1DN, 50 Ω tracking generator, do the following:

    a. On the analyzer, press **Source, Amplitude, 0 dBm**.

    b. Connect a 50 Ω termination to the RF OUT 50 Ω.

14. If the analyzer is equipped with Option 1DQ, 75 Ω Tracking Generator, do the following:

    a. On the analyzer, press **Source, Amplitude, –6 dBm**.

    b. Connect a 75 Ω termination to the RF OUT 75 Ω.

Measurement Sequence

The DANL Measurement Sequence tables, for analyzers with 50 Ω inputs and for analyzers with 75 Ω inputs, list the procedures to be performed and the parameters to be used in each procedure. The table also lists the TR Entry number for recording the results in the performance verification test record.

1. If the analyzer is not equipped with Option 1DR, narrow bandwidths, or Option 1DS, preamplifier, perform only those procedures with an “X” (“X” = “Don’t Care”) in each of the Analyzer Options columns. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
2. If the analyzer is equipped with Option 1DR, but not Option 1DS, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DR option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
3. If the analyzer is equipped with Option 1DS, but not Option 1DR, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DS Option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
4. If the analyzer is equipped with both Option 1DS and Option 1DR, perform all procedures. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
5. After performing all applicable DANL measurement procedures, proceed to Remove Reference Level Offset.

Table 2-75 DANL Measurement Sequence, 50 Ω Inputs

Analyzer Options		Procedure	Procedure Parameters				TR Entry
1DR	1DS		Start Freq	Stop Freq	Test RBW	Preamp State	
X	X	Measure DANL at 400 kHz	N/A	N/A	1 kHz	Off	**1)**
X	X	Measure DANL	1 MHz	10 MHz	1 kHz	Off	**2)**
X	X	Measure DANL	10 MHz	500 MHz	1 kHz	Off	**3)**
X	X	Measure DANL	500 MHz	1 GHz	1 kHz	Off	**4)**
X	X	Measure DANL	1 GHz	1.5 GHz	1 kHz	Off	**5)**
X	Y	Measure DANL at 400 kHz	N/A	N/A	1 kHz	On	**6)**
X	Y	Measure DANL	1 MHz	10 MHz	1 kHz	On	**7)**
X	Y	Measure DANL	10 MHz	500 MHz	1 kHz	On	**8)**
X	Y	Measure DANL	500 MHz	1 GHz	1 kHz	On	**9)**
X	Y	Measure DANL	1 GHz	1.5 GHz	1 kHz	On	**10)**
Y	X	Measure DANL at 400 kHz	N/A	N/A	10 Hz	Off	**11)**
Y	X	Measure DANL	1 MHz	10 MHz	10 Hz	Off	**12)**
Y	X	Measure DANL	10 MHz	500 MHz	10 Hz	Off	**13)**
Y	X	Measure DANL	500 MHz	1 GHz	10 Hz	Off	**14)**
Y	X	Measure DANL	1 GHz	1.5 GHz	10 Hz	Off	**15)**
Y	Y	Measure DANL at 400 kHz	N/A	N/A	10 Hz	On	**16)**
Y	Y	Measure DANL	1 MHz	10 MHz	10 Hz	On	**17)**
Y	Y	Measure DANL	10 MHz	500 MHz	10 Hz	On	**18)**
Y	Y	Measure DANL	500 MHz	1 GHz	10 Hz	On	**19)**
Y	Y	Measure DANL	1 GHz	1.5 GHz	10 Hz	On	**20)**

Table 2-76 DANL Measurement Sequence, 75 Ω Inputs

Analyzer Options		Procedure	Procedure Parameters				TR Entry
1DR	1DS		Start Freq	Stop Freq	Test RBW	Preamp State	
X	X	Measure DANL	1 MHz	10 MHz	1 kHz	Off	**21)**
X	X	Measure DANL	10 MHz	500 MHz	1 kHz	Off	**22)**
X	X	Measure DANL	500 MHz	1 GHz	1 kHz	Off	**23)**
X	X	Measure DANL	1 GHz	1.5 GHz	1 kHz	Off	**24)**
X	X	Measure DANL	1 MHz	10 MHz	1 kHz	On	**25)**
X	Y	Measure DANL	10 MHz	500 MHz	1 kHz	On	**26)**
X	Y	Measure DANL	500 MHz	1 GHz	1 kHz	On	**27)**
X	Y	Measure DANL	1 GHz	1.5 GHz	1 kHz	On	**28)**
X	X	Measure DANL	1 MHz	10 MHz	1 kHz	Off	**29)**
Y	X	Measure DANL	10 MHz	500 MHz	10 Hz	Off	**30)**
Y	X	Measure DANL	500 MHz	1 GHz	10 Hz	Off	**31)**
Y	X	Measure DANL	1 GHz	1.5 GHz	10 Hz	Off	**32)**
X	X	Measure DANL	1 MHz	10 MHz	1 kHz	On	**33)**
Y	Y	Measure DANL	10 MHz	500 MHz	10 Hz	On	**34)**
Y	Y	Measure DANL	500 MHz	1 GHz	10 Hz	On	**35)**
Y	Y	Measure DANL	1 GHz	1.5 GHz	10 Hz	On	**36)**

Measuring Displayed Average Noise Level (DANL)

1. Set the analyzer as follows using the start and stop frequencies, test RBW and preamp state as specified in Table 2-75 or Table 2-76:

   Auto Couple
   FREQUENCY, Start Freq, (*enter specified start frequency*)
   FREQUENCY, Stop Freq, (*enter specified stop frequency*)
   AMPLITUDE, –70 dBm (*50 Ω Input only*)
   Attenuation, 0 dB
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**)
   dBmV, **More**, **Ref Level**, **–21.24 dBmV** (*75 Ω Input only*)
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (1 kHz) if test RBW = 1 kHz*)
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (10 Hz) if test RBW = 10 Hz*)
   BW/Avg, Resolution BW, 100 kHz

BW/Avg, Video BW, 10 kHz
AMPLITUDE, More, Int Preamp (Off) (*if preamp state = Off*)
AMPLITUDE, More, Int Preamp (On) (*if preamp state = On*)
Sweep, **Sweep** (Cont)
Sweep, **Sweep Time** (Auto)

3. On the analyzer, press **Single**, **View/Trace**, **Trace 1**, **Clear Write**, **BW/Avg**, **Average Type** (Video), **Averages**, **3**, **Enter**, **Single**.

   Wait until VAvg 3 is displayed to the left of the graticule (the analyzer will take three sweeps, then stop).

2. On the analyzer, press **Peak Search** (or **Search**). Set the analyzer by pressing the following keys:

   BW/Avg, Average (Off).
   Marker →, Μκρ→ ΧΦ

3. If the test RBW is 1 kHz, press **Span, 20 kHz**.

   If the test RBW is 10 Hz, press **Span, 500 Hz**.

4. If the test RBW is 1 kHz, press **BW/Avg, Resolution BW, 1 kHz, Video BW, 30 Hz**.

   If the test RBW is 10 Hz, press **BW/Avg, Resolution BW, 10 Hz, Video BW, 1 Hz**.

5. On the analyzer, press **Single** and wait for the new sweep to finish.

6. On the analyzer, press **Display, Display Line** (On), and adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

Measuring Displayed Average Noise Level at 400 kHz

1. Press **FREQUENCY, Center Freq, 400 kHz**. Set the analyzer by pressing the following keys:

   SPAN, **20 kHz** (*if test RBW = 1 kHz*)
   SPAN, **500 Hz** (*if test RBW = 10 Hz*)
   AMPLITUDE, –70 dBm (*50 Ω Input only*)
   Attenuation, 0 dB
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBmV**, **More**, **Ref Level, –21.24 dBmV** (*75 Ω Input only*)
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (1 kHz) if test RBW = 1 kHz*)
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (10 Hz) if test RBW = 10 Hz*)
   AMPLITUDE, More, Int Preamp (Off) (*if preamp state = Off*)
   AMPLITUDE, More, Int Preamp (On) (*if preamp state = On*)
   BW/Avg, Resolution BW, 1 kHz (*if test RBW = 1 kHz*)
   BW/Avg, Resolution BW, 10 Hz (*if test RBW = 10 Hz*)

BW/Avg, Video BW, 30 Hz (*if test RBW = 1 kHz*)
BW/Avg, Video BW, 30 Hz (*if test RBW = 10 Hz*)

2. On the analyzer, press **Single** and wait for a new sweep to complete.
3. On the analyzer, press **Display**, **Display Line** (On). Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

Remove Reference Level Offset

1. Press **AMPLITUDE, More, Ref Lvl Offst, 0 dB**.
2. On the analyzer, press **Preset**.

35. Displayed Average Noise Level: Agilent E4402B and E4403B

This performance test measures the displayed average noise level (DANL) within the frequency range specified. The analyzer input is terminated in its characteristic impedance. If the analyzer is also equipped with a tracking generator (Option 1DN), the tracking generator is also terminated in its characteristic impedance and set for maximum leveled output power.

The test tunes the analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in a narrow span.

To reduce measurement uncertainty due to input attenuator switching and resolution bandwidth switching, a reference level offset is added. The 50 MHz alignment signal is used as the amplitude reference for determining the amount of offset required. The offset is removed at the end of the test by pressing instrument preset.

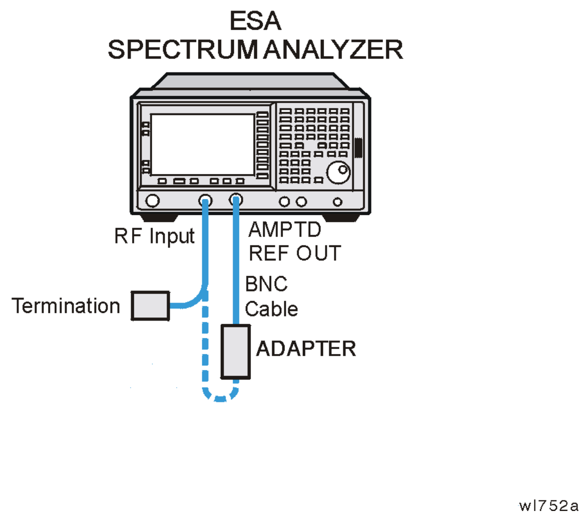
For analyzers equipped with narrow resolution bandwidths (Option 1DR), DANL is also tested in the 10 Hz resolution bandwidth setting.

The related adjustment for this procedure is “Frequency Response.”

Equipment Required

Termination, 50 Ω, Type-N (m) (*2 required for Option 1DN*)
Cable, BNC
Adapter, Type-N (m) to BNC (f)

Figure 2-51 Displayed Average Noise Level Test Setup



Procedure

1. Connect the AMPTD REF OUT to the 50 Ω Input using a BNC cable and adapter as shown in Figure 2-51.

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   Input/Output (or **Input**), **Amptd Ref Out** (On)
   FREQUENCY, **50 MHz**
   SPAN, **2 kHz**
   AMPLITUDE, –20 dBm
   AMPLITUDE, Attenuation, **10 dB**
   AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 1 kHz
   Det/Demod, Detector, Sample, Return

3. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the Ref Amptd reading below.

   Ref Amptd ____________ dB

4. On the analyzer, press the following keys:

   AMPLITUDE, Attenuation, 0 dB
   SPAN, 20 kHz
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 30 Hz

5. On the analyzer, press **Single**.

6. On the analyzer, press **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(1 kHz RBW).

   Meas Amptd(1 kHz RBW)____________ dB

7. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 6 from the Ref Amptd in step 3. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(1 kHz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(1 kHz RBW)}$$

   Ref Lvl Offst(1 kHz RBW)____________ dB

8. If the analyzer is not equipped with Option 1DR, proceed to step 12.

9. On the analyzer, press the following keys:

   AMPLITUDE, Attenuation, 0 dB
   SPAN, 500 Hz
   BW/Avg, Resolution BW, 10 Hz
   BW/Avg, Video BW, 1 Hz

10. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(10 Hz RBW).

    Meas Amptd(10 Hz RBW)__________ dB

11. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 10 from the Ref Amptd in step 3. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(10 Hz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(10 Hz RBW)}$$

    Ref Lvl Offst(10 Hz RBW)__________ dB

12. On the analyzer, press **Input, Amptd Ref Out** (Off), then **AMPLITUDE, More, Ref Lvl Offst**, and enter the value recorded in step 7.

13. Connect the 50 Ω termination to the analyzer input as shown in Figure 2-51.

14. Disconnect the BNC cable and adapter from the AMPTD REF OUT and the 50 Ω Input.

15. If the analyzer is equipped with Option 1DN, 50 Ω tracking generator, do the following:

    a. On the analyzer, press **Source, Amplitude, 0 dBm**.

    b. Connect a 50 Ω termination to the RF OUT 50 Ω.

Measurement Sequence

The DANL Measurement Sequence tables list the procedures to be performed and the parameters to be used in each procedure. The table also lists the TR Entry number for recording the results in the performance verification test record.

1. If the analyzer is not equipped with Option 1DR, narrow bandwidths, or Option 1DS, preamplifier, perform only those procedures with an “X” (“X” = “Don’t Care”) in each of the Analyzer Options columns. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.

2. If the analyzer is equipped with Option 1DR, but not Option 1DS, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DR option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.

3. If the analyzer is equipped with Option 1DS, but not Option 1DR, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DS Option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.

4. If the analyzer is equipped with both Option 1DS and Option 1DR, perform all procedures. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.

5. After performing all applicable DANL measurement procedures, proceed to Remove Reference Level Offset.

Table 2-77 DANL Measurement Sequence

Analyzer Options		Procedure	Procedure Parameters				TR Entry[a]
1DR	1DS		Start Freq	Stop Freq	Test RBW	Preamp State	
X	X	Measure DANL	10 MHz	1 GHz	1 kHz	Off	**1)**
X	X	Measure DANL	1 GHz	2 GHz	1 kHz	Off	**2)**
X	X	Measure DANL	2 GHz	3 GHz	1 kHz	Off	**3)**
X	Y	Measure DANL	10 MHz	1 GHz	1 kHz	On	**4/13)**
X	Y	Measure DANL	1 GHz	2 GHz	1 kHz	On	**5/14)**
X	Y	Measure DANL	2 GHz	3 GHz	1 kHz	On	**6/15)**
Y	X	Measure DANL	10 MHz	1 GHz	10 Hz	Off	**7)**
Y	X	Measure DANL	1 GHz	2 GHz	10 Hz	Off	**8)**
Y	X	Measure DANL	2 GHz	3 GHz	10 Hz	Off	**9)**
Y	Y	Measure DANL	10 MHz	1 GHz	10 Hz	On	**10/16)**
Y	Y	Measure DANL	1 GHz	2 GHz	10 Hz	On	**11/17)**
Y	Y	Measure DANL	2 GHz	3 GHz	10 Hz	On	**12/18)**

a. There are two possible TR Entries for measurements made with Preamp On, depending upon the ambient temperature. The first entry is for measurements made with an ambient temperature outside of the 20 to 30° C range, but within the 0 to 55° C range. The second entry is for measurements made with an ambient temperature within the 20 to 30° C range.

Measuring Displayed Average Noise Level (DANL)

1. Set the analyzer as follows using the start and stop frequencies, test RBW and preamp state as specified in Table 2-77:

   Auto Couple
   FREQUENCY, Start Freq, (*enter specified start frequency*)
   FREQUENCY, Stop Freq, (*enter specified stop frequency*)
   AMPLITUDE, –70 dBm
   Attenuation, 0 dB
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (1 kHz) if test RBW = 1 kHz*)
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (10 Hz) if test RBW = 10 Hz*)
   BW/Avg, Resolution BW, 1 MHz
   BW/Avg, Video BW, 10 kHz
   AMPLITUDE, More, Int Preamp (Off) (*if preamp state = Off*)
   AMPLITUDE, More, Int Preamp (On) (*if preamp state = On*)
   Sweep, **Sweep** (Cont)
   Sweep, **Sweep Time** (Auto)

2. On the analyzer, press **Single**, **View/Trace**, **Trace 1**, **Clear Write**, **BW/Avg**, **Average Type** (Video), **Averages**, **3**, **Enter**, **Single**

3. Wait until VAvg 3 is displayed to the left of the graticule (the analyzer will take three sweeps, then stop).

4. On the analyzer, press the following keys:

   BW/Avg, **Average** (Off)
   Peak Search (or **Search**)
   BW/Avg, **Average** (On)
   Marker →, **Mkr→ CF**

5. If the test RBW is 1 kHz, press **Span, 20 kHz**.

6. If the test RBW is 10 Hz, press **Span, 500 Hz**.

7. If the test RBW is 1 kHz, press **BW/Avg, Resolution BW, 1 kHz, Video BW, 30 Hz**.

8. If the test RBW is 10 Hz, press **BW/Avg, Resolution BW, 10 Hz, Video BW, 1 Hz**.

9. On the analyzer, press **Single** and wait for the new sweep to finish. Then press **Display, Display Line** (On), and adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

Remove Reference Level Offset

1. Press **AMPLITUDE, More, Ref Lvl Offst, 0 dB**.

2. On the analyzer, press **Preset**.

36. Displayed Average Noise Level: Agilent E4404B and E4405B

This performance test measures the displayed average noise level (DANL) within the frequency range specified. The analyzer input is terminated in its characteristic impedance. If the analyzer is also equipped with a tracking generator (Option 1DN), the tracking generator is also terminated in its characteristic impedance and set for maximum leveled output power.

The test tunes the analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in a narrow span.

To reduce measurement uncertainty due to input attenuator switching and resolution bandwidth switching, a reference level offset is added. The 50 MHz alignment signal is used as the amplitude reference for determining the amount of offset required. The offset is removed at the end of the test by pressing instrument preset.

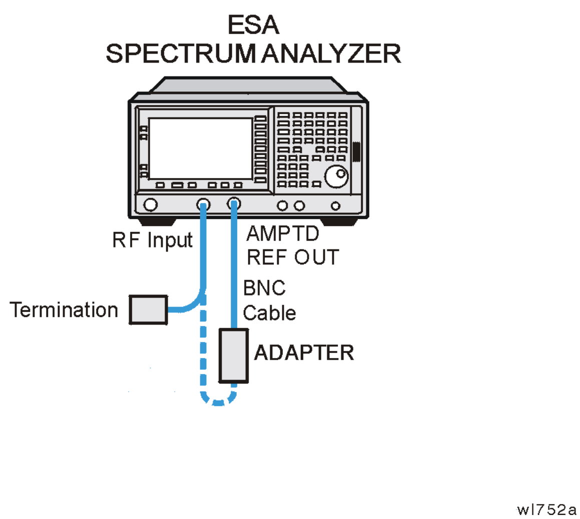
For analyzers equipped with narrow resolution bandwidths (Option 1DR), DANL is also tested in the 10 Hz resolution bandwidth setting.

The related adjustment for this procedure is “Frequency Response.”

Equipment Required

Termination, 50 Ω, Type-N (m) (*2 required for Option 1DN*)
Cable, BNC
Adapter, Type-N (m) to BNC (f)

Figure 2-52 Displayed Average Noise Level Test Setup



Procedure

1. Connect the AMPTD REF OUT to the 50 Ω Input using a BNC cable and adapter as shown in Figure 2-52.

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   Input/Output (or **Input**), **Amptd Ref Out** (On)
   FREQUENCY, **50 MHz**
   SPAN, **2 kHz**
   AMPLITUDE, –20 dBm
   AMPLITUDE, Attenuation, **10 dB**
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 1 kHz
   Det/Demod, Detector, Sample, Return

3. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the Ref Amptd reading below.

   Ref Amptd ____________ dB

4. On the analyzer, press the following keys:

   AMPLITUDE, Attenuation, 0 dB
   SPAN, 20 kHz
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 30 Hz

5. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(1 kHz RBW).

   Meas Amptd(1 kHz RBW)____________ dB

6. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 5 from the Ref Amptd in step 3. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(1 kHz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(1 kHz RBW)}$$

   Ref Lvl Offst(1 kHz RBW)____________ dB

7. If the analyzer is not equipped with Option 1DR, proceed to step 11.

8. On the analyzer, press the following keys:

   AMPLITUDE, Attenuation, 0 dB
   SPAN, 500 Hz
   BW/Avg, Resolution BW, 10 Hz
   BW/Avg, Video BW, 1 Hz

9. On the analyzer, press **Single**, **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(10 Hz RBW).

   Meas Amptd(10 Hz RBW)____________ dB

10. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 9 from the Ref Amptd in step 3. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(10 Hz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(10 Hz RBW)}$$

Ref Lvl Offst(10 Hz RBW)___________ dB

11. On the analyzer, press **Input, Amptd Ref Out** (Off), then **AMPLITUDE, More, Ref Lvl Offst**, and enter the value recorded in step 5.

12. Connect the 50 Ω termination to the analyzer input as shown in Figure 2-52.

13. Disconnect the BNC cable and adapter from the AMPTD REF OUT and the 50 Ω Input.

14. If the analyzer is equipped with Option 1DN, 50 Ω tracking generator, do the following:

    a. On the analyzer, press **Source, Amplitude, 0 dBm**.

    b. Connect a 50 Ω termination to the RF OUT 50 Ω.

Measurement Sequence

The DANL Measurement Sequence tables list the procedures to be performed and the parameters to be used in each procedure. The tables also list the TR Entry number for recording the results in the performance verification test record.

1. If the analyzer is not equipped with Option 1DR, narrow bandwidths, or Option 1DS, preamplifier, perform only those procedures with an “X” (“X” = “Don’t Care”) in each of the Analyzer Options columns. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.

2. If the analyzer is equipped with Option 1DR, but not Option 1DS, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DR option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.

3. If the analyzer is equipped with Option 1DS, but not Option 1DR, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DS Option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
4. If the analyzer is equipped with both Option 1DS and Option 1DR, perform all procedures. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
5. After performing all applicable DANL measurement procedures, proceed to Remove Reference Level Offset.

Table 2-78 DANL Measurement Sequence, E4404B

Analyzer Options		Procedure	Procedure Parameters				TR Entry[a]
1DR	1DS		Start Freq	Stop Freq	Test RBW	Preamp State	
X	X	Measure DANL	10 MHz	1 GHz	1 kHz	Off	**1)**
X	X	Measure DANL	1 GHz	2 GHz	1 kHz	Off	**2)**
X	X	Measure DANL	2 GHz	3 GHz	1 kHz	Off	**3)**
X	X	Measure DANL	3 GHz	6 GHz	1 kHz	Off	**4)**
X	X	Measure DANL	6 GHz	6.7 GHz	1 kHz	Off	**5)**
X	Y	Measure DANL	10 MHz	1 GHz	1 kHz	On	**6/20)**
X	Y	Measure DANL	1 GHz	2 GHz	1 kHz	On	**7/21)**
X	Y	Measure DANL	2 GHz	3 GHz	1 kHz	On	**8/22)**
Y	X	Measure DANL	10 MHz	1 GHz	10 Hz	Off	**9)**
Y	X	Measure DANL	1 GHz	2 GHz	10 Hz	Off	**10)**
Y	X	Measure DANL	2 GHz	3 GHz	10 Hz	Off	**11)**
Y	X	Measure DANL	3 GHz	6 GHz	10 Hz	Off	**12)**
Y	X	Measure DANL	6 GHz	6.7 GHz	10 Hz	Off	**13)**
Y	Y	Measure DANL	10 MHz	1 GHz	10 Hz	On	**14/23)**
Y	Y	Measure DANL	1 GHz	2 GHz	10 Hz	On	**15/24)**
Y	Y	Measure DANL	2 GHz	3 GHz	10 Hz	On	**16/25)**

a. There are two possible TR Entries for measurements made with Preamp On, depending upon the ambient temperature. The first entry is for measurements made with an ambient temperature outside of the 20 to 30°C range, but within the 0 to 55°C range. The second entry is for measurements made with an ambient temperature within the 20 to 30°C range.

Table 2-79 DANL Measurement Sequence, E4405B

Analyzer Options		Procedure	Procedure Parameters				TR Entry[a]
1DR	1DS		Start Freq	Stop Freq	Test RBW	Preamp State	
X	X	Measure DANL	10 MHz	1 GHz	1 kHz	Off	**1)**
X	X	Measure DANL	1 GHz	2 GHz	1 kHz	Off	**2)**
X	X	Measure DANL	2 GHz	3 GHz	1 kHz	Off	**3)**
X	X	Measure DANL	3 GHz	6 GHz	1 kHz	Off	**4)**
X	X	Measure DANL	6 GHz	12 GHz	1 kHz	Off	**5)**
X	X	Measure DANL	12 GHz	13.2 GHz	1 kHz	Off	**6)**
X	Y	Measure DANL	10 MHz	1 GHz	1 kHz	On	**7/26)**
X	Y	Measure DANL	1 GHz	2 GHz	1 kHz	On	**8/27)**
X	Y	Measure DANL	2 GHz	3 GHz	1 kHz	On	**9/28)**
Y	X	Measure DANL	10 MHz	1 GHz	10 Hz	Off	**10)**
Y	X	Measure DANL	1 GHz	2 GHz	10 Hz	Off	**11)**
Y	X	Measure DANL	2 GHz	3 GHz	10 Hz	Off	**12)**
Y	X	Measure DANL	3 GHz	6 GHz	10 Hz	Off	**13)**
Y	X	Measure DANL	6 GHz	12 GHz	10 Hz	Off	**14)**
Y	X	Measure DANL	12 GHz	13.2 GHz	10 Hz	Off	**16)**
Y	Y	Measure DANL	10 MHz	1 GHz	10 Hz	On	**17/29)**
Y	Y	Measure DANL	1 GHz	2 GHz	10 Hz	On	**18/30)**
Y	Y	Measure DANL	2 GHz	3 GHz	10 Hz	On	**19/31)**

a. There are two possible TR Entries for measurements made with Preamp On, depending upon the ambient temperature. The first entry is for measurements made with an ambient temperature outside of the 20 to 30°C range, but within the 0 to 55°C range. The second entry is for measurements made with an ambient temperature within the 20 to 30°C range.

Measuring Displayed Average Noise Level (DANL)

1. Set the analyzer as follows using the start and stop frequencies, test RBW and preamp state as specified in Table 2-78 for E4404B or Table 2-79 for E4405B:

   Auto Couple
   FREQUENCY, Start Freq, (*enter specified start frequency*)
   FREQUENCY, Stop Freq, (*enter specified stop frequency*)
   AMPLITUDE, –70 dBm
   Attenuation 0 dB
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (1 kHz) if test RBW = 1 kHz*)
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (10 Hz) if test RBW = 10 Hz*)
   BW/Avg, Resolution BW, 1 MHz
   BW/Avg, Video BW, 10 kHz
   AMPLITUDE, More, Int Preamp (Off) (*if preamp state = Off*)
   AMPLITUDE, More, Int Preamp (On) (*if preamp state = On*)
   Sweep, **Sweep** (Cont)
   Sweep, **Sweep Time** (Auto)

2. If the analyzer is equipped with Option 1DN and the current stop frequency is >3 GHz, press **Source, Amplitude** (Off).

3. On the analyzer, press **Single**, **View/Trace**, **Trace 1**, **Clear Write**, **BW/Avg**, **Average Type** (Video), **Averages**, **3**, **Enter**, **Single**.

   Wait until VAvg 3 is displayed to the left of the graticule (the analyzer will take three sweeps, then stop).

4. On the analyzer, press the following keys:

   Peak Search (or **Search**)
   BW/Avg Average (Off)
   Marker →,**Mkr**→ **CF**

5. If the test RBW is 1 kHz, press **Span, 20 kHz**.

   If the test RBW is 10 Hz, press **Span, 500 Hz**.

6. If the test RBW is 1 kHz, press **BW/Avg, Resolution BW, 1 kHz, Video BW, 30 Hz**.

   If the test RBW is 10 Hz, press **BW/Avg, Resolution BW, 10 Hz, Video BW, 1 Hz**.

7. On the analyzer, press **Single** and wait for the new sweep to finish.

8. On the analyzer, press **Display, Display Line** (On), and adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

Remove Reference Level Offset

1. Press **AMPLITUDE, More, Ref Lvl Offst, 0 dB**.
2. On the analyzer, press **Preset**.

37. Displayed Average Noise Level: Agilent E4407B and E4408B

This performance test measures the displayed average noise level (DANL) within the frequency range specified. The analyzer input is terminated in its characteristic impedance. If the analyzer is also equipped with a tracking generator (Option 1DN), the tracking generator is also terminated in its characteristic impedance and set for maximum leveled output power.

The test tunes the analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in a narrow span.

To reduce measurement uncertainty due to input attenuator switching and resolution bandwidth switching, a reference level offset is added. The 50 MHz alignment signal is used as the amplitude reference for determining the amount of offset required. The offset is removed at the end of the test by pressing instrument preset.

For analyzers equipped with narrow resolution bandwidths (Option 1DR), DANL is also tested in the 10 Hz resolution bandwidth setting.

The related adjustment for this procedure is “Frequency Response.”

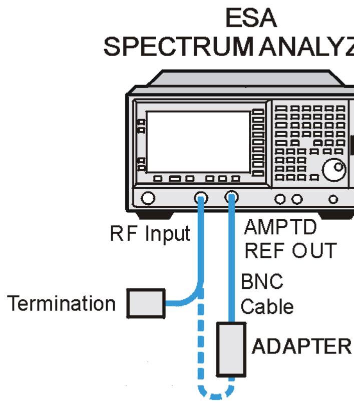
Equipment Required

Termination, 50 Ω, Type-N (m) (*2 required for Option 1DN*)
Cable, BNC
Adapter, Type-N (m) to BNC (f)

Additional Equipment for Option BAB

Adapter, APC 3.5 (f) to Type-N (f)

Figure 2-53 Displayed Average Noise Level Test Setup



Procedure

1. Connect the AMPTD REF OUT to the 50 Ω Input using a BNC cable and adapter as shown in Figure 2-53.
2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   Input/Output (or **Input**), **Amptd Ref Out** (On)
   FREQUENCY, **50 MHz**
   SPAN, **2 kHz**
   AMPLITUDE, –20 dBm
   AMPLITUDE, Attenuation, **10 dB**
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 1 kHz
   Det/Demod, Detector, Sample, Return

3. On the analyzer, press **Single**.
4. On the analyzer, press **Peak Search** (or **Search**) and record the Ref Amptd reading below.

   Ref Amptd ____________ dB

5. On the analyzer, press the following keys:

   AMPLITUDE, Attenuation, 0 dB
   SPAN, 20 kHz
   BW/Avg, Resolution BW, 1 kHz
   BW/Avg, Video BW, 30 Hz

6. On the analyzer, press **Single**.

7. On the analyzer, press **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(1 kHz RBW).

   Meas Amptd(1 kHz RBW)___________ dB

8. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 7 from the Ref Amptd in step 4. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(1 kHz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(1 kHz RBW)}$$

   Ref Lvl Offst(1 kHz RBW)___________ dB

9. If the analyzer is not equipped with Option 1DR, proceed to step 14.

10. On the analyzer, press the following keys:

    AMPTLITUDE, Attenuation, 0 dB
    SPAN, 500 Hz
    BW/Avg, Resolution BW, 10 Hz
    BW/Avg, Video BW, 1 Hz

11. On the analyzer, press **Single**.

12. On the analyzer, press **Peak Search** (or **Search**) and record the amplitude reading below as Meas Amptd(10 Hz RBW).

    Meas Amptd(10 Hz RBW)___________ dB

13. Calculate the necessary reference level offset by subtracting the Meas Amptd in step 12 from the Ref Amptd in step 4. If the calculated Ref Lvl Offst is greater than 0.05 dB or less than –0.05 dB, record the Ref Lvl Offst value below. Otherwise, enter 0.

$$\text{Ref Lvl Offset(10 Hz RBW)} = \text{Ref Amptd} - \text{Meas Amptd(10 Hz RBW)}$$

    Ref Lvl Offst(10 Hz RBW)___________ dB

14. On the analyzer, press **Input, Amptd Ref Out** (Off), then **AMPLITUDE, More, Ref Lvl Offst**, and enter the value recorded in step 7.

15. Connect the 50 Ω termination to the analyzer input as shown in Figure 2-53.

16. Disconnect the BNC cable and adapter from the AMPTD REF OUT and the 50 Ω Input.

17. If the analyzer is equipped with Option 1DN, 50 Ω tracking generator, do the following:

    a. On the analyzer, press **Source, Amplitude, 0 dBm**.

    b. Connect a 50 Ω termination to the RF OUT 50 Ω.

Measurement Sequence

The DANL Measurement Sequence tables list the procedures to be performed and the parameters to be used in each procedure. The table also lists the TR Entry number for recording the results in the performance verification test record.

1. If the analyzer is not equipped with Option 1DR, narrow bandwidths, or Option 1DS, preamplifier, perform only those procedures with an “X” (“X” = “Don’t Care”) in each of the Analyzer Options columns. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
2. If the analyzer is equipped with Option 1DR, but not Option 1DS, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DR option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
3. If the analyzer is equipped with Option 1DS, but not Option 1DR, perform those procedures with an “X” in each of the Analyzer Options columns, and those procedures with a “Y” in the 1DS Option column. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
4. If the analyzer is equipped with both Option 1DS and Option 1DR, perform all procedures. For each procedure performed, use the appropriate Procedure Parameters as described in the DANL Measurement Sequence table. Record the display line amplitude setting as the indicated TR Entry in the performance verification test record.
5. After performing all applicable DANL measurement procedures, proceed to Remove Reference Level Offset.

Table 2-80 DANL Measurement Sequence

Analyzer Options		Procedure	Procedure Parameters				TR Entry[a]
1DR	1DS		Start Freq	Stop Freq	Test RBW	Preamp State	
X	X	Measure DANL	10 MHz	1 GHz	1 kHz	Off	**1)**
X	X	Measure DANL	1 GHz	2 GHz	1 kHz	Off	**2)**
X	X	Measure DANL	2 GHz	3 GHz	1 kHz	Off	**3)**
X	X	Measure DANL	3 GHz	6 GHz	1 kHz	Off	**4)**
X	X	Measure DANL	6 GHz	12 GHz	1 kHz	Off	**5)**
X	X	Measure DANL	12 GHz	22 GHz	1 kHz	Off	**6)**
X	X	Measure DANL	22 GHz	26.5 GHz	1 kHz	Off	**7)**
X	Y	Measure DANL	10 MHz	1 GHz	1 kHz	On	**8/21)**
X	Y	Measure DANL	1 GHz	2 GHz	1 kHz	On	**9/22)**
X	Y	Measure DANL	2 GHz	3 GHz	1 kHz	On	**10/23)**
Y	X	Measure DANL	10 MHz	1 GHz	10 Hz	Off	**11)**
Y	X	Measure DANL	1 GHz	2 GHz	10 Hz	Off	**12)**
Y	X	Measure DANL	2 GHz	3 GHz	10 Hz	Off	**13)**
Y	X	Measure DANL	3 GHz	6 GHz	10 Hz	Off	**14)**
Y	X	Measure DANL	6 GHz	12 GHz	10 Hz	Off	**15)**
Y	X	Measure DANL	12 GHz	22 GHz	10 Hz	Off	**16)**
Y	X	Measure DANL	22 GHz	26.5 GHz	10 Hz	Off	**17)**
Y	Y	Measure DANL	10 MHz	1 GHz	10 Hz	On	**18/24)**
Y	Y	Measure DANL	1 GHz	2 GHz	10 Hz	On	**19/25)**
Y	Y	Measure DANL	2 GHz	3 GHz	10 Hz	On	**20/26)**

a. There are two possible TR Entries for measurements made with Preamp On, depending upon the ambient temperature. The first entry is for measurements made with an ambient temperature outside of the 20 to 30°C range, but within the 0 to 55°C range. The second entry is for measurements made with an ambient temperature within the 20 to 30°C range.

Measuring Displayed Average Noise Level

1. Set the analyzer as follows using the start and stop frequencies, test RBW and preamp state as specified in Table 2-77:

   Auto Couple
   FREQUENCY, Start Freq, (*enter specified start frequency*)
   FREQUENCY, Stop Freq, (*enter specified stop frequency*)
   AMPLITUDE, –70 dBm
   Attenuation, 0 dB
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (1 kHz) if test RBW = 1 kHz*)
   AMPLITUDE, More, Ref Lvl Offset, (*enter Ref Lvl Offset (10 Hz) if test RBW = 10 Hz*)
   BW/Avg, Resolution BW, 1 MHz
   BW/Avg, Video BW, 10 kHz
   AMPLITUDE, More, Int Preamp (Off) (*if preamp state = Off*)
   AMPLITUDE, More, Int Preamp (On) (*if preamp state = On*)
   Sweep, **Sweep** (Cont)
   Sweep, **Sweep Time** (Auto)

2. If the analyzer is equipped with Option 1DN, press **Source, Amplitude** (Off).

3. On the analyzer, press **Single, View/Trace, Trace 1, Clear Write, BW/Avg, Average Type (Video), Averages, 3, Enter, Single.**

   Wait until VAvg 3 is displayed to the left of the graticule (the analyzer will take three sweeps, then stop).

4. On the analyzer, press the following keys:

   Peak Search (or **Search**)
   BW/Avg, Average (Off)
   Marker →,**Mkr**→ **CF**

5. If the test RBW is 1 kHz, press **Span, 20 kHz**.

   If the test RBW is 10 Hz, press **Span, 500 Hz**.

6. If the test RBW is 1 kHz, press **BW/Avg, Resolution BW, 1 kHz, Video BW, 30 Hz**.

   If the test RBW is 10 Hz, press **BW/Avg, Resolution BW, 10 Hz, Video BW, 1 Hz**.

7. On the analyzer, press **Single** and wait for the new sweep to finish.

8. On the analyzer, press **Display, Display Line** (On), and adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

Remove Reference Level Offset

9. Press **AMPLITUDE, More, Ref Lvl Offst, 0 dB**.

10. On the analyzer, press **Preset**.

38. Residual Responses

The analyzer input is terminated and the analyzer is swept from 150 kHz to 1 MHz. Then the analyzer is swept in incremental 10 MHz spans from 1 MHz to the upper frequency range. Any responses above the specification are noted.

There are no related adjustment procedures for this performance test.

Equipment Required

Termination, 50 Ω Type-N (m)

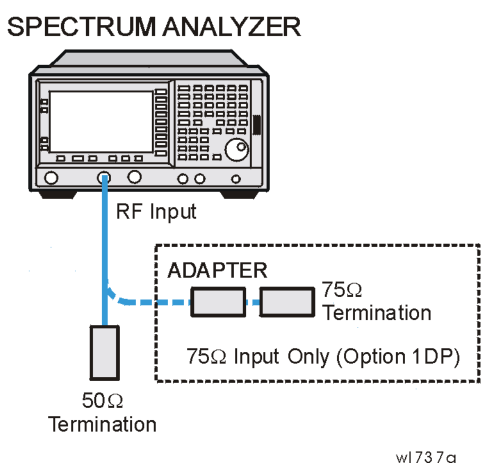
Additional Equipment for 75 Ω Input

Termination, 75 Ω, BNC (m)
Adapter, Type-N (f) to BNC (m), 75 Ω

Additional Equipment for Option BAB

Adapter, Type-N (f) to APC 3.5 (f)

Figure 2-54 Residual Response Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω input, or damage to the input connector will occur.

Procedure

150 kHz to 1 MHz

1. Connect the 50 Ω termination to the analyzer input as shown in Figure 2-54.

   75 Ω Input: Use the adapter to connect the 75 Ω termination, and proceed with step 3.

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   FREQUENCY, Start Freq, 150 kHz
   FREQUENCY, Stop Freq, 1 MHz
   AMPLITUDE, –60 dBm
   AMPLITUDE, Attenuation, 0 dB
   BW/Avg, 3 kHz
   BW/Avg, Video BW, 1 kHz
   Display, Display Line On, –90 dBm

3. Press **Single** and wait for a new sweep to finish. Look for any residual responses at or above the display line.

   If a residual is suspected, press **Single** again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line in Table 1.

4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   FREQUENCY, 5.9 MHz
   FREQUENCY, CF Step, 9.9 MHz
   SPAN, 10 MHz
   AMPLITUDE, –60 dBm (*50 Ω Input only*)
   AMPLITUDE, –11.2 dBmV (*75 Ω Input only*)
   AMPLITUDE, Attenuation, 0 dB
   BW/Avg, 10 kHz
   BW/Avg, Video BW, 3 kHz
   Display, Display Line On, –90 dBm (*50 Ω Input only*)
   Display, Display Line On, –36 dBmV (*75 Ω Input only*)

5. Repeat step 6 and step 7 until the complete range of frequencies has been checked for the model and frequency ranges below.

Model	Frequency Range
E4401B and E4411B	1 MHz to 1.5 GHz
E4402B and E4403B	1 MHz to 3.0 GHz
E4404B, E4405B, E4407B, and E4408B	1 MHz to 6.7 GHz

6. Press **Single** and wait for a new sweep to finish. Look for any residual responses at or above the display line.

   If a residual is suspected, press **Single** again. A residual response will persist on successive sweeps, but a noise peak will not. Record the frequency and amplitude of any residual responses above the display line in Table 2-81.

7. Press **FREQUENCY** ↑.

   If there are any residuals at or near the frequency specification limits (1 MHz, 1.5 GHz, 3 GHz, or 6.7 GHz), it is recommended that a known frequency source be used as a frequency marker. This will ensure that testing is done at or below the specification limits.

Table 2-81 Residual Responses Worksheet

Frequency (MHz)	Amplitude (dBm or dBmV)

8. Record the highest residual from Table 2-81 as TR Entry 1 in the performance verification test record. If no residuals are found, then record “N/A” in the performance verification test record.

39. Fast Time Domain Amplitude Accuracy: Agilent E4401B, E4402B, E4404B, E4405B, and E4407B (Option AYX)

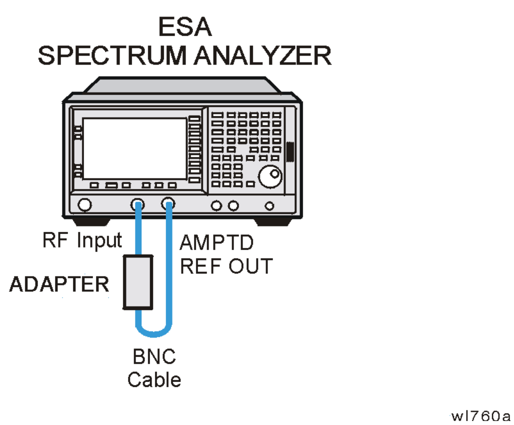
The analyzer amplitude reference signal is used to compare the amplitude level of a normal sweep time (≥5 ms) to a fast sweep time (≤5 ms) using the marker functions. The difference should be less than the marker readout resolution specification for the fast sweep times.

Equipment Required

Cable, BNC, 122 cm (48 in)
Adapter, Type-N (m) to BNC (f)

Procedure

Figure 2-55 Fast Time Domain Amplitude Accuracy Test Setup



Fast Sweep Time Amplitude Accuracy

1. Connect the equipment as shown in Figure 2-55.

NOTE No test setup is required for E4401B.

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.

3. Set the analyzer as follows:

   FREQUENCY, **50 MHz**
   SPAN, **Zero Span**
   Sweep 5 ms
   Input/Output (or **Input**), **Amptd Ref** (On) *(E4401B only)*
   Input/Output (or **Input**), **Amptd Ref Out** (On) *(E4402B, E4404B, E4405B, E4407B only)*
   AMPLITUDE, **Scale Type** (Lin)
   AMPLITUDE, **Ref Level**, **12.57 mV** *(E4401B, 50 Ω only)*
   AMPLITUDE, **Ref Level**, **15.05 mV** *(E4401B, 75 Ω only)*
   AMPLITUDE, **Ref Level**, **30.73 mV** *(E4402B, E4404B, E4405B, E4407B only)*

4. On the analyzer, press:

   Marker, **More 1 of 2**, **Function**
   Marker Noise, **Single**
   Marker, **Delta**
   Sweep, **1 ms**

5. If the ΔMkr1 amplitude readout (the second line) is not expressed as a percentage, subtract 1 from the ΔMkr1 amplitude (ignore the “X”) and multiply the result by 100 to obtain the amplitude error in percent:

$$\text{Amplitude Error} = (\Delta\text{Mkr1} - 1.0) \times 100$$

6. If the ΔMkr1 amplitude readout is expressed as a percentage, subtract 100% from the ΔMkr1 amplitude reading to obtain the amplitude error in percent:

$$\text{Amplitude Error} = \Delta\text{Mkr1} - 100$$

7. Record the Amplitude Error as TR Entry 1 in the performance verification test record.

40. Tracking Generator Absolute Amplitude and Vernier Accuracy: Agilent E4401B and E4411B (Option 1DN or 1DQ)

A calibrated power sensor is connected to the tracking generator output to measure the power level at 50 MHz.

The power meter is set to relative mode so that future power level readings are in dB relative to the reference power level setting. The output power level setting is decreased in 1 dB steps and the power level is measured at each step. The difference between the ideal and actual power levels is calculated at each step.

Since a power sweep is accomplished by stepping through the vernier settings, the peak-to-peak variation of the vernier accuracy is equal to the power sweep accuracy.

The related adjustments for this performance test are “Tracking Generator ALC Calibration” and “Tracking Generator Frequency Slope.”

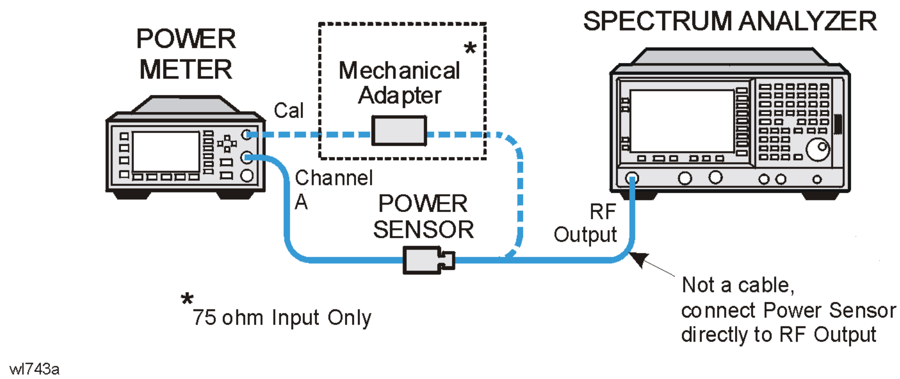
Equipment Required

Power meter, compatible with power sensor
RF power sensor, 50 Ω

Additional Equipment for Option 1DQ

Power sensor, 75 Ω
Adapter, Type-N (f) to BNC (m), 75 Ω
Adapter, Type-N (f), 75 Ω to Type-N (m), 50 Ω

Figure 2-56 Absolute Amplitude, Vernier, and Power Sweep Accuracy Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or damage to the connectors will occur.

Procedure

For E4411B analyzers, this test must be performed at 20 to 30° C.

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   SPAN, **Zero Span**
   AMPLITUDE, **0 dBm** (*Option 1DN*)
   AMPLITUDE, **42.76 dBmV** (*Option 1DQ*)
   Source, **Amplitude** (On), **0 dBm** (*Option 1DN*)
   Source, **Amplitude** (On), **42.76 dBmV** (*Option 1DQ*)
   Source, **Attenuation**, **0 dB**
   Single

2. Zero and calibrate the power meter and power sensor in log mode (power reads out in dBm), as described in the power meter operation manual. Enter the 50 MHz Cal Factor of the power sensor into the power meter.

3. Connect the 50 Ω power sensor to the RF OUT as shown in Figure 2-56.

   Option 1DQ: Connect the 75 Ω power sensor to the RF OUT 75 Ω as shown in Figure 2-56.

4. Read the power level displayed on the power meter and record the result as TR Entry 1 of the performance verification test record as the Absolute Amplitude Accuracy.

   Absolute Amplitude Accuracy at 50 MHz = ___________dB

   Option 1DQ: Add 6 dB to the power level displayed on the power meter and record the result as TR Entry 1 of the performance verification test record as the Absolute Amplitude Accuracy.

5. Set the power meter to dB relative mode as described in the power meter operation manual so that the readout is in power level relative to the power level at 50 MHz (press **Rel/Offset**, **Rel**).

6. Set the source amplitude to the settings indicated in Table 2-82.

   Option 1DQ: Use the source amplitude settings for Option 1DQ analyzers.

7. Press **Single** on the analyzer. At each setting, record the power level displayed on the power meter as Measured Power Level in Table 2-82.

8. Calculate the Vernier Accuracy by subtracting the Source Vernier Setting from the Measured Power Level for each Source Amplitude Setting in Table 2-82.

$$\text{Vernier Accuracy} = \text{Measured Power Level (dB)} - \text{Source Vernier Setting (dB)}$$

9. Locate the most positive and most negative Vernier Accuracy Values for Source Vernier Settings of –1 dBm to –10 dBm recorded in Table 2-82. Record the Positive Vernier Accuracy as TR entry 2 and the Negative Vernier Accuracy as TR entry 3 in the performance verification test record.

   Option 1DQ: For source amplitudes of 41.76 dBmV to 27.76 dBmV.

   Positive Vernier Accuracy ____________ dB

   Negative Vernier Accuracy ____________ dB

10. Locate the most positive and most negative Vernier Accuracy values for all Source Amplitude Settings in Table 2-82 and record these values below:

    Positive Power Sweep Accuracy ____________ dB

    Negative Power Sweep Accuracy ____________ dB

11. Calculate the Power Sweep Accuracy by subtracting the Negative Power Sweep Accuracy recorded in the previous step from the Positive Power Sweep Accuracy recorded in the previous step. Record the Power Sweep Accuracy as TR Entry 4 in the performance verification test record.

$$\text{Power Sweep Accuracy} = \text{Positive Power Sweep Accuracy} - \text{Negative Power Sweep Accuracy}$$

Power Sweep Accuracy ____________ dB

Table 2-82 Vernier Accuracy Worksheet

Source Amplitude Setting		Source Vernier Setting	Measured Power Level	Vernier Accuracy
Option 1DN (dBm)	Option 1DQ (dBmV)	(dB)	(dB)	(dB)
0 (Ref)	42.76 (Ref)	0 (Ref)	NA	NA
–1	41.76	–1		
–2	40.76	–2		
–3	39.76	–3		
–4	38.76	–4		
–5	37.76	–5		
–6	36.76	–6		
–7	35.76	–7		
–8	34.76	–8		
–9	33.76	–9		
–10	32.76	–10		
–11	31.76	–11		
–12	30.76	–12		
–13	29.76	–13		
–14	28.76	–14		
–15	27.76	–15		

41. Tracking Generator Absolute Amplitude and Vernier Accuracy: Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B (Option 1DN)

A calibrated power sensor is connected to the tracking generator output to measure the power level at 50 MHz.

The power meter is set to relative mode so that future power level readings are in dB relative to the reference power level setting. The output power level setting is decreased in 1 dB steps and the power level is measured at each step. The difference between the ideal and actual power levels is calculated at each step.

Since a power sweep is accomplished by stepping through the vernier settings, the peak-to-peak variation of the vernier accuracy is equal to the power sweep accuracy.

The related adjustments for this performance test are “Tracking Generator ALC Calibration” and “Tracking Generator Frequency Slope.”

Equipment Required

Power meter, compatible with power sensor
Power sensor, 50 Ω

Procedure

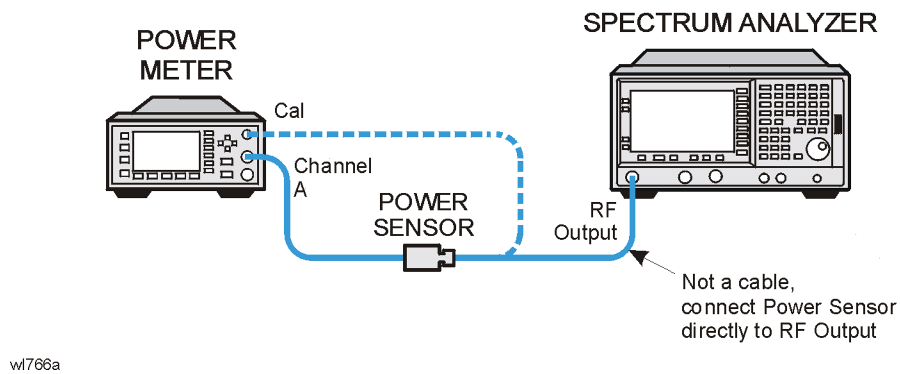
1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   SPAN, **Zero Span**
   AMPLITUDE, **0 dBm**
   System, Alignments, Auto Align, Off
   Source Amptd, **Amplitude** (On), **–20 dBm**
   Source Amptd, **Attenuation Auto Man**, **–20 dB**
   Single Sweep

2. Zero and calibrate the power meter and power sensor in log mode (power reads out in dBm), as described in the power meter operation manual. Enter the 50 MHz Cal Factor of the power sensor into the power meter.

3. Connect the 50 Ω power sensor to the as shown in Figure 2-57.

Figure 2-57 Absolute Amplitude, Vernier, and Power Sweep Accuracy Test Setup



4. Read the power level displayed on the power meter, add 20 dB, and record the result as TR Entry 1 of the performance verification test record as the Absolute Amplitude Accuracy.

   Absolute Amplitude Accuracy at 50 MHz = ___________dB

5. Set the power meter to dB relative mode as described in the power meter operation manual so that the readout is in power level relative to the power level at 50 MHz (press **Rel/Offset**, **Rel**).

6. Press **Single** on the analyzer. At each setting, record the power level displayed on the power meter in Table 2-83.

7. Set the source amplitude to the settings indicated in Table 2-83.

Table 2-83 Vernier and Power Sweep Accuracy Worksheet

Source Amplitude Setting (dBm)	Source Vernier Setting (dBm)	Measured Power Level (dB)	Vernier Accuracy (dB)
−18	−2		**1)**
−19	−3		**2)**
−20 (Ref)	−4	N/A	N/A
−21	−5		**3)**
−22	−6		**4)**
−23	−7		**5)**
−24	−8		**6)**
−25	−9		**7)**
−26	−10		**8)**

8. Calculate the Vernier Accuracy by adding 4 dB to the Source Vernier setting and subtracting the result from the Measured Power Level for each Source Amplitude Setting in Table 2-83.

$$\text{Vernier Accuracy} = \text{Measured Power Level (dB)} - (\text{Source Vernier Setting (dB)} + 4\text{ dB})$$

9. Record the vernier accuracy values from Table 2-83 as test record entries 2 through 9 in the performance test record.

10. Press **System, Alignments, Auto Align, All**.

42. Tracking Generator Level Flatness: Agilent E4401B and E4411B (Option 1DN or 1DQ)

This test verifies that analyzers with the tracking generator option (1DN or 1DQ) meet their tracking generator level flatness specification. A calibrated power sensor is connected to the tracking generator output to measure the power level at 50 MHz. The power meter is set for dB relative mode so that future power level readings are in dB, relative to the power level at 50 MHz.

Next, the tracking generator is stepped to several frequencies throughout its range, and the output power difference relative to the power level at 50 MHz is measured for each frequency recorded.

For frequencies below 100 kHz, a digital voltmeter and precision 50 Ω termination are used to measure the power of the tracking generator output. The DVM is set to read out in dBm using the MATH function with R value set to 50 Ω. The following equation is used to calculate dBm:

$$dBm = 10\log((E^2/R)/1mW)$$

The DVM readout is corrected by making the readings relative to the 100 kHz reading from the power sensor.

Option 1DN, 50 Ω tracking generators are tested from 9 kHz to 1500 MHz.

Option 1DQ, 75 Ω tracking generators are tested from 1 MHz to 1500 MHz.

The related adjustments for this procedure are “Tracking Generator ALC Calibration” and “Tracking Generator Frequency Slope.”

Equipment Required

Power meter
Power sensor, 50 Ω, 100 kHz to 1.5 GHz
Digital multimeter
Termination, 50 Ω
Cable, BNC
Adapter, Type-N tee, (m) (f) (f)
Adapter, Type-N (m) to BNC (f)
Adapter, BNC (f) to dual banana plug

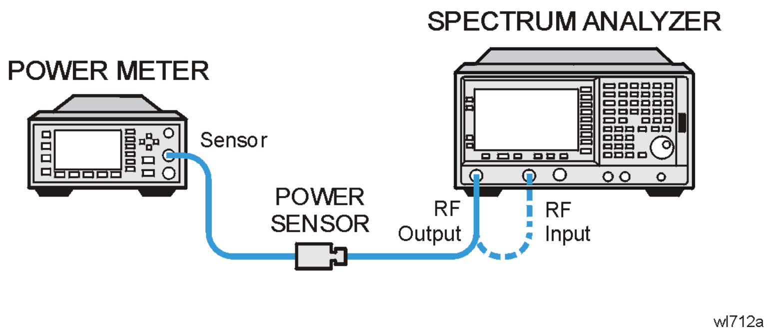
Additional Equipment for Option 1DQ

Power sensor, 75 Ω, 1 MHz to 1.5 GHz
Adapter, Type-N (f) to BNC (m), 75 Ω

CAUTION Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 1DQ or damage to the input connector will occur.

Procedure

Figure 2-58 Tracking Generator Level Flatness Test Setup, ≥100 kHz



Tracking Generator Level Flatness, Center Frequency ≥100 kHz

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.

2. Set the analyzer by pressing the following keys:

   FREQUENCY, **50 MHz**
   FREQUENCY, **CF Step**, **100 MHz**
   SPAN, **Zero Span**
   Source, **Amplitude On, 0 dBm** (*Option 1DN*)
   Source, **Amplitude On, 42.76 dBmV** (*Option 1DQ*)
   Single

3. Zero and calibrate the power meter with the power sensor in log mode (power reads out in dBm), as described in the power meter operation manual.

   Option 1DQ: Use a 75 Ω power sensor.

4. Connect the power sensor to the RF Out on the analyzer. See Figure 2-58.

5. Set the power meter to relative mode, as described in the power meter operation manual. Power levels now read out in power level relative to the power level at 50 MHz.

Perform the next four steps for each measurement value in Table 2-84.

1. Set the center frequency of the analyzer according to the values in Table 2-84. For 100 kHz, press **FREQUENCY**, **100 kHz**. The step up key (⇑) may be used to tune to center frequencies above 100 MHz.

   Option 1DQ: Start at 1 MHz by pressing **FREQUENCY, 1 MHz**.

2. Press **Single** on the analyzer.
3. Enter the appropriate power sensor Cal Factor into the power meter as indicated in Table 2-84.
4. Record the power level displayed on the power meter in the Level Flatness column in Table 2-84.

Table 2-84 Tracking Generator Level Flatness Worksheet, ≥100 kHz

Center Frequency	Level Flatness (dB)	Cal Factor (MHz)
100 kHz[a]		0.1
300 kHz[a]		0.3
500 kHz[a]		0.3
1 MHz		1
2 MHz		3
5 MHz		3
10 MHz		10
20 MHz		30
40 MHz		50
50 MHz	0 (Ref)	50
80 MHz		100
100 MHz		100
200 MHz		300
300 MHz		300
400 MHz		300
500 MHz		300
600 MHz		300
700 MHz		1000
800 MHz		1000

Table 2-84 Tracking Generator Level Flatness Worksheet, ≥100 kHz

Center Frequency	Level Flatness (dB)	Cal Factor (MHz)
900 MHz		1000
1000 MHz		1000
1100 MHz		1000
1200 MHz		1000
1300 MHz		1000
1400 MHz		1000
1500 MHz		2000

a. *These frequencies do not apply to analyzers with Option 1DQ Tracking Generators (75 Ω RF Output).*

5. Disconnect the power sensor from the RF Out on the analyzer.

Tracking Generator Level Flatness, Center Frequency ≤100 kHz

NOTE Perform step 2 to step 7 for 50 Ω tracking generators only (*Option 1DN*).

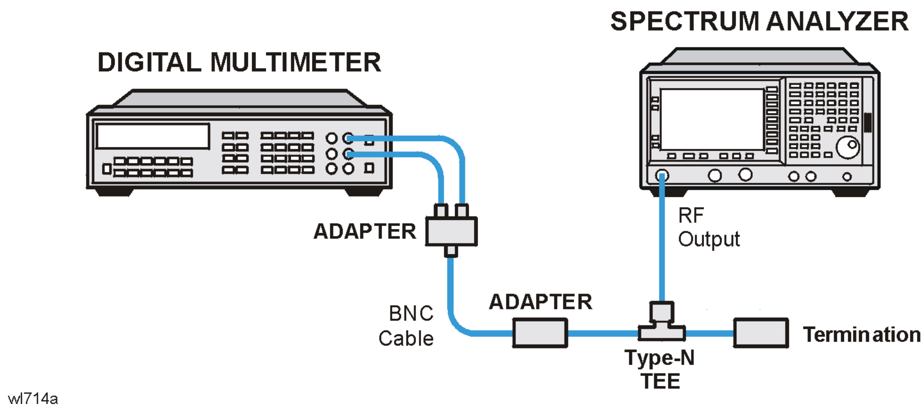
1. Set up the digital multimeter as follows.

Parameter	Setting
AC/DC	AC Volts
Impedance & Units:	
Set to 50 Ω impedance	SMATH 10[a]
Set to dBm	MATH 5[a]
Set to Synchronous	SETACV 3[a]
Sub-sampled mode	

a. *To set the HP/Agilent 3458A multi-meter functions from the front panel, press the blue shift key, then Recall State (T) key, then use the ⇑ (up) and ⇓ (down) arrows to select the appropriate function, then enter the value from the numeric keypad and press enter.*

NOTE Perform step 2 to step 7 for each measurement value in Table 2-86.

Figure 2-59 Tracking Generator Level Flatness Test Setup, ≤100 kHz



2. Refer to Figure 2-59 to set up the equipment.
3. To set the analyzer center frequency to 9 kHz, press **FREQUENCY**, **9 kHz** (or as indicated in Table 2-85).
4. Press **Single**.
5. Record the DVM readout in Table 2-85.
6. Subtract the 100 kHz Level Flatness readout in Table 2-84 from the 100 kHz DVM Readout in Table 2-85 and record as the DVM Offset at 100 kHz.

   DVM Offset at 100 kHz ___________ dB

   For example, if the Level Flatness reading from Table 2-84 is 0.7 dB and the DVM Readout from Table 2-85 is –0.53 dBm, the DVM offset would be –1.23 dB.

$$\text{DVM Offset} = \text{DVM Readout} - \text{Level Flatness}$$

7. Add the DVM Offset at 100 kHz from step 6, above, to each of the DVM Readouts in Table 2-85 and record as the Corrected Level Flatness in column 3.

   For example, if the DVM Readout from Table 2-85 is 0.22 dBm, and the DVM Offset is –1.23 dB, the Corrected Level Flatness would be –1.01 dB.

$$\text{Corrected Level Flatness} = \text{DVM} + \text{DVM Offset}$$

Table 2-85 Tracking Generator Level Flatness Worksheet, ≤100 kHz

Center Frequency	DVM Readout (dBm)	Corrected Level Flatness (dBm)
9 kHz[a]		
20 kHz[a]		
40 kHz[a]		
60 kHz[a]		
80 kHz[a]		
100 kHz[a]		

a. *These frequencies do not apply to analyzers with Option 1DQ, 75 Ω tracking generators.*

8. For 50 Ω tracking generators only, locate the most positive Level Flatness reading in Table 2-84 and Table 2-85 for frequencies <1 MHz and enter this value as Test Record Entry 1 of the performance verification test record.

9. For 50 Ω tracking generators only, locate the most negative Level Flatness reading in Table 2-84 and Table 2-85 for frequencies <1 MHz and enter this value as Test Record Entry 2 of the performance verification test record.

10. Locate the most positive Level Flatness reading in Table 2-84 and Table 2-85 for frequencies ≥1 MHz and ≤10 MHz and enter this value as Test Record Entry 3 of the performance verification test record.

11. Locate the most negative Level Flatness reading in Table 2-84 and Table 2-85 for frequencies ≥1 MHz and ≤10 MHz and enter this value as Test Record Entry 4 of the performance verification test record.

12. Locate the most positive Level Flatness reading in Table 2-84 for frequencies ≥10 MHz and ≤1.5 GHz and enter this value as Test Record Entry 5 of the performance verification test record.

13. Locate the most negative Level Flatness reading in Table 2-84 for frequencies ≥10 MHz and ≤1.5 GHz and enter this value as Test Record Entry 6 of the performance verification test record.

43. Tracking Generator Level Flatness: Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B (Option 1DN)

This test verifies that analyzers with the tracking generator option 1DN meet their tracking generator level flatness specification. In this test, a calibrated power sensor is connected to the tracking generator output to measure the power level at 50 MHz. The power meter is set for dB Relative mode so that future power level readings are in dB, relative to the power level at 50 MHz.

Next, the tracking generator is stepped to several frequencies throughout its range, and the output power difference relative to the power level at 50 MHz is measured for each frequency recorded.

For frequencies below 100 kHz, a digital voltmeter and precision 50 Ω termination are used to measure the power of the tracking generator output. The DVM is set to read out in dBm using the MATH function with R value set to 50 Ω. The following equation is used to calculate dBm:

$$\text{dBm} = 10\log((E^2/R)/1\text{mW})$$

The DVM readout is corrected by making the readings relative to the 100 kHz reading from the power sensor.

Option 1DN, 50 Ω *tracking generators are tested from 9 kHz to 3000 MHz.*

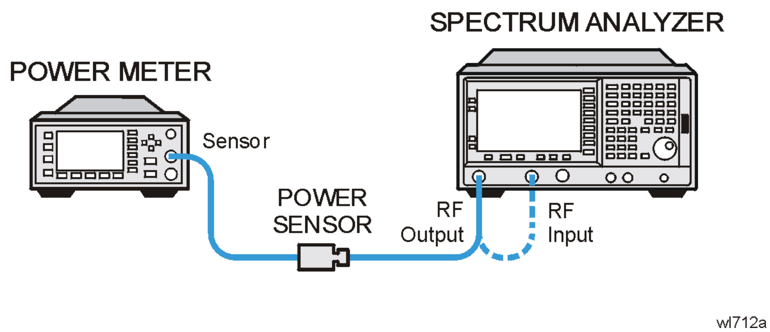
The related adjustment for this procedure is “Modulator Gain and Offset Adjustment.”

Equipment Required

Power meter
Power sensor, 50 Ω
Digital multimeter
Termination, 50 Ω
Cable, BNC
Cable, Type-N (m) (m)
Adapter, Type-N tee, (m) (f) (f)
Adapter, Type-N (m) to BNC (f)
Adapter, BNC (f) to dual banana plug

Procedure

Figure 2-60 Tracking Generator Level Flatness Test Setup ≥100 kHz



Tracking Generator Level Flatness, Center Frequency ≥100 kHz

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.
2. Connect the Type-N cable between the RF Input and the tracking generator RF OUT, as shown in Figure 2-60. Do not connect the power sensor to the analyzer yet.
3. Disconnect the Type-N cable.
4. Set the analyzer by pressing the following keys:

   FREQUENCY, **50 MHz**
   FREQUENCY, **CF Step**, **100 MHz**
   SPAN, **Zero Span**
   System, Alignments, Auto Align, Off
   Marker, **Source**
   Amplitude (On), **Source**
   Tracking Peak (*Wait for the* Peaking *message to disappear*.)
   Source, **Amplitude**
   –20 dBm, **Single**

5. Zero and calibrate the power meter with the power sensor in log mode (power reads out in dBm), as described in the power meter operation manual.
6. Connect the 50 Ω power sensor to the RF OUT 50 Ω on the analyzer. See Figure 2-60.
7. Set the power meter to relative mode, as described in the power meter operation manual. Power levels now read out in power level relative to the power level at 50 MHz.

Perform the next four steps for each measurement value in Table 2-86.

8. Set the center frequency of the analyzer according to the values in Table 2-86. For 100 kHz, press **FREQUENCY**, **100 kHz**. The ⇑ (step up key) may be used to tune to center frequencies above 100 MHz.

9. Press **Single** on the analyzer.

10. Enter the appropriate power sensor Cal Factor into the power meter as indicated in Table 2-86.

11. Record the power level displayed on the power meter in the Level Flatness column in Table 2-86.

Table 2-86 Tracking Generator Level Flatness Worksheet, ≥100 kHz

Center Frequency	Level Flatness (dB)	Cal Factor (MHz)
100 kHz		0.1
300 kHz		0.3
500 kHz		0.3
1 MHz		1
2 MHz		3
5 MHz		3
10 MHz		10
20 MHz		30
40 MHz		50
50 MHz	0 (Ref)	50
80 MHz		100
100 MHz		100
200 MHz		300
300 MHz		300
400 MHz		300
500 MHz		300
600 MHz		300
700 MHz		1000
800 MHz		1000
900 MHz		1000
1000 MHz		1000
1100 MHz		1000

Table 2-86 Tracking Generator Level Flatness Worksheet, ≥100 kHz

Center Frequency	Level Flatness (dB)	Cal Factor (MHz)
1200 MHz		1000
1300 MHz		1000
1400 MHz		1000
1500 MHz		2000
1600 MHz		2000
1700 MHz		2000
1800 MHz		2000
1900 MHz		2000
2000 MHz		2000
2100 MHz		2000
2200 MHz		2000
2300 MHz		2000
2400 MHz		2000
2500 MHz		3000
2600 MHz		3000
2700 MHz		3000
2800 MHz		3000
2900 MHz		3000
3000 MHz		3000

12. Disconnect the power sensor from the RF Out 50 Ω on the analyzer. See Figure 2-60.

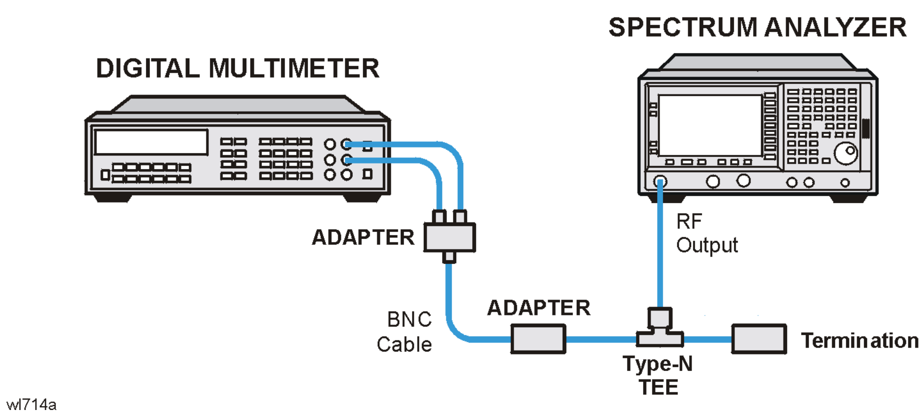
Tracking Generator Level Flatness, Center Frequency ≤100 kHz

1. Set up the digital multimeter as follows.

Parameter	Setting
AC/DC	AC Volts
Impedance & Units:	
Set to 50 Ω impedance	SMATH 10[a]
Set to dBm	MATH 5[a]
Set to Synchronous Sub-sampled mode	SETACV 3[a]

a. *To set the HP/Agilent 3458A multi-meter functions from the front panel, press the blue shift key, then Recall State (T) key, then use the ⇑ (up) and ⇓ (down) arrows to select the appropriate function, then enter the value from the numeric keypad and press enter.*

Figure 2-61 Tracking Generator Level Flatness Test Setup, ≤100 kHz



2. Refer to Figure 2-61 to set up the equipment.

   Repeat step 3 through step 7 for each Center Frequency value in Table 2-87.

3. Set the analyzer center frequency to 9 kHz, by pressing **FREQUENCY**, **9 kHz**.

4. Press **Single**.

5. Record the DVM readout in Table 2-87.

6. Subtract the 100 kHz Level Flatness readout in Table 2-86 from the 100 kHz DVM Readout in Table 2-87 and record as the DVM Offset at 100 kHz.

   DVM Offset at 100 kHz __________ dB

For example, if the Level Flatness reading from Table 2-86 is 0.7 dB and the DVM Readout from Table 2-87 is -0.53 dBm, the DVM offset would be -1.23 dB.

$$\text{DVM Offset} = \text{DVM Readout} - \text{Level Flatness}$$

7. Add the DVM Offset at 100 kHz from step 6, above, to each of the DVM Readouts in Table 2-87 and record as the Corrected Level Flatness in column 3.

   For example, if the DVM Readout from Table 2-87 is 0.22 dBm, and the DVM Offset is -1.23 dB, the Corrected Level Flatness would be -1.01 dB.

$$\text{Corrected Level Flatness} = \text{DVM Readout} + \text{DVM Offset}$$

8. Press **System, Alignments, Auto Align, All.**

Table 2-87 Tracking Generator Level Flatness Worksheet, 100 kHz

Center Frequency	DVM Readout (dBm)	Corrected Level Flatness (dBm)
9 kHz		
20 kHz		
40 kHz		
60 kHz		
80 kHz		
100 kHz		

1. Locate the most positive Level Flatness reading in Table 2-86 and Table 2-87 for frequencies <1 MHz and enter this value as Test Record Entry 1 of the performance verification test record.
2. Locate the most negative Level Flatness reading in Table 2-86 and Table 2-87 for frequencies <1 MHz and enter this value as Test Record Entry 2 of the performance verification test record.
3. Locate the most positive Level Flatness reading in Table 2-86 and Table 2-87 for frequencies ≥1 MHz and ≤10 MHz and enter this value as Test Record Entry 3 of the performance verification test record.
4. Locate the most negative Level Flatness reading in Table 2-86 and Table 2-87 for frequencies ≥1 MHz and ≤10 MHz and enter this value as Test Record Entry 4 of the performance verification test record.
5. Locate the most positive Level Flatness reading in Table 2-86 for frequencies ≥10 MHz and ≤1.5 GHz and enter this value as Test Record Entry 5 of the performance verification test record.

6. Locate the most negative Level Flatness reading in Table 2-86 for frequencies ≥10 MHz and ≤1.5 GHz and enter this value as Test Record Entry 6 of the performance verification test record.
7. Locate the most positive Level Flatness reading in Table 2-86 for frequencies >1.5 GHz and enter this value as Test Record Entry 7 of the performance verification test record.
8. Locate the most negative Level Flatness reading in Table 2-86 for frequencies >1.5 GHz and enter this value as Test Record Entry 8 of the performance verification test record.

44. Tracking Generator Harmonic Spurious Outputs: Agilent E4401B and E4411B (Option 1DN or 1DQ)

The measurement for tracking generator harmonic spurious outputs determines the maximum level of tracking generator harmonics. The tracking generator output is connected to the input of a microwave analyzer, then tuned to several different frequencies as the amplitude of the second and third harmonics relative to the fundamental are measured at each frequency.

There are no related adjustment procedures for this performance test.

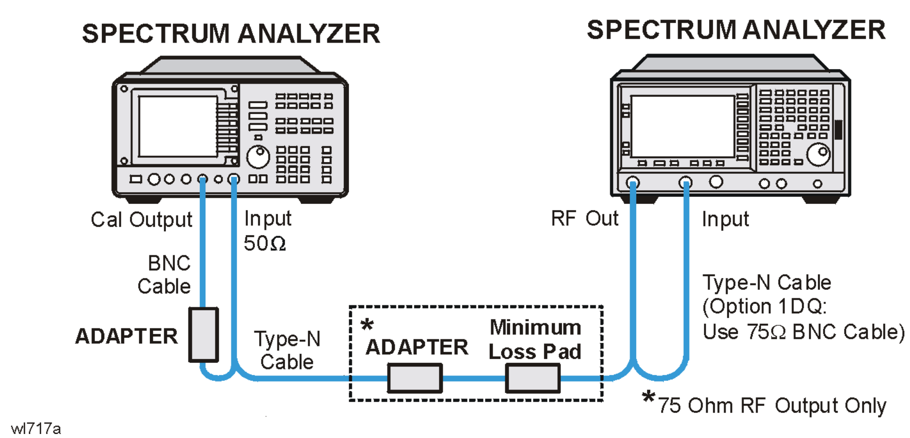
Equipment Required

Microwave analyzer
Cable, Type-N, 62 cm (24 in)
Cable, BNC to BNC, 23 cm (9 in)
Adapter, Type-N (m) to BNC (f)

Additional Equipment Required for Option 1DQ

50 Ω to 75 Ω Minimum loss pad
Adapter, Type-N (f) to BNC (m), 75 Ω

Figure 2-62 Harmonic Spurious Outputs Test Setup



CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors or damage to the connectors will occur.

Procedure

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

1. Connect the 10 MHz reference output from the microwave analyzer to the 10 MHz reference input of the analyzer as shown in Figure 2-62.
2. *Complete this step only if more than 24 hours have elapsed since performing a front-panel calibration of the microwave analyzer.*

   The microwave analyzer should be allowed to warm up for at least 5 minutes before proceeding.

   Complete a front-panel calibration of the microwave analyzer by performing the following steps:

   a. Preset the microwave analyzer.

   b. Connect a BNC cable between CAL OUTPUT and 50 Ω Input.

   c. Press **CAL**, **REALIGN LO & IF**.

   d. Set **FREQUENCY**, **300 MHz**.

   e. Set **SPAN**, **20 MHz**.

   f. Set **AMPLITUDE**, **–10 dBm**.

   g. Press **PEAK SEARCH**.

   h. Press **CAL**, **REF LVL ADJ** and use the ⇑ ⇓ arrows to adjust the DAC value to a marker amplitude reading of –10 dBm. Press **STORE REF LVL**.

   i. Disconnect the BNC cable from between the CAL OUTPUT and 50 Ω Input.
3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.
4. Set the analyzer by pressing the following keys:

   FREQUENCY, **10 MHz**
   SPAN, **Zero Span**
   BW/Avg, **10 kHz**
   Source, **Amplitude** (On)
   Source, **Amplitude** (On), **0 dBm** (*Option 1DN*)
   Source, **Amplitude** (On),
   42.76 dBmV (Option 1DQ), **Single**

5. Set the microwave analyzer controls as follows:

   FREQUENCY, 10 MHz
   FREQUENCY, CF STEP, 10 MHz
   SPAN, 10 kHz
   AMPLITUDE, 5 dBm (*Option 1DN*)
   AMPLITUDE, 0 dBm (*Option 1DQ*)
   BW, 1 kHz

6. Refer to Figure 2-62 to connect the Type-N cable from the spectrum analyzer RF OUT to the input of the microwave analyzer.

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

Perform step 7 and step 8 for each measurement value in Table 2-88.

7. Set the analyzer center frequency to the next frequency listed in Table 2-88. Similarly, set the microwave analyzer frequency and step size to match the analyzer center frequency. Press **Single** on the analyzer.

8. On the microwave analyzer:

   a. Press **MKR**, **SIG TRK** (On). Wait for the signal to be displayed at center screen.

   b. Press **PEAK SEARCH**, **MKR**, **SIG TRK** (Off), **MARKER DELTA**.

   c. Press **FREQUENCY** and ⇑ (step-up key) to tune to the second harmonic.

   d. Press **PEAK SEARCH** and record the marker amplitude reading in Table 2-88 as the 2nd Harmonic Level for the appropriate Tracking Generator Output Frequency.

   e. Perform this step only if the Tracking Generator Output Frequency is ≤500 MHz. Press **FREQUENCY** and ⇑ (step-up key) to tune to the third harmonic. Press **PEAK SEARCH**.

      Record the marker amplitude reading in Table 2-88 as the 3rd Harmonic Level for the appropriate Tracking Generator Output Frequency.

   f. Press **MKR**, **MARKERS** (Off).

Table 2-88 Tracking Generator Harmonic Spurious Response Worksheet

1.5 GHz Tracking Generator Output Frequency	2nd Harmonic Level (dBc)	3rd Harmonic Level (dBc)
10 MHz		
100 MHz		
300 MHz		
750 MHz		N/A

9. From Table 2-88, enter the 2nd Harmonic Level at 10 MHz as Test Record Entry 1 and copy this value into the performance verification test record.

   Test Record Entry 1:
   TG 2nd Harmonic Spurious Output __________ dB

10. From Table 2-88, locate the most positive 2nd Harmonic Level for tracking generator frequencies of 100 MHz to 750 MHz and record this value as Test Record Entry 2 and copy this value into the performance verification test record.

    Test Record Entry 2:
    TG 2nd Harmonic Spurious Output __________ dB

11. From Table 2-88, enter the 3rd Harmonic Level at 10 MHz as Test Record Entry 3 and copy this value into the performance verification test record.

    Test Record Entry 3:
    TG 3rd Harmonic Spurious Output __________ dB

12. From Table 2-88, locate the most positive 3rd Harmonic Level for tracking generator frequencies of 100 MHz to 750 MHz and record this value as Test Record Entry 4 and copy this value into the performance verification test record.

    Test Record Entry 4:
    TG 3rd Harmonic Spurious Output __________ dB

45. Tracking Generator Harmonic Spurious Outputs: Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B (Option 1DN)

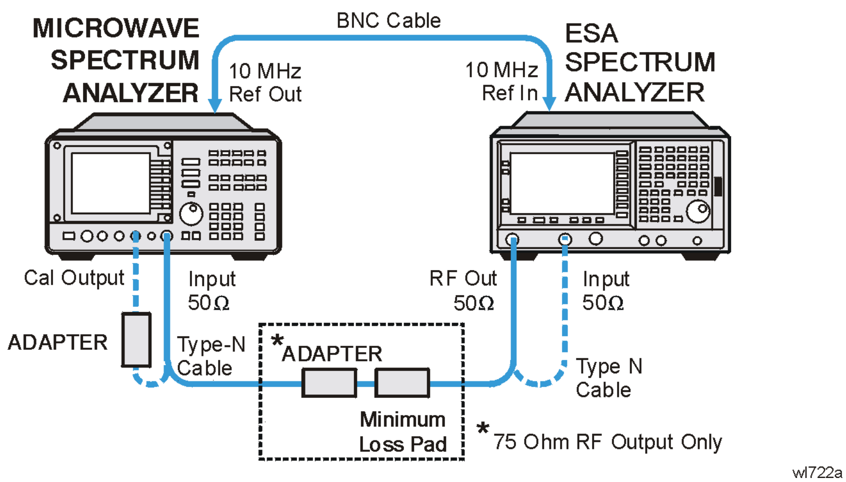
The measurement for tracking generator harmonic spurious outputs determines the maximum level of tracking generator harmonics. The tracking generator output is connected to the input of a microwave analyzer, then tuned to several different frequencies as the amplitude of the second and third harmonics (relative to the fundamental) are measured at each frequency.

There are no related adjustment procedures for this performance test.

Equipment Required

Microwave analyzer
Cable, Type-N, 62 cm (24 in)
Cable, BNC to BNC, 23 cm (9 in)
Adapter, Type-N (m) to BNC (f)

Figure 2-63 Harmonic Spurious Outputs Test Setup



Procedure

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

1. *Complete this step only if more than 24 hours have elapsed since performing a front-panel calibration of the microwave analyzer.*

   The microwave analyzer should be allowed to warm up for at least 5 minutes before proceeding.

Complete a front-panel calibration of the microwave analyzer by performing the following steps:

a. Preset the microwave analyzer.

b. Connect a BNC cable between CAL OUTPUT and 50 Ω Input.

c. Press **CAL**, **REALIGN LO & IF**.

d. Set **FREQUENCY**, **300 MHz**.

e. Set **SPAN**, **20 MHz**.

f. Set **AMPLITUDE**, **–10 dBm**.

g. Press **PEAK SEARCH**.

h. Press **CAL**, **REF LVL ADJ** and use the ⇑ ⇓ arrows to adjust the DAC value to a marker amplitude reading of –10 dBm. Press **STORE REF LVL**.

i. Disconnect the BNC cable from between the CAL OUTPUT and 50 Ω Input.

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.

3. Use the Type-N cable to connect the RF INPUT to the tracking generator RF OUT as shown in Figure 2-63. Do not connect the Type-N cable to the microwave analyzer yet. Connect the 10 MHz Reference from the output of the microwave analyzer to the 10 MHz Reference Input of the analyzer being tested.

4. Set the analyzer by pressing the following keys:

   FREQUENCY, **10 MHz**
   SPAN, **Zero Span**
   BW/Avg, **10 kHz**
   System, Alignments, Auto Align, Off
   Marker
   Source, **Amplitude** (On)
   Source, **Tracking Peak** *(Wait for the* `Peaking` *message to appear*.)
   Source, **Amplitude** (On), **–2 dBm**
   Single

5. Set the microwave analyzer controls as follows:

   FREQUENCY, 9 kHz
   FREQUENCY, **CF STEP**, **9 kHz**
   SPAN, 10 kHz
   AMPLITUDE, 5 dBm
   BW, 1 kHz

6. Disconnect the Type-N cable from between the analyzer RF INPUT and the tracking generator RF OUT. Refer to Figure 2-63 to connect the Type-N cable from the analyzer RF OUT to the input of the microwave analyzer.

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

Perform step 7 and step 8 for each measurement value in Table 2-89.

7. Set the analyzer center frequency to the next frequency listed in Table 2-89. Similarly, set the microwave analyzer frequency and step size to match the analyzer center frequency. Press **Single** on the analyzer.
8. On the microwave analyzer:
   a. Press **MKR**, **SIG TRK** (On). Wait for the signal to be displayed at center screen.
   b. Press **PEAK SEARCH**, **MKR**, **SIG TRK** (Off), **MARKER DELTA**.
9. Press **FREQUENCY** and ⇑ (step up key) to tune to the second harmonic.
   a. Press **PEAK SEARCH** and record the marker amplitude reading in Table 2-89 as the 2nd Harmonic Level for the appropriate Tracking Generator Output Frequency.
10. Perform this step only if the Tracking Generator Output Frequency is ≤900 MHz. Press **FREQUENCY** and ⇑ (step up key) to tune to the third harmonic. Press **PEAK SEARCH**.

    Record the marker amplitude reading in Table 2-89 as the 3rd Harmonic Level for the appropriate Tracking Generator Output Frequency.

    a. Press **MKR**, **MARKERS** (Off).

Table 2-89 Tracking Generator Harmonic Spurious Response Worksheet

1.5 GHz Tracking Generator Output Frequency	2nd Harmonic Level (dBc)	3rd Harmonic Level (dBc)
9 kHz		
25 kHz		
100 MHz		
300 MHz		
900 MHz		
1500 MHz		N/A

11. From Table 2-89, enter the 2nd Harmonic Level at 9 kHz as Test Record Entry 1 and copy this value into the performance verification test record.

    Test Record Entry 1:
    TG 2nd Harmonic Spurious Output __________ dB

12. From Table 2-89, locate the most positive 2nd Harmonic Level for tracking generator frequencies of 9 kHz to 750 MHz and record this value as Test Record Entry 2 and copy this value into the performance verification test record.

    Test Record Entry 2:
    TG 2nd Harmonic Spurious Output __________ dB

13. From Table 2-89, enter the 3rd Harmonic Level at 9 kHz as Test Record Entry 3 and copy this value into the performance verification test record.

    Test Record Entry 3:
    TG 3rd Harmonic Spurious Output __________ dB

14. From Table 2-89, locate the most positive 3rd Harmonic Level for tracking generator frequencies of 25 kHz to 1500 MHz and record this value as Test Record Entry 4 and copy this value into the performance verification test record.

    Test Record Entry 4:
    TG 3rd Harmonic Spurious Output __________ dB

15. Press **System, Alignments, Auto Align, All**.

46. Tracking Generator Non-Harmonic Spurious Outputs: Agilent E4401B and E4411B (Option 1DN or 1DQ)

This procedure determines the maximum level of the non-harmonic spurious outputs of the tracking generator. The tracking generator output is set to several different output frequencies. For each output frequency, several sweeps are taken on the microwave analyzer over different frequency spans and the highest displayed spurious response is measured in each span. Responses at the fundamental frequency of the tracking generator output or their harmonics are ignored. The amplitude of the highest spurious response is recorded.

There are no related adjustments for this performance test.

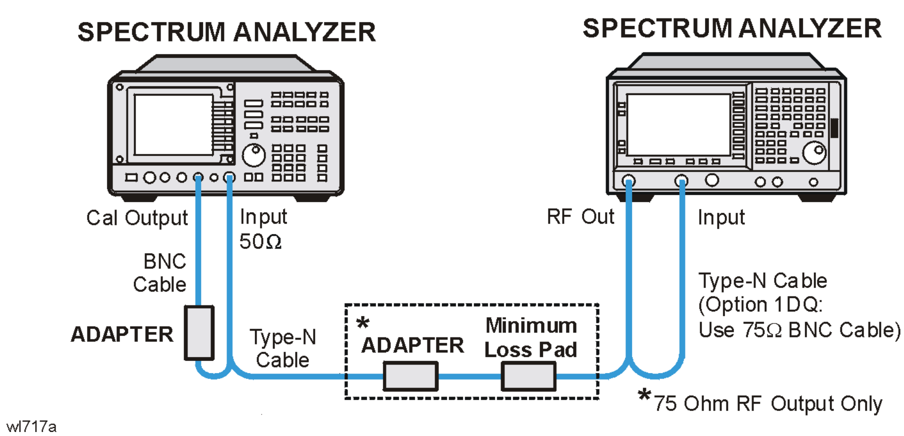
Equipment Required

Microwave analyzer
Cable, Type-N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)
Adapter, Type-N (m) to BNC (f)

Additional Equipment for 75 Ω Input

Pad, minimum loss
Adapter, Type-N (f) to BNC (m), 75 Ω

Figure 2-64 Non-Harmonic Spurious Outputs Test Setup



Procedure

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

1. *Complete this step only if more than two hours have elapsed since performing a front-panel calibration of the microwave analyzer.*

   The microwave analyzer should be allowed to warm up for at least 30 minutes before proceeding.

   Complete a front-panel calibration of the microwave analyzer by performing the following steps:

   a. Preset the microwave analyzer.

   b. Connect a BNC cable between CAL OUTPUT and 50 Ω Input.

   c. Press **CAL**, **REALIGN LO & IF**.

   d. Set **FREQUENCY**, **300 MHz**.

   e. Set **SPAN**, **20 MHz**.

   f. Set **AMPLITUDE**, **–10 dBm**.

   g. Press **PEAK SEARCH**.

   h. Press **CAL**, **REF LVL ADJ** and use the ⇑ ⇓ arrows to adjust the DAC value to a marker amplitude reading of –10 dBm. Press **STORE REF LVL**.

   i. Disconnect the BNC cable from between the CAL OUTPUT and 50 Ω Input.

2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, **Points**, **401**, **Enter** *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   SPAN, **Zero Span**
   BW/Avg, **30 kHz**
   Marker
   Source, **Amplitude On**, **0 dBm**
   Source, **Amplitude On**, **42.76 dBmV** *(75 Ω Option only)*

3. Set the microwave analyzer by pressing the following keys:

   SPAN, **100 kHz**
   AMPLITUDE, **5 dBm**
   AMPLITUDE, **0 dBm** *(75 Ω Option only)*
   AMPLITUDE, **ATTEN**, **20 dB**
   AMPLITUDE, **LOG dB/DIV**, **10 dB**

4. Disconnect the Type-N cable from between the analyzer RF INPUT and the tracking generator RF OUT. Refer to Figure 2-64 to connect the Type-N cable from the analyzer RF OUT to the microwave analyzer 50 Ω Input.

Measuring Fundamental Amplitudes

Perform the following two steps for each fundamental frequency in Table 2-90.

1. Set the analyzer center frequency to the fundamental frequency listed in Table 2-90 and press **Single** to activate a single sweep. Set the microwave analyzer to the same frequency.
2. On the microwave analyzer, press **PEAK SEARCH**. Press **MKR** →, **MARKER** → **REF LVL**. Wait for another sweep to finish. Press **PEAK SEARCH**. Record the marker amplitude reading in Table 2-90 as the Fundamental Amplitude.

Table 2-90 Tracking Generator Fundamental Response Worksheet

Fundamental Frequency	Fundamental Amplitude (dBm)
10 MHz	
750 MHz	
1.5 GHz	

Measuring Non-Harmonic Responses

1. On the analyzer, set the center frequency to the initial value indicated in the first row of Table 2-90. Press **Single** on the analyzer to trigger a single sweep.
2. Set the microwave analyzer Start Freq, Stop Freq, and Res BW as indicated in the first row of Table 2-91.

   75 Ω outputs only: Measure only at start frequencies of 1 MHz and greater.
3. Press **SGL SWP** on the microwave analyzer to activate a single sweep and wait for the sweep to finish. Press **PEAK SEARCH** to locate the largest spurious response.
4. Verify that the marked signal is not the fundamental or a harmonic of the fundamental by performing the following steps:

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

a. Divide the marker frequency by the fundamental frequency (the analyzer center frequency setting). For example, if the marker frequency is 30.3 MHz and the fundamental frequency is 10 MHz, dividing 30.3 MHz by 10 MHz yields 3.03.

b. Round the number calculated in step a to the nearest whole number. In the example above, 3.03 should be rounded to 3. Values less than 1 should be rounded up to 1.

c. Multiply the fundamental frequency by the number calculated in step b. Following the example, multiplying 10 MHz by 3 yields 30 MHz.

d. Calculate the difference between the marker frequency and the frequency calculated in step c above. Continuing the example, the difference would be 300 kHz.

e. Due to span accuracy uncertainties in the microwave analyzer, the marker frequency might not equal the actual frequency. Given the marker frequency, check if the difference calculated in step d is within the appropriate tolerance:

   For marker frequencies <5 MHz, tolerance = ±200 kHz
   For marker frequencies <55 MHz, tolerance = ±750 kHz
   For marker frequencies >55 MHz, tolerance = ±10 MHz

f. If the difference in step d is within the indicated tolerance, the signal in question is the fundamental signal (if the number in step b = 1) or a harmonic of the fundamental (if the number in step b >1). This response should be ignored.

5. Verify that the marked signal is a true response and not a random noise peak by pressing **SINGLE** to trigger a new sweep and press **PEAK SEARCH**. A true response will remain at the same frequency and amplitude on successive sweeps but a noise peak will not.

   If the marked signal is not the fundamental or a harmonic of the fundamental and is a true response, proceed with step 7.

6. If the marked signal is either the fundamental or a harmonic of the fundamental or a noise peak, move the marker on the microwave analyzer to the next highest signal by pressing **NEXT PEAK**. Repeat step 4 above.

   Perform step 7 only if the marker signal is a true response and not a fundamental or harmonic of the fundamental. Otherwise, continue with step 8.

7. Calculate the difference between the amplitude of marked signal and the fundamental amplitude as listed in Table 2-90.

   For example, if the fundamental amplitude for a fundamental frequency of 10 MHz is 1.2 dBm and the marker amplitude is –40.8 dBm, the difference is –42 dBc.

Record this difference as the non-harmonic response amplitude for the appropriate analyzer center frequency and microwave analyzer start and stop frequency settings in Table 2-91.

Non-harmonic Amplitude = Marker Amplitude – Fundamental Amplitude

8. If a true non-harmonic spurious response is not found, record "NOISE" as the Amplitude of Non-Harmonic Response in Table 2-91 for the appropriate analyzer center frequency and microwave analyzer start and stop frequency settings.

9. Repeat step 1 through step 8 for the remaining analyzer center frequency and microwave analyzer settings in Table 2-91.

Table 2-91 1.5 GHz Tracking Generator Non-Harmonic Spurious Response Worksheet

Analyzer Center Frequency	Microwave Analyzer Start Frequency	Microwave Analyzer Stop Frequency	Microwave Analyzer Resolution Bandwidth	Amplitude of Non-Harmonic Response (dBc)
10 MHz	9 kHz[a]	100 kHz[a]	300 Hz[a]	
10 MHz	100 kHz[b]	5 MHz	10 kHz	
10 MHz	5 MHz	55 MHz	100 kHz	
10 MHz	55 MHz	1240 MHz	1 MHz	
10 MHz	1240 MHz	1500 MHz	1 MHz	
750 MHz	9 kHz[a]	100 kHz[a]	300 Hz[a]	
750 MHz	100 kHz[b]	5 MHz	10 kHz	
750 MHz	5 MHz	55 MHz	100 kHz	
750 MHz	55 MHz	1240 MHz	1 MHz	
750 MHz	1240 MHz	1500 MHz	1 MHz	
1.5 GHz	9 kHz[a]	100 kHz[a]	300 Hz[a]	
1.5 GHz	100 kHz[b]	5 MHz	10 kHz	
1.5 GHz	5 MHz	55 MHz	100 kHz	
1.5 GHz	55 MHz	1240 MHz	1 MHz	
1.5 GHz	1240 MHz	1500 MHz	1 MHz	

a. 75 Ω RF Outputs: Omit this frequency range.
b. 75 Ω RF Outputs: Set the start frequency to 1 MHz.

Determining the Highest Non-harmonic Spurious Response

1. In Table 2-91, locate the most positive non-harmonic response amplitude. Record this amplitude as the highest non-harmonic response amplitude in TR Entry 1 of the performance verification test record.

47. Tracking Generator Non-Harmonic Spurious Outputs: Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B (Option 1DN)

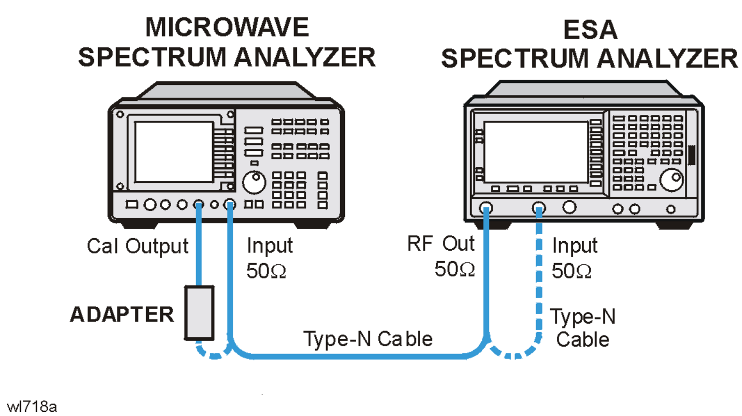
This procedure determines the maximum level of the non-harmonic spurious outputs of the tracking generator. The tracking generator output is set to several different output frequencies. For each output frequency, several sweeps are taken on the microwave analyzer over different frequency spans and the highest displayed spurious response is measured in each span. Responses at the fundamental frequency of the tracking generator output or their harmonics are ignored. The amplitude of the highest spurious response is recorded.

There are no related adjustments for this performance test.

Equipment Required

Microwave analyzer
Cable, Type-N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)
Adapter, Type-N (m) to BNC (f)

Figure 2-65 Non-Harmonic Spurious Outputs Test Setup



Procedure

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

1. *Complete this step only if more than two hours have elapsed since performing a front-panel calibration of the microwave analyzer.*

   The microwave analyzer should be allowed to warm up for at least 30 minutes before proceeding.

   Complete a front-panel calibration of the microwave analyzer by performing the following steps:

   a. Preset the microwave analyzer.

   b. Connect a BNC cable between CAL OUTPUT and 50 Ω Input.

   c. Press **CAL**, **REALIGN LO & IF**.

   d. Set **FREQUENCY**, **300 MHz**.

   e. Set **SPAN**, **20 MHz**.

   f. Set **AMPLITUDE**, **–10 dBm**.

   g. Press **PEAK SEARCH**.

   h. Press **CAL**, **REF LVL ADJ** and use the ⇑ ⇓ arrows to adjust the DAC value to a marker amplitude reading of –10 dBm. Press **STORE REF LVL**.

   i. Disconnect the BNC cable from between the CAL OUTPUT and 50 Ω Input.

2. Use the Type-N cable to connect the RF Input to the RF OUT of the tracking generator as shown in Figure 2-65. Do not connect to the RF Input of the microwave analyzer yet.

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, **50 MHz**
   SPAN, **Zero Span**
   BW/Avg, **30 kHz**
   System, Alignments, Auto Align, Off
   Marker
   Source, Tracking Peak (*wait for the* `Peaking` *message to appear*)
   Source, **Amplitude On**, **–2 dBm**
   Single

4. Set the microwave analyzer by pressing the following keys:

   SPAN, **100 kHz**
   AMPLITUDE, **5 dBm**
   AMPLITUDE, **Attenuation**, **20 dB**
   AMPLITUDE, **LOG dB/DIV**, **10 dB**

5. Disconnect the Type-N cable from between the analyzer RF INPUT and the tracking generator RF OUT. Refer to Figure 2-65 to connect the Type-N cable from the analyzer RF OUT to the microwave analyzer 50 Ω Input.

Measuring Fundamental Amplitudes

Perform the following two steps for each measurement value in Table 2-92.

6. Set the analyzer center frequency to the Fundamental Frequency listed in Table 2-92 and press **Single** to activate a single sweep. Set the microwave analyzer to the same frequency.
7. On the microwave analyzer, press **PEAK SEARCH**. Press **MARKER →**, **MKR → REF LVL**. Wait for another sweep to finish. Press **PEAK SEARCH**. Record the marker amplitude reading in Table 2-92 as the fundamental amplitude.

Table 2-92 Tracking Generator Fundamental Response Worksheet

Fundamental Frequency	Fundamental Amplitude (dBm)
10 MHz	
1.5 GHz	
3.0 GHz	

Measuring Non-Harmonic Responses

8. On the analyzer, set the center frequency to the initial value indicated in the first row of Table 2-92. Press **Single** on the analyzer to trigger a single sweep.
9. Set the Start Freq, Stop Freq, and Res BW of the microwave analyzer as indicated in the first row of Table 2-93.
10. Press **SGL SWP** on the microwave analyzer to activate a single sweep and wait for the sweep to finish. Press **PEAK SEARCH** to locate the largest spurious response.
11. Verify that the marked signal is not the fundamental or a harmonic of the fundamental by performing the following steps:

NOTE The following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

a. Divide the marker frequency by the fundamental frequency (the analyzer center frequency setting). For example, if the marker frequency is 30.3 MHz and the fundamental frequency is 10 MHz, dividing 30.3 MHz by 10 MHz yields 3.03.

b. Round the number calculated in step a to the nearest whole number. In the example above, 3.03 should be rounded to 3. Values less than 1 should be rounded up to 1.

c. Multiply the fundamental frequency by the number calculated in step b. Following the example, multiplying 10 MHz by 3 yields 30 MHz.

d. Calculate the difference between the marker frequency and the frequency calculated in step c above. Continuing the example, the difference would be 300 kHz.

e. Due to span accuracy uncertainties in the microwave analyzer, the marker frequency might not equal the actual frequency. Given the marker frequency, check if the difference calculated in step d is within the appropriate tolerance:

   For marker frequencies <5 MHz, tolerance = ±200 kHz
   For marker frequencies <55 MHz, tolerance = ±750 kHz
   For marker frequencies >55 MHz, tolerance = ±10 MHz

f. If the difference in step d is within the indicated tolerance, the signal in question is the fundamental signal (if the number in step b = 1) or a harmonic of the fundamental (if the number in step b >1). This response should be ignored.

12. Verify that the marked signal is a true response and not a random noise peak by pressing **SINGLE** to trigger a new sweep and press **PEAK SEARCH**. A true response will remain at the same frequency and amplitude on successive sweeps but a noise peak will not.

    If the marked signal is not the fundamental or a harmonic of the fundamental and is a true response, proceed with step 14.

13. If the marked signal is either the fundamental or a harmonic of the fundamental or a noise peak, move the marker on the microwave analyzer to the next highest signal by pressing **NEXT PEAK**. Repeat step 11 above.

    Perform step 14 only if the marker signal is a true response and not a fundamental or harmonic of the fundamental. Otherwise, continue with step 15.

14. Calculate the difference between the amplitude of marked signal and the fundamental amplitude as listed in Table 2-92.

    For example, if the fundamental amplitude for a fundamental frequency of 10 MHz is 1.2 dBm and the marker amplitude is –40.8 dBm, the difference is –42 dBc.

    Record this difference as the non-harmonic response amplitude for the appropriate analyzer center frequency and microwave analyzer start and stop frequency settings in Table 2-93.

$$\text{Non-harmonic Amplitude} = \text{Marker Amplitude} - \text{Fundamental Amplitude}$$

15.If a true non-harmonic spurious response is not found, record "NOISE" as the non-harmonic response Amplitude in Table 2-93 for the appropriate analyzer center frequency and microwave analyzer start and stop frequency settings.

16.Repeat step 8 through step 15 for the remaining analyzer center frequency and microwave analyzer settings in Table 2-93.

17.Press **System, Alignments, Auto Align, All**

Table 2-93 3.0 GHz Tracking Generator Non-Harmonic Spurious Response Worksheet

Analyzer Center Frequency	Microwave Analyzer Start Frequency	Microwave Analyzer Stop Frequency	Microwave Analyzer Resolution Bandwidth	Amplitude of Non-Harmonic Response (dBc)
10 MHz	9 kHz	100 kHz	300 Hz	
10 MHz	100 kHz	5 MHz	10 kHz	
10 MHz	5 MHz	55 MHz	100 kHz	
10 MHz	55 MHz	1240 MHz	1 MHz	
10 MHz	1240 MHz	2000 MHz	1 MHz	
10 MHz	2000 MHz	3000 MHz	1 MHz	
1.5 GHz	9 kHz	100 kHz	300 Hz	
1.5 GHz	100 kHz	5 MHz	10 kHz	
1.5 GHz	5 MHz	55 MHz	100 kHz	
1.5 GHz	55 MHz	1240 MHz	1 MHz	
1.5 GHz	1240 MHz	2000 MHz	1 MHz	
1.5 GHz	2000 MHz	3000 MHz	1 MHz	
3.0 GHz	9 kHz	100 kHz	300 Hz	
3.0 GHz	100 kHz	5 MHz	10 kHz	
3.0 GHz	5 MHz	55 MHz	100 kHz	
3.0 GHz	55 MHz	1240 MHz	1 MHz	
3.0 GHz	1240 MHz	2000 MHz	1 MHz	
3.0 GHz	2000 MHz	3000 MHz	1 MHz	

Determining the Highest Non-harmonic Spurious Response

1. In Table 2-93, locate the most positive non-harmonic response amplitude for microwave analyzer stop frequency settings ≤2000 MHz. Record this amplitude as the highest non-harmonic response amplitude in TR Entry 1 of the performance verification test record.
2. In Table 2-93, locate the most positive non-harmonic response amplitude for microwave analyzer start frequency settings ≥2000 MHz. Record this amplitude as the highest non-harmonic response amplitude in TR Entry 2 of the performance verification test record.

48. Tracking Generator LO Feedthrough Amplitude: Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B (Option 1DN)

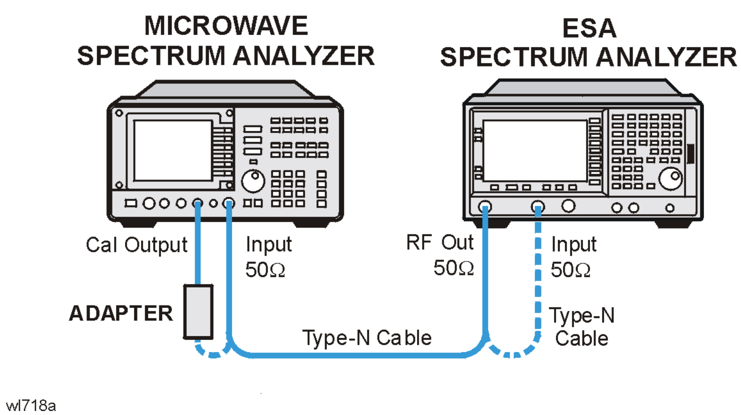
The tracking generator output is connected to the analyzer 50 Ω Input. and the tracking is adjusted at 50 MHz for a maximum signal level. The tracking generator output is then connected to the input of a microwave analyzer. The tracking generator is tuned to several different frequencies and the LO Feedthrough is measured at the frequency extremes of the LO.

The related adjustment for this procedure is “TG LO Leveling.”

Equipment Required

Microwave analyzer
Cable, Type-N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)
Adapter, Type-N (m) to BNC (f)

Figure 2-66 LO Feedthrough Amplitude Test Setup



Procedure

NOTE Note that the following steps are for an HP/Agilent 8563E microwave analyzer, the steps may be different if you are using another microwave analyzer.

1. Press **PRESET** on the microwave analyzer.

   The microwave analyzer should be allowed to warm up for at least five minutes before proceeding.

Complete step 2 only if more than 24 hours have elapsed since performing a front-panel calibration of the microwave analyzer.

2. Perform a front-panel calibration of the microwave analyzer by performing the following steps:

   a. Connect a BNC cable between CAL OUTPUT and 50 Ω Input.

   b. Press **CAL**, **REALIGN LO & IF**.

   c. Set **FREQUENCY**, **300 MHz**.

   d. Set **SPAN**, **20 MHz**.

   e. Set **AMPLITUDE**, **–10 dBm**.

   f. Press **PEAK SEARCH**.

   g. Press **CAL**, **REF LVL ADJ** and use the ⇑⇓ arrows to adjust the DAC value to a marker amplitude reading of –10 dBm. Press **STORE REF LVL**.

   h. Disconnect the BNC cable from between the CAL OUTPUT and 50 Ω Input.

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.

4. Use the type-N cable to connect the RF Input to the tracking generator RF OUT on the analyzer as shown in Figure 2-66. *Do not connect to the microwave analyzer RF Input yet.*

5. Initialize the test equipment by pressing the following keys on the analyzer:

   FREQUENCY, **50 MHz**
   SPAN, **Zero Span**
   BW / Avg, **30 kHz**
   System, Alignments, Auto Align, Off
   Marker
   Source, **Amplitude On**, **–5 dBm**
   Source, **Tracking Peak** (*Wait for the* `PEAKING SIGNAL` *message to disappear*.)
   FREQUENCY, **9 kHz**
   Source, **Amplitude On**, **–2 dBm**
   Single

6. On the microwave analyzer, press the following keys:

   FREQUENCY, **3.921409 GHz**
   SPAN, **100 kHz**
   AMPLITUDE, **0 dBm**
   BW, **1 kHz**

7. Disconnect the type-N cable from between the analyzer RF INPUT and the Tracking Generator RF OUT. Refer to Figure 2-66 to connect the type-N cable from the analyzer RF OUT to the microwave analyzer 50 Ω Input.

8. On the microwave analyzer, press:

   PEAK SEARCH
   MKR, SIG TRK (On)

   Wait for the signal to be displayed at center screen, then press **SIG TRK** (Off).

9. On the microwave analyzer, press **AUX CTRL**, **INTERNAL MIXER**, **PRESEL AUTO PK** then wait for the `PEAKING` message to disappear.

10. Record the microwave analyzer marker amplitude in Table 2-94 as the LO Feedthrough Amplitude for the Microwave analyzer CENTER FREQUENCY at 3.921409 GHz.

11. Repeat step 8 through step 10 for the remaining Analyzer CENTER FREQUENCY and Microwave Analyzer CENTER FREQUENCY settings listed in Table 2-94. Press **Single** on the analyzer to activate a single sweep each time the center frequency is changed.

12. Press **System, Alignments, Auto Align, All**.

13. In Table 2-94, for analyzer center frequencies of 9 kHz to 1.5 GHz, locate the highest LO Feedthrough Amplitude then record this amplitude as TR Entry 1 of the performance verification test record.

14. In Table 2-94, for the Analyzer Center Frequency of 3.0 GHz, record this LO Feedthrough Amplitude as TR Entry 2 of the performance verification test record.

Table 2-94 Tracking Generator LO Feedthrough Amplitude Worksheet

Analyzer CENTER FREQUENCY	Microwave Analyzer CENTER FREQUENCY	LO Feedthrough Amplitude (dBm)
9 kHz	3.921409 GHz	
70 MHz	3.9914 GHz	
150 MHz	4.0714 GHz	
1.5 GHz	5.4214 GHz	
3.0 GHz	6.9214 GHz	

49. Gate Delay Accuracy and Gate Length Accuracy: Agilent E4401B, E4402B, E4404B, E4405B, and E4407B (Option 1D6)

The method used for measuring the gate length times is determined by the length of the gate. Shorter gate-length times are measured with an oscilloscope, and longer gate-length times are measured with a counter.

For shorter gate-length times, the output signal of a pulse generator is used to trigger the gate circuitry. To measure the gate delay, Δt markers are used. The oscilloscope pulse width measurement feature is used to measure the short gate-length.

For longer gate-length times, a universal counter is used to measure the time period from the rising edge of the gate output to its falling edge. Because the gate-length time is equivalent to the clock accuracy of the analyzer, the gate-length time is compared to the specification for clock accuracy.

There are no related adjustments for this procedure.

Equipment Required

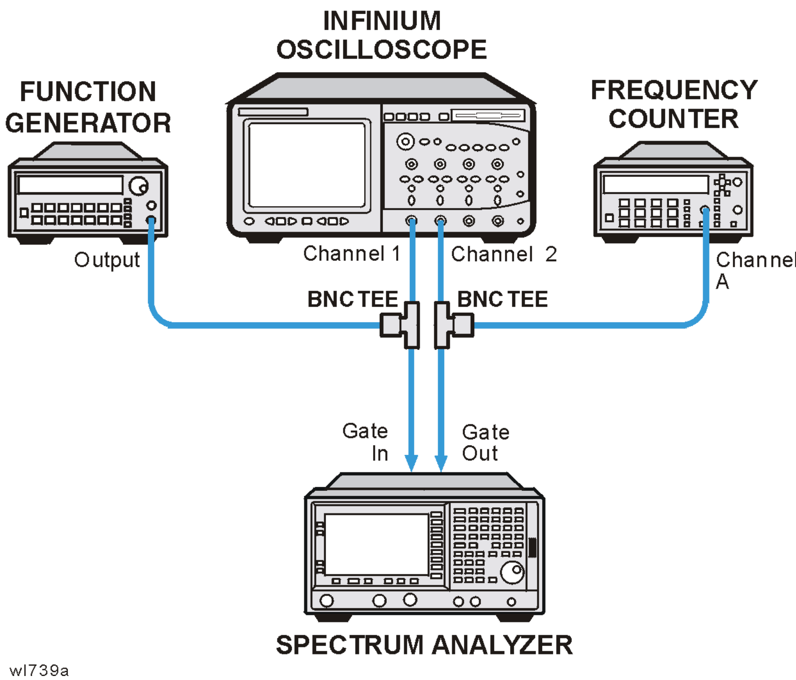
Universal counter
Function generator
Oscilloscope *(This procedure is written for the HP/Agilent 54820A.)*
Cable, BNC, 120 cm (48 in) *(four required)*
Adapter, BNC tee (m) (f) (f) *(two required)*

Procedure

1. Connect the equipment as shown in Figure 2-67. Connect the GATE OUT to Channel 2.
2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   Span, **Zero Span**
   Sweep, **Sweep Time**, **20ms**
   Sweep, **Gate** (On),
   Gate Setup, **Edge Setup**
   Gate Delay, **1 μs**
   Gate Length, **1 μs**

Figure 2-67 Gate Delay and Gate Length Test Setup



3. Set up the function generator as follows:

Waveform	Square
Frequency	100 Hz
Amplitude	2.5 V
Offset	1.25 V

4. Press **Default Setup** on the oscilloscope and set the controls as follows:

Timebase	500 ns/div
Trigger	Edge
Trigger Source	2
Trigger Level	2.0 V
Channel 1	
V/Div	1 V
Coupling	DC
Offset	2.0 V
Channel 2	
V/Div	1 V
Coupling	DC
Offset	3.0 V

5. On the oscilloscope, adjust the horizontal position to place the area between the rising edges of channel 1 and channel 2 at the center of the display. The horizontal position at the bottom of the grid should be between –500 ns and –650 ns.

6. Set the oscilloscope timebase to 200 ns/div. The rising edges of channel 1 and channel 2 should still be displayed. If not, adjust the horizontal position so the rising edges of channel 1 and channel 2 are displayed.

7. Use the mouse connected to the oscilloscope and click on the mouse icon in the upper right-hand corner of the display.

8. Set the oscilloscope statistics on.

   Click on **Measure** and verify that “Show Statistics” is checked.

9. Define the conditions for a delta time measurement on the oscilloscope.

   a. Click on **Measure**, **Customize**, **Measurement Definitions**.

   b. Set Threshold Definition to “10%, 50%, 90%”.

   c. Set Top-Base Definition to “Standard”.

   d. Set From Edge # to 1, and set To Edge # to 2.

   e. Set both Direction selections to “Rising”.

   f. Set both Threshold selections to “Middle Level”.

   g. Click **Close**.

10. Activate the delta time measurement.

    a. Click **Measure**, **Time**, **Delta Time**.

    b. Set Source 1 to “Channel 1”.

    c. Set Source 2 to “Channel 2”.

    d. Click **OK**.

11. Wait a few seconds for the minimum and maximum values displayed at the bottom of the oscilloscope grid to stabilize.

12. Refer to the measurement statistics at the bottom of the oscilloscope grid.

    Record the ΔTime (1)-(2) min value as Minimum Gate Delay in Table 2-95.

    Record the ΔTime (1)-(2) max value as the Maximum Gate Delay in Table 2-95.

13. Clear all current oscilloscope measurements. Click on **Measure**, **Clear**, and **All Measurements**.

14.Adjust the oscilloscope horizontal position to center the pulse on Channel 2 on the display.

15.Activate the pulse width measurement function for channel 2 of the oscilloscope.

Click on **Measure**, **Time**, and click on **+width**.

Set the Source to be channel 2 and click **OK**.

16.Record the +width (2) mean value in Table 2-95 as the 1 µs Gate Length.

17.On the analyzer, press

Sweep, **Sweep Time**
150 ms, **Sweep**
Gate Setup, **Edge Setup**
Gate Delay, **10ms**
Sweep, **Gate Setup**
Edge Setup, **Length**, **65 ms**

18.Set the universal counter controls as follows:

Function	Time Interval 1 - 2
Gate Time	0.1 s
Auto Trigger	On
Channel 1	
Coupling	DC
Impedance	1 MΩ
X10 Atten	Off
100 kHz Filter	Off
Common 1	On
Slope	Pos
Channel 2	
Coupling	DC
Impedance	1 MΩ
X10 Atten	Off
100 kHz Filter	Off
Common 1	On
Slope	Neg

19.Record the universal counter readout value as the 65ms Gate Length in Table 2-95.

Table 2-95 Gate Delay and Gate Length Accuracy Worksheet

Description	Value	TR Entry
Minimum Gate Delay		**1)**
Maximum Gate Delay		**2)**
1 μs Gate Length		**3)**
65 ms Gate Length		**4)**

50. Gate Mode Additional Amplitude Error: Agilent E4401B, E4402B, E4404B, E4405B, and E4407B (Option 1D6)

This procedure measures the additional amplitude error while gate mode is turned on. An amplitude reference is established while gate mode is off. Gate mode is then turned on with a function generator providing the gate trigger input. The amplitude with gate mode on is then measured using the marker delta function.

There are no related adjustments for this procedure.

Equipment Required

Synthesized signal generator
Function generator
Cable, Type-N (f), 50 Ω
Cable, BNC, 120 cm

Additional Equipment for Option 1DP

Adapter, Type-N (f) to BNC (m), 75 Ω
Minimum loss pad

Additional Equipment for Option BAB

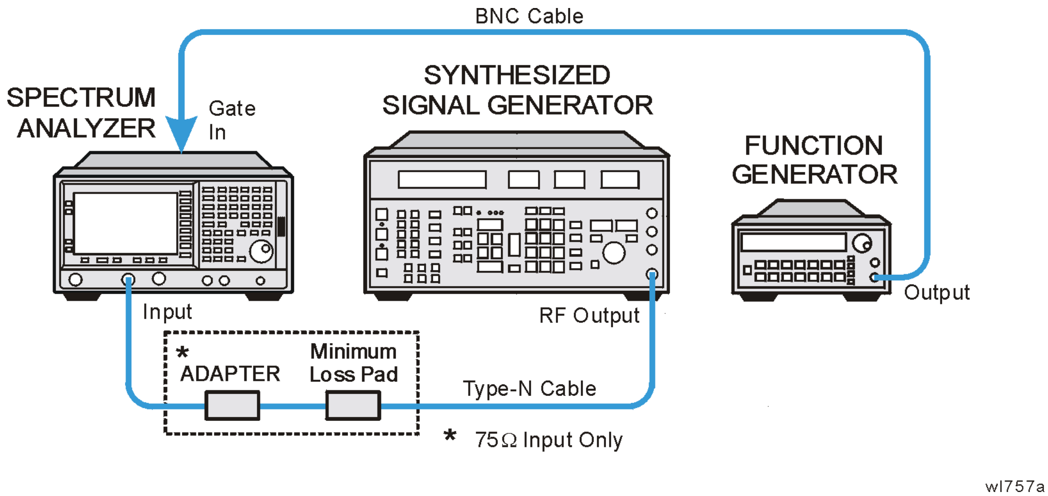
Adapter, Type-N (f) to APC 3.5 (f)

Procedure

1. Connect the equipment as shown in Figure 2-68.
2. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, 300 MHz
   SPAN, Zero Span
   AMPLITUDE, **MORE**, **Y Axis Units** (or **Amptd Units**), **dBm**
   AMPLITUDE, Ref Level, –20 dBm (*50 Ω Inputs only*)
   AMPLITUDE, Ref Level, –10 dBm (*75 Ω Inputs only*)
   Sweep, 20 ms

Figure 2-68 Gate Delay and Gate Length Accuracy Test Setup



3. Set up the function generator as follows:

Waveform	Square
Duty Cycle	50%
Frequency	100 Hz
Amplitude	2.5 V pk-pk
Offset	1.25V

4. On the synthesized signal generator, press **Blue Key, Special, 0, 0.** Set the signal generator as follows:

FREQUENCY	300 MHz
AMPLITUDE	–20 dBm (*50 Ω Inputs only*)
AMPLITUDE	–10 dBm (*75 Ω Inputs only*)

5. On the analyzer, press **Single** and wait for the sweep to finish. Press **Peak Search** (or **Search**).

6. On the analyzer, press **Meas Tools, Delta**.

7. Set the analyzer as follows:

   Trig, External
   Sweep, Gate (On)
   Gate Setup, Edge Setup, Gate Delay, 1 µs
   Gate Length, 1 µs
   Sweep, Gate Setup, Trig Type (Level)

8. On the analyzer, press **Single** and wait for the sweep to finish. Press **Peak Search** (or **Search**).

9. Record the ΔMkr1 amplitude reading as TR Entry 1 in the performance test record.

51. First LO OUTPUT Amplitude Accuracy (Option AYZ only)

This test applies only to analyzers equipped with external mixing (Option AYZ).

This test verifies that analyzers with external mixing (Option AYZ) meet their specification for First LO (local oscillator) output level. The flatness of the First LO output determines the flatness of measurements made using external mixers. In this test, a calibrated power sensor is connected to the First LO output to measure the power level at frequencies between 2.9 GHz and 7.1 GHz.

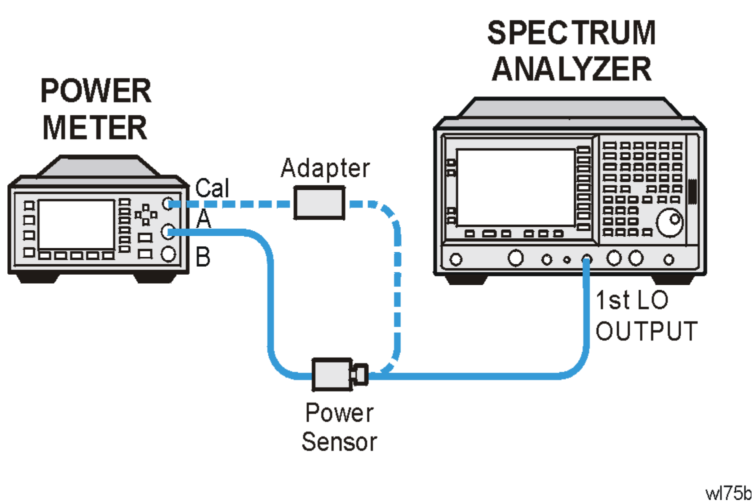
The analyzer is put into external mixing mode using a harmonic number of –10. The tuned frequency of the spectrum will therefore be 321.4 MHz (the frequency of the Second IF) below the Tenth harmonic of the First LO. A 321.4 MHz frequency offset is used so that the center frequency will be exactly 10 times the First LO frequency. Setting the center frequency step size to 2 GHz allows the LO frequency to be stepped in 200 MHz increments.

The related adjustment for this performance test is “LO Power Adjustment.”

Equipment Required

Power meter
Microwave power sensor
Adapter, type-N (m) to SMA (f)

Figure 2-69 First LO Output Amplitude Accuracy Test Setup



Procedure

1. Zero and calibrate the power sensor and power meter combination at 50 MHz. Set the power meter for dBm output.
2. Enter the 3 GHz calibration factor of the power sensor into the power meter.
3. Remove the termination from the First LO OUTPUT connector of the analyzer.
4. Connect the power sensor to the First LO OUTPUT connector of the analyzer as shown in Figure 2-69.
5. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   Input/Output, Input Mixer, Input Mixer (Ext)
   Mixer Config, Harmonic, –10
   SPAN, Zero Span
   FREQUENCY, 30 GHz
   CF Step, 2 GHz
   Freq Offset, 321.4 MHz
   System, Alignments, Auto Align, Off

6. Press **FREQUENCY** on the analyzer.
7. Read the power displayed on the power meter and record it as TR Entry 1 in the Performance Verification Test Record.
8. Press the ⇑ key on the analyzer to select the next center frequency and First LO frequency.
9. Enter the appropriate power sensor calibration factor into the power meter as shown in Table 2-96.
10. Read the power displayed on the power meter and record it in the Performance Verification Test Record as indicated in the TR Entry column of Table 2-96.
11. Repeat step 8 through step 10 for the remaining center frequency and First LO frequencies listed in Table 2-96.

Table 2-96 First LO Output Amplitude Accuracy Worksheet

First LO Frequency (GHz)	Center Frequency (GHz)	Calibration Factor Frequency (GHz)	TR Entry
2.9	29	3.0	**1)**
3.1	31	3.0	**2)**
3.3	33	3.0	**3)**
3.5	35	4.0	**4)**
3.7	37	4.0	**5)**
3.9	39	4.0	**6)**
4.1	41	4.0	**7)**
4.3	43	4.0	**8)**
4.5	45	5.0	**9)**
4.7	47	5.0	**10)**
4.9	49	5.0	**11)**
5.1	51	5.0	**12)**
5.3	53	5.0	**13)**
5.5	55	6.0	**14)**
5.7	57	6.0	**15)**
5.9	59	6.0	**16)**
6.1	61	6.0	**17)**
6.3	63	6.0	**18)**
6.5	65	7.0	**19)**
6.7	67	7.0	**20)**
6.9	69	7.0	**21)**
7.1	71	7.0	**22)**

Post-Test Instrument Restoration

12. Disconnect the power sensor from the First LO OUTPUT connector.
13. Replace the 50 Ω termination on the First LO OUTPUT connector.
14. Press **Preset** the analyzer.
15. Press **System, Alignments, Auto Align, All**.

52. IF INPUT Accuracy (Option AYZ only)

This test only applies to analyzers equipped with external mixing (Option AYZ).

This test measures the accuracy of the IF INPUT. A nominal –30 dBm, 321.4 MHz signal is applied to a power sensor and the power level is recorded. The actual frequency must be offset slightly to compensate for the IF centering error of the 1 kHz resolution bandwidth. This frequency offset is measured using the 321.4 MHz signal applied to the 50 Ω Input connector. The signal is measured with frequency corrections on and off. The difference between these two measurements is the IF centering error. The 321.4 MHz signal is then offset by the IF centering error.

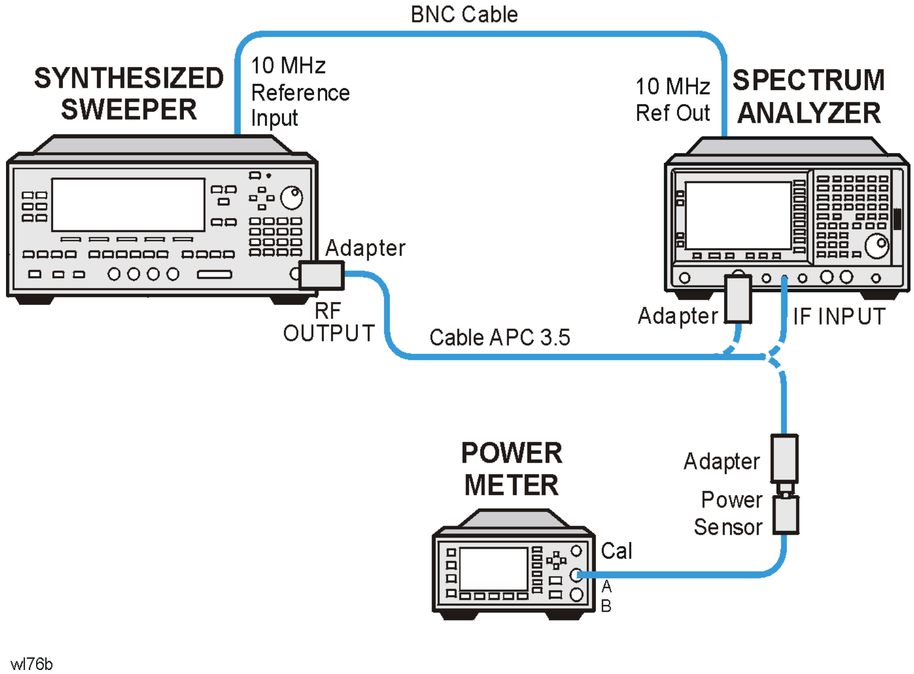
This signal is then applied to the IF INPUT of the analyzer which is set to external mixing mode in A band (26.5 GHz to 40 GHz). Amplitude corrections are set to 0 dB. The amplitude is measured by the analyzer and then recorded. The difference between the two measurements is the IF INPUT accuracy.

The related adjustment procedure for this performance test is “IF INPUT Correction.”

Equipment Required

Synthesized sweeper
Power meter
Low-power power sensor
30 dB reference attenuator
Cable, APC 3.5
Cable, BNC
Adapter, type-N (m) to APC 3.5 (f) (*not required for Option BAB*)
Adapter, APC 3.5 (f) to APC 3.5 (f) (*two required for Option BAB*)
Adapter, type-N (f) to APC 3.5 (f)

Figure 2-70 IF INPUT Accuracy Test Setup



Procedure

Determining the IF Centering Error

1. Preset the synthesized sweeper and set the controls as follows:

   CW. . . . . 321.4 MHz
   POWER LEVEL . . . . –30 dBm
   RF . . . . On

2. Connect the synthesized sweeper output to the analyzer 50 Ω Input connector. The analyzer provides the frequency reference for the synthesized sweeper.

3. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   System, Alignments, Auto Align, Off
   FREQUENCY, 321.4 MHz
   SPAN, 5 kHz
   AMPLITUDE, –30 dBm
   BW/Avg, Resolution BW, 1 kHz

4. On the analyzer, press **Single** and wait for the sweep to finish.

5. On the analyzer, press the following keys:

   Peak Search (or **Search**)
   Marker, **Delta**
   System, **Alignments**, **Freq Correct** (Off).

6. On the analyzer, press **Single** and wait for the sweep to finish.

7. On the analyzer, press **Peak Search** (or **Search**).

8. Note the ΔMkr1 frequency.

9. Calculate the new synthesized sweeper CW frequency by adding the ΔMkr1 frequency to 321.4 MHz. Set the synthesized sweeper CW frequency to the new calculated frequency.

   $$\text{New CW Frequency} = 321.4\text{ MHz} + \Delta\text{Mkr1 Frequency}$$

   For example, if the ΔMkr1 frequency is 725 Hz, the new CW frequency would be 321.400725 MHz.

10. On the analyzer, press **System**, **Alignments**, **Freq Correct** (On).

Setting the Synthesized Sweeper Power Level

11. Zero and calibrate the low-power sensor and power meter in dBm mode using the 30 dB reference attenuator. Enter the 300 MHz calibration factor of the power sensor into the power meter.

12. Connect the equipment as shown in Figure 2-70, with the output of the synthesized sweeper connected to the power sensor using an adapter between the cable and the power sensor.

13. Adjust the synthesized sweeper power level for a power meter reading of –30 dBm ±0.1 dB.

14. Record the power meter reading as Input Power.

    Input Power ____________dBm

Measuring the IF INPUT Accuracy

15. Connect the APC 3.5 cable from the RF OUTPUT of the synthesized sweeper to the IF INPUT of the analyzer.

16. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the analyzer by pressing the following keys:

    System, Alignments, Auto Align, Off
    AMPLITUDE, More 1 of 2, Corrections, Corrections (Off)
    AMPLITUDE, –30 dBm
    Input/Output, Input Mixer, Input Mixer (Ext)
    Ext Mix Band, 26.5–40 GHz
    FREQUENCY, 30 GHz
    SPAN, Zero Span
    BW/Avg, Resolution Bandwidth, 1 kHz

17. Press **Peak Search** on the analyzer. Record the Mkr1 amplitude reading as the Measured Power.

    Measured Power ____________dBm

18. Subtract the Input Power (step 14) from the Measured Power (step 17) and record the difference as the IF INPUT Accuracy.

    IF INPUT Accuracy = Measured Power – Input Power

    For example, if the Measured Power is –29.34 dBm and the Input Power is –30.08 dBm, the IF INPUT Accuracy would be 0.74 dB.

19. Record the IF INPUT Accuracy as TR Entry 1 in the Performance Verification Test Record.

Post-Test Instrument Restoration

20. Disconnect the cable from the IF INPUT connector.

21. Preset the analyzer.

22. On the analyzer, press the following keys:

    System, **Alignments**
    Auto Align, **All**

53. Comms Frequency Response (Option BAC or BAH)

This test measures the analyzer's amplitude error as a function of frequency. The output of a source is fed through a power splitter to a power sensor and the analyzer. The source's power level is adjusted at 50 MHz to place the displayed signal at the analyzer's center graticule line. The power meter is then set to measure dB relative to the power level at 50 MHz. At each new analyzer source frequency and center frequency, the source power level is adjusted to place the signal at the center horizontal graticule line. The power meter displays the inverse of the frequency response relative to 50 MHz.

For improved amplitude accuracy in the PCS and Cellular bands, a power splitter is characterized using a second power sensor (the "reference" sensor) connected to one power splitter output port. The other power splitter output port connects to the "buried" sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the analyzer.

The related adjustment for this performance test is "Frequency Response Error Correction".

Equipment Required

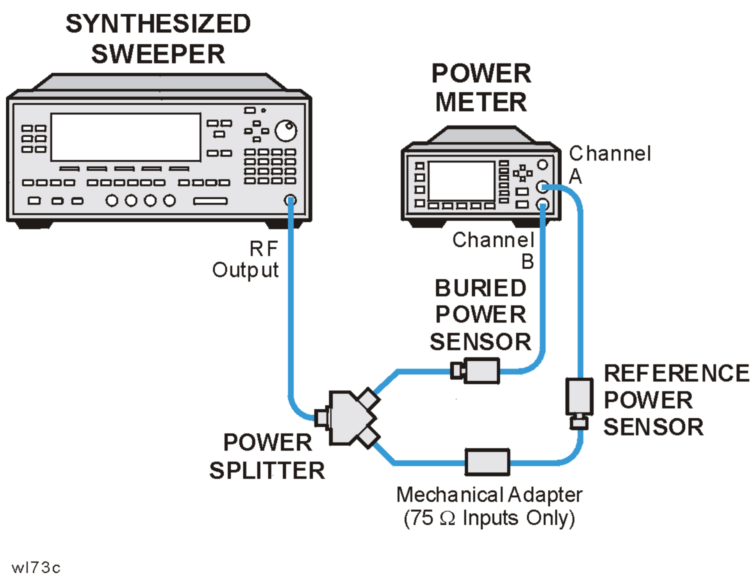
Synthesized sweeper
Function generator
Power meter
RF Power sensor (*2 required*)
Microwave power sensor
Microwave power splitter
Digital multimeter
Adapter, APC 3.5 (f) to APC 3.5 (f)
Adapter, Type-N (m) to Type-N (m)
Adapter, Type-N (m) to BNC (f)
Dual banana plug to BNC (f)
BNC Tee (BNC f,m,f)
Cable, BNC, 122-cm (48-in) (*2 required*)
Cable, Type-N, 183-cm (72-in)
Cable, APC 3.5
Termination, 50 Ω, BNC (m)

Procedure

Part 1: Source/splitter characterization

1. Connect the HP/Agilent 8482A to Channel A of the power meter. This will be the “reference” sensor. Connect the other HP/Agilent 8482A to Channel B of the power meter. This will be the “buried” sensor. Refer to Figure 2-71.

Figure 2-71 Source/splitter characterization setup



2. Zero and calibrate both power sensors.
3. On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for 100 kHz.
4. On the power meter, set the Channel B calibration factor to 100%. Do not change this calibration factor during this test.
5. Connect the equipment as shown in Figure 2-71. Use the function generator as the source.
6. Set the source frequency to 50 MHz and amplitude to 0 dBm.
7. Adjust the source amplitude to obtain a Channel A power meter reading of –10 dBm ±0.01 dB.
8. Record the source amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-97.
9. Tune the source to the next frequency in Table 2-97.

10.On the power meter, set the Channel A calibration factor to the calibration factor of the reference sensor for the current source frequency.

11.Adjust the source amplitude to obtain a Channel A power meter reading of –10 dBm ±0.1 dB.

12.Record the source amplitude setting, and both the Channel A and Channel B power meter readings in Table 2-97.

13.Repeat step 9 through step 12 for frequencies up to 2 GHz in Table 2-97.

14.For each entry in Table 2-97, calculate the splitter tracking error as follows:

$$\text{Splitter Tracking Error} = \text{Channel A Power} - \text{Channel B Power}$$

For example, if Channel A Power is –10.05 dBm and Channel B Power is –10.23 dBm, the Splitter Tracking Error is 0.18 dB.

Table 2-97 Source/splitter characterization

Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
50 MHz				0 dB (Ref)
800 MHz				
805 MHz				
810 MHz				
815 MHz				
820 MHz				
825 MHz				
830 MHz				
835 MHz				
840 MHz				
845 MHz				
850 MHz				
855 MHz				
860 MHz				
865 MHz				
875 MHz				

Table 2-97 Source/splitter characterization

Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
880 MHz				
885 MHz				
890 MHz				
895 MHz				
900 MHz				
905 MHz				
910 MHz				
915 MHz				
920 MHz				
925 MHz				
930 MHz				
935 MHz				
940 MHz				
945 MHz				
950 MHz				
955 MHz				
960 MHz				
965 MHz				
975 MHz				
980 MHz				
985 MHz				
990 MHz				
995 MHz				
1000 MHz				
1700 MHz				
1705 MHz				
1710 MHz				
1715 MHz				

Table 2-97 Source/splitter characterization

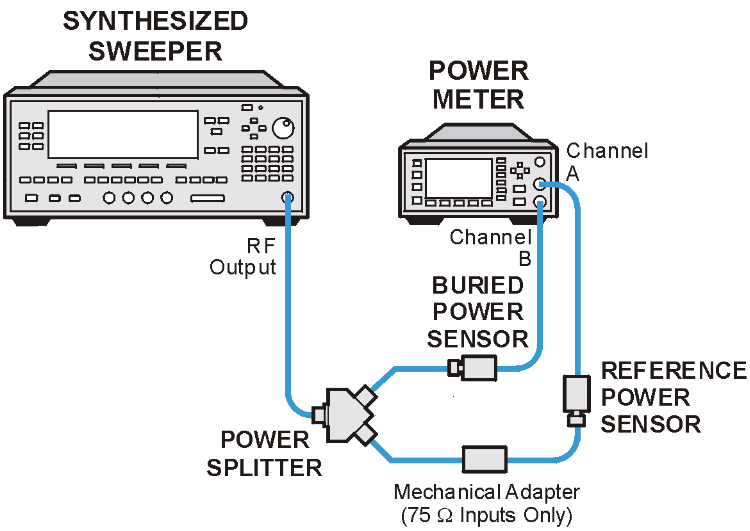
Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
1720 MHz				
1725 MHz				
1730 MHz				
1735 MHz				
1740 MHz				
1745 MHz				
1750 MHz				
1755 MHz				
1760 MHz				
1765 MHz				
1775 MHz				
1780 MHz				
1785 MHz				
1790 MHz				
1795 MHz				
1800 MHz				
1805 MHz				
1810 MHz				
1815 MHz				
1820 MHz				
1825 MHz				
1830 MHz				
1835 MHz				
1840 MHz				
1845 MHz				
1850 MHz				
1855 MHz				
1860 MHz				

Table 2-97 Source/splitter characterization

Frequency	Power Meter Reading		Splitter Tracking Error	Source Power Setting
	Channel A	Channel B		
1865 MHz				
1875 MHz				
1880 MHz				
1885 MHz				
1890 MHz				
1895 MHz				
1900 MHz				
1905 MHz				
1910 MHz				
1915 MHz				
1920 MHz				
1925 MHz				
1930 MHz				
1935 MHz				
1940 MHz				
1945 MHz				
1950 MHz				
1955 MHz				
1960 MHz				
1965 MHz				
1975 MHz				
1980 MHz				
1985 MHz				
1990 MHz				
1995 MHz				
2000 MHz				

Part 2: Measuring Frequency Response, 800 MHz to 1000 MHz, 1700 MHz to 2000 MHz (0 dB, 5 dB, 10 dB, 25 dB, and 40 dB Attenuation)

Figure 2-72 **Frequency response test setup, 800 MHz to 1000 MHz**



1. Remove the reference sensor (Channel A sensor) from the power splitter. Connect the power splitter to the analyzer 50 Ω Input using an adapter. Do not use a cable. Refer to Figure 2-72.

2. Set the source POWER LEVEL to the value corresponding to the source power setting in Table 2-98 for the current source frequency.

3. Adjust the source POWER LEVEL to obtain the Channel B power meter reading recorded in Table 2-97 ±0.1 dB.

4. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. Set the controls as follows:

   Sweep, Points, 401, Enter *(Firmware revision A.04.00 and later)*
   FREQUENCY, Center Freq, 800 MHz
   CF Step, 5 MHz
   SPAN, 0 kHz
   Input/Output (or **Input**), **Coupling** (DC) (*E4404B and E4405B)*
   AMPLITUDE, More, Int Preamp, (Off) *(Option 1DS only)*
   AMPLITUDE, Ref Level, –5 dBm
   Attenuation, 10 dB (Man)
   Scale/Div, 1 dB
   BW/Avg, Resolution BW, 10 kHz (Man)
   Video BW, 10 kHz (Man)

5. Record the current Channel B power reading in Table 2-98 as the current Channel B reading.
6. Trigger a sweep on the analyzer.
7. On the analyzer, press **Single**. Then, press **Peak Search** (or **Search**).
8. Record the Mkr1 amplitude reading in Table 2-98.
9. Set the source to the next frequency listed in Table 2-98 by pressing **FREQUENCY,** ↑
10. Adjust the source POWER LEVEL to obtain the Channel B power meter reading of 10 dBm ±0.1 dB for the current frequency.
11. Record the current Channel B power reading in Table 2-98 as the current Channel B reading.
12. Trigger a sweep on the analyzer.
13. On the analyzer, press **Single**. Then, press **Peak Search** (or **Search**).
14. Record the Mkr1 amplitude reading in Table 2-98.
15. Repeat step 9 through step 14 for each frequency in Table 2-98.
16. Copy the splitter tracking errors from Table 2-97 into Table 2-98.
17. Calculate the Flatness Error for each frequency in Table 2-98 as follows:

$$\text{Flatness Error} = \text{Mkr1 Amptd} - \text{Current Channel B} - \text{Splitter Tracking Error}$$

For example, if Mkr1 Amptd is –10.32 dBm, Current Channel B is –10.2 and Splitter Tracking Error is 0.18 dB, Flatness Error would be –0.30 dB.

18. Record the Flatness Error for 50 MHz below as the 50 MHz Ref Amptd:

50 MHz Ref Amptd: __________

19. Calculate the Flatness Relative to 50 MHz for each frequency in Table 2-98 as follows:

$$\text{Flatness Relative to 50 MHz} = \text{Flatness Error} - \text{50 MHz Ref Amptd}$$

For example, if Flatness Error is –30.0 dB, 50 MHz Ref Amptd is 0.15 dB and setup change error is –0.19 dB, Flatness Relative to 50 MHz would be –0.45 dB.

20. Repeat the Frequency Response test with input attenuation and resolution bandwidth settings for each of the following tests:

    a. cdmaOne Channel Power Accuracy (Option BAC)

        RBW = 10 kHz
        Atten = 40 dB, 25 dB, and 10 dB

b. cdmaOne Receive Channel Power Accuracy (Option BAC) Preamp On

RBW = 10 kHz
Atten = 0 dB

c. cdmaOne Receive Channel Power Accuracy (Option BAC) Preamp Off

RBW = 10 kHz
Atten = 0 dB

d. GSM Transmit Power

RBW = 300 kHz
Atten = 40, 5 dB

Table 2-98 Frequency response worksheet, 800 MHz to 1 GHz and 1700 MHz to 2 GHz

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
50 MHz					0 dB (Ref)
800 MHz					
805 MHz					
810 MHz					
815 MHz					
820 MHz					
825 MHz					
830 MHz					
835 MHz					
840 MHz					
845 MHz					
850 MHz					
855 MHz					
860 MHz					
865 MHz					
875 MHz					
880 MHz					
885 MHz					

Table 2-98 Frequency response worksheet, 800 MHz to 1 GHz and 1700 MHz to 2 GHz

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
890 MHz					
895 MHz					
900 MHz					
905 MHz					
910 MHz					
915 MHz					
920 MHz					
925 MHz					
930 MHz					
935 MHz					
940 MHz					
945 MHz					
950 MHz					
955 MHz					
960 MHz					
965 MHz					
970 MHz					
975 MHz					
980 MHz					
985 MHz					
990 MHz					
995 MHz					
1000 MHz					
1700 MHz					
1705 MHz					
1710 MHz					
1715 MHz					
1720 MHz					

Table 2-98 Frequency response worksheet, 800 MHz to 1 GHz and 1700 MHz to 2 GHz

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
1725 MHz					
1730 MHz					
1735 MHz					
1740 MHz					
1745 MHz					
1750 MHz					
1755 MHz					
1760 MHz					
1765 MHz					
1770 MHz					
1775 MHz					
1780 MHz					
1785 MHz					
1790 MHz					
1795 MHz					
1800 MHz					
1805 MHz					
1810 MHz					
1815 MHz					
1820 MHz					
1825 MHz					
1830 MHz					
1835 MHz					
1840 MHz					
1845 MHz					
1850 MHz					
1855 MHz					
1860 MHz					

Table 2-98 Frequency response worksheet, 800 MHz to 1 GHz and 1700 MHz to 2 GHz

Frequency	Current Channel B Reading	Mkr1 Amptd	Splitter Tracking Error	Flatness Error	Flatness Relative to 50 MHz
1865 MHz					
1870 MHz					
1875 MHz					
1880 MHz					
1885 MHz					
1890 MHz					
1895 MHz					
1900 MHz					
1905 MHz					
1910 MHz					
1915 MHz					
1920 MHz					
1925 MHz					
1930 MHz					
1935 MHz					
1940 MHz					
1945 MHz					
1950 MHz					
1955 MHz					
1960 MHz					
1965 MHz					
1970 MHz					
1975 MHz					
1980 MHz					
1985 MHz					
1990 MHz					
1995 MHz					
2000 MHz					

Part 3: Test Results

Perform the following steps to verify the frequency response of the analyzer:

1. Enter the most positive number from the Flatness Relative to 50 MHz column of Table 2-98 for the 800 MHz to 1000 MHz band:

   ____________ dB

2. Enter the most positive number from the response relative to 50 MHz column of Table 2-98 for the 1700 MHz to the 2000 MHz band:

   ____________ dB

3. Record the more positive of numbers from step 1 and step 2 as the maximum response for the 800 MHz to 1000 MHz and 1700 MHz to 2000 MHz bands.
4. Enter the most negative number from the Flatness Relative to 50 MHz column of Table 2-98 for the 800 MHz to 1000 MHz band:

   ____________ dB

5. Enter the most negative number from the Flatness Relative to 50 MHz column of Table 2-98 for the 1700 MHz to 2000 MHz band:

   ____________ dB

6. Record the more negative of numbers from step 4 and step 5 as the minimum response for band 0 in Table 2-99.
7. Subtract the minimum response for band 0 from the maximum response for band 0 and record the result (a positive number) as the Peak-to-Peak response to band 0 in Table 2-98.
8. The frequency response test is completed.

Table 2-99 cdmaOne Channel Power Accuracy Worksheet (Preamp Off)

Input Attenuation (dB)	Peak to Peak Response (dB) 800 to 1000 MHz (Cellular Band)	Peak to Peak Response (dB) 1700 to 2 GHz (PCS Band)	Resolution Bandwidth Setting (kHz)
40			10
25			10
10			10
10			10
10			10
10			10

Table 2-100 cdmaOne Receive Channel Power Accuracy Worksheet (Preamp On)

Input Attenuation (dB)	Peak to Peak Response (dB) 800 to 1000 MHz (Cellular Band)	Peak to Peak Response (dB) 1700 to 2 GHz (PCS Band)	Resolution Bandwidth Setting (kHz)
0			10
0			10
0			10
0			10
0			10
0			10

Table 2-101 cdmaOne Receive Channel Power Accuracy Worksheet (Preamp Off)

Input Attenuation (dB)	Peak to Peak Response (dB) 800 to 1000 MHz (Cellular Band)	Peak to Peak Response (dB) 1700 to 2 GHz (PCS Band)	Resolution Bandwidth Setting (kHz)
0			10
0			10
0			10
0			10
0			10
0			10

55. Modulation Accuracy – Rho (Options BAC and B7E)

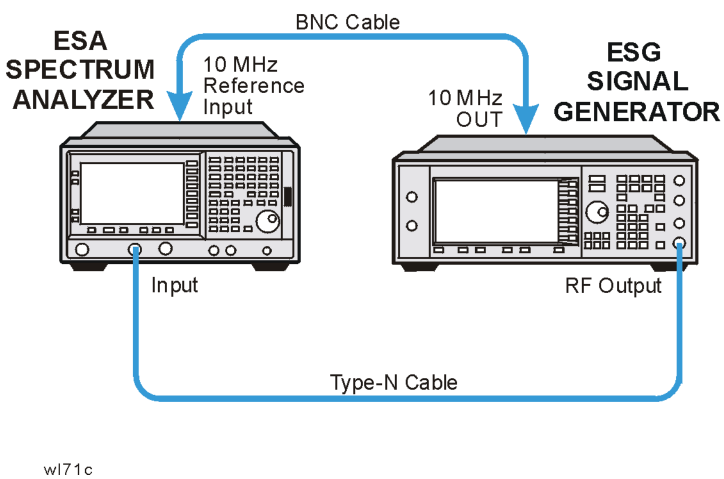
This test verifies the ability of a UUT (unit under test) to measure Rho. ESA Series Spectrum Analyzers that use both Options BAC and B7E are used to measure and verify the performance of Rho. Rho is measured by generating an IS-95A cdmaOne forward carrier with a single pilot channel. Note that the Option B7D is a required Option for B7E.

NOTE This test is repeated at different frequencies and amplitude signal levels.

Equipment Required

Synthesized signal generator with cdmaOne capabilities
Cable, BNC, 120-cm (48-in.)
Cable, Type N, 152-cm (60-in)

Figure 2-73 Modulation Accuracy – Rho Test Setup



Procedure

Set the signal generator to generate a single forward IS-95A carrier with a single pilot channel by performing the following steps:

NOTE The signal generator provides the 10 MHz reference for the analyzer.

1. Set up the equipment as shown in Figure 2-73.
2. Preset the signal generator by pressing the **PRESET** softkey.

3. Press **Preset** on the analyzer.
4. Perform the analyzer IQ Calibration by pressing the **Utility** hardkey followed by the **Instrument Adjustment** and **Hardware Adjustments** softkeys. Highlight the Dual Arb UND option and calibrate the selected items.
5. Load the Rho waveform by pressing the following keys:

   Mode, **Arb Waveform Generator**
   Dual Arb, **Select Waveform** *(Choose the CDMA_RHO waveform)*
6. Set up the Dual Arbs sample rate by pressing the **Arb Setup** softkey.
7. Set the sample rate to 6.144 MHz and the reconstruction filter to 2.5 MHz.
8. Turn the RF on by pressing the **RF ON/OFF** hardkey.
9. Set the signal generator frequency by pressing the **FREQUENCY** hardkey followed by the numeric value of the first frequency listed in column 1 of Table 2-102.
10. Set the signal generator amplitude by pressing the **AMPLITUDE** hardkey followed by the numeric value of the first amplitude listed in column 2 of Table 2-103.
11. Set the analyzer to measure Modulation Accuracy (Rho) by performing the following steps:
    a. Preset the analyzer by pressing the **Preset** hardkey.
    b. Enter the cdmaOne personality by pressing the **Mode** hardkey followed by the **cdmaOne** softkey.
    c. Initiate the Rho measurement by pressing the **Measure** hardkey followed by the **Modulation Accuracy (Rho)** softkey.
    d. Set the frequency of the analyzer by pressing the **Frequency** hardkey followed by the numeric value of the first frequency listed in Table 2-102.
12. Enter the Rho value measured in the first row of Table 2-102. Repeat this test for each of the frequencies and amplitudes in Table 2-102.

Table 2-102 cdmaOne Rho Accuracy Worksheet

ESA/ESG Frequency (MHz)	ESG Amplitude (dBm)	Rho Measured	Actual Rho	Rho Accuracy	Uncertainty	Specification (± dB)	Pass/ Fail
870.03	–10		0.905957			0.0015	
870.03	–45		0.905957			0.0015	
1930.05	–10		0.905957			0.0015	
1930.05	–45		0.905957			0.0015	

Table 2-103 Example Test Report for E4407B, Option BAC and B7E

ESA/ESG Frequency (MHz)	ESG Amplitude (dBm)	Rho Measured	Actual Rho	Rho Accuracy	Uncertainty	Specification (± dB)	Pass/ Fail
870.03	–10					0.0015	
870.03	–45					0.0015	
1930.05	–10					0.0015	
1930.05	–45					0.0015	

56. CDMA Modulation Accuracy – EVM (Options BAC and B7E)

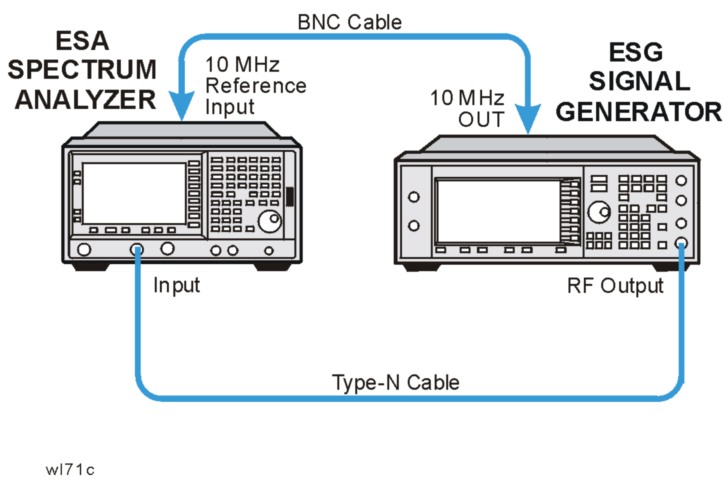
This test verifies the ability of a UUT (unit under test) to measure EVM (error vector magnitude). ESA Series Spectrum Analyzers that use both Options BAC and B7E are used to measure and verify the performance of EVM. Rho is measured by generating an IS-95A cdmaOne forward carrier with a single pilot channel. Note that the Option B7D is a required Option for B7E.

NOTE This test is repeated at different frequencies and amplitude signal levels.

Equipment Required

Sythesized signal generator with cdmaOne capabilities
Cable, BNC, 120-cm (48-in.)
Cable, Type N, 152-cm (60-in)

Figure 2-74 CDMA Modulation Accuracy – EVM Test Setup



Procedure

Set the Signal Generator to generate a single forward IS-95A carrier with a single pilot channel by performing the following steps:

NOTE The signal generator provides the 10 MHz reference for the analyzer.

1. Set up the equipment as shown in Figure 2-74.
2. Press **Preset** on the analyzer.

3. Perform the analyzer IQ Calibration by pressing the **Utility** hardkey followed by the **Instrument Adjustment** and **Hardware Adjustments** softkeys. Highlight the Dual Arb UND option and calibrate the selected items.

4. Load the Rho waveform by pressing the following keys:

   Mode, **Arb Waveform Generator**
   Dual Arb, **Select Waveform** *(Choose the CDMA_EVM waveform)*

5. Set up the Dual Arbs sample rate by pressing the **Arb Setup** softkey.

6. Set the sample rate to 6.144 MHz and the reconstruction filter to 2.5 MHz.

7. Turn the RF on by pressing the **RF ON/OFF** hardkey.

8. Set the signal generator frequency by pressing the **FREQUENCY** hardkey followed by the numeric value of the first frequency listed in column 1 of Table 2-104.

9. Set the signal generator amplitude by pressing the **AMPLITUDE** hardkey followed by the numeric value of the first amplitude listed in column 2 of Table 2-105.

10. Set the analyzer to measure Modulation Accuracy (Rho) by performing the following steps:

    a. Preset the analyzer by pressing the **Preset** hardkey.

    b. Enter the cdmaOne personality by pressing the **Mode** hardkey followed by the **cdmaOne** softkey.

    c. Initiate the Rho measurement by pressing the **Measure** hardkey followed by the **Modulation Accuracy (Rho)** softkey.

    d. Set the analyzer frequency by pressing the **Frequency** hardkey followed by the numeric value of the first frequency listed in the Table 2-104.

11. Enter the EVM value measured in the first row of Table 2-104. Repeat this test for each of the frequencies and amplitudes in Table 2-104.

Table 2-104 cdmaOne EVM Accuracy Worksheet

ESA/ESG Frequency (MHz)	ESG Amplitude (dBm)	EVM Measured	Actual EVM	EVM Accuracy
870.03	–10		8.70	
870.03	–45		8.70	
1930.05	–10		8.70	
1930.05	–45		8.70	

Table 2-105 Example Test Report for E4407B, Option BAC and B7E

ESA/ESG Frequency (MHz)	ESG Amplitude (dBm)	EVM Measured	Actual EVM	EVM Accuracy
870.03	–10	8.52	8.70	0.18
870.03	–45	8.65	8.70	0.05
1930.05	–10	8.75	8.70	0.05
1930.05	–45	8.82	8.70	0.12

57. CDMA – Code Domain Power (Options BAC and B7E)

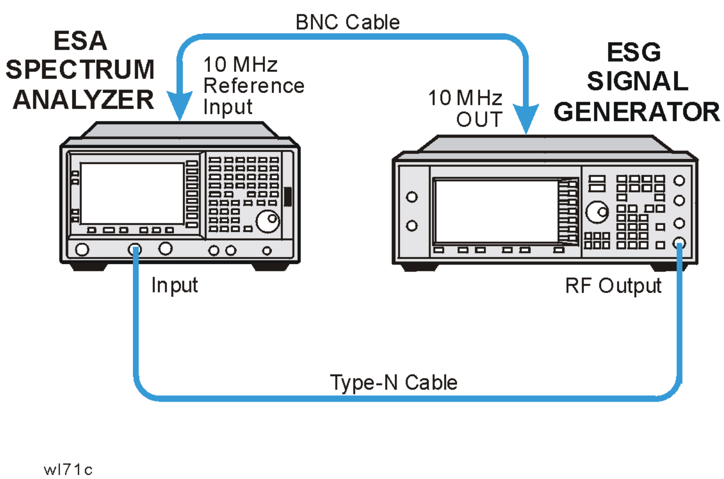
This test verifies the ability of a UUT (unit under test) to measure CDP (code domain power). ESA Series Spectrum Analyzers that use both Options BAC and B7E are used to measure and verify the performance of EVM. CDP is measured by generating an IS-95A cdmaOne forward carrier with a single pilot channel. Note that the Option B7D is a required Option for B7E.

NOTE This test is repeated at different frequencies and amplitude signal levels.

Equipment Required

Sythesized signal generator with cdmaOne capabilities
Cable, BNC, 120-cm (48-in.)
Cable, Type N (m), 62-cm (24-in)

Figure 2-75 CDMA – Code Domain Power Test setup



Procedure

Set the signal generator to generate a single forward IS-95A carrier with a single pilot channel by performing the following steps:

NOTE The signal generator provides the 10 MHz reference for the analyzer.

1. Set up the equipment as shown in Figure 2-75.
2. Press **Preset** on the analyzer.

3. Perform the analyzer IQ Calibration by pressing the **Utility** hardkey followed by the **Instrument Adjustment** and **Hardware Adjustments** softkeys. Highlight the Dual Arb UND option and calibrate the selected items.

4. Load the Rho waveform by pressing the following keys:

   Mode, **Arb Waveform Generator**
   Dual Arb, **Select Waveform** *(Choose the CDMA_CDP waveform)*

5. Set up the Dual Arbs sample rate by pressing the **Arb Setup** softkey.

6. Set the sample rate to 6.144 MHz and the reconstruction filter to 2.5 MHz.

7. Turn the RF on by pressing the **RF ON/OFF** hardkey.

8. Set the signal generator frequency by pressing the **FREQUENCY** hardkey followed by the numeric value of the first frequency listed in column 1 of Table 2-106.

9. Set the signal generator amplitude by pressing the **AMPLITUDE** hardkey followed by the numeric value of the first amplitude listed in column 2 of Table 2-107.

10. Set the analyzer to measure Modulation Accuracy (Rho) by performing the following steps:

    a. Preset the analyzer by pressing the **Preset** hardkey.

    b. Enter the cdmaOne personality by pressing the **Mode** hardkey followed by the **cdmaOne** softkey.

    c. Initiate the Rho measurement by pressing the **Measure** hardkey followed by the **Modulation Accuracy (Rho)** softkey.

    d. Set the analyzer frequency by pressing the **FREQUENCY** hardkey followed by the numeric value of the first frequency listed in the Table 2-106.

11. Enter the CDP value measured in the first row of Table 2-106. Repeat this test for each of the frequencies and amplitudes in Table 2-106.

Table 2-106 cdmaOne Code Domain Power Accuracy Worksheet

ESA/ESG Frequency (MHz)	ESG Amplitude (dBm)	CDP Measured	Actual CDP	CDP Accuracy	Uncertainty	Specification (± dB)	Pass/ Fail
870.03	–10					0.2	
870.03	–45					0.2	
1930.05	–10					0.2	
1930.05	–45					0.2	

Table 2-107 Example Test Report for E4407B, Option BAC and B7E

ESA/ESG Frequency (MHz)	ESG Amplitude (dBm)	CDP Measured	Actual CDP	CDP Accuracy	Uncertainty	Specification (± dB)	Pass/ Fail
870.03	–10					0.2	
870.03	–45					0.2	
1930.05	–10					0.2	
1930.05	–45					0.2	

58. GSM – Phase and Frequency (Options BAH and B7E)

This test verifies the ability of a UUT (unit under test) to measure phase and frequency error in the GSM personality (Option BAH). ESA Series Spectrum Analyzers that use both Options BAH and B7E are used to measure and verify the performance of the phase and frequency error in the GSM personality.

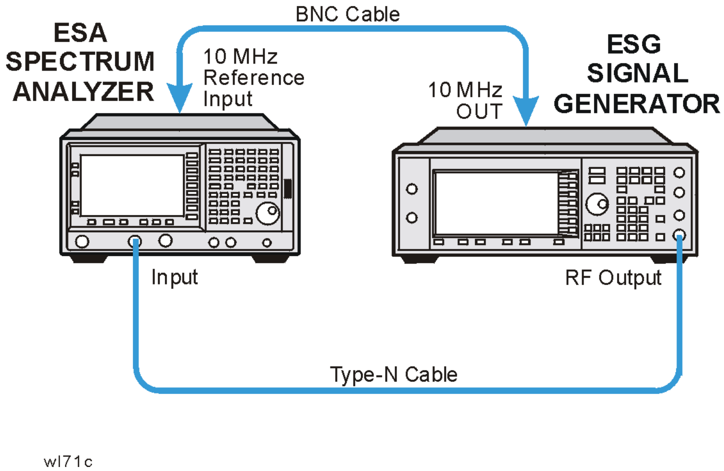
Phase and frequency error in the GSM personality is measured by generating a GSM forward link carrier with a single active time slot. Note that Option B7D is a required Option for B7E.

NOTE This test is repeated at different frequencies and amplitude signal levels.

Equipment Required

Sythesized signal generator with GSM capabilities
Cable, BNC, 120-cm (48-in.)
Cable, Type N, 183-cm (73-in.)

Figure 2-76 **GSM – Phase and Frequency test setup**



Procedure

Set the signal generator to generate a single forward link GSM modulated carrier with a single time slot by performing the following steps:

NOTE The signal generator provides the 10 MHz reference for the analyzer.

1. Set up the equipment as shown in Figure 2-76.
2. Preset the signal generator by pressing the **PRESET** hardkey.
3. To enter the GSM setup, press the following signal generator keys:

   MODE, **Real Time I/Q Baseband**
   TDMA, **GSM**
4. Press the **Data Format Continuous/Framed** softkey and highlight **Framed** to select a single time slot.
5. Turn on the GSM setup screen by pressing the **GSM ON/OFF** softkey and highlighting **ON**.
6. Turn RF on by pressing the **RF ON/OFF** softkey.
7. Set the signal generator frequency to the first frequency listed in column 1 of Table 2-108.
8. Set the signal generator amplitude to the first amplitude listed in column 2 of Table 2-109.
9. Set the analyzer to measure GSM phase and frequency error by performing the following steps:
   a. Preset the analyzer by pressing the **Preset** hardkey.
   b. Enter the GSM personality by pressing the **Mode** hardkey followed by the **GSM** softkey.
   c. Initiate the phase and frequency measurement by pressing the **Measure** hardkey followed by the **Phase and Frequency** softkey.
   d. Use the first frequency listed in the Table 2-108 by pressing the **Frequency** hardkey and entering the numeric value.
10. Enter the phase and frequency value measured in the first row of Table 2-108. Repeat this test for each of the frequencies and amplitudes in Table 2-108.

Table 2-108 GSM – Phase and Frequency Measurement Table

ESA/ESG Frequency (MHz)	ESG Amplitude (dBm)	Phase Error (deg)	Spec (deg)	Pass/Fail	Freq Error (Hz)	Spec (Hz)	Pass/Fail
900	0		–2.1			10	
900	–30		–2.1			10	
1800	0		–2.1			10	
1800	–30		–2.1			10	

59. Comms Absolute Amplitude Accuracy (Options BAC or BAH)

This test measures the absolute amplitude of the ESA Series Spectrum Analyzer at numerous input levels, attenuator settings, and log levels. When Option 1DS is present, this test also measures the amplitude accuracy with the preamp set to On. When added to the absolute frequency response over a 20 to 30° C temperature range, the measured performance yields the Comms Absolute Accuracy. The absolute frequency response is tested separately. Refer to the Frequency Response performance test.

The frequency response is not specified in the Cellular or PCS bands, therefore, the Comms Frequency Response test must be completed first. The worksheet data will be used with the results of the Comms Amplitude Accuracy at 50 MHz to yield to the Comms absolute accuracy in the Cellular and PCS bands.

A sythesized signal generator and attenuators are used as the signal source to the analyzer. A power meter is used to measure the signal source (with the attenuators set to 0 dB). The value measured is recorded as the source amplitude. 15 dBm as well as 0 dBm are the source levels used.

The attenuators are used to adjust the signal levels applied to the analyzer from the initial signal amplitude. The amplitude measured by the analyzer is compared to the actual signal level. The amplitude error is then calculated.

The related adjustment for this performance test is the “IF Amplitude Adjustment.”

NOTE This test is repeated at different frequencies and amplitude signal levels.

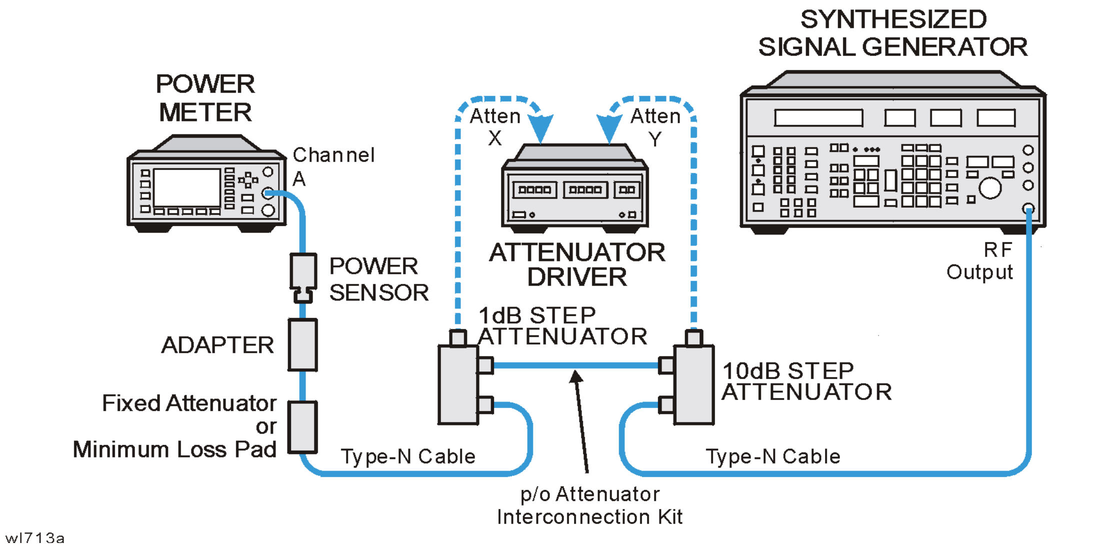
Equipment Required

Synthesized signal generator
10 dB step attenuator
1 dB step attenuator
Attenuator interconnection kit
Attenuator driver (if programmable step attenuators are used)
Power meter
Power sensor
Cable, Type-N, 62 cm (24 in.) (m) (2 *required*)
Cable, BNC
Adapter, Type-N (f) to Type-N (f)

Additional Equipment for Option BAB

Adapter, Type N (f) to APC 3.5 (f)

Figure 2-77 Measure Source Test Setup



Procedure

Part 1: cdmaOne Channel Power

Table 2-109 and Table 2-110 list the reference level, nominal input level, and nominal attenuation for calibrated 1 dB and 10 dB step attenuators for the amplitude accuracy measurements.

Table 2-109 cdmaOne Receive Channel Power (Option BAC) - Preamp Off, Reference Level 0 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
15	15	10	40	0	0	15
–5	–5	10	25	0	20	15
–25	–25	10	10	0	40	15
–45	–45	10	10	5	40	0
–55	–55	10	10	5	50	0
–70	–70	10	10	0	70	0

Table 2-110 cdmaOne Channel Power (Options BAC) - Preamp Off, Reference level –20 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
15	30	10	40	0	0	15
–5	15	10	25	0	20	15
–25	–5	10	10	0	40	15
–45	–25	10	10	5	40	0
–55	–35	10	10	5	50	0
–70	–50	10	10	0	70	0

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.
2. Perform a complete self-alignment and set Auto Align Off. Press **System, Alignments, Align Now, All**, and wait for the alignment routine to finish. Then, press **Return, Auto Align, Off**.
3. Zero and calibrate the power meter and power sensor connected to Channel A of the power meter.
4. Connect the equipment as shown in Figure 2-77.
5. Preset the synthesized signal generator. Manually press **Blue Key, Special, 0, 0**. Set the signal generator as follows:

   FREQUENCY, 50 MHz
   AMPLITUDE, 15 dBm

6. Set the 10 dB and 1 dB step attenuators to 0 dB.
7. From the metrology data for the step attenuators at 50 MHz, obtain the actual attenuation for the 0 dB setting of each attenuator (in some cases, this might be zero by definition). Add the two actual attenuations to obtain the 0 dB reference attenuation.

   $$\text{RefAtten}_{0\text{dB}} = 10\text{ dB Actual}_{0\text{dB}} + 1\text{ dB Actual}_{0\text{dB}}$$

   For example, if the actual attenuation for the 10 dB step attenuator is 0.03 dB, 10 dB $\text{Actual}_{0\text{dB}}$ is 0.03 dB. If the actual attenuation for the 1 dB step attenuator is 0.02 dB, 1 dB $\text{Actual}_{0\text{dB}}$ is 0.02 dB. In this case $\text{RefAtten}_{0\text{dB}}$ is 0.05 dB.
8. Retrieve metrology data for the step attenuators at 50 MHz. Enter the actual attenuation values for each attenuator setting as indicated in Table 2-111 and Table 2-112.

Table 2-111 Amplitude Accuracy Worksheet, 0 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			
0 dB		0 dB		0 dB		15 dBm		
0 dB		20 dB		20 dB		–5 dBm		
0 dB		40 dB		40 dB		–25 dBm		
0 dB		40 dB		45 dB		–45 dBm		
0 dB		50 dB		55 dB		–55 dBm		
0 dB		70 dB		70 dB		–70 dBm		

Table 2-112 Amplitude Accuracy Worksheet, –20 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			
0 dB		0 dB		0 dB		15 dBm		
0 dB		20 dB		20 dB		–5 dBm		
0 dB		40 dB		40 dB		–25 dBm		
5 dB		40 dB		45 dB		–45 dBm		
5 dB		50 dB		55 dB		–55 dBm		
0 dB		70 dB		70 dB		–70 dBm		

9. Calculate the actual total attenuation by adding the actual attenuation for the 1 dB step attenuator to the actual attenuation for the 10 dB step attenuator for each total attenuation setting listed in Table 2-111 and Table 2-112.

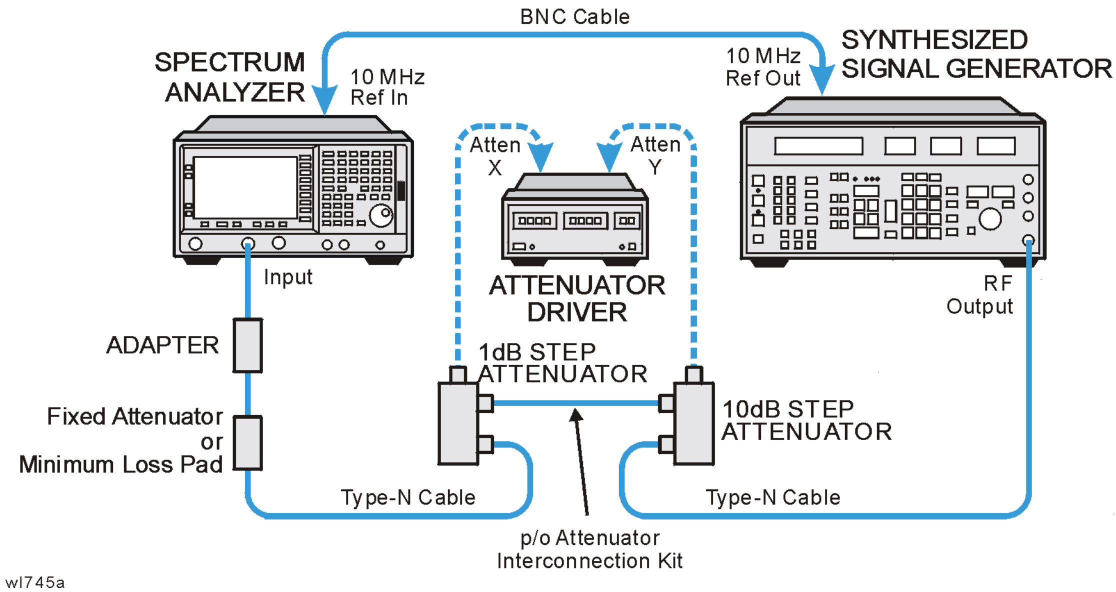
NOTE The external attenuators and cables are now part of the "source."

10. Adjust the signal generator amplitude for a power meter reading of 15 dBm ±0.2 dB. Record the power meter reading here:

    $Amptd_{15dBm}$ = _______ dBm

11. Connect the equipment as indicated in Figure 2-78. The fixed attenuator must connect directly to the analyzer input.

Figure 2-78 Amplitude Accuracy Test Setup



12.Set the analyzer as follows:

FREQUENCY, Center Freq, 50 MHz
SPAN, 0 kHz
BW/Avg, Resolution BW, 10 kHz
BW/Avg, Video BW, 10 kHz
AMPLITUDE, **More**, **Y Axis Units** (or **Amptd Units**), **dBm**
AMPLITUDE, Ref Level, 0 dBm
Attenuation, **10 dB** (Man)

13.Perform the following steps for each of the nominal amplitude values listed in Table 2-109 and Table 2-110:

a. Set the 1 dB step attenuator as indicated in Table 2-109 and Table 2-110.
b. Set the 10 dB step attenuator as indicated in Table 2-109 and Table 2-110.
c. Press **Single** and wait for the sweep to finish.
d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-111 and Table 2-112.
f. If the nominal amplitude is 15 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - \text{Amptd}_{15\text{dBm}}$$

g. If the amplitude is less than 0 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{15\text{dBm}} - \text{ActualTotalAtten} + \text{RefAtten}_{0\text{dB}})$$

h. Record the amplitude accuracy in the performance verification test record as indicated in Table 2-111.

14. Record the largest error between Table 2-111 and Table 2-112 in Table 2-113 and Table 2-114 for each of the nominal input levels.

15. Copy the Peak to Peak frequency response error from the Comms Frequency Response performance test for both the 800 MHz to 1 GHz Cellular band and the 1700 MHz to 2 GHz PCS bands measured in a 10 kHz resolution bandwidth.

16. Report the cdmaOne Channel Power Accuracy by summing together column 2 through 4.

Table 2-113 cdmaOne Channel Power Accuracy (Cellular Band)

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (800 MHz to 1 GHz) (dB)	Uncertainty (dB)	cdmaOne Channel Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
15			0.19		0.80	
–5			0.19		0.80	
–25			0.19		0.77	
–45			0.19		0.65	
–55			0.19		0.72	
–70			0.19		0.86	

Table 2-114 cdmaOne Channel Power Accuracy (PCS Band)

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (800 MHz to 1 GHz) (dB)	Uncertainty (dB)	cdmaOne Channel Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
15			0.19		0.70	
–5			0.19		0.70	
–25			0.19		0.67	
–45			0.19		0.66	
–55			0.19		0.73	
–70			0.19		0.87	

17. Proceed to Part 2.

Part 2: cdmaOne Receive Channel Power (Preamp On)

Table 2-115 and Table 2-116 list the reference level, nominal input level, and nominal attenuation for the calibrated 1 dB and 10 dB step attenuators for the amplitude accuracy measurements.

Table 2-115 cdmaOne Receive Channel Power (Option BAC or 1DS) - Preamp On, Reference Level 0 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
–40	–40	10	0	0	40	0
–60	–60	10	0	0	60	0
–70	–70	10	0	0	70	0
–80	–80	10	0	0	80	0
–90	–90	10	0	0	90	0
–105	–105	10	0	5	100	0

Table 2-116 cdmaOne Receive Channel Power (Options BAC) - Preamp Off, Reference Level –20 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
–40	–20	10	0	0	40	0
–60	–40	10	0	0	60	0
–70	–50	10	0	0	70	0
–80	–60	10	0	0	80	0
–90	–70	10	0	0	90	0
–105	–85	10	0	5	100	0

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.
2. Perform a complete self-alignment and set Auto Align Off. Press **System, Alignments, Align Now, All**, and wait for the alignment routine to finish. Then, press **Return, Auto Align, Off**.
3. Zero and calibrate the power meter and power sensor connected to Channel A of the power meter.

4. Connect the equipment as shown in Figure 2-77. The power sensor should connect directly to the 6 dB fixed attenuator using an adapter.

5. Preset the synthesized signal generator. Manually press **Blue Key, Special, 0, 0**. Set the signal generator as follows:

   FREQUENCY, 50 MHz
   AMPLITUDE, 0 dBm

6. Set the 10 dB attenuator to 40 dB and the 1 dB step attenuator to 0 dB.

7. From the metrology data for the step attenuators at 50 MHz, obtain the actual attenuation for the 0 dB setting of each attenuator (in some cases, this might be zero by definition). Add the two actual attenuations to obtain the 0 dB reference attenuation.

$$RefAtten_{0dB} = 10\ dB\ Actual_{0dB} + 1\ dB\ Actual_{0dB}$$

   For example, if the actual attenuation for the 10 dB step attenuator is 0.03 dB, 10 dB $Actual_{0dB}$ is 0.03 dB. If the actual attenuation for the 1 dB step attenuator is 0.02 dB, 1 dB $Actual_{0dB}$ is 0.02 dB. In this case $RefAtten_{0dB}$ is 0.05 dB.

8. Retrieve metrology data for the step attenuators at 50 MHz. Enter the actual attenuation values for each attenuator setting as indicated in Table 2-117 and Table 2-118. If using a programmable attenuator, the section two 40 dB step should be used for the 40 dB setting on the 10 dB step attenuator. Similarly, the section two 4 dB step should be used for the 4 dB setting on the 1 dB step attenuator.

Table 2-117 Amplitude Accuracy Worksheet, 0 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			(TR Entry)
0 dB		40 dB		40 dB		–40 dBm		
0 dB		60 dB		60 dB		–60 dBm		
0 dB		70 dB		70 dB		–70 dBm		
0 dB		80 dB		80 dB		–80 dBm		
0 dB		90 dB		90 dB		–90 dBm		
5 dB		100 dB		105 dB		–105 dBm		

Table 2-118 Amplitude Accuracy Worksheet, –20 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			(TR Entry)
0 dB		40 dB		40 dB		–40 dBm		
0 dB		60 dB		60 dB		–60 dBm		
0 dB		70 dB		70 dB		–70 dBm		
0 dB		80 dB		80 dB		–80 dBm		
0 dB		90 dB		90 dB		–90 dBm		
5 dB		100 dB		105 dB		–105 dBm		

9. Calculate the actual attenuation by adding the actual attenuation for the 1 dB step attenuator to the actual attenuation for the 10 dB step attenuator for each total attenuation setting listed in Table 2-117 and Table 2-118.

NOTE The external attenuators and cables are now part of the "source."

10. Adjust the signal generator amplitude for a power meter reading of –40 dBm ±0.2 dB. Record the power meter reading here:

    $Amptd_{0dBm}$ = _______ dBm

11. Connect the equipment as shown in Figure 2-78.

12. Set the analyzer as follows:

    FREQUENCY, Center Freq, 50 MHz
    SPAN, 0 kHz
    BW/Avg, Resolution BW, 10 kHz
    BW/Avg, Video BW, 10 kHz
    AMPLITUDE, More 1 of 2, Int Preamp (On)
    AMPLITUDE, Amptd Units, dBm
    Attenuation, 0 dB (Man)

13. Perform the following steps for each of the nominal amplitude values listed in Table 2-115 and Table 2-116:

    a. Set the 1 dB step attenuator as indicated in Table 2-115 and Table 2-116.
    b. Set the 10 dB step attenuator as indicated in Table 2-115 and Table 2-116.
    c. Press **Single** and wait for the sweep to finish.
    d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.

e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-117 and Table 2-118.

f. Calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

14. Record the largest error between Table 2-117 (0 dB Log level) and Table 2-118 (20 dB Log level) in for each of the nominal input levels.

15. Report the cdmaOne Receive Channel Power Accuracy by summing together column 2 through 4.

16. Report the cdmaOne Receive Channel Power (Preamp On) in the Test Record. This will be the worst value found in Table 2-119 and Table 2-120.

Table 2-119 cdmaOne Channel Receive Channel Power (Cellular Band) Preamp On

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (800 MHz to 1 GHz) (dB)	Uncertainty (dB)	cdmaOne Channel Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
−40			0.19		2.30	
−60			0.19		2.30	
−70			0.19		2.30	
−80			0.19		2.30	
−90			0.19		2.30	
−105			0.19		2.30	

Table 2-120 cdmaOne Channel Receive Channel Power (PCS Band) Preamp On

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (1700 MHz to 2 GHz) (dB)	Uncertainty (dB)	cdmaOne Channel Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
–40			0.19		2.30	
–60			0.19		2.30	
–70			0.19		2.30	
–80			0.19		2.30	
–90			0.19		2.30	
–105			0.19		2.30	

17.Proceed to Part 3.

Part 3: GSM Transmit Power

Table 2-121 and Table 2-122 list the reference level, nominal input level, and nominal attenuation for the calibrated 1 dB and 10 dB step attenuators for the amplitude accuracy measurements.

Table 2-121 GSM Transmit Power (Option BAH) - Preamp Off Reference Level –20 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
15	15	300	40	0	0	15
–20	–20	300	5	0	20	0
–30	–30	300	5	0	40	0
–40	–40	300	5	0	50	0
–50	–50	300	5	0	60	0
–60	–60	300	5	0	60	0

Table 2-122 GSM Transmit Power (Option BAH) - Preamp Off, Reference Level 0 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
15	30	300	40	0	0	15
–20	0	300	5	0	20	0
–30	–10	300	5	0	30	0
–40	–20	300	5	0	40	0
–50	–30	300	5	0	50	0
–60	–40	300	5	0	60	0

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.
2. Perform a complete self-alignment and set Auto Align Off. Press **System, Alignments, Align Now, All**, and wait for the alignment routine to finish. Then, press **Return, Auto Align, Off**.
3. Zero and calibrate the power meter and power sensor connected to Channel A of the power meter.
4. Connect the equipment as shown in Figure 2-77. The power sensor should connect directly to the 6 dB fixed attenuator using an adapter.
5. Preset the synthesized signal generator. Manually press **Blue Key, Special, 0, 0**. Set the signal generator as follows:

   FREQUENCY, 50 MHz
   AMPLITUDE, 15 dBm

6. Set the 10 dB and 1 dB step attenuators to 0 dB.
7. From the metrology data for the step attenuators at 50 MHz, obtain the actual attenuation for the 0 dB setting of each attenuator (in some cases, this might be zero by definition). Add the two actual attenuations to obtain the 0 dB reference attenuation.

   $$RefAtten_{0dB} = 10\text{ dB }Actual_{0dB} + 1\text{ dB }Actual_{0dB}$$

   For example, if the actual attenuation for the 10 dB step attenuator is 0.03 dB, 10 dB $Actual_{0dB}$ is 0.03 dB. If the actual attenuation for the 1 dB step attenuator is 0.02 dB, 1 dB $Actual_{0dB}$ is 0.02 dB. In this case $RefAtten_{0dB}$ is 0.05 dB.

8. Retrieve metrology data for the step attenuators at 50 MHz. Enter the actual attenuation values for each attenuator setting as indicated in Table 2-123 and Table 2-124.

Table 2-123 Amplitude Accuracy Worksheet, 0 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			(TR Entry)
0 dB		0 dB		0 dB		15 dBm		
0 dB		20 dB		20 dB		–20 dBm		
0 dB		30 dB		30 dB		–30 dBm		
0 dB		40 dB		40 dB		–40 dBm		
0 dB		50 dB		50 dB		–50 dBm		
0 dB		60 dB		60 dB		–60 dBm		

Table 2-124 Amplitude Accuracy Worksheet, –20 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			(TR Entry)
0 dB		0 dB		0 dB		15 dBm		
0 dB		20 dB		20 dB		–20 dBm		
0 dB		30 dB		30 dB		–30 dBm		
0 dB		40 dB		40 dB		–40 dBm		
0 dB		50 dB		50 dB		–50 dBm		
0 dB		60 dB		60 dB		–60 dBm		

9. Calculate the actual attenuation by adding the actual attenuation for the 1 dB step attenuator to the actual attenuation for the 10 dB step attenuator for each total attenuation setting listed in Table 2-123 and Table 2-124.

NOTE The external attenuators and cables are now part of the “source.”

10. Adjust the signal generator amplitude for a power meter reading of 15 dBm ±0.2 dB. Record the power meter reading here:

    $Amptd_{15dBm}$ = _______ dBm

11. Connect the equipment as shown in Figure 2-78.

12.Set the analyzer as follows:

FREQUENCY, Center Freq, 50 MHz
SPAN, 0 kHz
BW/Avg, Resolution BW, 300 kHz
BW/Avg, **Video BW**, **300 kHz**
AMPLITUDE, **More 1 of 2**, **Int Preamp** (On)
AMPLITUDE, Amptd Units, dBm
Attenuation, **40 dB** (Man)

13.Perform the following steps for each of the nominal amplitude values listed in Table 2-121 and Table 2-122:

a. Set the 1 dB step attenuator as indicated in Table 2-121 and Table 2-122.
b. Set the 10 dB step attenuator as indicated in Table 2-121 and Table 2-122.
c. Press **Single** and wait for the sweep to finish.
d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-123 and Table 2-124.
f. If the nominal amplitude is 15 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - \text{Amptd}_{15dBm}$$

g. If the nominal amplitude is less than 0 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{15dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{15dBm})$$

14.Record the largest error between Table 2-125 (0 dB Log level) and Table 2-126 (20 dB Log level) for each of the nominal input levels.

15.Report the cdmaOne Receive Channel Power Accuracy by summing together column 2 through 4.

16.Copy the peak to peak frequency response error from the Comms Frequency Response performance test for both the 800 MHz to 1 GHz Cellular band and the 1700 MHz to 2 GHz PCS bands measured in a 300 kHz resolution bandwidth.

17.Calculate the GSM Transmit Power Accuracy by summing together column 2 through 4.

18.Report the GSM Transmit Power Results in the Test Record.

19.Proceed to Part 4.

Table 2-125 GSM Transmit Power (Cellular Band) 800 MHz to 1 GHz, Preamp On

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (1700 MHz to 2 GHz) (dB)	Uncertainty (dB)	GSM Transmit Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
15			0.19		0.81	
–20			0.19		0.81	
–30			0.19		0.74	
–40			0.19		0.79	
–50			0.19		0.95	
–60			0.19		1.09	

Table 2-126 GSM Transmit Power (PCS Band) 1700 MHz to 2 GHz, Preamp Off

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (1700 MHz to 2 GHz) (dB)	Uncertainty (dB)	cdmaOne Channel Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
15			0.19		0.68	
–20			0.19		0.68	
–30			0.19		0.61	
–40			0.19		0.66	
–50			0.19		0.82	
–60			0.19		0.96	

Part 4: cdmaOne Receive Channel Power (Preamp Off)

Table 2-127 and Table 2-128 lists the reference level, nominal level, and nominal attenuation for the calibrated 1 dB and 10 dB step attenuators for the amplitude accuracy measurements.

Table 2-127 cdmaOne Receive Channel Power (Option BAC) - Preamp Off, Reference Level 0 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
−40	−40	10	0	0	40	0
−60	−60	10	0	0	60	0
−70	−70	10	0	0	70	0
−80	−80	10	0	0	80	0
−90	−90	10	0	0	90	0
−105	−105	10	0	5	100	0

Table 2-128 cdmaOne Receive Channel Power (Options BAC) - Preamp Off, Reference Level −20 dB

Nominal Input Level (dBm)	Reference Level (dBm)	Resolution Bandwidth (kHz)	Internal Attenuator (dB)	1 dB Step Attenuator (dB)	10 dB Step Attenuator (dB)	Source Nominal Level (dBm)
−40	−20	10	0	0	40	0
−60	−40	10	0	0	60	0
−70	−50	10	0	0	70	0
−80	−60	10	0	0	80	0
−90	−70	10	0	0	90	0
−105	−85	10	0	5	100	0

1. Press **Preset** on the analyzer. Press the **Factory Preset** softkey, if it is displayed. If the firmware revision is A.04.00 or later, press **Sweep**, **Points**, **401**, **Enter**.
2. Perform a complete self-alignment and set Auto Align Off. Press **System, Alignments, Align Now, All**, and wait for the alignment routine to finish. Then, press **Return, Auto Align, Off**.
3. Zero and calibrate the power meter and power sensor connected to Channel A of the power meter.

4. Connect the equipment as shown in Figure 2-77. The power sensor should connect directly to the 6 dB fixed attenuator using an adapter.

5. Preset the synthesized signal generator. Manually press **Blue Key, Special, 0, 0**. Set the signal generator as follows:

   FREQUENCY, 50 MHz
   AMPLITUDE, 0 dBm

6. Set the 10 dB and 1 dB step attenuators to 0 dB. Refer to Table x earlier in this chapter for information on manually controlling a programmable step attenuator with an HP/Agilent 11713A attenuator/switch driver.

7. From the metrology data for the step attenuators at 50 MHz, obtain the actual attenuation for the 0 dB setting of each attenuator (in some cases, this might be zero by definition). Add the two actual attenuations to obtain the 0 dB reference attenuation.

$$RefAtten_{0dB} = 10\text{ dB }Actual_{0dB} + 1\text{ dB }Actual_{0dB}$$

   For example, if the actual attenuation for the 10 dB step attenuator is 0.03 dB, 10 dB $Actual_{0dB}$ is 0.03 dB. If the actual attenuation for the 1 dB step attenuator is 0.02 dB, 1 dB $Actual_{0dB}$ is 0.02 dB. In this case $RefAtten_{0dB}$ is 0.05 dB.

8. Retrieve metrology data for the step attenuators at 50 MHz. Enter the actual attenuation values for each attenuator setting as indicated in Table 2-129 and Table 2-130.

Table 2-129 Amplitude Accuracy Worksheet, 0 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			(TR Entry)
0 dB		40 dB		40 dB		–40 dBm		
0 dB		60 dB		60 dB		–60 dBm		
0 dB		70 dB		70 dB		–70 dBm		
0 dB		80 dB		80 dB		–80 dBm		
0 dB		90 dB		90 dB		–90 dBm		
5 dB		100 dB		105 dB		–105 dBm		

Table 2-130 Amplitude Accuracy Worksheet, –20 dBm Reference Level

1 dB Step Attenuator		10 dB Step Attenuator		Total Attenuation		Nominal Amptd.	Meas. Amptd.	Amptd. Accuracy
Setting	Actual	Setting	Actual	Setting	Actual			(TR Entry)
0 dB		40 dB		40 dB		–40 dBm		
0 dB		60 dB		60 dB		–60 dBm		
0 dB		70 dB		70 dB		–70 dBm		
0 dB		80 dB		80 dB		–80 dBm		
0 dB		90 dB		90 dB		–90 dBm		
5 dB		100 dB		105 dB		–105 dBm		

9. Calculate the actual attenuation by adding the actual attenuation for the 1 dB step attenuator to the actual attenuation for the 10 dB step attenuator for each total attenuation setting listed in Table 2-125 and Table 2-126.

NOTE The external attenuators and cables are now part of the "source."

10. Adjust the signal generator amplitude for a power meter reading of 0 dBm ±0.2 dB. Record the power meter reading here:

    $Amptd_{0dBm}$ = _______ dBm

11. Connect the equipment as shown in Figure 2-78. The 6 dB fixed attenuator must connect directly to the analyzer input.

12. Set the analyzer as follows:

    FREQUENCY, Center Freq, 50 MHz
    SPAN, 0 kHz
    BW/Avg, Resolution BW, 10 kHz
    BW/Avg, Video BW, 10 kHz
    AMPLITUDE, More 1 of 2, Int Preamp (Off)
    AMPLITUDE, Amptd Units, dBm
    Attenuation, 0 dB (Man)

13. Perform the following steps for each of the nominal amplitude values listed in Table 2-127 and Table 2-128:

    a. Set the 1 dB step attenuator as indicated in Table 2-127 and Table 2-128.
    b. Set the 10 dB step attenuator as indicated in Table 2-127 and Table 2-128.
    c. Press **Single** and wait for the sweep to finish.

d. Press **Peak Search** (or **Search**). Even though the signal may be slightly above the reference level for the first nominal amplitude setting, the marker can still make a valid measurement.
e. Record the Mkr 1 amplitude value as the measured amplitude in Table 2-129 and Table 2-130.
f. If the nominal amplitude is 15 dBm, calculate the amplitude accuracy as follows:

$$\text{Amplitude Accuracy} = \text{Measured Amplitude} - (\text{Amptd}_{0dBm} - \text{ActualTotalAtten} + \text{RefAtten}_{0dB})$$

14.Record the largest error between Table 2-129 (0 dB Log level) and Table 2-130 (20 dB Log level) for each of the nominal input levels.

15.Report the cdmaOne Receive Channel Power Accuracy by summing together column 2 through 4.

16.Report the cdmaOne Receive Channel Power (Preamp On) in the Test Record. This will be the worst value found in Table 2-131 and Table 2-132.

17.Copy the peak to peak frequency response error from the Comms Frequency Response performance test for both the 800 MHz to 1 GHz Cellular band and the 1700 MHz to 2 GHz PCS bands measured in a 300 kHz resolution bandwidth.

18.Calculate the cdmaOne Receive Channel Power Accuracy by summing together column 2 through 4.

19.Report the cdmaOne Transmit Power results in the Test Record. This will be the worst value found in Table 2-131 and Table 2-132.

20.Report the cdmaOne Receive Channel Power (Preamp Off) in the Test Record. This will be the worst value found in Table 2-131 and Table 2-132.

Table 2-131 cdmaOne Receive Channel Power (Cellular Band) - Preamp Off

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (1700 MHz to 2 GHz) (dB)	Uncertainty (dB)	cdmaOne Channel Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
-40			0.19		2.30	
–60			0.19		2.30	
–70			0.19		2.30	
–80			0.19		2.30	
–90			0.19		2.30	
–105			0.19		2.30	

Table 2-132 cdmaOne Receive Channel Power (PCS) - Preamp Off

Nominal Input Level (dBM)	50 MHz Amplitude Accuracy (dB)	Peak to Peak Response (1700 MHz to 2 GHz) (dB)	Uncertainty (dB)	cdmaOne Channel Power Accuracy (dB) Col 1+2+3	Specification (± dB)	Pass/Fail
–40			0.19		2.30	
–60			0.19		2.30	
–70			0.19		2.30	
–80			0.19		2.30	
–90			0.19		2.30	
–105			0.19		2.30	

21.The Comms Absolute Accuracy test is now complete.

3 Performance Verification Test Records

Agilent E4401B Performance Verification Test Record

Only the tests for E4401B are included in this test record, therefore not all test numbers are included.

Table 3-1 E4401B Performance Verification Test Record

Agilent Technologies			
Address: ______________________		Report No. ______________	
______________________		Date ______________	
______________________			
Model E4401B			
Serial No. ______________		Ambient temperature ______° C	
Options ______________		Power mains line frequency ______ Hz (nominal)	
Firmware Revision ________		Relative humidity ______%	
Customer ______________________		Tested by ______________________	
Test Equipment Used:			
Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	________	________	________
Synthesized Sweeper	________	________	________
Function Generator	________	________	________
Power Meter, Dual-Channel	________	________	________
RF Power Sensor #1	________	________	________
RF Power Sensor #2 *(Non-Option 1DP only)*	________	________	________
Low-Power Power Sensor	________	________	________
75 Ω Power Sensor *(Option 1DP only)*	________	________	________
Digital Multimeter	________	________	________
Universal Counter	________	________	________
Frequency Standard	________	________	________
Power Splitter	________	________	________

Table 3-1 E4401B Performance Verification Test Record

50 Ω Termination	___________	___________	___________
Minimum Loss Pad *(Option 1DP only)*	___________	___________	___________
1 dB Step Attenuator	___________	___________	___________
10 dB Step Attenuator	___________	___________	___________
6 dB Fixed Attenuator	___________	___________	___________
20 dB Fixed Attenuator *(Option 1DS only)*	___________	___________	___________
Oscilloscope *(Option 1D6 only)*	___________	___________	___________
Microwave Spectrum Analyzer *(Option 1DN or 1DQ only)*	___________	___________	___________
Notes/comments:	___________		

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies

Model E4401B **Report No. ___________**

Serial No. ___________ **Date ___________**

Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1. 10 MHz Reference Output Accuracy (*Non-Option 1D5 only*)				
Settability	–5.0 Hz	(1)________	5.0 Hz	±293.3 µHz
2. 10 MHz Precision Frequency Reference Output Accuracy (*Option 1D5 only*)				
5 Minute Warm-Up Error	–0.1 ppm	(1)________	0.1 ppm	±0.000072 ppm
15 Minute Warm-Up Error	–0.01 ppm	(2)________	0.01 ppm	±0.000070 ppm

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
3. Frequency Readout Accuracy and Marker Count Accuracy				
Frequency Readout Accuracy				
Center Freq / Span				
1490 MHz / 20 MHz	1489.83 MHz	(1)________	1490.17 MHz	±0 Hz
1490 MHz / 10 MHz	1489.91 MHz	(2)________	1490.09 MHz	±0 Hz
1490 MHz / 1 MHz	1489.991 MHz	(3)________	1490.009 MHz	±0 Hz
Marker Count Accuracy				
Center Freq / Span				
1490 MHz / 10 MHz	1489.999999 MHz	(4)________	1490.000001 MHz	±0 Hz
1490 MHz / 1 MHz	1489.999999 MHz	(5)________	1490.000001 MHz	±0 Hz
5. Frequency Span Readout Accuracy				
Span / Start Freq				
1500 MHz / 0 Hz	1185 MHz	(1)________	1215 MHz	±3.06 MHz
100 MHz / 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz / 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz / 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz / 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz / 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz / 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)________	–90 dBc/Hz	±1.154 dB
20 kHz		(2)________	–100 dBc/Hz	±1.154 dB
30 kHz		(3)________	–102 dBc/Hz	±1.154 dB
100 kHz		(4)________	–112 dBc/Hz	±1.154 dB
8. System Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)________	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)________	–65 dBc	±1.154 dB
9. Residual FM				
1 kHz Res BW, (*Non-Option 1D5)*		(1)_________	150 Hz	±9.24 Hz
1 kHz Res BW, (*Option 1D5)*		(1)_________	100 Hz	±9.24 Hz
10 Hz Res BW (*Options 1DR and 1D5 only*)		(2)_________	2 Hz	±0.274 Hz
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)________	±1.0%	±0.28%
20 ms	–1.0%	(2)________	±1.0%	±0.28%
100 ms	–1.0%	(3)________	±1.0%	±0.28%
1 s	–1.0%	(4)________	±1.0%	±0.28%
10 s	–1.0%	(5)________	±1.0%	±0.28%
1 ms (*Option AYX only)*	–1.0%	(6)________	±1.0%	±0.28%

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies

Model E4401B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
500 µs (*Option AYX only)*	–1.0%	(7)________	±1.0%	±0.28%
100 µs (*Option AYX only)*	–1.0%	(8)________	±1.0%	±0.28%
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(6)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(14)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(15)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)________	1.10 dB	±0.088 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(37)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(38)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)___	0.4 dB	±0.088 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies

Model E4401B **Report No. ___________**

Serial No. ___________ **Date ___________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
Cumulative Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.34 dB	(43)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(44)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(45)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(46)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(47)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(48)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(49)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(50)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(51)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(52)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(53)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(54)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(55)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(56)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(57)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(58)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(59)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(60)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(61)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(62)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(63)________	1.14 dB	±0.089 dB
–88	–1.18 dB	(64)________	1.18 dB	±0.089 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–92	–1.22 dB	(65)________	1.22 dB	±0.089 dB
–96	–1.26 dB	(66)________	1.26 dB	±0.088 dB
–98	–1.28 dB	(67)________	1.28 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.4 dB	(68)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(69)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(70)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(71)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(72)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(73)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(74)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(75)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(76)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(77)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(78)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(79)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(80)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(81)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(82)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(83)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(84)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(85)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(86)________	0.4 dB	±0.089 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–80	–0.4 dB	(87)________	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)________	2.0%	±0.064%
–8	–2.0%	(90)________	2.0%	±0.064%
–12	–2.0%	(91)________	2.0%	±0.064%
–16	–2.0%	(92)________	2.0%	±0.064%
–20	–2.0%	(93)________	2.0%	±0.063%
Linear Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–2.0%	(94)________	2.0%	±0.064%
–8	–2.0%	(95)________	2.0%	±0.064%
–12	–2.0%	(96)________	2.0%	±0.064%
–16	–2.0%	(97)________	2.0%	±0.064%
–20	–2.0%	(98)________	2.0%	±0.063%
Zero Span, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.36 dB	(99)________	0.36 dB	±0.064 dB
–8	–0.42 dB	(100)________	0.42 dB	±0.064 dB
–12	–0.48 dB	(101)________	0.48 dB	±0.064 dB
–16	–0.54 dB	(102)________	0.54 dB	±0.064 dB
–20	–0.60 dB	(103)________	0.60 dB	±0.063 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–24	–0.66 dB	(104)________	0.66 dB	±0.064 dB
–28	–0.72 dB	(105)________	0.72 dB	±0.064 dB
–32	–0.78 dB	(106)________	0.78 dB	±0.064 dB
–36	–0.84 dB	(107)________	0.84 dB	±0.064 dB
–40	–0.90 dB	(108)________	0.90 dB	±0.063 dB
–44	–0.96 dB	(109)________	0.96 dB	±0.064 dB
–48	–1.02 dB	(110)________	1.02 dB	±0.064 dB
–52	–1.08 dB	(111)________	1.08 dB	±0.089 dB
–56	–1.14 dB	(112)________	1.14 dB	±0.089 dB
–60	–1.20 dB	(113)________	1.20 dB	±0.088 dB
–64	–1.5 dB	(114)________	1.5 dB	±0.089 dB
–68	–1.5 dB	(115)________	1.5 dB	±0.089 dB
–70	–1.5 dB	(116)________	1.5 dB	±0.089 dB
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)________	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)________	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)________	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)________	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)________	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)________	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)________	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)________	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)________	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)________	0.60 dB	±0.089 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
13. Reference Level Accuracy				
Log, Res BW ≥1 kHz				
Reference Level				
50 Ω (dBm) 75 Ω (dBmV)				
–15 33.75	–0.3 dB	(1)________	0.3 dB	±0.144 dB
–5 43.75	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–35 13.75	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–45 3.75	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–55 –6.25	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–65 –16.25	–0.5 dB	(6)________	0.5 dB	±0.156 dB
–75 –26.25	–0.7 dB	(7)________	0.7 dB	±0.156 dB
Linear, Res BW ≤300 Hz				
Reference Level				
50 Ω (dBm) 75 Ω (dBmV)				
–15 33.75	–0.3 dB	(8)________	0.3 dB	±0.144 dB
–5 43.75	–0.3 dB	(9)________	0.3 dB	±0.144 dB
–35 13.75	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–45 3.75	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–55 –6.25	–0.5 dB	(12)________	0.5 dB	±0.156 dB
–65 –16.25	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–75 –26.25	–0.7 dB	(14)________	0.7 dB	±0.156 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Log, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
50 Ω (dBm) 75 Ω (dBmV)				
–15 33.75	–0.3 dB	(15)________	0.3 dB	±0.144 dB
–5 43.75	–0.3 dB	(16)________	0.3 dB	±0.144 dB
–35 13.75	–0.3 dB	(17)________	0.3 dB	±0.144 dB
–45 3.75	–0.3 dB	(18)________	0.3 dB	±0.144 dB
–55 –6.25	–0.5 dB	(19)________	0.5 dB	±0.156 dB
–65 –16.25	–0.5 dB	(20)________	0.5 dB	±0.156 dB
–75 –26.25	–0.7 dB	(21)________	0.7 dB	±0.156 dB
Linear, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
50 Ω (dBm) 75 Ω (dBmV)				
–15 33.75	–0.3 dB	(22)________	0.3 dB	±0.144 dB
–5 43.75	–0.3 dB	(23)________	0.3 dB	±0.144 dB
–35 13.75	–0.3 dB	(24)________	0.3 dB	±0.144 dB
–45 3.75	–0.3 dB	(25)________	0.3 dB	±0.144 dB
–55 –6.25	–0.5 dB	(26)________	0.5 dB	±0.156 dB
–65 –16.25	–0.5 dB	(27)________	0.5 dB	±0.156 dB
–75 –26.25	–0.7 dB	(28)________	0.7 dB	±0.156 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
300 Hz *(Option 1DR only)*	–0.3 dB	(11)________	0.3 dB	±0.064 dB
200 Hz *(Option 1DR only)*	–0.3 dB	(12)________	0.3 dB	±0.064 dB
100 Hz *(Option 1DR only)*	–0.3 dB	(13)________	0.3 dB	±0.064 dB
30 Hz *(Option 1DR only)*	–0.3 dB	(14)________	0.3 dB	±0.064 dB
10 Hz *(Option 1DR only)*	–0.3 dB	(15)________	0.3 dB	±0.064 dB
16. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.34 dB	(1)________	0.34 dB	±0.148 dB
Lin, Preamp Off	–0.34 dB	(2)________	0.34 dB	±0.148 dB
Log, Preamp On	–0.5 dB	(3)________	0.5 dB	±0.148 dB
Lin, Preamp On	–0.5 dB	(4)________	0.5 dB	±0.148 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
18. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.54 dB	(1)________	0.54 dB	±0.08 dB
–10 dBm input	–0.54 dB	(2)________	0.54 dB	±0.081 dB
–20 dBm input	–0.54 dB	(3)________	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(4)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(5)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(6)________	0.54 dB	±0.086 dB
–20 dBm Reference Level				
–20 dBm input	–0.54 dB	(7)________	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(8)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(9)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(10)________	0.54 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.54 dB	(11)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(12)________	0.54 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.54 dB	(13)________	0.54 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)________	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)________	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)________	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)________	345 kHz	±2.29 kHz

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz
9 kHz	7.65 kHz	(11)________	10.35kHz	±11.5 Hz
21. Frequency Response	Note: Enter data in the appropriate section below depending upon the input impedance of the analyzer and the ambient temperature at which the test was performed.			
50 Ω, 20 to 30° C:				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
50 Ω, 0 to 55° C:				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	–1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
75 Ω, 20 to 30° C:				
Maximum Response		(1)________	0.5 dB	±0.189 dB
Minimum Response	–0.5 dB	(2)________		±0.189 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.189 dB
75 Ω, 0 to 55° C:				
Maximum Response		(1)________	1.0 dB	±0.189 dB
Minimum Response	–1.0 dB	(2)________		±0.189 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.189 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
24. Frequency Response (Preamp On) *(Option 1DS only)*	Note: Enter data in the appropriate section below depending upon the input impedance of the analyzer and the ambient temperature at which the test was performed.			
50 Ω, 20 to 30° C:				
Maximum Response		(1)________	1.0 dB	±0.358 dB
Minimum Response	–1.0 dB	(2)________		±0.358 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.358 dB
50 Ω, 0 to 55° C:				
Maximum Response		(1)________	1.5 dB	±0.358 dB
Minimum Response	–1.5 dB	(2)________		±0.358 dB
Peak-to-Peak Response		(3)________	3.0 dB	±0.358 dB
75 Ω, 20 to 30° C:				
Maximum Response		(1)________	1.5 dB	±0.337 dB
Minimum Response	–1.5 dB	(2)________		±0.337 dB
Peak-to-Peak Response		(3)________	3.0 dB	±0.337 dB
75 Ω, 0 to 55° C:				
Maximum Response		(1)________	2.0 dB	±0.337 dB
Minimum Response	–2.0 dB	(2)________		±0.337 dB
Peak-to-Peak Response		(3)________	4.0 dB	±0.337 dB
27. Other Input Related Spurious Responses				
Input Frequency				
542.8 MHz		(1)________	–65 dBc	±1.08 dB
510.7 MHz		(2)________	–65 dBc	±1.08 dB
1310.7 MHz		(3)________	–45 dBc	±1.08 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
29. Spurious Responses	Note: Enter the results in the appropriate lines below based upon the input impedance of the analyzer.			
50 MHz TOI, 1 kHz RBW, 50 Ω	10 dBm	(1)________		±0.489 dB
50 MHz TOI, 1 kHz RBW, 75 Ω	58.75 dBmV	(1)________		±0.481 dB
50 MHz TOI, 30 Hz RBW, 50 Ω (*Option 1DR only)*	10 dBm	(2)________		±0.489 dB
50 MHz TOI, 30 Hz RBW, 75 Ω (*Option 1DR only)*	58.75 dBmV	(2)________		±0.481 dB
40 MHz SHI, 50 Ω	35 dBm	(3)________		±1.11 dB
40 MHz SHI, 75 Ω	83.75 dBmV	(3)________		±1.11 dB
32. Gain Compression				
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
50.004 MHz (*Option 1DR only)*		(2)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
34. Displayed Average Noise Level	Note: Enter results in the appropriate section below based upon the input impedance of the analyzer.			
50 Ω, 1 kHz RBW, Preamp Off:				
400 kHz		(1)________	–115 dBm	±1.82 dB
1 MHz to 10 MHz		(2)________	–115 dBm	±1.82 dB
10 MHz to 500 MHz		(3)________	–119 dBm	±1.82 dB
500 MHz to 1 GHz		(4)________	–117 dBm	±1.82 dB
1 GHz to 1.5 GHz		(5)________	–113 dBm	±1.82 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
50 Ω, 1 kHz RBW, Preamp On:				
400 kHz		(6)________	–131 dBm	±1.82 dB
1 MHz to 10 MHz		(7)________	–131 dBm	±1.82 dB
10 MHz to 500 MHz		(8)________	–135 dBm	±1.82 dB
500 MHz to 1 GHz		(9)________	–133 dBm	±1.82 dB
1 GHz to 1.5 GHz		(10)________	–129 dBm	±1.82 dB
50 Ω, 10 Hz RBW, Preamp Off:				
400 kHz		(11)________	–134 dBm	±1.82 dB
1 MHz to 10 MHz		(12)________	–134 dBm	±1.82 dB
10 MHz to 500 MHz		(13)________	–138 dBm	±1.82 dB
500 MHz to 1 GHz		(14)________	–136 dBm	±1.82 dB
1 GHz to 1.5 GHz		(15)________	–132 dBm	±1.82 dB
50 Ω, 10 Hz RBW, Preamp On:				
400 kHz		(16)________	–149 dBm	±1.82 dB
1 MHz to 10 MHz		(17)________	–149 dBm	±1.82 dB
10 MHz to 500 MHz		(18)________	–153 dBm	±1.82 dB
500 MHz to 1 GHz		(19)________	–151 dBm	±1.82 dB
1 GHz to 1.5 GHz		(20)________	–147 dBm	±1.82 dB
75 Ω, 1 kHz RBW, Preamp Off:				
1 MHz to 10 MHz		(21)________	–63 dBmV	±1.82 dB
10 MHz to 500 MHz		(22)________	–65 dBmV	±1.82 dB
500 MHz to 1 GHz		(23)________	–60 dBmV	±1.82 dB
1 GHz to 1.5 GHz		(24)________	–53 dBmV	±1.82 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
75 Ω, 1 kHz RBW, Preamp On:				
1 MHz to 10 MHz		(25)________	–80 dBmV	±1.82 dB
10 MHz to 500 MHz		(26)________	–81 dBmV	±1.82 dB
500 MHz to 1 GHz		(27)________	–76 dBmV	±1.82 dB
1 GHz to 1.5 GHz		(28)________	–69 dBmV	±1.82 dB
75 Ω, 10 Hz RBW, Preamp Off:				
1 MHz to 10 MHz		(29)________	–82 dBmV	±1.82 dB
10 MHz to 500 MHz		(30)________	–84 dBmV	±1.82 dB
500 MHz to 1 GHz		(31)________	–79 dBmV	±1.82 dB
1 GHz to 1.5 GHz		(32)________	–72 dBmV	±1.82 dB
75 Ω, 10 Hz RBW, Preamp On:				
1 MHz to 10 MHz		(33)________	–98 dBmV	±1.82 dB
10 MHz to 500 MHz		(34)________	–99 dBmV	±1.82 dB
500 MHz to 1 GHz		(35)________	–94 dBmV	±1.82 dB
1 GHz to 1.5 GHz		(36)________	–87 dBmV	±1.82 dB
38. Residual Responses	Note: Enter results in the appropriate section below based upon the input impedance of the analyzer.			
50 Ω, 150 kHz to 1.5 GHz		(1)________	–90 dBm	±0.90 dB
75 Ω, 1 MHz to 1.5 GHz		(1)________	–36 dBmV	±0.90 dB
39. Fast Time Domain Amplitude Accuracy *(Option AYX only)*				
Amplitude Error	–0.3%	(1)________	0.3%	±0.029%

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
40. Tracking Generator Absolute Amplitude and Vernier Accuracy	Note: Enter results in the appropriate section below based upon the input impedance of the analyzer.			
50 Ω *(Option 1DN)*				
Absolute Amplitude Accuracy	–0.5 dB	(1)________	0.5 dB	±0.14 dB
Positive Vernier Accuracy		(2)________	0.75 dB	±0.19 dB
Negative Vernier Accuracy	–0.75 dB	(3)________		±0.19 dB
Power Sweep Accuracy		(4)________	1.5 dB	±0.19 dB
75 Ω *(Option 1DQ)*				
Absolute Amplitude Accuracy	–1.5 dB	(1)________	1.5 dB	±0.14 dB
Positive Vernier Accuracy		(2)________	0.9 dB	±0.19 dB
Negative Vernier Accuracy	–0.9 dB	(3)________		±0.19 dB
Power Sweep Accuracy		(4)________	1.8 dB	±0.19 dB
42. Tracking Generator Level Flatness	Note: Enter results in the appropriate section below based upon the input impedance of the analyzer.			
50 Ω *(Option 1DN)*				
Positive Level Flatness, <1 MHz		(1)________	2.0 dB	±0.588 dB
Negative Level Flatness, <1 MHz	–2.0 dB	(2)________		±0.588 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	2.0 dB	±0.281 dB
Negative Level Flatness, 1 MHz to 10 MHz	–2.0 dB	(4)________		±0.281 dB
Positive Level Flatness, >10 MHz		(5)________	1.5 dB	±0.202 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Negative Level Flatness, >10 MHz	–1.5 dB	(6)_______		±0.202 dB
75 Ω *(Option 1DQ)*				
Positive Level Flatness, 1 MHz to 10 MHz		(3)_______	2.5 dB	±0.314 dB
Negative Level Flatness, 1 MHz to 10 MHz	–2.5 dB	(4)_______		±0.314 dB
Positive Level Flatness, >10 MHz		(5)_______	2.0 dB	±0.314 dB
Negative Level Flatness, >10 MHz	–2.0 dB	(6)_______		±0.314 dB
44. Tracking Generator Harmonic Spurious Outputs *(Option 1DN or Option 1DQ only)*				
2^{nd} Harmonic, <20 MHz		(1)_______	–20 dBc	±2.6 dB
2^{nd} Harmonic, ≥20 MHz		(2)_______	–25 dBc	±2.6 dB
3^{rd} Harmonic, <20 MHz		(3)_______	–20 dBc	±2.6 dB
3^{rd} Harmonic, ≥20 MHz		(4)_______	–25 dBc	±2.6 dB
46. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN or Option 1DQ only)*				
Highest Non-Harmonic Spurious Output Amplitude		(1)_______	–35 dBc	±2.67 dB

Table 3-2 E4401B Performance Verification Test Record

Agilent Technologies				
Model E4401B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
49. Gate Delay Accuracy and Gate Length Accuracy *(Option 1D6 only)*				
Minimum Gate Delay	499.9 ns	(1)________	1.5001 µs	±475 ps
Maximum Gate Delay	499.9 ns	(2)________	1.5001 µs	±475 ps
1 µs Gate Length	499.9 ns	(3)________	1.5001 µs	±450 ps
65 ms Gate Length	64.993 ms	(4)________	65.007 ms	±561 ns
50. Gate Mode Amplitude Error *(Option 1D6 only)*				
Amplitude Error	–0.2 dB	(1)________	0.2 dB	±0.023 dB

Agilent E4402B Performance Verification Test Record

Only the tests for E4402B are included in this test record, therefore not all test numbers are included.

Table 3-3 E4402B Performance Verification Test Record

Agilent Technologies

Address: ______________________ Report No. ______________

______________________ Date ______________

____

Model E4402B

Serial No. ____________ Ambient temperature ______° C

Options ____________ Power mains line frequency ______ Hz (nominal)

Firmware Revision ________ Relative humidity ______%

Customer ______________________ Tested by ______________________

Test Equipment Used:

Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	________	________	________
Synthesized Sweeper	________	________	________
Function Generator	________	________	________
Power Meter, Dual-Channel	________	________	________
RF Power Sensor #1	________	________	________
RF Power Sensor #2	________	________	________
Low-Power Power Sensor	________	________	________
Digital Multimeter	________	________	________
Universal Counter	________	________	________
Frequency Standard	________	________	________
Power Splitter	________	________	________
50 Ω Termination	________	________	________
1 dB Step Attenuator	________	________	________
10 dB Step Attenuator	________	________	________

Table 3-3 E4402B Performance Verification Test Record

6 dB Fixed Attenuator	________	________	________
20 dB Fixed Attenuator *(Option 1DS only)*	________	________	________
Oscilloscope *(Option 1D6 only)*	________	________	________
Microwave Spectrum Analyzer *(Option 1DN only)*	________	________	________
Notes/comments:	________________________		

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies

Model E4402B **Report No. ________**

Serial No. ________ **Date ________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
1. 10 MHz Reference Output Accuracy (*Non-Option 1D5 only*)				
Settability	–5.0 Hz	(1)________	5.0 Hz	±293.3 µHz
2. 10 MHz Precision Frequency Reference Output Accuracy (*Option 1D5 only*)				
5 Minute Warm-Up Error	–0.1 ppm	(1)________	0.1 ppm	±0.000072 ppm
15 Minute Warm-Up Error	–0.01 ppm	(2)________	0.01 ppm	±0.000070 ppm
3. Frequency Readout Accuracy and Marker Count Accuracy				
Frequency Readout Accuracy				
Center Freq / Span				
1500 MHz / 20 MHz	1499.83 MHz	(1)________	1500.17 MHz	0 Hz
1500 MHz / 10 MHz	1499.91 MHz	(2)________	1500.09 MHz	0 Hz
1500 MHz / 1 MHz	1499.988490 MHz	(3)________	1500.011510 MHz	±0 Hz

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Marker Count Accuracy				
Center Freq Span				
1500 MHz 10 MHz	1499.991 MHz	(4)________	1500.009 MHz	±0 Hz
1500 MHz 1 MHz	1499.999999 MHz	(5)________	1500.000001 MHz	±0 Hz
6. Frequency Span Readout Accuracy				
Span Start Freq				
3000 MHz 0 Hz	2370 MHz	(1)________	2430 MHz	±6.12 MHz
100 MHz 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)________	–90 dBc/Hz	±1.154 dB
20 kHz		(2)________	–98 dBc/Hz	±1.154 dB
30 kHz		(3)________	–100 dBc/Hz	±1.154 dB
100 kHz		(4)________	–112 dBc/Hz	±1.154 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
8. System Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)________	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)________	–65 dBc	±1.154 dB
9. Residual FM				
1 kHz Res BW, (*Non-Option 1D5)*		(1)_________	150 Hz	±9.24 Hz
1 kHz Res BW, (*Option 1D5)*		(1)_________	100 Hz	±9.24 Hz
10 Hz Res BW (*Options 1DR and 1D5 only*)		(3)_________	2 Hz	±0.274 Hz
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)________	1.0%	±0.28%
20 ms	–1.0%	(2)________	1.0%	±0.28%
100 ms	–1.0%	(3)________	1.0%	±0.28%
1 s	–1.0%	(4)________	1.0%	±0.28%
10 s	–1.0%	(5)________	1.0%	±0.28%
1 ms (*Option AYX only)*	–1.0%	(6)________	1.0%	±0.28%
500 µs (*Option AYX only)*	–1.0%	(7)________	1.0%	±0.28%
100 µs (*Option AYX only)*	–1.0%	(8)________	1.0%	±0.28%

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(6)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(14)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(15)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Incremental Log Fidelity, Res BW ≥1 kHz dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(37)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(38)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)________	0.4 dB	±0.088 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Cumulative Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.34 dB	(43)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(44)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(45)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(46)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(47)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(48)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(49)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(50)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(51)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(52)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(53)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(54)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(55)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(56)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(57)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(58)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(59)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(60)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(61)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(62)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(63)________	1.14 dB	±0.089 dB
–88	–1.18 dB	(64)________	1.18 dB	±0.089 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–92	–1.22 dB	(65)________	1.22 dB	±0.089 dB
–96	–1.26 dB	(66)________	1.26 dB	±0.088 dB
–98	–1.28 dB	(67)________	1.28 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.4 dB	(68)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(69)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(70)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(71)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(72)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(73)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(74)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(75)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(76)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(77)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(78)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(79)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(80)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(81)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(82)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(83)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(84)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(85)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(86)________	0.4 dB	±0.089 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–80	–0.4 dB	(87)___	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)________	2.0%	±0.064%
–8	–2.0%	(90)________	2.0%	±0.064%
–12	–2.0%	(91)________	2.0%	±0.064%
–16	–2.0%	(92)________	2.0%	±0.064%
–20	–2.0%	(93)________	2.0%	±0.063%
Linear Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–2.0%	(94)________	2.0%	±0.064%
–8	–2.0%	(95)________	2.0%	±0.064%
–12	–2.0%	(96)________	2.0%	±0.064%
–16	–2.0%	(97)________	2.0%	±0.064%
–20	–2.0%	(98)________	2.0%	±0.063%
Zero Span, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.36 dB	(99)_________	0.36 dB	±0.064 dB
–8	–0.42 dB	(100)________	0.42 dB	±0.064 dB
–12	–0.48 dB	(101)________	0.48 dB	±0.064 dB
–16	–0.54 dB	(102)________	0.54 dB	±0.064 dB
–20	–0.60 dB	(103)________	0.60 dB	±0.063 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies

Model E4402B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–24	–0.66 dB	(104)________	0.66 dB	±0.064 dB
–28	–0.72 dB	(105)________	0.72 dB	±0.064 dB
–32	–0.78 dB	(106)________	0.78 dB	±0.064 dB
–36	–0.84 dB	(107)________	0.84 dB	±0.064 dB
–40	–0.90 dB	(108)________	0.90 dB	±0.063 dB
–44	–0.96 dB	(109)________	0.96 dB	±0.064 dB
–48	–1.02 dB	(110)________	1.02 dB	±0.064 dB
–52	–1.08 dB	(111)________	1.08 dB	±0.089 dB
–56	–1.14 dB	(112)________	1.14 dB	±0.089 dB
–60	–1.20 dB	(113)________	1.20 dB	±0.088 dB
–64	–1.5 dB	(114)________	1.5 dB	±0.089 dB
–68	–1.5 dB	(115)________	1.5 dB	±0.089 dB
–70	–1.5 dB	(116)________	1.5 dB	±0.089 dB
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)________	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)________	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)________	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)________	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)________	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)________	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)________	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)________	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)________	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)________	0.60 dB	±0.089 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
65 dB	–0.75 dB	(13)________	0.75 dB	±0.089 dB
14. Reference Level Accuracy				
Log, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(1)________	0.3 dB	±0.144 dB
0	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(6)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(7)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(8)________	0.7 dB	±0.156 dB
Linear, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(9)________	0.3 dB	±0.144 dB
0	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(12)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(14)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(15)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(16)________	0.7 dB	±0.156 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Log, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(17)________	0.3 dB	±0.144 dB
0	–0.3 dB	(18)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(19)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(20)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(21)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(22)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(23)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(24)________	0.7 dB	±0.156 dB
Linear, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(25)________	0.3 dB	±0.144 dB
0	–0.3 dB	(26)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(27)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(28)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(29)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(30)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(31)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(32)________	0.7 dB	±0.156 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
300 Hz *(Option 1DR only)*	–0.3 dB	(11)________	0.3 dB	±0.064 dB
200 Hz *(Option 1DR only)*	–0.3 dB	(12)________	0.3 dB	±0.064 dB
100 Hz *(Option 1DR only)*	–0.3 dB	(13)________	0.3 dB	±0.064 dB
30 Hz *(Option 1DR only)*	–0.3 dB	(14)________	0.3 dB	±0.064 dB
10 Hz *(Option 1DR only)*	–0.3 dB	(15)________	0.3 dB	±0.064 dB
17. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.34 dB	(1)________	0.34 dB	±0.148 dB
Lin, Preamp Off	–0.34 dB	(2)________	0.34 dB	±0.148 dB
Log, Preamp On	–0.5 dB	(3)________	0.5 dB	±0.148 dB
Lin, Preamp On	–0.5 dB	(4)________	0.5 dB	±0.148 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
19. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.54 dB	(1)________	0.54 dB	±0.08 dB
–10 dBm input	–0.54 dB	(2)________	0.54 dB	±0.081 dB
–20 dBm input	–0.54 dB	(3)________	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(4)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(5)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(6)________	0.54 dB	±0.086 dB
–20 dBm Reference Level				
–20 dBm input	–0.54 dB	(7)________	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(8)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(9)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(10)________	0.54 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.54 dB	(11)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(12)________	0.54 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.54 dB	(13)________	0.54 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)________	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)________	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)________	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)________	345 kHz	±2.29 kHz

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		Report No. ________		
Serial No. ________		Date ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz
9 kHz	7.65 kHz	(11)________	10.35kHz	±11.5 Hz
22. Frequency Response	Note: Enter data in the appropriate section below depending upon the ambient temperature at which the test was performed.			
20 to 30° C:				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
0 to 55° C:				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	–1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
26. Frequency Response (Preamp On) *(Option 1DS only)*				
Maximum Response		(1)________	2.0 dB	±0.343 dB
Minimum Response	–2.0 dB	(2)________		±0.343 dB
Peak-to-Peak Response		(3)________	4.0 dB	±0.343 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
28. Other Input Related Spurious Responses				
Input Frequency				
2042.8 MHz		(1)________	–65 dBc	±1.14 dB
2642.8 MHz		(2)________	–65 dBc	±1.14 dB
1820.8 MHz		(3)________	–65 dBc	±1.14 dB
278.5 MHz		(4)________	–65 dBc	±1.14 dB
30. Spurious Responses				
300 MHz TOI, 1 kHz RBW	11 dBm	(1)________		±0.49 dB
300 MHz TOI, 30 Hz RBW (*Option 1DR only)*	11 dBm	(2)________		±0.49 dB
300 MHz SHI	35 dBm	(3)________		±0.90 dB
900 MHz SHI	45 dBm	(4)________		±0.90 dB
33. Gain Compression				
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
50.004 MHz (*Option 1DR only)*		(2)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
2503 MHz		(4)________	1.0 dB	±0.144 dB
35. Displayed Average Noise Level	Note: Enter results with preamp on in the appropriate section based upon the ambient temperature when the test was performed.			
1 kHz RBW, Preamp Off:				
10 MHz to 1 GHz		(1)________	–117 dBm	±1.82 dB
1 GHz to 2 GHz		(2)________	–116 dBm	±1.82 dB
2 GHz to 3 GHz		(3)________	–114 dBm	±1.82 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1kHz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(4)________	–132 dBm	±1.82 dB
1 GHz to 2 GHz		(5)________	–131 dBm	±1.82 dB
2 GHz to 3 GHz		(6)________	–129 dBm	±1.82 dB
10 Hz RBW, Preamp Off:				
10 MHz to 1 GHz		(7)________	–136 dBm	±1.82 dB
1 GHz to 2 GHz		(8)________	–135 dBm	±1.82 dB
2 GHz to 3 GHz		(9)________	–133 dBm	±1.82 dB
10 Hz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(10)________	–150 dBm	±1.82 dB
1 GHz to 2 GHz		(11)________	–149 dBm	±1.82 dB
2 GHz to 3 GHz		(12)________	–147 dBm	±1.82 dB
1kHz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(13)________	–133 dBm	±1.82 dB
1 GHz to 2 GHz		(14)________	–133 dBm	±1.82 dB
2 GHz to 3 GHz		(15)________	–132 dBm	±1.82 dB
10 Hz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(16)________	–151 dBm	±1.82 dB
1 GHz to 2 GHz		(17)________	–151 dBm	±1.82 dB
2 GHz to 3 GHz		(18)________	–150 dBm	±1.82 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
38. Residual Responses				
150 kHz to 3.0 GHz		(1)________	–90 dBm	±0.93 dB
39. Fast Time Domain Amplitude Accuracy *(Option AYX only)*				
Amplitude Error	–0.3%	(1)________	0.3%	±0.029%
41. Tracking Generator Absolute Amplitude and Vernier Accuracy				
Absolute Amplitude Accuracy	–0.75 dB	(1)________	0.75 dB	±0.087 dB
Vernier Accuracy, –2 dB	–0.4 dB	(2)________	0.4 dB	±0.11 dB
Vernier Accuracy, –3 dB	–0.5 dB	(3)________	0.5 dB	±0.16 dB
Vernier Accuracy, –5 dB	–0.5 dB	(4)________	0.5 dB	±0.16 dB
Vernier Accuracy, –6 dB	–0.5 dB	(5)________	0.5 dB	±0.16 dB
Vernier Accuracy, –7 dB	–0.5 dB	(6)________	0.5 dB	±0.16 dB
Vernier Accuracy, –8 dB	–0.5 dB	(7)________	0.5 dB	±0.16 dB
Vernier Accuracy, –9 dB	–0.5 dB	(8)________	0.5 dB	±0.16 dB
Vernier Accuracy, –10 dB	–0.5 dB	(9)________	0.5 dB	±0.16 dB
43. Tracking Generator Level Flatness				
Positive Level Flatness, <1 MHz		(1)________	3.0 dB	±0.255 dB
Negative Level Flatness, <1 MHz	–3.0 dB	(2)________		±0.255 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	3.0 dB	±0.145 dB
Negative Level Flatness, 1 MHz to 10 MHz	–3.0 dB	(4)________		±0.145 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		Report No. ________		
Serial No. ________		Date ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Positive Level Flatness, >10 MHz to 1.5 GHz		(5)________	2.0 dB	±0.122 dB
Negative Level Flatness, >10 MHz to 1.5 GHz	–2.0 dB	(6)________		±0.122 dB
Positive Level Flatness, >1.5 GHz		(7)________	2.0 dB	±0.172 dB
Negative Level Flatness, >1.5 GHz	–2.0 dB	(8)________		±0.172 dB
45. Tracking Generator Harmonic Spurious Outputs *(Option 1DN only)*				
2nd Harmonic, <20 kHz		(1)________	–15 dBc	±2.6 dB
2nd Harmonic, ≥20 kHz		(2)________	–25 dBc	±2.6 dB
3rd Harmonic, <20 kHz		(3)________	–15 dBc	±2.6 dB
3rd Harmonic, ≥20 kHz		(4)________	–25 dBc	±2.6 dB
47. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN only)*				
Highest Non-Harmonic Spurious Output Amplitude, 9 kHz to 2 GHz		(1)________	–27 dBc	±2.67 dB
Highest Non-Harmonic Spurious Output Amplitude, 2 GHz to 3 GHz		(2)________	–23 dBc	±3.12 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
48. Tracking Generator LO Feedthrough Amplitude *(Option 1DN only)*				
9 kHz to 2.9 GHz		(1)________	–16 dBm	±1.94 dB
2.9 GHz to 3.0 GHz		(2)________	–16 dBm	±2.49 dB
49. Gate Delay Accuracy and Gate Length Accuracy *(Option 1D6 only)*				
Minimum Gate Delay	499.9 ns	(1)________	1.5001 µs	±475 ps
Maximum Gate Delay	499.9 ns	(2)________	1.5001 µs	±475 ps
1 µs Gate Length	499.9 ns	(3)________	1.5001 µs	±450 ps
65 ms Gate Length	64.993 ms	(4)________	65.007 ms	±561 ns
50. Gate Mode Amplitude Error *(Option 1D6 only)*				
Amplitude Error	–0.2 dB	(1)________	0.2 dB	±0.023 dB
55. cdmaOne Modulation Accuracy (Rho) *(Option BAC only)*	–0.0015 dB	(1)________	0.0015 dB	
56. cdmaOne Modulation Accuracy - EVM *(Option BAC only)*	–0.80%	(1)________	0.80%	
57. cdmaOne Code Domain Power *(Option BAC only)*	–0.20 dB	(1)________	0.20 dB	
58. GSM Phase and Frequency Accuracy *(Option BAH and B7E)*				

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Peak	–2.1 Deg	(1)________	2.1 Deg	
RMS (Avg >10)	–1.1 Deg	(2)________	2.1 Deg	
59. Comms Absolute Accuracy *(Options BAC or BAH)*				
cdmaOne *(Option BAC only)*				
Channel Power Accuracy (Option BAC only)				
Cellular Bands				
30 dBm to –5 dBm				
20 to 30° C	–0.78 dB	(1)________	0.78 dB	±0.19 dB
–5 dBm to –25 dBm				
20 to 30° C	–0.72 dB	(2)________	0.72 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.63 dB	(3)________	0.63 dB	±0.19 dB
–45 dBm to –55 dBm				
20 to 30° C	–0.70 dB	(4)________	0.70 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.82 dB	(5)________	0.82 dB	±0.19 dB
PCS Bands				
–30 dBm to –5 dBm				
20 to 30° C	–0.67 dB	(6)________	0.67 dB	±0.19 dB
–5 dBm to –25 dBm				
20 to 30° C	–0.63 dB	(7)________	0.63 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.63 dB	(8)________	0.63 dB	±0.19 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–45 dBm to –55 dBm				
20 to 30° C	–0.70 dB	(9)________	0.70 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.82 dB	(10)________	0.82 dB	±0.19 dB
Receive Channel Power Accuracy				
Preamp On	–2.3 dB	(11)________	2.3 dB	±0.24 dB
Preamp Off	–2.3 dB	(12)________	2.3 dB	±0.24 dB
P-GSM, E-GSM, and R-GSM Bands				
Transmit Power Accuracy				
Cellular Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.89 dB	(13)________	0.89 dB	±0.19 dB
–20 dBm to –30 dBm				
20 to 30° C	–0.82 dB	(14)________	0.82 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.87 dB	(15)________	0.87 dB	±0.19 dB
–40 dBm to –50 dBm				
20 to 30° C	–1.06 dB	(16)________	1.06 dB	±0.19 dB
–50 dBm to –60 dBm				
20 to 30° C	–1.19 dB	(17)________	1.19 dB	±0.19 dB
DCS 1800 and PCS 1900 Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.76 dB	(18)________	0.76 dB	±0.19 dB

Table 3-4 E4402B Performance Verification Test Record

Agilent Technologies				
Model E4402B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–20 dBm to –30 dBm				
20 to 30° C	–0.66 dB	(19)________	0.66 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.71 dB	(20)________	0.71 dB	±0.19 dB
–40 dBm to –50 dBm				
20 to 30° C	–0.90 dB	(21)________	0.90 dB	±0.19 dB
–50 dBm to –60 dBm				
20 to 30° C	–1.03 dB	(22)________	1.03 dB	±0.19 dB

Agilent E4403B Performance Verification Test Record

Only the tests for E4403B are included in this test record, therefore not all test numbers are included.

Table 3-5 E4403B Performance Verification Test Record

Agilent Technologies	
Address: ____________________	Report No. ______________
____________________	Date ______________
____________________	
Model E4403B	
Serial No. ______________	Ambient temperature _______° C
Options ______________	Power mains line frequency ______ Hz (nominal)
Firmware Revision __________	Relative humidity _______%
Customer ____________________	Tested by ____________________

Test Equipment Used:

Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	________	________	________
Synthesized Sweeper	________	________	________
Function Generator	________	________	________
Power Meter, Dual-Channel	________	________	________
RF Power Sensor #1	________	________	________
RF Power Sensor #2	________	________	________
Low-Power Power Sensor	________	________	________
Digital Multimeter	________	________	________
Universal Counter	________	________	________
Frequency Standard	________	________	________
Power Splitter	________	________	________
50 Ω Termination	________	________	________
1 dB Step Attenuator	________	________	________

Table 3-5 E4403B Performance Verification Test Record

10 dB Step Attenuator	________	________	________
6 dB Fixed Attenuator	________	________	________
Microwave Spectrum Analyzer *(Option 1DN only)*	________	________	________
Notes/comments:	________________________________		

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies

Model E4403B **Report No. ________**

Serial No. ________ **Date ________**

Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1. 10 MHz Reference Output Accuracy				
Settability	–5.0 Hz	(1)________	5.0 Hz	±293.3 µHz
3. Frequency Readout Accuracy and Marker Count Accuracy				
Frequency Readout Accuracy				
Center Freq Span				
1500 MHz 20 MHz	1499.83 MHz	(1)________	1500.17 MHz	±0 Hz
1500 MHz 10 MHz	1499.91 MHz	(2)________	1500.09 MHz	±0 Hz
1500 MHz 1 MHz	1499.991 MHz	(3)________	1500.009 MHz	±0 Hz
Marker Count Accuracy				
Center Freq Span				
1500 MHz 10 MHz	1499.999999 MHz	(4)________	1500.000001 MHz	±0 Hz
1500 MHz 1 MHz	1499.999999 MHz	(5)________	1500.000001 MHz	±0 Hz

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
6. Frequency Span Readout Accuracy				
Span Start Freq				
3000 MHz 0 Hz	2370 MHz	(1)________	2430 MHz	±6.12 MHz
100 MHz 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)________	–90 dBc/Hz	±1.154 dB
20 kHz		(2)________	–98 dBc/Hz	±1.154 dB
30 kHz		(3)________	–100 dBc/Hz	±1.154 dB
100 kHz		(4)________	–112 dBc/Hz	±1.154 dB
8. System Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)________	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)________	–65 dBc	±1.154 dB
9. Residual FM				
1 kHz Res BW		(1)________	150 Hz	±9.24 Hz

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)________	1.0%	±0.28%
20 ms	–1.0%	(2)________	1.0%	±0.28%
100 ms	–1.0%	(3)________	1.0%	±0.28%
1 s	–1.0%	(4)________	1.0%	±0.28%
10 s	–1.0%	(5)________	1.0%	±0.28%
10 s	–1.0%	(5)________	1.0%	±0.28%
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(6)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(14)________	0.86 dB	±0.089 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–60	–0.90 dB	(15)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(37)________	0.4 dB	±0.089 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies

Model E4403B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
–68	–0.4 dB	(38)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)________	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)________	2.0%	±0.064%
–8	–2.0%	(90)________	2.0%	±0.064%
–12	–2.0%	(91)________	2.0%	±0.064%
–16	–2.0%	(92)________	2.0%	±0.064%
–20	–2.0%	(93)________	2.0%	±0.063%
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)________	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)________	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)________	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)________	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)________	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)________	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)________	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)________	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)________	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)________	0.60 dB	±0.089 dB
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
65 dB	–0.75 dB	(13)________	0.75 dB	±0.089 dB
13. Reference Level Accuracy				
Log				
Reference Level				
–10	–0.3 dB	(1)________	0.3 dB	±0.144 dB
0	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(6)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(7)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(8)________	0.7 dB	±0.156 dB
Linear				
Reference Level				
–10	–0.3 dB	(9)________	0.3 dB	±0.144 dB
0	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(12)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(14)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(15)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(16)________	0.7 dB	±0.156 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
17. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.4 dB	(1)________	0.4 dB	±0.148 dB
Lin, Preamp Off	–0.4 dB	(2)________	0.4 dB	±±0.148 dB
19. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.6 dB	(1)________	0.6 dB	±0.08 dB
–10 dBm input	–0.6 dB	(2)________	0.6 dB	±0.081 dB
–20 dBm input	–0.6 dB	(3)________	0.6 dB	±0.082 dB
–30 dBm input	–0.6 dB	(4)________	0.6 dB	±0.083 dB
–40 dBm input	–0.6 dB	(5)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(6)________	0.6 dB	±0.086 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–20 dBm Reference Level				
–20 dBm input	–0.6 dB	(7)________	0.6 dB	±0.082 dB
–30 dBm input	–0.6 dB	(8)________	0.6 dB	±0.083 dB
–40 dBm input	–0.6 dB	(9)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(10)________	0.6 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.6 dB	(11)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(12)________	0.6 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.6 dB	(13)________	0.6 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)________	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)________	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)________	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)________	345 kHz	±2.29 kHz
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz
9 kHz	7.65 kHz	(11)________	10.35kHz	±11.5 Hz

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
22. Frequency Response	Note: Enter data in the appropriate section below depending upon the ambient temperature at which the test was performed.			
20 to 30° C:				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
0 to 55° C:				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	–1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
28. Other Input Related Spurious Responses				
Input Frequency				
2042.8 MHz		(1)________	–65 dBc	±1.14 dB
2642.8 MHz		(2)________	–65 dBc	±1.14 dB
1820.8 MHz		(3)________	–65 dBc	±1.14 dB
278.5 MHz		(4)________	–65 dBc	±1.14 dB
31. Spurious Responses				
300 MHz TOI	7.5 dBm	(1)________		±0.49 dB
300 MHz SHI	30 dBm	(3)________		±0.90 dB
900 MHz SHI	40 dBm	(4)________		±0.90 dB
33. Gain Compression				
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
2503 MHz		(4)________	1.0 dB	±0.144 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
35. Displayed Average Noise Level				
10 MHz to 1 GHz		(1)________	–117 dBm	±1.82 dB
1 GHz to 2 GHz		(2)________	–116 dBm	±1.82 dB
2 GHz to 3 GHz		(3)________	–114 dBm	±1.82 dB
38. Residual Responses				
150 kHz to 3.0 GHz		(1)________	–90 dBm	±0.93 dB
39. Fast Time Domain Amplitude Accuracy *(Option AYX only)*				
Amplitude Error	–0.3%	(1)________	0.3%	±0.029%
41. Tracking Generator Absolute Amplitude and Vernier Accuracy				
Absolute Amplitude Accuracy	–0.75 dB	(1)________	0.75 dB	±0.087 dB
Vernier Accuracy, –2 dB	–0.4 dB	(2)________	0.4 dB	±0.11 dB
Vernier Accuracy, –3 dB	–0.5 dB	(3)________	0.5 dB	±0.16 dB
Vernier Accuracy, –5 dB	–0.5 dB	(4)________	0.5 dB	±0.16 dB
Vernier Accuracy, –6 dB	–0.5 dB	(5)________	0.5 dB	±0.16 dB
Vernier Accuracy, –7 dB	–0.5 dB	(6)________	0.5 dB	±0.16 dB
Vernier Accuracy, –8 dB	–0.5 dB	(7)________	0.5 dB	±0.16 dB
Vernier Accuracy, –9 dB	–0.5 dB	(8)________	0.5 dB	±0.16 dB
Vernier Accuracy, –10 dB	–0.5 dB	(9)________	0.5 dB	±0.16 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
43. Tracking Generator Level Flatness				
Positive Level Flatness, <1 MHz		(1)________	3.0 dB	±0.255 dB
Negative Level Flatness, <1 MHz	–3.0 dB	(2)________		±0.255 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	3.0 dB	±0.145 dB
Negative Level Flatness, 1 MHz to 10 MHz	–3.0 dB	(4)________		±0.145 dB
Positive Level Flatness, >10 MHz to 1.5 GHz		(5)________	2.0 dB	±0.122 dB
Negative Level Flatness, >10 MHz to 1.5 GHz	–2.0 dB	(6)________		±0.122 dB
Positive Level Flatness, >1.5 GHz		(7)________	2.0 dB	±0.172 dB
Negative Level Flatness, >1.5 GHz	–2.0 dB	(8)________		±0.172 dB
47. Tracking Generator Harmonic Spurious Outputs *(Option 1DN only)*				
2^{nd} Harmonic, <20 kHz		(1)________	–15 dBc	±2.6 dB
2^{nd} Harmonic, ≥20 kHz		(2)________	–25 dBc	±2.6 dB
3^{rd} Harmonic, <20 kHz		(3)________	–15 dBc	±2.6 dB
3^{rd} Harmonic, ≥20 kHz		(4)________	–25 dBc	±2.6 dB

Table 3-6 E4403B Performance Verification Test Record

Agilent Technologies				
Model E4403B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
49. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN only)*				
Highest Non-Harmonic Spurious Output Amplitude, 9 kHz to 2 GHz		(1)________	–27 dBc	±2.67 dB
Highest Non-Harmonic Spurious Output Amplitude, 2 GHz to 3 GHz		(2)________	–23 dBc	±3.12 dB
50. Tracking Generator LO Feedthrough Amplitude *(Option 1DN only)*				
9 kHz to 2.9 GHz		(1)________	–16 dBm	±1.94 dB
2.9 GHz to 3.0 GHz		(2)________	–16 dBm	±2.49 dB

Agilent E4404B Performance Verification Test Record

Only the tests for E4404B are included in this test record, therefore not all test numbers are included.

Table 3-7 E4404B Performance Verification Test Record

Agilent Technologies	
Address: ______________________	Report No. ______________
______________________	Date ______________
______________________	
Model E4404B	
Serial No. ____________	Ambient temperature _______° C
Options ____________	Power mains line frequency ______ Hz (nominal)
Firmware Revision ________	Relative humidity _______%
Customer ______________________	Tested by ______________________

Test Equipment Used:

Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	________	________	________
Synthesized Sweeper #1	________	________	________
Synthesized Sweeper #2	________	________	________
Function Generator	________	________	________
Power Meter, Dual-Channel	________	________	________
RF Power Sensor #1	________	________	________
RF Power Sensor #2	________	________	________
Microwave Power Sensor	________	________	________
Low-Power Power Sensor	________	________	________
Digital Multimeter	________	________	________
Universal Counter	________	________	________
Frequency Standard	________	________	________

Table 3-7 E4404B Performance Verification Test Record

Power Splitter	________	________	________
50 Ω Termination	________	________	________
1 dB Step Attenuator	________	________	________
10 dB Step Attenuator	________	________	________
6 dB Fixed Attenuator	________	________	________
20 dB Fixed Attenuator *(Option 1DS only)*	________	________	________
Oscilloscope *(Option 1D6 only)*	________	________	________
Microwave Spectrum Analyzer *(Option 1DN only)*	________	________	________
Notes/comments:	________________________		

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies

Model E4404B **Report No. ________**

Serial No. ________ **Date ________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
1. 10 MHz Reference Accuracy (*Non-Option 1D5 only*)				
Settability	−5.0 Hz	(1)________	5.0 Hz	±293.3 µHz
2. 10 MHz Precision Frequency Reference Output Accuracy (*Option 1D5 only*)				
5 Minute Warm-Up Error	−0.1 ppm	(1)________	0.1 ppm	±0.000072 ppm
15 Minute Warm-Up Error	−0.01 ppm	(2)________	0.01 ppm	±0.000070 ppm
4. Frequency Readout Accuracy and Marker Count Accuracy				
Frequency Readout Accuracy				
Center Freq Span				

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1500 MHz 20 MHz	1499.83 MHz	(1)________	1500.17 MHz	±0 Hz
1500 MHz 10 MHz	1499.91 MHz	(2)________	1500.09 MHz	±0 Hz
1500 MHz 1 MHz	1499.991 MHz	(3)________	1500.009 MHz	±0 Hz
4000 MHz 20 MHz	3999.83 MHz	(4)________	4000.17 MHz	±0 Hz
4000 MHz 10 MHz	3999.91 MHz	(5)________	4000.09 MHz	±0 Hz
4000 MHz 1 MHz	3999.991 MHz	(6)________	4000.009 MHz	±0 Hz
Marker Count Accuracy				
Center Freq Span				
1500 MHz 10 MHz	1499.999999 MHz	(16)________	1500.000001 MHz	±0 Hz
1500 MHz 1 MHz	1499.999999 MHz	(17)________	1500.000001 MHz	±0 Hz
4000 MHz 10 MHz	3999.999999 MHz	(18)________	4000.000001 MHz	±0 Hz
4000 MHz 1 MHz	3999.999999 MHz	(19)________	4000.000001 MHz	±0 Hz
6. Frequency Span Readout Accuracy				
Span Start Freq				
3000 MHz 0 Hz	2370 MHz	(1)________	2430 MHz	±6.12 MHz
100 MHz 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)_______	–90 dBc/Hz	±1.154 dB
20 kHz		(2)_______	–98 dBc/Hz	±1.154 dB
30 kHz		(3)_______	–100 dBc/Hz	±1.154 dB
100 kHz		(4)_______	–112 dBc/Hz	±1.154 dB
8. System Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)_______	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)_______	–65 dBc	±1.154 dB
9. Residual FM				
1 kHz Res BW, (*Non-Option 1D5*)		(1)________	150 Hz	±9.24 Hz
1 kHz Res BW, (*Option 1D5*)		(1)________	100 Hz	±9.24 Hz
10 Hz Res BW (*Options 1DR and 1D5 only*)		(2)________	2 Hz	±0.274 Hz
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)_______	1.0%	±0.28%
20 ms	–1.0%	(2)_______	1.0%	±0.28%
100 ms	–1.0%	(3)_______	1.0%	±0.28%
1 s	–1.0%	(4)_______	1.0%	±0.28%
10 s	–1.0%	(5)_______	1.0%	±0.28%
1 ms (*Option AYX only*)	–1.0%	(6)_______	1.0%	±0.28%

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
500 us (*Option AYX only)*	–1.0%	(7)_______	1.0%	±0.28%
100 us (*Option AYX only)*	–1.0%	(8)_______	1.0%	±0.28%
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)_______	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)_______	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)_______	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)_______	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)_______	0.50 dB	±0.063 dB
–24	–0.54 dB	(6)_______	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)_______	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)_______	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)_______	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)_______	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)_______	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)_______	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)_______	0.82 dB	±0.089 dB
–56	–0.86 dB	(14)_______	0.86 dB	±0.089 dB
–60	–0.90 dB	(15)_______	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)_______	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)_______	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)_______	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)_______	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)_______	1.10 dB	±0.088 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(37)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(38)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)________	0.4 dB	±0.088 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies

Model E4404B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
Cumulative Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.34 dB	(43)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(44)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(45)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(46)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(47)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(48)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(49)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(50)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(51)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(52)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(53)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(54)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(55)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(56)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(57)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(58)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(59)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(60)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(61)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(62)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(63)________	1.14 dB	±0.089 dB
–88	–1.18 dB	(64)________	1.18 dB	±0.089 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–92	–1.22 dB	(65)________	1.22 dB	±0.089 dB
–96	–1.26 dB	(66)________	1.26 dB	±0.088 dB
–98	–1.28 dB	(67)________	1.28 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.4 dB	(68)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(69)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(70)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(71)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(72)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(73)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(74)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(75)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(76)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(77)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(78)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(79)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(80)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(81)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(82)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(83)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(84)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(85)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(86)________	0.4 dB	±0.089 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–80	–0.4 dB	(87)________	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)________	2.0%	±0.064%
–8	–2.0%	(90)________	2.0%	±0.064%
–12	–2.0%	(91)________	2.0%	±0.064%
–16	–2.0%	(92)________	2.0%	±0.064%
–20	–2.0%	(93)________	2.0%	±0.063%
Linear Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–2.0%	(94)________	2.0%	±0.064%
–8	–2.0%	(95)________	2.0%	±0.064%
–12	–2.0%	(96)________	2.0%	±0.064%
–16	–2.0%	(97)________	2.0%	±0.064%
–20	–2.0%	(98)________	2.0%	±0.063%
Zero Span, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.36 dB	(99)________	0.36 dB	±0.064 dB
–8	–0.42 dB	(100)________	0.42 dB	±0.064 dB
–12	–0.48 dB	(101)________	0.48 dB	±0.064 dB
–16	–0.54 dB	(102)________	0.54 dB	±0.064 dB
–20	–0.60 dB	(103)________	0.60 dB	±0.063 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–24	–0.66 dB	(104)________	0.66 dB	±0.064 dB
–28	–0.72 dB	(105)________	0.72 dB	±0.064 dB
–32	–0.78 dB	(106)________	0.78 dB	±0.064 dB
–36	–0.84 dB	(107)________	0.84 dB	±0.064 dB
–40	–0.90 dB	(108)________	0.90 dB	±0.063 dB
–44	–0.96 dB	(109)________	0.96 dB	±0.064 dB
–48	–1.02 dB	(110)________	1.02 dB	±0.064 dB
–52	–1.08 dB	(111)________	1.08 dB	±0.089 dB
–56	–1.14 dB	(112)________	1.14 dB	±0.089 dB
–60	–1.20 dB	(113)________	1.20 dB	±0.088 dB
–64	–1.5 dB	(114)________	1.5 dB	±0.089 dB
–68	–1.5 dB	(115)________	1.5 dB	±0.089 dB
–70	–1.5 dB	(116)________	1.5 dB	±0.089 dB
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)________	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)________	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)________	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)________	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)________	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)________	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)________	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)________	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)________	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)________	0.60 dB	±0.089 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
65 dB	–0.75 dB	(13)________	0.75 dB	±0.089 dB
14. Reference Level Accuracy				
Log, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(1)________	0.3 dB	±0.144 dB
0	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(6)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(7)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(8)________	0.7 dB	±0.156 dB
Linear, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(9)________	0.3 dB	±0.144 dB
0	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(12)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(14)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(15)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(16)________	0.7 dB	±0.156 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Log, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(17)________	0.3 dB	±0.144 dB
0	–0.3 dB	(18)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(19)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(20)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(21)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(22)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(23)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(24)________	0.7 dB	±0.156 dB
Linear, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(25)________	0.3 dB	±0.144 dB
0	–0.3 dB	(26)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(27)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(28)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(29)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(30)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(31)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(32)________	0.7 dB	±0.156 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
300 Hz *(Option 1DR only)*	–0.3 dB	(11)________	0.3 dB	±0.064 dB
200 Hz *(Option 1DR only)*	–0.3 dB	(12)________	0.3 dB	±0.064 dB
100 Hz *(Option 1DR only)*	–0.3 dB	(13)________	0.3 dB	±0.064 dB
30 Hz *(Option 1DR only)*	–0.3 dB	(14)________	0.3 dB	±0.064 dB
10 Hz *(Option 1DR only)*	–0.3 dB	(15)________	0.3 dB	±0.064 dB
17. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.34 dB	(1)________	0.34 dB	±0.148 dB
Lin, Preamp Off	–0.34 dB	(2)________	0.34 dB	±0.148 dB
Log, Preamp On	–0.5 dB	(3)________	0.5 dB	±0.148 dB
Lin, Preamp On	–0.5 dB	(4)________	0.5 dB	±0.148 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
19. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.54 dB	(1)_______	0.54 dB	±0.08 dB
–10 dBm input	–0.54 dB	(2)_______	0.54 dB	±0.081 dB
–20 dBm input	–0.54 dB	(3)_______	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(4)_______	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(5)_______	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(6)_______	0.54 dB	±0.086 dB
–20 dBm Reference Level				
–20 dBm input	–0.54 dB	(7)_______	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(8)_______	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(9)_______	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(10)_______	0.54 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.54 dB	(11)_______	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(12)_______	0.54 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.54 dB	(13)_______	0.54 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)_______	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)_______	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)_______	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)_______	345 kHz	±2.29 kHz

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies

Model E4404B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz
9 kHz	7.65 kHz	(11)________	10.35kHz	±11.5 Hz
23. Frequency Response	Note: Enter data in the appropriate section below depending upon the ambient temperature at which the test was performed.			
20 to 30° C:				
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	1.5 dB	±0.355 dB
Minimum Response	–1.5 dB	(5)________		±0.355 dB
Peak-to-Peak Response		(6)________	2.6 dB	±0.355 dB
0 to 55° C:				
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	–1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	2.5 dB	±0.355 dB
Minimum Response	–2.5 dB	(5)________		±0.355 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Peak-to-Peak Response		(6)________	3.0 dB	±0.355 dB
26. Frequency Response (Preamp On) (*Option 1DS only)*				
Maximum Response		(1)________	2.0 dB	±0.343 dB
Minimum Response	–2.0 dB	(2)________		±0.343 dB
Peak-to-Peak Response		(3)________	4.0 dB	±0.343 dB
28. Other Input Related Spurious Responses				
Center Freq Input Freq				
2.0 GHz 2042.8 MHz		(1)________	–65 dBc	±1.14 dB
2.0 GHz 2642.8 MHz		(2)________	–65 dBc	±1.14 dB
2.0 GHz 1820.8 MHz		(3)________	–65 dBc	±1.14 dB
2.0 GHz 278.5 MHz		(4)________	–65 dBc	±1.14 dB
2.0 GHz 5600.0 MHz		(5)________	–80 dBc	±1.14 dB
2.0 GHz 6242.8 MHz		(6)________	–80 dBc	±1.14 dB
4.0 GHz 4042.8 MHz		(7)________	–65 dBc	±1.14 dB
4.0 GHz 4642.8 MHz		(8)________	–65 dBc	±1.14 dB
4.0 GHz 3742.9 MHz		(9)________	–65 dBc	±1.14 dB
4.0 GHz 2242.8 MHz		(10)________	–80 dBc	±1.14 dB
31. Spurious Responses				
300 MHz TOI, 1 kHz RBW	11 dBm	(1)________		±0.49 dB
300 MHz TOI, 30 Hz RBW (*Option 1DR only)*	11 dBm	(2)________		±0.49 dB
5 GHz TOI	11 dBm	(3)________		±0.589 dB
8 GHz TOI	7.5 dBm	(4)________		±0.589 dB
300 MHz SHI	35 dBm	(5)________		±0.90 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
900 MHz SHI	45 dBm	(6)________		±0.90 dB
1.55 GHz SHI	75 dBm	(7)________		±0.90 dB
3.1 GHz SHI	90 dBm	(8)________		±0.90 dB
33. Gain Compression				
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
50.004 MHz (*Option 1DR only)*		(2)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
2503 MHz		(4)________	1.0 dB	±0.144 dB
4403 MHz		(5)________	1.0 dB	±0.201 dB
36. Displayed Average Noise Level	Note: Enter results with preamp on in the appropriate section based upon the ambient temperature when the test was performed.			
1 kHz RBW, Preamp Off:				
10 MHz to 1 GHz		(1)________	–116 dBm	±1.82 dB
1 GHz to 2 GHz		(2)________	–115 dBm	±1.82 dB
2 GHz to 3 GHz		(3)________	–112 dBm	±1.82 dB
3 GHz to 6 GHz		(4)________	–112 dBm	±1.82 dB
6 GHz to 6.7 GHz		(5)________	–110 dBm	±1.82 dB
1kHz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(6)________	–131 dBm	±1.82 dB
1 GHz to 2 GHz		(7)________	–129 dBm	±1.82 dB
2 GHz to 3 GHz		(8)________	–127 dBm	±1.82 dB
10 Hz RBW, Preamp Off:				
10 MHz to 1 GHz		(9)________	–135 dBm	±1.82 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1 GHz to 2 GHz		(10)________	–134 dBm	±1.82 dB
2 GHz to 3 GHz		(11)________	–131 dBm	±1.82 dB
3 GHz to 6 GHz		(12)________	–131 dBm	±1.82 dB
6 GHz to 6.7 GHz		(13)________	–129 dBm	±1.82 dB
10 Hz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(14)________	–149 dBm	±1.82 dB
1 GHz to 2 GHz		(15)________	–147 dBm	±1.82 dB
2 GHz to 3 GHz		(16)________	–145 dBm	±1.82 dB
1 kHz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(17)________	–132 dBm	±1.82 dB
1 GHz to 2 GHz		(18)________	–131 dBm	±1.82 dB
2 GHz to 3 GHz		(19)________	–130 dBm	±1.82 dB
10 Hz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(20)________	–150 dBm	±1.82 dB
1 GHz to 2 GHz		(21)________	–149 dBm	±1.82 dB
2 GHz to 3 GHz		(22)________	–148 dBm	±1.82 dB
38. Residual Responses				
150 kHz to 6.7 GHz		(1)________	–90 dBm	±0.93 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
39. Fast Time Domain Amplitude Accuracy *(Option AYX only)*				
Amplitude Error	–0.3%	(1)________	0.3%	±0.029%
41. Tracking Generator Absolute Amplitude and Vernier Accuracy				
Absolute Amplitude Accuracy	–0.75 dB	(1)________	0.75 dB	±0.087 dB
Vernier Accuracy, –2 dB	–0.4 dB	(2)________	0.4 dB	±0.11 dB
Vernier Accuracy, –3 dB	–0.5 dB	(3)________	0.5 dB	±0.16 dB
Vernier Accuracy, –5 dB	–0.5 dB	(4)________	0.5 dB	±0.16 dB
Vernier Accuracy, –6 dB	–0.5 dB	(5)________	0.5 dB	±0.16 dB
Vernier Accuracy, –7 dB	–0.5 dB	(6)________	0.5 dB	±0.16 dB
Vernier Accuracy, –8 dB	–0.5 dB	(7)________	0.5 dB	±0.16 dB
Vernier Accuracy, –9 dB	–0.5 dB	(8)________	0.5 dB	±0.16 dB
Vernier Accuracy, –10 dB	–0.5 dB	(9)________	0.5 dB	±0.16 dB
43. Tracking Generator Level Flatness				
Positive Level Flatness, <1 MHz		(1)________	3.0 dB	±0.255 dB
Negative Level Flatness, <1 MHz	–3.0 dB	(2)________		±0.255 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	3.0 dB	±0.145 dB
Negative Level Flatness, 1 MHz to 10 MHz	–3.0 dB	(4)________		±0.145 dB
Positive Level Flatness, >10 MHz to 1.5 GHz		(5)________	2.0 dB	±0.122 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Negative Level Flatness, >10 MHz to 1.5 GHz	–2.0 dB	(6)________		±0.122 dB
Positive Level Flatness, >1.5 GHz		(7)________	2.0 dB	±0.172 dB
Negative Level Flatness, >1.5 GHz	–2.0 dB	(8)________		±0.172 dB
45. Tracking Generator Harmonic Spurious Outputs *(Option 1DN only)*				
2^{nd} Harmonic, <20 kHz		(1)________	–15 dBc	±2.6 dB
2^{nd} Harmonic, ≥ 20 kHz		(2)________	–25 dBc	±2.6 dB
3^{rd} Harmonic, <20 kHz		(3)________	–15 dBc	±2.6 dB
3^{rd} Harmonic, ≥ 20 kHz		(4)________	–25 dBc	±2.6 dB
47. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN only)*				
Highest Non-Harmonic Spurious Output Amplitude, 9 kHz to 2 GHz		(1)________	–27 dBc	±2.67 dB
Highest Non-Harmonic Spurious Output Amplitude, 2 GHz to 3 GHz		(2)________	–23 dBc	±3.12 dB
48. Tracking Generator LO Feedthrough Amplitude *(Option 1DN only)*				
9 kHz to 2.9 GHz		(1)________	–16 dBm	±1.94 dB
2.9 GHz to 3.0 GHz		(2)________	–16 dBm	±2.49 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No.** ________		
Serial No. ________		**Date** ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
49. Gate Delay Accuracy and Gate Length Accuracy *(Option 1D6 only)*				
Minimum Gate Delay	499.9 ns	(1)________	1.5001 µs	±475 ps
Maximum Gate Delay	499.9 ns	(2)________	1.5001 µs	±475 ps
1 us Gate Length	499.9 ns	(3)________	1.5001 µs	±450 ps
65 ms Gate Length	64.993 ms	(4)________	65.007 ms	±561 ns
50. Gate Mode Amplitude Error *(Option 1D6 only)*				
Amplitude Error	–0.2 dB	(1)________	0.2 dB	±0.023 dB
55. cdmaOne Modulation Accuracy (Rho) *(Option BAC only)*	–0.0015 dB	(1)________	0.0015 dB	
56. cdmaOne Modulation Accuracy - EVM *(Option BAC only)*	–0.80%	(1)________	0.80%	
57. cdmaOne Code Domain Power *(Option BAC only)*	–0.20 dB	(1)________	0.20 dB	
58. GSM Phase and Frequency Accuracy *(Option BAH and B7E)*				
Peak	–2.1 Deg	(1)________	2.1 Deg	
RMS (Avg >10)	–1.1 Deg	(2)________	2.1 Deg	
59. Comms Absolute Accuracy *(Options BAC or BAH)*				

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
cdmaOne *(Option BAC only)*				
Channel Power Accuracy (Option BAC only)				
Cellular Bands				
30 dBm to –5 dBm				
20 to 30° C	–0.80 dB	(1)________	0.80 dB	±0.19 dB
–5 dBm to –25 dBm				
20 to 30° C	–0.77 dB	(2)________	0.77 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.65 dB	(3)________	0.65 dB	±0.19 dB
–45 dBm to –55 dBm				
20 to 30° C	–0.72 dB	(4)________	0.72 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.86 dB	(5)________	0.86 dB	±0.19 dB
PCS Bands				
30 dBm to –5 dBm				
20 to 30° C	–0.70 dB	(6)________	0.70 dB	±0.19 dB
–5 dBm to –25 dBm				
20 to 30° C	–0.67 dB	(7)________	0.67 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.66 dB	(8)________	0.66 dB	±0.19 dB
–45 dBm to –55 dBm				
20 to 30° C	–0.73 dB	(9)________	0.73 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.87 dB	(10)________	0.87 dB	±0.19 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		Report No. ________		
Serial No. ________		Date ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Receive Channel Power Accuracy				
Preamp On	–2.3 dB	(11)________	2.3 dB	± 0.24 dB
Preamp Off	–2.3 dB	(12)________	2.3 dB	± 0.24 dB
P-GSM, E-GSM, and R-GSM Bands				
Transmit Power Accuracy				
Cellular Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.81 dB	(13)________	0.81 dB	±0.19 dB
–20 dBm to –30 dBm				
20 to 30° C	–0.74 dB	(14)________	0.74 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.79 dB	(15)________	0.79 dB	±0.19 dB
–40 dBm to –50 dBm				
20 to 30° C	–0.95 dB	(16)________	0.95 dB	±0.19 dB
–50 dBm to –60 dBm				
20 to 30° C	–1.09 dB	(17)________	1.09 dB	±0.19 dB
DCS 1800 and PCS 1900 Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.68 dB	(18)________	0.68 dB	±0.19 dB
–20 dBm to –30 dBm				
20 to 30° C	–0.61 dB	(19)________	0.61 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.66 dB	(20)________	0.66 dB	±0.19 dB

Table 3-8 E4404B Performance Verification Test Record

Agilent Technologies				
Model E4404B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–40 dBm to –50 dBm 20 to 30° C	–0.82 dB	(21)________	0.82 dB	±0.19 dB
–50 dBm to –60 dBm 20 to 30° C	–0.96 dB	(22)________	0.96 dB	±0.19 dB

Agilent E4405B Performance Verification Test Record

Only the tests for E4405B are included in this test record, therefore not all test numbers are included.

Table 3-9 E4405B Performance Verification Test Record

Agilent Technologies			
Address: _______________		Report No. _______________	
_______________		Date _______________	
_______________			
Model E4405B			
Serial No. _______________		Ambient temperature _______° C	
Options _______________		Power mains line frequency ______ Hz (nominal)	
Firmware Revision ___________		Relative humidity _______%	
Customer _______________		Tested by _______________	
Test Equipment Used:			
Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	___________	___________	___________
Synthesized Sweeper #1	___________	___________	___________
Synthesized Sweeper #2	___________	___________	___________
Function Generator	___________	___________	___________
Power Meter, Dual-Channel	___________	___________	___________
RF Power Sensor #1	___________	___________	___________
RF Power Sensor #2	___________	___________	___________
Microwave Power Sensor	___________	___________	___________
Low-Power Power Sensor	___________	___________	___________
Digital Multimeter	___________	___________	___________
Universal Counter	___________	___________	___________
Frequency Standard	___________	___________	___________
Power Splitter	___________	___________	___________

Table 3-9 E4405B Performance Verification Test Record

50 Ω Termination	________	________	________
1 dB Step Attenuator	________	________	________
10 dB Step Attenuator	________	________	________
6 dB Fixed Attenuator	________	________	________
20 dB Fixed Attenuator *(Option 1DS only)*	________	________	________
Oscilloscope *(Option 1D6 only)*	________	________	________
Microwave Spectrum Analyzer *(Option 1DN only)*	________	________	________
Notes/comments:	________________________		

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies

Model E4405B **Report No. ________**

Serial No. ________ **Date ________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
1. 10 MHz Reference Output Accuracy (*Non-Option 1D5 only*)				
Settability	–5.0 Hz	(1)________	5.0 Hz	±293.3 µHz
2. 10 MHz Precision Frequency Reference Accuracy (*Option 1D5 only*)				
5 Minute Warm-Up Error	–0.1 ppm	(1)________	0.1 ppm	±0.000072 ppm
15 Minute Warm-Up Error	–0.01 ppm	(2)________	0.01 ppm	±0.000070 ppm

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
4. Frequency Readout Accuracy and Marker Count Accuracy	Note: TR Entries 10 through 15 do not apply to the E4405B.			
Frequency Readout Accuracy				
Center Freq Span				
1500 MHz 20 MHz	1499.83 MHz	(1)________	1500.17 MHz	0 Hz
1500 MHz 10 MHz	1499.91 MHz	(2)________	1500.09 MHz	0 Hz
1500 MHz 1 MHz	1499.991 MHz	(3)________	1500.009 MHz	0 Hz
4000 MHz 20 MHz	3999.83 MHz	(4)________	4000.17 MHz	0 Hz
4000 MHz 10 MHz	3999.91 MHz	(5)________	4000.09 MHz	0 Hz
4000 MHz 1 MHz	3999.991 MHz	(6)________	4000.009 MHz	0 Hz
9000 MHz 20 MHz	8999.83 MHz	(7)________	9000.17 MHz	0 Hz
9000 MHz 10 MHz	8999.91 MHz	(8)________	9000.09 MHz	0 Hz
9000 MHz 1 MHz	8999.991 MHz	(9)________	9000.009 MHz	0 Hz
Marker Count Accuracy	Note: Enter results in the appropriate section below based upon the firmware revision of the analyzer.			
Firmware Revision Prior to A.03.00				
Center Freq Span				
1500 MHz 10 MHz	1499.999998 MHz	(16)________	1500.000002 MHz	±0 Hz
1500 MHz 1 MHz	1499.999998 MHz	(17)________	1500.000002 MHz	±0 Hz
4000 MHz 10 MHz	3999.999998 MHz	(18)________	4000.000002 MHz	±0 Hz

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
4000 MHz 1 MHz	3999.999998 MHz	(19)________	4000.000002 MHz	±0 Hz
9000 MHz 10 MHz	8999.999997 MHz	(20)________	9000.000003 MHz	±0 Hz
9000 MHz 1 MHz	8999.999997 MHz	(21)________	9000.000003 MHz	±0 Hz
Marker Count Accuracy				
Firmware Revision A.03.00 or later				
Center Freq Span				
1500 MHz 10 MHz	1499.999999 MHz	(16)________	1500.000001 MHz	±0 Hz
1500 MHz 1 MHz	1499.999999 MHz	(17)________	1500.000001 MHz	±0 Hz
4000 MHz 10 MHz	3999.999999 MHz	(18)________	4000.000001 MHz	±0 Hz
4000 MHz 1 MHz	3999.999999 MHz	(19)________	4000.000001 MHz	±0 Hz
9000 MHz 10 MHz	8999.999999 MHz	(20)________	9000.000001 MHz	±0 Hz
9000 MHz 1 MHz	8999.999999 MHz	(21)________	9000.000001 MHz	±0 Hz

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
6. Frequency Span Readout Accuracy				
Span Start Freq				
3000 MHz 0 Hz	2370 MHz	(1)________	2430 MHz	±6.12 MHz
100 MHz 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)________	–90 dBc/Hz	±1.154 dB
20 kHz		(2)________	–98 dBc/Hz	±1.154 dB
30 kHz		(3)________	–100 dBc/Hz	±1.154 dB
100 kHz		(4)________	–112 dBc/Hz	±1.154 dB
8. System Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)________	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)________	–65 dBc	±1.154 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
9. Residual FM				
1 kHz Res BW (*Non-Option 1D5)*		(1)________	150 Hz	±9.24 Hz
1 kHz Res BW (*Option 1D5)*		(1)________	100 Hz	±9.24 Hz
10 Hz Res BW (*Options 1DR and 1D5 only*)		(2)________	2 Hz	±0.274 Hz
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)________	1.0%	±0.28%
20 ms	–1.0%	(2)________	1.0%	±0.28%
100 ms	–1.0%	(3)________	1.0%	±0.28%
1 s	–1.0%	(4)________	1.0%	±0.28%
10 s	–1.0%	(5)________	1.0%	±0.28%
1 ms (*Option AYX only)*	–1.0%	(6)________	1.0%	±0.28%
500 µs (*Option AYX only)*	–1.0%	(7)________	1.0%	±0.28%
100 µs (*Option AYX only)*	–1.0%	(8)________	1.0%	±0.28%
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)________	0.50 dB	±0.063 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–24	–0.54 dB	(6)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(14)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(15)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(37)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(38)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)________	0.4 dB	±0.088 dB
Cumulative Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.34 dB	(43)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(44)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(45)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(46)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(47)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(48)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(49)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(50)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(51)________	0.66 dB	±0.064 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–40	–0.70 dB	(52)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(53)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(54)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(55)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(56)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(57)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(58)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(59)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(60)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(61)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(62)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(63)________	1.14 dB	±0.089 dB
–88	–1.18 dB	(64)________	1.18 dB	±0.089 dB
–92	–1.22 dB	(65)________	1.22 dB	±0.089 dB
–96	–1.26 dB	(66)________	1.26 dB	±0.088 dB
–98	–1.28 dB	(67)________	1.28 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.4 dB	(68)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(69)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(70)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(71)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(72)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(73)________	0.4 dB	±0.064 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–28	–0.4 dB	(74)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(75)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(76)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(77)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(78)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(79)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(80)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(81)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(82)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(83)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(84)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(85)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(86)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(87)________	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)________	2.0%	±0.064%
–8	–2.0%	(90)________	2.0%	±0.064%
–12	–2.0%	(91)________	2.0%	±0.064%
–16	–2.0%	(92)________	2.0%	±0.064%
–20	–2.0%	(93)________	2.0%	±0.063%
Linear Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–2.0%	(94)________	2.0%	±0.064%

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–8	–2.0%	(95)________	2.0%	±0.064%
–12	–2.0%	(96)________	2.0%	±0.064%
–16	–2.0%	(97)________	2.0%	±0.064%
–20	–2.0%	(98)________	2.0%	±0.063%
Zero Span, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.36 dB	(99)________	0.36 dB	±0.064 dB
–8	–0.42 dB	(100)________	0.42 dB	±0.064 dB
–12	–0.48 dB	(101)________	0.48 dB	±0.064 dB
–16	–0.54 dB	(102)________	0.54 dB	±0.064 dB
–20	–0.60 dB	(103)________	0.60 dB	±0.063 dB
–24	–0.66 dB	(104)________	0.66 dB	±0.064 dB
–28	–0.72 dB	(105)________	0.72 dB	±0.064 dB
–32	–0.78 dB	(106)________	0.78 dB	±0.064 dB
–36	–0.84 dB	(107)________	0.84 dB	±0.064 dB
–40	–0.90 dB	(108)________	0.90 dB	±0.063 dB
–44	–0.96 dB	(109)________	0.96 dB	±0.064 dB
–48	–1.02 dB	(110)________	1.02 dB	±0.064 dB
–52	–1.08 dB	(111)________	1.08 dB	±0.089 dB
–56	–1.14 dB	(112)________	1.14 dB	±0.089 dB
–60	–1.20 dB	(113)________	1.20 dB	±0.088 dB
–64	–1.5 dB	(114)________	1.5 dB	±0.089 dB
–68	–1.5 dB	(115)________	1.5 dB	±0.089 dB
–70	–1.5 dB	(116)________	1.5 dB	±0.089 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)________	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)________	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)________	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)________	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)________	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)________	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)________	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)________	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)________	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)________	0.60 dB	±0.089 dB
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
65 dB	–0.75 dB	(13)________	0.75 dB	±0.089 dB
14. Reference Level Accuracy				
Log, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(1)________	0.3 dB	±0.144 dB
0	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(6)________	0.5 dB	±0.156 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–70	–0.5 dB	(7)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(8)________	0.7 dB	±0.156 dB
Linear, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(9)________	0.3 dB	±0.144 dB
0	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(12)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(14)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(15)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(16)________	0.7 dB	±0.156 dB
Log, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(17)________	0.3 dB	±0.144 dB
0	–0.3 dB	(18)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(19)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(20)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(21)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(22)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(23)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(24)________	0.7 dB	±0.156 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Linear, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(25)________	0.3 dB	±0.144 dB
0	–0.3 dB	(26)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(27)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(28)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(29)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(30)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(31)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(32)________	0.7 dB	±0.156 dB
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
300 Hz *(Option 1DR only)*	–0.3 dB	(11)________	0.3 dB	±0.064 dB
200 Hz *(Option 1DR only)*	–0.3 dB	(12)________	0.3 dB	±0.064 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
100 Hz *(Option 1DR only)*	–0.3 dB	(13)________	0.3 dB	±0.064 dB
30 Hz *(Option 1DR only)*	–0.3 dB	(14)________	0.3 dB	±0.064 dB
10 Hz *(Option 1DR only)*	–0.3 dB	(15)________	0.3 dB	±0.064 dB
17. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.34 dB	(1)________	0.34 dB	±0.148 dB
Lin, Preamp Off	–0.34 dB	(2)________	0.34 dB	±0.148 dB
Log, Preamp On	–0.5 dB	(3)________	0.5 dB	±0.148 dB
Lin, Preamp On	–0.5 dB	(4)________	0.5 dB	±0.148 dB
19. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.54 dB	(1)________	0.54 dB	±0.08 dB
–10 dBm input	–0.54 dB	(2)________	0.54 dB	±0.081 dB
–20 dBm input	–0.54 dB	(3)________	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(4)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(5)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(6)________	0.54 dB	±0.086 dB
–20 dBm Reference Level				
–20 dBm input	–0.54 dB	(7)________	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(8)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(9)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(10)________	0.54 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.54 dB	(11)________	0.54 dB	±0.084 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–50 dBm input	–0.54 dB	(12)________	0.54 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.54 dB	(13)________	0.54 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)________	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)________	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)________	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)________	345 kHz	±2.29 kHz
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz
9 kHz	7.65 kHz	(11)________	10.35 kHz	±11.5 Hz
23. Frequency Response	Note: Enter data in the appropriate section below depending upon the ambient temperature at which the test was performed.			
20 to 30° C:				
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	1.5 dB	±0.355 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Minimum Response	−1.5 dB	(5)________		±0.355 dB
Peak-to-Peak Response		(6)________	2.6 dB	±0.355 dB
Band 2, 6.7 GHz to 13.2 GHz				
Maximum Response		(7)________	2.0 dB	±0.429 dB
Minimum Response	−2.0 dB	(8)________		±0.429 dB
Peak-to-Peak Response		(9)________	3.6 dB	±0.429 dB
0 to 55° C:				
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	−1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	2.5 dB	±0.355 dB
Minimum Response	−2.5 dB	(5)________		±0.355 dB
Peak-to-Peak Response		(6)________	3.0 dB	±0.355 dB
Band 2, 6.7 GHz to 13.2 GHz				
Maximum Response		(7)________	3.0 dB	±0.429 dB
Minimum Response	−3.0 dB	(8)________		±0.429 dB
Peak-to-Peak Response		(9)________	4.0 dB	±0.429 dB
26. Frequency Response (Preamp On) *(Option 1DS only)*				
Maximum Response		(1)________	2.0 dB	±0.343 dB
Minimum Response	−2.0 dB	(2)________		±0.343 dB
Peak-to-Peak Response		(3)________	4.0 dB	±0.343 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
28. Other Input Related Spurious Responses				
Center Freq Input Freq				
2.0 GHz 2042.8 MHz		(1)________	–65 dBc	±1.14 dB
2.0 GHz 2642.8 MHz		(2)________	–65 dBc	±1.14 dB
2.0 GHz 1820.8 MHz		(3)________	–65 dBc	±1.14 dB
2.0 GHz 278.5 MHz		(4)________	–65 dBc	±1.14 dB
2.0 GHz 5600.0 MHz		(5)________	–80 dBc	±1.14 dB
2.0 GHz 6242.8 MHz		(6)________	–80 dBc	±1.14 dB
4.0 GHz 4042.8 MHz		(7)________	–65 dBc	±1.14 dB
4.0 GHz 4642.8 MHz		(8)________	–65 dBc	±1.14 dB
4.0 GHz 3742.9 MHz		(9)________	–65 dBc	±1.14 dB
4.0 GHz 2242.8 MHz		(10)________	–80 dBc	±1.14 dB
9.0 GHz 9042.8 MHz		(11)________	–65 dBc	±1.14 dB
9.0 GHz 9642.8 MHz		(12)________	–65 dBc	±1.14 dB
9.0 GHz 9342.8 MHz		(13)________	–65 dBc	±1.14 dB
9.0 GHz 4982.1 MHz		(14)________	–80 dBc	±1.14 dB
31. Spurious Responses				
300 MHz TOI, 1 kHz RBW	11 dBm	(1)________		±0.49 dB
300 MHz TOI, 30 Hz RBW (*Option 1DR only)*	11 dBm	(2)________		±0.49 dB
5 GHz TOI	11 dBm	(3)________		±0.589 dB
8 GHz TOI	7.5 dBm	(4)________		±0.589 dB
300 MHz SHI	35 dBm	(5)________		±0.90 dB
900 MHz SHI	45 dBm	(6)________		±0.90 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1.55 GHz SHI	75 dBm	(7)________		±0.90 dB
3.1 GHz SHI	90 dBm	(8)________		±0.90 dB
33. Gain Compression				
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
50.004 MHz *(Option 1DR only)*		(2)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
2503 MHz		(4)________	1.0 dB	±0.144 dB
4403 MHz		(5)________	1.0 dB	±0.201 dB
7603 MHz		(6)________	1.0 dB	±0.201 dB
36. Displayed Average Noise Level	Note: Enter results with preamp on in the appropriate section based upon the ambient temperature when the test was performed.			
1 kHz RBW, Preamp Off:				
10 MHz to 1 GHz		(1)________	–116 dBm	±1.82 dB
1 GHz to 2 GHz		(2)________	–115 dBm	±1.82 dB
2 GHz to 3 GHz		(3)________	–112 dBm	±1.82 dB
3 GHz to 6 GHz		(4)________	–112 dBm	±1.82 dB
6 GHz to 12 GHz		(5)________	–110 dBm	±1.82 dB
12 GHz to 13.2 GHz		(6)________	–107 dBm	±1.82 dB
1 kHz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(7)________	–131 dBm	±1.82 dB
1 GHz to 2 GHz		(8)________	–129 dBm	±1.82 dB
2 GHz to 3 GHz		(9)________	–127 dBm	±1.82 dB
10 Hz RBW, Preamp Off:				

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
10 MHz to 1 GHz		(10)________	–135 dBm	±1.82 dB
1 GHz to 2 GHz		(11)________	–134 dBm	±1.82 dB
2 GHz to 3 GHz		(12)________	–131 dBm	±1.82 dB
3 GHz to 6 GHz		(13)________	–131 dBm	±1.82 dB
6 GHz to 12 GHz		(14)________	–129 dBm	±1.82 dB
12 GHz to 13.2 GHz		(15)________	–126 dBm	±1.82 dB
10 Hz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(16)________	–149 dBm	±1.82 dB
1 GHz to 2 GHz		(17)________	–147 dBm	±1.82 dB
2 GHz to 3 GHz		(18)________	–145 dBm	±1.82 dB
1 kHz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(19)________	–132 dBm	±1.82 dB
1 GHz to 2 GHz		(20)________	–131 dBm	±1.82 dB
2 GHz to 3 GHz		(21)________	–130 dBm	±1.82 dB
10 Hz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(22)________	–150 dBm	±1.82 dB
1 GHz to 2 GHz		(23)________	–149 dBm	±1.82 dB
2 GHz to 3 GHz		(24)________	–148 dBm	±1.82 dB
38. Residual Responses				
150 kHz to 6.7 GHz		(1)________	–90 dBm	±0.93 dB
39. Fast Time Domain Amplitude Accuracy *(Option AYX only)*				
Amplitude Error	–0.3%	(1)________	0.3%	±0.029%

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
41. Tracking Generator Absolute Amplitude and Vernier Accuracy				
Absolute Amplitude Accuracy	–0.75 dB	(1)________	0.75 dB	±0.087 dB
Vernier Accuracy, –2 dB	–0.4 dB	(2)________	0.4 dB	±0.11 dB
Vernier Accuracy, –3 dB	–0.5 dB	(3)________	0.5 dB	±0.16 dB
Vernier Accuracy, –5 dB	–0.5 dB	(4)________	0.5 dB	±0.16 dB
Vernier Accuracy, –6 dB	–0.5 dB	(5)________	0.5 dB	±0.16 dB
Vernier Accuracy, –7 dB	–0.5 dB	(6)________	0.5 dB	±0.16 dB
Vernier Accuracy, –8 dB	–0.5 dB	(7)________	0.5 dB	±0.16 dB
Vernier Accuracy, –9 dB	–0.5 dB	(8)________	0.5 dB	±0.16 dB
Vernier Accuracy, –10 dB	–0.5 dB	(9)________	0.5 dB	±0.16 dB
43. Tracking Generator Level Flatness				
Positive Level Flatness, <1 MHz		(1)________	3.0 dB	±0.255 dB
Negative Level Flatness, <1 MHz	–3.0 dB	(2)________		±0.255 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	3.0 dB	±0.145 dB
Negative Level Flatness, 1 MHz to 10 MHz	–3.0 dB	(4)________		±0.145 dB
Positive Level Flatness, >10 MHz to 1.5 GHz		(5)________	2.0 dB	±0.122 dB
Negative Level Flatness, >10 MHz to 1.5 GHz	–2.0 dB	(6)________		±0.122 dB
Positive Level Flatness, >1.5 GHz		(7)________	2.0 dB	±0.172 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Negative Level Flatness, >1.5 GHz	–2.0 dB	(8)________		±0.172 dB
45. Tracking Generator Harmonic Spurious Outputs *(Option 1DN only)*				
2^{nd} Harmonic, <20 kHz		(1)________	–15 dBc	±2.6 dB
2^{nd} Harmonic, ≥ 20 kHz		(2)________	–25 dBc	±2.6 dB
3^{rd} Harmonic, <20 kHz		(3)________	–15 dBc	±2.6 dB
3^{rd} Harmonic, ≥ 20 kHz		(4)________	–25 dBc	±2.6 dB
47. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN only)*				
Highest Non-Harmonic Spurious Output Amplitude, 9 kHz to 2 GHz		(1)________	–27 dBc	±2.67 dB
Highest Non-Harmonic Spurious Output Amplitude, 2 GHz to 3 GHz		(2)________	–23 dBc	±3.12 dB
48. Tracking Generator LO Feedthrough Amplitude *(Option 1DN only)*				
9 kHz to 2.9 GHz		(1)________	–16 dBm	±1.94 dB
2.9 GHz to 3.0 GHz		(2)________	–16 dBm	±2.49 dB
49. Gate Delay Accuracy and Gate Length Accuracy *(Option 1D6 only)*				
Minimum Gate Delay	499.9 ns	(1)________	1.5001µs	±475 ps
Maximum Gate Delay	499.9 ns	(2)________	1.5001µs	±475 ps

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1 µs Gate Length	499.9 ns	(3)________	1.5001µs	±450 ps
65 ms Gate Length	64.993 ms	(4)________	65.007 ms	±561 ns
50. Gate Mode Amplitude Error *(Option 1D6 only)*				
55. cdmaOne Modulation Accuracy (Rho) *(Option BAC only)*	–0.0015 dB	(1)________	0.0015 dB	
56. cdmaOne Modulation Accuracy - EVM *(Option BAC only)*	–0.80%	(1)________	0.80%	
57. cdmaOne Code Domain Power *(Option BAC only)*	–0.20 dB	(1)________	0.20 dB	
58. GSM Phase and Frequency Accuracy *(Option BAH and B7E)*				
Peak	–2.1 Deg	(1)________	2.1 Deg	
RMS (Avg >10)	–1.1 Deg	(2)________	2.1 Deg	
59. Comms Absolute Accuracy *(Options BAC or BAH)* cdmaOne *(Option BAC only)* Channel Power Accuracy (Option BAC only) Cellular Bands 30 dBm to –5 dBm 20 to 30° C	–0.80 dB	(1)________	0.80 dB	±0.19 dB

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies				
Model E4405B		**Report No. __________**		
Serial No. __________		**Date __________**		

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
–5 dBm to –25 dBm				
20 to 30° C	–0.77 dB	(2)________	0.77 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.65 dB	(3)________	0.65 dB	±0.19 dB
–45 dBm to –55 dBm				
20 to 30° C	–0.72 dB	(4)________	0.72 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.86 dB	(5)________	0.86 dB	±0.19 dB
PCS Bands				
30 dBm to –5 dBm				
20 to 30° C	–0.70 dB	(6)________	0.70 dB	±0.19 dB
–5 dBm to –25 dBm				
20 to 30° C	–0.67 dB	(7)________	0.67 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.66 dB	(8)________	0.66 dB	±0.19 dB
–45 dBm to –55 dBm				
20 to 30° C	–0.73 dB	(9)________	0.73 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.87 dB	(10)________	0.87 dB	±0.19 dB
Receive Channel Power Accuracy				
Preamp On	–2.3 dB	(11)________	2.3 dB	± 0.24 dB
Preamp Off	–2.3 dB	(12)________	2.3 dB	± 0.24 dB
P-GSM, E-GSM, and R-GSM Bands				
Transmit Power Accuracy				

Table 3-10 E4405B Performance Verification Test Record

Agilent Technologies

Model E4405B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
Cellular Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.81 dB	(13)________	0.81 dB	±0.19 dB
–20 dBm to –30 dBm				
20 to 30° C	–0.74 dB	(14)________	0.74 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.79 dB	(15)________	0.79 dB	±0.19 dB
–40 dBm to –50 dBm				
20 to 30° C	–0.95 dB	(16)________	0.95 dB	±0.19 dB
–50 dBm to –60 dBm				
20 to 30° C	–1.09 dB	(17)________	1.09 dB	±0.19 dB
DCS 1800 and PCS 1900 Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.68 dB	(18)________	0.68 dB	±0.19 dB
–20 dBm to –30 dBm				
20 to 30° C	–0.61 dB	(19)________	0.61 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.66 dB	(20)________	0.66 dB	±0.19 dB
–40 dBm to –50 dBm				
20 to 30° C	–0.82 dB	(21)________	0.82 dB	±0.19 dB
–50 dBm to –60 dBm				
20 to 30° C	–0.96 dB	(22)________	0.96 dB	±0.19 dB

Agilent E4407B Performance Verification Test Record

Only the tests for E4407B are included in this test record, therefore not all test numbers are included.

Table 3-11 E4407B Performance Verification Test Record

Agilent Technologies			
Address: ________________		Report No. ____________	
________________		Date ____________	
________________			
Model E4407B			
Serial No. ____________		Ambient temperature _______° C	
Options ____________		Power mains line frequency ______ Hz (nominal)	
Firmware Revision ____________		Relative humidity _______%	
Customer ________________		Tested by ________________	
Test Equipment Used:			
Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	________	________	________
Synthesized Sweeper #1	________	________	________
Synthesized Sweeper #2	________	________	________
Function Generator	________	________	________
Power Meter, Dual-Channel	________	________	________
RF Power Sensor #1	________	________	________
RF Power Sensor #2	________	________	________
Microwave Power Sensor	________	________	________
Low-Power Power Sensor	________	________	________
Digital Multimeter	________	________	________
Universal Counter	________	________	________
Frequency Standard	________	________	________
Power Splitter	________	________	________

Table 3-11 E4407B Performance Verification Test Record

50 Ω Termination	___________	___________	___________
1 dB Step Attenuator	___________	___________	___________
10 dB Step Attenuator	___________	___________	___________
6 dB Fixed Attenuator	___________	___________	___________
20 dB Fixed Attenuator *(Option 1DS only)*	___________	___________	___________
Oscilloscope *(Option 1D6 only)*	___________	___________	___________
Microwave Spectrum Analyzer *(Option 1DN only)*	___________	___________	___________
Notes/comments:	___________		

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies

Model E4407B **Report No.** ___________

Serial No. ___________ **Date** ___________

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
1. 10 MHz Reference Output Accuracy (*Non-Option 1D5 only*)				
Settability	–5.0 Hz	(1)________	5.0 Hz	±293.3 μHz
2. 10 MHz Precision Frequency Reference Output Accuracy (*Option 1D5 only*)				
5 Minute Warm-Up Error	–0.1 ppm	(1)________	0.1 ppm	±0.000072 ppm
15 Minute Warm-Up Error	–0.01 ppm	(2)________	0.01 ppm	±0.000070 ppm
4. Frequency Readout and Marker Frequency Accuracy				
Frequency Readout Accuracy				
Center Freq Span				

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ________**		
Serial No. ________		**Date ________**		

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
1500 MHz 20 MHz	1499.83 MHz	(1)________	1500.17 MHz	±0 Hz
1500 MHz 10 MHz	1499.91 MHz	(2)________	1500.09 MHz	±0 Hz
1500 MHz 1 MHz	1499.991 MHz	(3)________	1500.009 MHz	±0 Hz
4000 MHz 20 MHz	3999.83 MHz	(4)________	4000.17 MHz	±0 Hz
4000 MHz 10 MHz	3999.91 MHz	(5)________	4000.09 MHz	±0 Hz
4000 MHz 1 MHz	3999.991 MHz	(6)________	4000.009 MHz	±0 Hz
9000 MHz 20 MHz	8999.83 MHz	(7)________	9000.17 MHz	±0 Hz
9000 MHz 10 MHz	8999.91 MHz	(8)________	9000.09 MHz	±0 Hz
9000 MHz 1 MHz	8999.991 MHz	(9)________	9000.009 MHz	±0 Hz
16000 MHz 20 MHz	15999.83 MHz	(10)________	16000.17 MHz	±0 Hz
16000 MHz 10 MHz	15999.91 MHz	(11)________	16000.09 MHz	±0 Hz
16000 MHz 1 MHz	15999.991 MHz	(12)________	16000.009 MHz	±0 Hz
21000 MHz 20 MHz	20999.83 MHz	(13)________	21000.17 MHz	±0 Hz
21000 MHz 10 MHz	20999.91 MHz	(14)________	21000.09 MHz	±0 Hz
21000 MHz 1 MHz	20999.991 MHz	(15)________	21000.009 MHz	±0 Hz

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Marker Count Accuracy	Note: Enter results in the appropriate section below based upon the firmware revision of the analyzer.			
Firmware Revision Prior to A.03.00				
Center Freq Span				
1500 MHz 10 MHz	1499.999998 MHz	(16)________	1500.000002 MHz	±0 Hz
1500 MHz 1 MHz	1499.999998 MHz	(17)________	1500.000002 MHz	±0 Hz
4000 MHz 10 MHz	3999.999998 MHz	(18)________	4000.000002 MHz	±0 Hz
4000 MHz 1 MHz	3999.999998 MHz	(19)________	4000.000002 MHz	±0 Hz
9000 MHz 10 MHz	8999.999997 MHz	(20)________	9000.000003 MHz	±0 Hz
9000 MHz 1 MHz	8999.999997 MHz	(21)________	9000.000003 MHz	±0 Hz
16000 MHz 10 MHz	15999.999995 MHz	(22)________	16000.000005 MHz	±0 Hz
16000 MHz 1 MHz	20999.999995 MHz	(23)________	21000.000005 MHz	±0 Hz
21000 MHz 10 MHz	20999.999995 MHz	(24)________	21000.000005 MHz	±0 Hz
21000 MHz 1 MHz	20999.999995 MHz	(25)________	21000.000005 MHz	±0 Hz
Firmware Revision A.03.00 or later				
Center Freq Span				
1500 MHz 10 MHz	1499.999999 MHz	(16)________	1500.000001 MHz	±0 Hz

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1500 MHz 1 MHz	1499.999999 MHz	(17)________	1500.000001 MHz	±0 Hz
4000 MHz 10 MHz	3999.999999 MHz	(18)________	4000.000001 MHz	±0 Hz
4000 MHz 1 MHz	3999.999999 MHz	(19)________	4000.000001 MHz	±0 Hz
9000 MHz 10 MHz	8999.999999 MHz	(20)________	9000.000001 MHz	±0 Hz
9000 MHz 1 MHz	8999.999999 MHz	(21)________	9000.000001 MHz	±0 Hz
16000 MHz 10 MHz	15999.999999 MHz	(22)________	16000.000001 MHz	±0 Hz
16000 MHz 1 MHz	20999.999999 MHz	(23)________	21000.000001 MHz	±0 Hz
21000 MHz 10 MHz	20999.999999 MHz	(24)________	21000.000001 MHz	±0 Hz
21000 MHz 1 MHz	20999.999999 MHz	(25)________	21000.000001 MHz	±0 Hz
6. Frequency Span Accuracy				
Span Start Freq				
3000 MHz 0 Hz	2370 MHz	(1)________	2430 MHz	±6.12 MHz
100 MHz 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)________	–90 dBc/Hz	±1.154 dB
20 kHz		(2)________	–98 dBc/Hz	±1.154 dB
30 kHz		(3)________	–100 dBc/Hz	±1.154 dB
100 kHz		(4)________	–112 dBc/Hz	±1.154 dB
8. System-Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)________	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)________	–65 dBc	±1.154 dB
9. Residual FM				
1 kHz Res BW, (*Non-Option 1D5)*		(1)_________	150 Hz	±9.24 Hz
1 kHz Res BW, (*Option 1D5)*		(1)_________	100 Hz	±9.24 Hz
10 Hz Res BW (*Options 1DR and 1D5 only*)		(2)_________	2 Hz	±0.274 Hz
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)________	±1.0%	±0.28%
20 ms	–1.0%	(2)________	±1.0%	±0.28%
100 ms	–1.0%	(3)________	±1.0%	±0.28%
1 s	–1.0%	(4)________	±1.0%	±0.28%
10 s	–1.0%	(5)________	±1.0%	±0.28%
1 ms (*Option AYX only*)	–1.0%	(6)________	±1.0%	±0.28%

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
500 µs (*Option AYX only)*	–1.0%	(7)________	±1.0%	±0.28%
100 µs (*Option AYX only)*	–1.0%	(8)________	±1.0%	±0.28%
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(6)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(14)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(15)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)________	1.10 dB	±0.088 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies

Model E4407B **Report No. ___________**

Serial No. ___________ **Date ___________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB
–64	–0.4 dB	(37)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(38)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)________	0.4 dB	±0.088 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		Report No. ________		
Serial No. ________		Date ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Cumulative Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.34 dB	(43)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(44)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(45)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(46)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(47)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(48)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(49)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(50)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(51)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(52)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(53)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(54)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(55)________	0.82 dB	±0.089 dB
–56	–0.86 dB	(56)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(57)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(58)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(59)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(60)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(61)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(62)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(63)________	1.14 dB	±0.089 dB
–88	–1.18 dB	(64)________	1.18 dB	±0.089 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–92	–1.22 dB	(65)_______	1.22 dB	±0.089 dB
–96	–1.26 dB	(66)_______	1.26 dB	±0.088 dB
–98	–1.28 dB	(67)_______	1.28 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.4 dB	(68)_______	0.4 dB	±0.064 dB
–8	–0.4 dB	(69)_______	0.4 dB	±0.064 dB
–12	–0.4 dB	(70)_______	0.4 dB	±0.064 dB
–16	–0.4 dB	(71)_______	0.4 dB	±0.064 dB
–20	–0.4 dB	(72)_______	0.4 dB	±0.063 dB
–24	–0.4 dB	(73)_______	0.4 dB	±0.064 dB
–28	–0.4 dB	(74)_______	0.4 dB	±0.064 dB
–32	–0.4 dB	(75)_______	0.4 dB	±0.064 dB
–36	–0.4 dB	(76)_______	0.4 dB	±0.064 dB
–40	–0.4 dB	(77)_______	0.4 dB	±0.063 dB
–44	–0.4 dB	(78)_______	0.4 dB	±0.064 dB
–48	–0.4 dB	(79)_______	0.4 dB	±0.064 dB
–52	–0.4 dB	(80)_______	0.4 dB	±0.089 dB
–56	–0.4 dB	(81)_______	0.4 dB	±0.089 dB
–60	–0.4 dB	(82)_______	0.4 dB	±0.088 dB
–64	–0.4 dB	(83)_______	0.4 dB	±0.089 dB
–68	–0.4 dB	(84)_______	0.4 dB	±0.089 dB
–72	–0.4 dB	(85)_______	0.4 dB	±0.089 dB
–76	–0.4 dB	(86)_______	0.4 dB	±0.089 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–80	–0.4 dB	(87)___	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)________	2.0%	±0.064%
–8	–2.0%	(90)________	2.0%	±0.064%
–12	–2.0%	(91)________	2.0%	±0.064%
–16	–2.0%	(92)________	2.0%	±0.064%
–20	–2.0%	(93)________	2.0%	±0.063%
Linear Fidelity, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–2.0%	(94)________	2.0%	±0.064%
–8	–2.0%	(95)________	2.0%	±0.064%
–12	–2.0%	(96)________	2.0%	±0.064%
–16	–2.0%	(97)________	2.0%	±0.064%
–20	–2.0%	(98)________	2.0%	±0.063%
Zero Span, Res BW ≤300 Hz *(Option 1DR only)*				
dB from Ref Level				
–4	–0.36 dB	(99)________	0.36 dB	±0.064 dB
–8	–0.42 dB	(100)________	0.42 dB	±0.064 dB
–12	–0.48 dB	(101)________	0.48 dB	±0.064 dB
–16	–0.54 dB	(102)________	0.54 dB	±0.064 dB
–20	–0.60 dB	(103)________	0.60 dB	±0.063 dB
–24	–0.66 dB	(104)________	0.66 dB	±0.064 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies

Model E4407B **Report No. ___________**

Serial No. ___________ **Date ___________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
–28	–0.72 dB	(105)________	0.72 dB	±0.064 dB
–32	–0.78 dB	(106)________	0.78 dB	±0.064 dB
–36	–0.84 dB	(107)________	0.84 dB	±0.064 dB
–40	–0.90 dB	(108)________	0.90 dB	±0.063 dB
–44	–0.96 dB	(109)________	0.96 dB	±0.064 dB
–48	–1.02 dB	(110)________	1.02 dB	±0.064 dB
–52	–1.08 dB	(111)________	1.08 dB	±0.089 dB
–56	–1.14 dB	(112)________	1.14 dB	±0.089 dB
–60	–1.20 dB	(113)________	1.20 dB	±0.088 dB
–64	–1.5 dB	(114)________	1.5 dB	±0.089 dB
–68	–1.5 dB	(115)________	1.5 dB	±0.089 dB
–70	–1.5 dB	(116)________	1.5 dB	±0.089 dB
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)________	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)________	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)________	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)________	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)________	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)________	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)________	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)________	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)________	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)________	0.60 dB	±0.089 dB
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
65 dB	–0.75 dB	(13)________	0.75 dB	±0.089 dB
14. Reference Level Accuracy				
Log, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(1)________	0.3 dB	±0.144 dB
0	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(6)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(7)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(8)________	0.7 dB	±0.156 dB
Linear, Res BW ≥1 kHz				
Reference Level				
–10	–0.3 dB	(9)________	0.3 dB	±0.144 dB
0	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(12)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(14)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(15)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(16)________	0.7 dB	±0.156 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Log, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(17)________	0.3 dB	±0.144 dB
0	–0.3 dB	(18)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(19)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(20)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(21)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(22)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(23)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(24)________	0.7 dB	±0.156 dB
Linear, Res BW ≤300 Hz *(Option 1DR only)*				
Reference Level				
–10	–0.3 dB	(25)________	0.3 dB	±0.144 dB
0	–0.3 dB	(26)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(27)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(28)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(29)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(30)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(31)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(32)________	0.7 dB	±0.156 dB
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
300 Hz *(Option 1DR only)*	–0.3 dB	(11)________	0.3 dB	±0.064 dB
200 Hz *(Option 1DR only)*	–0.3 dB	(12)________	0.3 dB	±0.064 dB
100 Hz *(Option 1DR only)*	–0.3 dB	(13)________	0.3 dB	±0.064 dB
30 Hz *(Option 1DR only)*	–0.3 dB	(14)________	0.3 dB	±0.064 dB
10 Hz *(Option 1DR only)*	–0.3 dB	(15)________	0.3 dB	±0.064 dB
17. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.34 dB	(1)________	0.34 dB	±0.148 dB
Lin, Preamp Off	–0.34 dB	(2)________	0.34 dB	±0.148 dB
Log, Preamp On	–0.5 dB	(3)________	0.5 dB	±0.148 dB
Lin, Preamp On	–0.5 dB	(4)________	0.5 dB	±0.148 dB
19. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.54 dB	(1)________	0.54 dB	±0.08 dB
–10 dBm input	–0.54 dB	(2)________	0.54 dB	±0.081 dB
–20 dBm input	–0.54 dB	(3)________	0.54 dB	±0.082 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ______**		
Serial No. ______		**Date ______**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–30 dBm input	–0.54 dB	(4)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(5)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(6)________	0.54 dB	±0.086 dB
–20 dBm Reference Level				
–20 dBm input	–0.54 dB	(7)________	0.54 dB	±0.082 dB
–30 dBm input	–0.54 dB	(8)________	0.54 dB	±0.083 dB
–40 dBm input	–0.54 dB	(9)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(10)________	0.54 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.54 dB	(11)________	0.54 dB	±0.084 dB
–50 dBm input	–0.54 dB	(12)________	0.54 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.54 dB	(13)________	0.54 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)________	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)________	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)________	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)________	345 kHz	±2.29 kHz
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
9 kHz	7.65 kHz	(11)________	10.35kHz	±11.5 Hz
23. Frequency Response	Note: Enter data in the appropriate section below depending upon the ambient temperature at which the test was performed.			
20 to 30° C:				
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	1.5 dB	±0.355 dB
Minimum Response	–1.5 dB	(5)________		±0.355 dB
Peak-to-Peak Response		(6)________	2.6 dB	±0.355 dB
Band 2, 6.7 GHz to 13.2 GHz				
Maximum Response		(7)________	2.0 dB	±0.429 dB
Minimum Response	–2.0 dB	(8)________		±0.429 dB
Peak-to-Peak Response		(9)________	3.6 dB	±0.429 dB
Band 3, 13.2 GHz to 25 GHz				
Maximum Response		(10)________	2.0 dB	±0.425 dB
Minimum Response	–2.0 dB	(11)________		±0.425 dB
Peak-to-Peak Response		(12)________	3.6 dB	±0.425 dB
Band 4, 25 GHz to 26.5 GHz				
Maximum Response		(13)________	2.0 dB	±0.428 dB
Minimum Response	–2.0 dB	(14)________		±0.428 dB
Peak-to-Peak Response		(15)________	3.6 dB	±0.428 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
0 to 55° C:				
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	–1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	2.5 dB	±0.355 dB
Minimum Response	–2.5 dB	(5)________		±0.355 dB
Peak-to-Peak Response		(6)________	3.0 dB	±0.355 dB
Band 2, 6.7 GHz to 13.2 GHz				
Maximum Response		(7)________	3.0 dB	±0.429 dB
Minimum Response	–3.0 dB	(8)________		±0.429 dB
Peak-to-Peak Response		(9)________	4.0 dB	±0.429 dB
Band 3, 13.2 GHz to 25 GHz				
Maximum Response		(10)________	3.0 dB	±0.425 dB
Minimum Response	–3.0 dB	(11)________		±0.425 dB
Peak-to-Peak Response		(12)________	4.0 dB	±0.425 dB
Band 4, 25 GHz to 26.5 GHz				
Maximum Response		(13)________	3.0 dB	±0.428 dB
Minimum Response	–3.0 dB	(14)________		±0.428 dB
Peak-to-Peak Response		(15)________	4.0 dB	±0.428 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies

Model E4407B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
26. Frequency Response (Preamp On) (*Option 1DS only)*				
Maximum Response		(1)________	2.0 dB	±0.343 dB
Minimum Response	−2.0 dB	(2)________		±0.343 dB
Peak-to-Peak Response		(3)________	4.0 dB	±0.343 dB
28. Other Input-Related Spurious Responses				
Center Freq Input Freq				
2.0 GHz 2042.8 MHz		(1)________	−65 dBc	±1.14 dB
2.0 GHz 2642.8 MHz		(2)________	−65 dBc	±1.14 dB
2.0 GHz 1820.8 MHz		(3)________	−65 dBc	±1.14 dB
2.0 GHz 278.5 MHz		(4)________	−65 dBc	±1.14 dB
2.0 GHz 5600.0 MHz		(5)________	−80 dBc	±1.14 dB
2.0 GHz 6242.8 MHz		(6)________	−80 dBc	±1.14 dB
4.0 GHz 4042.8 MHz		(7)________	−65 dBc	±1.14 dB
4.0 GHz 4642.8 MHz		(8)________	−65 dBc	±1.14 dB
4.0 GHz 3742.9 MHz		(9)________	−65 dBc	±1.14 dB
4.0 GHz 2242.8 MHz		(10)________	−80 dBc	±1.14 dB
9.0 GHz 9042.8 MHz		(11)________	−65 dBc	±1.14 dB
9.0 GHz 9642.8 MHz		(12)________	−65 dBc	±1.14 dB
9.0 GHz 9342.8 MHz		(13)________	−65 dBc	±1.14 dB
9.0 GHz 4982.1 MHz		(14)________	−80 dBc	±1.14 dB
15.0 GHz 15042.8 MHz		(15)________	−65 dBc	±1.14 dB
15.0 GHz 15642.8 MHz		(16)________	−65 dBc	±1.14 dB
15.0 GHz 18830.35 MHz		(17)________	−65 dBc	±1.14 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		Report No. ________		
Serial No. ________		Date ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
15.0 GHz 4151.75 MHz		(18)________	–80 dBc	±1.14 dB
21.0 GHz 21042.8 MHz		(19)________	–65 dBc	±1.14 dB
21.0 GHz 21642.8 MHz		(20)________	–65 dBc	±1.14 dB
21.0 GHz 21342.8 MHz		(21)________	–65 dBc	±1.14 dB
21.0 GHz 5008.95 MHz		(22)________	–80 dBc	±1.14 dB
31. Spurious Responses				
300 MHz TOI, 1 kHz RBW	11 dBm	(1)________		±0.49 dB
300 MHz TOI, 30 Hz RBW (*Option 1DR only*)	11 dBm	(2)________		±0.49 dB
5 GHz TOI	11 dBm	(3)________		±0.589 dB
8 GHz TOI	7.5 dBm	(4)________		±0.589 dB
300 MHz SHI	35 dBm	(5)________		±0.90 dB
900 MHz SHI	45 dBm	(6)________		±0.90 dB
1.55 GHz SHI	75 dBm	(7)________		±0.90 dB
3.1 GHz SHI	90 dBm	(8)________		±0.90 dB
33. Gain Compression				
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
50.004 MHz (*Option 1DR only*)		(2)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
2503 MHz		(4)________	1.0 dB	±0.144 dB
4403 MHz		(5)________	1.0 dB	±0.201 dB
7603 MHz		(6)________	1.0 dB	±0.201 dB
14003 MHz		(7)________	1.0 dB	±0.201 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
37. Displayed Average Noise Level	Note: Enter results with preamp on in the appropriate section based upon the ambient temperature when the test was performed.			
1 kHz RBW, Preamp Off:				
10 MHz to 1 GHz		(1)________	–116 dBm	±1.82 dB
1 GHz to 2 GHz		(2)________	–115 dBm	±1.82 dB
2 GHz to 3 GHz		(3)________	–112 dBm	±1.82 dB
3 GHz to 6 GHz		(4)________	–112 dBm	±1.82 dB
6 GHz to 12 GHz		(5)________	–110 dBm	±1.82 dB
12 GHz to 22 GHz		(6)________	–107 dBm	±1.82 dB
22 GHz to 26.5 GHz		(7)________	–101 dBm	±1.82 dB
1kHz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(8)________	–131 dBm	±1.82 dB
1 GHz to 2 GHz		(9)________	–129 dBm	±1.82 dB
2 GHz to 3 GHz		(10)________	–127 dBm	±1.82 dB
10 Hz RBW, Preamp Off:				
10 MHz to 1 GHz		(11)________	–135 dBm	±1.82 dB
1 GHz to 2 GHz		(12)________	–134 dBm	±1.82 dB
2 GHz to 3 GHz		(13)________	–131 dBm	±1.82 dB
3 GHz to 6 GHz		(14)________	–131 dBm	±1.82 dB
6 GHz to 12 GHz		(15)________	–129 dBm	±1.82 dB
12 GHz to 22 GHz		(16)________	–126 dBm	±1.82 dB
22 GHz to 26.5 GHz		(17)________	–120 dBm	±1.82 dB
10 Hz RBW, Preamp On, 0 to 55° C:				
10 MHz to 1 GHz		(18)________	–149 dBm	±1.82 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1 GHz to 2 GHz		(19)________	–147 dBm	±1.82 dB
2 GHz to 3 GHz		(20)________	–145 dBm	±1.82 dB
1kHz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(21)________	–132 dBm	±1.82 dB
1 GHz to 2 GHz		(22)________	–131 dBm	±1.82 dB
2 GHz to 3 GHz		(23)________	–130 dBm	±1.82 dB
10 Hz RBW, Preamp On, 20 to 30° C:				
10 MHz to 1 GHz		(24)________	–150 dBm	±1.82 dB
1 GHz to 2 GHz		(25)________	–149 dBm	±1.82 dB
2 GHz to 3 GHz		(26)________	–148 dBm	±1.82 dB
38. Residual Responses				
150 kHz to 6.7 GHz		(1)________	–90 dBm	±0.93 dB
39. Fast Time Domain Amplitude Accuracy *(Option AYX only)*				
Amplitude Error	–0.3%	(1)________	0.3%	±0.029%
41. Tracking Generator Absolute Amplitude and Vernier Accuracy				
Absolute Amplitude Accuracy	–0.75 dB	(1)________	0.75 dB	±0.087 dB
Vernier Accuracy, –2 dB	–0.4 dB	(2)________	0.4 dB	±0.11 dB
Vernier Accuracy, –3 dB	–0.5 dB	(3)________	0.5 dB	±0.16 dB
Vernier Accuracy, –5 dB	–0.5 dB	(4)________	0.5 dB	±0.16 dB
Vernier Accuracy, –6 dB	–0.5 dB	(5)________	0.5 dB	±0.16 dB
Vernier Accuracy, –7 dB	–0.5 dB	(6)________	0.5 dB	±0.16 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies

Model E4407B **Report No.** ___________

Serial No. ___________ **Date** ___________

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
Vernier Accuracy, –8 dB	–0.5 dB	(7)________	0.5 dB	±0.16 dB
Vernier Accuracy, –9 dB	–0.5 dB	(8)________	0.5 dB	±0.16 dB
Vernier Accuracy, –10 dB	–0.5 dB	(9)________	0.5 dB	±0.16 dB
43. Tracking Generator Output Level Flatness				
Positive Level Flatness, <1 MHz		(1)________	3.0 dB	±0.255 dB
Negative Level Flatness, <1 MHz	–3.0 dB	(2)________		±0.255 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	3.0 dB	±0.145 dB
Negative Level Flatness, 1 MHz to 10 MHz	–3.0 dB	(4)________		±0.145 dB
Positive Level Flatness, >10 MHz to 1.5 GHz		(5)________	2.0 dB	±0.122 dB
Negative Level Flatness, >10 MHz to 1.5 GHz	–2.0 dB	(6)________		±0.122 dB
Positive Level Flatness, >1.5 GHz		(7)________	2.0 dB	±0.172 dB
Negative Level Flatness, >1.5 GHz	–2.0 dB	(8)________		±0.172 dB
45. Tracking Generator Harmonic Spurious Outputs *(Option 1DN only)*				
2nd Harmonic, <20 kHz		(1)________	–15 dBc	±2.6 dB
2nd Harmonic, ≥20 kHz		(2)________	–25 dBc	±2.6 dB
3rd Harmonic, <20 kHz		(3)________	–15 dBc	±2.6 dB
3rd Harmonic, ≥20 kHz		(4)________	–25 dBc	±2.6 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
47. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN only)*				
Highest Non-Harmonic Spurious Output Amplitude, 9 kHz to 2 GHz		(1)________	–27 dBc	±2.67 dB
Highest Non-Harmonic Spurious Output Amplitude, 2 GHz to 3 GHz		(2)________	–23 dBc	±3.12 dB
48. Tracking Generator LO Feedthrough Amplitude *(Option 1DN only)*				
9 kHz to 2.9 GHz		(1)________	–16 dBm	±1.94 dB
2.9 GHz to 3.0 GHz		(2)________	–16 dBm	±2.49 dB
49. Gate Delay and Gate Length Accuracy *(Option 1D6 only)*				
Minimum Gate Delay	499.9 ns	(1)________	1.5001µs	±475 ps
Maximum Gate Delay	499.9 ns	(2)________	1.5001µs	±475 ps
1 µs Gate Length	499.9 ns	(3)________	1.5001µs	±450 ps
65 ms Gate Length	64.993ms	(4)________	65.007ms	±561 ns
50. Gate Mode Amplitude Error *(Option 1D6 only)*				
Amplitude Error	–0.2 dB	(1)________	0.2 dB	±0.023 dB
51. First LO Output Amplitude Accuracy *(Option AYZ only)* 20 to 30° C	Note: Enter data in the appropriate section based upon the ambient temperature at which the test was performed.			
First LO Frequency				
2.9 GHz	15.5 dBm	(1)________	17.0 dBm	±0.357 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		Report No. ________		
Serial No. ________		Date ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
3.1 GHz	15.5 dBm	(2)________	17.0 dBm	±0.357 dB
3.3 GHz	15.5 dBm	(3)________	17.0 dBm	±0.357 dB
3.5 GHz	15.5 dBm	(4)________	17.0 dBm	±0.357 dB
3.7 GHz	15.5 dBm	(5)________	17.0 dBm	±0.357 dB
3.9 GHz	15.5 dBm	(6)________	17.0 dBm	±0.357 dB
4.1 GHz	15.5 dBm	(7)________	17.0 dBm	±0.357 dB
4.3 GHz	15.5 dBm	(8)________	17.0 dBm	±0.357 dB
4.5 GHz	15.5 dBm	(9)________	17.0 dBm	±0.357 dB
4.7 GHz	15.5 dBm	(10)________	17.0 dBm	±0.357 dB
4.9 GHz	15.5 dBm	(11)________	17.0 dBm	±0.357 dB
5.1 GHz	15.5 dBm	(12)________	17.0 dBm	±0.357 dB
5.3 GHz	15.5 dBm	(13)________	17.0 dBm	±0.357 dB
5.5 GHz	15.5 dBm	(14)________	17.0 dBm	±0.357 dB
5.7 GHz	15.5 dBm	(15)________	17.0 dBm	±0.357 dB
5.9 GHz	15.5 dBm	(16)________	17.0 dBm	±0.357 dB
6.1 GHz	15.5 dBm	(17)________	17.0 dBm	±0.357 dB
6.3 GHz	13.0 dBm	(18)________	17.5 dBm	±0.357 dB
6.5 GHz	13.0 dBm	(19)________	17.5 dBm	±0.357 dB
6.7 GHz	13.0 dBm	(20)________	17.5 dBm	±0.357 dB
6.9 GHz	13.0 dBm	(21)________	17.5 dBm	±0.357 dB
7.1 GHz	13.0 dBm	(22)________	17.5 dBm	±0.357 dB
0 to 55° C First LO Frequency				
2.9 GHz	15.0 dBm	(1)________	17.5 dBm	±0.357 dB
3.1 GHz	15.0 dBm	(2)________	17.5 dBm	±0.357 dB
3.3 GHz	15.0 dBm	(3)________	17.5 dBm	±0.357 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
3.5 GHz	15.0 dBm	(4)________	17.5 dBm	±0.357 dB
3.7 GHz	15.0 dBm	(5)________	17.5 dBm	±0.357 dB
3.9 GHz	15.0 dBm	(6)________	17.5 dBm	±0.357 dB
4.1 GHz	15.0 dBm	(7)________	17.5 dBm	±0.357 dB
4.3 GHz	15.0 dBm	(8)________	17.5 dBm	±0.357 dB
4.5 GHz	15.0 dBm	(9)________	17.5 dBm	±0.357 dB
4.7 GHz	15.0 dBm	(10)________	17.5 dBm	±0.357 dB
4.9 GHz	15.0 dBm	(11)________	17.5 dBm	±0.357 dB
5.1 GHz	15.0 dBm	(12)________	17.5 dBm	±0.357 dB
5.3 GHz	15.0 dBm	(13)________	17.5 dBm	±0.357 dB
5.5 GHz	15.0 dBm	(14)________	17.5 dBm	±0.357 dB
5.7 GHz	15.0 dBm	(15)________	17.5 dBm	±0.357 dB
5.9 GHz	15.0 dBm	(16)________	17.5 dBm	±0.357 dB
6.1 GHz	15.0 dBm	(17)________	17.5 dBm	±0.357 dB
6.3 GHz	13.0 dBm	(18)________	17.5 dBm	±0.357 dB
6.5 GHz	13.0 dBm	(19)________	17.5 dBm	±0.357 dB
6.7 GHz	13.0 dBm	(20)________	17.5 dBm	±0.357 dB
6.9 GHz	13.0 dBm	(21)________	17.5 dBm	±0.357 dB
7.1 GHz	13.0 dBm	(22)________	17.5 dBm	±0.357 dB
52. IF Input Accuracy, *(Option AYZ only)*	Note: Enter data in the appropriate section below depending upon the ambient temperature at which the test was performed.			
20 to 30° C:				
IF Input Accuracy	–1.0 dB	(1)________	1.0 dBm	±0.23 dB
0 to 50° C:				
IF Input Accuracy	–1.5 dB	(1)________	1.5 dBm	±0.23 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
55. cdmaOne Modulation Accuracy (Rho) *(Option BAC only)*				
	–0.0015 dB	(1)________	0.0015 dB	
56. cdmaOne Modulation Accuracy - EVM *(Option BAC only)*				
	–0.80%	(1)________	0.80%	
57. cdmaOne Code Domain Power *(Option BAC only)*				
	–0.20 dB	(1)________	0.20 dB	
58. GSM Phase and Frequency Accuracy *(Option BAH and B7E)*				
Peak	–2.1 Deg	(1)________	2.1 Deg	
RMS (Avg >10)	–1.1 Deg	(2)________	2.1 Deg	
59. Comms Absolute Accuracy *(Options BAC or BAH)*				
cdmaOne *(Option BAC only)*				
Channel Power Accuracy (Option BAC only)				
Cellular Bands				
30 dBm to –5 dBm				
20 to 30° C	–0.80 dB	(1)________	0.80 dB	±0.19 dB
–5 dBm to –25 dBm				
20 to 30° C	–0.77 dB	(2)________	0.77 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.65 dB	(3)________	0.65 dB	±0.19 dB

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–45 dBm to –55 dBm				
20 to 30° C	–0.72 dB	(4)________	0.72 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.86 dB	(5)________	0.86 dB	±0.19 dB
PCS Bands				
30 dBm to –5 dBm				
20 to 30° C	–0.70 dB	(6)________	0.70 dB	±0.19 dB
–5 dBm to –25 dBm				
20 to 30° C	–0.67 dB	(7)________	0.67 dB	±0.19 dB
–25 dBm to –45 dBm				
20 to 30° C	–0.66 dB	(8)________	0.66 dB	±0.19 dB
–45 dBm to –55 dBm				
20 to 30° C	–0.73 dB	(9)________	0.73 dB	±0.19 dB
–55 dBm to –70 dBm				
20 to 30° C	–0.87 dB	(10)________	0.87 dB	±0.19 dB
Receive Channel Power Accuracy				
Preamp On	–2.3 dB	(11)________	2.3 dB	± 0.24 dB
Preamp Off	–2.3 dB	(12)________	2.3 dB	± 0.24 dB
P-GSM, E-GSM, and R-GSM Bands				
Transmit Power Accuracy				
Cellular Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.81 dB	(13)________	0.81 dB	±0.19 dB
–20 dBm to –30 dBm				

Table 3-12 E4407B Performance Verification Test Record

Agilent Technologies				
Model E4407B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
20 to 30° C	–0.74 dB	(14)________	0.74 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.79 dB	(15)________	0.79 dB	±0.19 dB
–40 dBm to –50 dBm				
20 to 30° C	–0.95 dB	(16)________	0.95 dB	±0.19 dB
–50 dBm to –60 dBm				
20 to 30° C	–1.09 dB	(17)________	1.09 dB	±0.19 dB
DCS 1800 and PCS 1900 Bands				
30 dBm to –20 dBm				
20 to 30° C	–0.68 dB	(18)________	0.68 dB	±0.19 dB
–20 dBm to –30 dBm				
20 to 30° C	–0.61 dB	(19)________	0.61 dB	±0.19 dB
–30 dBm to –40 dBm				
20 to 30° C	–0.66 dB	(20)________	0.66 dB	±0.19 dB
–40 dBm to –50 dBm				
20 to 30° C	–0.82 dB	(21)________	0.82 dB	±0.19 dB
–50 dBm to –60 dBm				
20 to 30° C	–0.96 dB	(22)________	0.96 dB	±0.19 dB

Agilent E4408B Performance Verification Test Record

Only the tests for E4408B are included in this test record, therefore not all test numbers a re included.

Table 3-13 E4408B Performance Verification Test Record

Agilent Technologies			
Address: ______________________		Report No. ______________	
______________________		Date ______________	
______________________			
Model E4408B			
Serial No. ______________		Ambient temperature _______° C	
Options ______________		Power mains line frequency ______ Hz (nominal)	
Firmware Revision __________		Relative humidity _______%	
Customer ______________________		Tested by ______________________	
Test Equipment Used:			
Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	________	________	________
Synthesized Sweeper #1	________	________	________
Synthesized Sweeper #2	________	________	________
Function Generator	________	________	________
Power Meter, Dual-Channel	________	________	________
RF Power Sensor #1	________	________	________
RF Power Sensor #2	________	________	________
Microwave Power Sensor	________	________	________
Low-Power Power Sensor	________	________	________
Digital Multimeter	________	________	________
Universal Counter	________	________	________
Frequency Standard	________	________	________
Power Splitter	________	________	________
50 Ω Termination	________	________	________

Table 3-13 E4408B Performance Verification Test Record

1 dB Step Attenuator	___________	___________	___________
10 dB Step Attenuator	___________	___________	___________
6 dB Fixed Attenuator	___________	___________	___________
Microwave Spectrum Analyzer *(Option 1DN only)*	___________	___________	___________
Notes/comments:	___________________________________		
	___________________________________		

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies

Model E4408B **Report No. ___________**

Serial No. ___________ **Date ___________**

Test Description			Minimum	Results Measured	Maximum	Measurement Uncertainty
1.	**10 MHz Reference Output Accuracy**					
	Settability		–5.0 Hz	(1)________	5.0 Hz	±293.3 μHz
4.	**Frequency Readout Accuracy and Marker Count Accuracy**					
	Frequency Readout Accuracy					
	Center Freq	Span				
	1500 MHz	20 MHz	1499.83 MHz	(1)________	1500.17 MHz	±0 Hz
	1500 MHz	10 MHz	1499.91 MHz	(2)________	1500.09 MHz	±0 Hz
	1500 MHz	1 MHz	1499.991 MHz	(3)________	1500.009 MHz	±0 Hz
	4000 MHz	20 MHz	3999.83 MHz	(4)________	4000.17 MHz	±0 Hz
	4000 MHz	10 MHz	3999.91 MHz	(5)________	4000.09 MHz	±0 Hz
	4000 MHz	1 MHz	3999.991 MHz	(6)________	4000.009 MHz	±0 Hz
	9000 MHz	20 MHz	8999.83 MHz	(7)________	9000.17 MHz	±0 Hz
	9000 MHz	10 MHz	8999.91 MHz	(8)________	9000.09 MHz	±0 Hz
	9000 MHz	1 MHz	8999.991 MHz	(9)________	9000.009 MHz	±0 Hz

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B	**Report No. __________**			
Serial No. __________	**Date __________**			

Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
16000 MHz 20 MHz	15999.83 MHz	(10)________	16000.17 MHz	±0 Hz
16000 MHz 10 MHz	15999.91 MHz	(11)________	16000.09 MHz	±0 Hz
16000 MHz 1 MHz	15999.991 MHz	(12)________	16000.009 MHz	±0 Hz
21000 MHz 20 MHz	20999.83 MHz	(13)________	21000.17 MHz	±0 Hz
21000 MHz 10 MHz	20999.91 MHz	(14)________	21000.09 MHz	±0 Hz
21000 MHz 1 MHz	20999.991 MHz	(15)________	21000.009 MHz	±0 Hz
Marker Count Accuracy	Note: Enter results in the appropriate section below based upon the firmware revision of the analyzer.			
Firmware Revision Prior to A.03.00				
Center Freq Span				
1500 MHz 10 MHz	1499.999998 MHz	(16)________	1500.000002 MHz	±0 Hz
1500 MHz 1 MHz	1499.999998 MHz	(17)________	1500.000002 MHz	±0 Hz
4000 MHz 10 MHz	3999.999998 MHz	(18)________	4000.000002 MHz	±0 Hz
4000 MHz 1 MHz	3999.999998 MHz	(19)________	4000.000002 MHz	±0 Hz
9000 MHz 10 MHz	8999.999997 MHz	(20)________	9000.000003 MHz	±0 Hz
9000 MHz 1 MHz	8999.999997 MHz	(21)________	9000.000003 MHz	±0 Hz
16000 MHz 10 MHz	15999.999995 MHz	(22)________	16000.000005 MHz	±0 Hz

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
16000 MHz 1 MHz	20999.999995 MHz	(23)________	21000.000005 MHz	±0 Hz
21000 MHz 10 MHz	20999.999995 MHz	(24)________	21000.000005 MHz	±0 Hz
21000 MHz 1 MHz	20999.999995 MHz	(25)________	21000.000005 MHz	±0 Hz
Firmware Revision A.03.00 or later				
Center Freq Span				
1500 MHz 10 MHz	1499.999999 MHz	(16)________	1500.000001 MHz	±0 Hz
1500 MHz 1 MHz	1499.999999 MHz	(17)________	1500.000001 MHz	±0 Hz
4000 MHz 10 MHz	3999.999999 MHz	(18)________	4000.000001 MHz	±0 Hz
4000 MHz 1 MHz	3999.999999 MHz	(19)________	4000.000001 MHz	±0 Hz
9000 MHz 10 MHz	8999.999999 MHz	(20)________	9000.000001 MHz	±0 Hz
9000 MHz 1 MHz	8999.999999 MHz	(21)________	9000.000001 MHz	±0 Hz
16000 MHz 10 MHz	15999.999999 MHz	(22)________	16000.000001 MHz	±0 Hz
16000 MHz 1 MHz	20999.999999 MHz	(23)________	21000.000001 MHz	±0 Hz
21000 MHz 10 MHz	20999.999999 MHz	(24)________	21000.000001 MHz	±0 Hz
21000 MHz 1 MHz	20999.999999 MHz	(25)________	21000.000001 MHz	±0 Hz

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
6. Frequency Span Readout Accuracy				
Span / Start Freq				
3000 MHz / 0 Hz	2370 MHz	(1)________	2430 MHz	±6.12 MHz
100 MHz / 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz / 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz / 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz / 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz / 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz / 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)________	–90 dBc/Hz	±1.154 dB
20 kHz		(2)________	–98 dBc/Hz	±1.154 dB
30 kHz		(3)________	–100 dBc/Hz	±1.154 dB
100 kHz		(4)________	–112 dBc/Hz	±1.154 dB
8. System Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)________	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)________	–65 dBc	±1.154 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
9. Residual FM				
1 kHz Res BW		(1)________	150 Hz	±9.24 Hz
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)________	±1.0%	±0.28%
20 ms	–1.0%	(2)________	±1.0%	±0.28%
100 ms	–1.0%	(3)________	±1.0%	±0.28%
1 s	–1.0%	(4)________	±1.0%	±0.28%
10 s	–1.0%	(5)________	±1.0%	±0.28%
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(6)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)________	0.82 dB	±0.089 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		Report No. ________		
Serial No. ________		Date ________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–56	–0.86 dB	(14)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(15)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–64	–0.4 dB	(37)________	0.4 dB	±0.089 dB
–68	–0.4 dB	(38)________	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)________	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)________	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)________	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)________	2.0%	±0.064%
–8	–2.0%	(90)________	2.0%	±0.064%
–12	–2.0%	(91)________	2.0%	±0.064%
–16	–2.0%	(92)________	2.0%	±0.064%
–20	–2.0%	(93)________	2.0%	±0.063%
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)________	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)________	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)________	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)________	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)________	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)________	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)________	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)________	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)________	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)________	0.60 dB	±0.089 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies

Model E4408B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
65 dB	–0.75 dB	(13)________	0.75 dB	±0.089 dB
14. Reference Level Accuracy				
Log				
Reference Level				
–10	–0.3 dB	(1)________	0.3 dB	±0.144 dB
0	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(6)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(7)________	0.5 dB	±0.156 dB
–80	–0.7 dB	(8)________	0.7 dB	±0.156 dB
Linear				
Reference Level				
–10	–0.3 dB	(9)________	0.3 dB	±0.144 dB
0	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–30	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–40	–0.3 dB	(12)________	0.3 dB	±0.144 dB
–50	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–60	–0.5 dB	(14)________	0.5 dB	±0.156 dB
–70	–0.5 dB	(15)________	0.5 dB	±0.156 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–80	–0.7 dB	(16)________	0.7 dB	±0.156 dB
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
17. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.4 dB	(1)________	0.4 dB	±0.148 dB
Lin, Preamp Off	–0.4 dB	(2)________	0.4 dB	±0.148 dB
19. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.6 dB	(1)________	0.6 dB	±0.08 dB
–10 dBm input	–0.6 dB	(2)________	0.6 dB	±0.081 dB
–20 dBm input	–0.6 dB	(3)________	0.6 dB	±0.082 dB
–30 dBm input	–0.6 dB	(4)________	0.6 dB	±0.083 dB
–40 dBm input	–0.6 dB	(5)________	0.6 dB	±0.084 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–50 dBm input	–0.6 dB	(6)________	0.6 dB	±0.086 dB
–20 dBm Reference Level				
–20 dBm input	–0.6 dB	(7)________	0.6 dB	±0.082 dB
–30 dBm input	–0.6 dB	(8)________	0.6 dB	±0.083 dB
–40 dBm input	–0.6 dB	(9)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(10)________	0.6 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.6 dB	(11)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(12)________	0.6 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.6 dB	(13)________	0.6 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)________	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)________	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)________	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)________	345 kHz	±2.29 kHz
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz
9 kHz	7.65 kHz	(11)________	10.35kHz	±11.5 Hz

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
24. Frequency Response	Note: Enter data in the appropriate section below depending upon the ambient temperature at which the test was performed.			
20 to 30° C:				
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	1.5 dB	±0.355 dB
Minimum Response	–1.5 dB	(5)________		±0.355 dB
Peak-to-Peak Response		(6)________	2.6 dB	±0.355 dB
Band 2, 6.7 GHz to 13.2 GHz				
Maximum Response		(7)________	2.0 dB	±0.429 dB
Minimum Response	–2.0 dB	(8)________		±0.429 dB
Peak-to-Peak Response		(9)________	3.6 dB	±0.429 dB
Band 3, 13.2 GHz to 25 GHz				
Maximum Response		(10)________	2.0 dB	±0.425 dB
Minimum Response	–2.0 dB	(11)________		±0.425 dB
Peak-to-Peak Response		(12)________	3.6 dB	±0.425 dB
Band 4, 25 GHz to 26.5 GHz				
Maximum Response		(13)________	2.0 dB	±0.428 dB
Minimum Response	–2.0 dB	(14)________		±0.428 dB
Peak-to-Peak Response		(15)________	3.6 dB	±0.428 dB
0 to 55° C:				

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies

Model E4408B **Report No. __________**

Serial No. __________ **Date __________**

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
Band 0, 9 kHz to 3 GHz				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	–1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
Band 1, 3 GHz to 6.7 GHz				
Maximum Response		(4)________	2.5 dB	±0.355 dB
Minimum Response	–2.5 dB	(5)________		±0.355 dB
Peak-to-Peak Response		(6)________	3.0 dB	±0.355 dB
Band 2, 6.7 GHz to 13.2 GHz				
Maximum Response		(7)________	3.0 dB	±0.429 dB
Minimum Response	–3.0 dB	(8)________		±0.429 dB
Peak-to-Peak Response		(9)________	4.0 dB	±0.429 dB
Band 3, 13.2 GHz to 25 GHz				
Maximum Response		(10)________	3.0 dB	±0.425 dB
Minimum Response	–3.0 dB	(11)________		±0.425 dB
Peak-to-Peak Response		(12)________	4.0 dB	±0.425 dB
Band 4, 25 GHz to 26.5 GHz				
Maximum Response		(13)________	3.0 dB	±0.428 dB
Minimum Response	–3.0 dB	(14)________		±0.428 dB
Peak-to-Peak Response		(15)________	4.0 dB	±0.428 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
28. Other Input Related Spurious Responses				
Center Freq Input Freq				
2.0 GHz 2042.8 MHz		(1)________	−65 dBc	±1.14 dB
2.0 GHz 2642.8 MHz		(2)________	−65 dBc	±1.14 dB
2.0 GHz 1820.8 MHz		(3)________	−65 dBc	±1.14 dB
2.0 GHz 278.5 MHz		(4)________	−65 dBc	±1.14 dB
2.0 GHz 5600.0 MHz		(5)________	−80 dBc	±1.14 dB
2.0 GHz 6242.8 MHz		(6)________	−80 dBc	±1.14 dB
4.0 GHz 4042.8 MHz		(7)________	−65 dBc	±1.14 dB
4.0 GHz 4642.8 MHz		(8)________	−65 dBc	±1.14 dB
4.0 GHz 3742.9 MHz		(9)________	−65 dBc	±1.14 dB
4.0 GHz 2242.8 MHz		(10)________	−80 dBc	±1.14 dB
9.0 GHz 9042.8 MHz		(11)________	−65 dBc	±1.14 dB
9.0 GHz 9642.8 MHz		(12)________	−65 dBc	±1.14 dB
9.0 GHz 9342.8 MHz		(13)________	−65 dBc	±1.14 dB
9.0 GHz 4982.1 MHz		(14)________	−80 dBc	±1.14 dB
15.0 GHz 15042.8 MHz		(15)________	−65 dBc	±1.14 dB
15.0 GHz 15642.8 MHz		(16)________	−65 dBc	±1.14 dB
15.0 GHz 18830.35 MHz		(17)________	−65 dBc	±1.14 dB
15.0 GHz 4151.75 MHz		(18)________	−80 dBc	±1.14 dB
21.0 GHz 21042.8 MHz		(19)________	−65 dBc	±1.14 dB
21.0 GHz 21642.8 MHz		(20)________	−65 dBc	±1.14 dB
21.0 GHz 21342.8 MHz		(21)________	−65 dBc	±1.14 dB
21.0 GHz 5008.95 MHz		(22)________	−80 dBc	±1.14 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
32. Spurious Responses	Note: TR Entry 2 does not apply to the E4408B.			
300 MHz TOI	7.5 dBm	(1)________		±0.49 dB
5 GHz TOI	7.5 dBm	(3)________		±0.589 dB
8 GHz TOI	5 dBm	(4)________		±0.589 dB
300 MHz SHI	30 dBm	(5)________		±0.90 dB
900 MHz SHI	40 dBm	(6)________		±0.90 dB
1.55 GHz SHI	70 dBm	(7)________		±0.90 dB
3.1 GHz SHI	85 dBm	(8)________		±0.90 dB
33. Gain Compression	Note: TR Entry 2 does not apply to the E4408B.			
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
2503 MHz		(4)________	1.0 dB	±0.144 dB
4403 MHz		(5)________	1.0 dB	±0.201 dB
7603 MHz		(6)________	1.0 dB	±0.201 dB
14003 MHz		(7)________	1.0 dB	±0.201 dB
37. Displayed Average Noise Level				
10 MHz to 1 GHz		(1)________	–116 dBm	±1.82 dB
1 GHz to 2 GHz		(2)________	–115 dBm	±1.82 dB
2 GHz to 3 GHz		(3)________	–112 dBm	±1.82 dB
3 GHz to 6 GHz		(4)________	–112 dBm	±1.82 dB
6 GHz to 12 GHz		(5)________	–110 dBm	±1.82 dB
12 GHz to 22 GHz		(6)________	–107 dBm	±1.82 dB
22 GHz to 26.5 GHz		(7)________	–101 dBm	±1.82 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
38. Residual Responses				
150 kHz to 6.7 GHz		(1)________	–90 dBm	±0.93 dB
41. Tracking Generator Absolute Amplitude and Vernier Accuracy				
Absolute Amplitude Accuracy	–0.75 dB	(1)________	0.75 dB	±0.087 dB
Vernier Accuracy, –2 dB	–0.4 dB	(2)________	0.4 dB	±0.11 dB
Vernier Accuracy, –3 dB	–0.5 dB	(3)________	0.5 dB	±0.16 dB
Vernier Accuracy, –5 dB	–0.5 dB	(4)________	0.5 dB	±0.16 dB
Vernier Accuracy, –6 dB	–0.5 dB	(5)________	0.5 dB	±0.16 dB
Vernier Accuracy, –7 dB	–0.5 dB	(6)________	0.5 dB	±0.16 dB
Vernier Accuracy, –8 dB	–0.5 dB	(7)________	0.5 dB	±0.16 dB
Vernier Accuracy, –9 dB	–0.5 dB	(8)________	0.5 dB	±0.16 dB
Vernier Accuracy, –10 dB	–0.5 dB	(9)________	0.5 dB	±0.16 dB
43. Tracking Generator Level Flatness				
Positive Level Flatness, <1 MHz		(1)________	3.0 dB	±0.255 dB
Negative Level Flatness, <1 MHz	–3.0 dB	(2)________		±0.255 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	3.0 dB	±0.145 dB
Negative Level Flatness, 1 MHz to 10 MHz	–3.0 dB	(4)________		±0.145 dB
Positive Level Flatness, >10 MHz to 1.5 GHz		(5)________	2.0 dB	±0.122 dB
Negative Level Flatness, >10 MHz to 1.5 GHz	–2.0 dB	(6)________		±0.122 dB

Table 3-14 E4408B Performance Verification Test Record

Agilent Technologies				
Model E4408B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Positive Level Flatness, >1.5 GHz		(7)________	2.0 dB	±0.172 dB
Negative Level Flatness, >1.5 GHz	–2.0 dB	(8)________		±0.172 dB
45. Tracking Generator Harmonic Spurious Outputs *(Option 1DN only)*				
2^{nd} Harmonic, <20 kHz		(1)________	–15 dBc	±2.6 dB
2^{nd} Harmonic, ≥20 kHz		(2)________	–25 dBc	±2.6 dB
3^{rd} Harmonic, <20 kHz		(3)________	–15 dBc	±2.6 dB
3^{rd} Harmonic, ≥20 kHz		(4)________	–25 dBc	±2.6 dB
47. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN only)*				
Highest Non-Harmonic Spurious Output Amplitude, 9 kHz to 2 GHz		(1)________	–27 dBc	±2.67 dB
Highest Non-Harmonic Spurious Output Amplitude, 2 GHz to 3 GHz		(2)________	–23 dBc	±3.12 dB
48. Tracking Generator LO Feedthrough Amplitude *(Option 1DN only)*				
9 kHz to 2.9 GHz		(1)________	–16 dBm	±1.94 dB
2.9 GHz to 3.0 GHz		(2)________	–16 dBm	±2.49 dB

Agilent E4411B Performance Verification Test Record

Only the tests for E4411B are included in this test record, therefore not all test numbers are included.

Table 3-15 E4411B Performance Verification Test Record

Agilent Technologies			
Address: ______________________		Report No. ______________	
______________________		Date ______________	
______________________			
Model E4411B			
Serial No. ______________		Ambient temperature _______° C	
Options ______________		Power mains line frequency ______ Hz (nominal)	
Firmware Revision __________		Relative humidity _______%	
Customer ______________________		Tested by ______________________	
Test Equipment Used:			
Description	**Model No.**	**Trace No.**	**Cal Due Date**
Synthesized Signal Generator	________	________	________
Synthesized Sweeper	________	________	________
Function Generator	________	________	________
Power Meter, Dual-Channel	________	________	________
RF Power Sensor #1	________	________	________
RF Power Sensor #2 *(Non-Option 1DP only)*	________	________	________
Low-Power Power Sensor	________	________	________
75Ω Power Sensor *(Option 1DP only)*	________	________	________
Digital Multimeter	________	________	________
Universal Counter	________	________	________
Frequency Standard	________	________	________
Power Splitter	________	________	________

Table 3-15 E4411B Performance Verification Test Record

50Ω Termination	____________	____________	____________
Minimum Loss Pad *(Option 1DP only)*	____________	____________	____________
1 dB Step Attenuator	____________	____________	____________
10 dB Step Attenuator	____________	____________	____________
6 dB Fixed Attenuator	____________	____________	____________
20 dB Fixed Attenuator *(Option 1DS only)*			
Oscilloscope *(Option 1D6 only)*			
Notes/comments:	____________________		

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies

Model E4411B **Report No.** ____________

Serial No. ____________ **Date** ____________

Test Description	Minimum	Results Measured	Maximum	Measurement Uncertainty
1. 10 MHz Reference Output Accuracy				
Settability	–5.0 Hz	(1)________	5.0 Hz	±293.3 µHz
3. Frequency Readout Accuracy and Marker Count Accuracy				
Frequency Readout Accuracy				
Center Freq Span				
1490 MHz 20 MHz	1489.83 MHz	(1)________	1490.17 MHz	±0 Hz
1490 MHz 10 MHz	1489.91 MHz	(2)________	1490.09 MHz	±0 Hz
1490 MHz 1 MHz	1489.991 MHz	(3)________	1490.009 MHz	±0 Hz
Marker Count Accuracy				
Center Freq Span				

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
1490 MHz 10 MHz	1489.999998 MHz	(4)________	1490.000002 MHz	±0 Hz
1490 MHz 1 MHz	1489.999998 MHz	(5)________	1490.000002 MHz	±0 Hz
5. Frequency Span Readout Accuracy				
Span Start Freq				
1500 MHz 0 Hz	1185 MHz	(1)________	1215 MHz	±3.06 MHz
100 MHz 10 MHz	79 MHz	(2)________	81 MHz	±204 kHz
100 kHz 10 MHz	79 kHz	(3)________	81 kHz	±204 Hz
100 MHz 800 MHz	79 MHz	(4)________	81 MHz	±204 kHz
100 kHz 800 MHz	79 kHz	(5)________	81 kHz	±204 Hz
100 MHz 1400 MHz	79 MHz	(6)________	81 MHz	±204 kHz
100 kHz 1499 MHz	79 kHz	(7)________	81 kHz	±204 Hz
7. Noise Sidebands				
Offset from 1 GHz signal				
10 kHz		(1)________	–90 dBc/Hz	±1.154 dB
20 kHz		(2)________	–100 dBc/Hz	±1.154 dB
30 kHz		(3)________	–102 dBc/Hz	±1.154 dB
100 kHz		(4)________	–112 dBc/Hz	±1.154 dB
8. System Related Sidebands				
Offset from 500 MHz signal				
30 kHz to 230 kHz		(1)________	–65 dBc	±1.154 dB
–30 kHz to –230 kHz		(2)________	–65 dBc	±1.154 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		Report No. ___________		
Serial No. ___________		Date ___________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
9. Residual FM				
1 kHz Res BW		(1)________	150 Hz	±9.24 Hz
10. Sweep Time Accuracy				
Sweep Time				
5 ms	–1.0%	(1)________	1.0%	±0.28%
20 ms	–1.0%	(2)________	1.0%	±0.28%
100 ms	–1.0%	(3)________	1.0%	±0.28%
1 s	–1.0%	(4)________	1.0%	±0.28%
10 s	–1.0%	(5)________	1.0%	±0.28%
11. Display Scale Fidelity				
Cumulative Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.34 dB	(1)________	0.34 dB	±0.064 dB
–8	–0.38 dB	(2)________	0.38 dB	±0.064 dB
–12	–0.42 dB	(3)________	0.42 dB	±0.064 dB
–16	–0.46 dB	(4)________	0.46 dB	±0.064 dB
–20	–0.50 dB	(5)________	0.50 dB	±0.063 dB
–24	–0.54 dB	(6)________	0.54 dB	±0.064 dB
–28	–0.58 dB	(7)________	0.58 dB	±0.064 dB
–32	–0.62 dB	(8)________	0.62 dB	±0.064 dB
–36	–0.66 dB	(9)________	0.66 dB	±0.064 dB
–40	–0.70 dB	(10)________	0.70 dB	±0.063 dB
–44	–0.74 dB	(11)________	0.74 dB	±0.064 dB
–48	–0.78 dB	(12)________	0.78 dB	±0.064 dB
–52	–0.82 dB	(13)________	0.82 dB	±0.089 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–56	–0.86 dB	(14)________	0.86 dB	±0.089 dB
–60	–0.90 dB	(15)________	0.90 dB	±0.088 dB
–64	–0.94 dB	(16)________	0.94 dB	±0.089 dB
–68	–0.98 dB	(17)________	0.98 dB	±0.089 dB
–72	–1.02 dB	(18)________	1.02 dB	±0.089 dB
–76	–1.06 dB	(19)________	1.06 dB	±0.089 dB
–80	–1.10 dB	(20)________	1.10 dB	±0.088 dB
–84	–1.14 dB	(21)________	1.14 dB	±0.089 dB
Incremental Log Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–0.4 dB	(22)________	0.4 dB	±0.064 dB
–8	–0.4 dB	(23)________	0.4 dB	±0.064 dB
–12	–0.4 dB	(24)________	0.4 dB	±0.064 dB
–16	–0.4 dB	(25)________	0.4 dB	±0.064 dB
–20	–0.4 dB	(26)________	0.4 dB	±0.063 dB
–24	–0.4 dB	(27)________	0.4 dB	±0.064 dB
–28	–0.4 dB	(28)________	0.4 dB	±0.064 dB
–32	–0.4 dB	(29)________	0.4 dB	±0.064 dB
–36	–0.4 dB	(30)________	0.4 dB	±0.064 dB
–40	–0.4 dB	(31)________	0.4 dB	±0.063 dB
–44	–0.4 dB	(32)________	0.4 dB	±0.064 dB
–48	–0.4 dB	(33)________	0.4 dB	±0.064 dB
–52	–0.4 dB	(34)________	0.4 dB	±0.089 dB
–56	–0.4 dB	(35)________	0.4 dB	±0.089 dB
–60	–0.4 dB	(36)________	0.4 dB	±0.088 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–64	–0.4 dB	(37)_______	0.4 dB	±0.089 dB
–68	–0.4 dB	(38)_______	0.4 dB	±0.089 dB
–72	–0.4 dB	(39)_______	0.4 dB	±0.089 dB
–76	–0.4 dB	(40)_______	0.4 dB	±0.089 dB
–80	–0.4 dB	(41)___	0.4 dB	±0.088 dB
Linear Fidelity, Res BW ≥1 kHz				
dB from Ref Level				
–4	–2.0%	(89)_______	2.0%	±0.064%
–8	–2.0%	(90)_______	2.0%	±0.064%
–12	–2.0%	(91)_______	2.0%	±0.064%
–16	–2.0%	(92)_______	2.0%	±0.064%
–20	–2.0%	(93)_______	2.0%	±0.063%
12. Input Attenuation Switching Uncertainty				
Input Attenuation Setting				
0 dB	–0.3 dB	(1)_______	0.3 dB	±0.108 dB
5 dB	–0.3 dB	(2)_______	0.3 dB	±0.107 dB
15 dB	–0.3 dB	(3)_______	0.3 dB	±0.107 dB
20 dB	–0.3 dB	(4)_______	0.3 dB	±0.089 dB
25 dB	–0.35 dB	(5)_______	0.35 dB	±0.089 dB
30 dB	–0.40 dB	(6)_______	0.40 dB	±0.089 dB
35 dB	–0.45 dB	(7)_______	0.45 dB	±0.089 dB
40 dB	–0.50 dB	(8)_______	0.50 dB	±0.089 dB
45 dB	–0.55 dB	(9)_______	0.55 dB	±0.089 dB
50 dB	–0.60 dB	(10)_______	0.60 dB	±0.089 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		**Report No. __________**		
Serial No. __________		**Date __________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
55 dB	–0.65 dB	(11)________	0.65 dB	±0.089 dB
60 dB	–0.70 dB	(12)________	0.70 dB	±0.089 dB
13. Reference Level Accuracy				
Log				
Reference Level				
50 Ω (dBm) 75 Ω (dBmV)				
–15 33.75	–0.3 dB	(1)________	0.3 dB	±0.144 dB
–5 43.75	–0.3 dB	(2)________	0.3 dB	±0.144 dB
–35 13.75	–0.3 dB	(3)________	0.3 dB	±0.144 dB
–45 3.75	–0.3 dB	(4)________	0.3 dB	±0.144 dB
–55 –6.25	–0.5 dB	(5)________	0.5 dB	±0.156 dB
–65 –16.25	–0.5 dB	(6)________	0.5 dB	±0.156 dB
–75 –26.25	–0.7 dB	(7)________	0.7 dB	±0.156 dB
Linear				
Reference Level				
50Ω (dBm) 75Ω (dBmV)				
–15 33.75	–0.3 dB	(8)________	0.3 dB	±0.144 dB
–5 43.75	–0.3 dB	(9)________	0.3 dB	±0.144 dB
–35 13.75	–0.3 dB	(10)________	0.3 dB	±0.144 dB
–45 3.75	–0.3 dB	(11)________	0.3 dB	±0.144 dB
–55 –6.25	–0.5 dB	(12)________	0.5 dB	±0.156 dB
–65 –16.25	–0.5 dB	(13)________	0.5 dB	±0.156 dB
–75 –26.25	–0.7 dB	(14)________	0.7 dB	±0.156 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
15. Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	–0.3 dB	(1)________	0.3 dB	±0.064 dB
9 kHz	–0.3 dB	(2)________	0.3 dB	±0.064 dB
10 kHz	–0.3 dB	(3)________	0.3 dB	±0.064 dB
30 kHz	–0.3 dB	(4)________	0.3 dB	±0.064 dB
100 kHz	–0.3 dB	(5)________	0.3 dB	±0.064 dB
120 kHz	–0.3 dB	(6)________	0.3 dB	±0.064 dB
300 kHz	–0.3 dB	(7)________	0.3 dB	±0.064 dB
1 MHz	–0.3 dB	(8)________	0.3 dB	±0.064 dB
3 MHz	–0.3 dB	(9)________	0.3 dB	±0.064 dB
5 MHz	–0.6 dB	(10)________	0.6 dB	±0.083 dB
16. Absolute Amplitude Accuracy (Reference Settings)				
Log, Preamp Off	–0.4 dB	(1)________	0.4 dB	±0.148 dB
Lin, Preamp Off	–0.4 dB	(2)________	0.4 dB	±0.148 dB
18. Overall Absolute Amplitude Accuracy				
0 dBm Reference Level				
0 dBm input	–0.6 dB	(1)________	0.6 dB	±0.08 dB
–10 dBm input	–0.6 dB	(2)________	0.6 dB	±0.081 dB
–20 dBm input	–0.6 dB	(3)________	0.6 dB	±0.082 dB
–30 dBm input	–0.6 dB	(4)________	0.6 dB	±0.083 dB
–40 dBm input	–0.6 dB	(5)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(6)________	0.6 dB	±0.086 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
–20 dBm Reference Level				
–20 dBm input	–0.6 dB	(7)________	0.6 dB	±0.082 dB
–30 dBm input	–0.6 dB	(8)________	0.6 dB	±0.083 dB
–40 dBm input	–0.6 dB	(9)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(10)________	0.6 dB	±0.086 dB
–40 dBm Reference Level				
–40 dBm input	–0.6 dB	(11)________	0.6 dB	±0.084 dB
–50 dBm input	–0.6 dB	(12)________	0.6 dB	±0.086 dB
–50 dBm Reference Level				
–50 dBm input	–0.6 dB	(13)________	0.6 dB	±0.086 dB
20. Resolution Bandwidth Accuracy				
Resolution Bandwidth				
5 MHz	3.5 MHz	(1)________	6.5 MHz	±38.2 kHz
3 MHz	2.55 MHz	(2)________	3.45 MHz	±22.9 kHz
1 MHz	0.85 MHz	(3)________	1.15 MHz	±7.64 kHz
300 kHz	255 kHz	(4)________	345 kHz	±2.29 kHz
100 kHz	85 kHz	(5)________	115 kHz	±764 Hz
30 kHz	25.5 kHz	(6)________	34.5 kHz	±229 Hz
10 kHz	8.5 kHz	(7)________	11.5 kHz	±76.4 Hz
3 kHz	2.55 kHz	(8)________	3.45 kHz	±22.9 Hz
1 kHz	850 Hz	(9)________	1.15 kHz	±7.64 Hz
120 kHz	102 kHz	(10)________	138 kHz	±154 Hz
9 kHz	7.65 kHz	(11)________	10.35 kHz	±11.5 Hz

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
21. Frequency Response	Note: Enter data in the appropriate section below depending upon the input impedance of the analyzer and the ambient temperature at which the test was performed.			
50 Ω, 20 to 30° C:				
Maximum Response		(1)________	0.5 dB	±0.245 dB
Minimum Response	–0.5 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.245 dB
50 Ω, 0 to 55° C:				
Maximum Response		(1)________	1.0 dB	±0.245 dB
Minimum Response	–1.0 dB	(2)________		±0.245 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.245 dB
75 Ω, 20 to 30° C:				
Maximum Response		(1)________	0.5 dB	±0.189 dB
Minimum Response	–0.5 dB	(2)________		±0.189 dB
Peak-to-Peak Response		(3)________	1.0 dB	±0.189 dB
75 Ω, 0 to 55° C:				
Maximum Response		(1)________	1.0 dB	±0.189 dB
Minimum Response	–1.0 dB	(2)________		±0.189 dB
Peak-to-Peak Response		(3)________	2.0 dB	±0.189 dB
27. Other Input Related Spurious Responses				
Input Frequency				
542.8 MHz		(1)________	–65 dBc	±1.08 dB
510.7 MHz		(2)________	–65 dBc	±1.08 dB
1310.7 MHz		(3)________	–45 dBc	±1.08 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		Report No. __________		
Serial No. __________		Date __________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
29. Spurious Responses	Note: Enter the results in the appropriate lines below based upon the input impedance of the analyzer. TR Entry 2 does not apply to E4411B.			
50 MHz TOI, 50 Ω	7.5 dBm	(1)________		±0.489 dB
50 MHz TOI, 75 Ω	56.25 dBmV	(1)________		±0.481 dB
40 MHz SHI, 50 Ω	35 dBm	(3)________		±1.11 dB
40 MHz SHI, 75 Ω	83.75 dBmV	(3)________		±1.11 dB
32. Gain Compression	Note: TR Entry 2 does not apply to E4411B.			
Test Frequency				
53 MHz		(1)________	1.0 dB	±0.127 dB
1403 MHz		(3)________	1.0 dB	±0.127 dB
34. Displayed Average Noise Level	Note: Enter data in the appropriate section below depending upon the input impedance of the analyzer.			
50 Ω:				
400 kHz		(1)________	–115 dBm	±1.82 dB
1 MHz to 10 MHz		(2)________	–115 dBm	±1.82 dB
10 MHz to 500 MHz		(3)________	–119 dBm	±1.82 dB
500 MHz to 1 GHz		(4)________	–117 dBm	±1.82 dB
1 GHz to 1.5 GHz		(5)________	–113 dBm	±1.82 dB
75 Ω:				
1 MHz to 10 MHz		(21)________	–63 dBmV	±1.82 dB
10 MHz to 500 MHz		(22)________	–65 dBmV	±1.82 dB
500 MHz to 1 GHz		(23)________	–60 dBmV	±1.82 dB
1 GHz to 1.5 GHz		(24)________	–53 dBmV	±1.82 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		Report No. ___________		
Serial No. ___________		Date ___________		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
38. Residual Responses	Note: Enter data in the appropriate section below depending upon the input impedance of the analyzer.			
50 Ω, 150 kHz to 1.5 GHz		(1)________	–90 dBm	±0.90 dB
75 Ω, 1 MHz to 1.5 GHz		(1)________	–36 dBmV	±0.90 dB
40. Tracking Generator Absolute Amplitude and Vernier Accuracy	Note: Enter data in the appropriate section below depending upon the input impedance of the analyzer.			
50 Ω *(Option 1DN)*				
Absolute Amplitude Accuracy	–0.5 dB	(1)________	0.5 dB	±0.14 dB
Positive Vernier Accuracy		(2)________	0.75 dB	±0.19 dB
Negative Vernier Accuracy	–0.75 dB	(3)________		±0.19 dB
Power Sweep Accuracy		(4)________	1.5 dB	±0.19 dB
75 Ω *(Option 1DQ)*				
Absolute Amplitude Accuracy	–1.5 dB	(1)________	1.5 dB	±0.14 dB
Positive Vernier Accuracy		(2)________	0.9 dB	±0.19 dB
Negative Vernier Accuracy	–0.9 dB	(3)________		±0.19 dB
Power Sweep Accuracy		(4)________	1.8 dB	±0.19 dB
42. Tracking Generator Level Flatness	Note: Enter data in the appropriate section below depending upon the input impedance of the analyzer.			
50Ω *(Option 1DN)*				
Positive Level Flatness, <1 MHz		(1)________	2.0 dB	±0.588 dB
Negative Level Flatness, <1 MHz	–2.0 dB	(2)________		±0.588 dB
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	2.0 dB	±0.281 dB

Table 3-16 E4411B Performance Verification Test Record

Agilent Technologies				
Model E4411B		**Report No. ___________**		
Serial No. ___________		**Date ___________**		
Test Description	**Minimum**	**Results Measured**	**Maximum**	**Measurement Uncertainty**
Negative Level Flatness, 1 MHz to 10 MHz	–2.0 dB	(4)________		±0.281 dB
Positive Level Flatness, >10 MHz		(5)________	1.5 dB	±0.202 dB
Negative Level Flatness, >10 MHz	–1.5 dB	(6)________		±0.202 dB
75 Ω *(Option 1DQ)*				
Positive Level Flatness, 1 MHz to 10 MHz		(3)________	2.5 dB	±0.314 dB
Negative Level Flatness, 1 MHz to 10 MHz	–2.5 dB	(4)________		±0.314 dB
Positive Level Flatness, >10 MHz		(5)________	2.0 dB	±0.314 dB
Negative Level Flatness, >10 MHz	–2.0 dB	(6)________		±0.314 dB
44. Tracking Generator Harmonic Spurious Outputs *(Option 1DN or Option 1DQ only)*				
2^{nd} Harmonic, <20 MHz		(1)________	–20 dBc	±2.6 dB
2^{nd} Harmonic, ≥20 MHz		(2)________	–25 dBc	±2.6 dB
3^{rd} Harmonic, <20 MHz		(3)________	–20 dBc	±2.6 dB
3^{rd} Harmonic, ≥20 MHz		(4)________	–25 dBc	±2.6 dB
46. Tracking Generator Non-Harmonic Spurious Outputs *(Option 1DN or Option 1DQ only)*				
Highest Non-Harmonic Spurious Output Amplitude		(1)________	–35 dBc	±2.67 dB

4 If You Have a Problem

This chapter includes information on how to check for a problem with your Agilent ESA Series Spectrum Analyzer, and how to return it for service. It also includes descriptions of the types of built-in messages.

What You'll Find in This Chapter

This chapter includes information on how to check for a problem with your Agilent ESA Series Spectrum Analyzer, and how to return it for service. It also includes descriptions of all of the analyzer built-in messages.

Your analyzer is built to provide dependable service. However, if you experience a problem, desire additional information, or wish to order parts, options, or accessories, Agilent Technologies's worldwide sales and service organization is ready to provide the support you need.

In general, a problem can be caused by a hardware failure, a software error, or a user error. Follow these general steps to determine the cause and to resolve the problem.

1. Perform the quick checks listed in "Check the Basics" in this chapter. It is possible that a quick check may eliminate your problem altogether.
2. If the problem is a hardware problem, you have several options:
   - Repair it yourself; see the "Service Options" section in this chapter.
   - Return the analyzer to Agilent Technologies for repair; if the analyzer is still under warranty or is covered by an Agilent Technologies maintenance contract, it will be repaired under the terms of the warranty or plan (the warranty is at the front of this manual).
   - If the analyzer is no longer under warranty or is not covered by an Agilent Technologies maintenance plan, Agilent Technologies will notify you of the cost of the repair after examining the instrument. See "How to Call Agilent Technologies" and "How to Return Your Analyzer for Service" for more information.

WARNING **No operator serviceable parts inside the analyzer. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

Before You Call Agilent Technologies

Check the Basics

A problem can often be resolved by repeating the procedure you were following when the problem occurred. Before calling Agilent Technologies or returning the analyzer for service, please make the following checks:

- ❏ Check the line fuse.
- ❏ Is there power at the receptacle?
- ❏ Is the analyzer turned on? Make sure the fan is running, which indicates that the power supply is on.
- ❏ If the display is dark or dim, press the upper **Viewing Angle** key in the upper-left corner of the front panel. If the display is too bright, adjust the lower **Viewing Angle** key in the upper-left corner of the front panel.
- ❏ If other equipment, cables, and connectors are being used with your Agilent ESA Series Spectrum Analyzer, make sure they are connected properly and operating correctly.
- ❏ Review the procedure for the measurement being performed when the problem appeared. Are all the settings correct?
- ❏ If the analyzer is not functioning as expected, return the analyzer to a known state by pressing the **Preset** key.

  Some analyzer settings are not affected by a Preset. If you wish to reset the analyzer configuration to the state it was in when it was originally sent from the factory, press **System**, **Power On/Preset**, **Factory Preset** (if it is displayed).
- ❏ Is the measurement being performed, and the results that are expected, within the specifications and capabilities of the analyzer? Refer to the “Specifications and Characteristics” chapters in Specifications Guide for analyzer specifications.
- ❏ In order to meet specifications, the analyzer must be aligned. Either Auto Align All must be selected (press **System**, **Alignments**, **Auto Align**, **All**), or the analyzer must be manually aligned at least once per hour, or whenever the temperature changes more than 3° C. When **Auto Align**, **All** is selected, AA appears on the left edge of the display.
- ❏ If the necessary test equipment is available, perform the Chapter 2, “Performance Verification Tests” of this guide. Record all results on the appropriate form in Chapter 3 , “Performance Verification Test Records,” which follows the tests chapter.

- ❑ If the equipment to perform the performance verification tests is not available, you may still be able to perform the functional checks in the ***Agilent ESA Series Spectrum Analyzers User's Guide***.

Read the Warranty

The warranty for your analyzer is at the front of this manual. Please read it and become familiar with it's terms.

If your analyzer is covered by a separate maintenance agreement, please be familiar with its terms.

Service Options

Agilent Technologies offers several optional maintenance plans to service your analyzer after the warranty has expired. Call your Agilent Technologies sales and service office for full details.

If you want to service the analyzer yourself after the warranty expires, you can purchase the service documentation that provides all necessary test and maintenance information.

You can order the service documentation, Option 0BV (component level information including parts lists, component location diagrams and schematic diagrams) and Option 0BW (assembly level troubleshooting and adjustment procedures), through your Agilent Technologies sales and service office. Service documentation is described under "Component Level Service Documentation (Option 0BV)" and "Service Documentation and Adjustment Software (Option 0BW)" in Chapter 6 of the user's guide.

How to Call Agilent Technologies

Agilent Technologies has sales and service offices around the world to provide you with complete support for your analyzer. To obtain servicing information or to order replacement parts, contact the nearest Agilent Technologies sales and service office listed in Table 4-1. In any correspondence or telephone conversations, refer to your analyzer by its product number, full serial number, and firmware revision. (Press **System**, **More 1 of 3**, **Show System**, and the product number, serial number, and firmware revision information will be displayed on your analyzer screen.) A serial number label is also attached to the rear panel of the analyzer.

Table 4-1 Hewlett-Packard Sales and Service Offices

UNITED STATES		
Instrument Support Center Hewlett-Packard Company (800) 403-0801		
EUROPEAN FIELD OPERATIONS		
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China China Hewlett-Packard Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888		

How to Return Your Analyzer for Service

Service Tag

If you are returning your analyzer to Agilent Technologies for servicing, fill in and attach a blue service tag. Several service tags are supplied at the rear of this chapter. Please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the display, or have completed a Performance Test Record, or have any other specific data on the performance of your analyzer, please send a copy of this information with your return.

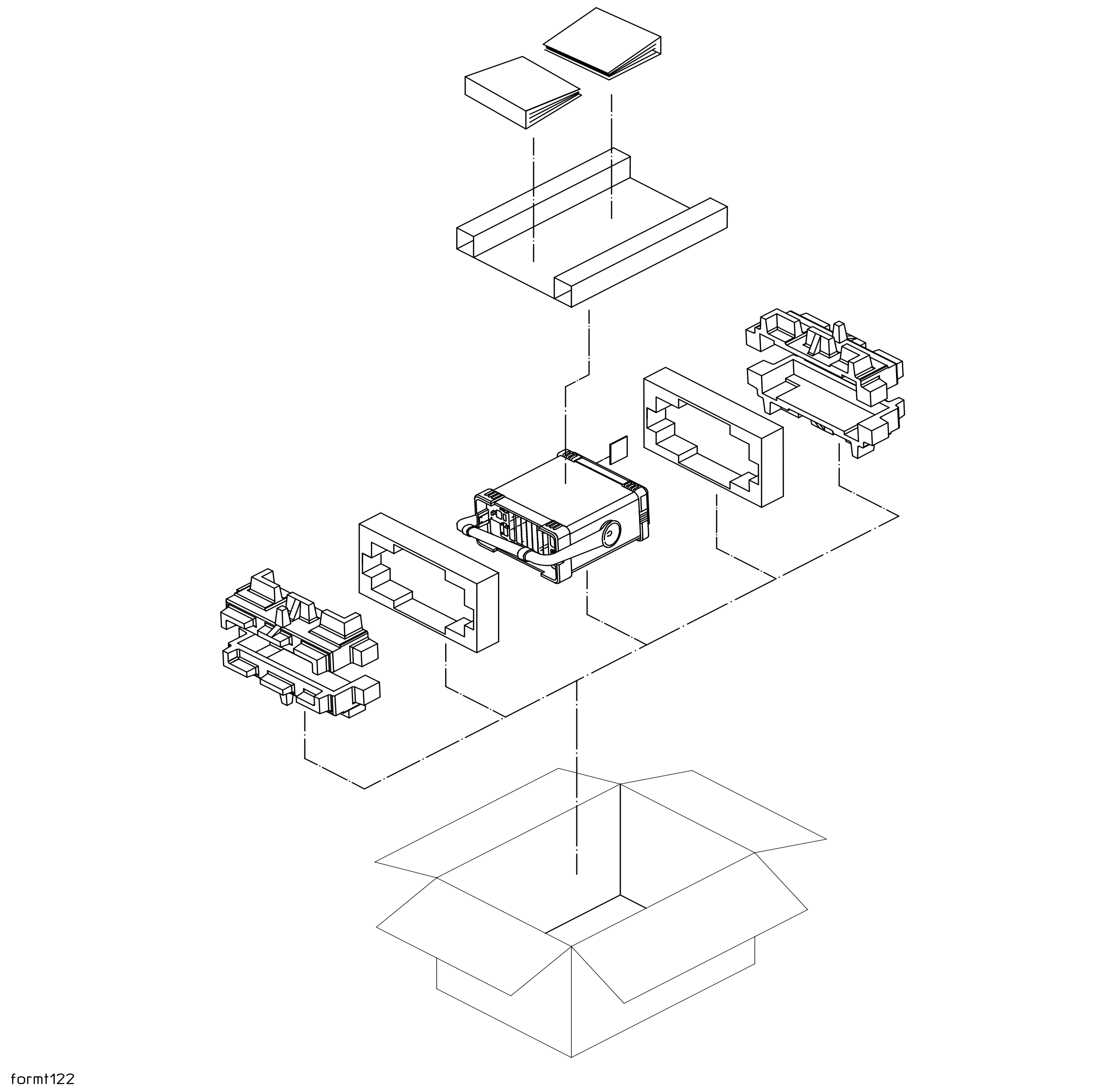
Original Packaging

Before shipping, pack the unit in the original factory packaging materials if they are available. If the original materials were not retained, see "Other Packaging".

NOTE Ensure that the instrument handle is in the rear-facing position in order to reduce the possibility of damage during shipping. Refer to Figure 4-1.

NOTE Install the transportation disk into the floppy drive to reduce the possibility of damage during shipping. If the original transportation disk is not available, a blank floppy may be substituted.

Figure 4-1



Other Packaging

CAUTION Analyzer damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the equipment or prevent it from shifting in the carton. They cause equipment damage by generating static electricity and by lodging in the analyzer louvers, blocking airflow.

You can repackage the instrument with commercially available materials, as follows:

1. Attach a completed service tag to the instrument.
2. Install the transportation disk or a blank floppy disk into the disk drive.
3. If you have a front-panel cover, install it on the instrument. If you do not have a front panel cover, make sure the instrument handle is in the forward-facing position to protect the control panel.
4. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
5. Use a strong shipping container. A double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength is adequate. The carton must be both large enough and strong enough to accommodate the analyzer. Allow at least 3 to 4 inches on all sides of the analyzer for packing material.
6. Surround the equipment with three to four inches of packing material and prevent the equipment from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation (Hayward, California, 94545). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrapping the equipment several times in this material should both protect the equipment and prevent it from moving in the carton.
7. Seal the shipping container securely with strong nylon adhesive tape.
8. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to assure careful handling.
9. Retain copies of all shipping papers.