Technical Specifications

(Printed Version of Help)

Agilent Technologies PNA Series Network Analyzers



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This is a complete list of the E8356A, E8357A, and E8358A network analyzer technical specifications.

- To optimize viewing of uncertainty curves, click the Maximize button.
- To view or print the PNA Series Data Sheet (a condensed version of the specifications), visit our web site at http://www.agilent.com/find/pna, select your analyzer model, and click on the link for the data sheet.
- The uncertainty curves contained in this document apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

Definitions

All specifications and characteristics apply over a 25 °C ±5 °C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

Specification (spec.): Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Characteristic (char.): A performance parameter that the product is expected to meet before it leaves the factory, but that is not verified in the field and is not covered by the product warranty. A characteristic includes the same guardbands as a specification.

Typical (typ.): Expected performance of an average unit which does not include guardbands. It is not covered by the product warranty.

Nominal (nom.): A general, descriptive term that does not imply a level of performance. It is not covered by the product warranty.

Calibration: The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

Corrected (residual): Indicates performance after error correction (calibration). It is determined by the quality of calibration standards and how well "known" they are, plus system repeatability, stability, and noise.

Uncorrected (raw): Indicates instrument performance without error correction. The uncorrected performance affects the stability of a calibration.

Standard: When referring to the analyzer, this includes no options unless noted otherwise.

Corrected System Performance

The specifications in this section apply for measurements made with the E8356A, E8357A, and E8358A analyzer with the following conditions:

- 10 Hz IF bandwidth
- No averaging applied to data
- Environmental temperature of 25 °C ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Note: The uncertainty curves contained in these specifications apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

Table 1. System Dynamic Range

Description	Specification (dB)	Characteristic (dB)
Dynamic range ^a		
(at test port)		
300 kHz to 25 MHz ^b	125	
25 MHz to 3 GHz ^b	128	
3 GHz to 6 GHz	118	
6 GHz to 9 GHz	113	
Dynamic range ^c		
(at receiver input)		
300 kHz to 25 MHz ^d		140
25 MHz to 3 GHz ^d		143
3 GHz to 6 GHz		133
6 GHz to 9 GHz		128

^a The test port dynamic range is calculated as the difference between the test port rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

May be limited to 100 dB at particular frequencies below 750 MHz due to spurious receiver residuals.

c The receiver input dynamic range is calculated as the difference between the receiver rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its damage level. When the analyzer is in segment sweep mode, frequency segments can be defined with a higher power level when the extended dynamic range is required (i.e. the portion of the device's response with high insertion loss), and reduced power when receiver damage may occur (i.e. the portion of the devices's response with low insertion loss).

d May be limited to 115 dB at particular frequencies below 750 MHz due to spurious receiver residuals.

Corrected System Performance with Type-N Connectors

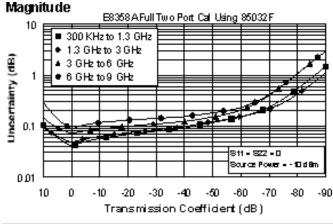
Table 2. Corrected System Performance With Type-N Device Connectors, 85032F Calibration Kit

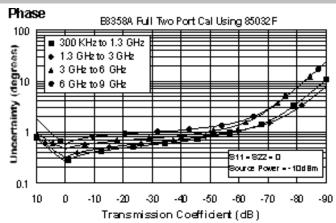
Applies to the E8356A, E8357A, and E8358A analyzer, 85032F (Type-N, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

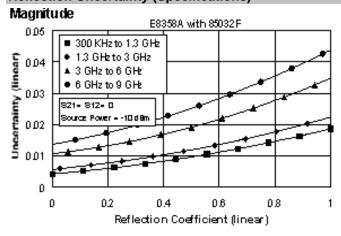
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to	1.3 GHz to	3 to	6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz
Directivity	49	46	40	38
Source Match	41	40	36	35
Load Match	49	45	39	37
Reflection Tracking	±0.011	±0.021	±0.032	±0.054
Transmission Tracking	±0.011	±0.019	±0.041	±0.051

Transmission Uncertainty (Specifications)







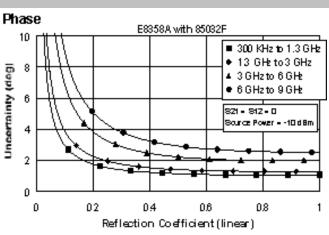


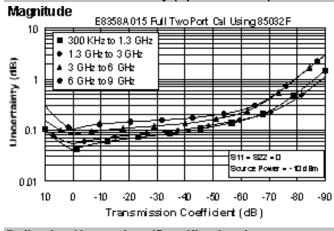
Table 3. Corrected System Performance With Type-N Device Connectors, Option 015 With 85032F Calibration Kit

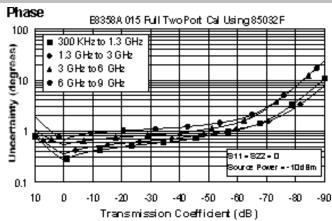
Applies to the E8356A, E8357A, and E8358A analyzer with Option 015, 85032F (Type-N, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

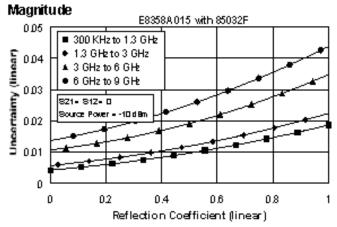
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)				
	300 kHz to	1.3 GHz to	3 to	6 to	
	1.3 GHz	3 GHz	6 GHz	9 GHz	
Directivity	49	46	40	38	
Source Match	41	40	36	35	
Load Match	49	45	39	37	
Reflection Tracking	±0.011	±0.021	±0.032	±0.054	
Transmission Tracking	±0.011	±0.024	±0.052	±0.065	

Transmission Uncertainty (Specifications)







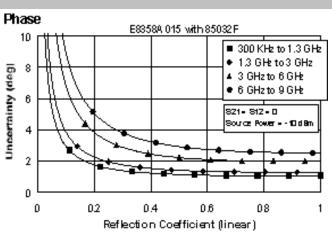


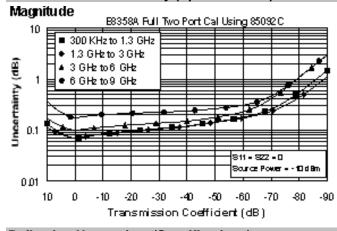
Table 4. Corrected System Performance With Type-N Device Connectors, 85092C Electronic Calibration Module

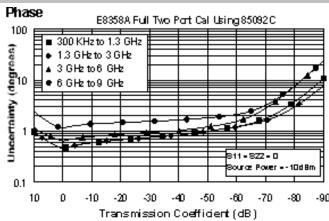
Applies to the E8356A, E8357A, and E8358A analyzer, 85092C (Type-N, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

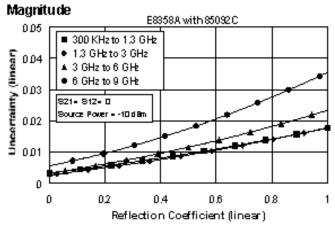
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)				
	300 kHz to	1.3 GHz to	3 to	6 to	
	1.3 GHz	3 GHz	6 Hz	9 GHz ^a	
Directivity	52	54	52	47	
Source Match	45	44	41	36	
Load Match	47	47	44	39	
Reflection Tracking	±0.040	±0.040	±0.060	±0.070	
Transmission Tracking	±0.039	±0.039	±0.068	±0.135	

Transmission Uncertainty (Specifications)







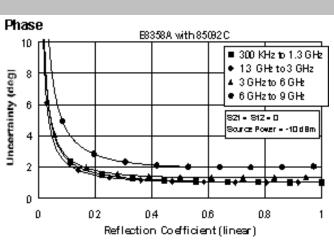


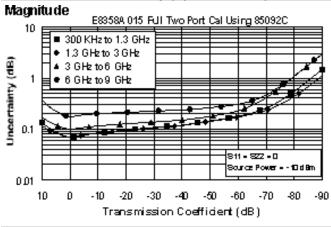
Table 5. Corrected System Performance With Type-N Device Connectors, Option 015 With 85092C Electronic Calibration Module

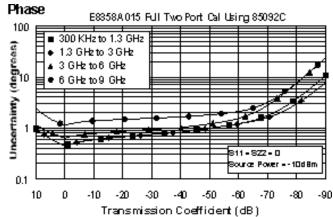
Applies to the E8356A, E8357A, and E8358A analyzer with Option 015, 85092C (Type-N, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

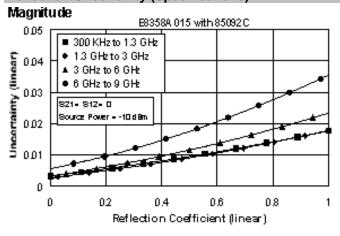
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

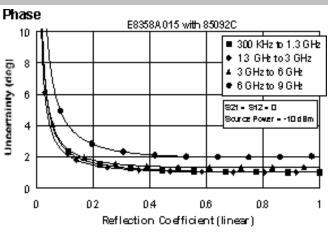
Description	Specification (dB)				
	300 kHz to	1.3 GHz to	3 to	6 to	
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a	
Directivity	52	54	52	47	
Source Match	45	44	41	36	
Load Match	47	47	44	39	
Reflection Tracking	±0.040	±0.040	±0.060	±0.070	
Transmission Tracking	±0.039	±0.039	±0.068	±0.135	

Transmission Uncertainty (Specifications)









Corrected System Performance with 3.5 mm Connectors

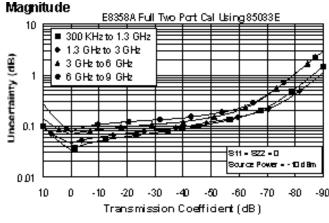
Table 6. Corrected System Performance With 3.5 mm Device Connector Type, 85033E Calibration Kit

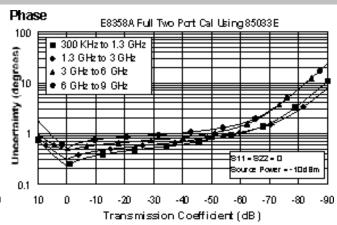
Applies to the E8356A, E8357A, and E8358A analyzer, 85033E (3.5 mm, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

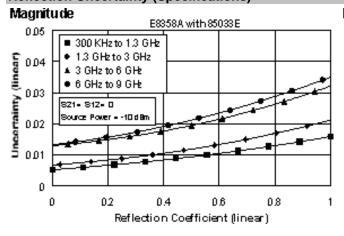
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to	1.3 GHz to 3	3 to 6	6 to
	1.3 GHz	GHz	GHz	9 GHz
Directivity	46	44	38	38
Source Match	43	40	37	36
Load Match	46	44	38	38
Reflection Tracking	±0.006	±0.007	±0.009	±0.010
Transmission	±0.011	±0.020	±0.041	±0.047
Tracking				

Transmission Uncertainty (Specifications)







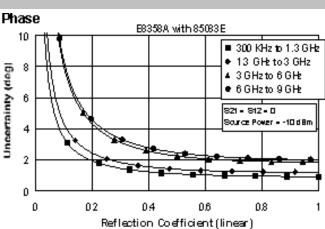


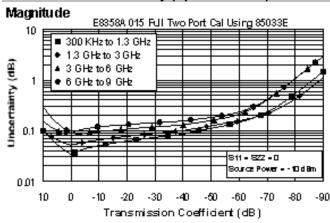
Table 7. Corrected System Performance With 3.5 mm Device Connector Type, Option 015 With 85033E Calibration Kit

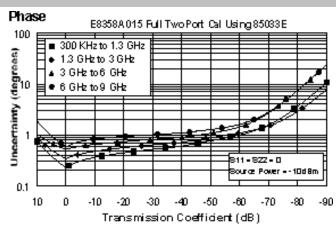
Applies to the E8356A, E8357A, and E8358A analyzer with Option 015, 85033E (3.5 mm, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

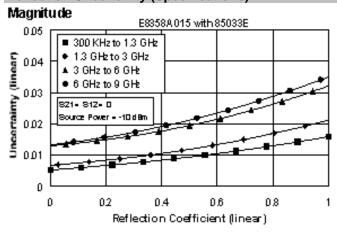
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to	1.3 GHz to	3 to	6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz
Directivity	46	44	38	38
Source Match	43	40	37	36
Load Match	46	44	38	38
Reflection Tracking	±0.006	±0.007	±0.009	±0.010
Transmission Tracking	±0.011	±0.025	±0.052	±0.059

Transmission Uncertainty (Specifications)







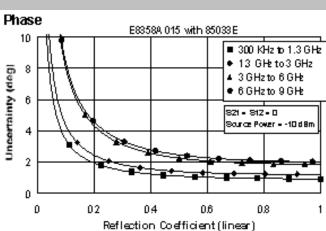


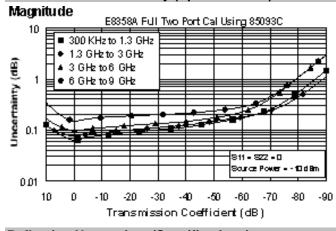
Table 8. Corrected System Performance With 3.5 mm Device Connector Type, 85093C Electronic Calibration Module

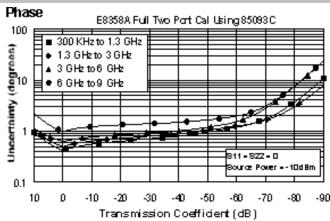
Applies to the E8356A, E8357A, and E8358A analyzer, 85093C (3.5 mm, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

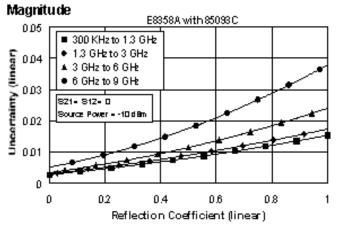
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to 1.3 GHz to		3 to	6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	52	52	51	47
Source Match	44	44	39	34
Load Match	47	47	44	40
Reflection Tracking	±0.030	±0.040	±0.050	±0.070
Transmission Tracking	±0.039	±0.049	±0.068	±0.116

Transmission Uncertainty (Specifications)







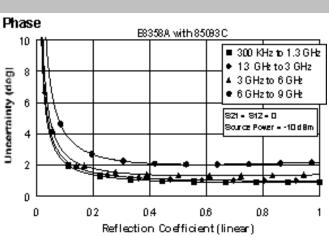


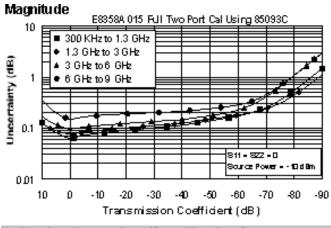
Table 9. Corrected System Performance With 3.5 mm Device Connector Type, Option 015 With 85093C Electronic Calibration Module

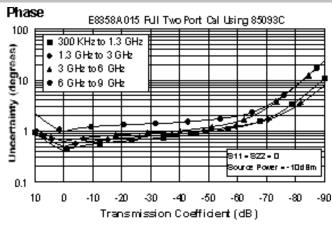
Applies to the E8356A, E8357A, and E8358A analyzer with Option 015, 85093C (3.5 mm, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

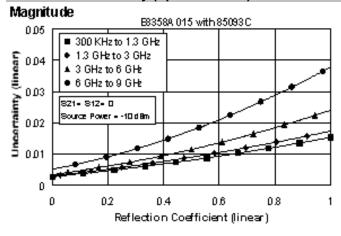
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

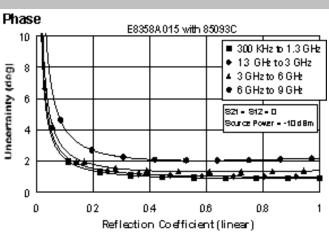
Description	Specification (dB)			
	300 kHz to 1.3 GHz t		3 to	6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	52	52	51	47
Source Match	44	44	39	34
Load Match	47	47	44	40
Reflection Tracking	±0.030	±0.040	±0.050	±0.070
Transmission Tracking	±0.039	±0.049	±0.068	±0.116

Transmission Uncertainty (Specifications)









Corrected System Performance with 7-16 Connectors

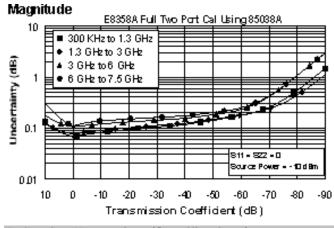
Table 10. Corrected System Performance With 7-16 Device Connector Type, 85038A Calibration Kit

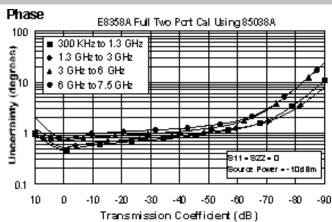
Applies to the E8356A, E8357A, and E8358A analyzer, 85038A (7-16, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

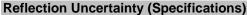
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

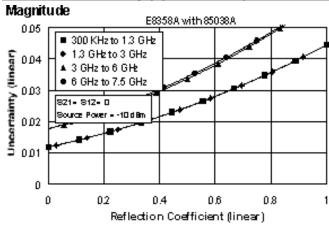
•	Specification (dB)			
	300 kHz to	1.3 GHz to	3 to	6 to
	1.3 GHz	3 GHz	6 GHz	9 GHza
Directivity	40	40	36	36
Source Match	37	37	34	34
Load Match	39	39	35	35
Reflection Tracking	±0.089	±0.089	±0.115	±0.115
Transmission Tracking	±0.022	±0.031	±0.059	±0.062

Transmission Uncertainty (Specifications)









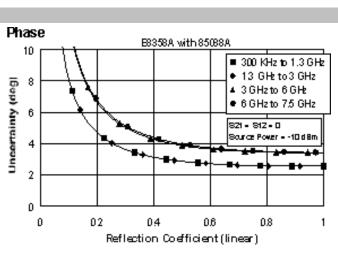


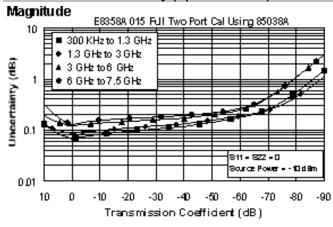
Table 11. Corrected System Performance With 7-16 Device Connector Type, Option 015 With 85038A Calibration Kit

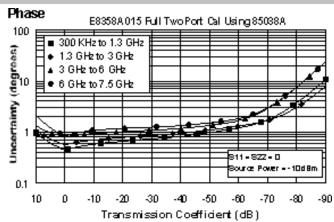
Applies to the E8356A, E8357A, and E8358A analyzer with Option 015, 85038A (7-16, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

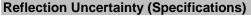
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

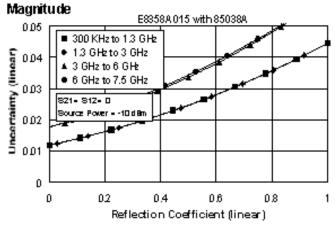
Description	Specification (dB)			
	300 kHz to	1.3 GHz to	3 to	6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	40	40	36	36
Source Match	37	37	34	34
Load Match	39	39	35	35
Reflection Tracking	±0.089	±0.089	±0.115	±0.115
Transmission Tracking	±0.022	±0.040	±0.075	±0.080

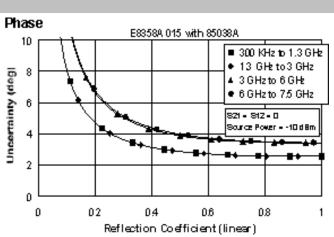
Transmission Uncertainty (Specifications)











Uncorrected Instrument Performance

Table 12. Uncorrected Instrument Performance

Description	Specification (dB)				
	300 kHz to	1MHz to	1.3 GHz to	3 GHz to	6 GHz to
	1 MHz	1.3 GHz	3 GHz	6 GHz	9 GHz
Directivity	30	33	27	20	13
Source Match	20	20	17	15	14
Source Match (Opt. 015)	20	20	15	13	12
Load Match	20	20	17	15	15
Load Match (Opt. 015)	20	20	15	13	13
Reflection Tracking	±1.5	±1.5	±1.5	±2.5	±3.0
Transmission Tracking	±1.5	±1.5	±1.5	±2.5	±3.0

Test Port Output Characteristics (Source) Table 13. Test Port Output Frequency

Description	Specification	Supplemental Information
Range		
E8356A	300 kHz to 3.0 GHz	
E8357A	300 kHz to 6.0 GHz	
E8358A	300 kHz to 9.0 GHz	
Resolution	1 Hz	
Source Stability		±0.05 ppm, -0° to 40 °C, typical
		±0.1 ppm/year, typical
CW Accuracy	±1 ppm	

Table 14. Test Port Output Power^a

Description	Specification	Supplemental Information
Level Accuracy		
		Variation from 0 dBm in power range 0
		(step attenuator at 0 dB) ±1.5dB below 10 MHz
300 kHz to 10 MHz	±1.5 dB	
10 MHz to 6 GHz	±1.0 dB	
6 GHz to 9 GHz	±2.0 dB	
Level Linearity		
		Variation from 0 dBm in power range 0
300 kHz to 9 GHz	±0.3 dB	-15 to +5 dBm
300 kHz to 1 MHz	±1.0 dB	+5 to +10 dBm
1 MHz to 6 GHz	±0.5 dB	+5 to +10 dBm
Range ^b		
300 kHz to 6 GHz	-85 to +10 dBm	
6 GHz to 9 GHz	-85 to +5 dBm	
Sweep Range		
300 kHz to 6 GHz	25 dB	
6 GHz to 9 GHz	20 dB	
Level Resolution	0.01 dB	

^a Source output performance on port 1 only. Port 2 output performance is typical.

^b Power to which the source can be set and phase lock is assured.

Table 15. Test Port Output Signal Purity

Specification	Supplemental Information
	< -25 dBc, typical
	< -25 dBc, characteristic ^a
	< -35 dBc, typical
	< -38 dBc, typical, in power range 0 (step attenuator at 0 dB)
	-30 dBc, typical for offset freq >1kHz
	-50 dBc, typical for offset freg >1kHz
	Specification

^a Typical below 25 MHz.

Test Port and Receiver Input Characteristics Table 16. Test Port and Receiver Input Levels

Description	Specification	Supplemental Information
Maximum Test Port Input		
Test Ports 1 and 2:	20101	
300 kHz to 25 MHz	+10 dBm	< 0.6 dB compression
25 MHz to 3 GHz	+10 dBm	< 0.4 dB compression
3 GHz to 6 GHz	+10 dBm	< 0.7 dB compression
6 GHz to 9 GHz	+5 dBm	< 0.7 dB compression
Damage Level	1.0 0.5111	Ton ab compression
Test Port 1, 2		+30 dBm or ±30 VDC, typ.
R1, R2 IN		+15 dBm or ±5 VDC, typ.
A, B IN (standard)		+15 dBm or ±5 VDC, typ.
A, B IN (Opt. 015)		+15 dBm or ±0 VDC, typ.
Coupler IN (Opt. 015)		+33 dBm or ±0 VDC, typ.
Test Port Noise Floor ^a		7 31
300 kHz to 25 MHz ^b		
10 Hz IF Bandwidth	-115 dBm	
1 kHz IF Bandwidth	-95 dBm	
25 MHz to 3 GHz ^b		
10 Hz IF Bandwidth	-118 dBm	
1 kHz IF Bandwidth	-98 dBm	
3 GHz to 9 GHz		
10 Hz IF Bandwidth	≤ -108 dBm	
1 kHz IF Bandwidth	≤ -88 dBm	
Receiver Noise Floor ^a		
300 kHz to 25 MHz ^c		
10 Hz IF Bandwidth	≤ -130 dBm	
1 kHz IF Bandwidth	≤ -110 dBm	
25 MHz to 3 GHz ^c		
10 Hz IF Bandwidth	≤ -133 dBm	
1 kHz IF Bandwidth	≤ -113 dBm	
6 GHz to 9 GHz		
10 Hz IF Bandwidth	≤ -123 dBm	
1 kHz IF Bandwidth	≤ -103 dBm	

Crosstalk			
		Between test ports 1 and 2, with	
		short circuits at both ports	
300 kHz to 1 MHz	<-120 dB		
1 MHz to 25 MHz	<-125 dB		
25 MHz to 3 GHz	<-128 dB		
3 GHz to 6 GHz	<-118 dB		
6 GHz to 9 GHz	<-113 dB		
Maximum Receiver Input L	evel (A, B, R1, R2)		
300 kHz to 6 GHz		-6 dBm, typical	
6 GHz to 9 GHz		-11 dBm, typical	
Reference Input Level (R1, R2) ^d			
300 kHz to 9 GHz		-10 to -35 dBm, typical	
Maximum Coupler Input Lo	evel (Opt 015)		
300 kHz to 9 GHz		+33 dBm, typical	

^a Total average (RMS) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

Table 17. Test Port Input (Trace Noise)

Description	Specification	Supplemental Information
Trace Noise ^a Magnitude)	
1 kHz IF Bandwidth	< 0.002 dB rms	
10 kHz IF Bandwidth	< 0.005 dB rms	
Trace Noise ^a Phase		
1 kHz IF Bandwidth	< 0.010° rms	
10 kHz IF Bandwidth	< 0.035° rms	

^a Trace noise is defined as a ratio measurement of a through or a full reflection, with the source set to 0 dBm.

Table 18. Test Port Input (Reference Level and Stability)

Description	Specification	Supplemental Information		
Reference Level Magnitude				
Range	±200 dB			
Resolution	0.001 dB			
Reference Level Phase				
Range	±500°			
Resolution	0.01°			
Stability Magnitude ^a				
300 kHz to 3 GHz		0.02 dB/°C, typical		
3 GHz to 6 GHz		0.04 dB/°C, typical		
6 GHz to 9 GHz		0.06 dB/°C, typical		
Stability Phase ^a				
300 kHz to 3 GHz		0.2°/°C, typical		
3 GHz to 6 GHz		0.3°/°C, typical		
6 GHz to 9 GHz		0.6°/°C, typical		

^a Stability is defined as a ratio measurement at the test port.

^b May be limited to -90 dBm at particular frequencies below 750 MHz due to spurious receiver residuals.

^c May be limited to -105 dBm at particular frequencies below 750 MHz due to spurious receiver residuals.

^d Input level to maintain phase lock.

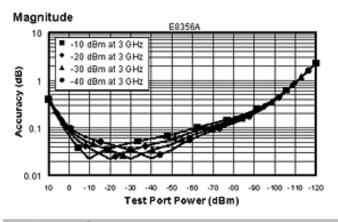
Table 19. Test Port Input (Dynamic Accuracy specification^a)

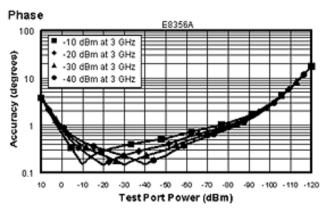
Accuracy of the test port input power reading is relative to the reference input power level. Applies to input ports 1 and 2 with the following conditions:

- IF bandwidth = 10 Hz
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature

300 kHz to 3 GHz

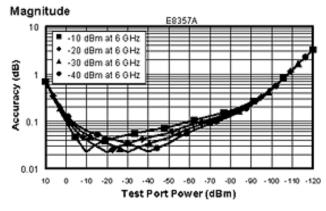
300 kHz to 3 GHz

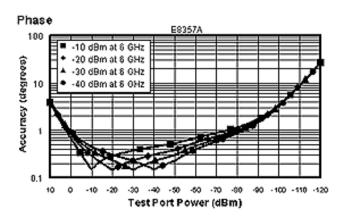




300 kHz to 6 GHz

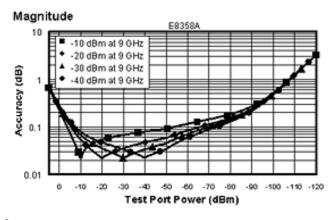
300 kHz to 6 GHz

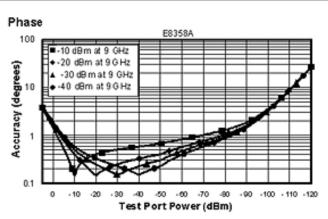




300 kHz to 9 GHz

300 kHz to 9 GHz





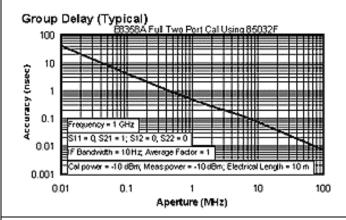
^a Dynamic accuracy is verified with the following measurements:

- compression over frequency
- IF linearity at a single frequency of 1.195 GHz and a reference level of -20 dBm

Table 20. Test Port Input (Group Delay)^a

Description	Specification	Supplemental Information
Aperture (selectable)	(frequency span)/(number of points -1)	
Maximum Aperture	20% of frequency span	
Range	0.5 x (1/minimum aperture)	
Maximum Delay		Limited to measuring no more than 180° of phase change within the minimum aperture.)
Accuracy		See graph below. Char.

The following graph shows group delay accuracy with type-N full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be < 2 dB and electrical length to be ten meters.



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

±Phase Accuracy (deg)/[360 x Aperture (Hz)]

Depending on the aperture and device length, the phase accuracy used is either incremental phase accuracy or worst case phase accuracy.

General Information

Table 21. System Bandwidths

Description	Specification	Supplemental Information
IF Bandwidth Settings		
Range		1 Hz to 40 kHz
		in a 1, 2, 3, 5, 7,10 sequence up to 30 kHz, 35 kHz, 40kHz, nominal

^a Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).

Table 22. Front Panel Information

Description	Supplemental Information
RF Connectors	
Туре	Type-N, female; 50 Ω , nominal
Center Pin Protrusion	0.204 to 0.207 in., characteristic
Probe Power	
Connector	3-pin connector, male
Positive Supply	+15 VDC ±2%, 400 mA, max, characteristic
Negative Supply	-12.6 VDC ±5%, 300 mA, max, characteristic
Display	
Size	21.3 cm (8.4 in) diagonal color active matrix LCD; 640 (horizontal) X 480
	(vertical) resolution
Refresh Rate	Vertical 59.83 Hz; Horizontal 31.41 Hz
Display Range	
Magnitude	±200 dB (at 20 dB/div), max
Phase	±180°, max
Polar	10 pUnits, min
	1000 Units, max
Display Resolution	
Magnitude	0.001 dB/div, min
Phase	0.01°/div, min
Marker Resolution	
Magnitude	0.001 dB, min
Phase	0.01°, min
Polar	0.01 mUnit, min; 0.01°, min

Table 23. Rear Panel Information

Table 23. Rear Panel Informat	
Description	Supplemental Information
Test Port Bias Input	
Connector	BNC, female
Maximum Voltage	±30 VDC, typical
Maximum Current (no	±200 mA, typical
degradation in RF	
specifications)	
Maximum Current	±1 A, typical
10 MHz Reference In	
Connector	BNC, female
Input Frequency	10 MHz ± 1 ppm, typical
Input Level	-15 dBm to +20 dBm, typical
Input Impedance	200Ω , nom.
10 MHz Reference Out	
Connector	BNC, female
Output Frequency	10 MHz ± 1 ppm, typical
Signal Type	Sine Wave, typical
Output Level	+10 dBm ± 4 dB into 50 Ω, typical
Output Impedance	50 Ω, nominal
Harmonics	<-40 dBc, typical
VGA Video Output	7 71
Connector	15-pin mini D-Sub; Drives VGA compatible monitors
Devices Supported:	Resolutions:
Flat Panel (TFT)	1024 X 768, 800 X 600, 640 X 480
Flat Panel (DSTN)	800 X 600, 640 X 480
CRT Monitor	1280 X 1024, 1024 X 768, 800 X 600, 640 X 480
	Simultaneous operation of the internal and external displays is allowed,
	but with 640 X 480 resolution only. If you change resolution, you can only
	view the external display (internal display will "white out").
Test Set IO	25-pin D-Sub connector, available for external test set control
Aux IO	25-pin D-Sub connector, male, analog and digital IO
Handler IO	36-pin IDC D-ribbon socket connector; all input/output signals are default
	set to negative logic; can be reset to positive logic via GPIB command
GPIB	24-pin D-sub (Type D-24), female; compatible with IEEE-488.
Parallel Port (LPT1)	25-pin D-Sub connector, female; provides connection to printers or any
, ,	other parallel port peripheral
Serial Port (COM 1)	9-pin D-Sub, male; compatible with RS-232
USB Port	· ·
	Universal Serial Bus jack, Type A configuration (4 contacts inline, contact
	1 on left); female
Contact 1	Vcc: 4.75 to 5.25 VDC, 500 mA, maximum
Contact 2	-Data
Contact 3	+Data
Contact 4	Ground
LAN	10/100BaseT Ethernet; 8-pin configuration; auto selects between the two
	data rates
Line Power ^{a, b}	
Frequency at 110/115 V	50/60/400 Hz
Frequency at 230/240 V	50/60 Hz
Maximum Watts	350 W
^a A third-wire ground is required.	

^a A third-wire ground is required.

^b Power supply has a voltage autoswitching feature.

Table 24. Rear Panel Information (continued)

Description	Supplemental Information
External AM Input	
Description	Input provides low-frequency AM modulation to test port output signal, or shifts the test port output. Zero volts input gives the power level set by the instrument, a positive voltage gives a higher level, and a negative voltage gives a lower level.
Connector	BNC, female
Input Sensitivity	8 dB/V, typical
Bandwidth	1 kHz, typical
Input Impedance	1 kΩ, typical
External Detector Input	
Description	Input from an external, negative polarity diode detector provides ALC for a test port remote from instrument's front panel
Connector	BNC, female
Input Sensitivity	-500 mV yields approximately -3 dBm at detector's input, typical
Bandwidth	50 kHz, typical
Input Impedance	1 kΩ, nominal

Table 25. Analyzer Environment and Dimensions

Weight Net

Shipping

Table 25. Analyzer Environment and D					
Description	n Supplemental Information				
General Environmental					
RFI/EMI Susceptibility	Defined by CISPR Pub. 11, Group 1,				
Class A, and IEC 50082-1					
ESD	Minimize ι	using static-s	safe work		
	procedures and an antistatic bench mat			mat	
Dust	Minimize f	or optimum	reliability		
Operating Environment					
Temperature	0 °C to +4	0 °C			
			phase locks		
	displays n	o error mess	sages within t	his	
	temperatu				
Error-Corrected Temperature Range	25°C ± 5°0	_			
		than 1°C de	viation from		
		calibration temp.			
Humidity	5% to 95%	5% to 95% at +40 °C			
Altitude	0 to 4500 m (14,760 ft.)				
Non-Operating Storage Environme					
Temperature	-40 °C to +70 °C				
Humidity	0% to 90% at +65 °C (non-condensing)				
Altitude	0 to 15,24	0 m (50,000	ft.)		
Cabinet Dimensions					
	Height	Width	Depth		
Excluding front and rear panel	222 mm	425 mm	426 mm		
hardware and feet	8.75 in	16.75 in	16.8 in		
As shipped - includes front panel	242 mm	425 mm	470 mm		
connectors, rear panel bumpers, and	9.5 in	16.75 in	18.5 in		
feet.					
As shipped plus handles	242 mm	458 mm	502 mm		
	9.5 in	18 in	19.75 in		
As shipped plus rack-mount flanges	242 mm	483 mm	470 mm		
	9.5 in	19 in	18.5 in		
As shipped plus handles and flanges	242 mm	483 mm	502 mm		
	9.5 in	19 in	19.75 in		

24 kg (54 lb), nominal 32 kg (70 lb), nominal

Measurement Throughput SummaryTable 26. Typical Cycle Time^{a,b} (ms)

Table 20. Typical Cycle Time (ms)				
	Number of Points			
	101	201	401	1601
Start 1.8 GHz, S	top 2 GHz,	35 kHz l	F bandw	idth
Uncorrected,	9	12	18	54
1-port cal				
2-Port cal	22	29	42	117
Start 300 kHz, S	top 3 GHz	35 kHz l	F bandw	idth
Uncorrected,	39	47	56	96
1-port cal				
2-Port cal	80	101	121	204
Start 300 kHz, Stop 9 GHz, 35 kHz IF bandwidth				
Uncorrected,	51	57	64	103
1-port cal				
2-Port cal	112	124	138	220

Table 27. Cycle Time vs. IF Bandwidth^a

Applies to the Preset condition (201 points, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

IF Bandwidth	Cycle Time (ms) ^b
(Hz)	
40,000	8
35,000	9
30,000	11
20,000	13
10,000	28
7000	36
5000	48
3000	72
1000	196
300	620
100	1875
30	8062
10	17877

 ^a Typical performance.
 ^b Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S11) measurement.

^a Typical performance.
^b Cycle time includes sweep and retrace time.

Table 28. Cycle Time vs. Number of Points^a

Applies to the Preset condition (35 kHz IF bandwidth, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

Number of Points	Cycle Time (ms) ^b		
3	4		
3 11	4		
51	5		
101	6		
201 401	9		
401	16		
801	29		
1601	52		

^a Typical performance.
^b Cycle time includes sweep and retrace time.

Table 29. Data Transfer Time^a (ms)

	Number of Points					
	51	201	401	1601		
SCPI over GPIB	SCPI over GPIB					
(program executed on	externa	I PC) ^b				
32-bit floating point	3	7	12	43		
64-bit floating point	4	12	22	84		
ASCII	7	64	124	489		
SCPI over 100 Mbit/s I	_AN					
(program executed on	externa	I PC) ^b				
32-bit floating point	1	1	1	1		
64-bit floating point	1	1	1	2		
ASCII	5	15	26	96		
SCPI (program execut	ed in the	e analyz	er) ^d			
32-bit floating point	1	1	2	3		
64-bit floating point	1	2	2	4		
ASCII	8	29	56	222		
COM (program execut	ed in th	e analyz	er) ^e			
32-bit floating point	1	1	1	1		
Variant type	1	1	2	6		
DCOM over 100 Mbit/s LAN						
(program executed on external PC) ^f						
32-bit floating point ⁹	1	1	1	2		
Variant type ^h	1	3	6	19		

^a Typical performance of unit with new 500 MHz Pentium III Processor.

b Measured using a VEE 5.0 program running on a 600 MHz HP Kayak, National InstrumentsTM GPIB card.

Transferred complex S11 data, using "CALC:DATA?SDATA".

Measured using a VEE 5.0 program running on a 600 MHz HP Kayak. Transferred complex S11 data, using "CALC:DATA?SDATA". Speed dependent on LAN traffic, if connected to network.

Measured using a VEE 5.0 program running inside PNA Series Analyzer. Transferred complex S11 data,

using "CALC:DATA?SDATA".

e Measured using a Visual Basic 6.0 program running inside PNA Series Analyzer. Transferred complex S11 data.

f Measured using a Visual Basic 6.0 program running on a 600 MHz HP Kayak. Transferred complex S11 data. Speed dependent on LAN traffic, if connected to network.

⁹ Used IArray Transfer.getComplex method for 32-bit floating point.

^h Used meas.getData method for Variant data type.

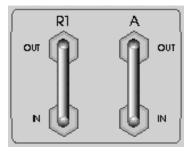
Table 30. Recall and Sweep Speed^a

Operations	Number	Number	Recall
	of Window(s)	of Trace(s)	Time (ms)
Recall	1	1	49
Recall and Sweep	1	1	59
Recall	1	2	82
Recall and Sweep	1	2	96
Recall	1	4	159
Recall and Sweep	1	4	203
Recall	2	2	93
Recall and Sweep	2	2	115
Recall	3	4	158
Recall and Sweep	3	4	218
Recall	4	4	187
Recall and Sweep	4	4	247
Recall	4	8	340
Recall and Sweep	4	8	507

^a CF= 177 MHz, Span = 200 MHz, 201 points, 35 kHz IF BW

Specifications: Front-Panel Jumpers

E8356A, 57A, 58A, Standard - Port 1



Use these SMA (female) connectors to develop custom measurements.

Receiver A Direct-Access Jumper

- The upper "A" connector comes from the coupled arm of the Port 1 coupler.
- The lower connector goes directly to the input of receiver "A." If Option 015 is installed, the path goes directly to a
 switchable attenuator and then to the receiver input.

Want to upgrade your analyzer? See information on Front-Panel Jumpers with Option 015.

For the A Receiver Input:

Maximum Input Level:

- -6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
- -6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
- -11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

<-130 dBm (300 kHz to 25 MHz)

<-123 dBm (3 GHz to 6 GHz)

<-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz) >12 dB (3 GHz to 6 GHz) >7 dB (6 GHz to 9 GHz)

Reference Channel R1 Jumper

- The upper connector comes from the transfer switch Reference 1 output.
- The lower connector goes directly to the R1 receiver input.

For the R1 Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Damage Level: >+15 dBm

Minimum Level to Maintain Phase-Lock:

-35 dBm (300 kHz to 3 GHz) -25 dBm (3 GHz to 9 GHz)

For the Reference Output: (with an External Input to Lock the Source)

Output Level:

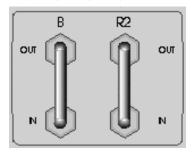
-5 to -30 dBm (300 kHz to 6 GHz) -10 to -35 dBm (6 GHz to 9 GHz)

Source Match Return Loss:

16 dB (300 kHz to 3 GHz) 14 dB (3 GHz to 9 GHz)

Damage Level: >+15 dBm Maximum DC Level: 40V

E8356A, 57A, 58A, Standard - Port 2



Use these SMA (female) connectors to develop custom measurements.

Receiver B Direct-Access Jumper

- The upper "B" connector comes from the coupled arm of the Port 2 coupler.
- The lower connector goes directly to the input of receiver "B." If Option 015 is installed, the path goes directly to a switchable attenuator and then to the receiver input.

Want to upgrade your analyzer? See information on Front-Panel Jumpers with Option 015.

For the B Receiver Input:

Maximum Input Level:

- -6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
- -6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
- -11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

- <-130 dBm (300 kHz to 25 MHz)
- <-123 dBm (3 GHz to 6 GHz)
- <-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz)

>12 dB (3 GHz to 6 GHz)

>7 dB (6 GHz to 9 GHz)

Reference Channel R2 Jumper

- The upper connector comes from the transfer switch Reference 2 output.
- The lower connector goes directly to the R2 receiver input.

For the R2 Receiver Input:

Maximum Input Level:

- -6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
- -6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
- -11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Damage Level: >+15 dBm

Minimum Level to Maintain Phase-Lock:

- -35 dBm (300 kHz to 3 GHz)
- -25 dBm (3 GHz to 9 GHz)

For the Reference Output: (with an External Input to Lock the Source)

Output Level:

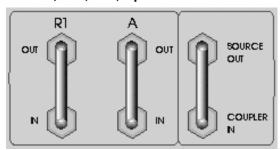
- -5 to -30 dBm (300 kHz to 6 GHz)
- -10 to -35 dBm (6 GHz to 9 GHz)

Source Match Return Loss:

16 dB (300 kHz to 3 GHz) 14 dB (3 GHz to 9 GHz)

Damage Level: >+15 dBm Maximum DC Level: 40V

E8356A, 57A, 58A, Option 015 - Port 1



Use these SMA (female) connectors to develop custom measurements.

Receiver A Direct-Access Jumper

- The upper "A" connector comes from the coupled arm of the Port 1 coupler.
- The lower connector goes directly to the input of receiver "A." With Option 015, the path goes directly to a switchable attenuator and then to the receiver input.

For the A Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)

-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)

-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

<-130 dBm (300 kHz to 25 MHz)

<-123 dBm (3 GHz to 6 GHz)

<-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz)

>12 dB (3 GHz to 6 GHz)

>7 dB (6 GHz to 9 GHz)

Reference Channel R1 Jumper

- The upper connector comes from the transfer switch Reference 1 output.
- The lower connector goes directly to the R1 receiver input.

For the R1 Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)

-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)

-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Damage Level: >+15 dBm

Minimum Level to Maintain Phase-Lock:

-35 dBm (300 kHz to 3 GHz)

-25 dBm (3 GHz to 9 GHz)

For the Reference Output: (with an External Input to Lock the Source)

Output Level:

-5 to -30 dBm (300 kHz to 6 GHz) -10 to -35 dBm (6 GHz to 9 GHz)

Source Match Return Loss:

16 dB (300 kHz to 3 GHz) 14 dB (3 GHz to 9 GHz)

Damage Level: >+15 dBm Maximum DC Level: 40V

Port 1 Test-Port Jumper

- The upper "source out" connector comes from the transfer switch Port 1 output.
- The lower "coupler in" connector goes directly to the main input of Port 1 coupler. This is where a power amplifier can be inserted to boost the test port power.

For the Source Output:

Output Level:

+12 to -83 dBm (300 kHz to 6 GHz) +7 to -88 dBm (6 GHz to 9 GHz)

Source Match: 15 dB at 9 GHz For the Input to the Coupler:

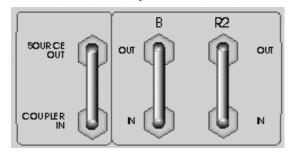
Insertion Loss to Test Port 1:

<3.5 dB at 3 GHz <5 dB at 9 GHz

Maximum Input Power: 2 Watts, CW

Damage Level: 4 Watts, CW

E8356A, 57A, 58A, Option 015 - Port 2



Use these SMA (female) connectors to develop custom measurements.

Receiver B Direct-Access Jumper

- The upper "B" connector comes from the coupled arm of the Port 2 coupler.
- The lower connector goes directly to the input of receiver "B." With Option 015, the path goes directly to a switchable attenuator and then to the receiver input.

For the B Receiver Input:

Maximum Input Level:

- -6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
- -6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
- -11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

- <-130 dBm (300 kHz to 25 MHz)
- <-123 dBm (3 GHz to 6 GHz)
- <-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz) >12 dB (3 GHz to 6 GHz) >7 dB (6 GHz to 9 GHz)

Reference Channel R2 Jumper

- The upper connector comes from the transfer switch Reference 2 output.
- The lower connector goes directly to the R2 receiver input.

For the R2 Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Damage Level: >+15 dBm

Minimum Level to Maintain Phase-Lock:

-35 dBm (300 kHz to 3 GHz) -25 dBm (3 GHz to 9 GHz)

For the Reference Output: (with an External Input to Lock the Source)

Output Level:

-5 to -30 dBm (300 kHz to 6 GHz) -10 to -35 dBm (6 GHz to 9 GHz)

Source Match Return Loss:

16 dB (300 kHz to 3 GHz) 14 dB (3 GHz to 9 GHz)

Damage Level: >+15 dBm Maximum DC Level: 40V Port 2 Test-Port Jumper

- The upper "source out" connector comes from the transfer switch Port 2 output.
- The lower "coupler in" connector goes directly to the main input of Port 2 coupler. This is where a power amplifier can be inserted to boost the test port power.

For the Source Output:

Output Level:

+12 to -83 dBm (300 kHz to 6 GHz) +7 to -88 dBm (6 GHz to 9 GHz)

Source Match: 15 dB at 9 GHz

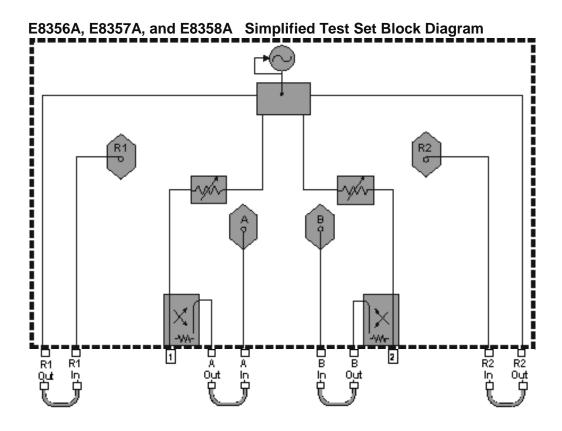
For the Input to the Coupler:

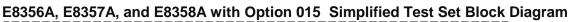
Insertion Loss to Test Port 2:

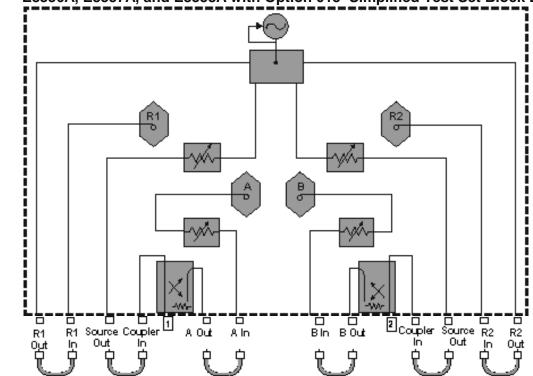
<3.5 dB at 3 GHz <5 dB at 9 GHz

Maximum Input Power: 2 Watts, CW

Damage Level: 4 Watts, CW







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This is a complete list of the E8801A, E8802A, and E8803A network analyzer technical specifications.

- To optimize viewing of uncertainty curves, click the Maximize button.
- To view or print the PNA Series Data Sheet (a condensed version of the specifications), visit our web site at http://www.agilent.com/find/pna, select your analyzer model, and click on the link for the data sheet.
- The uncertainty curves contained in this document apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

Definitions

All specifications and characteristics apply over a 25 °C ±5 °C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

Specification (spec.): Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Characteristic (char.): A performance parameter that the product is expected to meet before it leaves the factory, but that is not verified in the field and is not covered by the product warranty. A characteristic includes the same guardbands as a specification.

Typical (typ.): Expected performance of an average unit which does not include guardbands. It is not covered by the product warranty.

Nominal (nom.): A general, descriptive term that does not imply a level of performance. It is not covered by the product warranty.

Calibration: The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

Corrected (residual): Indicates performance after error correction (calibration). It is determined by the quality of calibration standards and how well "known" they are, plus system repeatability, stability, and noise.

Uncorrected (raw): Indicates instrument performance without error correction. The uncorrected performance affects the stability of a calibration.

Standard: When referring to the analyzer, this includes no options unless noted otherwise.

Corrected System Performance

The specifications in this section apply for measurements made with the E8801A, E8802A, and E8803A analyzer with the following conditions:

- 10 Hz IF bandwidth
- No averaging applied to data
- Environmental temperature of 25 °C ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Note: The uncertainty curves contained in these specifications apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

Table 1. System Dynamic Range

Description	Specification (dB)	Characteristic (dB)		
Dynamic range ^a (at test port)				
300 kHz to 25 MHz ^b	125			
25 MHz to 3 GHz ^b	128			
3 GHz to 6 GHz	118			
6 GHz to 9 GHz	115			
Dynamic range ^c (at receiver input)				
300 kHz to 25 MHz ^d		140		
25 MHz to 3 GHz ^d		143		
3 GHz to 6 GHz		133		
6 GHz to 9 GHz		130		

^a The test port dynamic range is calculated as the difference between the test port rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

^b May be limited to 100 dB at particular frequencies below 750 MHz due to spurious receiver residuals.

^c The receiver input dynamic range is calculated as the difference between the receiver rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its damage level. When the analyzer is in segment sweep mode, frequency segments can be defined with a higher power level when the extended dynamic range is required (i.e. the portion of the device's response with high insertion loss), and reduced power when receiver damage may occur (i.e. the portion of the devices's response with low insertion loss).

d May be limited to 115 dB at particular frequencies below 750 MHz due to spurious receiver residuals.

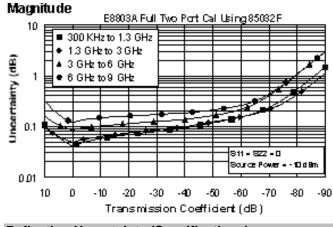
Corrected System Performance with Type-N Connectors

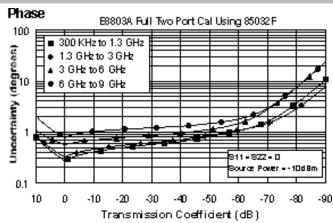
Table 2. Corrected System Performance With Type-N Device Connectors, 85032F Calibration Kit

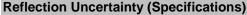
Applies to the E8801A, E8802A, and E8803A analyzer, 85032F (Type-N, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

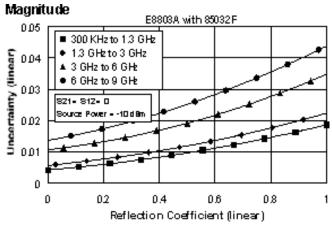
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to	1.3 GHz to	3 GHz to	6GHz to
	1.3 GHz	3 GHz	6 GHz	9 GHz
Directivity	49	46	40	38
Source Match	41	40	36	35
Load Match	49	45	39	37
Reflection Tracking	±0.011	±0.021	±0.032	±0.054
Transmission Tracking	±0.012	±0.020	±0.055	±0.083









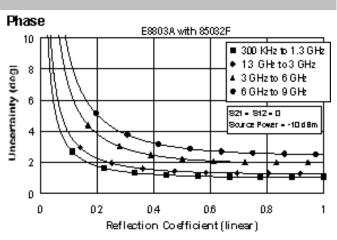
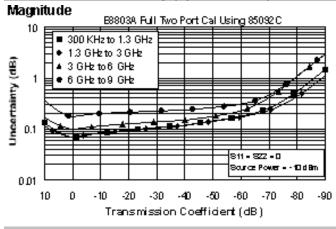


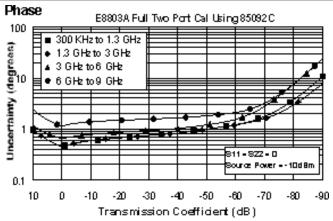
Table 3. Corrected System Performance With Type-N Device Connectors, 85092C Electronic Calibration Module

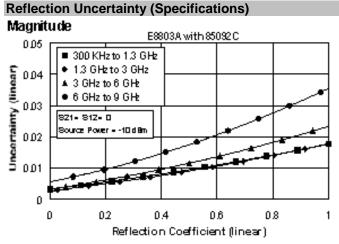
Applies to the E8801A, E8802A, and E8803A analyzer, 85092C (Type-N, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

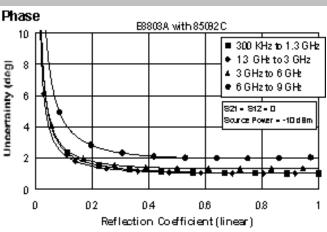
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to	300 kHz to 1.3 GHz to 3 GHz to		6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	52	54	52	47
Source Match	45	44	41	36
Load Match	47	47	44	39
Reflection Tracking	±0.040	±0.040	±0.060	±0.070
Transmission Tracking	±0.039	±0.039	±0.068	±0.136









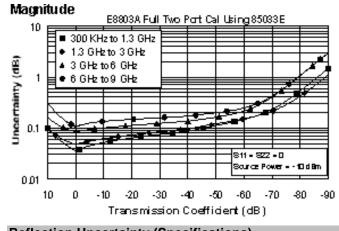
Corrected System Performance with 3.5 mm Connectors

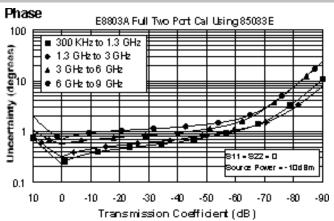
Table 4. Corrected System Performance With 3.5 mm Device Connector Type, 85033E Calibration Kit

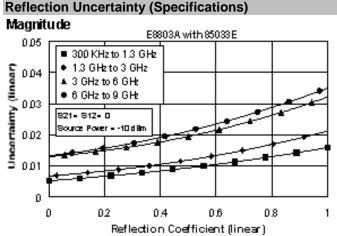
Applies to the E8801A, E8802A, and E8803A analyzer, 85033E (3.5 mm, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to	300 kHz to 1.3 GHz to 3 GHz to 6		6 GHz to
	1.3 GHz	3 GHz	6 GHz	9 GHz
Directivity	46	44	38	38
Source Match	43	40	37	36
Load Match	46	44	38	38
Reflection Tracking	±0.006	±0.007	±0.009	±0.010
Transmission Tracking	±0.012	±0.021	±0.057	±0.075







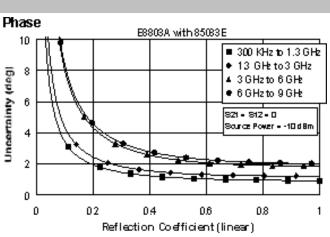
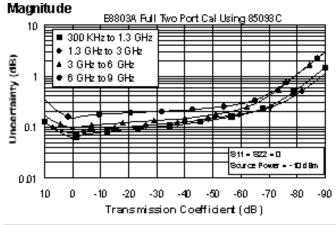


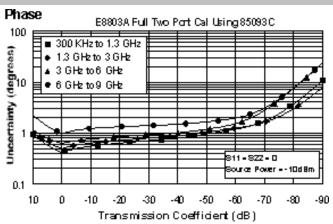
Table 5. Corrected System Performance With 3.5 mm Device Connector Type, 85093C Electronic Calibration Module

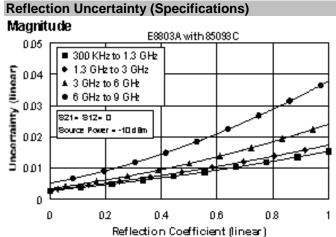
Applies to the E8801A, E8802A, and E8803A analyzer, 85093C (3.5 mm, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to 1.3 GHz to 3 GHz to 6 GHz to			6 GHz to
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	52	52	51	47
Source Match	44	44	39	34
Load Match	47	47	44	40
Reflection Tracking	±0.030	±0.040	±0.050	±0.070
Transmission Tracking	±0.039	±0.049	±0.068	±0.117







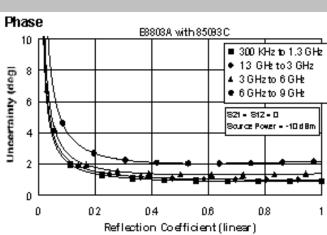


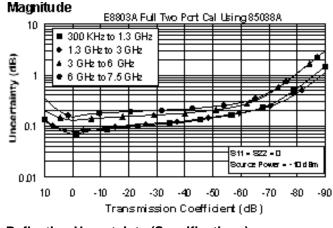
Table 6. Corrected System Performance With 7-16 Device Connector Type, 85038A Calibration Kit

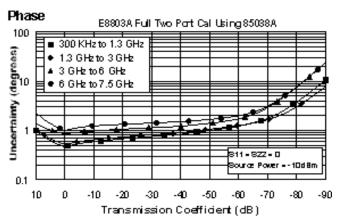
Applies to the E8801A, E8802A, and E8803A analyzer, 85038A (7-16, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

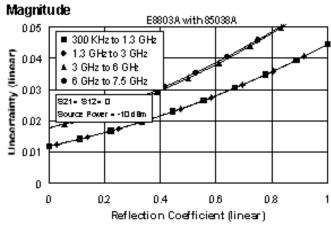
Description	Specification (dB)			
	300 kHz to	300 kHz to 1.3 GHz to 3		6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	40	40	36	36
Source Match	37	37	34	34
Load Match	39	39	35	35
Reflection Tracking	±0.089	±0.089	±0.115	±0.115
Transmission Tracking	±0.024	±0.033	±0.082	±0.103

Transmission Uncertainty (Specifications)





Reflection Uncertainty (Specifications)



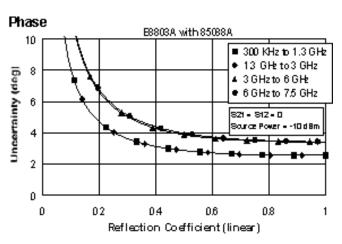


Table 7. Uncorrected Instrument Performance

Description	Specification (dB)				
	300 kHz to	1MHz to	1.3 GHz to	3 GHz to	6 GHz to
	1 MHz	1.3 GHz	3 GHz	6 GHz	9 GHz
Directivity	30	33	27	20	13
Source Match	18	18	16	11	8
Load Match	20	20	17	13.5	13
Reflection Tracking	±1.5	±1.5	±1.5	±2.5	±3.0
Transmission Tracking	±1.5	±1.5	±1.5	±2.5	±3.0

Test Port Output Characteristics (Source) Table 8. Test Port Output Frequency

Description	Specification	Supplemental Information
Range:		
E8801A	300 kHz to 3.0 GHz	
E8802A	300 kHz to 6.0 GHz	
E8803A	300 kHz to 9.0 GHz	
Resolution:	1 Hz	
Source Stability		±1 ppm, 0°C to 40 °C, typical ±1ppm/year maximum
Source Stability (Option 1E5)		±0.05 ppm, 0° to 70 °C, typical ±0.1 ppm/year maximum
CW Accuracy	±3 ppm	
CW Accuracy (Option 1E5)	±1 ppm	

Table 9. Test Port Output Power^a

Description	Specification	Supplemental Information
Level Accuracy:		
300 kHz to 6 GHz	±1.0 dB	Variation from 0 dBm in power range 0
6 GHz to 9 GHz	±2.0 dB	±1.5dB below 10 MHz
Level Linearity:		
		Variation from 0 dBm in power range 0
300 kHz to 9 GHz	±0.3 dB	-15 to +5 dBm
300 kHz to 1 MHz	±1.0 dB	+5 to +10 dBm
1 MHz to 6 GHz	±0.5 dB	+5 to +10 dBm
6 GHz to 9 GHz	±0.5 dB	+5 to +7 dBm
Range ^{b:}		
300 kHz to 6 GHz	-15 to +10 dBm	
6 GHz to 9 GHz	-15 to +7 dBm	
Range ^{b:}		
(Option 1E1):		
300 kHz to 6 GHz	-85 to +10 dBm	
6 GHz to 9 GHz	-85 to +7 dBm	
Sweep Range		
300 kHz to 6 GHz	25 dB	
6 GHz to 9 GHz	22 dB	
Level Resolution	0.01 dB	

^a Source output performance on port 1 only. Port 2 output performance is typical.

Table 10. Test Port Output Signal Purity

Description	Specification	Supplemental Information
Harmonics (2nd or 3rd)		
at max output power (< 25 MHz)		< -25 dBc, typical
at max output power (25 MHz to 9 GHz)		< -25 dBc, characteristic ^a
at 0 dBm output		< -35 dBc, typical
at -10 dBm output		< -38 dBc, typical, in power
		range 0
Non-harmonic Spurious		
at max output		-30 dBc, typical for offset freq>1kHz
at -10 dBm output		-50 dBc, typical for offset freq >1kHz

^a Typical below 25 MHz.

^b Power to which the source can be set and phase lock is assured.

Test Port and Receiver Input Characteristics Table 11. Test Port and Receiver Input Levels

Table 11. Test Port and Receiver Input Levels				
Description	Specification	Supplemental Information		
Maximum Test Port Input	Level			
Test Ports 1 and 2:				
300 kHz to 25 MHz	+10 dBm	< 0.6 dB compression		
25 MHz to 3 GHz	+10 dBm	< 0.4 dB compression		
3 GHz to 6 GHz	+10 dBm	< 0.7 dB compression		
6 GHz to 9 GHz	+5 dBm	< 0.7 dB compression		
Damage Level				
Test Port 1, 2		+30 dBm or ±30 VDC, typ.		
R, A, B (Opt. 014)		+15 dBm or ±5 VDC, typ.		
Coupler Thru (Opt. 014)		+33 dBm or ±0 VDC, typ.		
Test Port Noise Floor ^á				
300 kHz to 25 MHz ^b				
10 Hz IF Bandwidth	-115 dBm			
1 kHz IF Bandwidth	-95 dBm			
25 MHz to 3 GHz ^b				
10 Hz IF Bandwidth	-118 dBm			
1 kHz IF Bandwidth	-98 dBm			
3 GHz to 9 GHz	000			
10 Hz IF Bandwidth	≤ -108 dBm			
1 kHz IF Bandwidth	≤ -88 dBm			
Receiver Noise Floor ^a	<u> </u>			
300 kHz to 25 MHz ^c				
10 Hz IF Bandwidth	≤ -130 dBm			
1 kHz IF Bandwidth	≤ -130 dBm			
25 MHz to 3 GHz ^c	≤ -110 abiii			
10 Hz IF Bandwidth	< 400 dD			
	≤ -133 dBm			
1 kHz IF Bandwidth	≤ -113 dBm			
6 GHz to 9 GHz				
10 Hz IF Bandwidth	≤ -123 dBm			
1 kHz IF Bandwidth	≤ -103 dBm			
Crosstalk				
		Between test ports 1 and 2, with		
		short circuits at both ports		
300 kHz to 1 MHz	<-120 dB			
1 MHz to 25 MHz	<-125 dB			
25 MHz to 3 GHz	<-126 dB			
3 GHz to 6 GHz	<-117 dB			
6 GHz to 9 GHz	<-106 dB			
Maximum Receiver Input I	_evel (A, B, R)			
300 kHz to 6 GHz		-6 dBm, typical		
6 GHz to 9 GHz		-9 dBm, typical		
Reference Input Level (R)				
300 kHz to 9 GHz		-10 to -35 dBm, typical		
Maximum Coupler Input L	evel (Opt 014)			
300 kHz to 9 GHz		+33 dBm, typical		

^a Total average (RMS) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

^b May be limited to -90 dBm at particular frequencies below 750 MHz due to spurious receiver residuals.

^c May be limited to -105 dBm at particular frequencies below 750 MHz due to spurious receiver residuals.

^d Input level to maintain phase lock.

Table 12. Test Port Input (Trace Noise)

		Supplemental Information			
Trace Noise ^a Magnitud	Trace Noise ^a Magnitude				
1 kHz IF Bandwidth	< 0.002 dB rms				
10 kHz IF Bandwidth	< 0.005 dB rms				
Trace Noise ^a Phase					
1 kHz IF Bandwidth	< 0.010° rms				
10 kHz IF Bandwidth	< 0.035° rms				

^a Trace noise is defined as a ratio measurement of a through or a full reflection, with the source set to 0 dBm.

Table 13. Test Port Input (Reference Level and Stability)

Description	Specification	Supplemental Information		
Reference Level Mag	Reference Level Magnitude			
Range	±200 dB			
Resolution	0.001 dB			
Reference Level Pha	ise			
Range	±500°			
Resolution	0.01°			
Stability Magnitude ^a				
300 kHz to 3 GHz		0.02 dB/°C, typical		
3 GHz to 6 GHz		0.04 dB/°C, typical		
6 GHz to 9 GHz		0.06 dB/°C, typical		
Stability Phase ^a				
300 kHz to 3 GHz		0.2°/°C, typical		
3 GHz to 6 GHz		0.3°/°C, typical		
6 GHz to 9 GHz		0.6°/°C, typical		

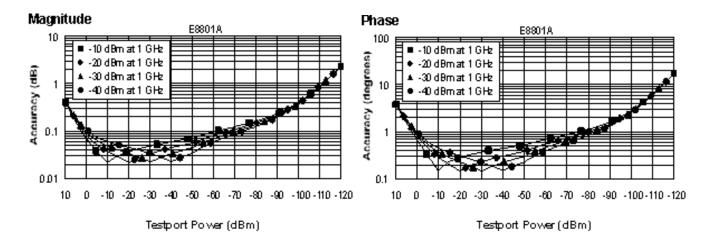
^a Stability is defined as a ratio measurement at the test port.

Table 14. Test Port Input (Dynamic Accuracy specification^a)

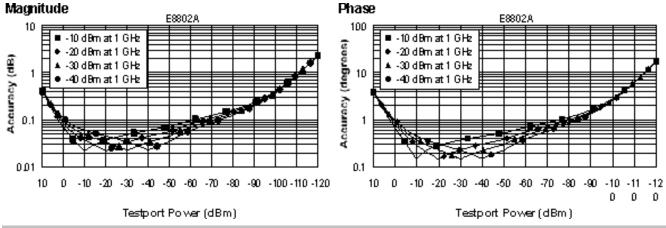
Accuracy of the test port input power reading is relative to the reference input power level. Applies to input ports 1 and 2 with the following conditions:

- IF bandwidth = 10 Hz
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature

300 kHz to 3 GHz 300 kHz to 3 GHz

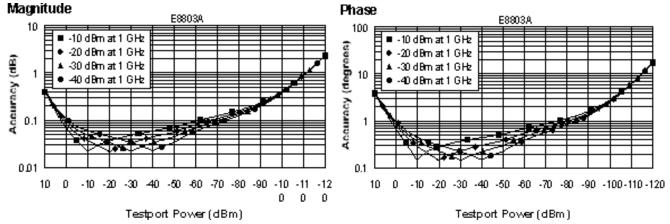


300 kHz to 6 GHz 300 kHz to 6 GHz



300 kHz to 9 GHz

300 kHz to 9 GHz



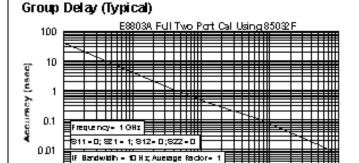
^a Dynamic accuracy is verified with the following measurements:

- compression over frequency
- IF linearity at a single frequency of 1.195 GHz and a reference level of -20 dBm

Table 15. Test Port Input (Group Delay)^a

Description	Specification	Supplemental Information
Aperture (selectable)	(frequency span)/(number of points -1)	
Maximum Aperture	20% of frequency span	
Range	0.5 x (1/minimum aperture)	
Maximum Delay		Limited to measuring no more than 180° of phase change within the minimum aperture.)
Accuracy		See graph below. Char.

The following graph shows group delay accuracy with type-N full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be < 2 dB and electrical length to be ten meters.



Calpower - - 10 d8m ;Weas power - - 10 d8m ; Bectrical Length - 10 m

Aperture (MHz)

In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

±Phase Accuracy (deg)/[360 x Aperture (Hz)]

0.1

Depending on the aperture and device length, the phase accuracy used is either incremental phase accuracy or worst case phase accuracy.

100

General Information

1000 لك 100

Table 16. System Bandwidths

Description	Specification	Supplemental Information
IF Bandwidth S	ettings	
Range		1 Hz to 40 kHz
		in a 1, 2, 3, 5, 7,10 sequence up to 30 kHz, 35 kHz, 40kHz, nominal

^a Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).

Table 17. Front Panel Information

Description	Supplemental Information
RF Connectors	
Туре	Type-N, female; 50 Ω , nominal
Center Pin Protrusion	0.204 to 0.207 in., characteristic
Probe Power	
Connector	3-pin connector, male
Positive Supply	+15 VDC ±2%, 400 mA, max, characteristic
Negative Supply	-12.6 VDC ±5%, 300 mA, max, characteristic
Display	
Size	21.3 cm (8.4 in) diagonal color active matrix LCD; 640 (horizontal) X 480
	(vertical) resolution
Refresh Rate	Vertical 59.83 Hz; Horizontal 31.41 Hz
Display Range	
Magnitude	±200 dB (at 20 dB/div), max
Phase	±180°, max
Polar	10 pUnits, min
	1000 Units, max
Display Resolution	
Magnitude	0.001 dB/div, min
Phase	0.01°/div, min
Marker Resolution	
Magnitude	0.001 dB, min
Phase	0.01°, min
Polar	0.01 mUnit, min; 0.01°,min

Table 18. Rear Panel Information

Description	Supplemental Information
10 MHz Reference In	
Connector	BNC, female
Input Frequency	10 MHz ± 1 ppm, typical
Input Level	-15 dBm to +20 dBm, typical
Input Impedance	200 Ω, nom.
10 MHz Reference Out	200 \$2, HOH.
Connector	BNC, female
Output Frequency	10 MHz ± 10 ppm, typical
Signal Type	Sine Wave, typical
Output Level	
Output Impedance	± 10 dBm ± 4 dB into 50 Ω , typical
· · · · · · · · · · · · · · · · · · ·	50 Ω, nominal
Harmonics	<-40 dBc, typical
VGA Video Output	145 · · · · · · · · · · · · · · · · · · ·
Connector	15-pin mini D-Sub; Drives VGA compatible monitors
Devices Supported	Resolutions
Flat Panel (TFT	1024 X 768, 800 X 600, 640 X 480
Flat Panel (DSTN)	800 X 600, 640 X 480
CRT Monitor	1280 X 1024, 1024 X 768, 800 X 600, 640 X 480
	Simultaneous operation of the internal and external displays is allowed,
	but with 640 X 480 resolution only. If you change resolution, you can only
	view the external display (internal display will "white out").
Test Set IO	25-pin D-Sub connector, available for external test set control
Aux IO	25-pin D-Sub connector, male, analog and digital IO
Handler IO	36-pin IDC D-ribbon socket connector; all input/output signals are default
	set to negative logic; can be reset to positive logic via GPIB command
GPIB	24-pin D-sub (Type D-24), female; compatible with IEEE-488.
Parallel Port (LPT1)	25-pin D-Sub connector, female; provides connection to printers or any
	other parallel port peripherals
Serial Port (COM 1)	9-pin D-Sub, male; compatible with RS-232
USB Port	
	Universal Serial Bus jack, Type A configuration (4 contacts inline, contact
	1 on left); female
Contact 1	Vcc: 4.75 to 5.25 VDC, 500 mA, maximum
Contact 2	-Data
Contact 3	+Data
Contact 4	Ground
LAN	10/100BaseT Ethernet, 8-pin configuration; auto selects between the two
	data rates
Line Power ^{a, b}	
Frequency at 110/115 V	50/60/400 Hz
Frequency at 230/240 V	50/60 Hz
Maximum Watts	350 W

^a A third-wire ground is required.

^b Power supply has a voltage autoswitching feature.

Table 19. Rear Panel Information (continued)

Description	Supplemental Information
External AM Input	
Description	Input provides low-frequency AM modulation to test port output signal, or shifts the test port output. Zero volts input gives the power
	level set by the instrument, a positive voltage gives a higher level, and a negative voltage gives a lower level.
Connector	BNC, female
Input Sensitivity	8 dB/V, typical
Bandwidth	1 kHz, typical
Input Impedance	1 kΩ, typical
External Detector Input	
Description	Input from an external, negative polarity diode detector provides ALC for a test port remote from instrument's front panel
Connector	BNC, female
Input Sensitivity	-500 mV yields approximately -3 dBm at detector's input, typical
Bandwidth	50 kHz, typical
Input Impedance	1 k Ω , nominal

Table 20. Analyzer Environment and Dimensions

Table 20. Analyzer Environm	ent and Dimensions			
Description		Supplemental Info	Supplemental Information	
General Environmental				
RFI/EMI Susceptibility		50082-1	Defined by CISPR Pub. 11, Group 1, Class A, and IEC 50082-1	
ESD		Minimize using sta	tic-safe work procedures and an	
		antistatic bench ma	at	
Dust		Minimize for optime	um reliability	
Operating Environment				
Temperature		0 °C to +40 °C		
			up, phase locks, and displays no thin this temperature range.	
Error-Corrected Temperatu	re Range	25°C ± 5°C	-	
			deviation from calibration temp.	
Humidity		5% to 95% at +40	°C	
Altitude		0 to 4500 m (14,76	60 ft.)	
Non-Operating Storage Er	nvironment			
Temperature		-40 °C to +70 °C	-40 °C to +70 °C	
Humidity		0% to 90% at +65	0% to 90% at +65 °C (non-condensing)	
Altitude		0 to 15,240 m (50,	0 to 15,240 m (50,000 ft.)	
Cabinet Dimensions				
	Height	Width	Depth	
Excluding front and rear	222 mm	425 mm	426 mm	
panel hardware and feet	8.75 in	16.75 in	16.8 in	
As shipped - includes front		425 mm	470 mm	
panel connectors, rear	9.5 in	16.75 in	18.5 in	
panel bumpers, and feet.				
As shipped plus handles	242 mm	458 mm	502 mm	
	9.5 in	18 in	19.75 in	
As shipped plus rack-	242 mm	483 mm	470 mm	
mount flanges	9.5 in	19 in	18.5 in	
As shipped plus handles	242 mm	483 mm	502 mm	
and flanges	9.5 in	19 in	19.75 in	
Weight				
Net	24 kg (54 lb), nomir			
Shipping	32 kg (70 lb), nomir	nal		

Measurement Throughput Summary Table 21. Typical Cycle Time^{a,b} (ms)

	Number of Points			
	101	201	401	1601
Start 1.8 GHz, St	top 2 GHz	, 35 kHz IF	bandwid	th
Uncorrected,	7	10	16	52
1-port cal				
2-Port cal	27	36	55	164
Start 300 kHz, S	top 3 GHz	, 35 kHz IF	bandwid	th
Uncorrected,	48	54	64	104
1-port cal				
2-Port cal	103	119	145	254
Start 300 kHz, Stop 9 GHz, 35 kHz IF bandwidth				
Uncorrected,	51	57	64	103
1-port cal				
2-Port cal	112	124	138	220

a Typical performance.

Table 22. Cycle Time vs. IF Bandwidth^a

Applies to the Preset condition (201 points, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

IF Bandwidth	Cycle Time (ms) ^b
(Hz)	
40,000	8
35,000	9
30,000	11
20,000	13
10,000	28
7000	36
5000	48
3000	72
1000	196
300	620
100	1875
30	8062
10	17877

b Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S11) measurement...

^a Typical performance. ^b Cycle time includes sweep and retrace time.

Table 23. Cycle Time vs. Number of Points^a

Applies to the Preset condition (35 kHz IF bandwidth, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

Number of Points	Cycle Time (ms) ^b
3	4
11	4
51 101	5
101	6
201 401 801	9
401	16
801	29
1601	52

^a Typical performance.
^b Cycle time includes sweep and retrace time.

Table 24. Data Transfer Time^a (ms)

Number of Points				
51	201	401	1601	
n externa	I PC) ^b			
3	7	12	43	
4	12	22	84	
7	64	24	489	
LAN				
n externa	I PC) ^b			
1	1	1	1	
1	1	1	2	
5	15	26	96	
ted in the	analyzer) ^d		
1	1	2	3	
1	2	2	4	
8	29	56	222	
ted in the	analyzer) ^e		
1	1	1	1	
1	1	2	6	
DCOM over 100 Mbit/s LAN				
(program executed on external PC) ^f				
1	1	1	2	
1	3	6	19	
	s LAN a externa a 4 b 7 c c c c c c c c c c c c c c c c c c	51 201 n external PC) ^b 3 7 4 12 7 64 LAN n external PC) ^b 1 1 1 1 5 15 ted in the analyzer 1 1 1 2 8 29 ted in the analyzer 1 1 1 1 5 LAN n external PC) ^f 1 1	51 201 401	

^a Typical performance of unit with 500 MHz Pentium III processor.

^b Measured using a VEE 5.0 program running on a 600 MHz HP Kayak, National InstrumentsTM GPIB card. Transferred complex S11 data, using "CALC:DATA?SDATA".

Complex S11 data, using "CALC:DATA?SDATA".

Complex S12 data, using a VEE 5.0 program running on a 600 MHz HP Kayak. Transferred complex S11 data,

using "CALC:DATA?SDATA". Speed dependent on LAN traffic, if connected to network.

d Measured using a VEE 5.0 program running inside PNA Series Analyzer. Transferred complex S11 data, using "CALC:DATA?SDATA".

Measured using a Visual Basic 6.0 program running inside PNA Series Analyzer. Transferred complex S11

^f Measured using a Visual Basic 6.0 program running on a 600 MHz HP Kayak. Transferred complex S11 data. Speed dependent on LAN traffic, if connected to network.

⁹ Used IArray Transfer.getComplex method for 32-bit floating point.

^h Used meas.getData method for Variant data type.

Table 25. Recall and Sweep Speed^a

Operations	Number of	Number of	Recall
	Window(s)	Trace(s)	Time (ms)
Recall	1	1	49
Recall and Sweep	1	1	59
Recall	1	2	82
Recall and Sweep	1	2	96
Recall	1	4	159
Recall and Sweep	1	4	203
Recall	2	2	93
Recall and Sweep	2	2	115
Recall	3	4	158
Recall and Sweep	3	4	218
Recall	4	4	187
Recall and Sweep	4	4	247
Recall	4	8	340
Recall and Sweep	4	8	507

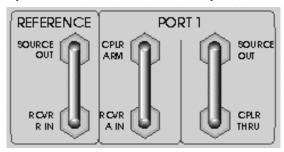
^a CF=177 MHz, Span=200 MHz, 201 points, 35 kHz IF BW

Specifications: Front-Panel Jumpers

Models E8801A, E8802A, E8803A Option 014

-

Specifications: Front-Panel Jumpers, Port 1



Option 014 Analyzer

NOTE: The standard analyzer (E8801A/ E8802A/ E8803A) has no front-panel jumpers.

Use these SMA (female) connectors to develop custom measurements.

Receiver A Direct-Access Jumper

- The "Cplr Arm" connector comes from the coupled arm of the Port 1 coupler.
- The "Rcvr A In"connector goes directly to the input of receiver "A."

For the A Receiver Input:

Maximum Input Level:

- -6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
- -6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
- -11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

- <-130 dBm (300 kHz to 25 MHz)
- <-123 dBm (3 GHz to 6 GHz)
- <-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm

Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz)

>12 dB (3 GHz to 6 GHz)

>7 dB (6 GHz to 9 GHz)

Reference Channel R Jumper

- The "Source Out" connector comes from the source Reference output.
- The "Rcvr R In" connector goes directly to the R receiver input.

For the R Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Damage Level: >+15 dBm

Minimum Level to Maintain Phase-Lock:

-35 dBm (300 kHz to 3 GHz) -25 dBm (3 GHz to 9 GHz)

For the Reference Output: (with an External Input to Lock the Source)

Output Level:

-5 to -30 dBm (300 kHz to 6 GHz) -10 to -35 dBm (6 GHz to 9 GHz)

Source Match Return Loss:

16 dB (300 kHz to 3 GHz) 14 dB (3 GHz to 9 GHz)

Damage Level: >+15 dBm Maximum DC Level: 40V Port 1 Test-Port Jumper

- The upper "Source Out" connector comes from the transfer switch Port 1 output.
- The lower "Coupler Thru" connector goes directly to the main input of Port 1 coupler. This is where a power amplifier can be inserted to boost the test port power.

For the Source Output:

Output Level:

+12 to -83 dBm (300 kHz to 6 GHz) +7 to -88 dBm (6 GHz to 9 GHz)

Source Match: 15 dB at 9 GHz For the Input to the Coupler:

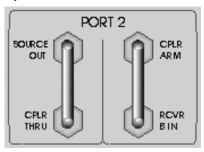
Insertion Loss to Test Port 1:

<3.5 dB at 3 GHz <5 dB at 9 GHz

Maximum Input Power: 2 Watts, CW

Damage Level: 4 Watts, CW

Specifications: Front-Panel Jumpers, Port 2



Option 014 Analyzer

NOTE: The standard analyzer (E8801A/ E8802A/ E8803A) has no front-panel jumpers.

Use these SMA (female) connectors to develop custom measurements.

Receiver B Direct-Access Jumper

- The upper "Cplr Arm" connector comes from the coupled arm of the Port 2 coupler.
- The "Rcvr B In" connector goes directly to the input of receiver "B."

For the B Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)

-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)

-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

<-130 dBm (300 kHz to 25 MHz)

<-123 dBm (3 GHz to 6 GHz)

<-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz)

>12 dB (3 GHz to 6 GHz)

>7 dB (6 GHz to 9 GHz)

Port 2 Test-Port Jumper

- The upper "Source Out" connector comes from the transfer switch Port 2 output.
- The lower "Coupler Thru" connector goes directly to the main input of Port 2 coupler. This is where a power amplifier can be inserted to boost the test port power.

For the Source Output:

Output Level:

+12 to -83 dBm (300 kHz to 6 GHz)

+7 to -88 dBm (6 GHz to 9 GHz)

Source Match: 15 dB at 9 GHz For the Input to the Coupler:

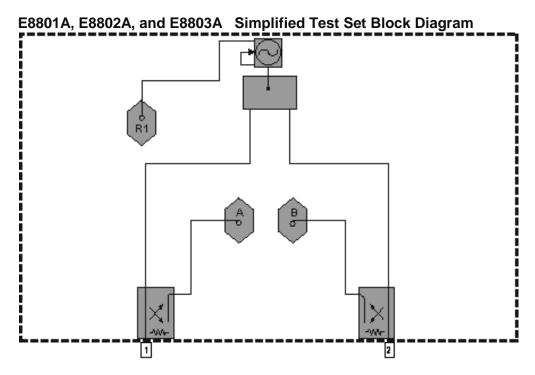
Insertion Loss to Test Port 2:

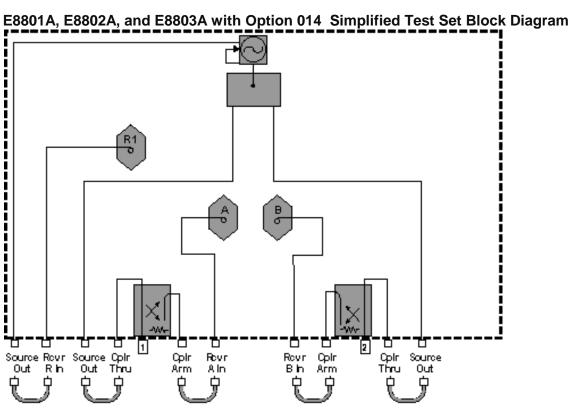
<3.5 dB at 3 GHz

<5 dB at 9 GHz

Maximum Input Power: 2 Watts, CW

Damage Level: 4 Watts, CW





3 Technical Specifications for the N3381A, N3382A, N3383A

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N3381A, N3382A, and N3383A with Option 014 Simplified Test Set Block I	Diagram 3-30

This is a complete list of the N3381A, N3382A, and N3383A network analyzer technical specifications.

- To optimize viewing of uncertainty curves, click the Maximize button.
- To view or print the PNA Series Data Sheet (a condensed version of the specifications), visit our web site at http://www.agilent.com/find/pna, select your analyzer model, and click on the link for the data sheet.
- The uncertainty curves contained in this document apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

Definitions

All specifications and characteristics apply over a 25 °C ±5 °C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

Specification (spec.): Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Characteristic (char.): A performance parameter that the product is expected to meet before it leaves the factory, but that is not verified in the field and is not covered by the product warranty. A characteristic includes the same guardbands as a specification.

Typical (typ.): Expected performance of an average unit which does not include guardbands. It is not covered by the product warranty.

Nominal (nom.): A general, descriptive term that does not imply a level of performance. It is not covered by the product warranty.

Calibration: The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

Corrected (residual): Indicates performance after error correction (calibration). It is determined by the quality of calibration standards and how well "known" they are, plus system repeatability, stability, and noise.

Uncorrected (raw): Indicates instrument performance without error correction. The uncorrected performance affects the stability of a calibration.

Standard: When referring to the analyzer, this includes no options unless noted otherwise.

Corrected System Performance

The specifications in this section apply for measurements made with the N3381A, N3382A, and N3383A analyzer with the following conditions:

- 10 Hz IF bandwidth
- No averaging applied to data
- Environmental temperature of 25 °C ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Note: The uncertainty curves contained in these specifications apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

Table 1. System Dynamic Range

Description	Specification (dB)	Characteristic (dB)			
	Dynamic range ^a (at test port)				
300 kHz to 25 MHz ^b	125				
25 MHz to 3 GHz ^b	128				
3 GHz to 6 GHz	118				
6 GHz to 9 GHz	115				
Dynamic range ^c (at receiver input)					
300 kHz to 25 MHz ^d		140			
25 MHz to 3 GHz ^d		143			
3 GHz to 6 GHz		133			
6 GHz to 9 GHz		130			

^a The test port dynamic range is calculated as the difference between the test port rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

b May be limited to 100 dB at particular frequencies below 750 MHz due to spurious receiver residuals.

The receiver input dynamic range is calculated as the difference between the receiver rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its damage level. When the analyzer is in segment sweep mode, frequency segments can be defined with a higher power level when the extended dynamic range is required (i.e. the portion of the device's response with high insertion loss), and reduced power when receiver damage may occur (i.e. the portion of the devices's response with low insertion loss). Specification applies only when power is sourced from Port 1. If power is sourced from either Port 2 or Port 3, dynamic range decreases by 3 dB.

^d May be limited to 115 dB at particular frequencies below 750 MHz due to spurious receiver residuals.

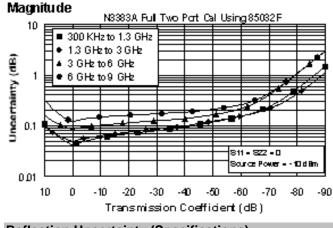
Corrected System Performance with Type-N Connectors

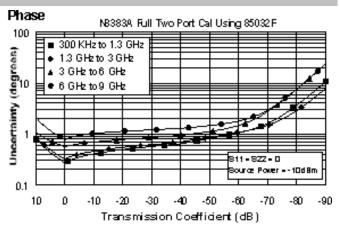
Table 2. Corrected System Performance With Type-N Device Connectors, 85032F Calibration Kit

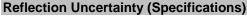
Applies to the N3381A, N3382A, and N3383A analyzer, 85032F (Type-N, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

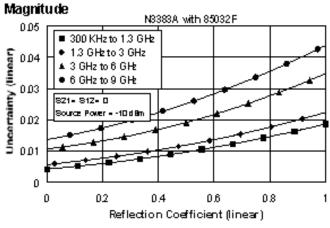
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)				
	300 kHz to 1.3 GHz to 3 to 6 to				
	1.3 GHz	3 GHz	6 GHz	9 GHz	
Directivity	49	46	40	38	
Source Match	41	40	36	35	
Load Match	49	45	39	37	
Reflection Tracking	±0.011	±0.021	±0.032	±0.054	
Transmission Tracking	±0.012	±0.020	±0.055	±0.083	









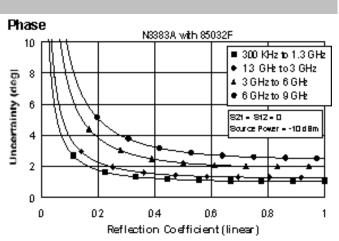


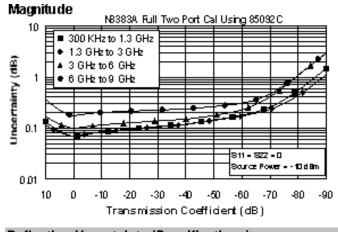
Table 3. Corrected System Performance With Type-N Device Connectors, 85092C Electronic Calibration Module

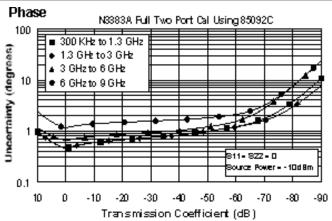
Applies to the N3381A, N3382A, and N3383A analyzer, 85092C (Type-N, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)			
	300 kHz to 1.3 GHz to 3 to 6 to			
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	52	54	52	47
Source Match	45	44	41	36
Load Match	47	47	44	39
Reflection Tracking	±0.040	±0.040	±0.060	±0.070
Transmission Tracking	±0.039	±0.039	±0.068	±0.136

Transmission Uncertainty (Specifications)





■ 300 KHz to 1.3 GHz

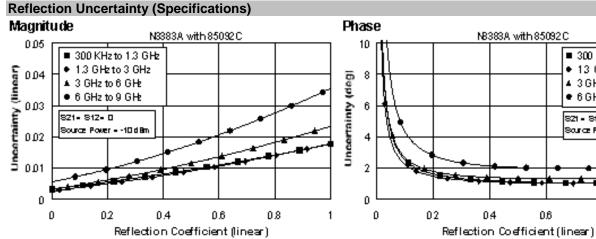
• 13 GHz to 3 GHz

▲ 3 GHz to 6 GHz

• 6 GHz to 9 GHz

08

821 = 812 = 0 Source Power = -10 d8m



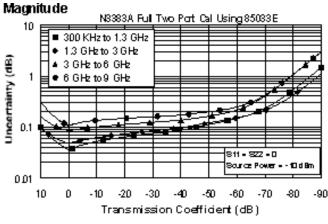
Corrected System Performance with 3.5 mm Connectors

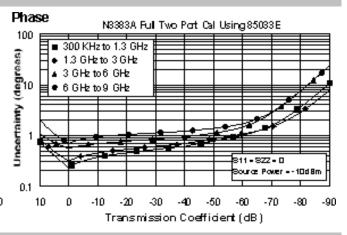
Table 4. Corrected System Performance With 3.5 mm Device Connector Type, 85033E Calibration Kit

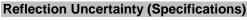
Applies to the N3381A, N3382A, and N3383A analyzer, 85033E (3.5 mm, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

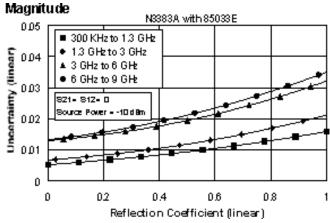
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specification (dB)				
	300 kHz to 1.3 GHz to 3 to 6 to				
	1.3 GHz	3 GHz	6 GHz	9 GHz	
Directivity	46	44	38	38	
Source Match	43	40	37	36	
Load Match	46	44	38	38	
Reflection Tracking	±0.006	±0.007	±0.009	±0.010	
Transmission Tracking	±0.012	±0.021	±0.057	±0.075	









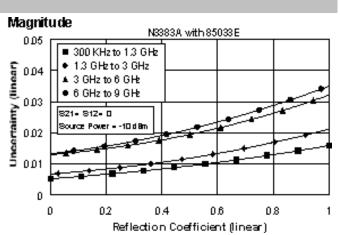


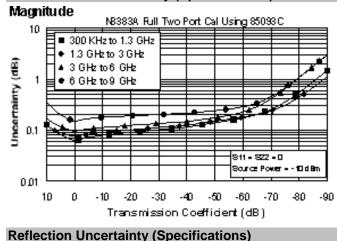
Table 5. Corrected System Performance With 3.5 mm Device Connector Type, 85093C Electronic Calibration Module

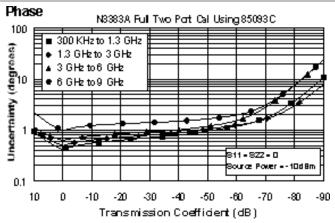
Applies to the N3381A, N3382A, and N3383A analyzer, 85093C (3.5 mm, 50Ω) electronic calibration (ECal) module, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

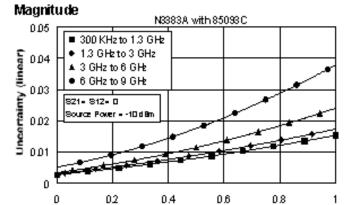
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

Description	Specificatio	Specification (dB)			
	300 kHz to 1.3 GHz to 3 to 6 to			6 to	
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a	
Directivity	52	52	51	47	
Source Match	44	44	39	34	
Load Match	47	47	44	40	
Reflection Tracking	±0.030	±0.040	±0.050	±0.070	
Transmission Tracking	±0.039	±0.049	±0.068	±0.117	

Transmission Uncertainty (Specifications)







Reflection Coefficient (linear)

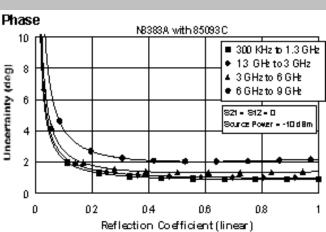


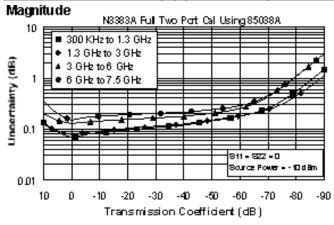
Table 6. Corrected System Performance With 7-16 Device Connector Type, 85038A Calibration Kit

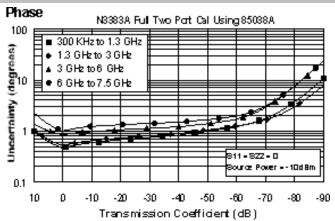
Applies to the N3381A, N3382A, and N3383A analyzer, 85038A (7-16, 50Ω) calibration kit, N6314A test port cable, and a full 2-port calibration. Also applies to the following conditions:

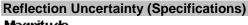
- IF bandwidth = 10 Hz
- No averaging applied to data
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature
- Isolation calibration not omitted

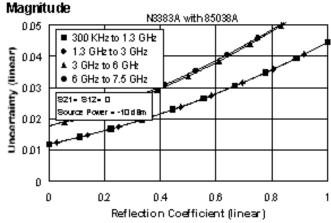
Description	Specification (dB)			
	300 kHz to	1.3 GHz to	3 to	6 to
	1.3 GHz	3 GHz	6 GHz	9 GHz ^a
Directivity	40	40	36	36
Source Match	37	37	34	34
Load Match	39	39	35	35
Reflection Tracking	±0.089	±0.089	±0.115	±0.115
Transmission Tracking	±0.024	±0.033	±0.082	±0.103

Transmission Uncertainty (Specifications)









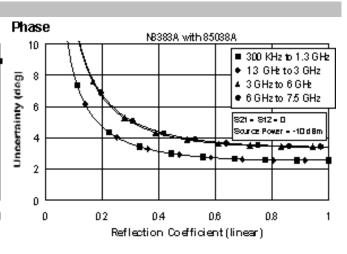


Table 7. Uncorrected Instrument Performance

Description	Specification (dB)				
	300 kHz to	1MHz to	1.3 GHz to	3 GHz to	6 GHz to
	1 MHz	1.3 GHz	3 GHz	6 GHz	9 GHz
Directivity	30	33	27	20	13
Source Match Ports 1 and 2	18	18	17	14	12
Source Match Port 3 only	18	18	17	14	12
Load Match Ports 1 and 2	20	20	17	13.5	11.5
Load Match Port 3 only	20	20	17	13.5	11.5
Reflection Tracking	±1.5	±1.5	±1.5	±2.5	±3.0
Transmission Tracking	±1.5	±1.5	±1.5	±2.5	±3.0

Test Port Output Characteristics (Source) Table 8. Test Port Output Frequency

Description	Specification	Supplemental Information
Range:		
N3381A	300 kHz to 3.0 GHz	
N3382A	300 kHz to 6.0 GHz	
N3383A	300 kHz to 9.0 GHz	
Resolution	1 Hz	
Source Stability		±1 ppm, 0° to 40 °C, typical ±1ppm/year maximum
Source Stability (Option 1E5)		±0.05 ppm, 0° to 40 °C, typical ±0.1 ppm/year maximum
CW Accuracy	±3 ppm	
CW Accuracy		
(Option 1E5)	±1 ppm	

Table 9. Test Port Output Power^a

Table 9. Test Port Outpu		T
Description	Specification	Supplemental Information
Level Accuracy		
		Variation from 0 dBm in power range
		0
		(step attenuator at 0 dB)
		±1.5dB below 10 MHz
300 kHz to 6 GHz	±1.0 dB	
6 GHz to 9 GHz	±2.0 dB	
Level Linearity		
		Variation from 0 dBm in power range
		0
300 kHz to 9 GHz	±0.3 dB	-15 to +5 dBm
300 kHz to 1 MHz	±1.0 dB	+5 to +10 dBm
1 MHz to 6 GHz	±0.5 dB	+5 to +10 dBm
6 GHz to 9 GHz	±0.5 dB	+5 to +7 dBm
Range ^b		
300 kHz to 6 GHz	-15 to +10 dBm	
6 GHz to 9 GHz	-15 to +7 dBm	
Range ^b (Option 1E1)		
300 kHz to 6 GHz	-85 to +10 dBm	
6 GHz to 9 GHz		
	-85 to +7 dBm	
Sweep Range		
Port 1:	OF 4D	
300 kHz to 6 GHz	25 dB	
6 GHz to 9 GHz	22 dB	
Level Resolution	0.01 dB	

^a Source output performance on port 1 only. Port 2 and port 3 output performance is typically 3 dB less.

Table 10. Test Port Output Signal Purity

Table for received at par eignarr an	· y	
Description	Specification	Supplemental Information
Harmonics (2nd or 3rd)		
at max output power (< 25 MHz)		< -25 dBc, typical
at max output power (25 MHz to		< -25 dBc, characteristic ^a
9 GHz)		
at 0 dBm output		< -35 dBc, typical
at -10 dBm output		< -38 dBc, typical, in power
		range 0
Non-harmonic Spurious		
at max output		-30 dBc, typical for offset freq>1kHz
at -10 dBm output		-50 dBc, typical for offset freq >1kHz

^a Typical below 25 MHz.

^b Power to which the source can be set and phase lock is assured.

Test Port and Receiver Input Characteristics Table 11. Test Port and Receiver Input Levels

Description	Specification	Supplemental Information
Maximum Test Port Input		
300 kHz to 25 MHz	+10 dBm	<0.6 dB compression
25 MHz to 3 GHz	+10 dBm	<0.4 dB compression
3 GHz to 6 GHz	+10 dBm	<0.7 dB compression
6 GHz to 9 GHz	+7 dBm	<0.7 dB compression
Damage Level		
Test Port 1, 2. 3		+30 dBm or ±30 VDC, typ.
R, A, B, C (Opt. 014)		+15 dBm or ±5 VDC, typ.
Coupler Thru (Opt. 014)		+33 dBm or ±0 VDC, typ.
Test Port Noise Floor ^a		
300 kHz to 25 MHz ^b		
10 Hz IF Bandwidth	-115 dBm	
1 kHz IF Bandwidth	-95 dBm	
25 MHz to 3 GHz ^b		
10 Hz IF Bandwidth	-118 dBm	
1 kHz IF Bandwidth	-98 dBm	
3 GHz to 9 GHz		
10 Hz IF Bandwidth	≤ -108 dBm	
1 kHz IF Bandwidth	≤ -88 dBm	
Receiver Noise Floor ^a		
300 kHz to 25 MHz ^c		
10 Hz IF Bandwidth	≤ -130 dBm,	
	characteristic	
1 kHz IF Bandwidth	≤ -110 dBm,	
	characteristic	
25 MHz to 3 GHz ^c		
10 Hz IF Bandwidth	-133 dBm,	
	characteristic	
1 kHz IF Bandwidth	-113 dBm,	
	characteristic	
6 GHz to 9 GHz		
10 Hz IF Bandwidth	≤ -123 dBm,	
	characteristic	
1 kHz IF Bandwidth	≤ -103 dBm,	
	characteristic	

<-120 dB	
<-125 dB	
<-126 dB	
<-117 dB	
<-106 dB	
<-120 dB	
<-125 dB	
<-126 dB	
<-113 dB	
<-106 dB	
<-120 dB	
<-125 dB	
<-115 dB	
<-107 dB	
evel (A, B, R, C)	
	6 dBm, typical
	9 dBm, typical
	-10 to -35 dBm, typical
evel (Opt 014)	
	+33 dBm, typical
	<-125 dB <-126 dB <-117 dB <-106 dB <-120 dB <-125 dB <-126 dB <-113 dB <-106 dB <-115 dB <-107 dB <-107 dB <-107 dB <-107 dB

^a Total average (RMS) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

Table 12. Test Port Input (Trace Noise)

Description	Specification	Supplemental Information
Trace Noise ^a Magnitud	е	
1 kHz IF Bandwidth	< 0.002 dB rms	
10 kHz IF Bandwidth	< 0.005 dB rms	
Trace Noise ^a Phase		
1 kHz IF Bandwidth	< 0.010° rms	
10 kHz IF Bandwidth	< 0.035° rms	

^a Trace noise is defined as a ratio measurement of a through or a full reflection, with the source set to 0 dBm.

^b May be limited to -90 dBm at particular frequencies below 750 MHz due to spurious receiver residuals.

^c May be limited to -105 dBm at particular frequencies below 750 MHz due to spurious receiver residuals.

^d Input level to maintain phase lock.

Table 13. Test Port Input (Reference Level and Stability)

Description	Specification	Supplemental Information		
Reference Level Magn	Reference Level Magnitude			
Range	±200 dB			
Resolution	0.001 dB			
Reference Level Phase	9			
Range	±500°			
Resolution	0.01°			
Stability Magnitude ^a				
300 kHz to 3 GHz		0.02 dB/°C, typical		
3 GHz to 6 GHz		0.04 dB/°C, typical		
6 GHz to 9 GHz		0.06 dB/°C, typical		
Stability Phase ^a				
300 kHz to 3 GHz		0.2°/°C, typical		
3 GHz to 6 GHz		0.3°/°C, typical		
6 GHz to 9 GHz		0.6°/°C, typical		

^a Stability is defined as a ratio measurement at the test port.

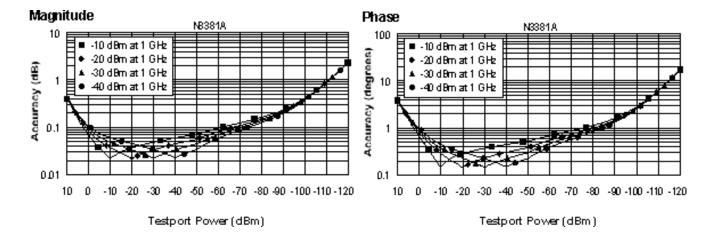
Table 14. Test Port Input (Dynamic Accuracy specification^a)

Accuracy of the test port input power reading is relative to the reference input power level. Applies to input ports 1 and 2 with the following conditions:

- IF bandwidth = 10 Hz
- Environmental temperature 25° ±5 °C, with < 1 °C deviation from calibration temperature

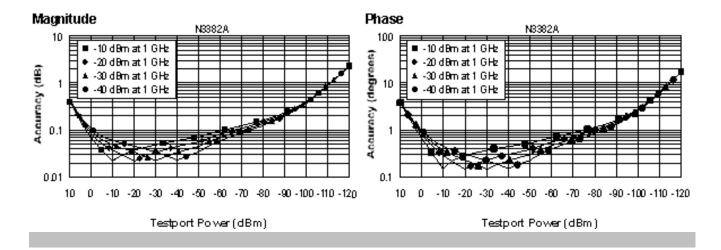
300 kHz to 3 GHz

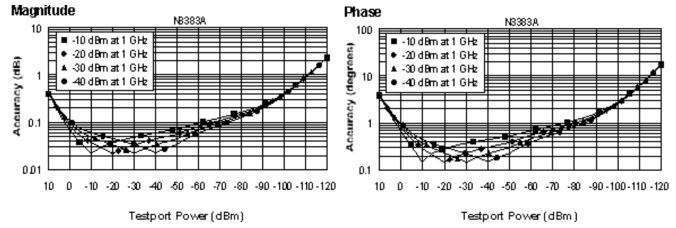
300 kHz to 3 GHz



300 kHz to 6 GHz

300 kHz to 6 GHz





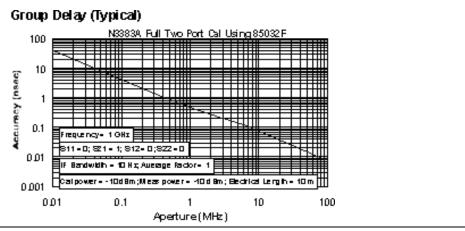
^aDynamic accuracy is verified with the following measurements:

- compression over frequency
- IF linearity at a single frequency of 1.195 GHz and a reference level of -20 dBm

Table 15. Test Port Input (Group Delay)^a

Description	Specification	Supplemental Information
Aperture (selectable)	(frequency span)/(number of points -1)	
Maximum Aperture	20% of frequency span	
Range	0.5 x (1/minimum aperture)	
Maximum Delay		Limited to measuring no more than 180° of phase change within the minimum aperture.)
Accuracy		See graph below. Char.

The following graph shows group delay accuracy with type-N full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be < 2 dB and electrical length to be ten meters.



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

±Phase Accuracy (deg)/[360 × Aperture (Hz)]

Depending on the aperture and device length, the phase accuracy used is either incremental phase accuracy or worst case phase accuracy.

^a Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).

General Information

Table 16. System Bandwidths

Description	Specification	Supplemental Information	
IF Bandwidth Sett	ings		
Range		1 Hz to 40 kHz in a 1, 2, 3, 5, 7,10 sequence up to 30 kHz,	
		35 kHz, 40kHz, nominal	

Table 17. Front Panel Information

Description	Supplemental Information	
RF Connectors		
Туре	Type-N, female; 50 Ω , nominal	
Center Pin Protrusion	0.204 to 0.207 in., characteristic	
Probe Power		
Connector	3-pin connector, male	
Positive Supply	+15 VDC ±2%, 400 mA, max, characteristic	
Negative Supply	-12.6 VDC ±5%, 300 mA, max, characteristic	
Display		
Size	21.3 cm (8.4 in) diagonal color active matrix LCD; 640	
	(horizontal) X 480 (vertical) resolution	
Refresh Rate	Vertical 59.83 Hz; Horizontal 31.41 Hz	
Display Range		
Magnitude	±200 dB (at 20 dB/div), max	
Phase	±180°, max	
Polar	10 pUnits, min	
	1000 Units, max	
Display Resolution		
Magnitude	0.001 dB/div, min	
Phase	0.01°/div, min	
Marker Resolution		
Magnitude	0.001 dB, min	
Phase	0.01°, min	
Polar	0.01 mUnit, min; 0.01°,min	

Table 18. Rear Panel Information

Description	Supplemental Information
	Supplemental information
10 MHz Reference In	DNO formale
Connector	BNC, female
Input Frequency	10 MHz ± 1 ppm, typical
Input Level	-15 dBm to +20 dBm, typical
Input Impedance	200 Ω, nom.
10 MHz Reference Out	
Connector	BNC, female
Output Frequency	10 MHz ± 10 ppm, typical
Signal Type	Sine Wave, typical
Output Level	+10 dBm ± 4 dB into 50 Ω, typical
Output Impedance	50 Ω, nominal
Harmonics	<-40 dBc, typical
VGA Video Output	
Connector	15-pin mini D-Sub; Drives VGA compatible monitors
Devices Supported:	Resolutions:
Flat Panel (TFT)	1024 X 768, 800 X 600, 640 X 480
Flat Panel (DSTN)	800 X 600, 640 X 480
CRT Monitor	1280 X 1024, 1024 X 768, 800 X 600, 640 X 480
CIVI Mornio	Simultaneous operation of the internal and external
	displays is allowed, but with 640 X 480 resolution only.
	If you change resolution, you can only view the external
	display (internal display will "white out").
Test Set IO	25-pin D-Sub connector, available for external test set
l'est det 10	control
Aux IO	25-pin D-Sub connector, male, analog and digital IO
Handler IO	36-pin IDC D-ribbon socket connector; all input/output
	signals are default set to negative logic; can be reset to
	positive logic via GPIB command
GPIB	24-pin D-sub (Type D-24), female; compatible with
O. I.S	IEEE-488.
Parallel Port (LPT1)	25-pin D-Sub connector, female; provides connection to
r aranor r ore (Er 11)	
1	
Serial Port (COM 1)	printers or any other parallel port peripherals
Serial Port (COM 1)	
Serial Port (COM 1) USB Port	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232
	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4
USB Port	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female
USB Port Contact 1	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum
Contact 1 Contact 2	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data
Contact 1 Contact 2 Contact 3	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data +Data
Contact 1 Contact 2 Contact 3 Contact 4	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data +Data Ground
Contact 1 Contact 2 Contact 3	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data +Data Ground 10/100BaseT Ethernet, 8-pin configuration; auto selects
Contact 1 Contact 2 Contact 3 Contact 4 LAN	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data +Data Ground
Contact 1 Contact 2 Contact 3 Contact 4 LAN Line Power ^{a, b}	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data +Data Ground 10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates
Contact 1 Contact 2 Contact 3 Contact 4 LAN Line Power ^{a, b} Frequency at 110/115 V	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data +Data Ground 10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates 50/60/400 Hz
Contact 1 Contact 2 Contact 3 Contact 4 LAN Line Power ^{a, b}	printers or any other parallel port peripherals 9-pin D-Sub, male; compatible with RS-232 Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female Vcc: 4.75 to 5.25 VDC, 500 mA, maximum -Data +Data Ground 10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates

^a A third-wire ground is required.

^b Power supply has a voltage autoswitching feature.

Table 19. Rear Panel Information (continued)

Description	Supplemental Information
External AM Input	
Description	Input provides low-frequency AM modulation to test port output signal, or shifts the test port output. Zero volts input gives the power level set by the instrument, a positive voltage gives a higher level, and a negative voltage gives a lower level.
Connector	BNC, female
Input Sensitivity	8 dB/V, typical
Bandwidth	1 kHz, typical
Input Impedance	1 k Ω , nominal
External Detector Inp	ut
Description	Input from an external, negative polarity diode detector provides ALC for a test port remote from instrument's front panel
Connector	BNC, female
Input Sensitivity	-500 mV yields approximately -3 dBm at detector's input, typical
Bandwidth	50 kHz, typical
Input Impedance	1 kΩ, typical

Table 20. Analyzer Environment and Dimensions

Supplemental Information
Defined by CISPR Pub. 11, Group 1,
Class A, and IEC 50082-1
Minimize using static-safe work
procedures and an antistatic bench mat
Minimize for optimum reliability
0 °C to +40 °C
Instrument powers up, phase locks, and
displays no error messages within this
temperature range.
25°C ± 5°C
with less than 1°C deviation from
calibration temp.
5% to 95% at +40 °C
0 to 4500 m (14,760 ft.)
nt
-40 °C to +70 °C
0% to 90% at +65 °C (non-condensing)
0 to 15,240 m (50,000 ft.)

Cabinet Dimensions			
	Height	Width	Depth
Excluding front and rear panel	222 mm	425 mm	426 mm
hardware and feet	8.75 in	16.75 in	16.8 in
As shipped - includes front panel	242 mm	425 mm	470 mm
connectors, rear panel bumpers, and	9.5 in	16.75 in	18.5 in
feet.			
As shipped plus handles	242 mm	458 mm	502 mm
	9.5 in	18 in	19.75 in
As shipped plus rack-mount flanges	242 mm	483 mm	470 mm
	9.5 in	19 in	18.5 in
As shipped plus handles and flanges	242 mm	483 mm	502 mm
	9.5 in	19 in	19.75 in
Weight			
Net	24 kg (54 lb), nominal	
Shipping	32 kg (70 lb), nominal	

Measurement Throughput Summary Table 21. Typical Cycle Time^{a,b} (ms)

Number of Points				
	101	201	401	1601
Start 1.8 GHz, Sto	p 2 GHz, 35	kHz IF band	width	
Uncorrected, 1-port cal	8	11	17	53
2-Port cal	27	36	55	164
Start 300 kHz, Sto	p 3 GHz, 35	kHz IF band	width	
Uncorrected, 1-port cal	48	54	64	104
2-Port cal	103	119	145	254
Start 300 kHz, Stop 9 GHz, 35 kHz IF bandwidth				
Uncorrected, 1-port cal	45	55	61	99
2-Port cal	99	119	133	212

a Typical performance.

Table 22. Cycle Time vs. IF Bandwidth^a

Applies to the Preset condition (201 points, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

IF	Cycle Time
Bandwidth	(ms) ^b
(Hz)	
40,000	8
35,000	9
30,000	11
20,000	13
10,000	28
7000	36
5000	48
3000	72
1000	196
300	620
100	1875
30	8062
10	17877

b Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with

DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S11) measurement.

c Option 010 only. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S11) measurement.

^a Typical performance.
^b Cycle time includes sweep and retrace time.

Table 23. Cycle Time vs. Number of Points^a

Applies to the Preset condition (35 kHz IF bandwidth, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

Number of Points	Cycle Time (ms) ^b
3	4
11	4
51	5
101	6
201	9
401	16
801	29
1601	52

^a Typical performance. ^b Cycle time includes sweep and retrace time.

Table 24. Data Transfer Timea (ms)

	Numb	Number of Points			
	51	201	401	1601	
SCPI over GPIB					
(program executed or	n externa	I PC) ^b			
32-bit floating point	3	7	12	43	
64-bit floating point	4	12	22	84	
ASCII	7	64	124	489	
SCPI over 100 Mbit/s	LAN				
(program executed or	n externa	I PC) ^b			
32-bit floating point	1	1	1	1	
64-bit floating point	1	1	1	2	
ASCII	5	15	26	96	
SCPI (program execu	ted in the	analyzer)	d		
32-bit floating point	1	1	2	3	
64-bit floating point	1	2	2	4	
ASCII	8	29	56	222	
COM (program execu	ted in the	analyzer)	e		
32-bit floating point	1	1	1	1	
Variant type	1	1	2	6	
DCOM over 100 Mbit/s	s LAN				
(program executed or	externa	I PC) ^f			
32-bit floating point ^g	1	1	1	2	
Variant type ^h	1	3	6	19	

^a Typical performance of unit with 500 MHz Pentium III processor.

^b Measured using a VEE 5.0 program running on a 600 MHz HP Kayak, National InstrumentsTM GPIB card. Transferred complex S11 data, using "CALC:DATA?SDATA".

Complex S11 data, using "CALC:DATA?SDATA".

Complex S12 data, using a VEE 5.0 program running on a 600 MHz HP Kayak. Transferred complex S11 data,

using "CALC:DATA?SDATA". Speed dependent on LAN traffic, if connected to network.

d Measured using a VEE 5.0 program running inside PNA Series Analyzer. Transferred complex S11 data, using "CALC:DATA?SDATA".

^e Measured using a Visual Basic 6.0 program running inside PNA Series Analyzer. Transferred complex S11

^f Measured using a Visual Basic 6.0 program running on a 600 MHz HP Kayak. Transferred complex S11 data. Speed dependent on LAN traffic, if connected to network.

⁹ Used IArray Transfer.getComplex method for 32-bit floating point.

^h Used meas.getData method for Variant data type.

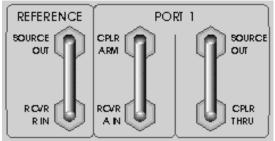
Table 25. Recall and Sweep Speed^a

Operations	Number of	Number of	Recall
	Window(s)	Trace(s)	Time (ms)
Recall	1	1	49
Recall and Sweep	1	1	59
Recall	1	2	82
Recall and Sweep	1	2	96
Recall	1	4	159
Recall and Sweep	1	4	203
Recall	2	2	93
Recall and Sweep	2	2	115
Recall	3	4	158
Recall and Sweep	3	4	218
Recall	4	4	187
Recall and Sweep	4	4	247
Recall	4	8	340
Recall and Sweep	4	8	507

^aCF=177MHz, Span=200 MHz, 201 points, 35 kHz IF BW

Specifications: Front-Panel Jumpers Models N3381A, N3382A, N3383A Option 014

Specifications: Front-Panel Jumpers, Port 1



Option 014 Analyzer

NOTE: The standard analyzer (N3381A/ N3382A/ N3383A) has no front-panel jumpers.

Use these SMA (female) connectors to develop custom measurements.

Receiver A Direct-Access Jumper

- The "Cplr Arm" connector comes from the coupled arm of the Port 1 coupler.
- The "Rcvr A In" connector goes directly to the input of receiver "A."

For the A Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)

-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)

-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

<-130 dBm (300 kHz to 25 MHz)

<-123 dBm (3 GHz to 6 GHz)

<-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz)

>12 dB (3 GHz to 6 GHz)

>7 dB (6 GHz to 9 GHz)

Reference Channel R Jumper

- The "Source Out" connector comes from the source Reference output.
- The "Rcvr R In" connector goes directly to the R receiver input.

For the R Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Damage Level: >+15 dBm

Minimum Level to Maintain Phase-Lock:

-35 dBm (300 kHz to 3 GHz) -25 dBm (3 GHz to 9 GHz)

For the Reference Output: (with an External Input to Lock the Source)

Output Level:

-5 to -30 dBm (300 kHz to 6 GHz) -10 to -35 dBm (6 GHz to 9 GHz)

Source Match Return Loss:

16 dB (300 kHz to 3 GHz) 14 dB (3 GHz to 9 GHz)

Damage Level: >+15 dBm Maximum DC Level: 40V Port 1 Test-Port Jumper

- The upper "Source Out" connector comes from the transfer switch Port 1 output.
- The lower "Coupler Thru" connector goes directly to the main input of Port 1 coupler. This is where a power amplifier can be inserted to boost the test port power.

For the Source Output:

Output Level:

+12 to -83 dBm (300 kHz to 6 GHz) +7 to -88 dBm (6 GHz to 9 GHz)

Source Match: 15 dB at 9 GHz For the Input to the Coupler:

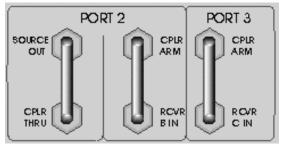
Insertion Loss to Test Port 1:

<3.5 dB at 3 GHz <5 dB at 9 GHz

Maximum Input Power: 2 Watts, CW

Damage Level: 4 Watts, CW

Specifications: Front-Panel Jumpers, Port 2 and Port 3



Option 014 Analyzer

NOTE: The standard analyzer (N3381A/ N3382A/ N3383A) has no front-panel jumpers.

Use these SMA (female) connectors to develop custom measurements.

Receiver B Direct-Access Jumper

- The upper "Cplr Arm" connector comes from the coupled arm of the Port 2 coupler.
- The "Rcvr B In" connector goes directly to the input of receiver "B."

For the B Receiver Input:

Maximum Input Level:

- -6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
- -6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
- -11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

Noise Floor; rms (10 Hz Bandwidth):

- <-130 dBm (300 kHz to 25 MHz)
- <-123 dBm (3 GHz to 6 GHz)
- <-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz)

>12 dB (3 GHz to 6 GHz)

>7 dB (6 GHz to 9 GHz)

Port 2 Test-Port Jumper

- The upper "Source Out" connector comes from the transfer switch Port 2 output.
- The lower "Coupler Thru" connector goes directly to the main input of Port 2 coupler. This is where a power amplifier can be inserted to boost the test port power.

For the Source Output:

Output Level:

+10 to -85 dBm (300 kHz to 6 GHz)

+7 to -88 dBm (6 GHz to 9 GHz)

Source Match: 15 dB at 9 GHz

For the Input to the Coupler:

Insertion Loss to Test Port 2:

<3.5 dB at 3 GHz <5 dB at 9 GHz

Maximum Input Power: 2 Watts, CW

Damage Level: 4 Watts, CW

Receiver C Direct-Access Jumper

- The upper "Cplr Arm" connector comes from the coupled arm of the Port 3 coupler.
- The "Rcvr C In" connector goes directly to the input of receiver "C."

For the C Receiver Input:

Maximum Input Level:

-6 dBm; <0.4 dB Compression (300 kHz to 3 GHz)
-6 dBm; <0.8 dB Compression (3 GHz to 6 GHz)
-11 dBm; <0.8 dB Compression (6 GHz to 9 GHz)

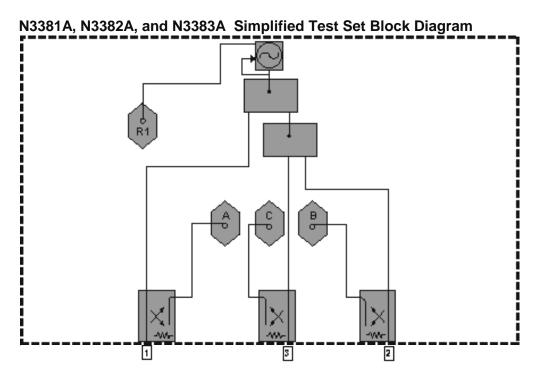
Noise Floor; rms (10 Hz Bandwidth):

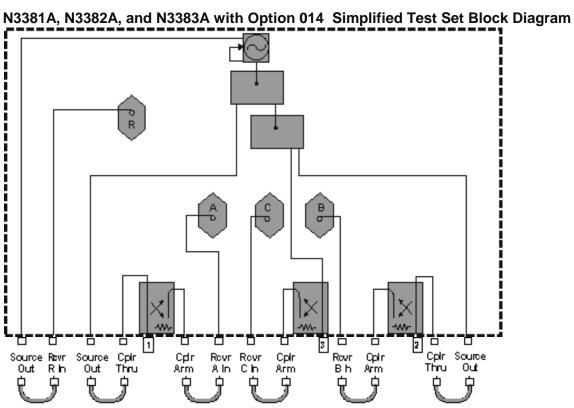
<-130 dBm (300 kHz to 25 MHz) <-123 dBm (6 GHz to 9 GHz)

Damage Level: +15 dBm Maximum DC Level: +/-5 V

Return Loss:

>17 dB (300 kHz to 3 GHz) >12 dB (3 GHz to 6 GHz) >7 dB (6 GHz to 9 GHz)





4 Technical Specifications for the E836xA

Definitions
Corrected System Performance
Table 1. System Dynamic Range ^a
Table 2. Receiver Dynamic Range ^a
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This is a complete list of the E8362A, E8363A, and E8364A network analyzer technical specifications.

- To optimize viewing of uncertainty curves, click the Maximize button.
- To view or print the PNA Series Data Sheet (a condensed version of the specifications), visit our web site at http://www.agilent.com/find/pna, select your analyzer model, and click on the link for the data sheet.
- The uncertainty curves contained in this document apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

See Specs for other PNA models

Definitions

All specifications and characteristics apply over a 25 °C ±5 °C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

Specification (spec.): Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Characteristic (char.): A performance parameter that the product is expected to meet before it leaves the factory, but that is not verified in the field and is not covered by the product warranty. A characteristic includes the same guardbands as a specification.

Typical (typ.): Expected performance of an average unit which does not include guardbands. It is not covered by the product warranty.

Nominal (nom.): A general, descriptive term that does not imply a level of performance. It is not covered by the product warranty.

Calibration: The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

Corrected (residual): Indicates performance after error correction (calibration). It is determined by the quality of calibration standards and how well "known" they are, plus system repeatability, stability, and noise.

Uncorrected (raw): Indicates instrument performance without error correction. The uncorrected performance affects the stability of a calibration.

Standard: When referring to the analyzer, this includes no options unless noted otherwise.

Corrected System Performance

The specifications in this section apply for measurements made with the E836xA analyzer with the following conditions:

- 10 Hz IF bandwidth
- No averaging applied to data
- Isolation calibration with an averaging factor of 8

Table 1. System Dynamic Range^a

Table 1. System Dynamic Range					
Description	Specification	on Typical (dB) at Direct term of the Port Receiver Access Input Typical (dB)			
Dynamic Range (in a 10 l	· · ·	it i Oit Neceivel Access illput			
Standard Configuration and Standard Power Range					
	ina Standard P	ower Range			
(E836xA - Standard)	1	Te ce			
45 MHz to 500 MHz ^d	94	NA			
500 MHz to 2 GHz	119	NA			
2 GHz to 10 GHz	122	NA			
10 GHz to 20 GHz	123	NA			
20 GHz to 30 GHz	114	NA			
30 GHz to 40 GHz	110	NA			
40 GHz to 45 GHz	109	NA			
45 GHz to 50 GHz	104	NA			
Extended Configuration	and Standard P	ower Range			
(E836xA - Option 014)		-			
45 MHz to 500 MHz ^d	94	132			
500 MHz to 2 GHz	119	138			
2 GHz to 10 GHz	122	137			
10 GHz to 20 GHz	122	137			
20 GHz to 30 GHz	115	127			
30 GHz to 40 GHz	107	119			
40 GHz to 45 GHz	105	116			
45 GHz to 50 GHz	100	111			
Standard Configuration a	nd Extended P	ower Range & Bias-Tees			
(E836xA - Option UNL)					
45 MHz to 500 MHz ^d	92	NA			
500 MHz to 2 GHz	117	NA			
2 GHz to 10 GHz	120	NA			
10 GHz to 20 GHz	121	NA			
20 GHz to 30 GHz	112	NA			
30 GHz to 40 GHz	108	NA			
40 GHz to 45 GHz	105	NA			
45 GHz to 50 GHz	99	NA			
	· · · · · · · · · · · · · · · · · · ·				

Standard Configuration and Extended Power Range & Bias-Tees				
(E836xA - Option UNL&014)				
45 MHz to 500 MHz ^d	92	130		
500 MHz to 2 GHz	117	136		
2 GHz to 10 GHz	120	135		
10 GHz to 20 GHz	119	134		
20 GHz to 30 GHz	109	121		
30 GHz to 40 GHz	105	117		
40 GHz to 45 GHz	101	112		
45 GHz to 50 GHz	95	108		

^a The system dynamic range is calculated as the difference between the noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

The test port system dynamic range is calculated as the difference between the test port noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

^c The direct receiver access input system dynamic range is calculated as the difference between the receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its damage level. When the analyzer is in segment sweep mode, the analyzer can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when receiver damage may occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

^d May be degraded by 10 dB at particular frequencies (multiples of 5 MHz) below 500 MHz due to spurious receiver residuals. Methods are available to regain the full dynamic range.

Table 2. Receiver Dynamic Range^a

Description	Specification at Test Port	n (dB) Typical (dB) at Direct Rece Access Input ^c	iver		
Dynamic Range (in a 10 Hz BW)					
Standard Configuration	and Standard Pov	ver Range (E836xA - Standard)			
OR					
	and Extended Po	ver Range & Bias Tees (E836xA - C	ption		
UNL)					
45 MHz to 500 MHz ^d	94	NA			
500 MHz to 2 GHz	119	NA			
2 GHz to 10 GHz	122	NA			
10 GHz to 20 GHz	125	NA			
20 GHz to 30 GHz	114	NA			
30 GHz to 40 GHz	111	NA			
40 GHz to 50 GHz	111	NA			
Extended Configuration	and Standard Po	ver Range (E836xA - Option 014)			
OR					
	and Extended Po	wer Range & Bias Tees (E836xA - 0	Option		
UNL&014)		,	•		
45 MHz to 500 MHz ^d	94	132			
500 MHz to 2 GHz	119	138			
2 GHz to 10 GHz	122	137			
10 GHz to 20 GHz	124	139			
20 GHz to 30 GHz	113	125			
30 GHz to 40 GHz	110	122			
40 GHz to 50 GHz	109	120			

^a The receiver dynamic range is calculated as the difference between the noise floor and the receiver maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

Note: This E836xA document provides technical specifications for the following calibration kits only: 85056A, 85056D, 85056K, 85052B, 85052C, 85052D, 85050B, 85050C, 85050D, 85054B, 85054D, K11644A, P11644A, R11644A, and the X11644A.

^bThe test port receiver dynamic range is calculated as the difference between the test port noise floor and the receiver maximum input level. The effective dynamic range must take measurement uncertainties and interfering signals into account.

^c The direct receiver access input receiver dynamic range is calculated as the difference between the direct receiver access input noise floor and the receiver maximum input level. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its damage level. When the analyzer is in segment sweep mode, the analyzer can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when receiver damage may occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

^d May be degraded by 10 dB at particular frequencies (multiples of 5 MHz) below 500 MHz due to spurious receiver residuals. Methods are available to regain the full dynamic range.

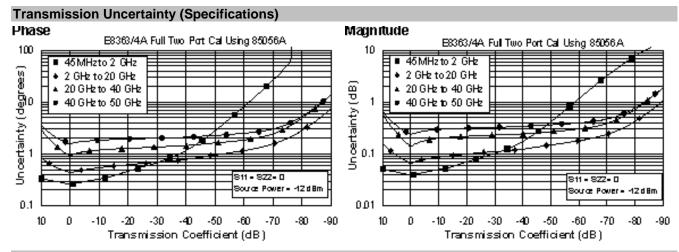
E8363/4A Corrected System Performance with 2.4mm Connectors

Table 3. 85056A Calibration Kit Standard Configuration and Standard Power Range (E8363/4A)

Applies to the E8363/4A analyzers, 85056A (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)						
	0.045 to	2 to	10 to	20 to	40 to		
	2 GHz	10 GHz	20 GHz	40 GHz	50 GHz		
Directivity	42	42	42	38	36		
Source Match	41	38	38	33	31		
Load Match	42	42	42	37	35		
Reflection Tracking	±0.001	±0.008	±0.008	±0.020	±0.027		
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		
Transmission Tracking	±0.014	±0.033	±0.039	±0.105	±0.200		
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		



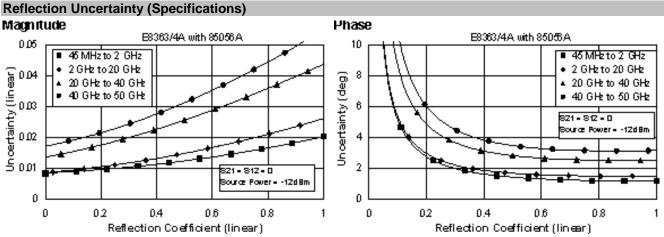


Table 4. 85056A Calibration Kit

Extended Configuration and Standard Power Range (E8363/4A - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL)

-OR-

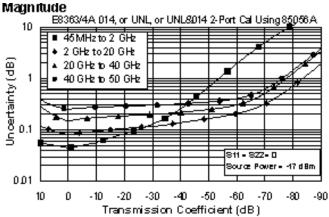
Extended Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL&014)

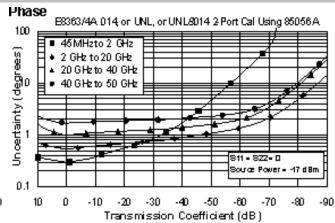
Applies to the, E8363/4A analyzers, 85056A (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

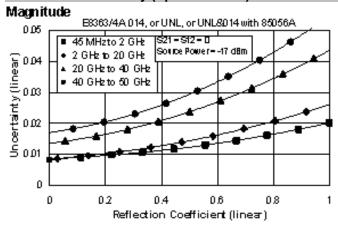
Description	Specification (dB)					
	0.045 to	2 to	10 to	20 to	40 to	
	2 GHz	10 GHz	20 GHz	40 GHz	50 GHz	
Directivity	42	42	42	38	36	
Source Match	41	38	38	33	31	
Load Match	42	42	42	37	35	
Reflection Tracking	±0.001 +0.02/°C	±0.008 +0.02/°C	±0.008 +0.02/°C	±0.020 +0.03/°C	±0.027 +0.04/°C	
Transmission Tracking	±0.019	±0.039	±0.053	±0.114	±0.215	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C	

Transmission Uncertainty (Specifications)





Reflection Uncertainty (Specifications)



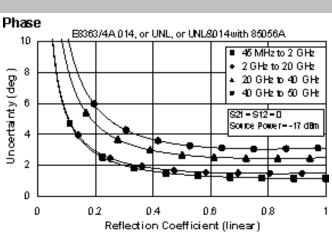
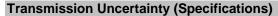


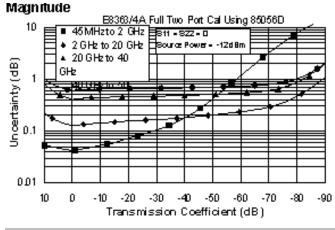
Table 5. 85056D Calibration Kit **Standard Configuration and Standard Power Range** (E8363/4A)

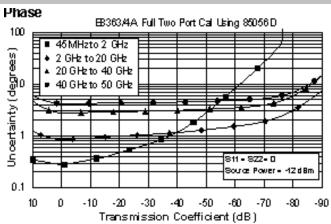
Applies to the, E8363/4A analyzers, 85056D (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification	Specification (dB)				
	0.045 to	2 to	20 to	40 to		
	2 GHz	20 GHz	40 GHz	50 GHz		
Directivity	42	34	34	26		
Source Match	40	30	30	23		
Load Match	42	34	34	25		
Reflection Tracking	±0.002	±0.029	±0.029	±0.075		
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		
Transmission Tracking	±0.016	±0.081	±0.095	±0.544		
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		







0.8

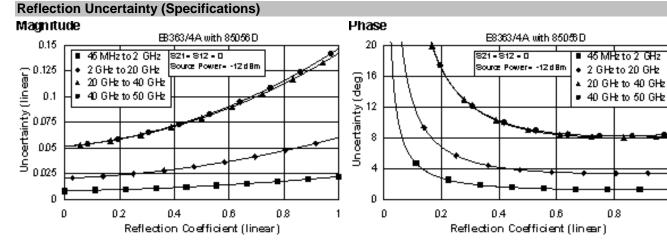


Table 6. 85056D Calibration Kit

Extended Configuration and Standard Power Range (E8363/4A - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL)

-OR-

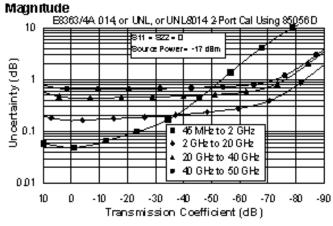
Extended Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL & 014)

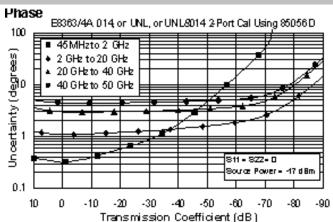
Applies to the, E8363/4A analyzers, 85056D (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

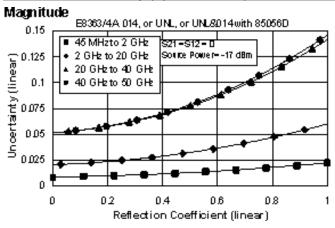
Description	Specification	Specification (dB)				
	0.045 to	2 to	20 to	40 to		
	2 GHz	20 GHz	40 GHz	50 GHz		
Directivity	42	34	26	26		
Source Match	40	30	24	23		
Load Match	42	33	25	25		
Reflection Tracking	±0.002	±0.029	±0.079	0.075		
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		
Transmission Tracking	±0.022	±0.130	±0.384	0.589		
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		

Transmission Uncertainty (Specifications)





Reflection Uncertainty (Specifications)



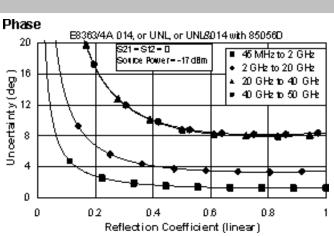


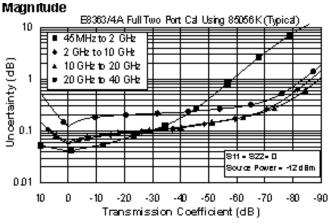
Table 7. 85056K Calibration Kit Standard Configuration and Standard Power Range (E8363/4A)

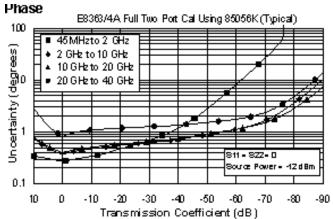
Applies to the, E8363/4A analyzers, 85056K (2.92mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

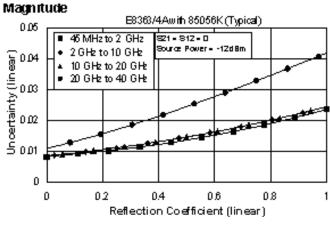
Description	Specification (dB)				
	0.045 to	2 to	10 to	20 to	
	2 GHz	10 GHz	20 GHz	40 GHz	
Directivity	42	42	42	40	
Source Match	40	40	40	35	
Load Match	42	42	42	38	
Reflection Tracking	±0.018	±0.018	±0.018	±0.067	
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C	
Transmission Tracking	±0.016	±0.028	±0.033	±0.089	
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C	

Transmission Uncertainty (Specifications)





Reflection Uncertainty (Specifications)



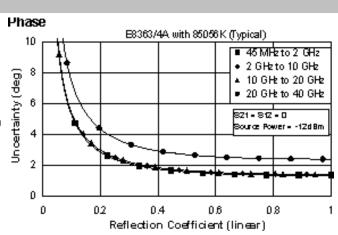


Table 8. 85056K Calibration Kit

Extended Configuration and Standard Power Range (E8363/4A - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL)

-OR-

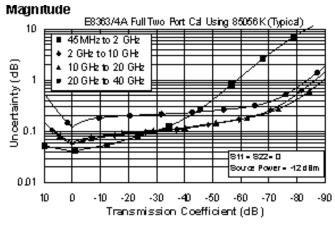
Extended Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL&014)

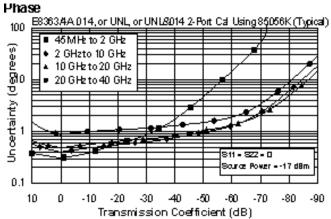
Applies to the, E8363/4A analyzers, 85056K (2.92mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

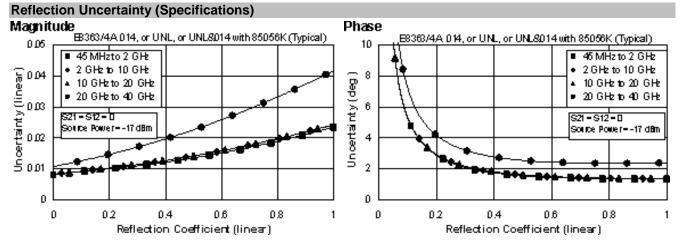
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification	Specification (dB)				
	0.045 to	2 to	10 to	20 to		
	2 GHz	10 GHz	20 GHz	40 GHz		
Directivity	42	42	42	40		
Source Match	40	40	40	35		
Load Match	42	42	41	38		
Reflection Tracking	±0.018	±0.018	±0.018	±0.067		
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		
Transmission Tracking	±0.021	±0.033	±0.046	±0.098		
	+0.02/°C	+0.02/°C	+0.03/°C	+0.04/°C		

Transmission Uncertainty (Specifications







E836xA Corrected System Performance with 3.5mm Connectors

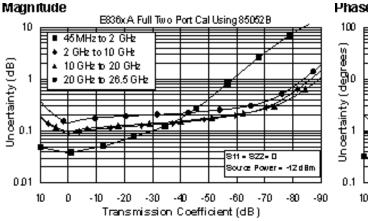
Table 9. 85052B Calibration Kit Standard Configuration and Standard Power Range (E836xA)

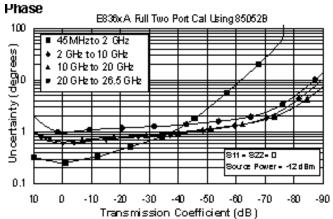
Applies to the, E836xA analyzers, 85052B (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

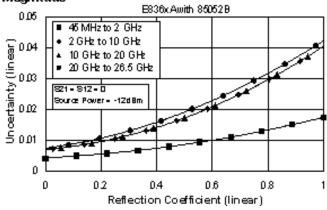
Description				
	0.045 to	2 to	10 to	20 to
	2 GHz	10 GHz	20 GHz	26.5 GHz
Directivity	48	44	44	44
Source Match	40	31	31	31
Load Match	48	44	44	44
Reflection Tracking	±0.003	±0.006	±0.006	±0.006
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.013	±0.057	±0.065	±0.104
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C

Transmission Uncertainty (Specifications)





Reflection Uncertainty (Specifications) Magnitude B836xAwith 85052B



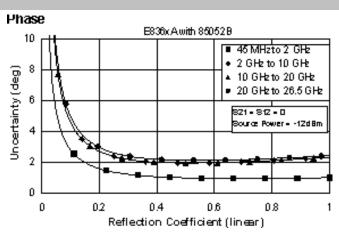


Table 10. 85052B Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

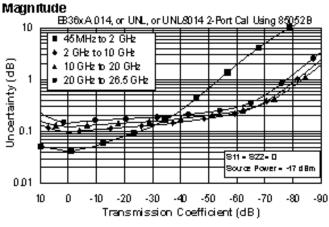
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

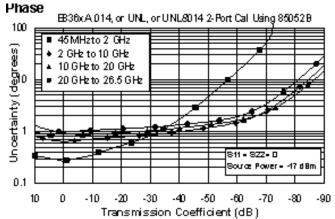
Applies to the, E836xA analyzers, 85052B (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

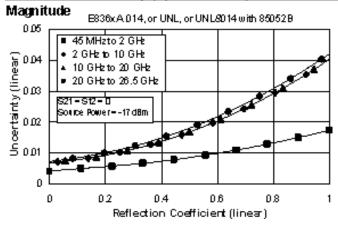
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)			
	0.045 to 2 to		10 to	20 to
	2 GHz	10 GHz	20 GHz	26.5 GHz
Directivity	48	44	44	44
Source Match	40	31	31	31
Load Match	48	44	44	44
Reflection Tracking	±0.003	±0.006	±0.006	±0.006
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.017	±0.065	±0.091	±0.109
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C

Transmission Uncertainty (Specifications)







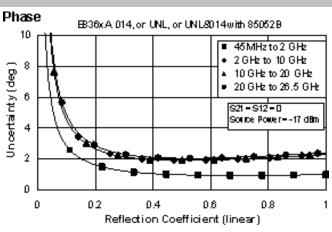


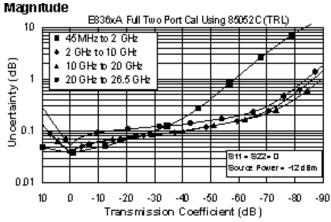
Table 11. 85052C Calibration Kit Standard Configuration and Standard Power Range (E836xA)

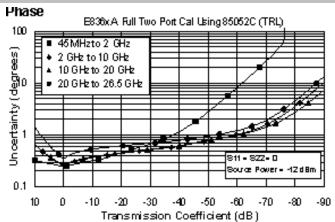
Applies to the, E836xA analyzers, 85052C (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)			
	0.045 to	2 to	10 to	20 to
	2 GHz	10 GHz	20 GHz	26.5 GHz
Directivity	48	50	50	50
Source Match	40	50	50	50
Load Match	48	50	50	50
Reflection Tracking	±0.003	±0.000	±0.000	±0.000
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.013	±0.010	±0.012	±0.018
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C







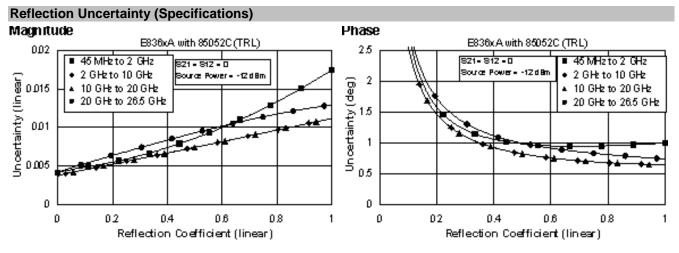


Table 12. 85052C Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

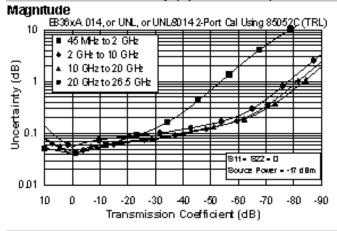
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

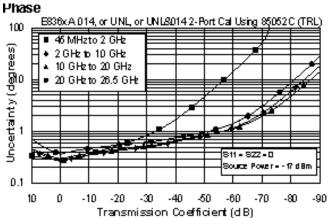
Applies to the, E836xA analyzers, 85052C (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification	Specification (dB)				
	0.045 to	2 to	10 to	20 to		
	2 GHz	10 GHz	20 GHz	26.5 GHz		
Directivity	48	50	50	50		
Source Match	40	50	50	50		
Load Match	48	50	50	50		
Reflection Tracking	±0.003	±0.000	±0.000	±0.000		
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C		
Transmission Tracking	±0.017	±0.012	±0.016	±0.021		
1	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C		

Transmission Uncertainty (Specifications)





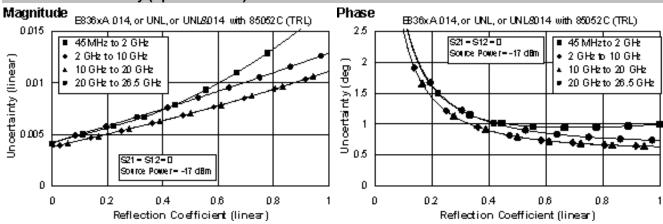
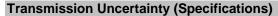


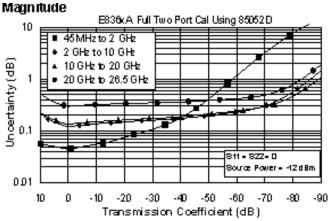
Table 13. 85052D Calibration Kit Standard Configuration and Standard Power Range (E836xA)

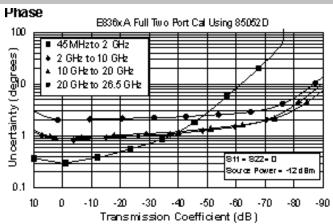
Applies to the, E836xA analyzers, 85052D (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)				
	0.045 to	2 to	10 to	20 to	
	2 GHz	10 GHz	20 GHz	26.5 GHz	
Directivity	42	36	36	30	
Source Match	37	28	28	25	
Load Match	42	36	36	30	
Reflection Tracking	±0.003	±0.008	±0.008	±0.011	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	
Transmission Tracking	±0.020	±0.087	±0.101	±0.250	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	







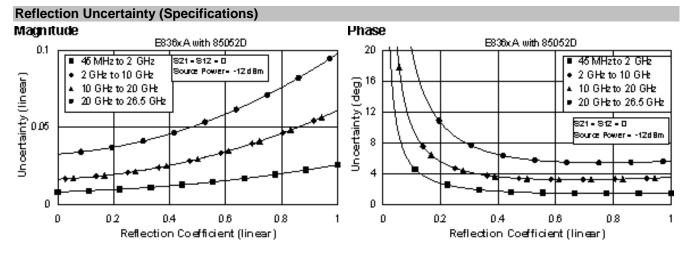


Table 14. 85052D Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

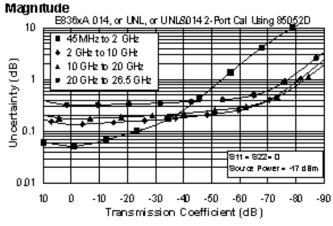
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

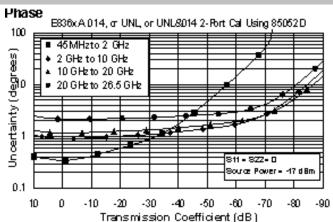
Applies to the, E836xA analyzers, 85052D (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

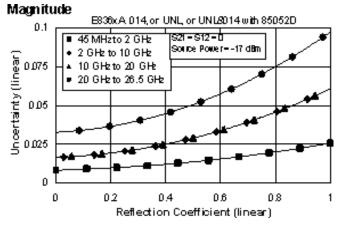
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

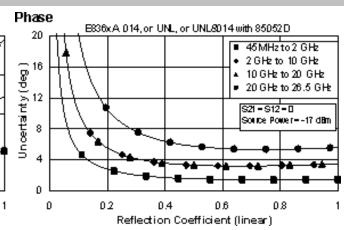
Description	Specification (dB)			
	0.045 to	2 to	10 to	20 to
	2 GHz	10 GHz	20 GHz	26.5 GHz
Directivity	42	36	36	30
Source Match	37	28	28	25
Load Match	42	36	36	30
Reflection Tracking	±0.003	±0.008	±0.008	±0.011
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.026	±0.101	±0.138	±0.272
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C

Transmission Uncertainty (Specifications)









E836xA Corrected System Performance with 7mm Connectors

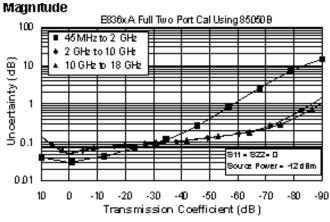
Table 15. 85050B Calibration Kit Standard Configuration and Standard Power Range (E836xA)

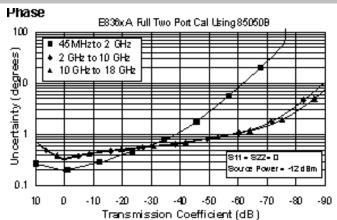
Applies to the, E836xA analyzers, 85050B (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

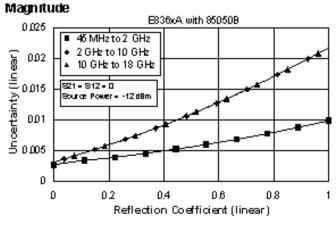
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)				
	0.045 to	2 to	10 to		
	2 GHz	10 GHz	18 GHz		
Directivity	52	52	52		
Source Match	48	41	41		
Load Match	52	52	52		
Reflection Tracking	±0.003	±0.047	±0.047		
	+0.02/°C	+0.02/°C	+0.02/°C		
Transmission Tracking	±0.006	±0.019	±0.022		
	+0.02/°C	+0.02/°C	+0.02/°C		

Transmission Uncertainty (Specifications)







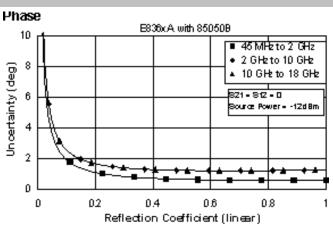


Table 16. 85050B Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

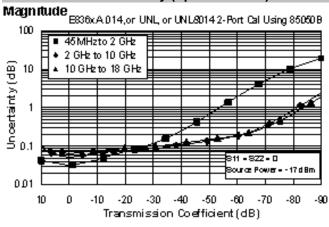
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

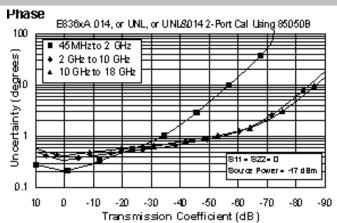
Applies to the, E836xA analyzers, 85050B (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

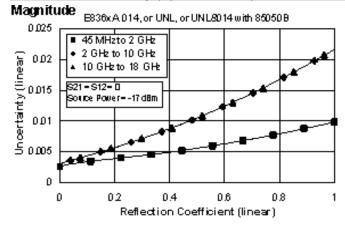
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)			
	0.045 to	2 to	10 to	
	2 GHz	10 GHz	18 GHz	
Directivity	52	52	52	
Source Match	48	41	41	
Load Match	52	52	47	
Reflection Tracking	±0.003	±0.047	±0.047	
	+0.02/°C	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.008	±0.022	±0.034	
	+0.02/°C	+0.02/°C	+0.02/°C	

Transmission Uncertainty (Specifications)







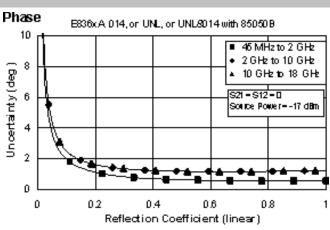
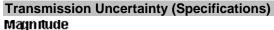


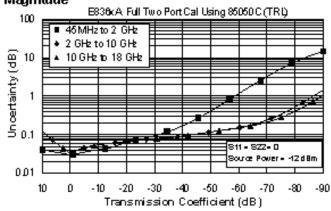
Table 17. 85050C Calibration Kit Standard Configuration and Standard Power Range (E836xA)

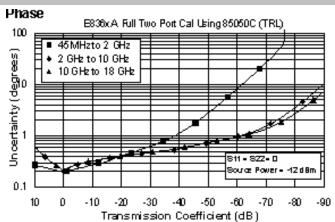
Applies to the, E836xA analyzers, 85050C (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)				
	0.045 to	2 to	10 to		
	2 GHz	10 GHz	18 GHz		
Directivity	52	60	60		
Source Match	48	60	60		
Load Match	52	60	60		
Reflection Tracking	±0.003	±0.000	±0.000		
	+0.02/°C	+0.02/°C	+0.02/°C		
Transmission Tracking	±0.006	±0.003	±0.004		
	+0.02/°C	+0.02/°C	+0.02/°C		







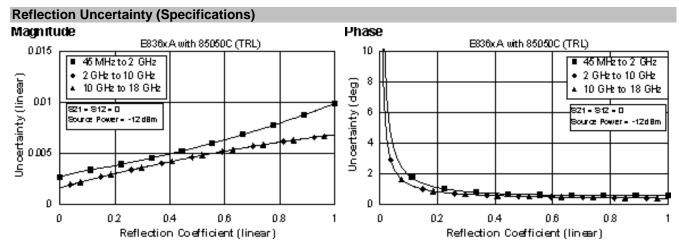


Table 18. 85050C Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

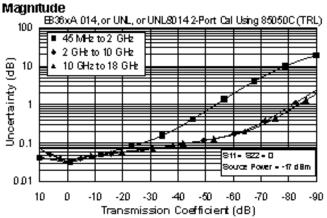
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

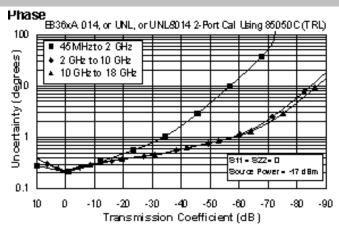
Applies to the, E836xA analyzers, 85050C (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

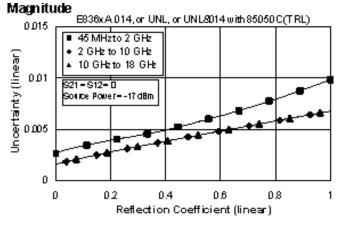
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)				
	0.045 to	2 to	10 to		
	2 GHz	10 GHz	18 GHz		
Directivity	52	60	60		
Source Match	48	60	60		
Load Match	52	60	60		
Reflection Tracking	±0.003	±0.000	±0.000		
	+0.02/°C	+0.02/°C	+0.02/°C		
Transmission Tracking	±0.008	±0.004	±0.005		
	+0.02/°C	+0.02/°C	+0.02/°C		

Transmission Uncertainty (Specifications)







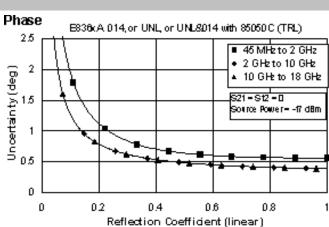
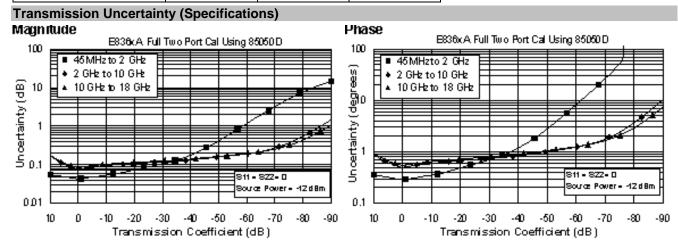


Table 19. 85050D Calibration Kit Standard Configuration and Standard Power Range (E836xA)

Applies to the, E836xA analyzers, 85050D (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)				
	0.045 to	2 to	10 to		
	2 GHz	10 GHz	18 GHz		
Directivity	40	40	40		
Source Match	39	35	35		
Load Match	40	40	40		
Reflection Tracking	±0.010	±0.100	±0.100		
	+0.02/°C	+0.02/°C	+0.02/°C		
Transmission Tracking	±0.018	±0.044	±0.052		
	+0.02/°C	+0.02/°C	+0.02/°C		



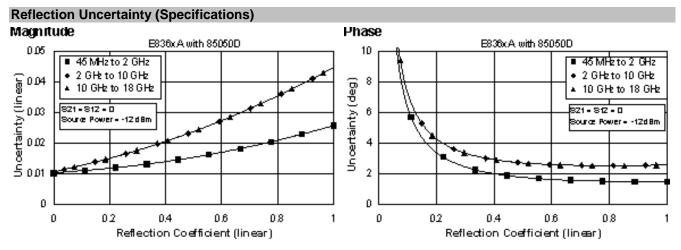


Table 20. 85050D Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

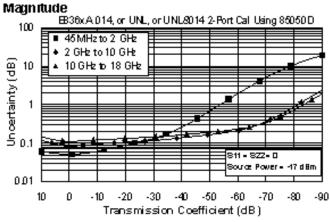
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

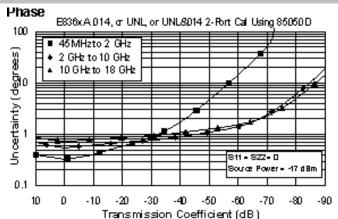
Applies to the, E836xA analyzers, 85050D (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

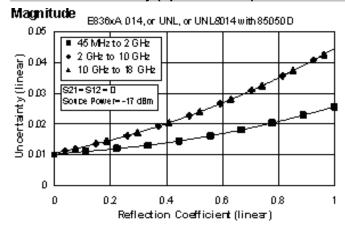
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

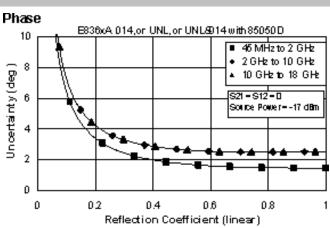
Description	Specification (dB)				
	0.045 to	2 to	10 to		
	2 GHz	10 GHz	18 GHz		
Directivity	40	40	40		
Source Match	39	35	35		
Load Match	40	40	37		
Reflection Tracking	±0.010	±0.100	±0.100		
	+0.02/°C	+0.02/°C	+0.02/°C		
Transmission Tracking	±0.025	±0.052	±0.078		
	+0.02/°C	+0.02/°C	+0.02/°C		

Transmission Uncertainty (Specifications)









E836xA Corrected System Performance with Type-N Connectors

Table 21. 85054B Calibration Kit

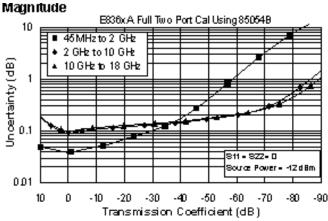
Standard Configuration and Standard Power Range (E836xA)

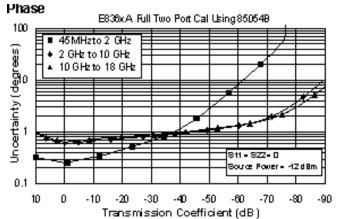
Applies to the, E836xA analyzers, 85054B (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

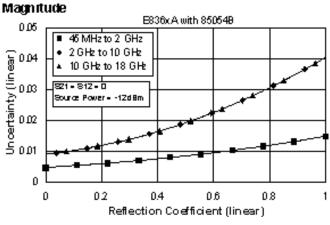
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)			
	0.045 to	2 to	10 to	
	2 GHz	10 GHz	18 GHz	
Directivity	48	42	42	
Source Match	45	33	33	
Load Match	48	42	42	
Reflection Tracking	±0.007	±0.096	±0.096	
	+0.02/°C	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.009	±0.052	±0.060	
	+0.02/°C	+0.02/°C	+0.02/°C	









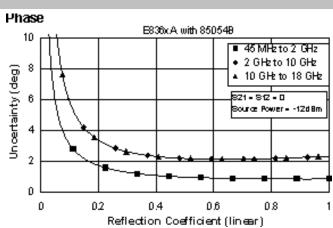


Table 22. 85054B Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

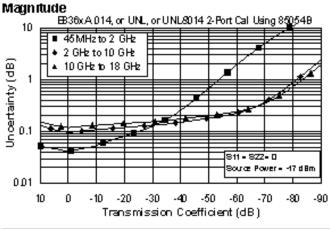
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

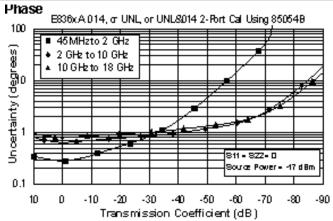
Applies to the, E836xA analyzers, 85054B (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

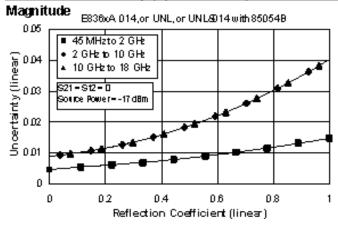
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)		
	0.045 to	2 to	10 to
	2 GHz	10 GHz	18 GHz
Directivity	48	42	42
Source Match	45	33	33
Load Match	48	42	41
Reflection Tracking	±0.007	±0.096	±0.096
	+0.02/°C	+0.02/°C	+0.02/°C
Transmission Tracking	±0.011	±0.060	±0.083
	+0.02/°C	+0.02/°C	+0.02/°C

Transmission Uncertainty (Specifications)







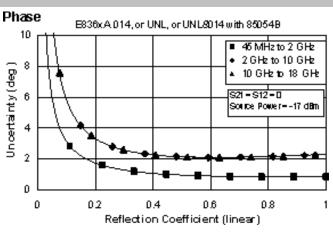
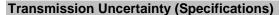


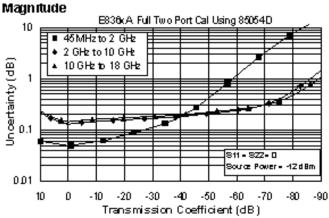
Table 23. 85054D Calibration Kit Standard Configuration and Standard Power Range (E836xA)

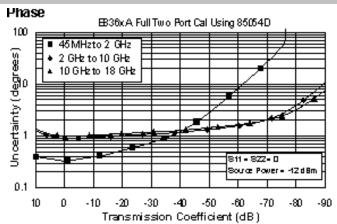
Applies to the, E836xA analyzers, 85054D (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)		
	0.045 to	2 to	10 to
	2 GHz	10 GHz	18 GHz
Directivity	40	34	34
Source Match	39	29	29
Load Match	40	34	34
Reflection Tracking	±0.003	±0.027	±0.027
	+0.02/°C	+0.02/°C	+0.02/°C
Transmission Tracking	±0.019	±0.091	±0.105
	+0.02/°C	+0.02/°C	+0.02/°C







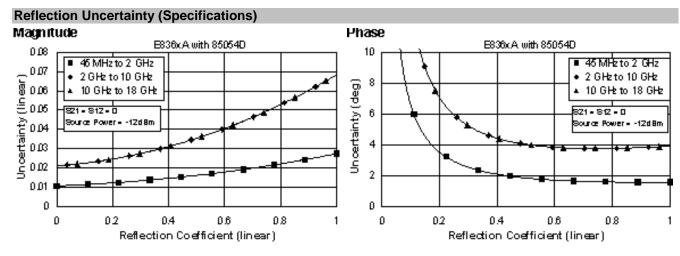


Table 24. 85054D Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

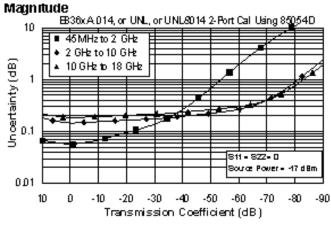
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

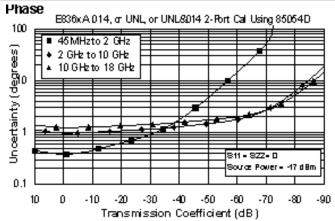
Applies to the, E836xA analyzers, 85054D (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

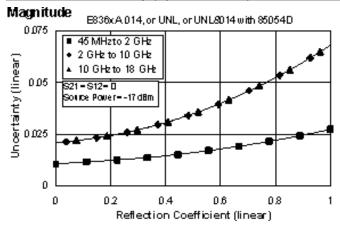
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

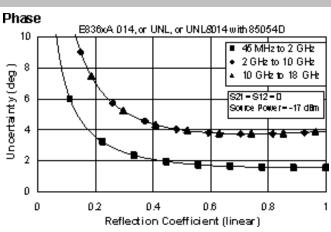
Description	Specification (dB)		
	0.045 to	2 to	10 to
	2 GHz	10 GHz	18 GHz
Directivity	40	34	34
Source Match	39	29	29
Load Match	40	34	34
Reflection Tracking	±0.003	±0.027	±0.027
	+0.02/°C	+0.02/°C	+0.02/°C
Transmission Tracking	±0.025	±0.105	±0.145
	+0.02/°C	+0.02/°C	+0.02/°C

Transmission Uncertainty (Specifications)









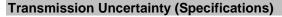
E8363/4A Corrected System Performance with WR-28 Connectors

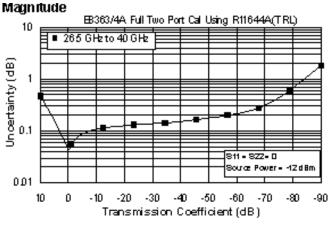
Table 25. R11644A Calibration Kit Standard Configuration and Standard Power Range (E8363/4A)

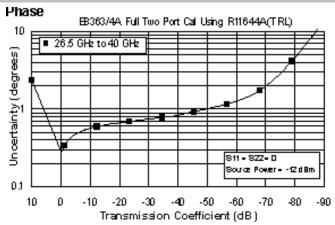
Applies to the, E8363/4A analyzers, R11644A (WR-28) calibration kit, 85133F flexible test port cable set with the R281A and R281B launch sets with the R281A and R281B launch sets, and a full 2-port calibration. Also applies to the following condition:

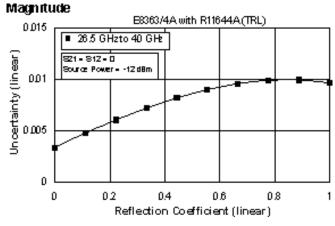
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)
	26.5 to
	40 GHz
Directivity	50
Source Match	50
Load Match	50
Reflection Tracking	±0.000
	+0.03/°C
Transmission Tracking	±0.018
	+0.03/°C









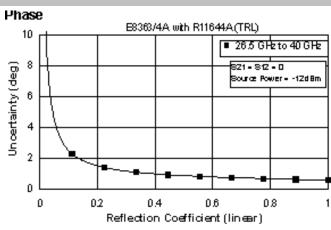


Table 26. R11644A Calibration Kit

Extended Configuration and Standard Power Range (E8363/4A - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL)

-OR-

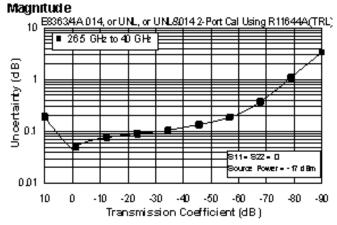
Extended Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL&014)

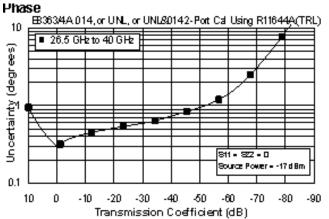
Applies to the, E8363/4A analyzers, R11644A (WR-28) calibration kit, 85133F flexible test port cable set with the R281A and R281B launch sets with the R281A and R281B launch sets, and a full 2-port calibration. Also applies to the following condition:

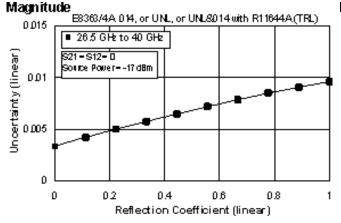
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

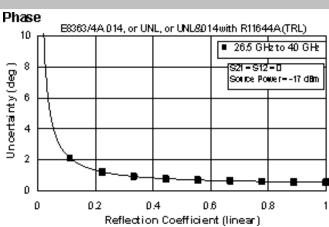
Description	Specification (dB)
	26.5 to
	40 GHz
Directivity	50
Source Match	50
Load Match	50
Reflection Tracking	±0.000
	+0.03/°C
Transmission Tracking	±0.021
	+0.03/°C

Transmission Uncertainty (Specifications)









E8363/4A Corrected System Performance with WR-42 Connectors

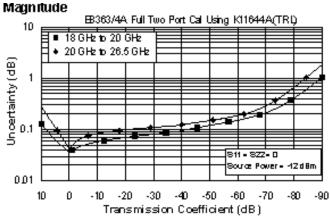
Table 27. K11644A Calibration Kit Standard Configuration and Standard Power Range (E8363/4A)

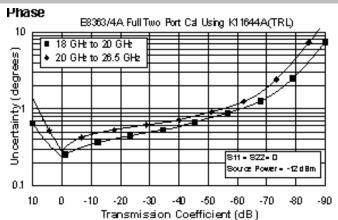
Applies to the, E8363/4A analyzers, K11644A (WR-42) calibration kit, 85134F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

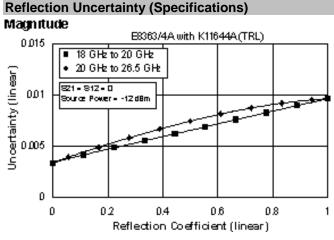
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)		
	18 to	20 to	
	20 GHz	26.5 GHz	
Directivity	50	50	
Source Match	50	50	
Load Match	50	50	
Reflection Tracking	±0.000	±0.000	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.010	±0.012	
	+0.02/°C	+0.02/°C	

Transmission Uncertainty (Specifications)







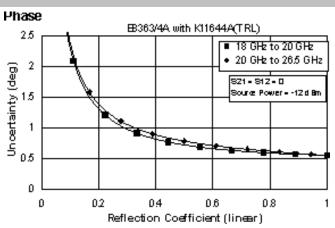


Table 28. K11644A Calibration Kit

Extended Configuration and Standard Power Range (E8363/4A - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL)

-OR-

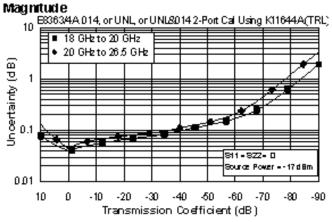
Extended Configuration and Extended Power Range & Bias-Tees (E8363/4A - Option UNL&014)

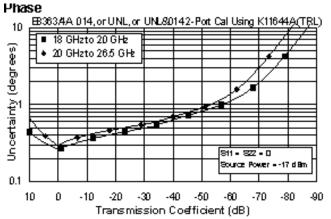
Applies to the, E8363/4A analyzers, K11644A (WR-42) calibration kit, 85134F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

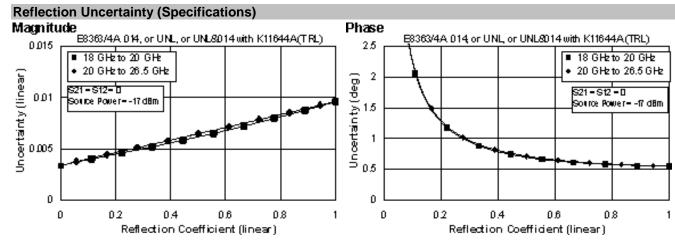
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)		
	18 to	20 to	
	20 GHz	26.5 GHz	
Directivity	50	50	
Source Match	50	50	
Load Match	50	50	
Reflection Tracking	±0.000	±0.000	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.016	±0.021	
	+0.02/°C	+0.02/°C	

Transmission Uncertainty (Specifications)







E836xA Corrected System Performance with WR-62 Connectors

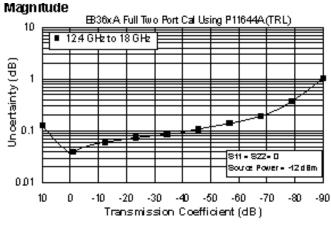
Table 29. P11644A Calibration Kit Standard Configuration and Standard Power Range (E836xA)

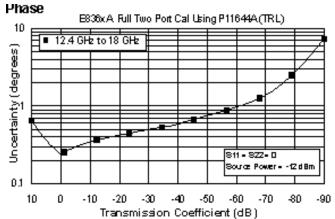
Applies to the, E836xA analyzers, R11644A (WR-62) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

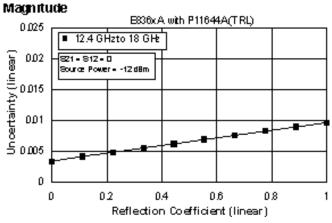
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)
	12.4 to
	18 GHz
Directivity	50
Source Match	50
Load Match	50
Reflection Tracking	±0.000
	+0.02/°C
Transmission Tracking	±0.012
	+0.02/°C

Transmission Uncertainty (Specifications)







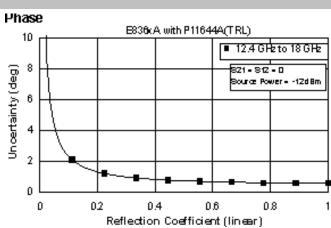


Table 30. P11644A Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

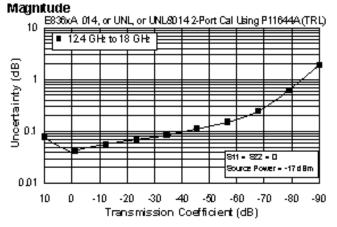
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

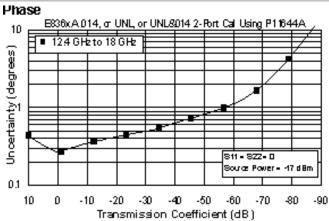
Applies to the, E836xA analyzers, P11644A (WR-62) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

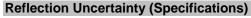
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

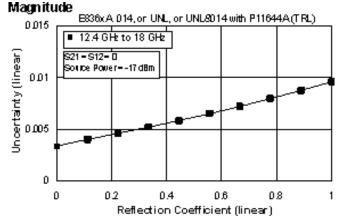
Description	Specification (dB)
	12.4 to
	18 GHz
Directivity	50
Source Match	50
Load Match	50
Reflection Tracking	±0.000
	+0.02/°C
Transmission Tracking	±0.016
	+0.02/°C

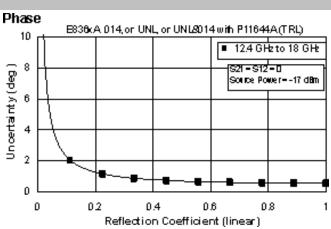
Transmission Uncertainty (Specifications)











E836xA Corrected System Performance with WR-90 Connectors

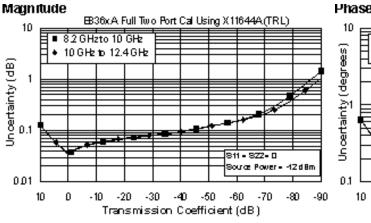
Table 31. X11644A Calibration Kit Standard Configuration and Standard Power Range (E836xA)

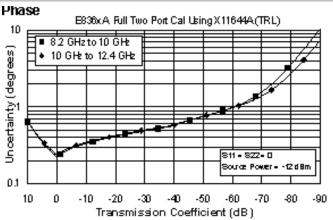
Applies to the, E836xA analyzers, X11644A (WR-90) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

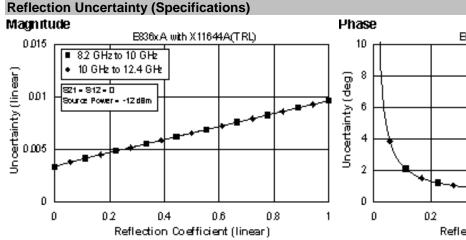
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)		
	8.2 to	10 to	
	10 GHz	12.4 GHz	
Directivity	50	50	
Source Match	50	50	
Load Match	50	50	
Reflection Tracking	±0.000	±0.000	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.010	±0.012	
	+0.02/°C	+0.02/°C	

Transmission Uncertainty (Specifications)







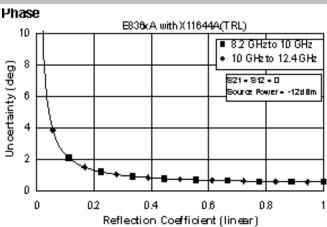


Table 32. X11644A Calibration Kit

Extended Configuration and Standard Power Range (E836xA - Option 014)

-OR

Standard Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL)

-OR

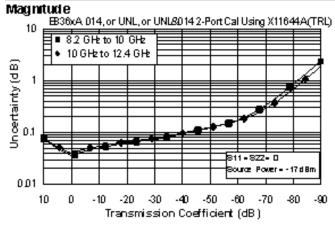
Extended Configuration and Extended Power Range & Bias-Tees (E836xA - Option UNL&014)

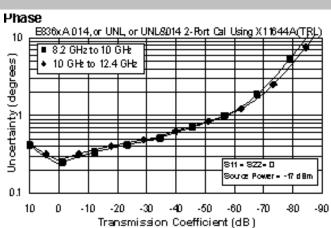
Applies to the, E836xA analyzers, X11644A (WR-90) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

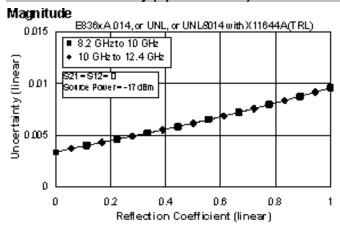
Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

Description	Specification (dB)		
	8.2 to	10 to	
	10 GHz	12.4 GHz	
Directivity	50	50	
Source Match	50	50	
Load Match	50	50	
Reflection Tracking	±0.000	±0.000	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.012	±0.016	
	+0.02/°C	+0.02/°C	

Transmission Uncertainty (Specifications)







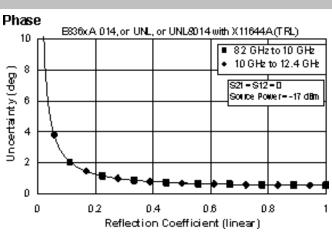


Table 33. Uncorrected System Performance

Specifications apply over environmental temperature of 23° ±3 °C, with < 1 °C deviation from the calibration temperature

Description	Specification	Supplemental Information
Directivity		
		Typical:
45 MHz to 2 GHz	24 dB	29 dB
2 GHz to 10 GHz	22 dB	25 dB
10 GHz to 20 GHz	16 dB	20 dB
20 GHz to 40 GHz	16 dB	20 dB
40 GHz to 45 GHz	15 dB	18 dB
45 GHz to 50 GHz	13 dB	18 dB
Source Match - Standa	ırd	
		Typical:
45 MHz to 2 GHz	23 dB	27 dB
2 GHz to 10 GHz	16 dB	19 dB
10 GHz to 20 GHz	14 dB	19 dB
20 GHz to 40 GHz	10 dB	14 dB
40 GHz to 45 GHz	9 dB	13.5 dB
45 GHz to 50 GHz	5.5 dB	9 dB
Source Match - Opt UN	IL, 014 or UNL&014	
		Typical:
45 MHz to 2 GHz	18 dB	22.5 dB
2 GHz to 10 GHz	14 dB	18 dB
10 GHz to 20 GHz	12 dB	15 dB
20 GHz to 40 GHz	8 dB	10 dB
40 GHz to 45 GHz	7 dB	10 dB
45 GHz to 50 GHz	4 dB	6.5 dB
Load Match - Standard		
		Typical:
45 MHz to 2 GHz	23 dB	29 dB
2 GHz to 10 GHz	14 dB	16 dB
10 GHz to 20 GHz	10 dB	12 dB
20 GHz to 40 GHz	9 dB	12 dB
40 GHz to 45 GHz	9 dB	13 dB
45 GHz to 50 GHz	7 dB	10 dB
Load Match - Opt UNL	, 014 or UNL&014	
_		Typical:
45 MHz to 2 GHz	17 dB	21.5 dB
2 GHz to 10 GHz	13 dB	16.5 dB
10 GHz to 20 GHz	10 dB	13 dB
20 GHz to 40 GHz	9 dB	11 dB
40 GHz to 45 GHz	8 dB	11 dB
45 GHz to 50 GHz	6 dB	8 dB
Reflection Tracking		
		Typical:
45 MHz to 20 GHz		±1.5
20 GHz to 40 GHz		±1.5
40 GHz to 50 GHz		±2.0

Transmission Tracking ^a			
	-9	Typical:	
45 MHz to 2 GHz		±2.5 dB	
2 GHz to 10 GHz		±2.0 dB	
10 GHz to 20 GHz		±3.0 dB	
20 GHz to 40 GHz		±4.5 dB	-
40 GHz to 45 GHz		±6.0 dB	
45 GHz to 50 GHz		±6.0 dB	-
Crosstalk - Standard			
45 MHz to 1 GHz	-85 dB		
1 GHz to 2 GHz	-100 dB		
2 GHz to 20 GHz	-110 dB		
20 GHz to 40 GHz	-108 dB		
40 GHz to 45 GHz	-105 dB		
45 GHz to 50 GHz	-100 dB		
Crosstalk - Option UN	IL or 014		
45 MHz to 1 GHz	-85 dB		
1 GHz to 2 GHz	-100 dB		
2 GHz to 20 GHz	-109 dB		
20 GHz to 40 GHz	-106 dB		
40 GHz to 45 GHz	-103 dB		
45 GHz to 50 GHz	-98 dB		
Crosstalk - Option UN			
45 MHz to 1 GHz	-85 dB		
1 GHz to 2 GHz	-98 dB		
2 GHz to 10 GHz	-108 dB		
10 GHz to 20 GHz	-107 dB		
20 GHz to 40 GHz	-104 dB		
40 GHz to 45 GHz	-100 dB		
45 GHz to 50 GHz	-95 dB		

^a Measurement conditions: normalized to a thru, measured with two shorts, 10 Hz IF bandwidth, averaging factor of 8, alternate mode, source power set to the lesser of the maximum power out or the maximum receiver power.

Table 34. Test Port Output^a

	t Port Output				Complements!
	Specification	n			Supplemental
Frequency F		10 1011	a	0.4100.000	
	Standard	Opt 014	Opt UNL	Opt UNL&014	
E8362A	45 MHz to 2				
E8363A	45 MHz to 4				
E8364A	45 MHz to 5	0 GHz			
Nominal Po					
	-12 dBm	-17 dBm	-17 dBm	-17 dBm	
Frequency F					
	1 Hz				
CW Accurac	y				
	+/-1 ppm				
Frequency S	Stability				
					+/-1 ppm 0° to 40° C, typical +/-0.2 ppm/yr, typical
Power Leve	I Accuracy				
45 MHz to 10 GHz	+/-1.5 dB	+/-1.5 dB	+/-1.5 dB	+/-1.5 dB	Variation from nominal power in range 0 (step
10 GHz to 20 GHz	+/-2.0 dB	+/-2.0 dB	+/-2.0 dB	+/-2.0 dB	attenuator at 0 dB)
20 GHz to 40 GHz	+/-3.0 dB	+/-3.0 dB	+/-3.0 dB	+/-3.0 dB	
40 GHz to 45 GHz	+/-3.0 dB	+/-3.5 dB	+/-3.0 dB	+/-3.5 dB	
45 GHz to 50 GHz	+/-3.0 dB	+/-4.0 dB	+/-3.0 dB	+/-4.0 dB	
Power Leve	I Linearity				
45 MHz to 20 GHz	+/-1.0 dB	+/-1.0 dB	+/-1.0 dB ^c	+/-1.0 dB ^c	Test reference is at the nominal power level (step
20 GHz to 40 GHz	+/-1.0 dB	+/-1.0 dB	+/-1.0 dB ^c	+/-1.0 dB ^c	attenuator at 0 dB)
40 GHz to 50 GHz	+/-1.0 dB	+/-1.0 dB	+/-1.0 dB	+/-1.0 dB	
Power Rang	je⁴				
45 MHz to	-25 to	-25 to	-87 to	-87 to	
10 GHz	+5 dBm	+5 dBm	+3 dBm	+3 dBm	
10 GHz to	-24 to	-25 to	-86 to	-87 to	
20 GHz	+3 dBm	+2 dBm	+1 dBm	0 dBm	
20 GHz to	-23 to	-25 to	-85 to	-87 to	
30 GHz	0 dBm	-2 dBm	-2 dBm	-4 dBm	
30 GHz to	-23 to	-25 to	-85 to	-87 to	
40 GHz	-4 dBm	-6 dBm	-6 dBm	-8 dBm	
40 GHz to	-25 to	-27 to	-87 to	-87 to	
45 GHz	-5 dBm	-7 dBm	-9 dBm	-11 dBm	
45 GHz to	-25 to	-27 to	-87 to	-87 to	
50 GHz	-10 dBm	-12 dBm	-15 dBm	-17 dBm	

Power Swee	ep Range (ALC)				
45 MHz to	30 dB	30 dB	30 dB	30 dB	ALC range starts at	
10 GHz					maximum leveled output	
10 GHz to	27 dB	27 dB	27 dB	27 dB	power and goes down to	
20 GHz					power level indicated by dB	
20 GHz to	23 dB	23 dB	23 dB	23 dB	amount specified	
30 GHz						
30 GHz to	19 dB	19 dB	19 dB	19 dB		
40 GHz						
40 GHz to	20 dB	20 dB	18 dB	16 dB		
45 GHz						
45 GHz to	15 dB	15 dB	12 dB	10 dB		
50 GHz						
Power Reso	_					
	0.01 dB					
Phase Noise	-					
	t from cente	er frequency, n	ominal power a	at test port		
45 MHz to					-70 dBc, typical	
10 GHz						
10 GHz to					-65 dBc, typical	
20 GHz						
20 GHz to					-55 dBc, typical	
40 GHz						
40 GHz to					-55 dBc, typical	
50 GHz						
Harmonics	(2nd or 3rd)				
					-23 dBc typical, in power	
					range 0	
	Non-Harmonic Spurious (at Nominal Output Power)					
45 MHz to					-50 dBc typical, for offset	
20 GHz					frequency > 1 kHz	
20 GHz to					-30 dBc typical, for offset	
40 GHz					frequency > 1 kHz	
40 GHz to					-30 dBc typical, for offset	
50 GHz					frequency > 1 kHz	

^a Source output performance on Port 1 only. Port 2 output performance is a characteristic.

^b Preset power.

^c 1.5 dB for power <= -23 dBm.

^d Power to which the source can be set and phase lock is assured.

Table 35: Test Port Input

Description	Specification				Supplemental
	Standard	Opt 014	Opt UNL	Opt UNL&014	
Test Port Noise					
10 Hz IF Bandw					
45 MHz to	<-89 dBm	<-89 dBm	<-89 dBm	<-89 dBm	
500 MHz ²					
500 MHz to 2	<-114 dBm	<-114 dBm	<-114 dBm	<-114 dBm	
GHz					
2 GHz to	<-117 dBm	<-117 dBm	<-117 dBm	<-117 dBm	
10 GHz					
10 GHz to	<-120 dBm	<-119 dBm	<-120 dBm	<-119 dBm	
20 GHz					
20 GHz to	<-120 dBm	<-113 dBm	<-114 dBm	<-113 dBm	
40 GHz					
40 GHz to	<-114 dBm	<-112 dBm	<-114 dBm	<-112 dBm	
50 GHz					
1 Hz IF Bandwi	dth				
45 MHz to	<-69 dBm	<-69 dBm	<-69 dBm	<-69 dBm	
500 MHz ²					
500 MHz to	<-94 dBm	<-94 dBm	<-94 dBm	<-94 dBm	
	V O I GEIII	V O I GEIII	V O I GEIII	l o i abiii	
2 GHz	<-97 dBm	<-97 dBm	<-97 dBm	<-97 dBm	
2 GHz to	C-97 UDIII	C-91 UDIII	C-97 UDIII	C-97 UDIII	
10 GHz	400 dD	00 -ID	400 dD	00 dD	
10 GHz to	<-100 dBm	<-99 dBm	<-100 dBm	<-99 dBm	
20 GHz	0.4 ID	00 10	0.4 ID	00 15	
20 GHz to	<-94 dBm	<-93 dBm	<-94 dBm	<-93 dBm	
40 GHz					
40 GHz to	<-94 dBm	<-92 dBm	<-94 dBm	<-92 dBm	
50 GHz					
Direct Receiver	•	Noise Floor ¹			
10 Hz IF Bandw	<u>/idth</u>				
45 MHz to 500		<-127 dBm		<-127 dBm	
MHz ² 500 MHz to 2		<-133 dBm		<-133 dBm	
GHz		<-133 ubili		<-133 dBill	
2 GHz to		<-132 dBm		<-132 dBm	
10 GHz					
10 GHz to 20		<-134 dBm		<-134 dBm	
GHz		10.00		10.45	
20 GHz to 40		<-125 dBm		<-125 dBm	
GHz					
40 GHz to 50		<-123 dBm		<-123 dBm	
GHz					

1 Hz IF Bandwi	idth			
45 MHz to	T	<-107 dBm	<-107 dBm	
500 MHz				
500 MHz to 2		<-113 dBm	<-113 dBm	
GHz				
2 GHz to		<-112 dBm	<-112 dBm	
10 GHz				
10 GHz to		<-114 dBm	<-114 dBm	
20 GHz				
20 GHz to		<-105 dBm	<-105 dBm	
40 GHz				
40 GHz to		<-103 dBm	<-103 dBm	
50 GHz				
Receiver Comp				
45 MHz to	<0.6 dB comp	ression at +5 dBm		
20 GHz				
20 GHz to	<0.6 dB comp	ression at 0 dBm		
30 GHz				
30 GHz to	<0.6 dB comp	ression at-3 dBm		
40 GHz				
40 GHz to	<0.6 dB comp	ression at -3 dBm		
50 GHz				
System Compr				
	maximum outp	See <u>dynamic</u> <u>accuracy</u> table		
Trace Noise Ma				
		surement, nominal power a	at test port.	1
45 MHz to		•		
	<0.010 dB rms	•		
500 MHz				
500 MHz to	<0.010 dB rms			
500 MHz to 20 GHz	<0.006 dB rms	3		
500 MHz to 20 GHz 20 GHz to		3		
500 MHz to 20 GHz 20 GHz to 40 GHz	<0.006 dB rms	3		
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to	<0.006 dB rms	3		
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to 50 GHz	<0.006 dB rms <0.006 dB rms <0.006 dB rms	3		
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to 50 GHz Trace Noise Ph	<0.006 dB rms <0.006 dB rms <0.006 dB rms	3 3	at toot port	
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to 50 GHz Trace Noise Ph 1 kHz IF bandw	<0.006 dB rms <0.006 dB rms <0.006 dB rms ase idth. Ratio meas	3	at test port.	
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to 50 GHz Trace Noise Pt 1 kHz IF bandw 45 MHz to	<0.006 dB rms <0.006 dB rms <0.006 dB rms	3 3	at test port.	
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to 50 GHz Trace Noise Pt 1 kHz IF bandw 45 MHz to 500 MHz ³	<0.006 dB rms <0.006 dB rms <0.006 dB rms <0.006 dB rms inase idth. Ratio mease <0.100° rms	3 3	at test port.	
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to 50 GHz Trace Noise Pt 1 kHz IF bandw 45 MHz to 500 MHz ³	<0.006 dB rms <0.006 dB rms <0.006 dB rms ase idth. Ratio meas	3 3	at test port.	
500 MHz to 20 GHz 20 GHz to 40 GHz to 50 GHz Trace Noise Pf 1 kHz IF bandw 45 MHz to 500 MHz 500 MHz to 20 GHz	<0.006 dB rms <0.006 dB rms <0.006 dB rms <0.006 dB rms idth. Ratio meas <0.100° rms <0.060° rms	3 3	at test port.	
500 MHz to 20 GHz 20 GHz to 40 GHz 40 GHz to 50 GHz Trace Noise Pr 1 kHz IF bandw 45 MHz to 500 MHz ³ 500 MHz to 20 GHz 20 GHz	<0.006 dB rms <0.006 dB rms <0.006 dB rms <0.006 dB rms inase idth. Ratio mease <0.100° rms	3 3	at test port.	
500 MHz to 20 GHz 20 GHz to 40 GHz to 50 GHz Trace Noise Pr 1 kHz IF bandw 45 MHz to 500 MHz ³ 500 MHz to 20 GHz 20 GHz to	<0.006 dB rms <0.006 dB rms <0.006 dB rms <0.006 dB rms idth. Ratio meas <0.100° rms <0.060° rms <0.100° rms	3 3	at test port.	
500 MHz to 20 GHz 20 GHz to 40 GHz to 50 GHz Trace Noise Pr 1 kHz IF bandw 45 MHz to 500 MHz ³ 500 MHz to 20 GHz 20 GHz to	<0.006 dB rms <0.006 dB rms <0.006 dB rms <0.006 dB rms idth. Ratio meas <0.100° rms <0.060° rms	3 3	at test port.	

Reference Lev	el Magnitude		
Range	+/-200 dB		
Resolution	0.001 dB		
Reference Lev			
Range	+/-500°		
Resolution	0.01°		
Stability Magn			
Typical ratio me	asurement, made at the test port.		
45 MHz to			+/-0.02 dB/°C
20 GHz			
20 GHz to			+/-0.03 dB/°C
40 GHz			
40 GHz to			+/-0.04 dB/°C
50 GHz			
Stability Phase	4		
Typical ratio me	asurement, measured at the test p	ort.	
45 MHz to			+/-0.2°/°C
20 GHz			
20 GHz to			+/-0.5°/°C
40 GHz			
40 GHz to			+/-0.8°/°C
50 GHz			
Damage Input	Level		
Test Port 1			+20 dBm or
and 2			+/-40 VDC,
			typical
R1, R2 in			+15 dBm or
			+/-15 VDC,
			typical
A, B in			+15 dBm or
			+/-15 VDC,
			typical
Coupler Thru			+30 dBm or
			+/-40 VDC,
			typical
Coupler Arm			+30 dBm or
			+/-7 VDC,
			typical

¹Total average (rms) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

²Noise floor may be degraded by 10 dB at particular frequencies (multiples of 5 MHz) due to spurious receiver residuals.

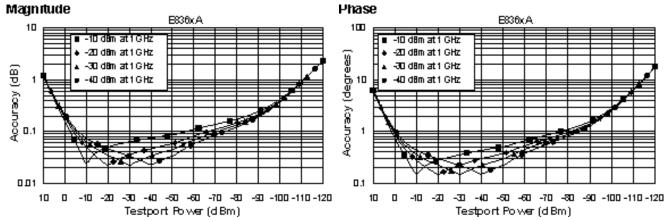
³Trace noise magnitude may be degraded to 20 mdB rms at harmonic frequencies of the first IF (8.33 MHz) below 80 MHz.

⁴Stability is defined as a ratio measurement made at the test port.

Table 36. Dynamic Accuracy (Specification^a)

Accuracy of the test port input power reading is relative to the reference input power level. Applies to input ports 1 and 2 with the following conditions:

- IF bandwidth = 10 Hz
- Test port powers = > -50 dBm and < 0 dBm



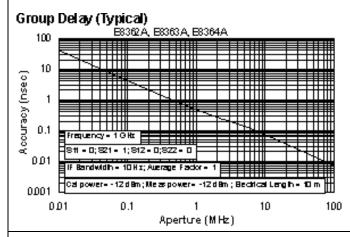
^a Dynamic accuracy is verified with the following measurements:

- compression over frequency
- IF linearity at a single frequency of 1.195 GHz and a reference level of -20 dBm

Table 37. Test Port Input (Group Delay)^a

Description	Specification	Supplemental Information
Aperture (selectable)	(frequency span)/(number of points - 1)	
Maximum Aperture	20% of frequency span	
Range	0.5 x (1/minimum aperture)	
Maximum Delay		Limited to measuring no more than 180° of phase change within the minimum aperture.)
Accuracy		See graph below. Char.

The following graph shows characteristic group delay accuracy with full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be < 2 dB and electrical length to be ten meters.



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

±Phase Accuracy (deg)/[360 × Aperture (Hz)]

Depending on the aperture and device length, the phase accuracy used is either incremental phase accuracy or worst case phase accuracy.

General Information

Table 38. Miscellaneous Information

Description	Specification	Supplemental Information
System IF Bandwidth Range		1 Hz to 40 kHz, nominal
CPU		Intel® 500 MHz Pentium® III

^a Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).

Table 39. Front Panel Information

Description	Supplemental Information
RF Connectors	
E8362A	
Туре	3.5 mm (male), 50 ohm, (nominal)
Center Pin Recession	0.002 in. (characteristic)
E8363/4A	
Туре	2.4 mm (male), 50 ohm, (nominal)
Center Pin Recession	0.002 in. (characteristic)
Display	
Size	21.3 cm (8.4 in) diagonal color active matrix LCD; 640 (horizontal) X 480 (vertical) resolution; 59.83 Hz vertical refresh rate; 31.41 Hz horizontal refresh rate
Refresh Rate	Vertical 59.83 Hz; Horizontal 31.41 Hz
Display Range	
Magnitude	±200 dB (at 20 dB/div), max
Phase	±180°, max
Polar	10 pUnits, min 1000 Units, max
Display Resolution	
Magnitude	0.001 dB/div, min
Phase	0.01°/div, min
Marker Resolution	
Magnitude	0.001 dB, min
Phase	0.01°, min
Polar	0.01 mUnit, min; 0.01°,min

Table 40. Rear Panel Information

Description	Supplemental Information
10 MHz Reference In	
Connector	BNC, female
Input Frequency	10 MHz ± 10 ppm, typical
Input Level	-15 dBm to +20 dBm, typical
Input Impedance	200 Ω , nom.
10 MHz Reference Ou	t
Connector	BNC, female
Output Frequency	10 MHz ± 1 ppm, typical
Signal Type	Sine Wave, typical
Output Level	+10 dBm ± 4 dB into 50 Ω, typical
Output Impedance	50 Ω, nominal
Harmonics	<-40 dBc, typical
VGA Video Output	
Connector	15-pin mini D-Sub; Drives VGA compatible monitors
Devices Supported:	
	Resolutions:
Flat Panel (TFT)	1024 X 768, 800 X 600, 640 X 480
Flat Panel (DSTN)	800 X 600, 640 X 480
CRT Monitor	1280 X 1024, 1024 X 768, 800 X 600, 640 X 480
	Simultaneous operation of the internal and external displays is allowed, but
	with 640 X 480 resolution only. If you change resolution, you can only view the external display (internal display will "white out").
Test Set IO	
	25-pin D-Sub connector, available for external test set control

Aux IO	
	25-pin D-Sub connector, male, analog and digital IO
Handler IO	
	36-pin parallel I/O port; all input/output signals are default set to negative logic; can be reset to positive logic via GPIB command
GPIB	
	24-pin D-sub (Type D-24), female; compatible with IEEE-488.
Parallel Port (LPT1)	
	25-pin D-Sub miniature connector, female; provides connection to printers or any other parallel port peripherals
Serial Port (COM 1)	
	9-pin D-Sub, male; compatible with RS-232
USB Port	
	Universal Serial Bus jack, Type A configuration
	(4 contacts inline, contact 1 on left); female
Contact 1	Vcc: 4.75 to 5.25 VDC, 500 mA, maximum
Contact 2	-Data
Contact 3	+Data
Contact 4	Ground
LAN	
	10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates
Line Power ^a	
Frequency	48 Hz to 66 Hz
Voltage at 115 V Setting	90 to 132 VAC; 120 VAC, nominal
Voltage at 220 V Setting	198 to 264 VAC; 240 VAC, nominal
VA Max	600 VA maximum

^a A third-wire ground is required.

Table 41. Analyzer Environment and Dimensions

Description	Supplemental Informati	on		
General Environmental				
RFI/EMI Susceptibility	Defined by CISPR Pub. 1	Defined by CISPR Pub. 11, Group 1, Class A, and IEC 50082-1		
ESD	Minimize using static-safe	work procedures and an ar	ntistatic bench mat	
Dust	Minimize for optimum reli	ability		
Operating Environment				
Temperature	0 °C to +40 °C			
	Instrument powers up, phase locks, and displays no error messages within this temperature range (except for "source unleveled" error message that may occur at temperature extremes when power approaches limits of ALC range).			
Error-Corrected	23°C ± 3°C			
Temperature Range	with less than 1°C deviat	with less than 1°C deviation from calibration temp.		
Humidity	5% to 95% at +40 °C			
Altitude	0 to 4500 m (14,760 ft.)	0 to 4500 m (14,760 ft.)		
Non-Operating Storage E	invironment			
Temperature	-40 °C to +70 °C			
Humidity	0% to 90% at +65 °C (no	0% to 90% at +65 °C (non-condensing)		
Altitude	0 to 15,240 m (50,000 ft.)			
Cabinet Dimensions				
	Height	Width	Depth	
Fueluding front and room	007	40E mana	40C	

Ailitude	0 to 13,240 fit (30,000 ft.)					
Cabinet Dimensions						
	Height	Width	Depth			
Excluding front and rear	267 mm	425 mm	426 mm			
panel hardware and feet	10.5 in	16.75 in	16.8 in			
As shipped - includes front	305 mm	425 mm	470 mm			
panel connectors, rear	12.0 in	16.75 in	18.5 in			
panel bumpers, and feet.						
As shipped plus handles	305 mm	458 mm	502 mm			
	12.0 in	18 in	19.75 in			
As shipped plus rack-	305 mm	483 mm	470 mm			
mount flanges	12.0 in	19 in	18.5 in			
As shipped plus handles	305 mm	483 mm	502 mm			
and flanges	12.0 in	19 in	19.75 in			
Weight						
Net						
E8362A	28.6 kg (63.5 lb), nominal					
E8363/4A	29 kg (64 lb), nominal					
Shipping						
E8362A	35.8 kg (79.5 lb), nominal					
E8363/4A	36.3 kg 80 lb), nominal					

Measurement Throughput Summary
Table 42. Typical Cycle Time^{a,b} (ms) for Measurement Completion

Number of Points							
	51	201	401	1601			
Start 13.5 GHz, Stop 16.5 GHz, 35 kHz IF bandwidth							
Uncorrected,	21	23	28	65			
1-port cal							
2-Port cal	52	57	70	152			
Start 45 MHz, Stop 10 GHz, 35 kHz IF bandwidth							
Uncorrected,	71	79	84	110			
1-port cal							
2-Port cal	153	171	182	243			
Start 45 MHz, Stop 20 GHz, 35 kHz IF bandwidth							
Uncorrected,	103	116	121	139			
1-port cal							
2-Port cal	216	245	256	303			
Start 45 MHz, Stop 40 GHz, 35 kHz IF bandwidth							
Uncorrected,	145	181	190	232			
1-port cal							
2-Port cal	293	367	382	428			
Start 45 MHz, Stop 50 GHz, 35 kHz IF bandwidth							
Uncorrected,	163	210	218	256			
1-port cal							
2-Port cal	332	425	442	487			
Time Domain ^c (increase over uncorrected sweep time)							
Conversions	< 1	< 1	4	13			
Gating	< 1	< 1	4	17			

^a Typical performance.
^b Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S11) measurement.

 $^{^{\}mbox{\tiny c}}$ Option 010 only.

Table 43. Cycle Time vs IF Bandwidth^a

Applies to the Preset condition (201 points, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

IF Bandwidth	Cycle Time (ms) ^b
(Hz)	
40,000	8
35,000	9
30,000	11
20,000	13
10,000	28
7000	36
5000	48
3000	72
1000	196
300	620
100	3853
30	8041
10	19855

Table 44. Cycle Time vs Number of Points^a

Applies to the <u>Preset condition</u> (35 kHz IF bandwidth, correction off) except for the following changes:

- CF = 1 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

Number of	Cycle Time (ms) ^b
Points	
3 11 51	4
11	4
	5 6
101	
201	9
201 401	16
801	29
1601	55

^a Typical performance.
^b Cycle time includes sweep and retrace time.

^a Typical performance. ^b Cycle time includes sweep and retrace time.

Table 45. Data Transfer Time (ms)^a

	Number of Points			
	51	201	401	1601
SCPI over GPIB				
(program executed on	externa	I PC) ^a		
32-bit floating point	3	7	12	43
64-bit floating point	4	12	22	84
ASCII	18	64	124	489
SCPI over 100 Mbit/s L	_AN			
(program executed on	externa	I PC) ^b		
32-bit floating point	1	1	1	1
64-bit floating point	1	1	1	2
ASCII	5	15	26	96
SCPI (program execut	ed in the	analyze	r) ^c	
32-bit floating point	1	1	2	3
64-bit floating point	1	2	2	4
ASCII	8	29	56	222
COM (program execut	ed in the	e analyze	r) ^d	
32-bit floating point	1	1	1	1
Variant type	1	1	2	6
DCOM over 100 Mbit/s	LAN			
(program executed on	externa	I PC) ^f		
32-bit floating point	1	1	1	2
Variant type	1	3	6	19

^a Typical performance

Note: Specifications for Recall & Sweep Speed are not provided for the E836xA analyzers.

Specifications: Front-Panel Jumpers

Models E8362A, E8363A, and E8364A Option 014

See Front-panel jumper configurations.

NOTE: The standard E8362A /63A/ 64A has no front-panel jumpers.

Table 46: Measurement Receiv	ver Inputs (Rcvr A In, Rcvr B In)
Description	Specification	Supplemental Information
Maximum Input Level		
E8362A:		
45 MHz to 500 MHz		-15 dBm, typical
500 MHz to 2 GHz		-11 dBm, typical
2 GHz to 10 GHz		-11 dBm, typical
10 GHz to 20 GHz		-11 dBm, typical
E8363A:		
45 MHz to 500 MHz		-14 dBm, typical
500 MHz to 2 GHz		-10 dBm, typical
2 GHz to 10 GHz		-10 dBm, typical
10 GHz to 20 GHz		-10 dBm, typical
20 GHZ to 30 GHz		-14.5 dBm, typical
30 GHZ to 40 GHz		-16.5 dBm, typical
E8364A:		
45 MHz to 500 MHz		- 14 dBm, typical
500 MHz to 2 GHz		- 10 dBm, typical
2 GHz to 10 GHz		- 10 dBm, typical
10 GHz to 20 GHz		- 10 dBm, typical
20 GHZ to 30 GHz		- 14.5 dBm, typical
30 GHZ to 40 GHz		- 16.5 dBm, typical
40 GHZ to 45 GHz		- 16 dBm, typical
45 GHZ to 50 GHz		- 15 dBm, typical
Noise Floor		
E8362A:		
	10 Hz IF Bandwidth	
45 MHz to 500 MHz	< -109 dBm	
500 MHz to 2 GHz	< -130 dBm	
2 GHz to 10 GHz	< -133 dBm	
10 GHz to 20 GHz	< -135 dBm	
	1 kHz IF Bandwidth	
45 MHz to 500 MHz	< -89 dBm	
500 MHz to 2 GHz	< -110 dBm	
2 GHz to 10 GHz	< -113 dBm	
10 GHz to 20 GHz	< -115 dBm	

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E8363A:		
	10 Hz IF Bandwidth	
45 MHz to 500 MHz	< -127 dBm	
500 MHz to 2 GHz	< -133 dBm	
2 GHz to 10 GHz	< -132 dBm	
10 GHz to 20 GHz	< -134 dBm	
20 GHZ to 40 GHz	< -125 dBm	
	1 kHz IF Bandwidth	
45 MHz to 500 MHz	< -107 dBm	
500 MHz to 2 GHz	< -113 dBm	
2 GHz to 10 GHz	< -112 dBm	
10 GHz to 20 GHz	< -114 dBm	
20 GHZ to 40 GHz	< -105 dBm	
E8364A:	·	
	10 Hz IF Bandwidth	
45 MHz to 500 MHz	< - 127 dBm	
500 MHz to 2 GHz	< - 133 dBm	
2 GHz to 10 GHz	< - 132 dBm	
10 GHz to 20 GHz	< - 134 dBm	
20 GHZ to 40 GHz	< - 125 dBm	
40 GHZ to 50 GHz	< - 123 dBm	
	1 kHz IF Bandwidth	
45 MHz to 500 MHz	< -107 dBm	
500 MHz to 2 GHz	< -113 dBm	
2 GHz to 10 GHz	< -112 dBm	
10 GHz to 20 GHz	< -114 dBm	
20 GHZ to 40 GHz	< -105 dBm	
40 GHZ to 50 GHz	< -103 dBm	
Damage Level		
E8362A		+ 15 dBm, typical
E8363A		+ 15 dBm, typical
E8364A		+ 15 dBm, typical
Maximum DC Level		
E8362A		+ 15 V, typical
E8363A		+ 15 V, typical
E8364A		+ 15 V, typical

Table 47: Reference Receiver Inputs (Rcvr R1, Rcvr R2)

Specification	Supplemental Information
	-15 dBm, typical
	-11 dBm, typical
	-11 dBm, typical
	-11 dBm, typical
	-14 dBm, typical
	-10 dBm, typical
	-10 dBm, typical
	-9.5 dBm, typical
	-14 dBm, typical
	-15.5 dBm, typical
	- 14 dBm, typical
	- 10 dBm, typical
	- 10 dBm, typical
	- 9.5 dBm, typical
	- 14 dBm, typical
	- 15.5 dBm, typical
	- 14 dBm, typical
	- 15 dBm, typical
	+ 15 dBm, typical
	+ 15 dBm, typical
	+ 15 dBm, typical
	+/- 15 V, typical
	+/- 15 V, typical
	+/- 15 V, typical
	Specification

Table 48: Reference Outputs (Reference 1 Source Out, Reference 2 Source Out)

Description	Specification	Supplemental Information
Maximum Output Level		
E8362A:		
45 MHz to 500 MHz		-24 dBm, typical
500 MHz to 2 GHz		-23 dBm, typical
2 GHz to 10 GHz		-23 dBm, typical
10 GHz to 20 GHz		-26 dBm, typical
E8363A:		
45 MHz to 500 MHz		-11.5 dBm, typical
500 MHz to 2 GHz		-10.5 dBm, typical
2 GHz to 10 GHz		-11 dBm, typical
10 GHz to 20 GHz		-11 dBm, typical
20 GHZ to 30 GHz		-11 dBm, typical
30 GHZ to 40 GHz		-11 dBm, typical
E8364A:		
45 MHz to 500 MHz		- 11.5 dBm, typical
500 MHz to 2 GHz		- 10.5 dBm, typical
2 GHz to 10 GHz		- 11 dBm, typical
10 GHz to 20 GHz		- 11 dBm, typical
20 GHZ to 30 GHz		- 11 dBm, typical
30 GHZ to 40 GHz		- 11 dBm, typical
40 GHZ to 45 GHz		- 11 dBm, typical
45 GHZ to 50 GHz		- 15 dBm, typical
Damage Level		
E8362A		+ 20 dBm, typical
E8363A		+ 20 dBm, typical
E8364A		+ 20 dBm, typical
Maximum DC Level		
E8362A		+/- 15 V, typical
E8363A		+/- 15 V, typical
E8364A		+/- 15 V, typical

Table 49: Source Outputs (Port 1 Source Out, Port 2 Source Out)

Description	Specification	Supplemental Information	
Maximum Qutnut Lavel			
Maximum Output Level E8362A, Option 014:			
	<u> </u>	C dDm timical	
45 MHz to 500 MHz		6 dBm, typical	
500 MHz to 2 GHz		7 dBm, typical	
2 GHz to 10 GHz		7 dBm, typical	
10 GHz to 20 GHz		4 dBm, typical	
E8362A, Option 014 and UN	NL:	Li in in in in	
45 MHz to 500 MHz		4 dBm, typical	
500 MHz to 2 GHz		5 dBm, typical	
2 GHz to 10 GHz		5 dBm, typical	
10 GHz to 20 GHz		2 dBm, typical	
E8363A, Option 014:		I	
45 MHz to 500 MHz		5.5 dBm, typical	
500 MHz to 2 GHz		6.5 dBm, typical	
2 GHz to 10 GHz		6.5 dBm, typical	
10 GHz to 20 GHz		4 dBm, typical	
20 GHZ to 30 GHz		1- dBm, typical	
30 GHZ to 40 GHz		-2 dBm, typical	
E8363A, Option 014 and UN	NL:		
45 MHz to 500 MHz		3.5 dBm, typical	
500 MHz to 2 GHz		5 dBm, typical	
2 GHz to 10 GHz		5 dBm, typical	
10 GHz to 20 GHz		3.5- dBm, typical	
20 GHZ to 30 GHz		0 dBm, typical	
30 GHZ to 40 GHz		-2.5 dBm, typical	
E8364A, Option 014:	•		
45 MHz to 500 MHz		5.5 dBm, typical	
500 MHz to 2 GHz		6.5 dBm, typical	
2 GHz to 10 GHz		6.5 dBm, typical	
10 GHz to 20 GHz		4 dBm, typical	
20 GHZ to 30 GHz		1 dBm, typical	
30 GHZ to 40 GHz		-2 dBm, typical	
40 GHZ to 45 GHz		-3 dBm, typical	
45 GHZ to 50 GHz		-7.5 dBm, typical	
E8364A, Option 014 and UN	JL:	The ability typical	
45 MHz to 500 MHz		3.5 dBm, typical	
500 MHz to 2 GHz		5 dBm, typical	
2 GHz to 10 GHz		5 dBm, typical	
10 GHz to 20 GHz		3.5 dBm, typical	
20 GHZ to 30 GHz		0 dBm, typical	
30 GHZ to 40 GHz		-2.5 dBm, typical	
40 GHZ to 45 GHz		-5 dBm, typical	
45 GHZ to 50 GHz		-10 dBm, typical	
43 GHZ 10 30 GHZ		ro ubiti, typicai	

Damage Level		
E8362A	20 dBm, typical	
E8363A	20 dBm, typical	
E8364A	20 dBm, typical	
Maximum DC Level		
E8362A	0 V, typical	
E8363A	0 V, typical	
E8364A	0 V, typical	

Table 50: Coupler Inputs (Port 1 Cplr Thru, Port 2 Cplr Thru)

Description	Specification	Supplemental Information	
Insertion Loss to Test Port			
E8362A, Option 014:			
45 MHz to 500 MHz		0.5 dB, typical	
500 MHz to 2 GHz		1.5 dB, typical	
2 GHz to 10 GHz		1.5 dB, typical	
10 GHz to 20 GHz		1.5 dB, typical	
E8362A, Option 014 and UNL	•		
45 MHz to 500 MHz		1 dB, typical	
500 MHz to 2 GHz		2 dB, typical	
2 GHz to 10 GHz		2 dB, typical	
10 GHz to 20 GHz		2 dB, typical	
E8363A, Option 014:			
45 MHz to 500 MHz		0.5 dB, typical	
500 MHz to 2 GHz		0.5 dB, typical	
2 GHz to 10 GHz		1.5 dB, typical	
10 GHz to 20 GHz		2 dB, typical	
20 GHZ to 30 GHz		3 dB, typical	
30 GHZ to 40 GHz		3.5 dB, typical	
E8363A, Option 014 and UNL	•		
45 MHz to 500 MHz		0.5 dB, typical	
500 MHz to 2 GHz		1 dB, typical	
2 GHz to 10 GHz		2 dB, typical	
10 GHz to 20 GHz		3 dB, typical	
20 GHZ to 30 GHz		4 dB, typical	
30 GHZ to 40 GHz		5 dB, typical	
E8364A, Option 014:			
45 MHz to 500 MHz		0.5 dB, typical	
500 MHz to 2 GHz		0.5 dB, typical	
2 GHz to 10 GHz		1.5 dB, typical	
10 GHz to 20 GHz		2 dB, typical	
20 GHZ to 30 GHz		3 dB, typical	
30 GHZ to 40 GHz		3.5 dB, typical	
40 GHZ to 45 GHz		3.5 dB, typical	
45 GHZ to 50 GHz		4 dB, typical	

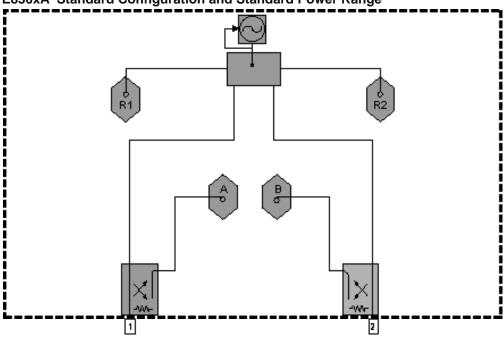
E8364A, Option 014 and UNL:		
45 MHz to 500 MHz	0.5 dB, typical	
500 MHz to 2 GHz	1 dB, typical	
2 GHz to 10 GHz	2 dB, typical	
10 GHz to 20 GHz	3 dB, typical	
20 GHZ to 30 GHz	4 dB, typical	
30 GHZ to 40 GHz	5 dB, typical	
40 GHZ to 45 GHz	5.5 dB, typical	
45 GHZ to 50 GHz	6 dB, typical	
Damage Level		
E8362A	+ 30 dBm, typical	
E8363A	+ 30 dBm, typical	
E8364A	+ 30 dBm, typical	
Maximum DC Level		
E8362A	+/- 40 V, typical	
E8363A	+/- 40 V, typical	
E8364A	+/- 40 V, typical	

Table 51: Coupler Outputs (Port 1 Cplr Arm, Port 2 Cplr Arm)

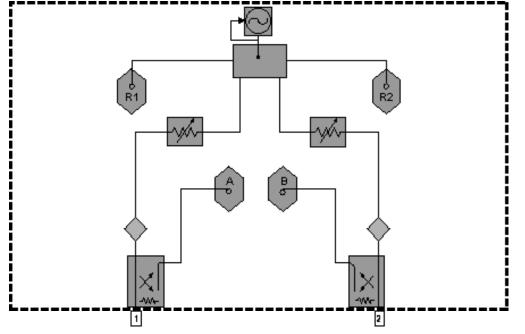
rabio ori obapioi oatpato (i ori i opii raini, i ori z opii raini)			
Description	Specification	Supplemental Information	
Damage Level			
E8362A		+ 30 dBm, typical	
E8363A		+ 30 dBm, typical	
E8364A		+ 30 dBm, typical	
Maximum DC Level			
E8362A		+/- 7 V, typical	
E8363A		+/- 7 V, typical	
E8364A		+/- 7 V, typical	

Test Set Block Diagrams

E836xA Standard Configuration and Standard Power Range

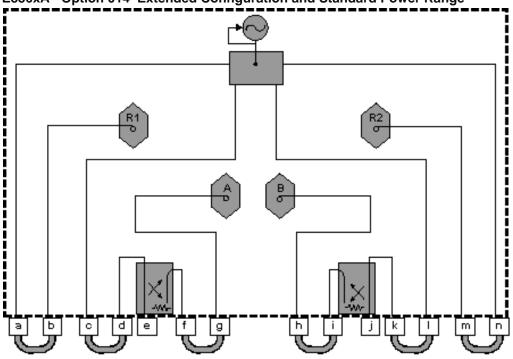


E836xA - Option UNL Standard Configuration with Extended Power Range and Bias - Tees



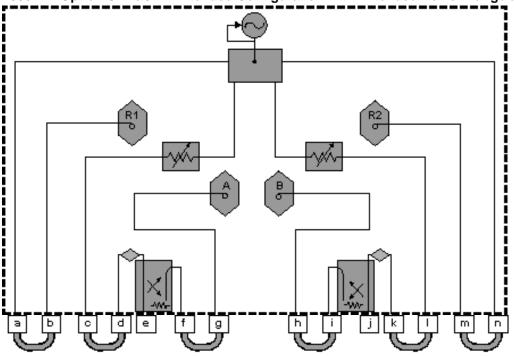
Test Set with Option 014 Block Diagrams

E836xA - Option 014 Extended Configuration and Standard Power Range



Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	İ	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1		SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT

E836xA - Option UNL&014 Extended Configuration with Extended Power Range and Bias - Tees



Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	i	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1	I	SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT

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This is a complete list of the E8362B, E8363B, and E8364B network analyzer technical specifications.

- To optimize viewing of uncertainty curves, click the Maximize button.
- To view or print the PNA Series Data Sheet (a condensed version of the specifications), visit our web site at http://www.agilent.com/find/pna, select your analyzer model, and click on the link for the data sheet.
- The uncertainty curves contained in this document apply only to the setup conditions listed. Please download our free Uncertainty Calculator from http://www.agilent.com/find/na_calculator to generate the curves for your PNA setup. View the equations used to generate the uncertainty curves.

Definitions

All specifications and characteristics apply over a 25 °C ±5 °C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

Specification (spec.): Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Characteristic (char.): A performance parameter that the product is expected to meet before it leaves the factory, but that is not verified in the field and is not covered by the product warranty. A characteristic includes the same guardbands as a specification.

Typical (typ.): Expected performance of an average unit which does not include guardbands. It is not covered by the product warranty.

Nominal (nom.): A general, descriptive term that does not imply a level of performance. It is not covered by the product warranty.

Calibration: The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

Corrected (residual): Indicates performance after error correction (calibration). It is determined by the quality of calibration standards and how well "known" they are, plus system repeatability, stability, and noise.

Uncorrected (raw): Indicates instrument performance without error correction. The uncorrected performance affects the stability of a calibration.

Standard: When referring to the analyzer, this includes no options unless noted otherwise.

Corrected System Performance

The specifications in this section apply for measurements made with the E836xB analyzer with the following conditions:

- 10 Hz IF bandwidth
- No averaging applied to data
- Isolation calibration with an averaging factor of 8

Table 1. System Dynamic Range^a

Description	Specification (dB) at Test Port ^b	Typical (dB) at Direct Receiver Access Input ^c	Supplemental Information
Dynamic Range (in a 10	Hz BW)		
Standard Configuration	and Standard Po	ower Range	
(E836xB - Standard)			
10 MHz to 45 MHz ^d	79		
45 MHz to 500 MHz ^e	94	NA	
500 MHz to 2 GHz	119	NA	
2 GHz to 10 GHz	122	NA	
10 GHz to 20 GHz	123	NA	
20 GHz to 30 GHz	114	NA	
30 GHz to 40 GHz	110	NA	
40 GHz to 45 GHz	109	NA	
45 GHz to 50 GHz	104	NA	
Configurable Test Set ar	nd Standard Pow	ver Range	
(E836xB - Option 014)		•	
10 MHz to 45 MHz ^d	79	129	
45 MHz to 500 MHz ^e	94	132	
500 MHz to 2 GHz	119	138	
2 GHz to 10 GHz	122	137	
10 GHz to 20 GHz	121	136	
20 GHz to 30 GHz	111	123	Option 016 degrades
30 GHz to 40 GHz	107	119	performance by 2 dB.
40 GHz to 45 GHz	105	116	
45 GHz to 50 GHz	100	111	
Standard Configuration	and Extended Po	ower Range & Bias-Tees	
(E836xB - Option UNL)		_	
10 MHz to 45 MHz ^d	79		
45 MHz to 500 MHz ^e	92	NA	
500 MHz to 2 GHz	117	NA	
2 GHz to 10 GHz	120	NA	
10 GHz to 20 GHz	121	NA	
20 GHz to 30 GHz	112	NA	
30 GHz to 40 GHz	108	NA	
40 GHz to 45 GHz	105	NA	
45 GHz to 50 GHz	99	NA	

Configurable Test Set	and Extended	l Power Range & Bias	-Tees
(E836xB - Option 014/L	JNL)		
10 MHz to 45 MHz ^d	79	129	
45 MHz to 500 MHz ^e	92	130	
500 MHz to 2 GHz	117	136	
2 GHz to 10 GHz	120	135	
10 GHz to 20 GHz	119	134	
20 GHz to 30 GHz	109	121	Option 016 degrades
30 GHz to 40 GHz	105	117	performance by 2 dB.
40 GHz to 45 GHz	101	112	
45 GHz to 50 GHz	95	106	

^a The system dynamic range is calculated as the difference between the noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

^bThe test port system dynamic range is calculated as the difference between the test port noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

The direct receiver access input system dynamic range is calculated as the difference between the receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its damage level. When the analyzer is in segment sweep mode, the analyzer can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when receiver damage may occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

d Typical performance.

^e May be limited to 100 dB at particular frequencies below 500 MHz due to spurious receiver residuals. Methods are available to regain the full dynamic range.

Table 2. Receiver Dynamic Range^a

Description	Specification (dB) at Test Port ^b	Typical (dB) at Direct Receiver Access Input ^c	
Dynamic Range (in a	10 Hz BW)		
Standard Configuration	on and Standard	l Power Range (E836xB - Stan	dard)
OR			
Standard Configuration	on and Extended	d Power Range & Bias Tees (E	836xB - Option UNL)
10 MHz to 45 MHz ^d	82	NA	,
45 MHz to 500 MHz ^e	94	NA	NA
500 MHz to 2 GHz	119	NA	
2 GHz to 10 GHz	122	NA	
10 GHz to 20 GHz	125	NA	
20 GHz to 30 GHz	114	NA	
30 GHz to 40 GHz	111	NA	
40 GHz to 50 GHz	111	NA	
Configurable Test Set	and Standard F	Power Range (E836xB - Option	า 014)
OR			·
	and Extended I	Power Range & Bias Tees (E8	36xB - Option 014/UNL)
10 MHz to 45 MHz ^d	82	132	
45 MHz to 500 MHz ^e	94	132	
500 MHz to 2 GHz	119	138	
2 GHz to 10 GHz	122	137	
10 GHz to 20 GHz	124	139	
20 GHz to 30 GHz	113	125	Option 016 degrades
30 GHz to 40 GHz	110	122	performance by 2 dB.
40 GHz to 50 GHz	109	120	

^a The receiver dynamic range is calculated as the difference between the noise floor and the receiver maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

Note: This E836xB document provides technical specifications for the following calibration kits only: 85056A, 85056D, 85056K, 85052B, 85052C, 85052D, 85050B, 85050C, 85050D, 85054B, 85054D, K11644A, P11644A, R11644A, and the X11644A.

^b The test port receiver dynamic range is calculated as the difference between the test port noise floor and the receiver maximum input level. The effective dynamic range must take measurement uncertainties and interfering signals into account.

The direct receiver access input receiver dynamic range is calculated as the difference between the direct receiver access input noise floor and the receiver maximum input level. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its compression or damage level. When the analyzer is in segment sweep mode, the analyzer can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when compression or receiver damage may occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

^l Typical performance.

^e May be degraded by 10 dB at particular frequencies (multiples of 5 MHz) below 500 MHz due to spurious receiver residuals. Methods are available to regain the full dynamic range.

E8363/4B Corrected System Performance with 2.4mm Connectors

Table 3. 85056A Calibration Kit Standard Configuration and Standard Power Range (E8363/4B)

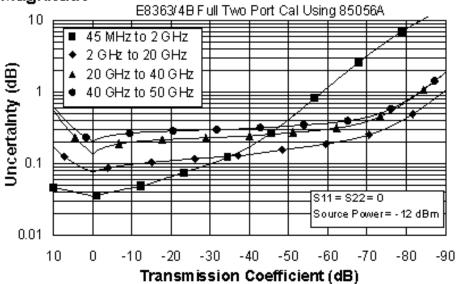
Applies to the E8363/4B analyzers, 85056A (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

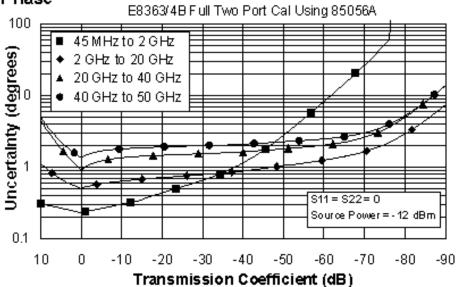
Specification	Specification (dB)			
45 MHz to 2 GHz	2 to 20 GHz	20 to 40 GHz	40 to 50 GHz	
42	42	38	36	
41	38	33	31	
42	42	37	35	
±0.001 +0.02/°C	±0.008 +0.02/°C	±0.020 +0.02/°C	±0.027 +0.03/°C	
±0.010	±0.049	±0.105	±0.170 +0.03/°C	
	45 MHz to 2 GHz 42 41 42 ±0.001 +0.02/°C	2 GHz 20 GHz 42 42 41 38 42 42 ±0.001 ±0.008 +0.02/°C +0.02/°C ±0.010 ±0.049	45 MHz to 2 to 20 to 2 GHz 40 GHz 42 42 38 41 38 33 42 42 42 37 ±0.001 ±0.008 ±0.020 +0.02/°C +0.02/°C ±0.010 ±0.049 ±0.105	

Transmission Uncertainty (Specifications)

Magnitude

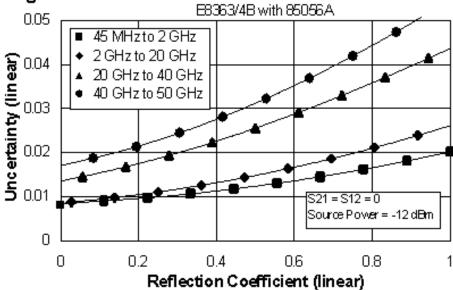


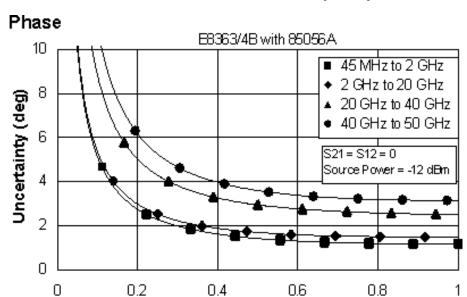




Reflection Uncertainty (Specifications)

Magnitude





Reflection Coefficient (linear)

Table 4. 85056A Calibration Kit

Fully Optioned

Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

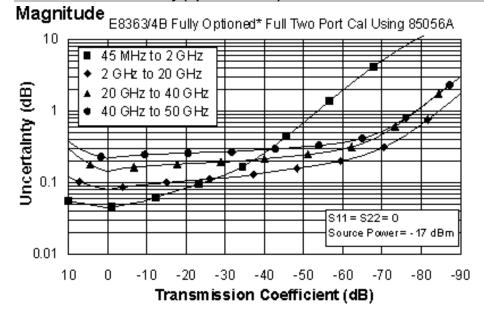
(E836xB - Option 014, UNL, 016, 080, and 081)

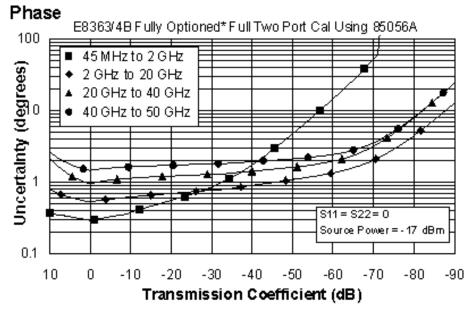
Applies to the, E8363/4B analyzers, 85056A (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ± 3 °C, with < 1 °C deviation from calibration temperature

Description	Specificatio	on (dB)			
	45 MHz to	2 to	20 to	40 to	
	2 GHz	20 GHz	40 GHz	50 GHz	
Directivity	42	42	38	36	
Source Match	41	38	33	31	
Load Match	42	42	37	35	
Reflection Tracking	±0.001	±0.008	±0.020	±0.027	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	
Transmission Tracking	±0.019	±0.053	±0.109	±0.182	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	

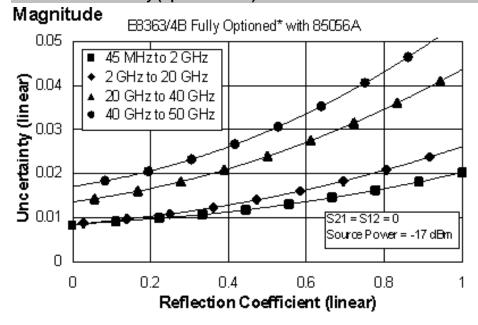
Transmission Uncertainty (Specifications)

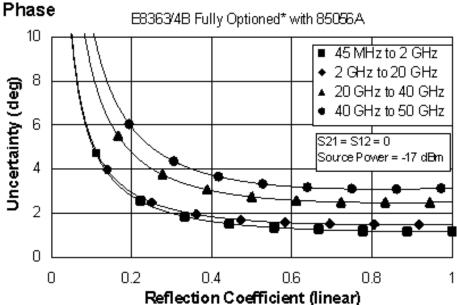




* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Reflection Uncertainty (Specifications)





* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Table 5. 85056D Calibration Kit Standard Configuration and Standard Power Range (E8363/4B)

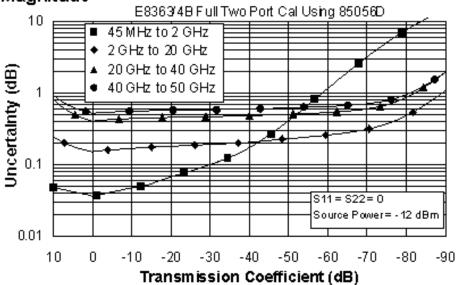
Applies to the, E8363/4B analyzers, 85056D (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

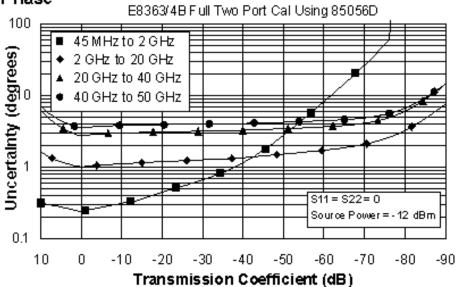
Description	Specification (dB)				
	45 MHz to 2 to		20 to	40 to	
	2 GHz	20 GHz	40 GHz	50 GHz	
Directivity	42	34	26	26	
Source Match	40	30	24	23	
Load Match	42	33	25	25	
Reflection Tracking	±0.002	±0.029	±0.079	±0.075	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	
Transmission Tracking	±0.011	±0.121	±0.347	±0.462	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	

Transmission Uncertainty (Specifications)



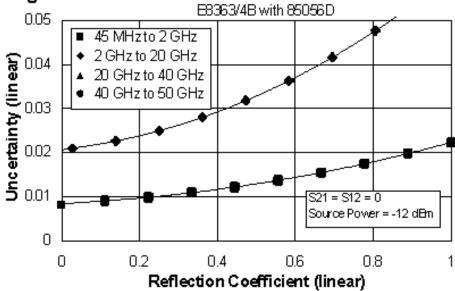






Reflection Uncertainty (Specifications)

Magnitude





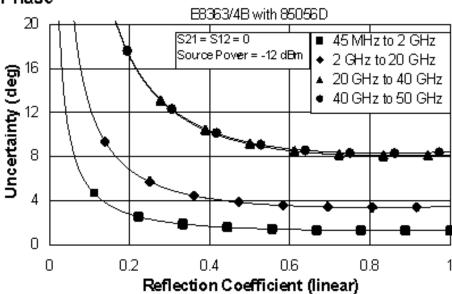


Table 6. 85056D Calibration Kit

Fully Optioned

Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

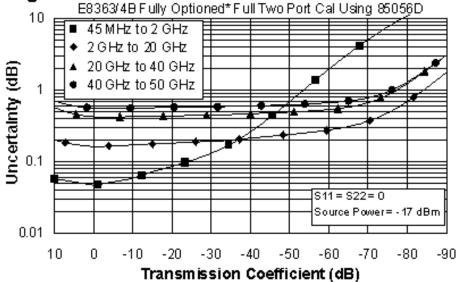
Applies to the, E8363/4B analyzers, 85056D (2.4mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ± 3 °C, with < 1 °C deviation from calibration temperature

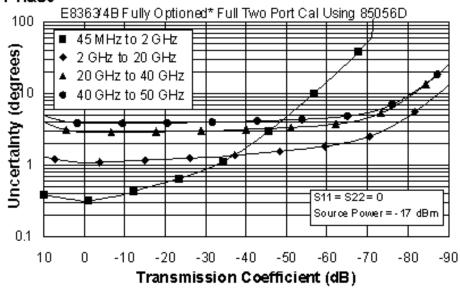
Description	Specificatio	on (dB)			
	45 MHz to 2 GHz	2 to 20 GHz	20 to 40 GHz	40 to 50 GHz	
Directivity	42	34	26	26	
Source Match	40	30	24	23	
Load Match	42	33	25	25	
Reflection Tracking	±0.002	±0.029	±0.079	±0.075	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	
Transmission Tracking	±0.022	±0.130	±0.365	±0.498	
	+0.02/°C	+0.02/°C	+0.02/°C	+0.03/°C	

Transmission Uncertainty (Specifications)

Magnitude

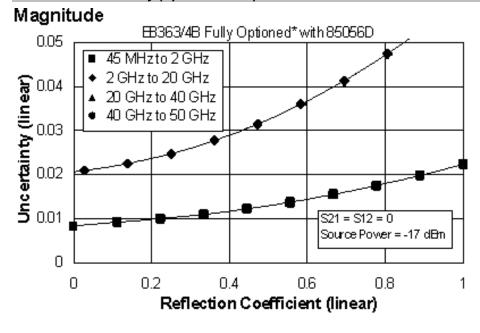


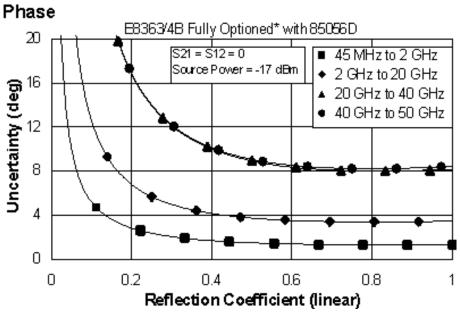
Phase



^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Reflection Uncertainty (Specifications)





^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

E8363/4B Corrected System Performance with 2.92mm Connectors

85056K Calibration Kit:

Table 7. 85056K Calibration Kit Standard Configuration and Standard Power Range (E8363/4B)

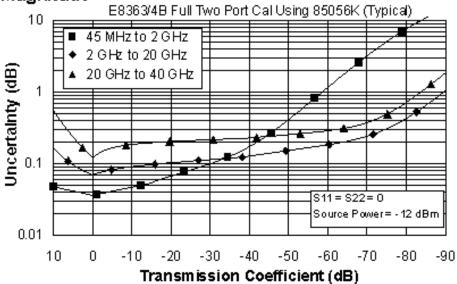
Applies to the, E8363/4B analyzers, 85056K (2.92mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

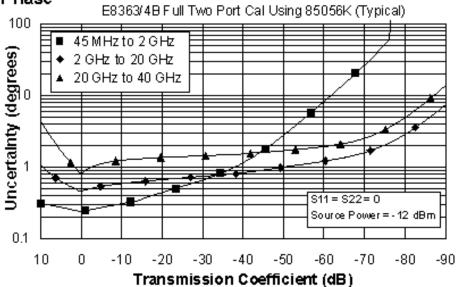
Description	Specification (dB)		
	0.045 to	2 to	20 to
	2 GHz	20 GHz	40 GHz
Directivity	42	42	40
Source Match	40	40	35
Load Match	42	41	38
Reflection Tracking	±0.018	±0.018	±0.067
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.011	±0.042	±0.089
	+0.02/°C	+0.02/°C	+0.03/°C

Transmission Uncertainty (Specifications)

Magnitude

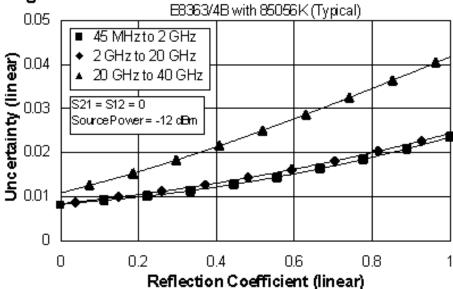






Reflection Uncertainty (Specifications)

Magnitude





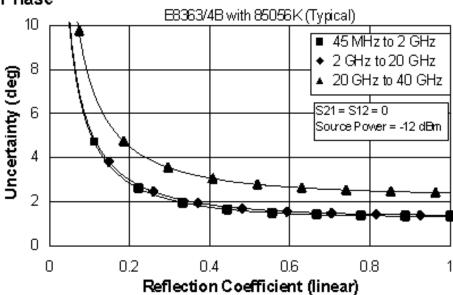


Table 8. 85056K Calibration Kit

Fully Optioned

Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

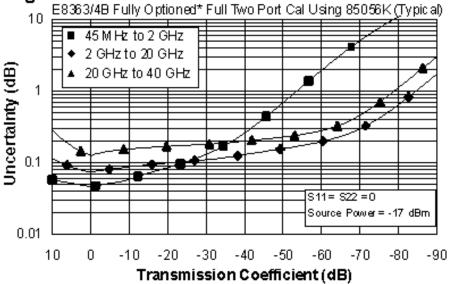
Applies to the, E8363/4B analyzers, 85056K (2.92mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature

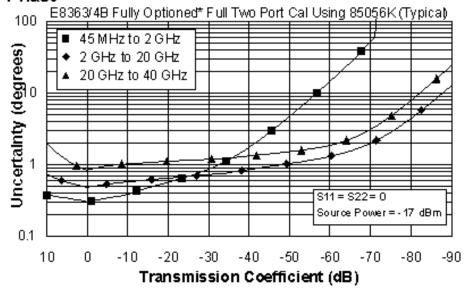
Description	Specification (dB)		
	0.045 to	2 to	20 to
	2 GHz	20 GHz	40 GHz
Directivity	42	42	40
Source Match	40	40	35
Load Match	42	41	38
Reflection Tracking	±0.018	±0.018	±0.067
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.021	±0.046	±0.094
	+0.02/°C	+0.02/°C	+0.03/°C

Transmission Uncertainty (Specifications

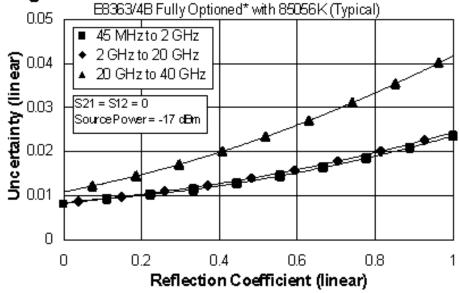
Magnitude

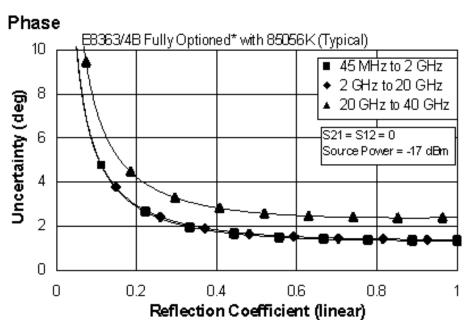


Phase



^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)





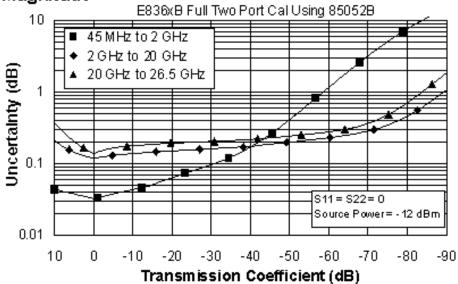
^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

E836xB Corrected System Performance with 3.5mm Connectors

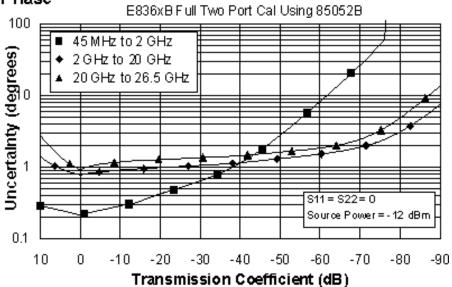
Table 9. 85052B Calibration Kit Standard Configuration and Standard Power Range (E836xB)

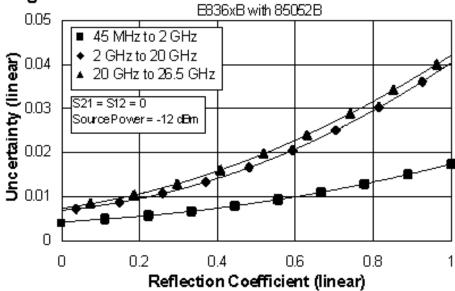
Applies to the, E836xB analyzers, 85052B (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)		
	45 MHz to	2 to	20 to
	2 GHz	20 GHz	26.5 GHz
Directivity	48	44	44
Source Match	40	31	31
Load Match	48	44	44
Reflection Tracking	±0.003	±0.006	±0.006
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.009	±0.088	±0.104
	+0.02/°C	+0.02/°C	+0.03/°C











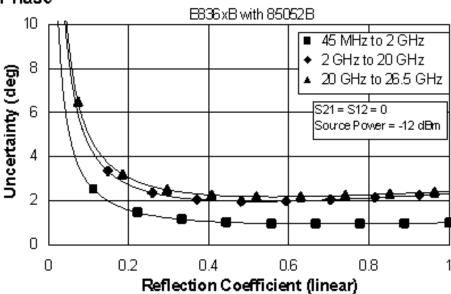


Table 10. 85052B Calibration Kit

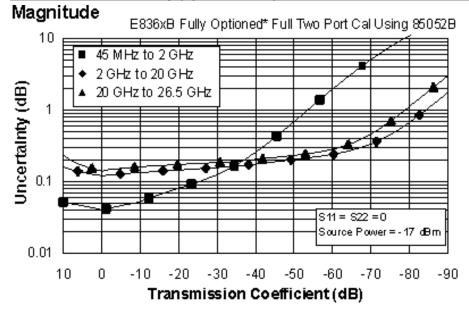
Fully Optioned

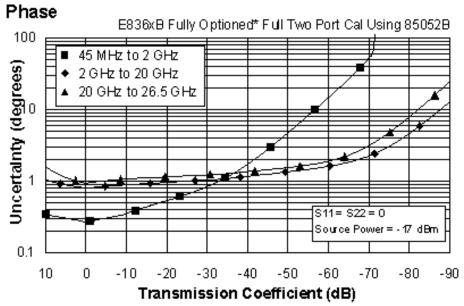
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

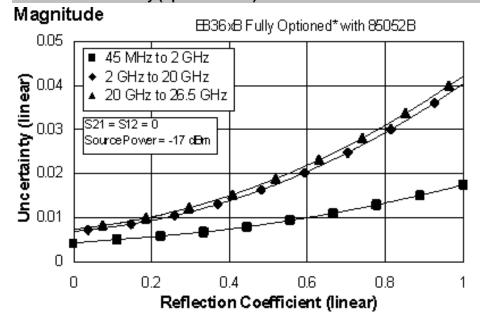
Applies to the, E836xB analyzers, 85052B (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

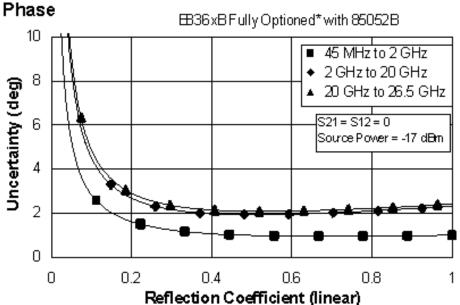
Description	Specification (dB)		
	45 MHz to	2 to	20 to
	2 GHz	20 GHz	26.5 GHz
Directivity	48	44	44
Source Match	40	31	31
Load Match	48	44	44
Reflection Tracking	±0.003	±0.006	±0.006
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.017	±0.091	±0.106
	+0.02/°C	+0.02/°C	+0.03/°C





* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)



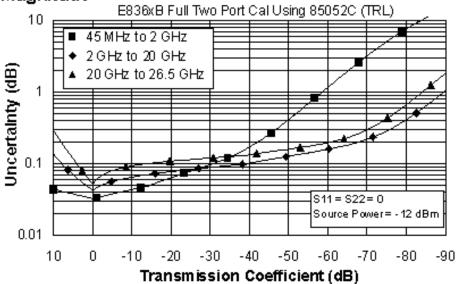


* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

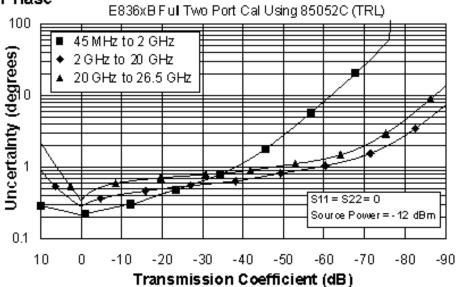
Table 11. 85052C Calibration Kit Standard Configuration and Standard Power Range (E836xB)

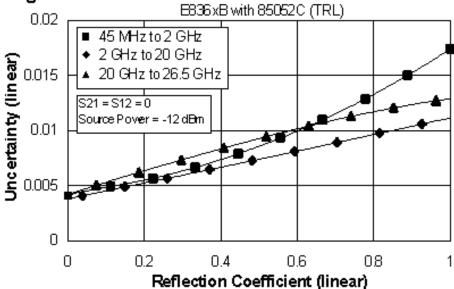
Applies to the, E836xB analyzers, 85052C (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description		Specification (dB)	
	45 MHz to	2 to	20 to
	2 GHz	20 GHz	26.5 GHz
Directivity	48	50	50
Source Match	40	50	50
Load Match	48	50	50
Reflection Tracking	±0.003	±0.000	±0.000
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.009	±0.014	±0.018
	+0.02/°C	+0.02/°C	+0.03/°C











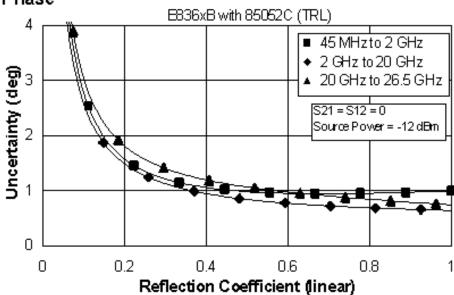


Table 12. 85052C Calibration Kit

Fully Optioned

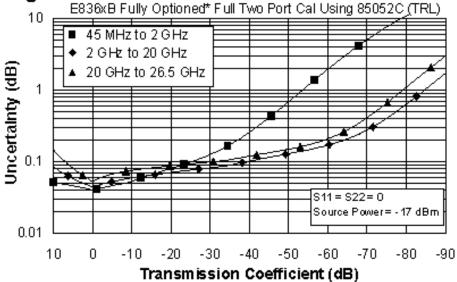
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

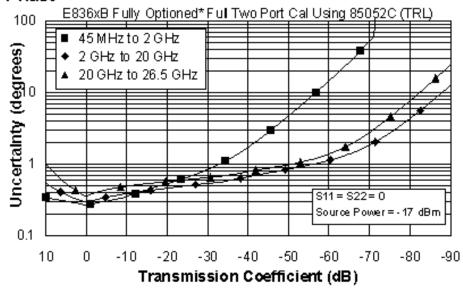
Applies to the, E836xB analyzers, 85052C (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description		Specification (dB)	
	45 MHz to	2 to	20 to
	2 GHz	20 GHz	26.5 GHz
Directivity	48	50	50
Source Match	40	50	50
Load Match	48	50	50
Reflection Tracking	±0.003	±0.000	±0.000
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.017	±0.016	±0.019
	+0.02/°C	+0.02/°C	+0.03/°C

Magnitude

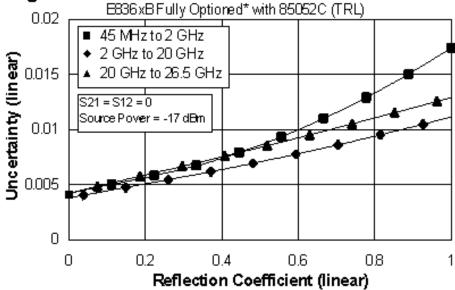


Phase

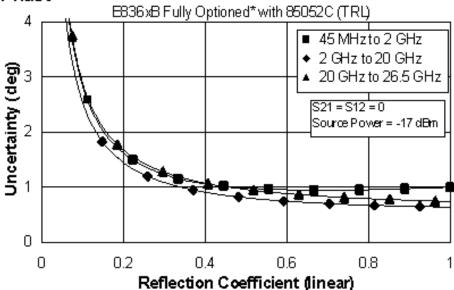


* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Magnitude





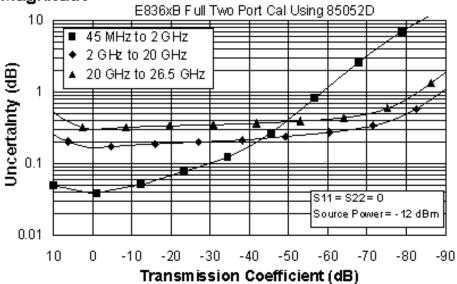


* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

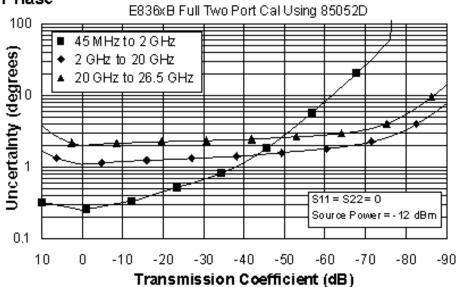
Table 13. 85052D Calibration Kit Standard Configuration and Standard Power Range (E836xB)

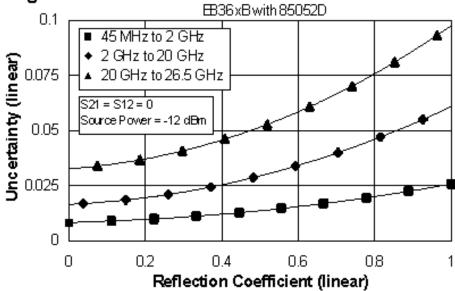
Applies to the, E836xB analyzers, 85052D (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description		Specification (dB)	
	45 MHz to	2 to	20 to
	2 GHz	20 GHz	26.5 GHz
Directivity	42	36	30
Source Match	37	28	25
Load Match	42	36	30
Reflection Tracking	±0.003	±0.008	±0.011
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.014	±0.131	±0.250
	+0.02/°C	+0.02/°C	+0.03/°C











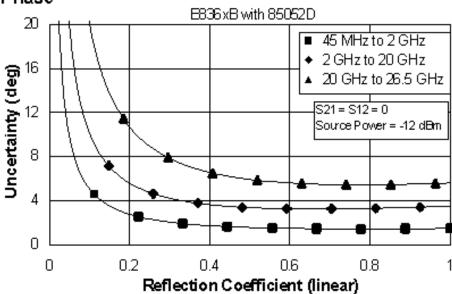


Table 14. 85052D Calibration Kit

Fully Optioned

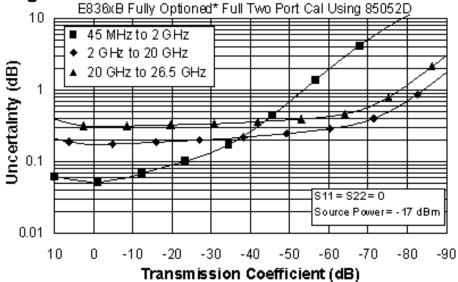
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

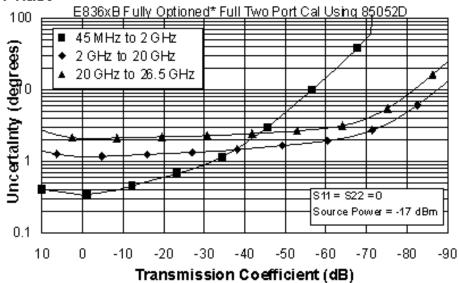
Applies to the, E836xB analyzers, 85052D (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description		Specification (dB)	
	45 MHz to	2 to	20 to
	2 GHz	20 GHz	26.5 GHz
Directivity	42	36	30
Source Match	37	28	25
Load Match	42	36	30
Reflection Tracking	±0.003	±0.008	±0.011
	+0.02/°C	+0.02/°C	+0.03/°C
Transmission Tracking	±0.026	±0.138	±0.261
	+0.02/°C	+0.02/°C	+0.03/°C

Magnitude

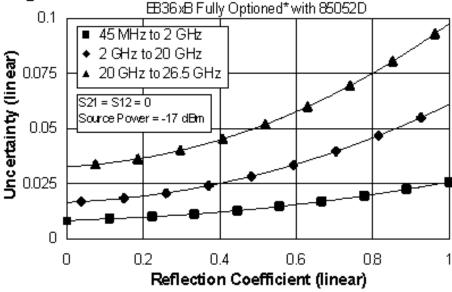


Phase

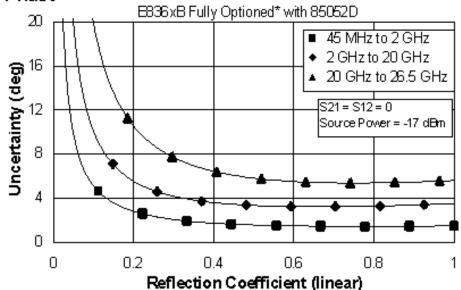


^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)





Phase



* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

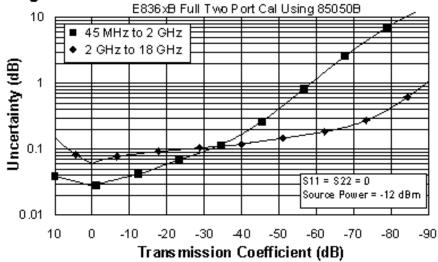
E836xB Corrected System Performance with 7mm Connectors

Table 15. 85050B Calibration Kit Standard Configuration and Standard Power Range (E836xB)

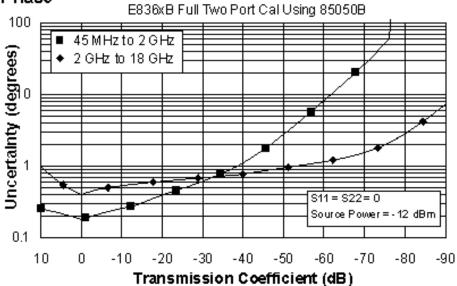
Applies to the, E836xB analyzers, 85050B (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

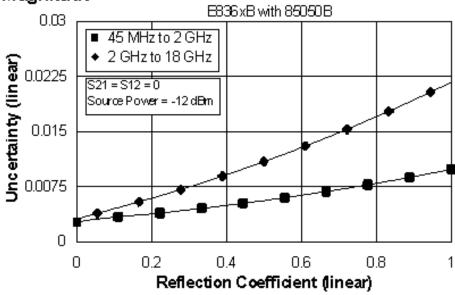
Description	Specification (dB)	
	0.045 to	2 to
	2 GHz	18 GHz
Directivity	52	52
Source Match	48	41
Load Match	52	47
Reflection Tracking	±0.003	±0.047
	+0.02/°C	+0.02/°C
Transmission Tracking	±0.004	±0.032
	+0.02/°C	+0.02/°C













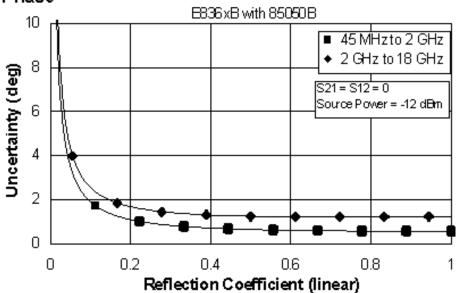


Table 16. 85050B Calibration Kit

Fully Optioned

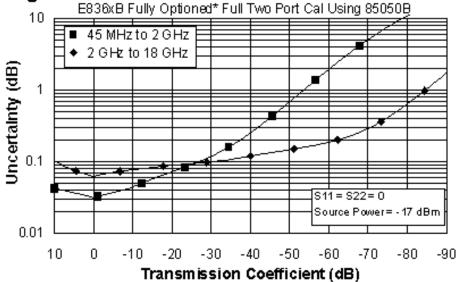
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

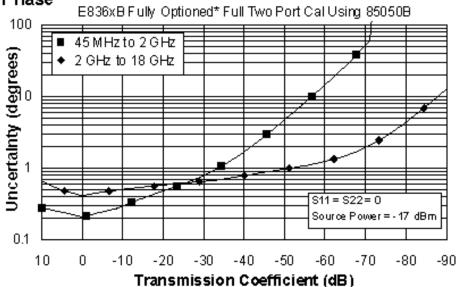
Applies to the, E836xB analyzers, 85050B (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)		
	0.045 to	2 to	
	2 GHz	18 GHz	
Directivity	52	52	
Source Match	48	41	
Load Match	52	47	
Reflection Tracking	±0.003	±0.047	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.008	±0.034	
	+0.02/°C	+0.02/°C	

Magnitude

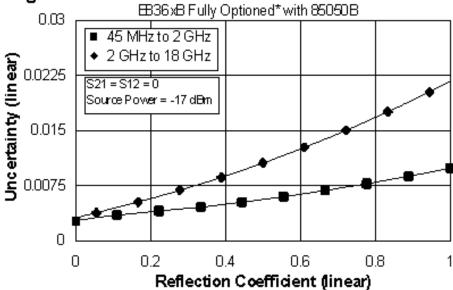




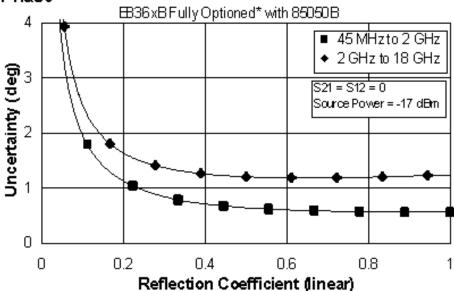


*Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)







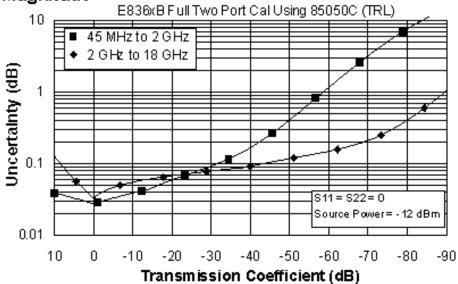


*Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

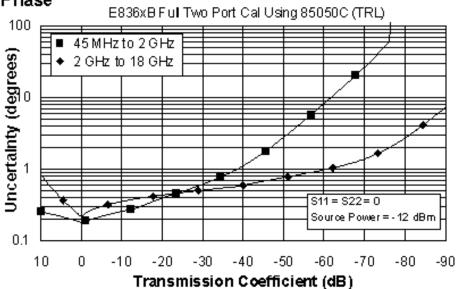
Table 17. 85050C Calibration Kit Standard Configuration and Standard Power Range (E836xB)

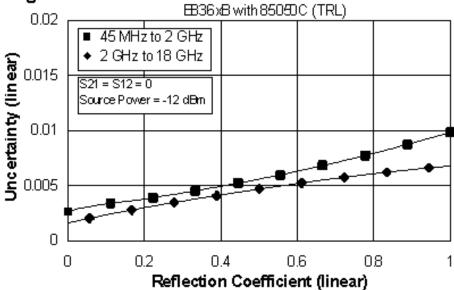
Applies to the, E836xB analyzers, 85050C (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	0.045 to	2 to
	2 GHz	18 GHz
Directivity	52	60
Source Match	48	60
Load Match	52	60
Reflection Tracking	±0.003	±0.000
	+0.02/°C	+0.02/°C
Transmission Tracking	±0.004	±0.004
	+0.02/°C	+0.02/°C











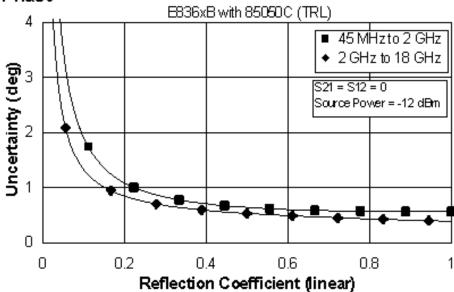


Table 18. 85050C Calibration Kit

Fully Optioned

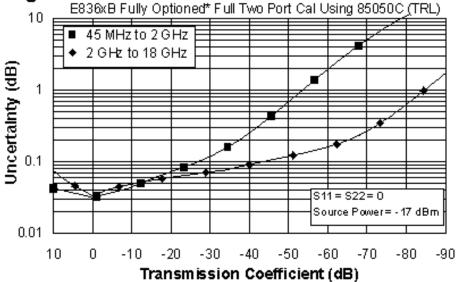
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

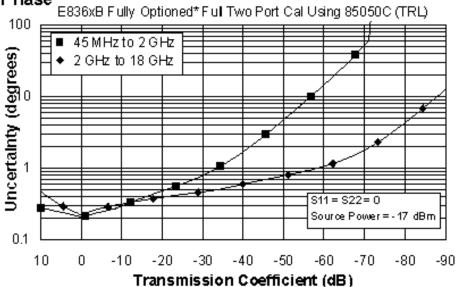
Applies to the, E836xB analyzers, 85050C (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)		
	0.045 to	2 to	
	2 GHz	18 GHz	
Directivity	52	60	
Source Match	48	60	
Load Match	52	60	
Reflection Tracking	±0.003	±0.000	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.008	±0.005	
	+0.02/°C	+0.02/°C	

Magnitude

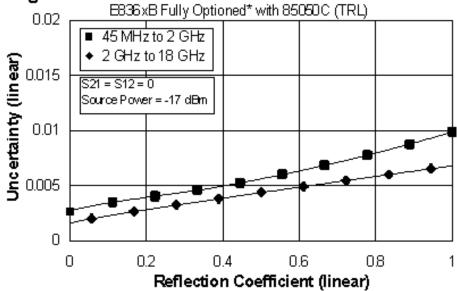


Phase

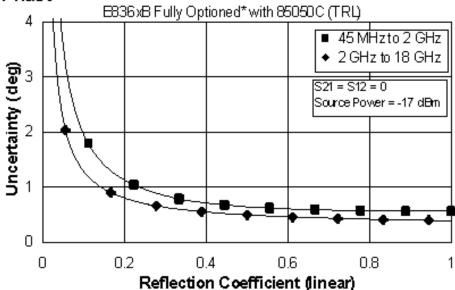


*Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Magnitude





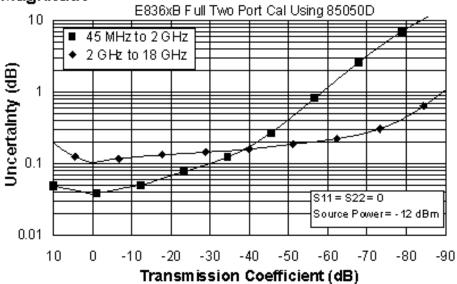


*Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

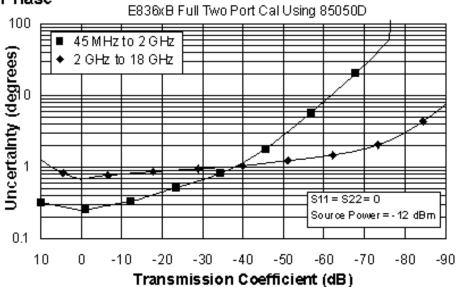
Table 19. 85050D Calibration Kit Standard Configuration and Standard Power Range (E836xB)

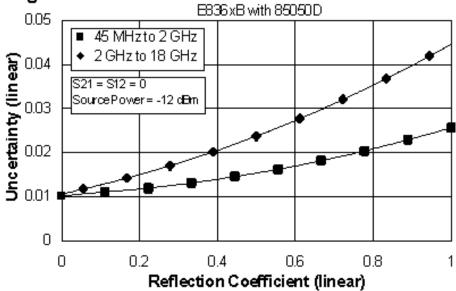
Applies to the, E836xB analyzers, 85050D (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)		
	0.045 to	2 to	
	2 GHz	18 GHz	
Directivity	40	40	
Source Match	39	35	
Load Match	40	37	
Reflection Tracking	±0.010	±0.100	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.013	±0.072	
	+0.02/°C	+0.02/°C	











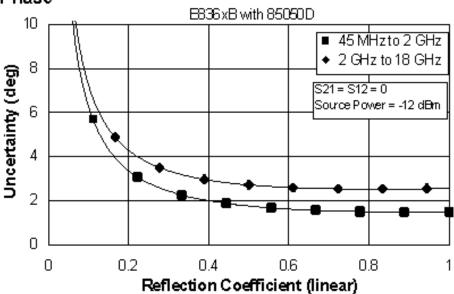


Table 20. 85050D Calibration Kit

Fully Optioned

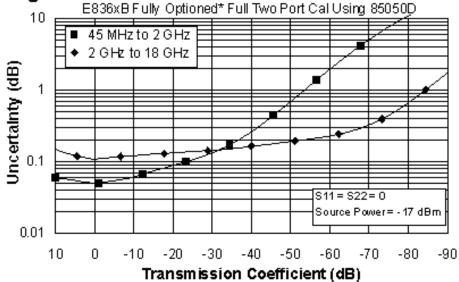
*Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

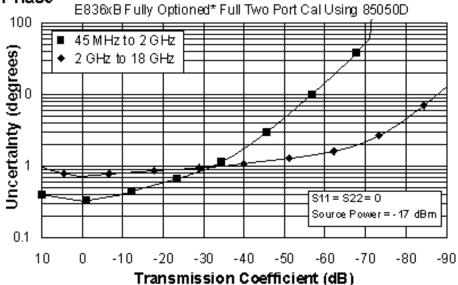
Applies to the, E836xB analyzers, 85050D (7mm) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	0.045 to	2 to
	2 GHz	18 GHz
Directivity	40	40
Source Match	39	35
Load Match	40	37
Reflection Tracking	±0.010	±0.100
	+0.02/°C	+0.02/°C
Transmission Tracking	±0.025	±0.078
	+0.02/°C	+0.02/°C

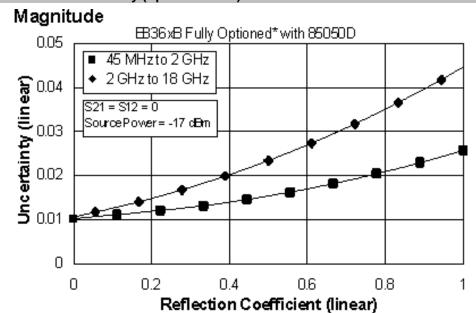
Magnitude

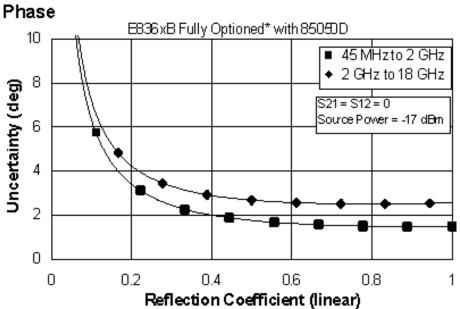






*Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)





*Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

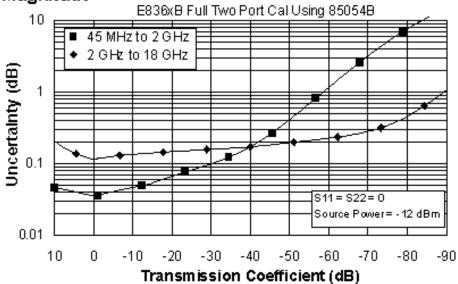
E836xB Corrected System Performance with Type-N Connectors

Table 21. 85054B Calibration Kit Standard Configuration and Standard Power Range (E836xB)

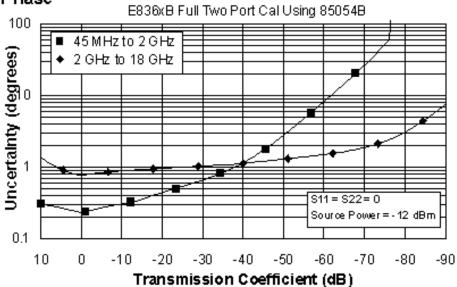
Applies to the, E836xB analyzers, 85054B (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	0.045 to	2 to
	2 GHz	18 GHz
Directivity	48	42
Source Match	45	33
Load Match	48	41
Reflection Tracking	±0.001	±0.015
	+0.02/°C	+0.02/°C
Transmission Tracking	±0.006	±0.079
	+0.02/°C	+0.02/°C

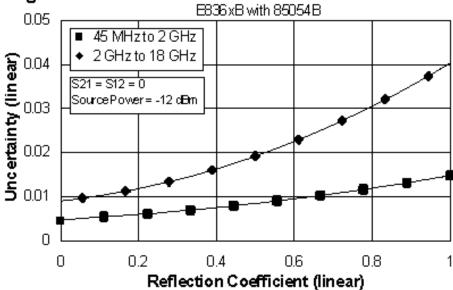
Magnitude







Magnitude





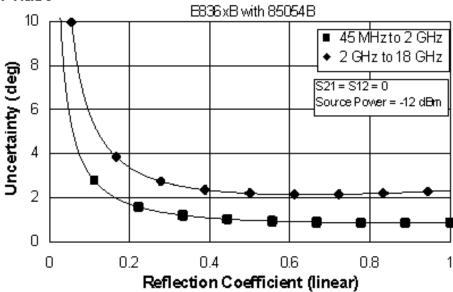


Table 22. 85054B Calibration Kit

Fully Optioned

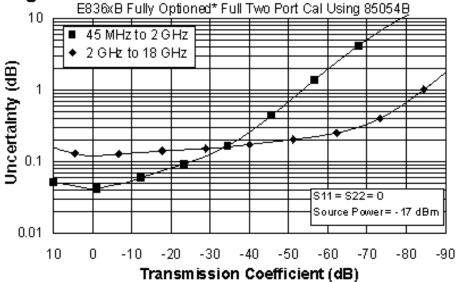
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

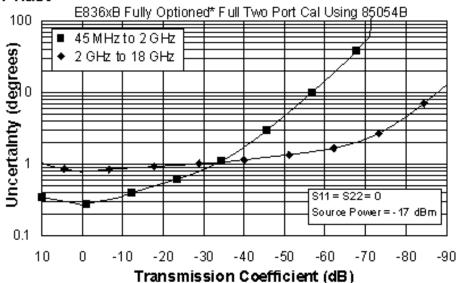
Applies to the, E836xB analyzers, 85054B (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	0.045 to	2 to
	2 GHz	18 GHz
Directivity	48	42
Source Match	45	33
Load Match	48	41
Reflection Tracking	±0.001	±0.015
	+0.02/°C	+0.02/°C
Transmission Tracking	±0.011	±0.083
	+0.02/°C	+0.02/°C

Magnitude

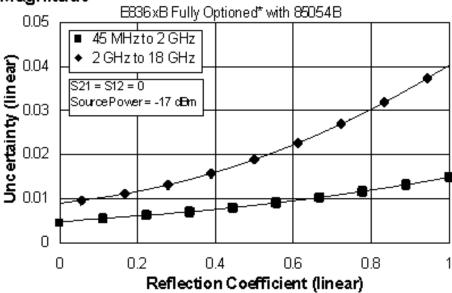


Phase

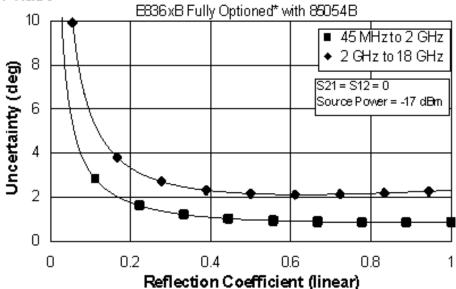


* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Magnitude







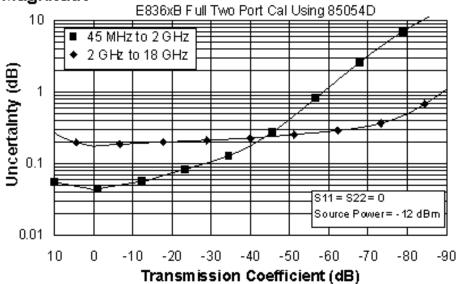
* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Table 23. 85054D Calibration Kit Standard Configuration and Standard Power Range (E836xB)

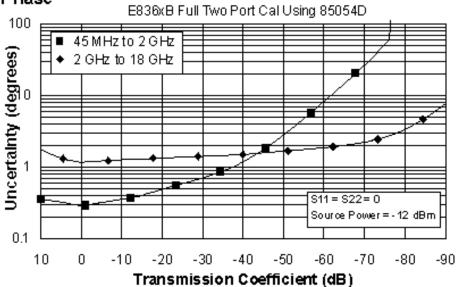
Applies to the, E836xB analyzers, 85054D (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	0.045 to	2 to
	2 GHz	18 GHz
Directivity	40	34
Source Match	39	29
Load Match	40	34
Reflection Tracking	±0.003	±0.027
	+0.02/°C	+0.02/°C
Transmission Tracking	±0.013	±0.136
	+0.02/°C	+0.02/°C

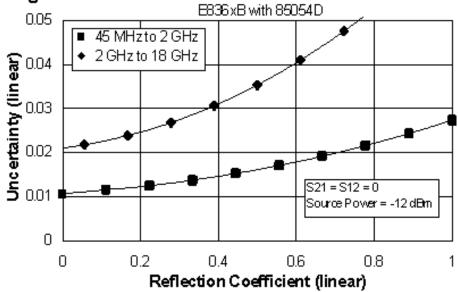
Magnitude







Magnitude





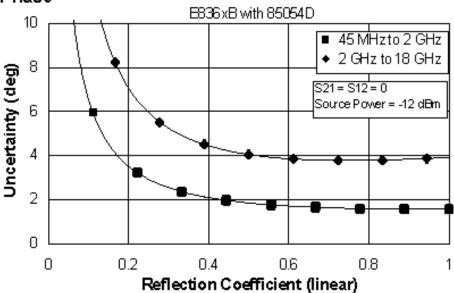


Table 24. 85054D Calibration Kit

Fully Optioned

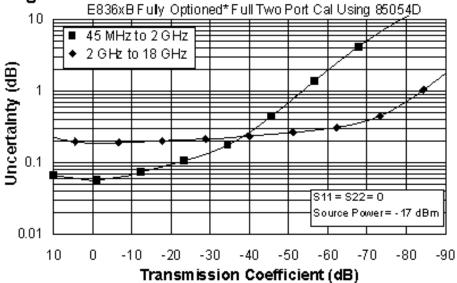
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

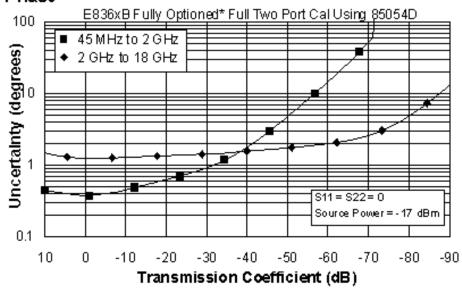
Applies to the, E836xB analyzers, 85054D (Type-N) calibration kit, 85132F flexible test port cable set with 85130C adapter set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	0.045 to	2 to
	2 GHz	18 GHz
Directivity	40	34
Source Match	39	29
Load Match	40	34
Reflection Tracking	±0.003	±0.027
	+0.02/°C	+0.02/°C
Transmission Tracking	±0.025	±0.145
	+0.02/°C	+0.02/°C

Magnitude

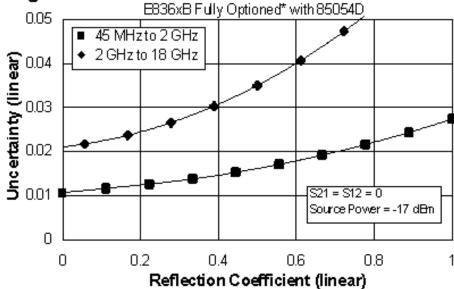


Phase

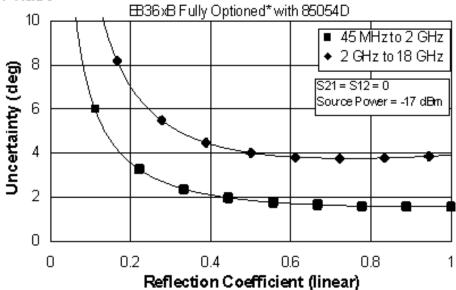


^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)









^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

E8363/4B Corrected System Performance with WR-28 Connectors

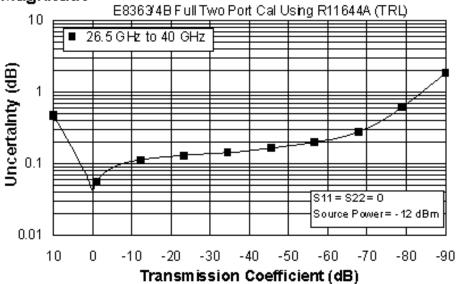
R11644A Calibration Kit:

Table 25. R11644A Calibration Kit Standard Configuration and Standard Power Range (E8363/4B)

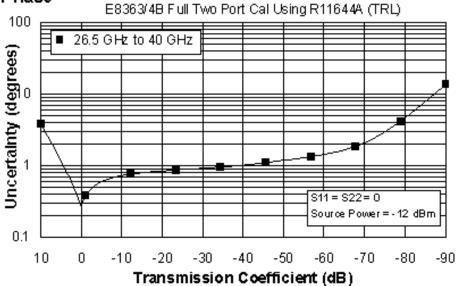
Applies to the, E8363/4B analyzers, R11644A (WR-28) calibration kit, 85133F flexible test port cable set with the R281A and R281B launch sets with the R281A and R281B launch sets, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	26.5 to	
	40 GHz	
Directivity	50	
Source Match	50	
Load Match	50	
Reflection Tracking	±0.000	
	+0.03/°C	
Transmission Tracking	±0.018	
	+0.03/°C	

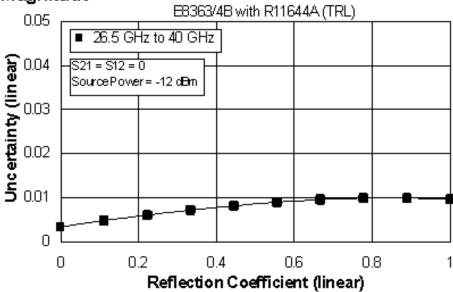








Magnitude





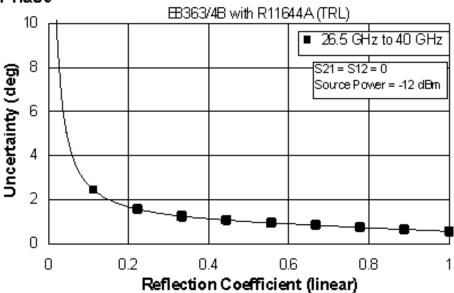


Table 26. R11644A Calibration Kit

Fully Optioned

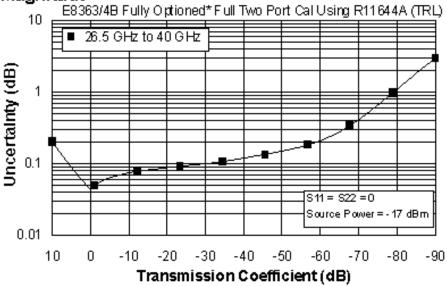
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

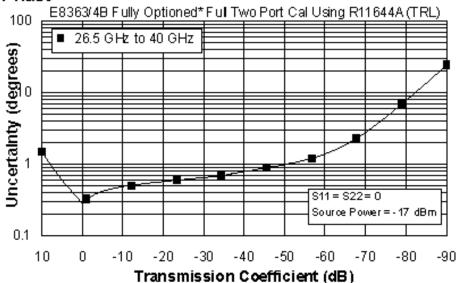
Applies to the, E8363/4B analyzers, R11644A (WR-28) calibration kit, 85133F flexible test port cable set with the R281A and R281B launch sets with the R281A and R281B launch sets, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	26.5 to	
	40 GHz	
Directivity	50	
Source Match	50	
Load Match	50	
Reflection Tracking	±0.000	
	+0.03/°C	
Transmission Tracking	±0.019	
	+0.03/°C	

Magnitude

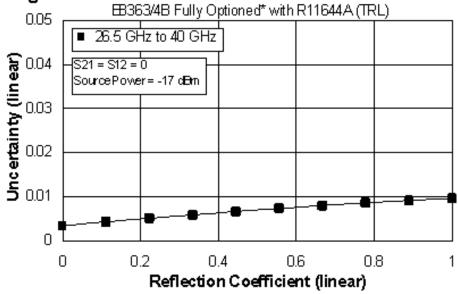


Phase

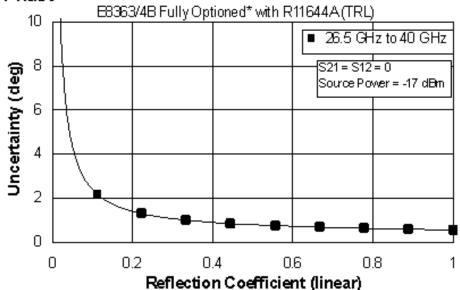


* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)









^{*} Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

E8363/4B Corrected System Performance with WR-42 Connectors

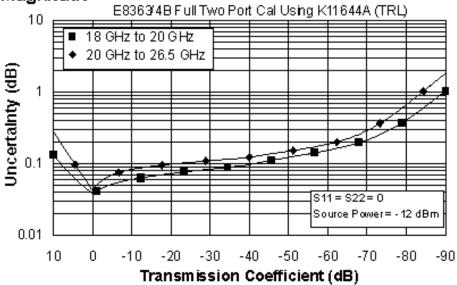
K11644A Calibration Kit:

Table 27. K11644A Calibration Kit Standard Configuration and Standard Power Range (E8363/4B)

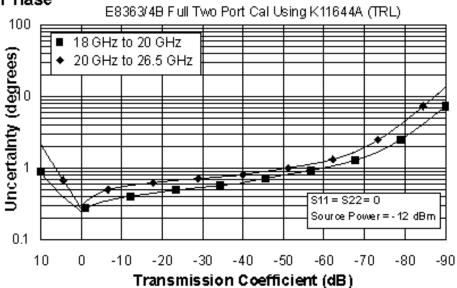
Applies to the, E8363/4B analyzers, K11644A (WR-42) calibration kit, 85134F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	Specification (dB)		
	18 to	20 to		
	20 GHz	26.5 GHz		
Directivity	50	50		
Source Match	50	50		
Load Match	50	50		
Reflection Tracking	±0.000	±0.000		
	+0.02/°C	+0.02/°C		
Transmission Tracking	±0.014	±0.018		
	+0.02/°C	+0.02/°C		

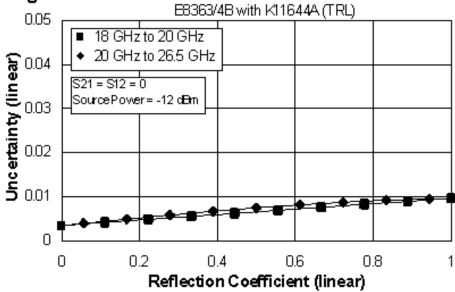








Magnitude





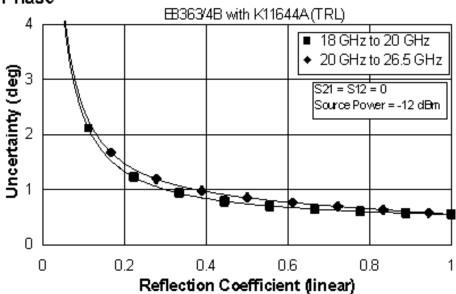


Table 28. K11644A Calibration Kit

Fully Optioned

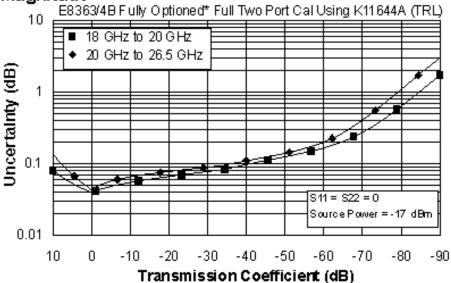
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

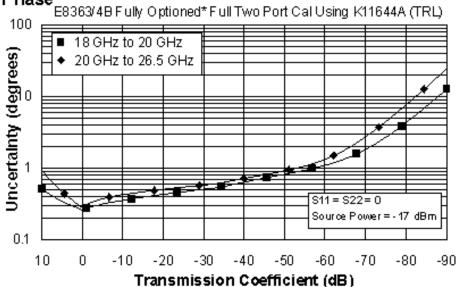
Applies to the, E8363/4B analyzers, K11644A (WR-42) calibration kit, 85134F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)		
	18 to	20 to	
	20 GHz	26.5 GHz	
Directivity	50	50	
Source Match	50	50	
Load Match	50	50	
Reflection Tracking	±0.000	±0.000	
	+0.02/°C	+0.02/°C	
Transmission Tracking	±0.016	±0.019	
	+0.02/°C	+0.02/°C	

Magnitude

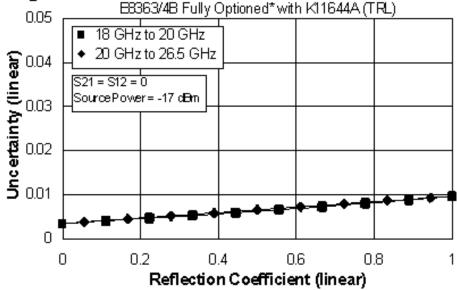




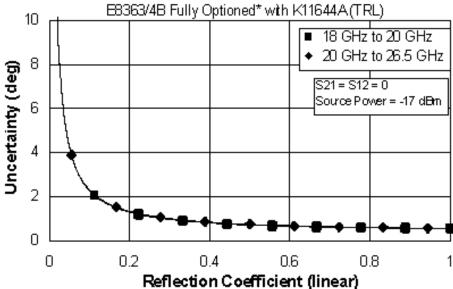


* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Magnitude







* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

E836xB Corrected System Performance with WR-62 Connectors

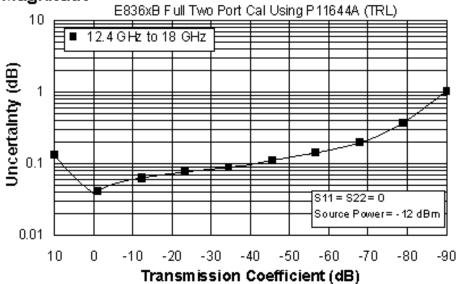
P11644A Calibration Kit:

Table 29. P11644A Calibration Kit Standard Configuration and Standard Power Range (E836xB)

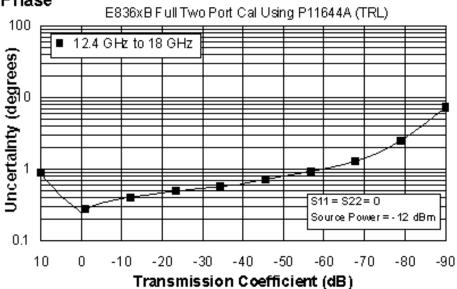
Applies to the, E836xB analyzers, R11644A (WR-62) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	12.4 to	
	18 GHz	
Directivity	50	
Source Match	50	
Load Match	50	
Reflection Tracking	±0.000	
	+0.02/°C	
Transmission Tracking	±0.014	
	+0.02/°C	

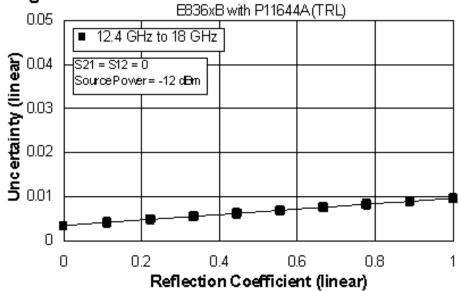








Magnitude





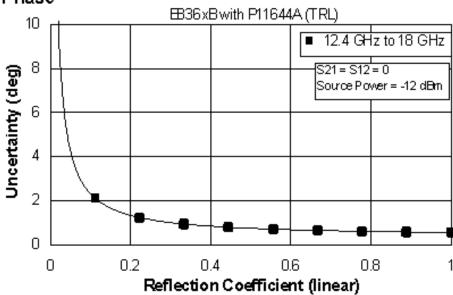


Table 30. P11644A Calibration Kit

Fully Optioned

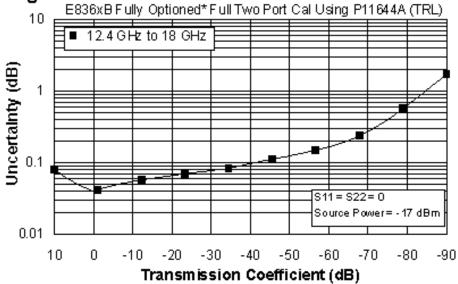
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

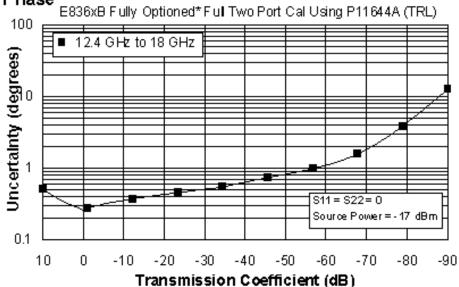
Applies to the, E836xB analyzers, P11644A (WR-62) calibration kit, 85132F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)
	12.4 to
	18 GHz
Directivity	50
Source Match	50
Load Match	50
Reflection Tracking	±0.000
	+0.02/°C
Transmission Tracking	±0.016
	+0.02/°C

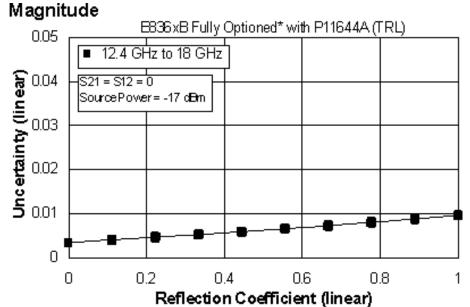
Magnitude

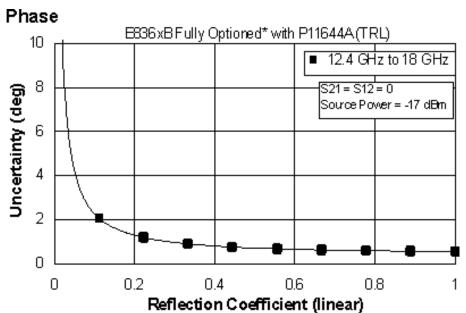






* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)





* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

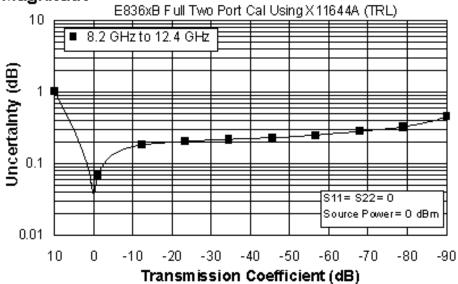
E836xB Corrected System Performance with WR-90 Connectors

Table 31. X11644A Calibration Kit Standard Configuration and Standard Power Range (E836xB)

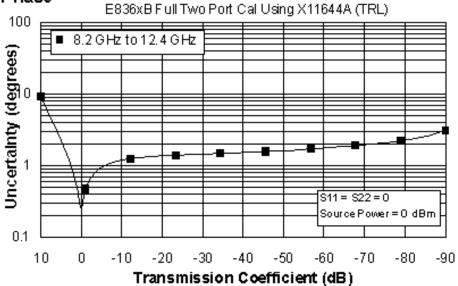
Applies to the, E836xB analyzers, X11644A (WR-90) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	8.2 to	
	12.4 GHz	
Directivity	50	
Source Match	50	
Load Match	50	
Reflection Tracking	±0.000	
	+0.02/°C	
Transmission Tracking	±0.014	
	+0.02/°C	

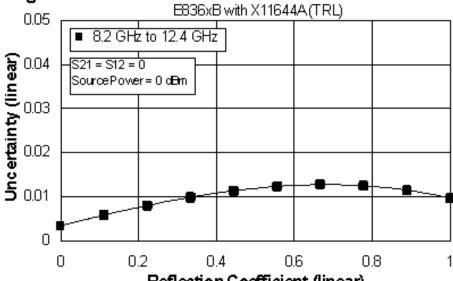








Magnitude



Reflection Coefficient (linear)

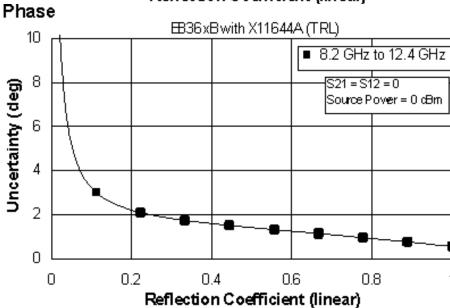


Table 32. X11644A Calibration Kit

Fully Optioned

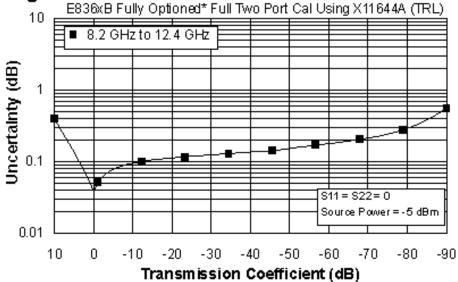
Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch

(E836xB - Option 014, UNL, 016, 080, and 081)

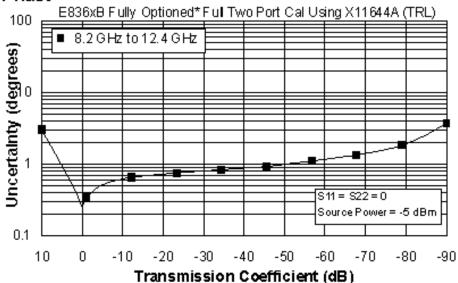
Applies to the, E836xB analyzers, X11644A (WR-90) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Description	Specification (dB)	
	8.2 to	
	12.4 GHz	
Directivity	50	
Source Match	50	
Load Match	50	
Reflection Tracking	±0.000	
	+0.02/°C	
Transmission Tracking	±0.016	
	+0.02/°C	

Magnitude



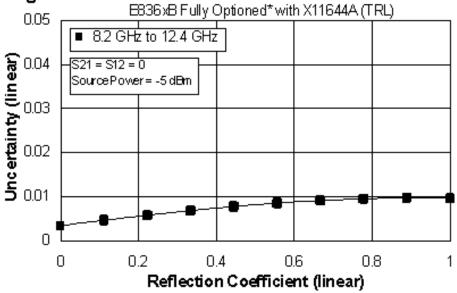
Phase

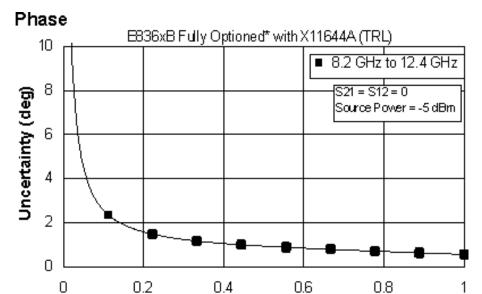


* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Reflection Uncertainty (Specifications)







Reflection Coefficient (linear)

* Configurable Test Set, Extended Power Range & Bias-Tees, Receiver Attenuators, Frequency Offset Mode, and Reference Channel Transfer Switch (E836xB - Option 014, UNL, 016, 080, and 081)

Table 33. Uncorrected System Performance^a

Specifications apply over environmental temperature of 23° ±3 °C, with < 1 °C deviation from the calibration temperature

		Supplemental Information
Description	Specification	Supplemental Information
Directivity	loo dD	
10 MHz to 45 MHz ^b 45 MHz to 2 GHz	23 dB	
2 GHz to 10 GHz	24 dB 22 dB	
10 GHz to 20 GHz	-	
20 GHz to 40 GHz	16 dB	
	16 dB	
40 GHz to 45 GHz 45 GHz to 50 GHz	15 dB 13 dB	
Source Match - Standard		
10 MHz to 45 MHz ^b	11 dB	
45 MHz to 2 GHz	23 dB	
2 GHz to 10 GHz	16 dB	
10 GHz to 20 GHz	14 dB	
20 GHz to 40 GHz	10 dB	
40 GHz to 45 GHz	9 dB	
45 GHz to 50 GHz	7.5 dB	
Source Match - Opt UNL	I .	
10 MHz to 45 MHz ^b	11 dB	
45 MHz to 2 GHz	18 dB	
2 GHz to 10 GHz	14 dB	
10 GHz to 20 GHz	12 dB	
20 GHz to 40 GHz	9 dB	
40 GHz to 45 GHz	8 dB	
45 GHz to 50 GHz	6 dB	
Load Match - Standard		
10 MHz to 45 MHz ^b	11 dB	
45 MHz to 2 GHz	23 dB	
2 GHz to 10 GHz	14 dB	
10 GHz to 20 GHz	10 dB	
20 GHz to 40 GHz	9 dB	
40 GHz to 45 GHz	9 dB	
45 GHz to 50 GHz	8 dB	
Load Match - Opt UNL, (
10 MHz to 45 MHz ^b	11 dB	
45 MHz to 2 GHz	17 dB	
2 GHz to 10 GHz	13 dB	
10 GHz to 20 GHz	10 dB	
20 GHz to 40 GHz	9 dB	
40 GHz to 45 GHz	9 dB	
45 GHz to 50 GHz	7 dB	
Reflection Tracking		Typical
10 MHz to 45 MHz		Typical:
10 MHz to 45 MHz		±1.5 dB
45 MHz to 20 GHz 20 GHz to 40 GHz		±1.5 dB ±1.5 dB
40 GHz to 50 GHz		±2.0 dB
40 902 10 30 902	1	J±∠.∪ UD

Transmission Tracking ^c		
		Typical:
10 MHz to 45 MHz		±3.0 dB
45 MHz to 2 GHz		±1.5 dB
2 GHz to 10 GHz		±2.0 dB
10 GHz to 20 GHz		±2.5 dB
20 GHz to 40 GHz		±3.5 dB
40 GHz to 45 GHz		±4.0 dB
45 GHz to 50 GHz		±4.5 dB
Crosstalk ^d - Standard		
10 MHz to 45 MHz ^b	-65 dB	
45 MHz to 1 GHz	-85 dB	
1 GHz to 2 GHz	-100 dB	
2 GHz to 20 GHz	-110 dB	
20 GHz to 40 GHz	-108 dB	
40 GHz to 45 GHz	-105 dB	
45 GHz to 50 GHz	-100 dB	
Crosstalk ^d - Option UNL	or 014	
10 MHz to 45 MHz ^b	-65 dB	
45 MHz to 1 GHz	-85 dB	
1 GHz to 2 GHz	-100 dB	
2 GHz to 20 GHz	-109 dB	
20 GHz to 40 GHz	-106 dB	
40 GHz to 45 GHz	-103 dB	
45 GHz to 50 GHz	-98 dB	
Crosstalkd - Option 014/U	JNL	
10 MHz to 45 MHz ^b	-65 dB	
45 MHz to 1 GHz	-85 dB	
1 GHz to 2 GHz	-98 dB	
2 GHz to 10 GHz	-108 dB	
10 GHz to 20 GHz	-107 dB	
20 GHz to 40 GHz	-104 dB	
40 GHz to 45 GHz	-100 dB	
45 GHz to 50 GHz	-95 dB	
Crosstalk - Option 080 er	nabled ^{b,e}	
		Typical:
10 MHz to 45 MHz		-65
45 MHz to 1 GHz		-85
1 GHz to 2 GHz		-100
2 GHz to 10 GHz		-109
10 GHz to 20 GHz		-110
20 GHz to 40 GHz		-106
40 GHz to 45 GHz		-103
45 GHz to 50 GHz		-98

 $^{^{\}rm a}$ Specifications apply over environment temperature of 23 $^{\rm o}$ C +/- 3 $^{\rm o}$ C, with less than 1 $^{\rm o}$ C deviation from the calibration temperature.

^b Typical performance.

^cTransmission tracking performance is strongly dependent on cable used. These typical specifications are based on the use of the Agilent thru cable (part number 85133-60016).

^d Measurement conditions: normalized to a thru, measured with two shorts, 10 Hz IF bandwidth, averaging factor of 8, alternate mode, source power set to the lesser of the maximum power out or the maximum receiver power.

^e 0 Hz offset.

Table 34. Test Port Output^a

Table 34. Test					
Description	Specification	1			Supplemental
Frequency F	Range				
	Standard	Opt 014	Opt UNL	Opt 014/UNL	
E8362B	10 MHz to 20	GHz	1 -	•	
E8363B	10 MHz to 40	GHz			
E8364B	10 MHz to 50				
Nominal Pov		O. I.E			
E8362B	0 dBm	-5 dBm	-5 dBm	-5 dBm	
E8363/4B	-12 dBm	-17 dBm	-17 dBm	-17 dBm	
Frequency F		-17 UDIII	-17 ubili	- 17 UDIII	
Frequency F					
O14/ A	1 Hz				
CW Accurac					
	+/-1 ppm				
Frequency S	Stability		1		
					+/-1 ppm. 0° to 40° C, typical +/-0.2 ppm/yr, typical
Power Level	Accuracy				
10 MHz to 45 MHz ^c	+/-2.0 dB	+/-2.0 dB	+/-2.0 dB	+/-2.0 dB	
45 MHz to	+/-1.5 dB	+/-1.5 dB	+/-1.5 dB	+/-1.5 dB	Variation from nominal
10 GHz	17 1.0 GB	17 1.0 dB	17 1.0 GB	17 1.0 GB	power in range 0 (step
10 GHz to	+/-2.0 dB	+/-2.0 dB	+/-2.0 dB	+/-2.0 dB	attenuator at 0 dB)
20 GHz	+/-2.0 db	+/-2.0 db	+/-2.0 GD	+/-2.0 UD	atteriation at 6 ab)
20 GHz to	+/-3.0 dB	+/-3.0 dB	+/-3.0 dB	+/-3.0 dB	
40 GHz	+/-3.0 UD	+/-3.0 UD	+/-3.0 UD	+/-3.0 UD	
	. / O O dD	./2540	. / 2 O dD	. / 2 5 4D	-
40 GHz to	+/-3.0 dB	+/-3.5 dB	+/-3.0 dB	+/-3.5 dB	
45 GHz	. / O O -ID	. / 4.0 -ID	. / O O -ID	. / 4.0 - ID	4
45 GHz to	+/-3.0 dB	+/-4.0 dB	+/-3.0 dB	+/-4.0 dB	
50 GHz	Lincovity				
Power Level		. / 4 0 IDd	L / 4 0 IDd	. / 4 0 ID	Tarifaction to a second discount
10 MHz to	+/-1.0 dB ^d	+/-1.0 dB ^d	+/-1.0 dB ^d	+/-1.0 dB ^d	Test reference is at the
45 MHz ^c	, , , , ,=d	, , <u>, , , , , , , , , , , , , , , , , </u>	, , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , ,	nominal power level (step
45 MHz to	+/-1.0 dB ^d	+/-1.0 dB ^d	+/-1.0 dB ^d	+/-1.0 dB ^d	attenuator at 0 dB)
20 GHz				d	
20 GHz to	+/-1.0 dB ^d	+/-1.0 dB ^d	+/-1.0 dB ^d	+/-1.0 dB ^d	
40 GHz					_
40 GHz to	+/-1.0 dB	+/-1.0 dB	+/-1.0 dB	+/-1.0 dB	
50 GHz					
Power Rang					
10 MHz to	-25 to	-25 to	-85 to	-85 to	
45 MHz ^c	+2 dBm	+2 dBm	+2 dBm	+2 dBm	
45 MHz to	-25 to	-25 to	-87 to	-87 to	
10 GHz	+5 dBm	+5 dBm	+3 dBm	+3 dBm	
10 GHz to	-24 to	-25 to	-86 to	-87 to	
20 GHz	+3 dBm	+2 dBm	+1 dBm	0 dBm	
20 GHz to	-23 to	-25 to	-85 to	-87 to	
30 GHz	0 dBm	-2 dBm	-2 dBm	-4 dBm	
30 GHz to	-23 to	-25 to	-85 to	-87 to	
40 GHz	-4 dBm	-6 dBm	-6 dBm	-8 dBm	
40 GHz to	-25 to	-27 to	-87 to	-87 to	
45 GHz	-5 dBm	-7 dBm	-9 dBm	-11 dBm	
45 GHz to	-25 to	-27 to	-87 to	-87 to	
50 GHz	-10 dBm	-12 dBm	-15 dBm	-17 dBm	
					1

Power Sweep Range (ALC)					
10 MHz to	27 dB	27 dB	27 dB	27 dB	
45 MHz ^c		27 05	27 UD	27 UB	
45 MHz to 10 GHz	30 dB	30 dB	30 dB	30 dB	ALC range starts at maximum leveled output
10 GHz to 20 GHz	27 dB	27 dB	27 dB	27 dB	power and decreases by power level indicated in the
20 GHz to 30 GHz	23 dB	23 dB	23 dB	23 dB	table.
30 GHz to 40 GHz	19 dB	19 dB	19 dB	19 dB	
40 GHz to 45 GHz	20 dB	20 dB	18 dB	16 dB	
45 GHz to 50 GHz	15 dB	15 dB	12 dB	10 dB	
Power Reso	lution				
	0.01 dB				
Phase Noise					
		er frequency,	nominal power	er at test port	
				_	Typical:
10 MHz to					-60 dBc
10 GHz					
10 GHz to					-55 dBc
20 GHz					
20 GHz to					-50 dBc
50 GHz					
1 kHz offset	from cent	er frequency,	nominal power	er at test port - (Option 080 enabled
					Typical:
10 MHz to 10 GHz					-60 dBc
10 GHz to					-60 dBc
20 GHz					
20 GHz to					-50 dBc
50 GHz	4 6				
10 KHZ OTISE	t from cen	iter frequency	, nominai pov	ver at test port	T in all
40 MHz (Typical:
10 MHz to 45 MHz					-70 dBc
45 MHz to 10 GHz					-70 dBc
10 GHz 10 GHz to					-65 dBc
20 GHz					-03 400
20 GHz to					-55 dBc
40 GHz					00 450
40 GHz to					-55 dBc
50 GHz					

10 kHz offset	t from center	frequency, nominal power	er at test port - Option 080 enabled
			Typical:
10 MHz to			-70 dBc
45 MHz			
45 MHz to			-70 dBc
10 GHz			
10 GHz to			-65 dBc
20 GHz			
20 GHz to			-55 dBc
40 GHz			
40 GHz to			-55 dBc
50 GHz			
100 kHz offse	et from cente	r frequency, nominal pow	ver at test port
			Typical:
10 MHz to			-60 dBc
10 GHz			
10 GHz to			-55 dBc
20 GHz			
20 GHz to			-50 dBc
50 GHz			
100 kHz offse	et from cente	r frequency, nominal pow	ver at test port - Option 080 enabled
			Typical:
10 MHz to			-75 dBc
10 GHz			
10 GHz to			-70 dBc
20 GHz			
20 GHz to			-65 dBc
50 GHz			
1 MHz offset	from center	frequency, nominal powe	r at test port
			Typical:
10 MHz to			-106 dBc
10 GHz			
10 GHz to			-103 dBc
20 GHz			
20 GHz to			-90 dBc
50 GHz			
1 MHz offset	from center	requency, nominal powe	r at test port - Option 080 enabled
			Typical:
10 MHz to			-103 dBc
10 GHz			
10 GHz to			-97 dBc
20 GHz			
20 GHz to			-85 dBc
50 GHz			
Harmonics (2	2nd or 3rd)		
	•		-23 dBc typical, in power
			range 0

Non-Harmonic Sp	Non-Harmonic Spurious (at Nominal Output Power)				
10 MHz to		-50 dBc typical, for offset			
45 MHz		frequency > 1 kHz			
45 MHz to		-50 dBc typical, for offset			
20 GHz		frequency > 1 kHz			
20 GHz to		-30 dBc typical, for offset			
40 GHz		frequency > 1 kHz			
40 GHz to		-30 dBc typical, for offset			
50 GHz		frequency > 1 kHz			

^a Source output performance on Port 1 only. Port 2 output performance is typical.

^b Preset power.

^c Typical performance.

^d 1.5 dB for power <= -23 dBm.

^e Power to which the source can be set and phase lock is assured.

Table 35: Test Port Input

Description	Specification				Supplemental	
2000111011	Standard	Opt 014	Opt UNL	Opt 014/UNL	Сарринания	
Test Port Noise	Test Port Noise Floor ^a					
10 Hz IF Bandv						
10 MHz to	<-77 dBm	<-77 dBm	<-77 dBm	<-77 dBm		
45 MHz ^b						
45 MHz to	<-89 dBm	<-89 dBm	<-89 dBm	<-89 dBm		
500 MHz ^c						
500 MHz to	<-114 dBm	<-114 dBm	<-114 dBm	<-114 dBm		
2 GHz						
2 GHz to	<-117 dBm	<-117 dBm	<-117 dBm	<-117 dBm		
10 GHz						
10 GHz to	<-120 dBm	<-119 dBm	<-120 dBm	<-119 dBm		
20 GHz						
20 GHz to	<-114 dBm	<-113 dBm	<-114 dBm	<-113 dBm	Option 016	
40 GHz					degrades	
40 GHz to	<-114 dBm	<-112 dBm	<-114 dBm	<-112 dBm	performance by 2 dB.	
50 GHz					2 32.	
1 KHz IF Band	width	•	•	•	•	
10 MHz to	<-57 dBm	<-57 dBm	<-57 dBm	<-57 dBm		
45 MHz ^b						
45 MHz to	<-69 dBm	<-69 dBm	<-69 dBm	<-69 dBm		
500 MHz ^c						
500 MHz to	<-94 dBm	<-94 dBm	<-94 dBm	<-94 dBm		
2 GHz						
2 GHz to	<-97 dBm	<-97 dBm	<-97 dBm	<-97 dBm		
10 GHz						
10 GHz to	<-100 dBm	<-99 dBm	<-100 dBm	<-99 dBm		
20 GHz						
20 GHz to	<-94 dBm	<-93 dBm	<-94 dBm	<-93 dBm	Option 016	
40 GHz					degrades performance by	
40 GHz to	<-94 dBm	<-92 dBm	<-94 dBm	<-92 dBm	2 dB.	
50 GHz						

Test Port Nois	Test Port Noise Floor ^{a,b} Option 080 enabled ^d					
10 Hz IF Band						
10 MHz to	<-77 dBm	<-77 dBm	<-77 dBm	<-77 dBm		
45 MHz ^b						
45 MHz to	<-88 dBm	<-88 dBm	<-88 dBm	<-88 dBm		
500 MHz ^c						
500 MHz to	<-113 dBm	<-113 dBm	<-113 dBm	<-113 dBm		
2 GHz						
2 GHz to	<-116 dBm	<-116 dBm	<-116 dBm	<-116 dBm		
10 GHz						
10 GHz to	<-118 dBm	<-118 dBm	<-118 dBm	<-118 dBm		
20 GHz						
20 GHz to	<-112 dBm	<-112 dBm	<-112 dBm	<-112 dBm	Option 016	
40 GHz					degrades	
40 GHz to	<-111 dBm	<-111 dBm	<-111 dBm	<-111 dBm	performance by 2 dB.	
50 GHz						
1 KHz IF Band						
10 MHz to	<-57 dBm	<-57 dBm	<-57 dBm	<-57 dBm		
45 MHz ^b						
45 MHz to	<-68 dBm	<-68 dBm	<-68 dBm	<-68 dBm		
500 MHz ^c						
500 MHz to	<-93 dBm	<-93 dBm	<-93 dBm	<-93 dBm		
2 GHz						
2 GHz to	<-96 dBm	<-96 dBm	<-96 dBm	<-96 dBm		
10 GHz						
10 GHz to	<-98 dBm	<-98 dBm	<-98 dBm	<-98 dBm		
20 GHz						
20 GHz to	<-92 dBm	<-92 dBm	<-92 dBm	<-92 dBm	Option 016	
40 GHz					degrades	
40 GHz to	<-91 dBm	<-91 dBm	<-91 dBm	<-91 dBm	performance by 2 dB.	
50 GHz						

Direct Receiver Acces	s Input Noise Floor ^{a,b}		
10 Hz IF Bandwidth	-		
10 MHz to	<-127 dBm	<-127 dBm	
45 MHz			
45 MHz to 500	<-127 dBm	<-127 dBm	
MHz ^c			
500 MHz to	<-133 dBm	<-133 dBm	
2 GHz			
2 GHz to	<-132 dBm	<-132 dBm	
10 GHz			
10 GHz to	<-134 dBm	<-134 dBm	
20 GHz			
20 GHz to	<-125 dBm	<-125 dBm	Option 016
40 GHz			degrades
40 GHz to	<-123 dBm	<-123 dBm	performance by 2 dB.
50 GHz			Z ub.
1 KHz IF Bandwidth	-	l .	L
10 MHz to	<-107 dBm	<-107 dBm	
45 MHz			
45 MHz to	<-107 dBm	<-107 dBm	
500 MHz ^c			
500 MHz to	<-113 dBm	<-113 dBm	
2 GHz			
2 GHz to	<-112 dBm	<-112 dBm	
10 GHz			
10 GHz to	<-114 dBm	<-114 dBm	
20 GHz			
20 GHz to	<-105 dBm	<-105 dBm	Option 016
40 GHz			degrades
40 GHz to	<-103 dBm	<-103 dBm	performance by 2 dB.
50 GHz			Z UD.
	ss Input Noise Floor ^{a,b} - Option 08	30 enabled ^d	
10 Hz IF Bandwidth			_
10 MHz to 45 MHz	<-127 dBm	<-127 dBm	
45 MHz to 500	<-126 dBm	<-126 dBm	
MHz ^c	400 ID.:	400 ID.:	
500 MHz to 2 GHz	<-132 dBm	<-132 dBm	
2 GHz to	<-131 dBm	<-131 dBm	
10 GHz			
10 GHz to 20 GHz	<-133 dBm	<-133 dBm	
20 GHz to 40 GHz	<-124 dBm	<-124 dBm	Option 016 degrades
40 GHz to 50 GHz	<-122 dBm	<-122 dBm	performance by 2 dB.

1 KHz IF Bandw	ridth			
10 MHz to 45	<-107 dBm	<-107	dBm	
MHz	1 101 32			
45 MHz to	<-106 dBm	<-106	3 dBm	
500 MHz ^c				
500 MHz to 2	<-112 dBm	<-112	2 dBm	
GHz				
2 GHz to	<-111 dBm	<-111	l dBm	
10 GHz				
10 GHz to	<-113 dBm	<-113	3 dBm	
20 GHz				
20 GHz to	<-104 dBm	<-104		Option 016
40 GHz				degrades
40 GHz to	<-102 dBm	<-102	2 dBm	performance by 2 dB.
50 GHz				2 ub.
Receiver Comp	ression Level			
10 MHz to 45 MHz ^b	<0.45 dB compression at +5 dBm			
45 MHz to 20 GHz	<0.45 dB compression at +5 dBm			
20 GHz to	<0.45 dB compression at 0 dBm			
30 GHz				
30 GHz to	<0.45 dB compression at-3 dBm			
40 GHz				
40 GHz to	<0.45 dB compression at -3 dBm			
50 GHz				
System Compre	ession Level			
	maximum output power			See <u>dynamic</u>
			accuracy table	
Third Order Inte	ercept - Tone spacing from 100 k	Hz - 5 MHz		
10 MHz to 150				Typical +38 dBm
MHz				+30 UDIII
150 MHz to 300				+34 dBm
MHz				
300 MHz to 500 MHz			+30 dBm	
500 MHz to 20			+22 dBm with	
GHz			two -7 dBm	
00 to 40 011				tones
20 to 40 GHz				+18 dBm with two -15 dBm
				tones
40 to 50 GHz				+15 dBm with
				two -21 dBm
				tones

Third Order Int	ercept - Tone spacing from 5 MHz - 20 MHz	
		Typical
10 MHz to 500		+20 dBm with
MHz		two -7 dBm
		tones
500 MHz to 20		+20 dBm with
GHz		two -7 dBm
		tones
20 to 40 GHz		+15 dBm with
		two -15 dBm
40 (50 0)		tones
40 to 50 GHz		+15 dBm with
		two -21 dBm
Third Order Int	ercept - Tone spacing from 20 MHz - 50 MHz	tones
Tillia Orael lill	ercept - Tone spacing from 20 Miliz - 30 Miliz	Typical
10 MHz to 500		+24 dBm with
MHz		two -7 dBm
1711 12		tones
500 MHz to 20		+24 dBm with
GHz		two -7 dBm
		tones
20 to 40 GHz		+20 dBm with
		two -15 dBm
		tones
40 to 50 GHz		+20 dBm with
		two -21 dBm
		tones
Trace Noise Ma	ngnitude	
1 kHz IF bandwi	dth. Ratio measurement, nominal power at test port.	
10 MHz to	<0.050 dB rms	
45 MHz ^b		
45 MHz to	<0.010 dB rms	
500 MHz ^e		
	<0.006 dB rms	
500 MHz to	CO.000 dB IIIIS	
20 GHz		
20 GHz to	<0.006 dB rms	
40 GHz		
40 GHz to	<0.006 dB rms	
50 GHz		
00 01.12	1	

Trace Noise Magnitude - Option 080 enabled ^{b,d}				
	1 kHz IF bandwidth. Ratio measurement, nominal power at test port.			
10 MHz to	<0.060 dB rms			
45 MHz ^b				
45 MHz to	<0.010 dB rms			
500 MHz ^e	100 to 02 mil			
500 MHz to	<0.006 dB rms			
20 GHz	10.000 d2 mil			
20 GHz to	<0.007 dB rms			
40 GHz				
40 GHz to	<0.008 dB rms			
50 GHz	10.000 d2 mil			
Trace Noise Pha	250			
	dth. Ratio measurement, nominal power at test port.			
10 MHz to	<0.350° rms			
45 MHz ^b				
45 MHz to	<0.100° rms			
500 MHz				
500 MHz to	<0.060° rms			
20 GHz				
20 GHz to	<0.100° rms			
40 GHz				
40 GHz to	<0.100° rms			
50 GHz				
Trace Noise Pha	ase - Option 080 enabled ^{b,d}			
	dth. Ratio measurement, nominal power at test port.			
10 MHz to	<0.350° rms			
45 MHz				
45 MHz to	<0.100° rms			
500 MHz ^e				
500 MHz to	<0.060° rms			
20 GHz				
20 GHz to	<0.100° rms			
40 GHz				
40 GHz to	<0.100° rms			
50 GHz				
Reference Leve				
Range	+/-200 dB 0.001 dB			
Resolution Reference Leve				
Range	+/-500°			
Resolution	0.01°			

Stability Magnit	tude ^d			
	asurement, made	at the test port.		
10 MHz to				+/-0.05 dB/°C
45 MHz				
45 MHz to				+/-0.02 dB/°C
20 GHz				
20 GHz to				+/-0.03 dB/°C
40 GHz				
40 GHz to				+/-0.04 dB/°C
50 GHz				
Stability Phase				
	asurement, meas	ured at the test p	ort.	
10 MHz to				+/-0.5°/°C
45 MHz				
45 MHz to				+/-0.2°/°C
20 GHz				
20 GHz to				+/-0.5°/°C
40 GHz				
40 GHz to				+/-0.8°/°C
50 GHz				
Damage Input L	evel			
Test Port 1				+20 dBm or
and 2				+/-40 VDC,
				typical
R1, R2 in				+15 dBm or
				+/-15 VDC,
				typical
A, B in				+15 dBm or
				+/-15 VDC,
				typical
Coupler Thru				+30 dBm or
(Option 014 or UNL/014)				+/-40 VDC,
,				typical
Coupler Arm				+30 dBm or
(Option 014 or UNL/014)				+/-7 VDC,
0112/014)				typical

^aTotal average (rms) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

^bTypical performance.

^cNoise floor may be degraded by 10 dB at particular frequencies (multiples of 5 MHz) due to spurious receiver residuals.

^d0 Hz offset

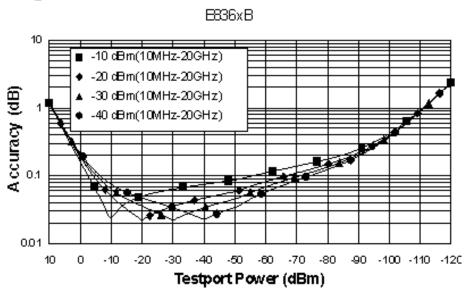
^eTrace noise magnitude may be degraded to 20 mdB rms at harmonic frequencies of the first IF (8.33 MHz) below 80 MHz.

^fStability is defined as a ratio measurement made at the test port.

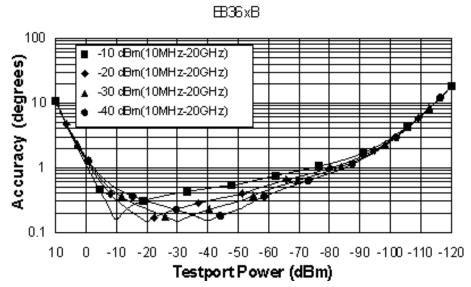
Table 36. Dynamic Accuracy (Specification^a)

Accuracy of the test port input power reading relative to the reference input power level.

Magnitude*

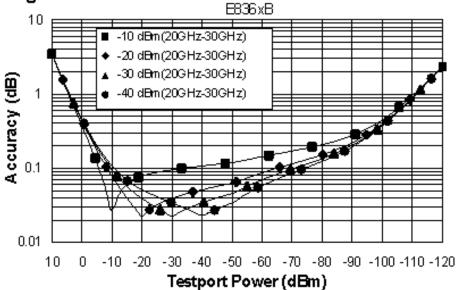


Phase*

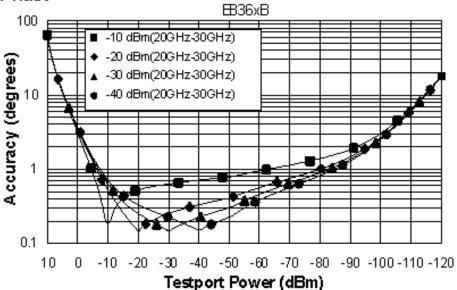


*Below 800 MHz the coupling factor rolls off 20 dB per decade causing a shift in the dynamic accuracy curves. Please see the Uncertainty Calculator (http://www.agilent.com/find/na_calculator) for detailed compression values.

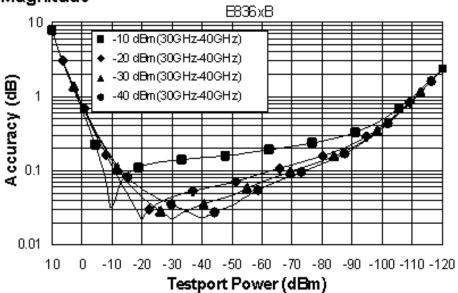
Magnitude



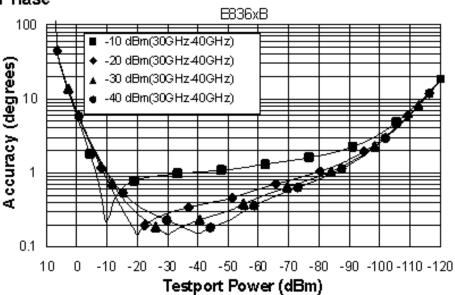




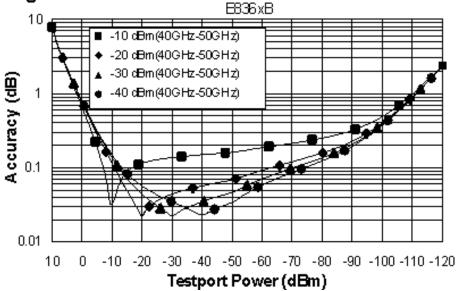




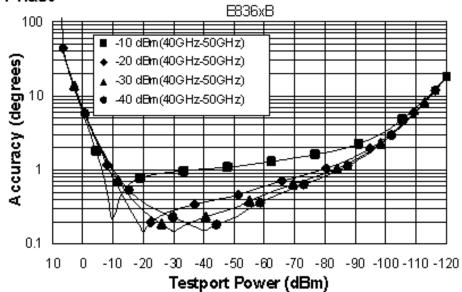
Phase



Magnitude



Phase

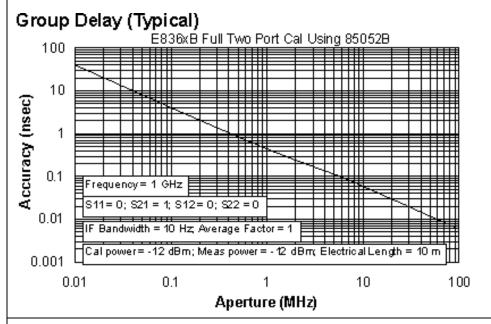


- ^a Dynamic accuracy is verified with the following measurements:
 - compression over frequency
 - IF linearity at a single frequency of 1.195 GHz and a reference level of -20 dBm

Table 37. Test Port Input (Group Delay)^a

Description	Specification	Supplemental Information
Aperture (selectable)	(frequency span)/(number of points - 1)	
Maximum Aperture	20% of frequency span	
Range	0.5 x (1/minimum aperture)	
Maximum Delay		Limited to measuring no more than 180° of phase change within the minimum aperture.)
Accuracy		See graph below. Char.

The following graph shows characteristic group delay accuracy with full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be < 2 dB and electrical length to be ten meters.



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

±Phase Accuracy (deg)/[360 x Aperture (Hz)]

Depending on the aperture and device length, the phase accuracy used is either incremental phase accuracy or worst case phase accuracy.

^a Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).

General Information

Table 38. Miscellaneous Information

Description	Specification	Supplemental Information	
System IF Bandwidth Range		1 Hz to 40 kHz, nominal	
CPU		Intel® 500 MHz Pentium® III	

Table 39. Front Panel Information

Description	Supplemental Information
Description	Supplemental Information
RF Connectors	
E8362B	
Туре	3.5 mm (male), 50 ohm, (nominal)
Center Pin Recession	0.002 in. (characteristic)
E8363/4B	
Туре	2.4 mm (male), 50 ohm, (nominal)
Center Pin Recession	0.002 in. (characteristic)
Display	
Size	21.3 cm (8.4 in) diagonal color active matrix LCD; 640 (horizontal) X 480 (vertical) resolution; 59.83 Hz vertical refresh rate; 31.41 Hz horizontal refresh rate
Refresh Rate	Vertical 59.83 Hz; Horizontal 31.41 Hz
Display Range	
Magnitude	±200 dB (at 20 dB/div), max
Phase	±180°, max
Polar	10 pUnits, min 1000 Units, max
Display Resolution	
Magnitude	0.001 dB/div, min
Phase	0.01°/div, min
Marker Resolution	
Magnitude	0.001 dB, min
Phase	0.01°, min
Polar	0.01 mUnit, min; 0.01°,min

Table 40. Rear Panel Information

Table 40. Rear Panel Info	-
Description	Supplemental Information
10 MHz Reference In	
Connector	BNC, female
Input Frequency	10 MHz ± 10 ppm, typical
Input Level	-15 dBm to +20 dBm, typical
Input Impedance	200Ω , nom.
10 MHz Reference Ou	it
Connector	BNC, female
Output Frequency	10 MHz ± 1 ppm, typical
Signal Type	Sine Wave, typical
Output Level	+10 dBm ± 4 dB into 50 Ω, typical
Output Impedance	50 Ω, nominal
Harmonics	<-40 dBc, typical
VGA Video Output	
Connector	15-pin mini D-Sub; Drives VGA compatible monitors
Devices Supported:	par par man a death and a service in a servi
z stroco capportou.	Resolutions:
Flat Panel (TFT)	1024 X 768, 800 X 600, 640 X 480
Flat Panel (DSTN)	800 X 600, 640 X 480
CRT Monitor	1280 X 1024, 1024 X 768, 800 X 600, 640 X 480
OTT WOTHO	Simultaneous operation of the internal and external displays is allowed, but
	with 640 X 480 resolution only. If you change resolution, you can only view the
	external display (internal display will "white out").
Test Set IO	one all play (internal all play in in internal play in in internal play in in internal play in in internal play in internal p
	25-pin D-Sub connector, available for external test set control
Aux IO	
- 1000 10	25-pin D-Sub connector, male, analog and digital IO
Handler IO	pin 2 cas comments, many amang ama ang am
110.110.101	36-pin parallel I/O port; all input/output signals are default set to negative logic;
	can be reset to positive logic via GPIB command
GPIB	
-	24-pin D-sub (Type D-24), female; compatible with IEEE-488.
Parallel Port (LPT1)	
(25-pin D-Sub miniature connector, female; provides connection to printers or
	any other parallel port peripherals
Serial Port (COM 1)	
	9-pin D-Sub, male; compatible with RS-232
USB Port	
	One port on front panel and five ports on rear panel. Universal Serial Bus jack,
	Type A configuration (4 contacts inline, contact 1 on left); female
Contact 1	Vcc: 4.75 to 5.25 VDC, 500 mA, maximum
Contact 2	-Data
Contact 3	+Data
Contact 4	Ground
LAN	
	10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data
	rates
	·

Line Power ^a	
Frequency	48 Hz to 66 Hz
Voltage at 115 V Setting	90 to 132 VAC; 120 VAC, nominal
Voltage at 220 V Setting	198 to 264 VAC; 240 VAC, nominal
VA Max	600 VA maximum

^a A third-wire ground is required.

 Table 41. Analyzer Environment and Dimensions

Supplemental Information		
Defined by CISPR Pub. 11, Group 1, Class A, and IEC 50082-1		
Minimize using static-safe work procedures and an antistatic bench mat		
Minimize for optimum reliability		
0 °C to +40 °C		
Instrument powers up, phase locks, and displays no error messages within this temperature range (except for "source unleveled" error message that may occur at temperature extremes).		
23°C ± 3°C		
with less than 1°C deviation from calibration temp.		
5% to 95% at +40 °C		
0 to 4500 m (14,760 ft.)		
vironment		
-40 °C to +70 °C		
0% to 90% at +65 °C (non-condensing)		
0 to 15,240 m (50,000 ft.)		

0 to 10,240 fit (00,000 ft.)					
Cabinet Dimensions					
Height	Width	Depth			
267 mm	425 mm	426 mm			
10.5 in	16.75 in	16.8 in			
305 mm	425 mm	470 mm			
12.0 in	16.75 in	18.5 in			
305 mm	458 mm	502 mm			
12.0 in	18 in	19.75 in			
305 mm	483 mm	470 mm			
12.0 in	19 in	18.5 in			
305 mm	483 mm	502 mm			
12.0 in	19 in	19.75 in			
28.6 kg (63.5 lb), nominal					
29 kg (64 lb), nominal					
35.8 kg (79.5 lb), nominal					
36.3 kg 80 lb), nominal					
	Height 267 mm 10.5 in 305 mm 12.0 in	Height Width 267 mm 425 mm 10.5 in 16.75 in 305 mm 425 mm 12.0 in 16.75 in 305 mm 458 mm 12.0 in 18 in 305 mm 483 mm 12.0 in 19 in 305 mm 483 mm 12.0 in 19 in 28.6 kg (63.5 lb), nominal 29 kg (64 lb), nominal 35.8 kg (79.5 lb), nominal			

Measurement Throughput Summary
Table 42 Typical Cycle Time^{a,b} (ms) for Measurement Completion

	Number of Points				
•	201	401	1601	16,001	
Start 28 GHz, Stop 30 GHz, 35 kHz IF					
bandwidth	1.0	140	T	1=00	
Uncorrected,	12	19	55	503	
1-port cal					
2-Port cal	29	44	124	1112	
Start 10 MHz, bandwidth	Stop 10	GHz, 35	kHz IF		
Uncorrected,	86	93	121	583	
1-port cal					
2-Port cal	179	199	267	1301	
Start 10 MHz,	Stop 20	GHz, 35	kHz IF		
bandwidth					
Uncorrected,	126	130	153	597	
1-port cal					
2-Port cal	264	275	335	1321	
Start 10 MHz, bandwidth	Stop 40	GHz, 35	kHz IF		
Uncorrected,	185	190	213	621	
1-port cal					
2-Port cal	382	401	459	1374	
Start 10 MHz, bandwidth	Stop 50	GHz, 35	kHz IF		
Uncorrected,	210	216	243	643	
1-port cal					
2-Port cal	436	450	522	1405	
Start 10 MHz, bandwidth	Stop 67	GHz, 35	kHz IF		
Uncorrected	244	254	300	645	
Corrected	502	524	591	1423	

a Typical performance.

b Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S11) measurement.

Table 43. Cycle Time vs IF Bandwidth^a

Applies to the <u>Preset condition</u> (201 points, correction off) except for the following changes:

- CF = 28 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

IF Bandwidth (Hz)	Cycle Time (ms) ^b	Cycle Time (ms) Option 080 enabled
40,000	11	100
35,000	12	101
30,000	13	102
20,000	16	106
10,000	30	127
7000	38	138
5000	50	152
3000	74	182
1000	274	326
300	694	782
100	1905	2054
30	6091	6355
10	17916	18372

Table 44. Cycle Time vs Number of Points^a

Applies to the <u>Preset condition</u> (35 kHz IF bandwidth, correction off) except for the following changes:

- CF = 28 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

Number of	Cycle Time (ms) ^b
Points	
3 11	6
11	6
51	7
101	9
201 401	12
	18
801	30
1601	55
16,001	497

^a Typical performance.
^b Cycle time includes sweep and retrace time.

^a Typical performance. ^b Cycle time includes sweep and retrace time.

Table 45. Data Transfer Time (ms)^a

Table 43. Data Hallster Hille (HIS)					
	Number of Points				
	201	401	1601	16,001	
SCPI over GPIB					
(program executed o	n exter	nal PC)			
32-bit floating point	7	12	43	435	
64-bit floating point	12	22	84	856	
ASCII	64	124	489	5054	
SCPI					
(program executed in	n the an	alyzer)			
32-bit floating point	1	2	3	30	
64-bit floating point	2	2	4	40	
ASCII	29	56	222	2220	
COM (program execu	uted in t	the analy	zer)		
32-bit floating point	1	1	1	6	
Variant type	1	2	6	68	
DCOM over LAN					
(program executed on external PC)					
32-bit floating point	1	1	2	121	
Variant type	3	6	19	939	

^a Typical performance

Note: Specifications for Recall & Sweep Speed are not provided for the E836xB analyzers.

Specifications: Front-Panel Jumpers

Models E8362B, E8363B, and E8364B Option 014

NOTE: The standard E8362/3/4B has no front-panel jumpers.

Table 46: Measurement Receiver Inputs (Rcvr A In, Rcvr B In)

Description	Specification	Supplemental Information		
Maximum Input Level				
E8362B:				
45 MHz to 500 MHz		-15 dBm, typical		
500 MHz to 2 GHz		-11 dBm, typical		
2 GHz to 10 GHz		-11 dBm, typical		
10 GHz to 20 GHz		-11 dBm, typical		
E8363B:				
45 MHz to 500 MHz		-14 dBm, typical		
500 MHz to 2 GHz		-10 dBm, typical		
2 GHz to 10 GHz		-10 dBm, typical		
10 GHz to 20 GHz		-10 dBm, typical		
20 GHZ to 30 GHz		-14.5 dBm, typical		
30 GHZ to 40 GHz		-16.5 dBm, typical		
E8364B:	·			
45 MHz to 500 MHz		- 14 dBm, typical		
500 MHz to 2 GHz		- 10 dBm, typical		
2 GHz to 10 GHz		- 10 dBm, typical		
10 GHz to 20 GHz		- 10 dBm, typical		
20 GHZ to 30 GHz		- 14.5 dBm, typical		
30 GHZ to 40 GHz		- 16.5 dBm, typical		
40 GHZ to 45 GHz		- 16 dBm, typical		
45 GHZ to 50 GHz		- 15 dBm, typical		
Noise Floor				
E8362B:				
	10 Hz IF Bandwidth			
45 MHz to 500 MHz	< -109 dBm			
500 MHz to 2 GHz	< -130 dBm			
2 GHz to 10 GHz	< -133 dBm			
10 GHz to 20 GHz	< -135 dBm			
	1 kHz IF Bandwidth			
45 MHz to 500 MHz	< -89 dBm			
500 MHz to 2 GHz	< -110 dBm			
2 GHz to 10 GHz	< -113 dBm			
10 GHz to 20 GHz	< -115 dBm			

E8363B:			
	10 Hz IF Bandwidth		
45 MHz to 500 MHz	< -127 dBm		
500 MHz to 2 GHz	< -133 dBm	< -133 dBm	
2 GHz to 10 GHz	< -132 dBm		
10 GHz to 20 GHz	< -134 dBm		
20 GHZ to 40 GHz	< -125 dBm		
	1 kHz IF Bandwidth		
45 MHz to 500 MHz	< -107 dBm		
500 MHz to 2 GHz	< -113 dBm		
2 GHz to 10 GHz	< -112 dBm		
10 GHz to 20 GHz	< -114 dBm		
20 GHZ to 40 GHz	< -105 dBm		
E8364B:			
	10 Hz IF Bandwidth		
45 MHz to 500 MHz	< - 127 dBm		
500 MHz to 2 GHz	< - 133 dBm		
2 GHz to 10 GHz	< - 132 dBm		
10 GHz to 20 GHz	< - 134 dBm		
20 GHZ to 40 GHz	< - 125 dBm		
40 GHZ to 50 GHz	< - 123 dBm		
	1 kHz IF Bandwidth		
45 MHz to 500 MHz	< -107 dBm		
500 MHz to 2 GHz	< -113 dBm		
2 GHz to 10 GHz	< -112 dBm		
10 GHz to 20 GHz	< -114 dBm		
20 GHZ to 40 GHz	< -105 dBm		
40 GHZ to 50 GHz	< -103 dBm		
Damage Level			
E8362B		+ 15 dBm, typical	
E8363B		+ 15 dBm, typical	
E8364B		+ 15 dBm, typical	
Maximum DC Level			
E8362B		+ 15 V, typical	
E8363B		+ 15 V, typical	
E8364B		+ 15 V, typical	

Table 47: Reference Receiver Inputs (Rcvr R1, Rcvr R2)

Description	Specification	Supplemental Information	
Maximum Input Level			
E8362B:			
45 MHz to 500 MHz		-15 dBm, typical	
500 MHz to 2 GHz		-11 dBm, typical	
2 GHz to 10 GHz		-11 dBm, typical	
10 GHz to 20 GHz		-11 dBm, typical	
E8363B:			
45 MHz to 500 MHz		-14 dBm, typical	
500 MHz to 2 GHz		-10 dBm, typical	
2 GHz to 10 GHz		-10 dBm, typical	
10 GHz to 20 GHz		-9.5 dBm, typical	
20 GHZ to 30 GHz		-14 dBm, typical	
30 GHZ to 40 GHz		-15.5 dBm, typical	
E8364B:			
45 MHz to 500 MHz		- 14 dBm, typical	
500 MHz to 2 GHz		- 10 dBm, typical	
2 GHz to 10 GHz		- 10 dBm, typical	
10 GHz to 20 GHz		- 9.5 dBm, typical	
20 GHZ to 30 GHz		- 14 dBm, typical	
30 GHZ to 40 GHz		- 15.5 dBm, typical	
40 GHZ to 45 GHz		- 14 dBm, typical	
45 GHZ to 50 GHz		- 15 dBm, typical	
Damage Level			
E8362B		+ 15 dBm, typical	
E8363B		+ 15 dBm, typical	
E8364B		+ 15 dBm, typical	
Maximum DC Level			
E8362B		+/- 15 V, typical	
E8363B		+/- 15 V, typical	
E8364B		+/- 15 V, typical	

Table 48: Reference Outputs (Reference 1 Source Out, Reference 2 Source Out)

Description	Specification	Supplemental Information	
Maximum Output Level			
E8362B:			
45 MHz to 500 MHz		-24 dBm, typical	
500 MHz to 2 GHz		-23 dBm, typical	
2 GHz to 10 GHz		-23 dBm, typical	
10 GHz to 20 GHz		-26 dBm, typical	
E8363B:			
45 MHz to 500 MHz		-11.5 dBm, typical	
500 MHz to 2 GHz		-10.5 dBm, typical	
2 GHz to 10 GHz		-11 dBm, typical	
10 GHz to 20 GHz		-11 dBm, typical	
20 GHZ to 30 GHz		-11 dBm, typical	
30 GHZ to 40 GHz		-11 dBm, typical	
E8364B:			
45 MHz to 500 MHz		- 11.5 dBm, typical	
500 MHz to 2 GHz		- 10.5 dBm, typical	
2 GHz to 10 GHz		- 11 dBm, typical	
10 GHz to 20 GHz		- 11 dBm, typical	
20 GHZ to 30 GHz		- 11 dBm, typical	
30 GHZ to 40 GHz		- 11 dBm, typical	
40 GHZ to 45 GHz		- 11 dBm, typical	
45 GHZ to 50 GHz		- 15 dBm, typical	
Damage Level			
E8362B		+ 20 dBm, typical	
E8363B		+ 20 dBm, typical	
E8364B		+ 20 dBm, typical	
Maximum DC Level			
E8362B		+/- 15 V, typical	
E8363B		+/- 15 V, typical	
E8364B		+/- 15 V, typical	

Table 49: Source Outputs (Port 1 Source Out, Port 2 Source Out)

Description	Specification Supplemental Information		
Maximum Output Level			
E8362B, Option 014:	1	la in	
45 MHz to 500 MHz	6 dBm, typical		
500 MHz to 2 GHz		7 dBm, typical	
2 GHz to 10 GHz		7 dBm, typical	
10 GHz to 20 GHz		4 dBm, typical	
E8362B, Option 014 and UNL:		A JD t	
45 MHz to 500 MHz		4 dBm, typical	
500 MHz to 2 GHz		5 dBm, typical	
2 GHz to 10 GHz		5 dBm, typical	
10 GHz to 20 GHz		2 dBm, typical	
E8363B, Option 014:		E E dDm timical	
45 MHz to 500 MHz		5.5 dBm, typical	
500 MHz to 2 GHz 2 GHz to 10 GHz		6.5 dBm, typical	
		6.5 dBm, typical	
10 GHz to 20 GHz		4 dBm, typical	
20 GHZ to 30 GHz 30 GHZ to 40 GHz		1- dBm, typical	
		-2 dBm, typical	
E8363B, Option 014 and UNL: 45 MHz to 500 MHz		2 E dDm trainel	
		3.5 dBm, typical	
500 MHz to 2 GHz 2 GHz to 10 GHz		5 dBm, typical	
10 GHz to 20 GHz		5 dBm, typical 3.5- dBm, typical	
20 GHZ to 30 GHz			
30 GHZ to 40 GHz		0 dBm, typical	
E8364B, Option 014:		-2.5 dBm, typical	
45 MHz to 500 MHz		5.5 dBm, typical	
500 MHz to 2 GHz		6.5 dBm, typical	
2 GHz to 10 GHz		6.5 dBm, typical	
10 GHz to 20 GHz		4 dBm, typical	
20 GHZ to 30 GHz		1 dBm, typical	
30 GHZ to 40 GHz		-2 dBm, typical	
40 GHZ to 45 GHz		-3 dBm, typical	
45 GHZ to 50 GHz		-7.5 dBm, typical	
E8364B, Option 014 and UNL:		7.5 dBm, typical	
45 MHz to 500 MHz		3.5 dBm, typical	
500 MHz to 2 GHz		5 dBm, typical	
2 GHz to 10 GHz		5 dBm, typical	
10 GHz to 20 GHz		3.5 dBm, typical	
20 GHZ to 30 GHz		0 dBm, typical	
30 GHZ to 40 GHz	-2.5 dBm, typical		
40 GHZ to 45 GHz	-5 dBm, typical		
45 GHZ to 50 GHz	-10 dBm, typical		
Damage Level			
E8362B		20 dBm, typical	
E8363B		20 dBm, typical	
E8364B		20 dBm, typical	

Maximum DC Level		
E8362B	0 V, typical	
E8363B	0 V, typical	
E8364B	0 V, typical	

Table 50: Coupler Inputs (Port 1 Cplr Thru, Port 2 Cplr Thru)

Description	Specification	Supplemental Information		
Insertion Loss to Test Port				
E8362B, Option 014:				
45 MHz to 500 MHz		0.5 dB, typical		
500 MHz to 2 GHz		1.5 dB, typical		
2 GHz to 10 GHz		1.5 dB, typical		
10 GHz to 20 GHz		1.5 dB, typical		
E8362B, Option 014 and UN	NL:	·		
45 MHz to 500 MHz		1 dB, typical		
500 MHz to 2 GHz		2 dB, typical		
2 GHz to 10 GHz		2 dB, typical		
10 GHz to 20 GHz		2 dB, typical		
E8363B, Option 014:				
45 MHz to 500 MHz		0.5 dB, typical		
500 MHz to 2 GHz		0.5 dB, typical		
2 GHz to 10 GHz		1.5 dB, typical		
10 GHz to 20 GHz		2 dB, typical		
20 GHZ to 30 GHz		3 dB, typical		
30 GHZ to 40 GHz		3.5 dB, typical		
E8363B, Option 014 and UN	<u> </u>			
45 MHz to 500 MHz		0.5 dB, typical		
500 MHz to 2 GHz		1 dB, typical		
2 GHz to 10 GHz		2 dB, typical		
10 GHz to 20 GHz		3 dB, typical		
20 GHZ to 30 GHz		4 dB, typical		
30 GHZ to 40 GHz		5 dB, typical		
E8364B, Option 014:				
45 MHz to 500 MHz		0.5 dB, typical		
500 MHz to 2 GHz		0.5 dB, typical		
2 GHz to 10 GHz		1.5 dB, typical		
10 GHz to 20 GHz		2 dB, typical		
20 GHZ to 30 GHz		3 dB, typical		
30 GHZ to 40 GHz		3.5 dB, typical		
40 GHZ to 45 GHz		3.5 dB, typical		
45 GHZ to 50 GHz		4 dB, typical		

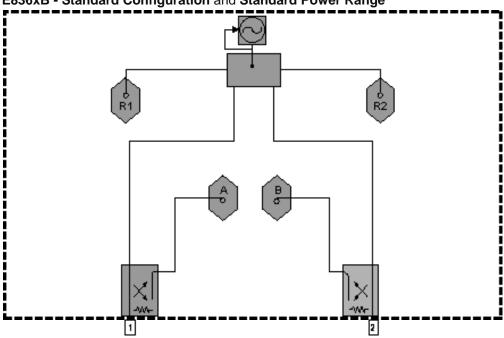
E8364B, Option 014 and UNL:			
45 MHz to 500 MHz	0.5 dB, typical		
500 MHz to 2 GHz	1 dB, typical		
2 GHz to 10 GHz	2 dB, typical		
10 GHz to 20 GHz	3 dB, typical		
20 GHZ to 30 GHz	4 dB, typical		
30 GHZ to 40 GHz	5 dB, typical		
40 GHZ to 45 GHz	5.5 dB, typical		
45 GHZ to 50 GHz	6 dB, typical		
Damage Level			
E8362B	+ 30 dBm, typical		
E8363B	+ 30 dBm, typical		
E8364B	+ 30 dBm, typical		
Maximum DC Level			
E8362B	+/- 40 V, typical		
E8363B	+/- 40 V, typical		
E8364B	+/- 40 V, typical		

Table 51: Coupler Outputs (Port 1 Cpir Arm, Port 2 Cpir Arm)

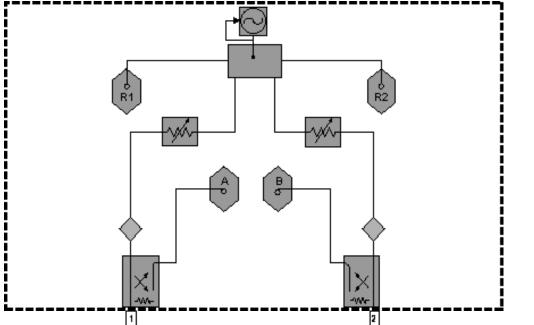
Description	Specification	Supplemental Information	
Damage Level			
E8362B		+ 30 dBm, typical	
E8363B		+ 30 dBm, typical	
E8364B		+ 30 dBm, typical	
Maximum DC Level	·		
E8362B		+/- 7 V, typical	
E8363B		+/- 7 V, typical	
E8364B		+/- 7 V, typical	

Test Set Block Diagrams

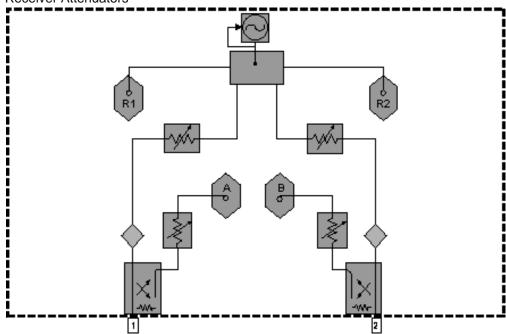
E836xB - Standard Configuration and Standard Power Range



E836xB - Option UNL Standard Configuration with Extended Power Range and Bias - Tees

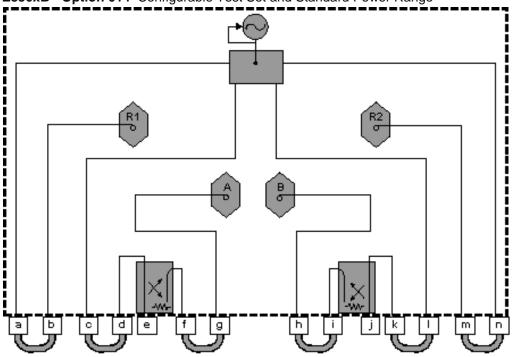


E836xB - Option UNL Standard Configuration with Extended Power Range and Bias - Tees, and **Option 016,** Receiver Attenuators



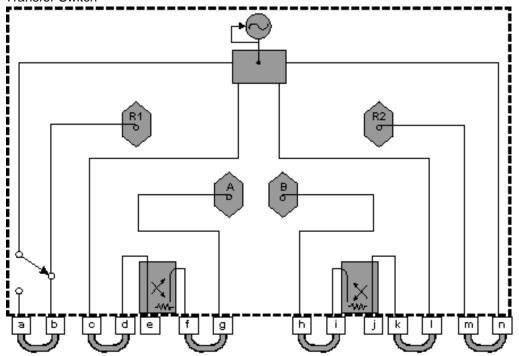
Test Set with Option 014 Block Diagrams

E836xB - Option 014 Configurable Test Set and Standard Power Range



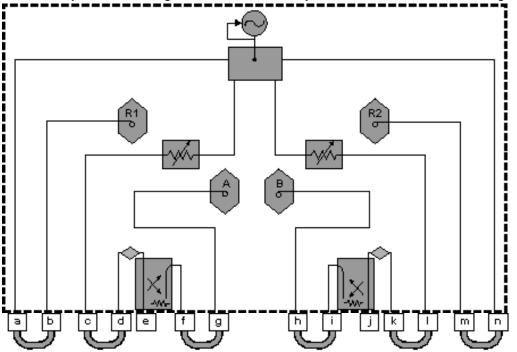
Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	İ	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1		SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT

E836xB - Option 014 Configurable Test Set and Standard Power Range, and **Option 081** Reference Channel Transfer Switch



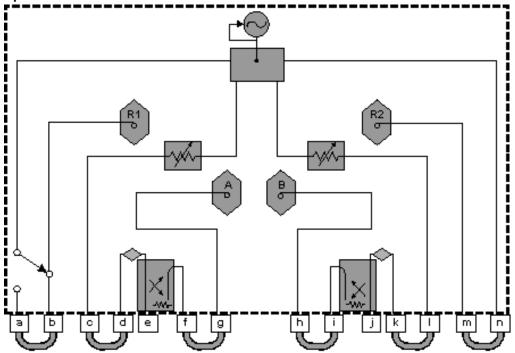
Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	i	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1	I	SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT





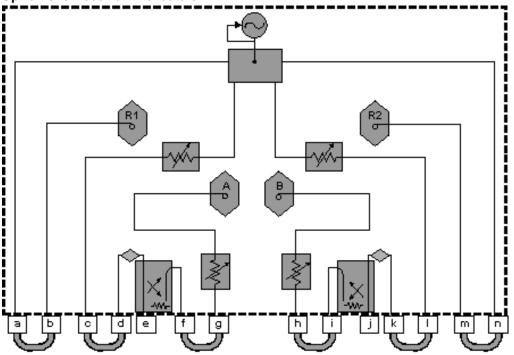
Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	i	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1	I	SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT

E836xB - Option 014 Configurable Test Set, and **Option UNL** Extended Power Range and Bias - Tees, and **Option 081** Reference Channel Transfer Switch



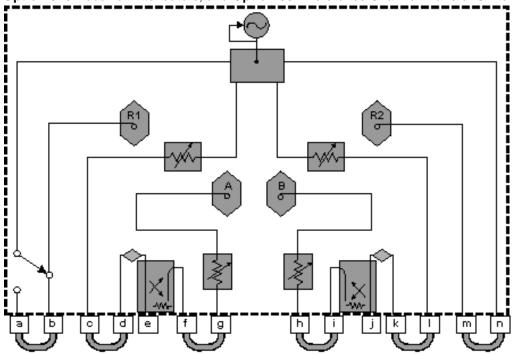
Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	i	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1	I	SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT

E836xB - Option 014 Configurable Test Set and **Option UNL**, Extended Power Range and Bias - Tees and **Option 016** Receiver Attenuators



Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	i	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1	I	SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT

E836xB - Option 014 Configurable Test Set, and **Option UNL** Extended Power Range and Bias - Tees, and **Option 016** Receiver Attenuators, and **Option 081** Reference Channel Transfer Switch



Item	Description	Item	Description
а	SOURCE OUT	h	RCVR B IN
b	RCVR R1 IN	i	CPLR ARM
С	SOURCE OUT	j	PORT 2
d	CPLR THRU	k	CPLR THRU
е	PORT 1	I	SOURCE OUT
f	CPLR ARM	m	RCVR R2 IN
g	RCVR A IN	n	SOURCE OUT

6 Equations Used to Generate Uncertainty Curves

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This topic contains the measurement uncertainty equations used to generate the uncertainty curves in the Specifications document. It also contains general information about determining system measurement

Learn about the following subjects:

uncertainties.

- Measurement Uncertainty Equations
 - Forward Reflection Uncertainty
 - Forward Transmission Uncertainty
 - Reverse Reflection Uncertainty
 - Reverse Transmission Uncertainty
- Sources of Systematic Errors
- Sources of Random Errors
- Determining Expected System Performance
- Determining Cable Stability Terms (C_{R1}, C_{R2}, C_{TM1}, C_{TM2}, C_{TP1}, C_{TP2})
- Measurement Errors
- What is Measurement Calibration?
- Why is Calibration Necessary?

Measurement Uncertainty Equations

Any measurement result is the vector sum of the actual test device response plus all error terms. The precise effect of each error term depends on its magnitude and phase relationship to the actual test device response. When the phase of an error response is not known, phase is assumed to be worst case (-I80x° to +180°).

View the abbreviations for residual systematic errors used in the equations.

View the abbreviations for random errors used in the error models and equations.

Forward Reflection Uncertainty

Equation 1: Forward Reflection Magnitude Uncertainty

$$\Delta S_{11(mag)} = \sqrt{(Systematic + Stability)^2 + Noise^2}$$

Where:

$$\begin{split} &\textit{Systematic} = E_{DF} + E_{RF}S_{11} + E_{SF}S_{11}^2 + E_{LF}S_{21}S_{12} + A_{M}S_{11} \\ &\textit{Stability} = \sqrt{C^2 + R^2} \\ &C^2 = C_{RM1}^2(1 + S_{11}^4) + 4C_{TM1}^2S_{11}^2 + C_{RM2}^2S_{21}^2S_{12}^2 \\ &R^2 = \left(R_{R1}(1 + S_{11}^2) + 2R_{T1}S_{11}\right)^2 + \left(R_{R2}S_{21}S_{12}\right)^2 \\ &\textit{Noise}^2 = \left(N_TS_{11}\right)^2 + N_T^2 \end{split}$$

Equation 2: Forward Reflection Phase Uncertainty

$$\Delta S_{11(phase)} = \sin^{-1}\!\!\left(\frac{\sqrt{\left(Systematic + Stability\right)^2 + Noise^2}}{S_{11}}\right) + 2\,C_{TP1}$$

Where:

$$\begin{aligned} &\textit{Systematic} = \ E_{DF} + E_{RF} S_{11} + E_{SF} S_{11}^2 + E_{LF} S_{21} S_{12} + \sin(A_F) S_{11} \\ &\textit{Stability} = \sqrt{C^2 + R^2} \\ &C^2 = C_{RM1}^2 (1 + S_{11}^A) + 4 C_{TM1}^2 S_{11}^2 + C_{RM2}^2 S_{21}^2 S_{12}^2 \\ &R^2 = \left(R_{R1} (1 + S_{11}^2) + 2 R_{T1} S_{11} \right)^2 + \left(R_{R2} S_{21} S_{12} \right)^2 \\ &\textit{Noise}^2 = \left(N_T S_{11} \right)^2 + N_F^2 \end{aligned}$$

Forward Transmission Uncertainty

Equation 3: Forward Transmission Magnitude Uncertainty

$$\Delta S_{21(mag)} = \sqrt{(Systematic + Stability)^2 + Noise^2}$$

Where:

$$\begin{split} &\textit{Systematic} = \ E_{\textit{XF}} + S_{21} (E_{\textit{TF}} + E_{\textit{SF}} S_{11} + E_{\textit{LF}} S_{22} + E_{\textit{SF}} E_{\textit{LF}} S_{21} S_{12} + A_{\textit{M}}) \\ &\textit{Stability} = \ \sqrt{C^2 + R^2} \\ &\textit{C}^2 = S_{21}^2 (C_{\textit{TM1}}^2 + C_{\textit{TM2}}^2 + (C_{\textit{R1}} S_{11})^2 + (C_{\textit{R2}} S_{22})^2) \\ &R^2 = S_{21}^2 ((R_{\textit{T1}} + R_{\textit{R1}} S_{11})^2 + (R_{\textit{T2}} + R_{\textit{R2}} S_{22})^2) \\ &\textit{Noise}^2 = (N_{\textit{T}} S_{21})^2 + N_{\textit{F}}^2 \end{split}$$

Equation 4: Forward Transmission Phase Uncertainty

$$\Delta S_{21(phase)} = \sin^{-1}\!\!\left(\frac{\sqrt{\left(Systematic + Stability\right)^2 + Noise^2}}{S_{21}}\right) + C_{TP1} + C_{TP2}$$

Where:

$$\begin{split} &Syste\ matic\ =\ E_{X\!F} + S_{21}(E_{T\!F} + E_{S\!F}S_{11} + E_{L\!F}S_{22} + E_{S\!F}E_{L\!F}S_{21}S_{12} + \sin(A_F)) \\ &Stability\ =\ \sqrt{C^2 + R^2} \\ &C^2\ =\ S_{21}^2(C_{T\!M\!A}^2 + C_{T\!M\!2}^2 + (C_{R\!1}S_{11})^2 + (C_{R\!2}S_{22})^2) \\ &R^2\ =\ S_{21}^2((R_{T\!1} + R_{R\!1}S_{11})^2 + (R_{T\!2} + R_{R\!2}S_{22})^2) \\ &Noise^2\ =\ (N_T S_{21})^2 + N_F^2 \end{split}$$

Reverse Reflection Uncertainty

Equation 5: Reverse Reflection Magnitude Uncertainty

$$\Delta S_{22(mag)} = \sqrt{(Systematic + Stability)^2 + Noise^2}$$

Where:

$$\begin{split} &\textit{Systematic} = E_{DR} + E_{RR}S_{22} + E_{SR}S_{22}^2 + E_{LR}S_{21}S_{12} + A_{M}S_{22} \\ &\textit{Stability} = \sqrt{C^2 + R^2} \\ &C^2 = C_{RM2}^2(1 + S_{22}^4) + 4C_{TM2}^2S_{22}^2 + C_{RM1}^2S_{21}^2S_{12}^2 \\ &R^2 = (R_{R2}(1 + S_{22}^2) + 2R_{T2}S_{22})^2 + (R_{R1}S_{21}S_{12})^2 \\ &\textit{Noise}^2 = (N_TS_{22})^2 + N_T^2 \end{split}$$

Equation 6: Reverse Reflection Phase Uncertainty

$$\Delta S_{22(yhase)} = \sin^{-1}\!\!\left(\frac{\sqrt{\left(Systematic + Stability\right)^2 + Noise^2}}{S_{22}}\right) + 2\,C_{TP2}$$

Where:

$$\begin{split} &Systematic = \ E_{DR} + E_{RR}S_{22} + E_{SR}S_{22}^2 + E_{LR}S_{21}S_{12} + \sin{(A_P)}S_{22} \\ &Stability = \sqrt{C^2 + R^2} \\ &C^2 = C_{RM2}^2(1 + S_{22}^4) + 4C_{IM2}^2S_{22}^2 + C_{RM1}^2S_{21}^2S_{12}^2 \\ &R^2 = \left(R_{R2}(1 + S_{22}^2) + 2R_{I2}S_{22}\right)^2 + \left(R_{R1}S_{21}S_{12}\right)^2 \\ &Noise^2 = \left(N_TS_{22}\right)^2 + N_T^2 \end{split}$$

Reverse Transmission Uncertainty

Equation 7: Reverse Transmission Magnitude Uncertainty

$$\Delta S_{12(mag)} = \sqrt{(Systematic + Stability)^2 + Noise^2}$$

Where:

$$\begin{aligned} &\textit{Sy stematic} = \ E_{\textit{XR}} + S_{12}(E_{\textit{TR}} + E_{\textit{SR}}S_{22} + E_{\textit{LR}}S_{11} + E_{\textit{SR}}E_{\textit{LR}}S_{21}S_{12} + A_{\textit{M}}) \\ &\textit{Stability} = \sqrt{C^2 + R^2} \\ &C^2 = \ S_{12}^2(C_{\textit{TM}1}^2 + C_{\textit{TM}2}^2 + (C_{\textit{R1}}S_{11})^2 + (C_{\textit{R2}}S_{22})^2) \\ &R^2 = \ S_{12}^2((R_{\textit{T1}} + R_{\textit{R1}}S_{11})^2 + (R_{\textit{T2}} + R_{\textit{R2}}S_{22})^2) \\ &\textit{Noise}^2 = \ (N_TS_{12})^2 + N_F^2 \end{aligned}$$

Equation 8: Reverse Transmission Phase Uncertainty

$$\Delta S_{12(phase)} = \sin^{-1}\!\!\left(\frac{\sqrt{\left(Systematic + Stability\right)^2 + Noise}^2}{S_{12}}\right) + C_{TP1} + C_{TP2}$$

Where:

$$\begin{split} &Syste\ matic\ =\ E_{XR} + S_{12}(E_{TR} + E_{SR}S_{22} + E_{LR}S_{11} + E_{SR}E_{LR}S_{21}S_{12} + \sin(A_P)) \\ &Stability\ =\ \sqrt{C^2 + R^2} \\ &C^2\ =\ S_{12}^2(C_{TM1}^2 + C_{TM2}^2 + (C_{R1}S_{11})^2 + (C_{R2}S_{22})^2) \\ &R^2\ =\ S_{12}^2((R_{T1} + R_{R1}S_{11})^2 + (R_{T2} + R_{R2}S_{22})^2) \\ &Noise^2\ =\ (N_TS_{12})^2 + N_F^2 \end{split}$$

Sources of Systematic Errors

The residual (after measurement calibration) **systematic errors** result from imperfections in the calibration standards

For **reflection measurements**, the associated residual errors are:

residual directivity residual load match residual source match residual reflection tracking

For transmission measurements, the additional residual errors are:

residual crosstalk residual load match

residual source match residual transmission tracking

The listing below shows the **abbreviations** used for residual systematic errors that are in the uncertainty equations.

 E_{DF} = forward residual directivity E_{SR} = reverse residual source match E_{RR} = reverse residual reflection tracking

 \mathbf{E}_{RF} = forward residual reflection tracking \mathbf{E}_{XR} = reverse crosstalk \mathbf{E}_{LR} = reverse load match

 $\begin{aligned} \textbf{E}_{\mathsf{LF}} &= \text{forward load match} \\ \textbf{E}_{\mathsf{TF}} &= \text{forward transmission tracking} \\ \textbf{E}_{\mathsf{DR}} &= \text{reverse residual directivity} \end{aligned} \qquad \begin{aligned} \textbf{E}_{\mathsf{TR}} &= \text{reverse transmission tracking} \\ \textbf{A}_{\mathsf{M}} &= \text{magnitude dynamic accuracy} \\ \textbf{A}_{\mathsf{P}} &= \text{phase dynamic accuracy} \end{aligned}$

All measurements are affected by **dynamic accuracy**. Dynamic accuracy includes: errors during internal self-calibration routines, gain compression in the microwave frequency converter (sampler) at high signal levels, errors generated in the synchronous detectors, localized non-linearities in the IF filter system, and from LO leakage into the IF signal paths.

Sources of Random Errors

The random error sources are

- noise
- connector repeatability
- interconnecting cable stability

There are two types of noise in any measurement system:

- 1. low level noise (noise floor)
- 2. high level noise (trace noise)

Low level noise is the broadband noise floor of the receiver which can be reduced through averaging or by changing the IF bandwidth.

High level noise or trace noise is due to the noise floor of the receiver, and the phase noise of the LO source inside the test set. It is worsened by reducing the IF bandwidth. Using a high stability 10 MHz time base can reduce high level noise.

A high stability time base is standard with PNA models E8356/7/8A and E8362/3/4A. It is available as Option 1E5 with PNA models E8801/2/3A and N3381/2/3A. Option 1E5 replaces a 10 ppm time base with a 1 ppm time base.

Connector repeatability is the random variation encountered when connecting a pair of RF connectors. Variations in both reflection and transmission can be observed.

Cable stability is dependent on the cable used and the amount of cable movement between calibration and measurement.

The listing below shows the **abbreviations** used for random errors in the error models and uncertainty equations.

 N_F = noise floor C_{TM2} = port 2 cable magnitude transmission

stability

 N_T = trace noise C_{TP2} = port 2 cable phase transmission stability

 C_{R1} = port 1 cable reflection stability R_{R1} = port 1 connector reflection repeatability

 C_{TM1} = port 1 cable magnitude transmission R_{T1} = port 1 connector transmission repeatability

stability

 C_{TP1} = port 1 cable phase transmission stability R_{R2} = port 2 connector reflection repeatability

 C_{R2} = port 2 cable reflection stability R_{T2} = port 2 connector transmission repeatability

Determining Expected System Performance

Improper connection techniques and contact surfaces can degrade measurement accuracy.

Proper connection techniques include using a torque wrench with proper torque limits, ensuring that the connector pin depths meet specifications, ensuring that the center conductor of sliding loads is properly set, and observing proper handling procedures for beadless airlines.

Contact surface errors are caused by improper cleaning procedures, scratches, worn plating, and rough seating.

View more information on connector care

If proper connection techniques and connector care is observed, the following table provides an indication of connector repeatability.

Connector Repeatabili	ty (R_{R1} , R_{R2} , R_{T1} , and R_{T2})				
Connector Type		Connector Type			
Frequency Range	Repeatability	Frequency Range Repeatability			
2.4-mm		3.5-mm			
0 to 2 GHz	0.0002	0 to 2 GHz	0.0001		
2 to 20 GHz	0.0004	2 to 8 GHz	0.0003		
20 to 36 GHz	0.0006	8 to 20 GHz	0.0006		
36 to 40 GHz	0.0008	20 to 26.5 GHz	0.0010		
7-mm		Type-N			
0 to 2 GHz	0.0001	0 to 2 GHz	0.0006		
2 to 8 GHz	0.0003	2 to 8 GHz	0.0006		
8 to 18 GHz	0.0006	8 to 18 GHz	0.0010		
Type-F		Waveguide	Waveguide		
0 to 3 GHz	0.0006	0 to 40 GHz	0.0002		

Determining Cable Stability Terms

 $(C_{R1}, C_{R2}, C_{TM1}, C_{TM2}, C_{TP1}, C_{TP2})$

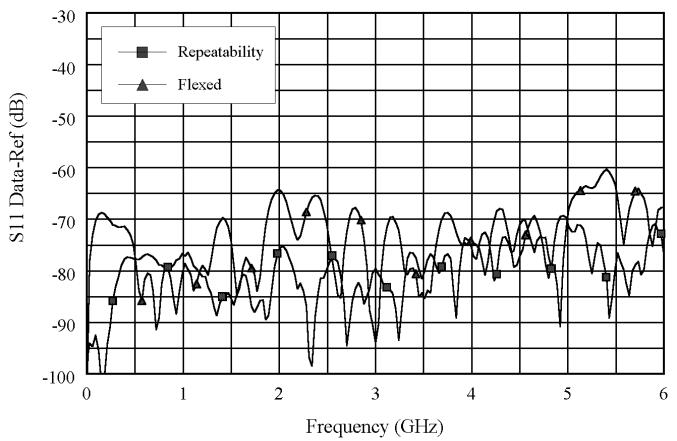
Cable stability is dependent on the cable used and the amount of cable movement between calibration and measurement. Values for **cable reflection stability** are determined by connecting a fixed load to the free end of the cable and measuring the change in reflection coefficient after flexing the cable through the normal range of cable movement for a particular setup. **Cable transmission stability** is determined by connecting a short to the free end of the cable and measuring the change in reflection coefficient due to changes in cable position.

Graphics 1-3 demonstrate concepts useful in determining cable stability. In each case, a cable (part number 8120-4779) was connected to port 1, with a fixed load connected to the free end. A reference trace is obtained by measuring S_{11} with the free end held close to port 2 and storing the results in memory. Two additional S_{11}

measurements are made; one with the cable flexed out to its straight position and the other with the cable positioned back to the same location as reference trace. As shown in Graphic 1, the flexed position demonstrates the effect of moving the cable after calibration. The repeatability trace demonstrates the stability of the cable when moved to its original position.

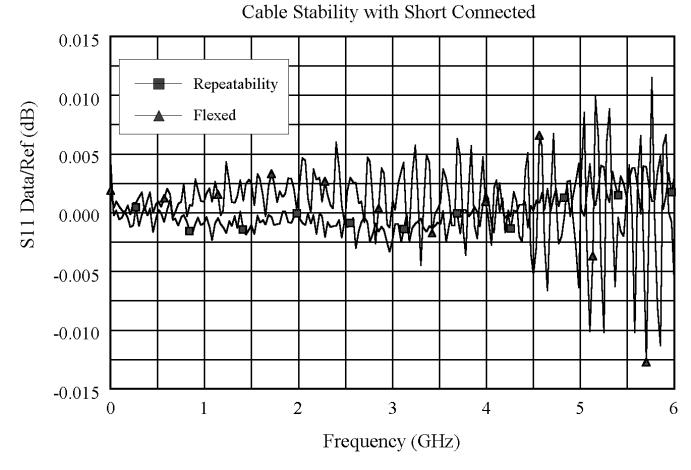
Graphic 1





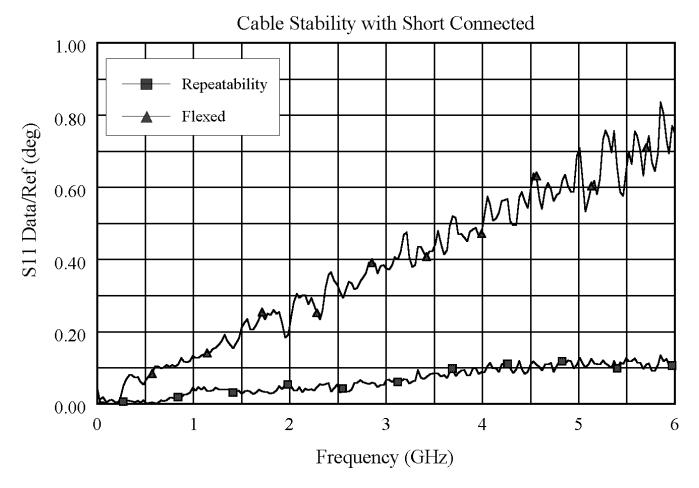
Graphic 1 demonstrates the concepts useful in determining cable reflection stability. A fixed load is connected to the free end. The DATA-MEM feature provides an indication of the cable reflection stability. A 60-dB peak on the chart yields a reflection stability estimated as $10^{(60/20)}$ or 0.001.

Graphic 2



Graphic 2 and Graphic 3 demonstrate the concepts useful in determining cable transmission stability. A short is connected to the free end. The DATA/MEM feature provides an indication of the two-way cable transmission stability. The one-way transmission magnitude stability is determined by dividing the two-way magnitude measurement by two before it is converted to linear. A 0.013-dB peak on the chart yields transmission magnitude stability estimated as $10^{(0.013/40)}$ 1 or 0.00075. The one-way transmission phase stability is determined by dividing the two-way phase measurement by two.

Graphic 3



Cable movement often has a much larger effect on phase measurements than magnitude measurements.

- Measurement Errors
- What is Measurement Calibration?
- Why is Calibration Necessary?