Agilent E4401B, E4402B, E4404B, E4405B, and E4407B ESA-E Series Spectrum Analyzers

Data Sheet

These specifications apply to the Agilent Technologies E4401B, E4402B, E4404B, E4405B, and E4407B spectrum analyzers.

Introduction

All specifications apply over 0 °C to + 55 °C unless otherwise noted and are covered by the product warranty. The analyzer will meet its specifications when: it's within the one year calibration cycle, AUTO ALIGN [ALL] is selected, stored a minimum 2 hours within the operating temperature range, turned on for at least 5 minutes, Align Now RF has been run once every 24 hour period. Characteristics describe product performance that is useful in the application of th product, but is not covered by the product warranty. Typical performance is beyond specifications that 80% of the units exhibit 95% confidence level over 20 to 30 °C not including measurement uncertainty and is not covered by the product warranty.

Frequency Specifications

Frequency range

E4401B		
50 Ω		9 kHz to 1.5 GHz
75 Ω		1 MHz to 1.5 GHz
E4402B		9 kHz to 3.0 GHz
dc coupled (Option UKB)		100 Hz[1] to 3 GHz
ac coupled (Option UKB)		100 kHz to 3 GHz
E4404B		
dc coupled		9 kHz to 6.7 GHz
dc coupled (Option UKB)		100 Hz[1] to 6.7 GHz
ac coupled		100 kHz to 6.7 GHz
Band		
0		9 kHz to 3.0 GHz
(Option UKB)		100 Hz[1] to 3.0 GHz
1		2.85 GHz to 6.7 GHz
E4405B		
dc coupled		9 kHz to 13.2 GHz
dc coupled (Option UKB)		100 Hz[1] to 13.2 GHz
ac coupled		100 kHz to 13.2 GHz
Band	N[2]	
0	1–	9 kHz to 3.0 GHz
0	(Option UKB)	100 Hz[1] to 3.0 GHz
1	1–	2.85 GHz to 6.7 GHz
2	2–	6.2 GHz to 13.2 GHz
E4407B		
Internal mixing		9 kHz to 26.5 GHz
dc coupled (Option UKB)		100 Hz[1] to 26.5 GHz
ac coupled (Option UKB)		10 MHz to 26.5 GHz
Band	N[2]	
0	1–	9 kHz to 3.0 GHz
0	(Option UKB)	100 Hz[1] to 3.0 GHz
1	1–	2.85 GHz to 6.7 GHz
2	2–	6.2 GHz to 13.2 GHz
3	4–	12.8 GHz to 19.2 GHz
4	4–	18.7 GHz to 26.5 GHz
External mixing (Option AYZ)		18 GHz to 325 GHz

1. 30 Hz characteristic

2. N = LO harmonic mixing load

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Frequency reference

		(Option 1D5)
Aging	±2 x 10^{-6}/year	±1 x 10^{-7}/year
Temperature stability	±5 x 10^{-6}	±1 x 10^{-8} (20 to 30 °C)
Settability	±5 x 10^{-7}	±1 x 10^{-8}

Frequency readout accuracy

(Start, Stop, Center, Marker) ±(frequency indication x frequency reference error[1] + span accuracy +15% of RBW + 10 Hz + 1 Hz x N^2)

Marker frequency counter[3]

Accuracy [4] ±(marker frequency ¥ frequency reference error[1] + counter resolution)

Counter resolution Selectable from 1 Hz to 100 kHz

Frequency span

Range 0 Hz (zero span), 100 Hz to the maximum frequency range of the analyzer

Resolution 2 Hz x N^2

Accuracy (> 2000 sweep points)

Sweep type Lin ±0.5% of span

Sweep type Log ±2.0% of span (characteristic)

Sweep time

Range

Span > 0 Hz	1 ms to 4000 s
Span = 0 Hz	10 µs[5] to 4000 s
(Option AYX)	50 ns[5] to 4000 s
(Option B7D)	25 ns[5] to 4000 s

Accuracy ±1%

Sweep trigger Free Run, Single, Line, Video, External, delay, Offset, Gate (Option 1D6), and TV (Option B7B)

Delay trigger range 1 µs to 400 s

Sweep (trace) point range

101 to 8192

Span = 0 Hz 2 to 8192

Resolution bandwidth

1 kHz to 5 MHz (–3 dB) in 1-3-10 sequence.
9 kHz and 120 kHz (–6 dB) EMI bandwidths.

Option 1DR Adds 10, 30, 100, and 300 Hz (–3 dB) bandwidths and 200 Hz (–6 dB) EMI bandwidth.

Option 1DR and 1D5[6] Adds 1, 3 Hz (for spans ≤ 5 MHz)

Accuracy

1 kHz to 3 MHz	±15%
5 MHz	±30%
1 Hz to 300 Hz (Option 1DR)	±10%

Selectivity (characteristic)

–60 dB/–3 dB

10 Hz to 300 Hz	< 5:1[7] digital, approximately Gaussian shape
1 kHz to 5 MHz	< 15:1[7] synchronously tuned four poles, approximately Gaussian shape

Video bandwidth range

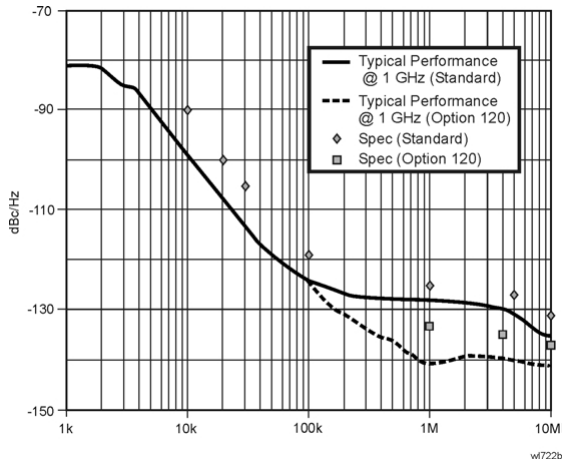
30 Hz to 3 MHz[7] in 1-3-10 sequence

Option 1DR Adds 1 Hz, 3 Hz, and 10 Hz (for RBW < 1 kHz)

Stability

Noise sidebands (1 kHz RBW, 30 Hz VBW and sample detector)

Offset from CW signal		Typical
E4401B		
≥ 1 kHz	na	≤ –79 dBc/Hz (Option 1D5)
≥ 10 kHz	≤ –93 dBc/Hz	≤ –95 dBc/Hz
≥ 20 kHz	≤ –100 dBc/Hz	≤ –102 dBc/Hz
≥ 30 kHz	≤ –104 dBc/Hz	≤ –106 dBc/Hz
≥ 100 kHz	≤ –113 dBc/Hz	≤ –116 dBc/Hz
E4402/04/05/07B		
≥ 1 kHz	na	≤ –78 dBc/Hz (Option 1D5)
≥ 10 kHz	≤ –90 dBc/Hz[8]	≤ –94 dBc/Hz[8]
≥ 20 kHz	≤ –100 dBc/Hz[8]	≤ –105 dBc/Hz[8]
≥ 30 kHz	≤ –106 dBc/Hz[8]	≤ –112 dBc/Hz[8]
≥ 100 kHz	≤ –118 dBc/Hz[8]	≤ –122 dBc/Hz[8]
≥ 1 MHz	≤ –125 dBc/Hz[8]	≤ –127 dBc/Hz[8]
≥ 5 MHz	≤ –127 dBc/Hz[8]	≤ –129 dBc/Hz[8]
≥ 10 MHz	≤ –131 dBc/Hz[8]	≤ –136 dBc/Hz[8]
Option 120		
≥ 1 MHz	≤ –133 dBc/Hz[8]	≤ –136 dBc/Hz[8]
≥ 5 MHz	≤ –135 dBc/Hz[8]	≤ –139 dBc/Hz[8]
≥ 10 MHz	≤ –137 dBc/Hz[8]	≤ –141 dBc/Hz[8]



Residual FM

1 kHz RBW, 1 kHz VBW	≤ 150 x N^2 Hz pk-pk in 100 ms
Option 1D5	≤ 100 x N^2 Hz pk-pk in 100 ms
Option 1DR	≤ 10 x N^2 Hz^7 pk-pk in 20 ms
Option 1DR and 1D5	≤ 2 x N^2 Hz pk-pk in 20 ms

System-related sidebands

≥ 30 kHz offset from CW signal ≤ –65 dBc + 20 Log N^2

1. Frequency reference error = (aging rate x period of time since adjustment + settability + temperature stability).
2. N = LO harmonic mixing mode.
3. Not available in RBW < 1 kHz (Option 1DR).
4. Marker level to DANL > 25 dB, RBW/span ≥ 0.002.
5. RBW ≥ 1 kHz, 2 sweep points.
6. Only available with firmware revision A.08.00 or later.
7. Characteristic
8. Add 20 log (N) for frequencies > 6.7 GHz.

Amplitude Specifications

Amplitude range

Measurement range	Displayed average noise level (DANL) to maximum safe input level
Input attenuator range	
E4401B	0 to 60 dB, in 5 dB steps
E4402B/04B/05B	0 to 65 dB (75 dB[1]), in 5 dB steps
E4407B	0 to 65 dB, in 5 dB steps
Trace detectors	Peak,negative peak, sample, rms[2], average[2]

Maximum safe input level

Average continuous power	
	(Input attenuator ≥ 15 dB)
E4401B	+30 dBm (1 Ω)
E4401B (75 Ω Option 1DP)	+75 dBmV (0.4 Ω)
	(Input attenuator ≥ 5 dB)
E4402B/04B/05B/07B	+30 dBm (1 Ω)
Peak pulse power	
	(Input attenuator ≥ 30 dB)
E4401B	+30 dBm (1 Ω)
E4401B (75 Ω Option 1DP)	+75 dBmV (0.4 Ω)
E4402B/04B/05B/07B	+50 dBm (100 Ω)
dc power	
E4401B, E4402B	100 Vdc
E4401B (75 Ω Opt. 1DP)	100 Vdc
E4402B (Option UKB)	0 Vdc (dc coupled) 50 V (ac coupled)
E4404B, E4405B	0 Vdc (dc coupled) 50 V (ac coupled)
E4407B	0 Vdc

1 dB gain compression (total power at input mixer[3])

50 MHz to 6.7 GHz	0 dBm
6.7 GHz to 13.2 GHz	–3 dBm
13.2 GHz to 26.5 GHz	–5 dBm

Displayed average noise level (DANL) (dBm)

(Input terminated, 0 dB attenuation, sample detector)
1 kHz RBW; 30 Hz VBW
10 Hz RBW; 1 Hz VBW (Option 1DR)
1 Hz RBW; 1 Hz VBW (Option 1DR and 1D5)[4]

	1 kHz RBW	10 Hz RBW (Option 1DR)	10 Hz RBW (Option 1DR) (w/preamp Option 1DS)	10 Hz RBW (Option 1DR) (w/preamp Option 1DS) typical	1Hz RBW (Option 1DR and 1D5)[4] typical	1Hz RBW (Option 1DR and 1D5)[4] (w/preamp Option 1DS)
E4401B						
400 kHz to 10 MHz	≤ –115	≤ –134	≤ –150	≤ –155	≤ –149	≤ –165
10 MHz to 500 MHz	≤ –119	≤ –138	≤ –154	≤ –156	≤ –151	≤ –166
500 MHz to 1 GHz	≤ –117	≤ –136	≤ –152	≤ –156	≤ –150	≤ –166
1 GHz to 1.5 GHz	≤ –114	≤ –133	≤ –150	≤ –155	≤ –148	≤ –165
E4402B						
30 Hz to 9 kHz[5] (Option UKB)	na	≤ –93	na	na	≤ –103	na
9 kHz to 100 kHz[5]	na	≤ –109	na	na	≤ –119	na
100 kHz to 1 MHz[5]	na	≤ –135	na	na	≤ –145	na
1 MHz to 10 MHz[5]	≤ –120[6]	≤ –139[6]	na	≤ –152	≤ –149[6]	≤ –162[7]
10 MHz to 1 GHz	≤ –117	≤ –136	≤ –152[7]	≤ –156	≤ –150	≤ –166[7]
1 GHz to 2 GHz	≤ –116	≤ –135	≤ –153[7]	≤ –156	≤ –150	≤ –166[7]
2 GHz to 3 GHz	≤ –114	≤ –133	≤ –151[7]	≤ –154	≤ –150	≤ –164[7]
E4404/05B/07B						
30 Hz to 9 kHz[5] (Option UKB)	na	≤ –93	na	na	≤ –103	na
9 kHz to 100 kHz[5]	na	≤ –109	na	na	≤ –119	na
100 kHz to 1 MHz[5]	na	≤ –135	na	na	≤ –145	na
1 MHz to 10 MHz[5]	≤ –120[6]	≤ –139[6]	na	≤ –155	≤ –149[6]	≤ –165[7]
10 MHz to 1 GHz	≤ –116	≤ –135	≤ –151[7]	≤ –157	≤ –149	≤ –167[7]
1 GHz to 2 GHz	≤ –116	≤ –135	≤ –151[7]	≤ –155	≤ –150	≤ –165[7]
2 GHz to 3 GHz	≤ –112	≤ –131	≤ –149[7]	≤ –152	≤ –148	≤ –162[7]
3 GHz to 6 GHz	≤ –112	≤ –131	na	≤ –138	≤ –148	na
6 GHz to 12 GHz	≤ –111	≤ –130	na	≤ –137	≤ –147	na
12 GHz to 22 GHz	≤ –107	≤ –126	na	≤ –134	≤ –107	na
22 GHz to 26.5 GHz	≤ –106	≤ –125	na	≤ –132	≤ –142	na
E4407B (Option AYZ)						
External mixer[1]	≤ –134 + external mixer	≤ –153 + external mixer	na	na	na	na

1. Characteristic
2. Detector not available in resolution bandwidth filters less than 1 KHz
3. Mixer power level (dBm) = input power (dBm) minus input attenuation (dB).
4. Only available with firmware revision A.08.00 or later.
5. Typical
6. Typical (Option 120)
7. 20 to 30 °C

Display range

Log scale	0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1dB steps; ten divisions displayed.
RBW ≥ 1 kHz	0 to -85 dB from reference level is calibrated
RBW ≤ 300 Hz (Option 1DR)	0 to –120[1] dB from reference level is calibrated
Linear scale	10 divisions
Scale units	dBm, dBmV, dBµV, Volts, dBµA, A, and Watts
(Option BAA, 106)	Add Hz

Marker readout resolution

Log scale	
0 to –85 dB	0.04 dB
0 to –120 dB (Option 1DR)	0.04 dB
Linear scale	0.01% of reference level

Fast sweep times for zero span (Option AYX)
(sweeptimes ≤ sweep points –1/100 kHz)

Log scale	
0 to –85 dB	0.3 dB
Linear	0.3% of reference level

Fast sweep times for zero span (Option B7D)
(sweeptimes ≤ sweep points –1/100 kHz)
sample rate < 40 MHz

Log scale	
0 to –85 dB	0.2 dB
Linear	0.2% of reference level

sample rate ≥ 40 MHz

Log scale	
0 to –85dB	0.3 dB
Linear	0.3% of reference level

Frequency response (10 dB input attenuation)

	Absolute[2]	Typical	Relative flatness[3]
E4401B			
9 kHz to 1.5 GHz	±0.5 dB	na	±0.5 dB
E4402B/04B/05B/07B			
30 Hz to 3 GHz[4] (Option UKB)	±0.5 dB	na	±0.5 dB
9 kHz to 3.0 GHz	±0.46 dB	±0.14 dB	±0.5 dB
3.0 GHz to 6.7 GHz	±1.5 dB	±0.38 dB	±1.3 dB
6.7 GHz to 13.2 GHz	±2.0 dB	±0.68 dB	±1.8 dB
13.2 GHz to 26.5 GHz	±2.0 dB	±0.86 dB	±1.8 dB

Input attenuation switching uncertainty at 50 MHz

Attenuation setting	
0 dB to 5 dB	±0.3 dB
10 dB	reference
15 dB	±0.3 dB
20 to 60 dB (E4401B)	±(0.1 dB + 0.01 x attenuator setting)
20 to 65 dB	±(0.1 dB + 0.01 x attenuator setting)

Absolute amplitude accuracy

		Typical
At reference settings[5]	±0.34 dB	±0.13 dB
E4401B	±0.30 dB	±0.10 dB
Preamp on[6] (Option 1DS)	±0.37 dB	±0.14 dB
External mixer (Option AYZ)	IF INPUT absolute amplitude accuracy + external mixer conversion loss accuracy[7]	
Overall amplitude accuracy[8]	±(0.54 dB + absolute frequency response)	

RF input VSWR[4] (at tuned frequency, 10 dB attenuation)

E4401B	
1 MHz to 1.5 GHz	1.35:1
E4402B	
100 Hz to 100 kHz	1.1:1 (Option UKB)
9 kHz to 100 kHz	2:1
100 kHz to 3 GHz	1.4:1
E4404B/05B	
100 Hz to 100 kHz	1.1:1 (Option UKB)
9 kHz to 100 kHz	2:1
100 kHz to 6.7 GHz	1.3:1
6.7 GHz to 13.2 GHz	1.5:1
E4407B	
100 Hz to 100 kHz	1.1:1 (Option UKB)
9 kHz to 6.7 GHz	1.3:1
6.7 GHz to 13.2 GHz	1.5:1
13.2 GHz to 22 GHz	2:1
22 GHz to 26.5 GHz	2.2:1

Resolution bandwidth switching uncertainty

(at reference level)

1 kHz RBW	Reference
1 Hz to 3 Hz[9]	±0.3 dB
10 Hz to 3 MHz RBW	±0.3 dB
5 MHz RBW	±0.6 dB

Reference level

Range	–149.9 dBm to maximum mixer level + attenuator setting
Resolution	
Log scale	±0.1 dB
Linear scale	±0.12% of reference level
Accuracy (reference level	±0.3 dB (–10 dBm to –60 dBm)
– attenuator setting	±0.5 dB (–60 dBm to –85 dBm)
+ preamp gain)	±0.7 dB (–85 dBm to –90 dBm)

1. 0 to –70 dB range when span = 0 Hz, when RBW = 200 Hz, or when auto ranging is off.
2. Referenced to 50 MHz amplitude reference (20 °C to 30 °C).
3. Referenced to midpoint between highest and lowest frequency response deviations (20 °C to 30 °C).
4. Characteristic
5. Reference level –25 dBm (E4401B) or –20 dBm (E4402B/04B/05B/07B); (75 Ω reference level + 28.75 dBmV); input attenuation 10 dB; center frequency 50 MHz; RBW 1 kHz; VBW 1 kHz; scale linear or log; span 2 kHz; sweep time coupled, sample detector, signal at reference level.
6. Reference level –30 dBm; (75 Ω reference level + 18.75 dBmV); input attenuation 0 dB; center frequency 50 MHz; RBW 1 kHz; VBW 1 kHz; scale linear or log; span 2 kHz; sweep time coupled, signal at reference level.
7. Preselector centered with the Agilent 11974-series
8. For reference levels 0 to –50 dBm; input attenuation 10 dB; 1 kHz RBW; 1 kHz video BW; log scale; log range, 0 to 50 dB; coupled sweep time; sample detector; signal input, 0 to –50 dBm; span = 20 kHz; internal mixing (20 °C to 30 °C).
9. Only available with firmware revision A.08.00 or later.

Display scale fidelity
Log maximum cumulative

RBW ≥ 1 KHz

dB below reference level		Typical
0 dB (reference)	±0.00 dB	±0.00 dB
> 0 to 10 dB	±0.30 dB	±0.08 dB
> 10 to 20 dB	±0.40 dB	±0.09 dB
> 20 to 30 dB	±0.50 dB	±0.10 dB
> 30 to 40 dB	±0.60 dB	±0.23 dB
> 40 to 50 dB	±0.70 dB	±0.35 dB
> 50 to 60 dB	±0.70 dB	±0.35 dB
> 60 to 70 dB	±0.80 dB	±0.39 dB
> 70 to 80 dB	±0.80 dB	±0.46 dB
> 80 to 85 dB	±1.15 dB	±0.79 dB

RBW ≤ 300 Hz, (Option 1DR)(span > 0 Hz)

0 dB to 98 dB[1]	±(0.3 dB + 0.01 x dB from reference level)
≥ 98 to 120 dB	±(2.0 dB from reference level)[2]
Log incremental accuracy	
0 dB to 80 dB	±0.4dB/4dB from reference level
Linear accuracy	±2% of reference level

Linear-to-log switching Uncertainty
±0.15 dB at reference level

W-CDMA adjacent channel

Power ratio [3]
Dynamic range[4]

Offset frequency	Standard	Option 120	Option 120 with noise correction on
5 MHz	–60.0 dBc	–65.0 dBc	–66.5 dBc
10 MHz	–64.5 dBc	–65.5 dBc	–67.0 dBc

Spurious responses
Second harmonic distortion

E4401B	
2 MHz to 750 MHz	< –75 dBc for –40 dBm tone at input mixer[5]. (+35 dBm SHI)
E4402/04/05/07B	
10 MHz to 500 MHz	< –65 dBc for –30 dBm tone at input mixer[5].
500 MHz to 1.5 GHz	< –75 dBc for –30 dBm tone at input mixer[6]. (+45 dBm SHI)
1.5 GHz to 2.0 GHz	< –85 dBc for –10 dBm tone at input mixer[6].
> 2.0 GHz	< –100 dBc for –10 dBm tone at input mixer[5] (or below displayed average noise level).

Third-order intermodulation distortion

E4401B	
10 MHz to 1.5 GHz	< –87 dBc for two –30 dBm tones at input mixer[5] and > 50 kHz separation. (+13.5 dBm TOI, +19 dBm typical)
E4402B/04B/05B/07B	
100 MHz to 3.0 GHz	< –85 dBc for two –30 dBm tones at input mixer[5] and > 50 kHz separation. (+12.5 dBm TOI, +16 dBm typical)
> 3.0 GHz to 6.7 GHz	< –82 dBc for two –30 dBm tones at input mixer[5] and > 50 kHz separation. (+11 dBm TOI, +18 dBm typical)
> 6.7 GHz	< –75 dBc for two –30 dBm tones at input mixer[5] and > 50 kHz separation.
Other input-related spurious	
> 30 kHz offset	< –65 dBc for –20 dBm tone at input mixer[5].

Residual responses (input terminated and 0 dB attenuation)
150 kHz to 6.7 GHz < –90 dBm

Amplitude reference output
E4402B/04B/05B/07B –20 dBm (nominal), 50 MHz

General Specifications

Temperature range

Operating	0 °C to + 55 °C
Storage	–40 °C to + 75 °C

EMI compatibility
Conducted and radiated interference is in compliance with CISPR Pub. 11/1990 Group 1 Class A
(Option 060) CISPR Pub. 11/1990 Group 1 Class B[7]

Audible noise
< 40 dBa pressure and < 4.6 bels power (ISODP7779)

Military specification
Type tested to the environmental specifications of MIL-PRF-28800F class 3.

Power requirements

ON (line 1)	90 to 132 V rms, 47 to 440 Hz 195 to 250 V rms, 47 to 66 Hz Power consumption < 300 Ω
Standby (line 0)	Power consumption < 5 Ω
dc operation	
Voltage	12 to 20 Vdc
Power consumption	< 200 Ω

Data storage (nominal)

Internal[8]	8.0 MB
External[8] (10 to 40 °C)	3.5" 1.44 MB, MS-DOS compatible floppy disk

Memory usage(nominal)

State	16 kB[8]
State plus 401-point trace	20 kB[8]

Weight[2] (without options)

E4401B	13.2 kg (29.1 lbs.)
E4402B	15.5 kg (34.2 lbs.)
E4404B/05B/07B	17.1 kg (37.7 lbs.)

1. 0 to 30 dB for RBW = 200 Hz.
2. Characteristic
3. Firmware revision A.07.00 or higher.
4. Characteristic. Measured by selecting "Measure, ACP", 20 to 30°C, 3GPP (3.1 Dec 1999) W-CDMA signal with 1 DPCH,channel power –9 dBm/3.84 MHz, integration bandwidth 3.84 MHz, carrier frequency 2 GHz, reference level –16 dBm, input attenuation 0 dB, RBW 30 kHz. Noise correction can be turned on by selecting Meas Setup, More, Noise Corr On.
5. Mixer power level (dBm) = input power (dBm) minus input attenuation (dB).
6. Not available in RBW <1 kHz (Option 1DR).
7. Meeting class A performance during dc operation.
8. For serial numbers < US4144000 or < MY41440000, 1 MB without Option B72, 8 MB with Option B72. 401 sweep points. The size of a state will increase depending on the installed application(s).

Dimensions

Without handle	222mm(H) x 409mm(D) x 373mm(W)
With handle (maximum)	222mm(H) x 516mm(D) x 416mm(W)

Measurement speed

	E4401B	E4402B	E4404B E4405B E4407B
Local measurement rate[1]	≥ 50/sec	≥ 45/sec	≥ 40/sec
Remote measurement and GPIB transfer rate[2]	≥ 45/sec	≥ 45/sec	≥ 40/sec
RF center frequency tuning time [3]	≤ 75 ms	≤ 75 ms	≤ 75 ms

Inputs/Outputs

Front panel

INPUT	50 Ω Type N (f)
Option 1DP	75 Ω BNC (f)
Option BAB	50 Ω APC 3.5 (m)
RF OUT	50 Ω Type N (f)
Option 1DP	75 Ω BNC (f)
PROBE POWER	+15 Vdc, –12.6 Vdc at 150 mA[4] maximum
EXT KEYBOARD	6-pin mini-DIN, PC keyboards (for entering screen titles and file menus)
Speaker	front-panel knob controls volume
Headphone jack	3.5mm (1/8 inch) miniature audio
Power output	0.2 Ω into 4 Ω[4]
AMPTD REF OUT	50 Ω[5], BNC (f)
IF INPUT (Option AYZ)	50 Ω[5], SMA (f)
LO OUTPUT (Option AYZ)	50 Ω[5], SMA (f)

Rear panel

10 MHz REF OUT	50 Ω[5], BNC (f), > 0 dBm[4]
10 MHz REF IN	50 Ω[5], BNC (f), –15 to +10 dBm[4]
GATE TRIG/EXT TRIG IN	BNC (f), 5 V TTL
GATE/HI SWP OUT	BNC (f), 5 V TTL
VGA OUTPUT	VGA compatible monitor, 15–pin mini D-SUB, (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) Analog RGB 640 x 480

IF, sweep and video ports (Option A4J or AYX)

AUX IF OUT	BNC (f), 21.4 MHz, nominal –10 to –70 dBm[5] (uncorrected)
AUX VIDEO OUT	BNC (f), 0 to 1 V[4] (uncorrected)
HI SWP IN	BNC (f), low stops sweep, (5 V TTL)
HI SWP OUT	BNC (f), (5 V TTL)
SWP OUT	BNC (f), 0 to +10 V[4] ramp

GPIB interface
(Option A4H) IEEE-488 bus connector

Serial interface
(Option 1AX) RS-232, 9-pin D-SUB (m)

Parallel interface
(Option A4H or 1AX) 25-pin D-SUB (f), printer port only

Option Specifications

Option 1D6 time-gated spectrum analysis

Gate delay/length

Range	1 µs to 400 s
Resolution	< gate delay(s)/65000; rounded up to nearest µs
Accuracy	±(500 ns + 0.01% x gate delay readout)

Option 1DN and 1DQ tracking generator

Frequency range

E4401B	
Option 1DN, (50 Ω)	9 kHz to 1.5 GHz
Option 1DQ, (75 Ω)	1 MHz to 1.5 GHz
E4402B/04B/05B/07B	
Option 1DN, (50 Ω)	9 kHz to 3.0 GHz

RBW range 1 kHz to 5 MHz

Output power level range

E4401B	
Option 1DN	0 to –70 dBm
Option 1DQ	+42.75 to –27.25 dBmV
E4402B/04B/05B/07B	
Option 1DN	–2 to –66 dBm

Output vernier range

E4401B	10 dB
E4402B/04B/05B/07B	8 dB

Output attenuator range

E4401B	0 to 60 dB, 10 dB steps
E4402B/04B/05B/07B	0 to 56 dB, 8 dB steps

Output flatness

E4401B	
Option 1DN, (50 Ω)	
9 kHz to 10 MHz	±2.0 dB
10 MHz to 1.5 GHz	±1.5 dB
Option 1DQ, (75 Ω)	
1 MHz to 10 MHz	±2.5 dB
1 MHz to 10 MHz	±2.0 dB
E4402B/04B/05B/07B	
9 kHz to 10 MHz	±3.0 dB
10 MHz to 3.0 GHz	±2.0 dB

1. Characteristic; factory preset, fixed center frequency, sweep points = 101, auto align off, RBW = 1 MHz, stop frequency ≤ 3 GHz, span > 10MHz and ≤ 600 MHz (E4401B, span > 102 MHz and ≤ 400 MHz).
2. Characteristic; factory preset, fixed center frequency, sweep points = 101, auto align off, RBW = 1 MHz, stop frequency = 3 GHz, span = 20 MHz, GPIB interface, display and markers off, fixed center frequency, single sweep.
3. Characteristic; includes center frequency tuning + measurement + GPIB transfer times, stop frequency ≤ 3GHz, sweep points = 101, display and markers off, single sweep.
4. Characteristic
5. Nominal

Effective source match (characteristic)

E4401B	< 2.5:1
E4402B/04B/05B/07B	< 2.0:1 (0 dB attenuator) < 1.5:1 (8 dB attenuator)

Spurious output

Harmonic spurs

E4401B	
(0 dBm output)	
9 kHz to 20 MHz	< –20 dBc
20 MHz to 1.5 GHz	< –25 dBc
E4402B/04B/05B/07B	
(–1 dBm output)	
20 kHz to 3 GHz	< –25 dBc

Non-Harmonic spurs

E4401B	< –35 dBc
E4402B/04B/05B/07B	
9 kHz to 2 GHz	< –27 dBc
2 GHz to 3 GHz	< –23 dBc

Dynamic range

Maximum output power – displayed average noise level

Output power sweep range

E4401B	
Option 1DN	(–15 dBm to 0 dBm) – (source attenuator setting)
Option 1DQ	(+27.75 dBmV to +42.75 dBmV) – (source attenuator setting)
E4402B/04B/05B/07B	
Option 1DN	(–10 dBm to –2 dBm) – (source attenuator setting)

Option 1DS preamp

Frequency range

E4401B	100 kHz to 1.5 GHz
E4402B/04B/05B/07B	1 MHz to 3 GHz

Gain +20 dB[1]

Noise figure

E4401B	4 dB[2]
E4402B/04B/05B/07B	5 dB[2]

Option AYZ external mixing

LO OUTPUT

Frequency range	2.9 to 7.1 GHz
Power	
2.9 to 6.1 GHz	15 to 17.5 dBm at the mixer
2.9 to 7.1 GHz	13 to 17.5 dBm
VSWR	< 1.9:1

IF INPUT

Frequency range	321.4 MHz ±5 MHz
Maximum safe input level	10 dBm (ac), ±10 V (dc)
VSWR	< 1.9:1.6

Absolute amplitude accuracy[3]
(reference levels from –10 to –60 dB)

Amplitude corrections

	20 °C to 30 °C	0 °C to 55 °C
15 to 30 dB	1.0 dB	1.5 dB
> 30 to 50 dB	1.2 dB	1.7 dB
> 50 to 60 dB	1.4 dB	1.9 dB

1 dB gain compression level –20 dBm with –10 dBm reference level and 0 dB

Mixer bias (IF INPUT)

Voltage

Maximum range	±3.3 V
Linear compliant range	±2 V

Current (0 Ω load)

Range	±10 mA
Resolution	< 20 mA
Accuracy	± (3% + resolution)
Output impedance	490 Ω[1]

Option BAA FM demodulation[2]

Optimum input level ≥ (–60 dBm + attenuator setting–preamp gain) and within 30 dB of the reference level

FM deviation (FM gain)

Range	10 kHz to 1 MHz
Resolution	provides 1 Hz display annotation resolution
FM deviation range	
10 kHz to 40 kHz	12 Hz
> 40 kHz to 200 kHz	60 Hz
> 200 kHz to 1 MHz	300 Hz
Accuracy[4]	< (2% of FM deviation range + 2 x resolution)

FM bandwidth (–3 dB)

FM deviation range	
10 kHz to 40 kHz	7.5 x FM deviation range
> 40 kHz to 200 kHz	1.3 x FM deviation range
> 200 kHz to 1 MHz	0.3 x FM deviation range

Option B7B TV trigger and picture on screen

Amplitude requirements[2]

TV source: SA	Top 50% of linear display
TV source: EXT VIDEO IN	500 mVp-p to 2 Vp-p
Compatible standards	NTSC-M, NTSC-Japan PAL-M, PAL-B, D, G, H, I, PAL-N, PAL-N combination, SECAM-L
Field selection	Entire frame, even, odd
TV trigger line selection	1 to 625

1. Nominal
2. Characteristic
3. RBW 1 kHz; VBW 1 kHz; scale linear or log; span 2 kHz; sweep time coupled; sample detector; signal at reference level.
4. In time-domain sweeps.

Option Ordering Information

For information on ordering options, please refer to the ESA/EMC Spectrum Analyzer Configuration Guide (literature number 5968-3412E).

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