

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

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

### Data Sheet

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 waranty. 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

<b>E4401B</b>		
50 Ω		9 kHz to 1.5 GHz
75 Ω		1 MHz to 1.5 GHz
<b>E4402B</b>		
dc coupled (Option UKB)		9 kHz to 3.0 GHz
ac coupled (Option UKB)		30 Hz <sup>6</sup> to 3 GHz
<b>E4404B</b>		
dc coupled		9 kHz to 6.7 GHz
dc coupled (Option UKB)		30 Hz <sup>6</sup> to 6.7 GHz
ac coupled		100 kHz to 6.7 GHz
Band		
0		9 kHz to 3.0 GHz
(Option UKB)		100 Hz to 3.0 GHz
1		2.85 GHz to 6.7 GHz
<b>E4405B</b>		
dc coupled		9 kHz to 13.2 GHz
dc coupled (Option UKB)		30 Hz <sup>6</sup> to 13.2 GHz
ac coupled		100 kHz to 13.2 GHz
Band	N <sup>4</sup>	
0	1-	9 kHz to 3.0 GHz
0	(Option UKB)	30 Hz <sup>6</sup> to 3.0 GHz
1	1-	2.85 GHz to 6.7 GHz
2	2-	6.2 GHz to 13.2 GHz
<b>E4407B</b>		
Internal mixing		9 kHz to 26.5 GHz
dc coupled (option UKB)		30 Hz <sup>6</sup> to 26.5 GHz
ac coupled (option UKB)		10 MHz to 26.5 GHz
Band	N <sup>4</sup>	
0	1-	9 kHz to 3.0 GHz
0	(option UKB)	30 Hz <sup>6</sup> 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



## Frequency reference

		(Option 1D5)
Aging	$\pm 2 \times 10^{-6}/\text{year}$	$\pm 1 \times 10^{-7}/\text{year}$
Temperature stability	$\pm 5 \times 10^{-6}$	$\pm 1 \times 10^{-8}$ (20 to 30 °C)
Settability	$\pm 5 \times 10^{-7}$	$\pm 1 \times 10^{-8}$

## Frequency readout accuracy

(Start, Stop, Center, Marker)	$\pm(\text{frequency indication} \times \text{frequency reference error}^1 + \text{span accuracy} + 15\% \text{ of RBW} + 10 \text{ Hz} + 1 \text{ Hz} \times N^4)$
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## Marker frequency counter<sup>2</sup>

Accuracy <sup>3</sup>	$\pm(\text{marker frequency} \times \text{frequency reference error}^1 + \text{counter resolution})$
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 $\times N^4$
Accuracy (>2000 sweep points)	$\pm 0.5\%$ of span

## Sweep time

Range	
Span >0 Hz	1 ms to 4000 s
Span = 0 Hz (Option AYX) (Option B7D)	10 $\mu$ s to 4000 s 50 ns to 4000 s 25 ns to 4000 s
Accuracy	$\pm 1\%$
Sweep trigger	Free Run, Single, Line, Video, External, delay, Offset, Gate (Option 1D6), and TV (Option B7B)
Delay trigger range	1 $\mu$ s to 400 s

## Sweep (trace) point range

Span = 0 Hz	101 to 8192 2 to 8192
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## 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. (for spans $\leq 5$ MHz)
Accuracy	
1 kHz to 3 MHz	$\pm 15\%$
5 MHz	$\pm 30\%$
10 Hz to 300 Hz (Option 1DR)	$\pm 10\%$

## Selectivity (characteristic)

-60 dB/-3 dB	
10 Hz to 300 Hz	$< 5:1^6$ digital, approximately Gaussian shape
1 kHz to 5 MHz	$< 15:1^6$ synchronously tuned four poles, approximately Gaussian shape

## Video bandwidth range

	30 Hz to 3 MHz <sup>6</sup> in 1-3-10 sequence
Option 1DR	Adds 1 Hz, 3 Hz, and 10 Hz (for RBW $\leq 1$ kHz)

## Stability

Noise sidebands (1 kHz RBW, 30 Hz VBW and sample detector)  
Offset from CW signal **Typical**

### E4401B

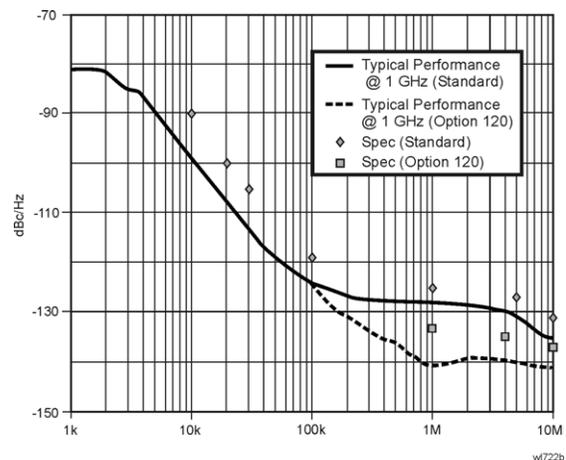
$\geq 1$ kHz	na	$\leq -79$ dBc/Hz (Option 1D5)
$\geq 10$ kHz	$\leq -93$ dBc/Hz	$\leq -95$ dBc/Hz
$\geq 20$ kHz	$\leq -100$ dBc/Hz	$\leq -102$ dBc/Hz
$\geq 30$ kHz	$\leq -104$ dBc/Hz	$\leq -106$ dBc/Hz
$\geq 100$ kHz	$\leq -113$ dBc/Hz	$\leq -116$ dBc/Hz

### E4402/04/05/07B

$\geq 1$ kHz	na	$\leq -78$ dBc/Hz (Option 1D5)
$\geq 10$ kHz	$\leq -90$ dBc/Hz <sup>21</sup>	$\leq -94$ dBc/Hz <sup>21</sup>
$\geq 20$ kHz	$\leq -100$ dBc/Hz <sup>21</sup>	$\leq -105$ dBc/Hz <sup>21</sup>
$\geq 30$ kHz	$\leq -106$ dBc/Hz <sup>21</sup>	$\leq -112$ dBc/Hz <sup>21</sup>
$\geq 100$ kHz	$\leq -119$ dBc/Hz <sup>21</sup>	$\leq -122$ dBc/Hz <sup>21</sup>
$\geq 1$ MHz	$\leq -125$ dBc/Hz <sup>21</sup>	$\leq -127$ dBc/Hz <sup>21</sup>
$\geq 5$ MHz	$\leq -127$ dBc/Hz <sup>21</sup>	$\leq -129$ dBc/Hz <sup>21</sup>
$\geq 10$ MHz	$\leq -131$ dBc/Hz <sup>21</sup>	$\leq -136$ dBc/Hz <sup>21</sup>

### Option 120

$\geq 1$ MHz	$\leq -133$ dBc/Hz <sup>21</sup>	$\leq -136$ dBc/Hz <sup>21</sup>
$\geq 5$ MHz	$\leq -135$ dBc/Hz <sup>21</sup>	$\leq -139$ dBc/Hz <sup>21</sup>
$\geq 10$ MHz	$\leq -137$ dBc/Hz <sup>21</sup>	$\leq -141$ dBc/Hz <sup>21</sup>



## Residual FM

1 kHz RBW, 1 kHz VBW	$\leq 150 \times N^4$ Hz pk-pk in 100 ms
Option 1D5	$\leq 100 \times N^4$ Hz pk-pk in 100 ms
Option 1DR	$\leq 10 \times N^4$ Hz <sup>6</sup> pk-pk in 20 ms
Option 1DR and 1D5	$\leq 2 \times N^4$ Hz pk-pk in 20 ms
System-related sidebands	
$\geq 30$ kHz offset from CW signal	$\leq -65$ dBc + 20 Log $N^4$

## 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 <sup>6</sup> ), in 5 dB steps
E4407B	0 to 65 dB, in 5 dB steps

## Maximum safe input level

Average continuous power

	(input attenuator $\geq 15$ dB)
E4401B	+30 dBm (1 W)
E4401B (75 $\Omega$ Option 1DP)	+75 dBmV (0.4 W)
	(input attenuator $\geq 5$ dB)
E4402B/04B/05B/07B	+30 dBm (1 W)
Peak pulse power	(input attenuator $\geq 30$ dB)
E4401B	+30 dBm (1 W)
E4401B (75 $\Omega$ Option 1DP)	+75 dBmV (0.4 W)
E4402B/04B/05B/07B	+50 dBm (100 W)

dc

E4401B, E4402B	100 Vdc
E4401B (75 $\Omega$ 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<sup>5</sup>)

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 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
<b>E4401B</b>				
400 kHz to 1 MHz	$\leq -115$	$\leq -134$	$\leq -150$	$\leq -155$
1 MHz to 500 MHz	$\leq -119$	$\leq -138$	$\leq -154$	$\leq -156$
500 MHz to 1 GHz	$\leq -117$	$\leq -136$	$\leq -152$	$\leq -156$
1 GHz to 1.5 GHz	$\leq -114$	$\leq -133$	$\leq -150$	$\leq -155$
<b>E4402B</b>				
30 Hz to 9 kHz <sup>22</sup> (Option UKB)	na	$\leq -93$	na	na
9 kHz to 100 kHz <sup>22</sup>	na	$\leq -109$	na	na
100 kHz to 1 MHz <sup>22</sup>	na	$\leq -135$	na	na
1 MHz to 10 MHz <sup>22</sup>	$\leq -117$	$\leq -136$	na	$\leq -152$
10 MHz to 1 GHz	$\leq -117$	$\leq -136$	$\leq -152^{19}$	$\leq -156$
1 GHz to 2 GHz	$\leq -116$	$\leq -135$	$\leq -153^{19}$	$\leq -156$
2 GHz to 3 GHz	$\leq -114$	$\leq -133$	$\leq -151^{19}$	$\leq -154$
<b>E4404/05B/07B</b>				
30 Hz to 9 kHz <sup>22</sup> (Option UKB)	na	$\leq -93$	na	na
9 kHz to 100 kHz <sup>22</sup>	na	$\leq -109$	na	na
100 kHz to 1 MHz <sup>22</sup>	na	$\leq -135$	na	na
1 MHz to 10 MHz <sup>22</sup>	$\leq -117$	$\leq -137$	na	$\leq -155$
10 MHz to 1 GHz	$\leq -116$	$\leq -135$	$\leq -151^{19}$	$\leq -157$
1 GHz to 2 GHz	$\leq -116$	$\leq -135$	$\leq -151^{19}$	$\leq -155$
2 GHz to 3 GHz	$\leq -112$	$\leq -131$	$\leq -149^{19}$	$\leq -152$
3 GHz to 6 GHz	$\leq -112$	$\leq -131$	na	$\leq -138$
6 GHz to 12 GHz	$\leq -111$	$\leq -130$	na	$\leq -137$
12 GHz to 22 GHz	$\leq -107$	$\leq -126$	na	$\leq -134$
22 GHz to 26.5 GHz	$\leq -106$	$\leq -125$	na	$\leq -132$
<b>E4407B (Option AYZ)</b>				
External mixer <sup>6</sup>	$\leq -134$ + external mixer conversion loss	$\leq -153$ + external mixer conversion loss	na	na

## 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 <sup>13</sup> dB from reference level is calibrated
Linear scale	10 divisions
Scale units (Option BAA)	dBm, dBmV, dB $\mu$ V, Volts, and Watts 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 AYZ)  
(sweeptimes  $\leq$  sweep points -1/100 kHz)

Log scale

0 to -85 dB	0.3 dB
Linear	0.3% of reference level

## Frequency response

(10 dB input attenuation)

Absolute<sup>7</sup>/Typical Relative flatness<sup>8</sup>

<b>E4401B</b>			
9 kHz to 1.5 GHz	$\pm 0.5$ dB	na	$\pm 0.5$ dB
<b>E4402B/04B/05B/07B</b>			
30 Hz to 3 GHz <sup>6</sup> (Option UKB)	$\pm 0.5$ dB	na	$\pm 0.5$ dB
9 kHz to 3.0 GHz	$\pm 0.46$ dB	$\pm 0.14$ dB	$\pm 0.5$ dB
3.0 GHz to 6.7 GHz	$\pm 1.5$ dB	$\pm 0.38$ dB	$\pm 1.3$ dB
6.7 GHz to 13.2 GHz	$\pm 2.0$ dB	$\pm 0.68$ dB	$\pm 1.8$ dB
13.2 GHz to 26.5 GHz	$\pm 2.0$ dB	$\pm 0.86$ dB	$\pm 1.8$ dB

## Input attenuation switching uncertainty at 50 MHz

Attenuation setting

0 dB to 5 dB	$\pm 0.3$ dB
10 dB	reference
15 dB	$\pm 0.3$ dB
20 to 60 dB (E4401B)	$\pm (0.1 \text{ dB} + 0.01 \times \text{attenuator setting})$
20 to 65 dB	$\pm (0.1 \text{ dB} + 0.01 \times \text{attenuator setting})$

## Absolute amplitude accuracy

		Typical
At reference settings <sup>15</sup>	$\pm 0.34$ dB	$\pm 0.13$ dB
E4401B	$\pm 0.30$ dB	$\pm 0.10$ dB
Preamp on <sup>16</sup> (Option 1DS)	$\pm 0.37$ dB	$\pm 0.14$ dB

External mixer (Option AYZ) IF INPUT absolute amplitude accuracy + external mixer conversion loss accuracy<sup>17</sup>

Overall amplitude accuracy<sup>9</sup>  $\pm (0.54 \text{ dB} + \text{absolute frequency response})$

## RF input VSWR<sup>6</sup> (at tuned frequency, 10 dB attenuation)

E4401B  
1 MHz to 1.5 GHz 1.35:1

E4402B  
9 kHz to 100 kHz 2:1  
100 kHz to 3 GHz 1.4:1

E4404B/05B  
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  
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  
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)  
– attenuator setting ±0.3 dB (–10 dBm to –60 dBm)  
+ preamp gain ±0.5 dB (–60 dBm to –85 dBm)  
±0.7 dB (–85 dBm to –90 dBm)

## Display scale fidelity

Log maximum cumulative

RBW ≥ 1 KHz dB below reference level	Reference	Typical
0 dB (Reference)	±0.00 dB	±0.00 dB
>0 to 10 dB	±0.22 dB	±0.08 dB
>10 to 20 dB	±0.24 dB	±0.09 dB
>20 to 30 dB	±0.26 dB	±0.10 dB
>30 to 40 dB	±0.40 dB	±0.23 dB
>40 to 50 dB	±0.57 dB	±0.35 dB
>50 to 60 dB	±0.57 dB	±0.35 dB
>60 to 70 dB	±0.66 dB	±0.39 dB
>70 to 80 dB	±0.66 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 ±(0.3 dB + 0.01 x dB from  
reference level)  
≥98 to 120 dB ±(2.0 dB from reference level)<sup>6</sup>  
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

## Spurious responses

Second harmonic distortion

E4401B  
2 MHz to 750 MHz <–75 dBc for –40 dBm tone at input  
mixer<sup>5</sup>. (+35 dBm SHI)

E4402/04/05/07B  
10 MHz to 500 MHz <–65 dBc for –30 dBm tone at input  
mixer<sup>5</sup>.

500 MHz to 1.5 GHz <–75 dBc for –30 dBm tone at input  
mixer<sup>2</sup>. (+45 dBm SHI)

1.5 GHz to 2.0 GHz <–85 dBc for –10 dBm tone at input  
mixer<sup>2</sup>.

>2.0 GHz <–100 dBc for –10 dBm tone at input  
mixer<sup>5</sup> (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<sup>5</sup> 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<sup>5</sup> 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<sup>5</sup> and >50 kHz separation.  
(+11 dBm TOI, +18 dBm typical)

>6.7 GHz <–75 dBc for two –30 dBm tones at  
input mixer<sup>5</sup> and >50 kHz separation.

Other input-related spurious

>30 kHz offset <–65 dBc for –20 dBm tone at input  
mixer<sup>5</sup>.

## 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  
CISPR Pub. 11/1990 Group 1 Class B<sup>23</sup>

(Option 060)

### 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 W  
Standby (line 0)  
dc operation  
Power consumption <5 W

Voltage 12 to 20 Vdc  
Power consumption <200 W

## Data storage (nominal)

Internal	200 traces or states
External (1.44 MB floppy disk)	200 traces or states

## Weight<sup>6</sup> (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.)

## 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 <sup>10</sup>	≥50/sec	≥45/sec	≥40/sec
Remote measurement and GPIB transfer rate <sup>11</sup>	≥45/sec	≥45/sec	≥40/sec
RF center frequency tuning time <sup>18</sup>	≤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 <sup>6</sup> maximum
EXT KEYBOARD	6-pin mini-DIN, PC keyboards (for entering screen titles and file menus)
Speaker	front-panel knob controls volume
Headphone Power output	3.5mm (1/8 inch) miniature audio jack 0.2 W into 4 Ω <sup>6</sup>
AMPTD REF OUT	50 Ω <sup>20</sup> , BNC (f)
IF INPUT (Option AYZ)	50 Ω <sup>20</sup> , SMA (f)
LO OUTPUT (Option AYZ)	50 Ω <sup>20</sup> , SMA (f)

### Rear panel

10 MHz REF OUT	50 Ω <sup>20</sup> , BNC (f), >0 dBm <sup>6</sup>
10 MHz REF IN	50 Ω <sup>20</sup> , BNC (f), -15 to +10 dBm <sup>6</sup>
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 AYZ)

AUX IF OUT	BNC (f), 21.4 MHz, nominal -10 to -70 dBm <sup>20</sup> (uncorrected)
AUX VIDEO OUT	BNC (f), 0 to 1 V <sup>6</sup> (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 <sup>6</sup> ramp

## GPIB interface

(Option A4H)	IEEE-488 bus connector
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## Serial interface

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

(Option A4H or 1AX)	25-pin D-SUB (f), printer port only
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## 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% × 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

#### 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<sup>20</sup>

#### Noise figure

E4401B	4 dB <sup>6</sup>
E4402B/04B/05B/07B	5 dB <sup>6</sup>

### 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 <sup>14</sup>	(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 amplitude corrections

### Mixer bias (IF INPUT)

Voltage	
Maximum range	±3.3 V
Linear compliant range	±2 V
Current (0 Ω load)	
Range	±10 mA
Resolution	<20 μA
Accuracy	± (3% + resolution)
Output impedance	490 Ω <sup>20</sup>

### Option BAA FM demodulation<sup>6</sup>

**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 <sup>12</sup>	<(2% of FM deviation range + 2 × resolution)

#### FM bandwidth (–3 dB)

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

### Option B7B TV trigger and picture on screen

#### Amplitude requirements<sup>6</sup>

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

## Notes

1. Frequency reference error = (aging rate x period of time since adjustment + settability + temperature stability).
2. Not available in RBW <1 kHz (Option 1DR).
3. Marker level to DANL >25 dB, RBW/span  $\geq 0.002$ .
4. N = LO harmonic mixing mode.
5. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).
6. Characteristic
7. Referenced to 50 MHz amplitude reference (20 °C to 30 °C).
8. Referenced to midpoint between highest and lowest frequency response deviations (20 °C to 30 °C).
9. 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).
10. Characteristic; factory preset, fixed center frequency, sweep points = 101, auto align off, RBW = 1 MHz, stop frequency  $\leq 3$  GHz, span >10MHz and  $\leq 600$  MHz (E4401B, span >102 MHz and  $\leq 400$  MHz).
11. 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.
12. In time-domain sweeps.
13. 0 to –70 dB range when span = 0 Hz, or when auto ranging is off.
14. RBW 1 kHz; VBW 1 kHz; scale linear or log; span 2 kHz; sweep time coupled; sample detector; signal at reference level.
15. Reference level –25 dBm (E4401B) or –20 dBm (E4402B/04B/05B/07B); (75  $\Omega$  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.
16. Reference level –30 dBm; (75  $\Omega$  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.
17. Preselector centered with the Agilent 11974-series mixers.
18. Characteristic; includes center frequency tuning + measurement + GPIB transfer times, stop frequency  $\leq 3$ GHz, sweep points = 101, display and markers off, single sweep.
19. 20 to 30 °C
20. Nominal
21. Add 20 log (N) for frequencies >6.7 GHz.
22. Typical
23. Meeting class A performance during dc operation.

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