Agilent
E7400A Series EMC Analyzers

Data Sheet

These specifications apply to the Agilent Technologies E7402A and E7405A EMC analyzers.

Frequency Specifications

Frequency range

E7402A			
	dc coupled		100 Hz[1] to 3.0 GHz
	ac coupled		100 kHz[1] to 3.0 GHz
E7405A			
Band	LO harmonic = N		
0	1-	dc coupled	30 Hz[1] to 3.6 GHz
		ac coupled	100 MHz to 3.6 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

Frequency reference

Aging	$\pm 1 \times 10^{-7}$/year
Temperature stability	$\pm 1 \times 10^{-8}$
Settability	$\pm 1 \times 10^{-8}$

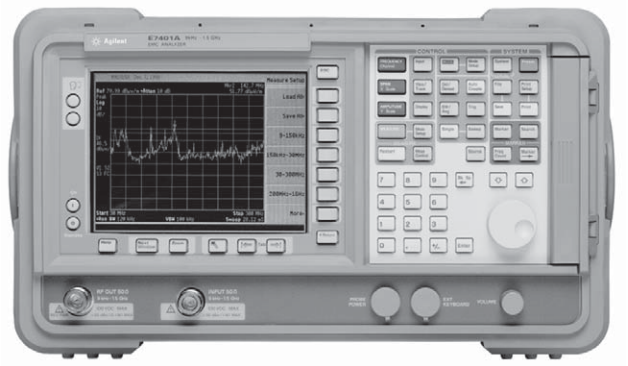
Frequency readout accuracy

(start, stop, center, marker) ±(frequency indication x frequency reference error[2] + span accuracy + 15% of RBW + 10 Hz) + 1 Hz x N[3]

1. Usable to 30 Hz
2. Frequency reference error = (aging rate x period of time since adjustment + settability + temperature stability)
3. N = LO harmonic mixing mode

Specifications

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, and Align Now RF has been run once every 24 hour period. Typical performance describes the level at which 80% of the units will meet or exceed with a 95% confidence level over 20 to 30 °C, but is not covered in the product warranty. Characteristics describe expected product performance levels that are not covered in the product warranty.



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Marker frequency counter [1]

Accuracy[2]	±(marker frequency x frequency reference error[3] + counter resolution)
Counter Resolution	Selectable from 1 Hz to 100 kHz

Frequency span

Range	0 Hz (zero span), 100 Hz x N[4] to the range of the spectrum analyzer
Resolution	2 Hz x N[4]
Accuracy	(> 2000 sweep points)
Sweep type linear	±0.5% of span
Sweep type log	±2% of span (characteristic)

Sweep time

Range	
Span > 0 Hz	1 ms to 4000 s
Span = 0 Hz	50 ns[5] to 4000 s
Accuracy	±1%
Sweep trigger	Free run, single, line, video, external, delay, offset, and gate (Option 1D6)
Delay trigger range	1 µs to 400 s

Sweep (trace) point range 101 to 8192

Span = 0 Hz 2 to 8192

Resolution bandwidth 1 Hz to 3 MHz (–3 dB) in 1-3-10 sequence[6]
5 MHz (–3 dB) bandwidth
200 Hz[6], 9 kHz, 120 kHz, 1 MHz (–6 dB) EMI bandwidths
1 MHz (impulse) EMI bandwidth

Accuracy

1 Hz to 300 MHz (–3 dB)	±10%
1 kHz to 3 MHz (–3 dB)	±15%
5 MHz (–3 dB)	±30%
200 Hz (–6 dB)	±10%
9 kHz to 120 kHz (–6 dB)	±20%
1 MHz (–6 dB)	±10%
1 MHz (impulse)	±15%

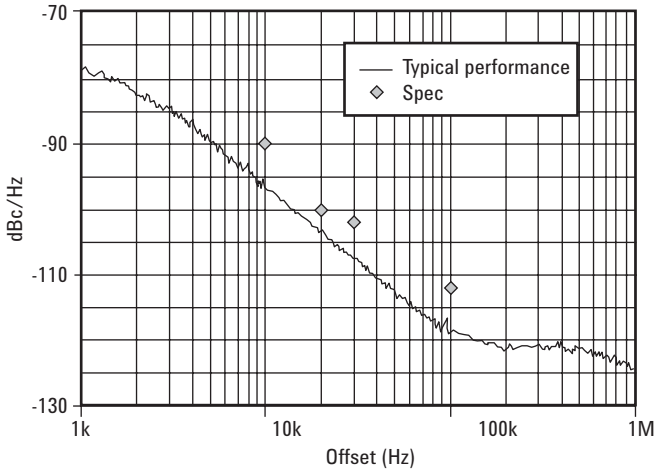
Selectivity (characteristic)

10 Hz to 300 Hz (–3 dB)	< 5:1 (–60 dB/–3 dB) (Digital, approximately Gaussian-shaped)
1 kHz to 3 MHz (–3 dB)	< 5:1 (–60 dB/–3 dB) (approximately Gaussian-shaped)
200 Hz (–6 dB)	< 3:1 (–40 dB/–6 dB) (Digital, Kaizer Windows)
9 kHz, 120 kHz, 1 MHz (–6 dB)	< 10:1 (–60 dB/–6 dB) (approximately Gaussian-shaped)
1 MHz (impulse)	< 10:1 (–60 dB/–6 dB) (approximately Gaussian-shaped)

Video bandwidth range 30 Hz to 3 MHz[7] in 1-3-10 sequence
1, 3, 10 Hz for RBWs < 1 kHz

Stability

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



Stability specifications

	Specified	Typical
≥ 1 kHz	na	–78 dBc/Hz[8]
≥ 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]

Residual FM

1 kHz RBW, 1 kHz VBW	≤ 100 x N[4] Hz pk-pk in 100 ms
10 Hz RBW, 10 Hz VBW	≤ 2 x N[4] Hz pk-pk in 20 ms

System-related sidebands

≥ 30 kHz offset from CW signal ≤ –65 dBc + 20 Log N[4]

1. Not available in RBW < 1 kHz
2. Marker level to DANL > 25 dB, Span ≤ 1.5 GHz, RBW/Span ≥ 0.002
3. Frequency reference error = (aging rate x period of time since adjustment + settability + temperature stability)
4. N = LO harmonic mixing mode
5. RBW ≥1 kHz, 2 sweep points
6. 1 Hz to 300 Hz are only available in spans of ≤ 5 MHz. This bandwidth is not usable when the tracking generator is turned on (Option 1DN).
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	
E7402A	0 to 65 dB (75 dB[1]), in 5 dB steps
E7405A	0 to 65 dB, in 5 dB steps

Maximum safe input level

Average continuous power	+30 dBm (1 W)
Peak pulse power	+50 dBm (100 W) (input attenuator ≥ 30 dB)
Maximum dc	0 Vdc (dc coupled) 50 V (ac coupled)

1 dB gain compression (total power at input mixer[2])

≥ 50 MHz	0 dB
≥ 6.7 GHz	–3 dB
≥ 13.2 GHz	–5 dB

Display range

Log Scale	0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps; ten divisions displayed
RBW ≥ 1kHz	0 to –85 dB from reference level is calibrated
RBW ≤ 300 Hz	0 to –120[5] dB from reference level is calibrated
Linear scale	10 divisions
Scale units	dBm, dBmV, dBµV, dBµA, Amps, Volts and Watts

Marker readout resolution

Log scale	
0 to –85 dB	0.04 dB
0 to –120 (RBW ≤ 300 Hz)	0.04 dB
Linear scale	0.01% of reference level

Fast sweep times for zero span (Option AYX)

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

Display average noise level (DANL)

	1 kHz RBW	10 Hz RBW	1 kHz w/preamp on	10 Hz w/preamp on, typical	1 Hz w/preamp on, typical
E7402A					
30 Hz to 9 kHz[3]	na	≤ –93	na	na	na
9 kHz to 100kHz[3]	na	≤ –109	na	na	na
100 kHz to 1 MHz[3]	na	≤ –135	na	na	na
1 MHz to 10 MHz[3]	≤ –117	≤ –136	na	≤ –152	≤ –162
10 MHz to 1 GHz	≤ –117	≤ –136	≤ –152[4]	≤ –156	≤ –166
1 GHz to 2 GHz	≤ –116	≤ –135	≤ –153[4]	≤ –156	≤ –166
2 GHz to 3 GHz	≤ –114	≤ –133	≤ –151[4]	≤ –154	≤ –164
E7405A					
30 Hz to 9 kHz[3]	na	≤ –93	na	na	na
9 kHz to 100kHz[3]	na	≤ –109	na	na	na
100 kHz to 1 MHz[3]	na	≤ –135	na	na	na
1 MHz to 10 MHz[3]	≤ –117	≤ –137	na	≤ –155	≤ –165
10 MHz to 1 GHz	≤ –116	≤ –135	≤ –151[4]	≤ –157	≤ –167
1 GHz to 2 GHz	≤ –116	≤ –131	≤ –151[4]	≤ –155	≤ –165
2 GHz to 3 GHz	≤ –112	≤ –131	≤ –149[4]	≤ –152	≤ –162
3 GHz to 6 GHz	≤ –112	≤ –131	na	na	na
6 GHz to 12 GHz	≤ –111	≤ –130	na	na	na
12 GHz to 22 GHz	≤ –107	≤ –126	na	na	na
22 GHz to 26.5 GHz	≤ –106	≤ –125	na	na	na

1. Characteristic
2. Mixer power level (dBm) = input power (dBm) – input attenuator (dB)
3. Typical
4. 0 to 50 dB for RBWs ≤ 300 Hz and span = 0 Hz, or when auto ranging is off, or 0 to 30 dB for RBW = 200 Hz.
5. 0 to –70 dB range when span = 0 Hz, when RBW = 200 Hz, or when IF gain is fixed.

Frequency response (10 dB input attenuation)

	Absolute[1]	Typical	Relative flatness[2]
30 Hz to 3 GHz [3]	±0.5 dB	na	±0.5 dB
3.0 GHz to 6.7 GHz	±1.5 dB	±0.39 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 65 dB	±(0.1 dB + 0.01 x attenuator setting)

Absolute amplitude accuracy		**Typical**
At reference settings [4]	±0.34 dB	±0.13 dB
Preamp on [5]	±0.37 dB	±0.14 dB
Overall amplitude accuracy [6]	±(0.54 dB + absolute frequency response)	

RF input VSWR [3] (at tuned frequency, 10 dB attenuation)

E7402A	
100 Hz to 100 kHz	1.1:1
100 kHz to 3 GHz	1.4:1
E7405A	
100 Hz to 100 kHz	1.1:1
100 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
(Referenced to 1 kHz RBW, at reference level)

10 Hz to 3 MHz RBW	±0.3 dB
5 MHz RBW	±0.6 dB
10 Hz to 300 Hz RBW	±0.3 dB

Reference level

Range	–149 dBm to max. 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)

Display scale fidelity

Log maximum cumulative

RBW ≥ 1 kHz

dB below reference level		**Typical**
0 dB (reference)	±0.00 dB	±0.00 dB
> 0 dB to 10 dB	±0.3 dB	±0.08 dB
> 10 dB to 20 dB	±0.4 dB	±0.09 dB
> 20 dB to 30 dB	±0.5 dB	±0.10 dB
> 30 dB to 40 dB	±0.6 dB	±0.23 dB
> 40 dB to 50 dB	±0.7 dB	±0.35 dB
> 50 dB to 60 dB	±0.7 dB	±0.35 dB
> 60 dB to 70 dB	±0.8 dB	±0.39 dB
> 70 dB to 80 dB	±0.8 dB	±0.46 dB
> 80 dB to 85 dB	±1.15 dB	±0.79 dB
RBW ≤ 300 Hz (span > 0 Hz)		
0 dB to 98 dB	±(0.3 dB + 0.01 x dB from reference level)	
≥ 98 dB to 120 dB	±(2.0 dB from reference level)[3]	
Log incremental accuracy		
0 dB to 80 dB [7]	±0.4 dB/4 dB from reference level	
Linear accuracy	± 2% of reference level	

Linear to log switching ±0.15 dB at reference level

1. Referenced to 50 MHz amplitude reference (20 °C to 30 °C)
2. Reference to midpoint between highest and lowest frequency response deviations. (20 °C to 30 °C)
3. Characteristic
4. Reference level –20 dBm; 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 director, signal at reference level.
5. 1 Hz to 300 Hz are only available in spans of ≤ 5 MHz and are not usable with tracking generator Option 1DN.
6. For reference levels 0 to 50 dBm; input attenuation 10 dB; dc coupled; RFW 1 kHz; VBW 1 kHz; scale loge range 0 to –50 dB from reference level; sweeptime coupled; signal input 0 to 50 dB; spsn ≤ 20 kHz.
7. 0 to 50 dB for RBWs ≤ 300 Hz and span = 0 Hz, or when auto ranging is off, or 0 to 30 dB for RBW = 200 Hz.

Spurious responses

Second harmonic distortion

10 MHz to 500 MHz	< –65 dBc for –30 dBm tone at input mixer [1]
500 MHz to 1.5 GHz	< –75 dBc for –30 dBm tone at input mixer [2]
1.5 GHz to 2.0 GHz	< –85 dBc for –10 dBm tone at input mixer [2]
> 2.0 GHz	< –100 dBc for –10 dBm tone at input mixer[1] (or below displayed average noise level)

Third order intermodulation distortion

100 MHz to 6.7 GHz	< –85 dBc for two –30 dBm tones at input mixer [1] and > 50 kHz separation
> 6.7 GHz	< –75 dBc for two –30 dBm tones at input mixer [1] and > 50 kHz separation

Other input related spurious

< –65 dBc, for –20 dBm tone at input mixer [1]

Residual responses (input terminated and 0 dB attenuation)

150 kHz to 6.7 GHz < –90 dBm

Amplitude ref. output

Amplitude –20 dBm (nominal)

FM demodulation [3]

Input level –60 dBm + attenuator setting

Signal level 0 to –30 dB below reference level

Quasi-peak detector specifications

The EMC analyzer displays the quasi-peak amplitude of a pulse radio frequency on continuous wave signals. Amplitude response conforms with Publication 16 of Comite International Special des Perturbations Radioelectrique (CISPR) Section 1, Clause 2, as indicated in the relative quasi-peak response table.

1. Mixer power level (dBm) = input power (dBm) – input attenuator (dB)
2. Not available in RBW < 1 kHz
3. Characteristic
4. Reference pulse amplitude accuracy relative a 66 µV CW signal < 1.5 dB as specified in CISPR Pub 16 CISPR reference pulse: 0.44 µVs for 30 MHz to 1 GHz, 0.316 µVs for 150 kHz to 30 MHz, 13.5 µVs for 9 kHz to 150 kHz
5. Meets Class A performance during dc operation or serial number US41110000 or lower.
6. Characteristic; factory preset, fixed center frequency, sweep points = 101 auto align off, RBW = 1 MHz, stop frequency ≤ 3 GHz, span > 10 MHz and ≤ 600 MHz.
7. 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
8. Characteristic; includes center frequency tuning and measurement plus GPIB transfer times, stop frequency ≤ 3 GHz, sweep points = 101, display and markers off, single sweep
9. When storing a 401-point trace plus the instrument state

Relative quasi-peak response to a CISPR pulse (dB)

Pulse repetition frequency (Hz)	120 kHz EMI BW .03 to 1 GHz	9 kHz EMI BW 0.150 to 30 MHz	200 Hz EMI BW 9 kHz to 150 kHz
1000	+8.0 ±1.0	+4.5 ±1.0	——
100	0 dB reference [4]	0 dB reference [4]	+4.0 ±1.0
60	——	——	+3.0 ±1.0
25	——	——	0 dB reference [4]
20	–9.0 ±1.0	–6.5 ±1.0	——
10	–14 ±1.5	–10.0 ±1.5	–4.0 ±1.0
5	——	——	–7.5 ±1.5
2	–26 ±2.0	–20.5 ±2.0	–13.0 ±2.0
1	——	–22.5 ±2.0	–17.0 ±2.0
Isolated pulse	——	–23.5 ±2.0	–19.0 ±2.0

General specifications

Temperature range

Operating 0° C to +55° C

Storage –40° C to +75° C

EMI compatibility Conducted and radiated emissions is in compliance with CISPR Pub. 11/1990 Group 1 Class B[5]

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 (line1) 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) Power consumption < 5 W

DC operation

Voltage 12 to 20 Vdc

Power consumption < 200 W

Measurement speed

	E7402A	E7405A
Local measurement rate [6]	≥ 45/sec	≥ 40/sec
Remote measurement as GPIB transfer rate [7]	≥ 45/sec	≥ 40/sec
RF center frequency tuning time [8]	≥ 75/ms	≥ 75/ms

Data storage (nominal)

Internal 200 traces [9] or states

External (floppy) 200 traces [9] or states

Weight (without options)

E7402A	14.9 kg	(32.9 lbs.)
E7405A	17.1 kg	(37.7 lbs.)

Dimensions

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

Inputs/outputs

Front panel connectors

Input	50 Ω type N (f)
RF Out	50 Ω type N (f)

Probe power +15 Vdc, –12.6 Vdc at 150 mA max. characteristic

Ext. keyboard 6-pin mini-DIN, PC keyboards (for entering screen titles and file names)

Speaker front-panel knob controls volume

Headphone 3.5 mm (1/8 inch) miniature audio jack

Power output 0.2 W into 4 Ω[1]

Amptd ref. output 50 Ω, BNC (f)

Rear panel connectors

10 MHz ref out 50 Ω, BNC (f), > 0 dBm[1]

10 MHz ref in 50 Ω, BNC (f), –15 to +10 dBm[1]

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 D-SUB, (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) Analog RGB 640 x 480

IF and sweep ports

Aux IF output	BNC (f), 21.4 MHz, nominal –10 to –70 dBm[1] (uncorrected)
Aux video out	BNC (f), 0 to 1 V[1] (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[1] ramp

GPIB interface

Standard (Option A4H) IEEE-488 bus connector

Serial interface

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

Parallel interface

Standard 25-pin D-SUB (f), printer port only

1. Characteristic

Option specifications

Option 1DN tracking generator

Frequency range 9 kHz to 3.0 GHz

Output power level range

Range	–2 to –66 dBm
Resolution	0.1 dB
Absolute accuracy (at 50 MHz)	±0.75 dB

Output vernier range 8 dB

Output attenuator range 0 to 56 dB, 8 dB steps

Output flatness

9 kHz to 10 MHz	±3.0 dB
10 MHz to 3.0 GHz	±2.0 dB

Effective source match (characteristic)

0 dB attenuation	< 2.0:1 (0 dB attenuation)
≥ 8 dB attenuation	< 1.5:1 (≥ 8 dB attenuation)

Spurious output

Harmonic spurs (–1 dBm output)

9 kHz to 3 GHz	< –25 dBc

Non-harmonic spurs

9 kHz to 2 GHz	< –27 dBc
2 GHz to 3 GHz	< –23 dBc

Dynamic range Maximum output power – displayed average noise level

Power sweep range (–10 dBm to –1 dBm) – (source attenuator setting)

Preamplifier (standard) 1 MHz to 3 GHz (nominal gain 20 dB)