Keysight Technologies
E5100A Network Analyzer

Data Sheet

KEYSIGHT TECHNOLOGIES
Unlocking Measurement Insights

These specifications are the performance standards or limits against which the instrument is tested. When shipped from the factory, the E5100A meets the specifications listed in this section.

Values followed by (SPC) are supplemental performance characteristics.

Source

Frequency characteristics
- Range 10 kHz to 300 MHz
- Accuracy (at 23 ±5 °C) ..... ±20 ppm
  - With Option E5100A-1D5 (at 0 to 55 °C, 20 minutes after power on) . ±1 ppm
- Stability (at 23 ±5 °C)±5 x 10–6/day (SPC)
  - With Option E5100A-1D5 (48 hours after power on) ±2.5 x 10–9/8 hours (SPC)
- Resolution 1 mHz

Output power characteristics
(measured at RF OUT 1, RF OUT 2 is terminated with 50 Ω termination)
- Range (nominal)
  - With Option E5100A-001 ..... –9 dBm to +11 dBm
  - With Option E5100A-002 ..... –15 dBm to +5 dBm
  - With Option E5100A-003 ..... –12 dBm to +8 dBm
  - With Option E5100A-801 ..... –48 dBm to +22 dBm
  - With Option E5100A-802 ..... –54 dBm to +16 dBm
  - With Option E5100A-803 ..... –51 dBm to +19 dBm
  - With Option E5100A-600 (at RF OUT 1) ..... –52 dBm to +18 dBm
  - With Option E5100A-600 (at RF OUT 2) ..... –65 dBm to +5 dBm
- Resolution 0.1 dB
- Level accuracy (at 23 ±5 °C, 0 dBm output level, 50 MHz) ..... ±1 dB
- Flatness (at 23 ±5 °C, relative to 0 dBm output level at 50 MHz) ..... +2 dB, –4 dB
  - With Option E5100A-803 ..... +2.5 dB, –4.5 dB
  - With Option E5100A-801 or E5100A-802
    - 10 kHz ≤ frequency < 50 kHz ..... +1.5 dB, –6 dB (SPC)
    - 50 kHz ≤ frequency ≤ 100 MHz ..... +2.5 dB, –4.5 dB
    - 100 MHz < frequency ≤ 300 MHz ..... +3 dB, –5 dB
  - With Option E5100A-600
    - 10 kHz ≤ frequency < 50 kHz ..... +1.5 dB, –7 dB (SPC)
    - 50 kHz ≤ frequency ≤ 100 MHz ..... +2.5 dB, –4.5 dB
    - 100 MHz < frequency ≤ 300 MHz ..... +3 dB, –5 dB
- Linearity (at 23 ±5 °C, relative to 0 dBm output level at 50 MHz) ..... ±1 dB
  - With Option E5100A-801/802/803
    - Maximum power level –70 dB ≤ power level < maximum power level –60 dB ..... ±1.5 dB
    - Maximum power level –60 dB ≤ power level ≤ maximum power level ..... ±1 dB

Power splitter
(When the analyzer is equipped with Option E5100A-001 or E5100A-003, delete this section.)
- Insertion loss (When the analyzer is equipped with Option E5100A-600, delete this item.) ..... 6 dB (nominal)
- Output tracking
  - Without Option E5100A-600
    - 10 kHz ≤ frequency ≤ 100 MHz ..... 0.1 dB (SPC)
    - 100 MHz < frequency ≤ 300 MHz ..... 0.2 dB (SPC)
  - With Option E5100A-600
    - 10 kHz ≤ frequency ≤ 100 MHz ..... 13 dB ±0.3 dB (SPC)
    - 100 MHz < frequency ≤ 300 MHz ..... 13 dB ±0.5 dB (SPC)
- Equivalent output SWR
  - Without Option E5100A-600
    - 10 kHz ≤ frequency < 100 MHz ..... ≤ 1.2 (SPC)
    - 100 MHz ≤ frequency ≤ 300 MHz ..... ≤ 1.4 (SPC)

With Option E5100A-600
10 kHz ≤ frequency < 50 kHz ..... ≤ 2.5 (SPC)
50 kHz ≤ frequency ≤ 100 MHz ..... ≤ 1.2 (SPC)
100 MHz < frequency ≤ 300 MHz ..... ≤ 1.4 (SPC)

Spectral purity characteristics
Non–harmonic spurious signals (at < 300 MHz)
With Option E5100A-001 (at –4 dBm output level) ..... < –45 dBc
With Option E5100A-002 (at –10 dBm output level) ..... < –45 dBc
With Option E5100A-003 (at –7 dBm output level) ..... < –45 dBc
With Option E5100A-600 (at 0 dBm output level) ..... < –45 dBc
With Option E5100A-801 (at +6 dBm output level) . . . . . < –45 dBc
With Option E5100A-802 (at 0 dBm output level) . . . . . < –45 dBc
With Option E5100A-803 (at +3 dBm output level) . . . . . < –45 dBc

Phase noise (at 10 kHz offset from 0 dBm fundamental) . . . . . < –90 dBc/Hz

Other source information
Reverse power protection . . . . . 20 dBm, 25 Vdc (SPC)
Output connector . . . . . BNC female
Output impedance . . . . . 50 Ω (nominal)

Receiver

Input characteristics
Frequency range ..... 10 kHz to 300 MHz
1 MΩ input for Options E5100A-703/704/707/708 ..... 10 kHz to 5 MHz
IF bandwidth (IF BW) ..... 10 Hz to 30 kHz, 1, 1.5, 2, 3, 4, 5, 8 step (nominal)
Impedance ..... 50 Ω (nominal)
1 MΩ input for Option E5100A-703/704/707/708 ..... 1 MΩ // 30 pF (nominal)
Return loss (at 50 Ω input)
10 kHz ≤ frequency < 100 MHz ..... 20 dB (SPC)
100 MHz ≤ frequency ≤ 300 MHz ..... 15 dB (SPC)

Maximum input level

50 Ω input

Frequency	RF attenuator	Maximum input level
10 kHz ≤ frequency < 200 kHz	25 dB	0 dBm
10 kHz ≤ frequency < 200 kHz	0 dB	– 25 dBm
200 kHz ≤ frequency ≤ 300 MHz	25 dB	+5 dBm
200 kHz ≤ frequency ≤ 300 MHz	0 dB	– 20 dBm

1 MΩ Input for Options E5100A-705/706/707/708

Frequency [1]	RF attenuator	Maximum input level
10 kHz ≤ frequency < 200	kHz 25 dB	0.22 Vrms
10 kHz ≤ frequency < 200	kHz 0 dB	0.013 Vrms
200 kHz ≤ frequency ≤ 300 MHz	25 dB	0.40 Vrms
200 kHz ≤ frequency ≤ 300 MHz	0 dB	0.022 Vrms

Damage level
DC ..... 25 Vdc
AC ..... 20 dBm

1. Measurement frequency ≤ 5 MHz

Averaging noise level (at magnitude measurement, 23 ±5 °C, RF attenuator: 0 dB, 50 Ω input)[1]

IF BW 30 kHz (at > 1 MHz) ..... –100 dBm
IF BW 10 kHz (at > 300 kHz) ..... –105 dBm
IF BW 3 kHz (at > 100 kHz) ..... –110 dBm
IF BW 1 kHz
30 kHz ≤ frequency < 100 kHz ..... –95 dBm
100 kHz ≤ frequency ≤ 300 MHz ..... –115 dBm
IF BW 300 Hz
10 kHz ≤ frequency < 100 kHz ..... –100 dBm
100 kHz ≤ frequency ≤ 300 MHz ..... –120 dBm
IF BW 100 Hz
10 kHz ≤ frequency < 100 kHz ..... –105 dBm
100 kHz ≤ frequency ≤ 300 MHz ..... –125 dBm

Input crosstalk
(When the analyzer is equipped with Option E5100A-100, delete this section.) Reference input (0 dBm input level at 10 kHz to 200 kHz and +5 dBm input level at 200 kHz to 300 MHz, RF attenuator: 25 dB, 50 Ω input)
Test input (RF attenuator: 0 dB, terminated with 50 Ω termination)

10 kHz ≤ frequency < 100 kHz ..... < –110 dB
100 kHz ≤ frequency ≤ 300 MHz ..... < –120 dB

Source crosstalk
(all RF OUT and input connectors are terminated with 50 Ω terminations)

Without Option E5100A-801/802/803 (at +5 dBm output level, RF attenuator: 0 dB, 50 Ω input)
10 kHz ≤ frequency < 100 kH ..... < –110 dB (SPC)
100 kHz ≤ frequency < 250 MHz ..... < –125 dB (SPC)
250 MHz ≤ frequency ≤ 300 MHz ..... < –120 dB (SPC)
With Option E5100A-801/802/803 (at +16 dBm output level, RF attenuator: 0 dB, 50 Ω input)
10 kHz ≤ frequency < 100 kHz ..... < –120 dB (SPC)
100 kHz ≤ frequency < 250 MHz ..... < –135 dB (SPC)
250 MHz ≤ frequency ≤ 300 MHz ..... < –130 dB (SPC)

Residual response
(RF attenuator: 0 dB, except for the following points) ..... < –80 dBm
50 kHz, 100 kHz, 95.825 MHz, 95.875 MHz,159.791667 MHz, 159.825 MHz, 159.841667 MHz, 159.875 MHz, 239.75 MHz, and 239.875 MHz
Input connector ..... BNC female
With Option E5100A-705/706/707/708 ..... BNC female, Type-N female (for A, B inputs)
Measurement mode
With Option E5100A-100 ..... A
With Option E5100A-200 or E5100A-600 ..... A/R, R/A, R, A
With Option E5100A-300 ..... A/R, B/R, R/A, B/A, R/B, A/B, R, A, B
With Option E5100A-400 ..... A/R, B/R, C/R, R/A, B/A, C/A, R/B, A/B, C/B, R/C, A/C, B/C, R, A, B, C
(When the measurement mode is either R/A, B/A, C/A, R/B, A/B, C/B, R/C, or A/C, the specification is SPC.)

Magnitude characteristics

Absolute characteristics
Absolute amplitude accuracy
(at 23 ±5 °C, –30 dBm input level for RF attenuator: 0 dB or –5 dBm input level for RF attenuator: 25 dB, 50 Ω input)
±1 dB

1. When the analyzer frequency is identical to the transmitted interference signal frequency, refer to “EMC” in “general characteristics.”

Ratio characteristics

Frequency response[1]
(at 23 ±5 °C, –30 dBm input level for RF attenuator: 0 dB or –5 dBm input level for RF attenuator: 25 dB, the same RF attenuator setting for both inputs)

50 Ω input

10 kHz ≤ frequency < 100 kHz ..... ±1 dB
100 kHz ≤ frequency ≤ 100 MHz ..... ±0.5 dB
100 MHz < frequency ≤ 300 MHz ..... ±1 dB

1 MΩ input for Option E5100A-703/704/707/708

(using 50 Ω feedthrough) ..... ±3 dB

Dynamic accuracy
(at 23 ±5 °C, 10 Hz IF BW, –10 dBm reference input level relative to maximum input level, –20 dBm test input level relative to maximum input . level, except for ramp frequency sweep)

Test channel input level RF attenuator		Dynamic accuracy frequency	
25 dB	**0 dB**	**Other**	**10 kHz to 50 kHz**
+5 to –5 dBm[1]	–20 to –30 dBm[2]	±0.4 dB	±0.4 dB (SPC)
–5 to –15 dBm	–30 to –40 dBm	±0.09 dB	±0.09 dB (SPC)
–15 to –45 dBm	–40 to –70 dBm	±0.05 dB	±0.05 dB (SPC)
–45 to –55 dBm	–70 to –80 dBm	±0.06 dB	±0.1 dB (SPC)
–55 to –65 dBm	–80 to –90 dBm	±0.1 dB	±0.3 dB (SPC)
–65 to –75 dBm	–90 to –100 dBm	±0.3 dB	±0.9 dB (SPC)
–75 to –85 dBm	–100 to –110 dBm	±0.9 dB	±3 dB (SPC)
–85 to –95 dBm	–110 to –120 dBm	±3 dB	N/A

With Option E5100A-100
(at 23 ±5 °C, 10 Hz IF BW, –20 dB input-A level relative to maximum input level, except for ramp frequency sweep, right after measuring reference)

Test channel input level RF attenuator		Dynamic accuracy frequency	
25 dB	**0 dB**	**Other**	**10 kHz to 50 kHz**
+5 to –5 dBm[1]	–20 to –30 dBm[2]	±0.4 dB	±0.4 dB (SPC)
–5 to –45 dBm	–30 to –70 dBm	±0.1 dB	±0.1 dB (SPC)
–45 to –55 dBm	–70 to –80 dBm	±0.1 dB	±0.2 dB (SPC)
–55 to –65 dBm	–80 to –90 dBm	±0.2 dB	±0.6 dB (SPC)
–65 to –75 dBm	–90 to –100 dBm	±0.6 dB	±1.8 dB (SPC)

Trace noise
(at 1 kHz IF BW, frequency > 305 kHz, –5 dBm input level for RF attenuator: 25 dB or –30 dBm input level for RF attenuator: 0 dB ..... < 10 dBm rms

Stability ..... 0.02 dB/°C (SPC)

With Option E5100A-100
(at 23 ±5 °C) ..... 0.05 dB/°C (SPC)

1. Frequency response can be improved by calibration.
2. 0 to –5 dBm at 10 kHz to 200 kHz
3. –25 to –30 dBm at 10 kHz to 200 kHz

Phase characteristics
(When the analyzer is equipped with Option E5100A-100, delete this section.)
Measurement mode ..... Normal/Expanded
Frequency response[1]
(at 23 ±5 °C, –30 dBm input level for RF attenuator:
0 dB or –5 dBm input level for RF attenuator: 25 dB,
the same RF attenuator setting for both inputs, 50 Ω input)
10 kHz ≤ frequency < 100 kHz ..... ±5°
100 kHz ≤ frequency ≤ 100 MHz..... +2.5°
100 MHz < frequency ≤ 300 MHz ..... ±5°

Dynamic accuracy
(at 23 ±5 °C, 10 Hz IF BW, –10 dBm reference input level relative to
maximum input level, –20 dBm test input level relative to maximum input .
level, except for ramp frequency sweep)

Test channel input level RF attenuator		Dynamic accuracy frequency	
25 dB	**0 dB**	**Other**	**10 kHz to 50 kHz**
+5 to –5 dBm[2]	–20 to –30 dBm[3]	±3°	±3° (SPC)
–5 to –45 dBm	–30 to –70 dBm	±0.6°	±0.6° (SPC)
–15 to –45 dBm	–40 to –70 dBm	±0.3°	±0.3° (SPC)
–45 to –55 dBm	–70 to –80 dBm	±0.3°	±0.6° (SPC)
–55 to –65 dBm	–80 to –90 dBm	±0.6°	±1.8° (SPC)
–65 to –75 dBm	–90 to –100 dBm	±1.8°	±6° SPC)
–75 to –85 dBm	–100 to –110 dBm	±6°	±18° (SPC)
–85 to –95 dBm	–110 to –120 dBm	±18°	NIA

Trace noise
(at 1 kHz IF BW, frequency > 305 kHz, –5 dBm input level
for RF attenuator: 25 dB or –30 dBm input level for
RF attenuator: 0 dB)..... < 50 mdeg rms
Stability..... 0.15 deg/°C (SPC)

Delay characteristics
Aperture frequency $\frac{200}{N\text{-}1}$ % to 100% of span, where N is number of points

Accuracy (at 23 ±5 °C, SPC)
In general, the following formula can be used to determine the accuracy, in seconds, of a specific group delay measurement:

$$\frac{\text{Phase accuracy [deg]}}{\text{360 [deg] x aperture [Hz]}} \text{ (sec)}$$

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

1. Frequency response can be improved by calibration.
2. 0 to –5 dBm at 10 kHz to 200 kHz
3. –25 to –30 dBm at 10 kHz to 200 kHz

General characteristics

Operating conditions
- When disk drive is in operation
  - Temperature ..... 10 to 40 °C
  - Humidity (at wet bulb ≤ 29 °C, without condensation) ..... 15% ≤ RH ≤ 80%
- When disk drive is not in operation
  - Temperature ..... 5 to 40 °C
  - Humidity (at wet bulb ≤ 29 °C, without condensation) ..... 15% ≤ RH ≤ 80%
- Altitude ..... 0 to 2,000 meters
- Warm-up time ..... 30 minutes

Non-operating conditions
- Temperature ..... – 20 to 60 °C
- Humidity (at wet bulb ≤ 40 °C, without condensation) ..... 15% ≤ RH ≤ 90%
- Altitude ..... 0 to 4,572 meters

Safety ..... Certified by CSA-C22.2 No.1010.1-92, Based on IEC 1010-1 (1990) including Amendment 1 (1992)

EMC[1] ..... Complies with CISPR 11(1990)/EN 55011(1991): Group 1, Class A
Complies with IEC 801-2 (1991)/EN 55082-1(1992): 4 kV CD, 8 kV AD
Complies with IEC 801-3 (1984)/EN 55082-1(1992): 3 V/m
Complies with IEC 801-4 (1988)/EN 55082-1(1992):1 kV power lines, 0.5 kV signal lines

Power requirement ..... 90 to 132 V or 198 to 264 V, 47 to 63 Hz, 400 VA max

Weight (depending on option) ..... 12 kg (SPC)

Cabinet dimensions ..... 425(W) x 177(H) x 425(D) mm (SPC

Supplemental characteristics

Measurement function
- Number of measurement channels ..... 1 to 4
- Display format ..... Cartesian
- Sweep parameter ..... frequency, power
- Sweep type
  - E5100A ..... linear (step, ramp), list
- Measurement point per sweep
  - E5100A ..... 2 to 1,601

Others
- Measurement calibration ..... Response, response and isolation, 1-port 3-term
- Display ..... 6.5 inch color LCD, 640 x 480 dots
- Flexible disk drive ..... 720 Kbytes/1.2 Mbytes/1.44 Mbytes, DOS format, binary or ASCII format
- Flash disk ..... 256 Kbytes
- Ram disk ..... 256 Kbytes
- Programming ..... Instrument BASIC
- GPIB ..... ANSI/IEEE 488.2 compatible
- Parallel I/O port .....
  16 bit output, 8 bit input/output, TTL level
  - Option E5100A-005 ..... 8 bit output, 4 bit input, TTL level
  - Option E5100A-006 ..... 16 bit output, 8 bit input/output, TTL level
  - Option E5100A-007 ..... 16 bit output, 8 bit input, open collector, opto-isolated
- Printer ..... Parallel I/F (Centronics compatible), HP PCL
- Keyboard ..... mini-DIN (IBM PC compatible)
- External video monitor output ..... VGA

Connectors
- Probe power ..... +15 V (300 mA max.), –12.6 V (160 mA max.), GND nominal (the maximum current values are total values of each probe connector)

1. When tested at 3 V/m according to IEC 801-3/1984, the averaging noise level will be within specifications over the full immunity test frequency range of 26 to 1000 MHz except when the analyzer frequency is identical to the transmitted interference signal test frequency.

EXT REF INPUT 10 MHz
- Frequency ..... 10 MHz ±5 ppm
- Amplitude ..... 0 ±5 dBm (SPC)
- Nominal impedance ..... 50 Ω

REF OVEN (OPTION E5100A-1D5)
- Frequency (at 0 to 55 °C, 20 minutes after power ON ..... 10 MHz ±1.0 ppm
- Amplitude 2 ±5 dBm (SPC)
- Nominal impedance ..... 50 Ω

INT REF OUTPUT
- Frequency (at 23 ±5 °C) ..... 10 MHz ±20 ppm
- Amplitude ..... 0 ±5 dBm (SPC)
- Nominal impedance ..... 50 Ω

EXT TRIGGER and EXT PROG RUN/CONT
(Positive edge trigger)
- V_{ih} ..... +2 V to +5 V (SPC)
- V_{il} ..... 0 V to +0.5 V (SPC)
- Sink current (Is) ..... Is ≤ 0.4 mA (SPC)
- Pulse width (Tp) ..... Tp ≥ 20 µsec (SPC)

Furnished accessories

Accessories	Qty.	Keysight part number
Power cable	1	–
Sample program disk	1	E5100-180X0[1]
CD-ROM (manuals)	1	E5100-905XX[2]
Option E5100A-ABA add manuals		
Function Reference	1	E5100-900X0[2]
Programming Manual	1	E5100-900X7[2]
User's Guide	1	E5100-900X1[2] .....
Instrument BASIC Users Handbook	1	04155-90150
Instrument BASIC Users Handbook Supplement	1	E5100-900X5[2]
Option E5100A-0BW add Service Manual		
Service Manual	1	E5100-901X0[2]
Option E5100A-1CM rack mount kit		
Front handle kit	1	5062-3978
Option E5100A-1CP front handle kit		
Rack and handle kit	1	5062-3990
Option E5100A-1CP rack and handle kit		
Rack and handle kit	1	5062-3984
Option E5100A-1D5 high stability frequency		
BNC adapter	1	1250-1859
Option E5100A-1F0 external keyboard		
Keyboard	1	–

1. Furnished with special sample program disk (E5100-180X1) as well as the original one if Option E5100A-022/023 is designated. The number indicated by "X" in the part number of the sample program disk, is allocated for numbers increased by one each time a revision is made. The latest edition comes with the product.
2. The number indicated by "X" in the part number of each manual, is allocated for numbers increased by one each time a revision is made. The latest edition omes with the product.

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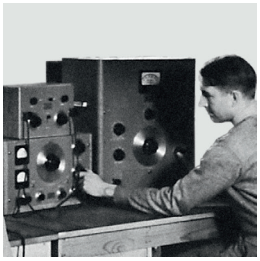
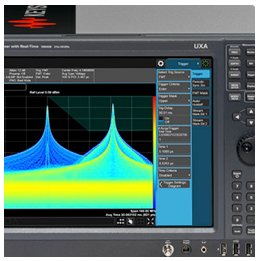


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