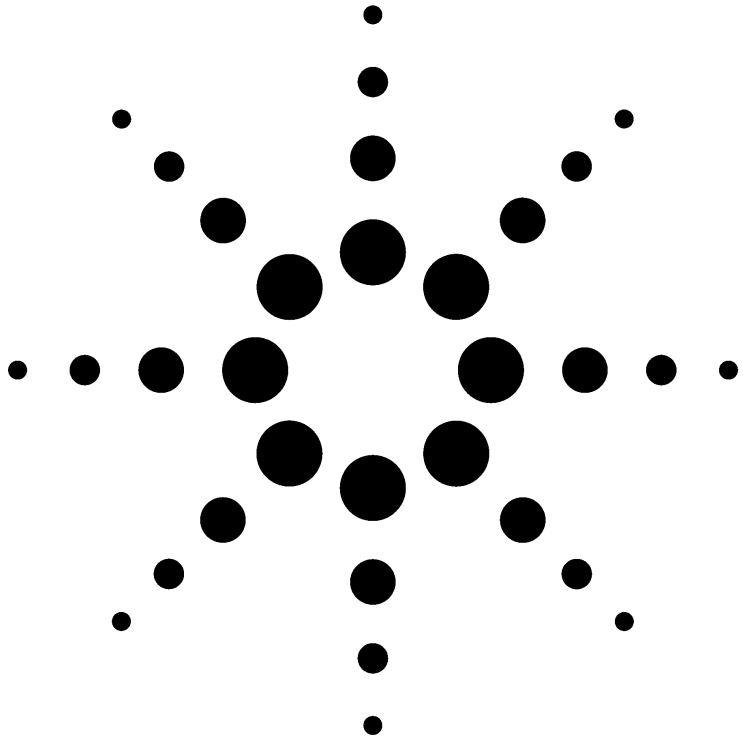
Agilent 93000 SOC Series
C200*e* / C400*e*
Technical Specifications



Agilent Technologies

CONTENTS

1. System Overview 4

2. Timing 5

3. Digital Channels 6

4. Parametric Measurement Units 9

5. Device Power Supplies 11

   5.1 General Purpose Device Power Supply (E7002AA) 11

   5.2 High Voltage Device Power Supply (E7002AB) 13

   5.3 High Current Device Power Supply (E7002C) 15

   5.4 Ultra Low Noise Device Power Supply (E9701A) 17

   5.5 Precision Parallel Source (PPS) (E7947B) 19

   5.6 Extended Device Power Supply (EDPS) (E9709A) 20

6. Analog Instruments 21

   6.1 High Resolution Digitizer (E9686A) 21

   6.2 High Speed Digitizer (E9684A) 22

   6.3 20 MHz Digitizer (E9707A) 23

   6.4 High Resolution AWG (E9685A) 23

   6.5 30 M AWG (E9706A) 24

   6.6 High Speed AWG (E9688A) 24

   6.7 500 M AWG(E9703A) 25

   6.8 Ultra High Speed AWG (E9689A/E9696C) 26

   6.9 4.1 G AWG (E9708A) 27

   6.10 Dual High Speed Sampler (E9687A) 27

   6.11 High Performance Time Interval Analyzer (E9690B/ E9691B) 28

   6.12 General Purpose Time Interval Analyzer (E9690B/ E9705A) 29

CONTENTS

7. RF Measurement Suite 30

7.1 RF Stimulus 30

7.2 Single-Site Test Head Card 30

7.3 Multi-Site Test Head Card 32

7.4 RF Receiver 34

7.5 Supplemental Characteristics 37

7.6 RF General 38

8. Miscellaneous Characteristics 39

8.1 Utility Lines I/O 39

8.2 External Clock Input 40

8.3 Reference Clock Output 40

8.4 Reference Clock Input (RF) 40

8.5 Reference Clock Input (TTL) 40

9. General 41

1. System Overview

Test Processor-Per-Pin Architecture

Maximum channel count	512 (1024) full digital (optional) [1]
Vector memory (max)	56 M
Scan memory per-pin (max)	336 M [2]

Model	C200*e*	C400*e*
Max. I/O data rate (at 3 V swing)	200 Mbit/s	400 Mbit/s
Max. I/O data rate (at 1 V swing)	200 Mbit/s	500 Mbit/s
Max. clock rate (at 3 V swing)	200 MHz	200 MHz
Max. clock rate (at 1 V swing)	200 Mhz	250 MHz

1. If analog capability is required the max. digital pin count will be reduced in incremence of 128 pins.
2. Using E6996AG.

Software Environment

Test programming and debug

The SmarTest production test environment includes manufacturing test interfaces to operators, handling equipment and factory networks. A graphical test flow editor links device tests into a production ready test program. Device tests are setup with fill-in-the-blank test functions. User specific tests are programmed with test methods in C. Links are available for design-to-test conversion. Test setup and debug can be performed via interactive user interfaces. Result analysis tools are available for error locations, timing behavior, analog waveforms, shmoo plots, pin margin tests and memory bit map.

Compatibility

Software is compatible between all Agilent 93000 NP-models, P-models and C*e*-models.

System Controller

Workstation	HP 9000 PA-RISC workstation
Operating system	HP-UX
System control	The system electronics are memory mapped into the workstation via a high-speed fiber optic link. Test execution and result analysis is supported by parallel processing with Test Processors-Per-Pin.

2. Timing

The following specifications are measured at the pogo pins of the DUT board interface. To keep the system within these specifications, the system must be calibrated once every 3 months and kept within ± 2.5 K of the temperature at calibration. For more details refer to chapter 8 (Calibration and Operation).

Timing

Overall timing accuracy (OTA)	±350 ps
Edge placement accuracy (EPA = OTA/2)	±175 ps
Edge placement resolution	10 ps
Edge placement range	-4 to 12 Periods [1)]

1. Edge placement range max. –4000 ns to +140000 ns.

Vector period

	C200*e*	C400*e*
Range	20 ns to 163840 ns	6 ns to 163840 ns
Accuracy	0.1% of period	
Resolution	3 digits	

3. Digital Channels

Drivers

AC Performance

Maximum transition time (10 to 90%)	
at 1 V swing	1.3 ns [1]
at 3 V swing	1.7 ns [1]
Minimum pulse width	
at 1 V swing	2.0 ns [1]
at 3 V swing	2.4 ns [1]

DC Performance

Level range	-2 V to 7 V
Level resolution	2.5 mV
Level accuracy	±10 mV [2]
High-Z compliance range	-2 V to 7 V
Minimum swing	200 mV [3]
Maximum swing	5.4 V

Impedance

Source impedance	50 Ohm ±5 Ohm

Z-Clamp mode

Voltage range	-2 V to 6 V
Maximum voltage window	5.4 V [4]
Voltage resolution	2.5 mV
Voltage accuracy	±100 mV

1. Verification condition: half the noted voltage into 50 Ohm
2. Valid for voltage range -1 V to 5 V and for DC update period of 2 weeks.
   Characteristics: ±15 mV within a DC update period of 1 month
3. Software allows programming to 0 mV swing, specification valid down to 200 mV.
4. Clamp levels and driver levels must be within this maximum voltage window.
   Maximal difference for DrvLow-ClmpLow ≤ 2.6 V
   Maximal difference for ClmpHigh-DrvHigh ≤ 2.6 V

3. Digital Channels continued

Programmable Load

Currents (I_{oh}, I_{ol})	0 to 35 mA
Current resolution	12.5 µA
Current accuracy	±75 µA ±1% of max (I_{ol}, I_{oh}) [1)]
Commutation voltage range (V_{com})	-2 V to 6 V
Voltage resolution	2.5 mV
Voltage accuracy	±100 mV
Impedance	50 Ohm ±5 Ohm

1. Accuracy valid at $V_{ol} < V_{com}$ - 0.7 V - I_{ol} * 50 Ohm, $V_{oh} > V_{com}$+0.7 V+I_{oh} * 50 Ohm (see Programmable Loads /Characteristics below). V_{ol} /V_{oh} is the resulting voltage at the pin output.

Programmable Load /Characteristics:

Idut vs. Vdut (for Vcom = 2.0V, Iol = 20mA, Ioh = 10mA)

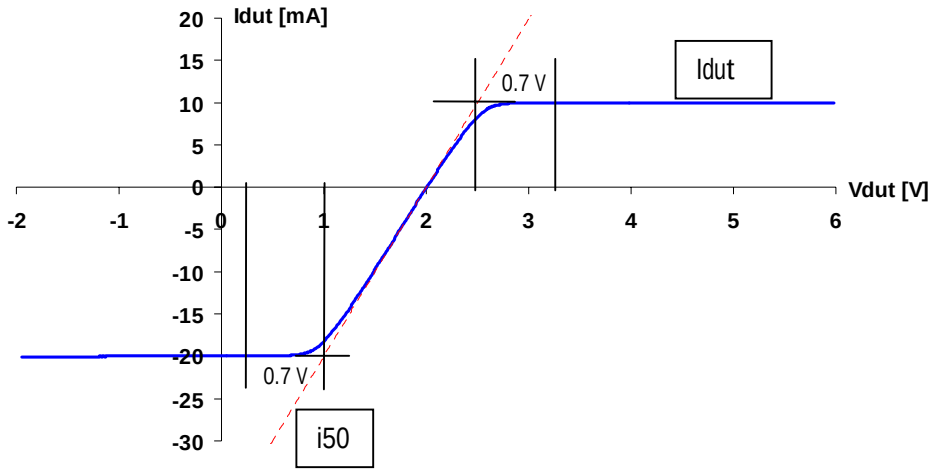


Fig. 1: Programmable Load /Characteristics

3. Digital Channels continued

Comparators

AC Performance

Minimum detectable pulse width	1.5 ns

DC Performance

Threshold range	-2 to 7 V [1)]
Threshold resolution	2.5 mV
Threshold accuracy	±10 mV [2)]
Minimum overdrive	50 mV
Input leakage current	±10 µA (Characteristics: ±2 µA between 0 V to 5 V level)

1. Minimum high-low threshold difference: 100 mV.
2. Valid for threshold voltage range -2 V to 6 V and a DC update period of 2 weeks.
   Characteristics: ±15 mV within a DC update period of 1 month

4. Parametric Measurement Units

Per-Pin PMU

Voltage force/measure

Range	-2 V to 7 V
Voltage force	
Resolution	5 mV
Accuracy	± 20 mV – (I_a*R) ± 0.5% of setting [1)]
Voltage measure	
Resolution compare mode	5 mV
Resolution measure mode	0.5 mV
Accuracy	± 20 mV – (Ia*R) ± 0.5% of reading [1)]
Typical accuracy in measure mode	± 5 mV [2)]

Current force/measure

	Range	Resolution (force/measure)	Measure accuracy	Force accuracy
Range 1	±40 mA	20 µA	±50 µA ±0.5% of reading	±200 µA ±0.5% of setting
Range 2	±1 mA	0.5 µA	±1.25 µA ±0.5% of reading	±5 µA ±0.5% of setting
Range 3	±100 µA	50 nA	±125 nA ±0.5% of reading	±500 nA ±0.5% of setting
Range 4	±10 µA	5 nA	±100 nA ±0.5% of reading	±100 nA ±0.5% of setting

1. I_a is the actual current, R is the wiring resistance of ≤0.5 Ohm.
2. This value is a characteristic and not guaranteed by Agilent Technologies

4. Parametric Measurement Units continued

High Precision PMU

Number of High Precision PMUs is depending on system configuration:
512 channel test head with maximum 4 High Precision PMUs
1024 channel test head with maximum 8 High Precision PMUs

Voltage range (force/measure)	-5 V to 8 V
Resolution	250 µV
Accuracy	± 2 mV – (I_a*R) [1)]

	Current range	Resolution	Accuracy
Range 1	±200 mA	6 µA	±200 µA ±0.1% of reading/setting
Range 2	±5 mA	250 nA	±10 µA ±0.1% of reading/setting
Range 3	±200 µA	6 nA	±200 nA ±0.1% of reading/setting
Range 4	±5 µA	250 pA	±10 nA ±0.1% of reading/setting

1. I_a is the actual current, R is the wiring resistance of ≤ 0.5 Ohm.

5. Device Power Supplies

5.1 General Purpose Device Power Supply (E7002AA)

Configuration

Maximum number of channels per system

512 channel test head	16 (4 DPS boards with 4 channels each)
1024 channel test head	32 (8 DPS boards with 4 channels each)

Maximum current

Per channel	8 A [1)]
Per board	16 A [1)]
Per system	
Test head 512 pin	64 A [1)]
Test head 1024 pin	128 A

Parallel connection	Parallel connection (ganging) possible for up to 32 channels (only across boards of the same product E7002AA). Maximum four gangs of pins allowed. Only subsequent pins can be ganged.

1. The DUT interface E6980A uses low current pogo pins for DPS pins 13-16.
   This only allows 4 A per channel in these locations. See "DUT board design guide" for details.

Supply Voltage/ Current Range Specifications

Mode	Range	Resolution	Accuracy	Comments
Voltage force	±7 V	1 mV	±5 mV ±0.1%	Imax = +8 A, -4 A
	±8 V	1 mV	±5 mV ±0.1%	Imax = ±4 A
Voltage measure	±8 V	1 mV	±5 mV ±0.1% of reading	
Current force (clamp)	8 A, -4 A	1 mA	±20 mA ±0.5% of setting	
Current measure	±8 A	1 mA	±20 mA ±0.1% of reading [2)]	
	±0.3 A	30 µA	±300 µA ±0.1% of reading [2)]	
	±10 mA	1 µA	±10 µA ±0.1% of reading [3)]	
	±100 µA	10 nA	±100 nA ±0.1% of reading [4)]	

2. Number of samples fixed to 16.
3. Maximum capacitance C_{load} at device 100 µF, number of samples fixed to 32.
4. Maximum capacitance C_{load} at device 1 µF, minimum number of samples 500.

5.1 General Purpose Device Power Supply (E7002AA) continued

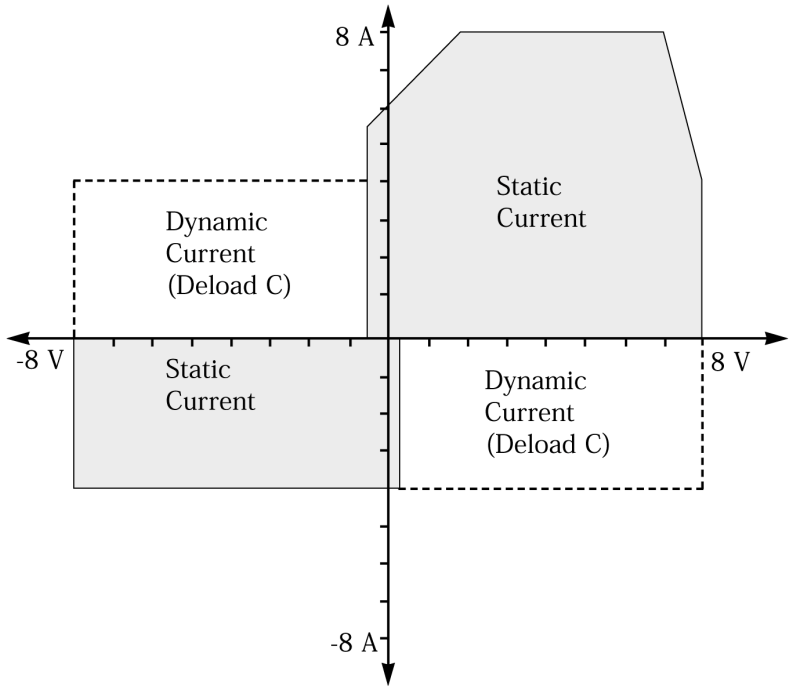


Fig. 1: General Purpose Device Power Supply: Power Diagram (E7002AA)

Product Characteristics

Current measure accuracy for parallel connection	n x ±20 µA n x ±600 µA (if ganging is not on the same board) (n = number of ganged pins).
V_{bump} function	Switchable between two values during test execution. DPS is calibrated to both values. Real-time signal provided from DUT board.
Voltage force accuracy for V_{bump}	±20 mV ±0.2% of setting
IDDQ measurement	To calculate measurement times for IDDQ measurements please refer to the user documentation.
Load capacitance on DUT board	To determine the adequate blocking capacitance on the DUT board please refer to the user documentation.

Note: If the High Voltage Device Power Supply (E7002AB) is installed, ganging of the General Purpose Device Power Supplies (E7002AA) is only possible for voltages above –4 V.

5.2 High Voltage Device Power Supply (E7002AB)

Configuration

Maximum number of channels per system

512 channel test head	16 (4 DPS boards with 4 channels each)
1024 channel test head	32 (8 DPS boards with 4 channels each)

Maximum current

per channel	1 A
per board	4 A

Parallel connection: Parallel connection (ganging) possible for up to 32 channels (only across boards of the same product E7002AB). Maximum four gangs of channels allowed. Only subsequent channels can be ganged.

Supply Voltage/ Current Range Specifications

Mode	Range	Resolution	Accuracy	Comments
Voltage force	0.5 V to 22 V	2 mV	±10 mV ±0.1%	Imax = +1 A
Voltage measure	0.5 V to 22 V	2 mV	±10 mV ±0.1%	
Current force (clamp)	1 A	1 mA	±20 mA ±0.5% of setting	
Current measure	±1 A	1 mA	±20 mA ±0.1% of reading [1)]	
	±0.3 A	30 µA	±300 µA ±0.1% of reading [1)]	
	±10 mA	1 µA	±10 µA ±0.1% of reading [2)]	
	±100 µA	10 nA	±100 nA ±0.1% of reading [3)]	

1. Number of samples fixed to 16.
2. Maximum capacitance C_{load} at device 100 µF, number of samples fixed to 32.
3. Maximum capacitance C_{load} at device 1 µF, minimum number of samples 500.

5.2 High Voltage Device Power Supply (E7002AB) continued

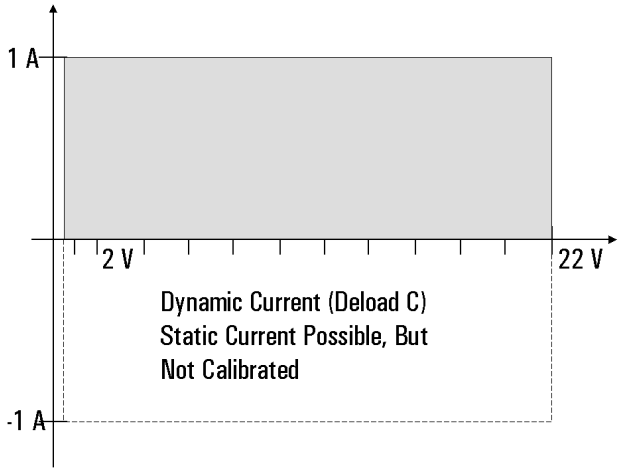


Fig. 1: High Voltage Device Power Supply: Power Diagram (E7002AB)

Product Characteristics

Current measure accuracy for parallel connection	n x ±20 µA n x ±600 µA (if ganging is not on the same board) (n = number of ganged pins).
V_{bump} function	Switchable between two values during test execution. DPS is calibrated to both values. Real-time signal provided from DUT board
Voltage force accuracy for V_{bump}	±20 mV ±0.2% of setting
IDDQ measurement	To calculate measurement times for IDDQ measurements please refer to the user documentation.
Load capacitance on DUT board	To determine the adequate blocking capacitance on the DUT board please refer to the user documentation.

Note: If the High Voltage Device Power Supply (E7002AB) is installed, ganging of the General Purpose Device Power Supplies (E7002AA) is only possible for voltages above –4 V.

Note: If the High Voltage Device Power Supply (E7002AB) is installed, ganging of the High Current Device Power Supplies (E7002C) is not possible.

5.3 High Current Device Power Supply (E7002C)

Configuration

Maximum number of supplies per system

512 channel test head	4 DPS boards with 1 channel each
1024 channel test head	8 DPS boards with 1 channel each

Maximum current per supply	100 A
Low current measurement with PMU	High current DPS can be switched to tristate to measure the small currents by a paralleled High Precision PMU.
Parallel connection	Parallel connection (ganging) possible for 2 supplies (only across supplies of the same product E7002C). Ganging is done in master/slave mode. Maximum ganging current is 200 A. Constant current mode not available in parallel connection.

Supply Voltage/ Current Range Specifications

Mode	Range	Resolution	Accuracy	Comments
Voltage force	0.3 V to 2.5 V	1 mV	±5 mV	Imax = +100 A
	2.5 V to 4 V	1 mV	±5 mV	Imax = +50 A
Voltage measure	0 V to 4 V	1 mV	±5 mV	
Current force (clamp)	+1 A to 100 A	100 mA	I ≤ 10 A: ±200 mA ±0.5% [1)]	
			I > 10 A: ±200 mA ±2% [1)]	
Current measure	±100 A	10 mA	±100 mA ±0.4% [1) 2)]	

1. Number of samples fixed to 128.
2. Negative currents are not calibrated.

5.3 High Current Device Power Supply (E7002C) continued

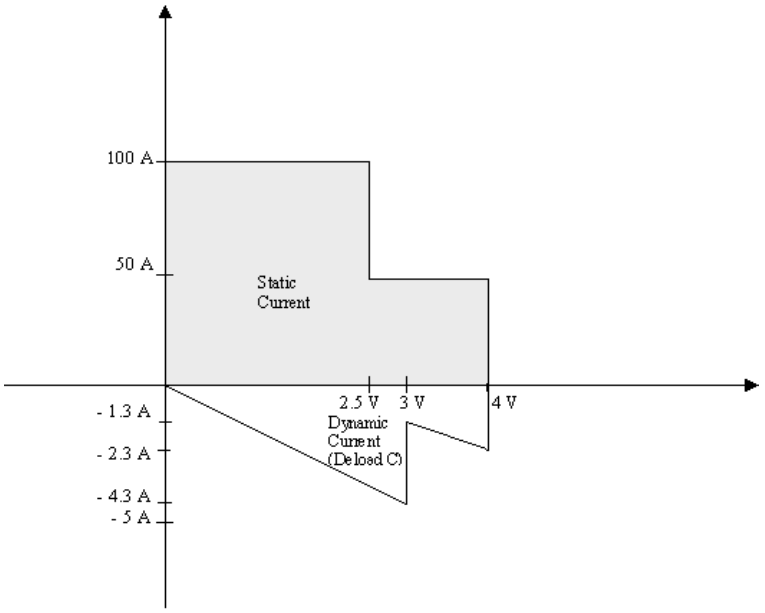


Fig. 1: High Current Device Power Supply: Power Diagram (E7002C)

Product Characteristics

Settling time (at 2 V, settling into ±20 mV of programmed value)

Loadstep	Blocking Caps	5 mF	10 mF	20 mF
0 A to 100 A		12 µs	37 µs	65 µs
100 A to 0 A		135 µs	160 µs	180 µs
40 A to 80 A		12 µs	18 µs	29 µs
80 A to 40 A		15 µs	15 µs	20 µs

Droop (at 2 V)

Loadstep	Blocking Caps	5 mF	10 mF	20 mF
0 A to 100 A		210 mV	125 mV	85 mV
100 A to 0 A		300 mV	150 mV	108 mV
40 A to 80 A		100 mV	56 mV	32 mV
80 A to 40 A		110 mV	56 mV	32 mV

Note: If the High Voltage Device Power Supply (E7002AB) is installed, ganging of the High Current Device Power Supplies (E7002C) is not possible.

5.4 Ultra Low Noise Device Power Supply (E9701A)

Configuration (Characteristic)

Maximum number of pins per system (2 pins per DPS board)

448 pin test head	8 (4 DPS boards with 2 channels each)
1024 pin test head	16 (8 DPS boards with 2 channels each)

Supply Voltage/ Current Range Specifications

Mode	Range	Resolution	Accuracy	Comments
Voltage force	8 V	16 bit	2 mV +0.1%	Imax = 8 V/4 A,-8 V/-2 A [1)]
Voltage measure	8 V	16 bit	2 mV +0.1%	
Current force	4 A	14 bit	20 mA +0.5%	
Current measure	4 A	16 bit	10 mA + 0.1%	
	200 mA	16 bit	300 µA +0.1%	
	10 mA	16 bit	10 µA +0.1%	
	1 mA	16 bit	1 µA +0.1%	
	100 µA	16 bit	100 nA + 0.1%	

1. The output VI range is as shown in figure 1

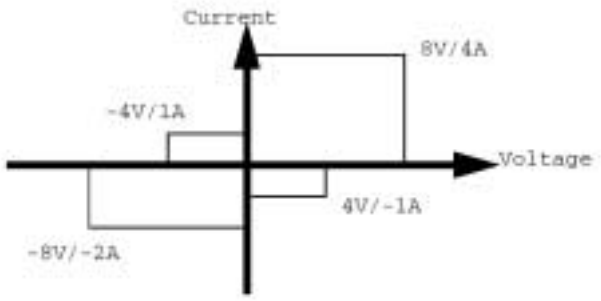


Fig. 1: Output VI Range

5.4 Ultra Low Noise Device Power Supply (E9701A) continued

Product Characteristics

Output Spurious	<-80 dBm (up to 1 MHz)
Iddq measurement Speed	3 kHz (at 1 nF load capacitance)
Iddq additional I-meas error	1% of reading + 1% of range
Modulation	Sinewave (1 Vpp@20 Hz, 0.2 Vpp@20 kHz), starts by external or SW trigger
Vbump	2 voltage levels, 50 µs interval, triggered by external trigger
Max Load capacitance	1 mF

[Parallel mode]

Max VI range	8 V/8 A,-8 V/-4 A (ganging mode)
Additional V-set/measure error	50 mV
Additional I-limit error	0.5% + 30 mA
Additional I-measure error	1% of range (@ 4 A-1 mA range)
	10 µA (@ 100 µA range)

5.5 Precision Parallel Source (PPS) (E7947B)

Number of analog output	16
Number of independent DAC core	2 [1)]
Pattern memory per DAC core	64 k words
Max output current per channel	15 mA
External trigger range	0 V to 5 V [2)]
External trigger threshold level	0.6 V
Max trigger speed	1 MHz @ 0 to 1 V trigger range [2)]
Analog band width	50 kHz [3)]
Output impedance	<1 Ohm

1. 8 output each
2. This is specified data.
   Please see below characteristics data, this is not specified
   50 kHz max. trigger speed @ 0 to 5 V as external trigger range
   300 kHzmax. trigger speed @ 0 to 3.3 V as external trigger range
   500 kHz max. trigger speed @ 0 to 2 V as external trigger range
3. Settling time : 10 µs (0 to 5 V, settle to 5%)

Supply Voltage/ Current Range Specifications

	voltage range	resolution	accuracy
range 1	-0.5 V -- 6.5 V	122 µV	0.1% + 2 mV
range 2	-0.3 V -- 4.0 V	73.2 µV	0.1% + 1 mV
range 3	-0.1 V -- 1.2 V	24.4 µV	0.1% + 1 mV

5.6 Extended Device Power Supply (EDPS) (E9709A)

Configuration

Maximum number of channels per system

448 channel test head	32 (4 EDPS boards with 8 channels each)
960 channel test head	64 (8 EDPS boards with 8 channels each)

Maximum current

Per channel	1A

Supply Voltage/Current Range Specifications

Mode	Range	Resolution	Accuracy
Voltage force	0 to 7 V	214 µV	± (5 mV ± 0.1%)
Voltage measure	0 to 7 V	214 µV	± (5 mV ± 0.1%)
Current force (clamp)	0 to 1 A	976 µA	5% ± 50 mA
Current measure	0 to 1 A	122 µA	± (5 mA ± 0.1%)
	0 to 300 mA	9.15 µA	± (300 µA ± 0.2%)
	0 to 10 mA	3.05 nA	± (10 µA ± 0.1%)
	0 to 100 µA	3.05 nA	± (100 nA ± 0.1%)

Vbump function Nominal, High, Low setting

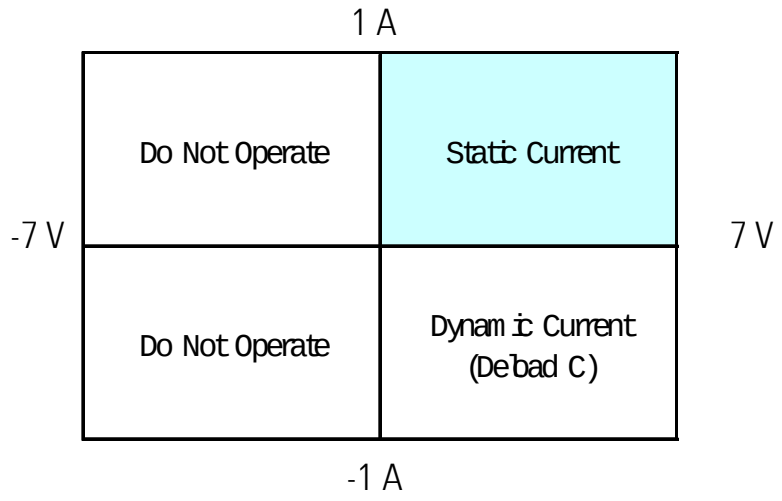


Fig. 1: Extended Device Power Supply: Power Diagram

6. Analog Instruments

6.1 High Resolution Digitizer (E9686A) [1)]

Pin counts per module	8 single-ended or 4 differential
Resolution	16 bit (up to 24 bit with hardware averaging)
Sampling rate	8 ksps to 2.048 Msps
Waveform capture memory	1 M samples
Input mode	single-ended or differential
Input range	±6 V, ±3 V, ±1.5 V, ±0.75 V, ±0.2 V
DC offset range	±5 V
Common mode range	±6 V ±1/2 x range at 1 MOhm single-ended (with offset) ±6 V at 50 Ohm single-ended (with offset) ±6 V at 100 Ohm differential (without offset)
Bandwidth at –3 dB	3 MHz [2)] at ±6 V range, filter through
Input impedance	
Single-ended	1 MOhm, 50 Ohm
Differential	1 MOhm, 100 Ohm
Absolute DC accuracy	
Single-ended	±0.1% of reading ±0.05% of range ±5 mV +(±1 mV ±0.04% of bias) at DC offset
Differential	±0.15% of reading ±0.05% of range ±0.02% of common mode voltage
THD	-100 dB [2)] at 1 kHz
Filter	through, 6 kHz, 30 kHz, 150 kHz, 500 kHz

1. These specifications are valid for recommended analog configuration.
2. Characteristic

6.2 High Speed Digitizer (E9684A) [1)]

Pin counts per module	8 single-ended or 4 differential
Resolution	12 bit
Sampling rate	1 Msps to 41 Msps
Waveform capture memory	512 k samples
Input mode	single-ended or differential
Input range	±2 V, ±1 V, ±0.5 V, ±0.25 V
DC offset range	±4 V
Common mode range	±2 V at 50 Ohm, 37.5 Ohm, 10 kOhm single-ended and 100 Ohm, 10 kOhm differential (without offset) ±2 V at 50 Ohm , 37.5 Ohm single-ended (with offset) ±6 V at 10 kOhm single-ended and 10 kOhm, 100 Ohm differential (with offset)
Bandwidth at –3 dB	100 MHz at ±0.5 V range [2)], filter through
Input impedance	
Single-ended	10 kOhm, 37.5 Ohm, 50 Ohm
Differential	10 kOhm, 100 Ohm
Absolute DC accuracy	
Single-ended	±0.3% of reading ±0.3% of range ±5 mV +(±5 mV ±0.4% of bias) at DC offset
Differential	±0.3% of reading ±0.5% of range ±0.4% of common mode voltage
THD	-75 dB [2)] at 1 MHz
Filter	through, 6.1 MHz (Video), 13 MHz, 26 MHz

1. These specifications are valid for recommended analog configuration.
2. Characteristic

6.3 20 MHz Digitizer (E9707A) [1)]

Pin counts per module	8 single-ended or 4 differential (2 parallel test)
Number of channels	2
Resolution	16 bit
Sampling Rate	125 ksps to 5 Msps
Waveform Capture Memory	1M Samples (per channel)
Input Mode	single-ended or differential
Input Range	±2 V, ±1 V, ±0.5 V, ±0.2 5V, ±0.125 V
DC Offset Range	±4 V
Common Mode Range	±6 V at 1 MOhm single-ended (with offset) ±2 V at 50 Ohm single-ended (with offset) ±6 V at 100 Ohm differential (with offset)
Bandwidth at -3dB	20 MHz [2)] at filter through
Input Impedance	
Single-ended	1 MOhm, 50 Ohm
Differential	1 MOhm, 100 Ohm
Absolute DC Accuracy	
Single-ended	±0.5% of reading ±0.5% of range + (±10 mV±0.5% of bias) at DC offset
Differential	±0.5% of reading ±0.8% of range + (±0.5% of bias) at DC offset
THD	-90 dB at 450 kHz [2)]
Filter	Through, 150 kHz, 500 kHz, 1.5 MHz, 3.25 M

6.4 High Resolution AWG (E9685A) [1)]

Pin counts per module	8 single-ended (4 parallel test) or 4 differential (2 parallel test)
Resolution	18 bit
Sampling rate	8 ksps to 1.024 Msps
Waveform memory	4 M
Max. sinewave frequency	250 kHz
Output mode	single-ended or differential
Output range	6 Vpp at 600 Ohm R_{load} (0 to 63 dB attenuation with 0.01 dB resolution)
DC offset range	±5 V at 600 Ohm R_{load}
Output impedance	50 Ohm
Absolute DC accuracy	±0.1% of setting ± 11 mV at R_{load}>10 kOhm
THD	-115 dB [2)] 1 kHz
Filter	through, 1.3 kHz, 13 kHz, 130 kHz, 300 kHz

1. These specifications are valid for recommended analog configuration.
2. Characteristic

6.5 30 M AWG (E9706A) [1)]

Pin counts per module	8 single-ended (4 parallel test) or 4 differential (2 parallel test)
Number of channels	2
Resolution	16 bit
Sampling rate	8 ksps to 30 Msps
Waveform Memory	4 M (per channel)
Max. Sinewave frequency	7.5 MHz
Output Mode	single-ended or differential
Output Range	2.5 Vpp at 50 Ohm_{load}
	(0 to 70 dB Attenuation with 0.01 dB resolution) [3)]
DC offset Range	±2.5 V at 50 Ohm R_{load} to GND
	0 V to 5 V at 50 Ohm R_{load} to external termination voltage (Vt) [4)]
Output impedance	50 Ohm
Absolute DC Accuracy	±1.0% of setting ± 20 mV at R_{load}>10 kOhm without DC offset
	±1.3% of setting ± 20 mV at R_{load}>10 kOhm with DC offset
THD	-90 dB at 1 MHz, 450 kHz [2)]
Filter	Through, 1.3 kHz, 150 kHz, 500 kHz, 1.4 MHz

6.6 High Speed AWG (E9688A) [1)]

Pin counts per module	8 single-ended (4 parallel test) or 4 differential (2 parallel test)
Resolution	12 bit
Sampling rate	8 ksps to 128 Msps
Waveform memory	2 M
Max. sinewave frequency	32 MHz
Output mode	single-ended or differential
Output range	2.5 Vpp at 50 Ohm R_{load}
	(0 to 63 dB attenuation with 0.01 dB resolution) [3)]
DC offset range	±2.5 V at 50 Ohm R_{load} to GND
	0 V to 5 V at 50 Ohm R_{load} to external termination voltage (Vt) [4)]
Output impedance	50 Ohm
Absolute DC accuracy	±0.3% ± 20 mV without offset into Hi-Z (>10 kOhm)
THD	-70 dB [2)] at 10 MHz
Filter	through, 1.3 MHz, 6.1 MHz (Video), 13 MHz, 42 MHz

1. These specifications are valid for recommended analog configuration.
2. Characteristic
3. Range 1 : -2.5 V<AC+DC<2.5 V at 50 Ohm_{load} to GND
   Range 2 : 0 V<AC+DC<5 V at 50 Ohm_{load} to external termination voltage (Vt) , Vt=2.5 V
4. Vt=2.5 V

6.7 500 M AWG(E9703A) [1)]

Pin counts per module	8 single-ended (4 parallel test) or 4 differential (2 parallel test)
Resolution	12 bit
Sampling rate	8 ksps to 500 Msps
Waveform Memory	8 M
Max. Sinewave frequency	125 MHz
Output Mode	single-ended or differential
Output Range	2.5 Vpp at 50 Ohm $_{load}$
	(0 to 50 dB attenuation with 0.01 dB resolution) [2)]
DC offset Range	±2.5V at 50 Ohm $_{load}$ to GND
	0 V to 5 V at 50 Ohm $_{load}$ to external termination voltage (Vt) [3)]
Output impedance	50 Ohm
Absolute DC Accuracy	±1.0% ± 15 mV without Offset into Hi-Z (>10 kOhm)
	±1.3% ± 35 mV with Offset into Hi-Z (>10 kOhm)
THD	-80 dB at 1 MHz [4)]
Filter	Through, 1.3 MHz, 3.8 MHz, 13 MHz, 42 MHz, 78 MHz, 163 MHz

1. These specifications are valid for recommended analog configuration.
2. Range 1 : -2.5 V<AC+DC<2.5 V at 50 Ohm load to GND
   Range 2 : 0 V<AC+DC<5 V at 50 Ohm load to external termination voltage (Vt) , Vt=2.5 V
3. Vt=2.5 V
4. Characteristic

6.8 Ultra High Speed AWG (E9689A/E9696C) [1) 2)]

Pin counts per module	8 single-ended (2 parallel test) or 4 differential (2 parallel test) [3)]
Resolution	8 bit
Sampling rate	50 ksps to 2.6 Gsps
Waveform memory	8 M
Output mode	differential pair
Output range	
Normal mode	2 Vpp at 50 Ohm (20 m Vpp to 2.0 Vpp with 1 mV resolution)
Direct mode	1 Vpp at 50 Ohm (20 m Vpp to 1.0 Vpp with 1 mV resolution)
DC offset range	±1 V (normal mode only)
Output impedance	50 Ohm
Absolute DC accuracy	
Normal mode	±3% of amplitude setting ±4 mV at 10 kOhm
Direct mode	±4% of amplitude setting ±4 mV at 10 kOhm
THD	-40 dB 4) at 81.25 MHz
Filter	through, 20 MHz, 50 MHz, 100 MHz, 200 MHz

1. These specifications are valid for recommended analog configuration.
2. Need 1 or 2 instrument(s) in support rack. This front-end module is able to support 2 instruments.
3. This specification is valid for using 2 instruments in the support rack.
   When there is 1 instrument placed in the support rack: 4 single-ended (1 parallel test) or 2 differential (1 parallel test)
4. Characteristic

6.9 4.1 G AWG (E9708A) [1]

DAC core /module	1 core/module
Pin counts per module	4 single-ended (4 parallel test) or 4 differential (4 parallel test)
Resolution	8 bit
Sampling rate	25 Msps to 4.1 Gsps
Max sinwave frequency	800 MHz (-3 dB) 1.2 GHz (-10 dB) [2]
Waveform memory	16 M words
Output mode	Differential quad output
Output range	Max 1 Vpp into 50 Ohm (2 Vpp differential)
Attenuation range	0 dB to –25 dB: 0.1 dB step
Output impedance	50 Ohm nominal (SE)
Absolute DC accuracy(differential)	1.5% of amplitude setting + 20 mV into HiZ
THD	-50 dBc [2] at 30 MHz. 1 Vpp
SFDR	47 dBc [2] at 100 MHz up to 1.2 GHz, 1 Vpp

6.10 Dual High Speed Sampler (E9687A) [3] [4]

Pin counts per module	4 single-ended (2 parallel test)
Resolution	12 bit
Sampling rate	8 ksps to 1 Msps
Waveform capture memory	1 M [5]
Input mode	single-ended
Input range	±1 V, ±0.2 V, ±0.02 V
DC offset range	same as input range
Common mode range	same as input range
Max. input frequency	1 GHz
Input impedance	50 Ohm
Absolute DC accuracy	± 0.5% of reading ± 2 mV [6]
THD	-60 dB [2] at 10 MHz
Filter	no

1. These specifications are valid for recommended analog configuration. Requires E9713A High grade analog pogo cbl
2. Characteristic
3. These specifications are valid for recommended analog configuration.
4. This module has 2 channels.
5. 512 k per channel. Total 1 M in module because this module has 2 channels.
6. This specification is valid for ±0.02 V range and ±0.2 V range.

6.11 High Performance Time Interval Analyzer (E9690B/ E9691B) [1) 2)]

Pin counts per front-end module	7 input pins (with signal loopback) 2 trigger pins
Number of triggers input	1 input to each TIA instrument (support rack)
Number of channels per TIA instrument	2 channels (ch1, ch2)
Max. input frequency	960 MHz @ 2 Vpp sine (signal input 50 Ohm) [3)]
Input voltage range (Vin)	
Signal input	-3 V to +7 V
Trigger (arming) input	-1.5 V to +2.5 V
Threshold voltage range (Vth)	-2 V to 6 V (I $V_{in} - V_{th}$ I ≤ 7 V) [4)]
Number of threshold per-pin	1
Resolution	1 mV
Accuracy	±10 mV
Hysteresis	6 mV [3)]
Input impedance	
Signal input	50 Ohm to termination voltage 10 kOhm to ground
Trigger (arming) input	50 Ohm to ground
Termination Voltage (Vterm)	-2V to +6V [4)] ($IV_{in} - V_{term}$I<=7 V @10 kOhm term. , $IV_{in} - V_{term}$I<=2 V @ 50 Ohm term.)
Resolution	1 mV
Accuracy	±10 mV
Slope	positive, negative
Measurement function	time interval, period, period jitter, frequency, pulse width, propagation delay
Range	-2.5 s to 2.5 s
Resolution	0.8 ps at single-shot
Time measurement accuracy	1 ppm of reading ± 30 ps at same slope, same channel [5)]
Trigger function	arm on stop, arm on start, arm start first

1. These specifications are valid for recommended analog configuration (front-end module and instrument).
2. Need of TIA instruments in support rack to use front-end module.
3. Characteristic
4. Independently settable for each channel, 1 instrument has 2 channels.
5. Condition : Square wave with average, frequency 30 MHz to 900 MHz, amplitude 0.2 Vpp to 3 Vpp.

6.12 General Purpose Time Interval Analyzer (E9690B/ E9705A) [1) 2)]

Pin counts per front-end module	7 input pins (with signal loopback) 2 trigger pins
Number of triggers input	1 input to each TIA instrument (support rack)
Number of channels per TIA instrument	2 channels (ch1, ch2)
Max. Input frequency	400 MHz @ 2 Vpp sine (Signal input 50 Ohm) [3)]
Input Voltage Range (Vin)	
Signal Input	-3 V to +7 V
Trigger (Arming) Input	-1.5 V to +2.5 V
Threshold Voltage Range (Vth)	-2 V to 6 V (I $V_{in} - V_{th}$ I <=7 V) [4)]
Number of threshold per-pin	1
Resolution	1 mV
Accuracy	±10 mV
Hysteresis	6 mV [3)]
Input impedance	
Signal Input	50 Ohm to termination voltage 10 kOhm to ground
Trigger (Arming) Input	50 Ohm to ground
Termination Voltage (Vterm)	-2 V to +6 V [4)] ($IV_{in} - V_{term}$I<=7 V @10 kOhm term. , $IV_{in} - V_{term}$I<=2 V @ 50 Ohm term.)
Resolution	1 mV
Accuracy	±10 mV
Slope	positive, negative
Measurement function	time interval, period, period jitter, frequency, pulse width, propagation delay
Range	-2.5 s to 2.5 s
Resolution	0.8 ps at single-shot
Time Measurement Accuracy	1 ppm of reading ± 50 ps at same slope, same channel [5)]
Trigger function	arm on stop, arm on start, arm start first

1. These specifications are valid for recommended analog configuration (front-end module and instrument).
2. Need of TIA instruments in support rack to use front-end module.
3. Characteristic
4. Independently settable for each channel, 1 instrument has 2 channels.
5. Condition : Square wave with average, frequency 30 MHz to 400 MHz, amplitude 0.2 Vpp to 3 Vpp.

7. RF Measurement Suite

The following RF specifications describe the warranted performance over the temperature range of 20°C to 26°C and receiver bandwidth of 325.52 Hz, unless otherwise noted.

These RF specifications are only applicable when a system calibration has been completed. Calibration is the process of measuring known standards that have fully defined models in order to quantify the system's systematic (repeatable) errors. Calibration must be performed within the 20 °C to 26 °C temperature range. For calibration to remain fully verifiable, the temperature of the system must remain within ± 1 °C around the initial calibration measurement temperature.

7.1 RF Stimulus

Frequency Accuracy[1)]

± 10 ppm (without an AMC)

Frequency Resolution Characteristics

RF Source	Frequency Resolution
E6432A	1 Hz
E4438C	0.01 Hz

7.2 Single-Site Test Head Card

Single-Tone Stimulus

Maximum CW Power Available at Test Port

	RF Source	0.01 – 0.05 GHz (typical)	0.05 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz	6 – 8 GHz
RF Channel 1	E6432A	- 9.5 dBm	- 1.5 dBm	- 3.5 dBm	+ 0.5 dBm	- 4.5 dBm	- 7.5 dBm
	E4438C	- 9.5 dBm	- 0.5 dBm	- 3.5 dBm	- 8.5 dBm	- 13.5 dBm	
RF Channel 2	E6432A	- 9.5 dBm	- 1.5 dBm	- 3.5 dBm	+ 0.5 dBm	- 4.5 dBm	- 7.5 dBm
	E4438C	- 9.5 dBm	- 0.5 dBm	- 3.5 dBm	- 8.5 dBm	- 13.5 dBm	
RF Channel 3	E6432A	- 12.0 dBm	- 4.0 dBm	- 6.0 dBm	-1.5 dBm		
	E4438C	- 12.0 dBm	- 3.0 dBm	- 6.0 dBm	- 10.5 dBm		

1. If there is an AMC, Frequency Accuracy is dependent on the AMC accuracy.

7.2 Single-Site Test Head Card continued

CW Power Accuracy at –15 dBm

RF Source	0.01 – 0.05 GHz (typical)	0.05 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz	6 – 8 GHz
E6432A	± 1.4 dB	± 1.4 dB	± 1.4 dB	± 1.5 dB	± 1.5 dB	± 1.7 dB
E4438C	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.1 dB	± 1.1 dB	

Multi-Tone Stimulus

Maximum CW Power Available at Test Port for All Tones

	RF Source	0.4 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz
RF Channel 1	E6432A	- 3.5 dBm	- 7.0 dBm	- 3.5 dBm	- 8.0 dBm
	E4438C	- 3.5 dBm	- 7.0 dBm	- 8.5 dBm	- 13.5 dBm
RF Channel 2	E6432A	- 3.5 dBm	- 7.0 dBm	- 3.5 dBm	- 8.0 dBm
	E4438C	- 3.5 dBm	- 7.0 dBm	- 8.5 dBm	- 13.5 dBm
RF Channel 3	E6432A	- 5.5 dBm	- 9.0 dBm	- 5.5 dBm	
	E4438C	- 5.5 dBm	- 9.0 dBm	- 10.5 dBm	

Typical Output Balance at –15 dBm (10 kHz signal separation)

Output balance is the peak-to-peak variance between the different tones.

0.4 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz
1 dBpp	1 dBpp	1 dBpp	1 dBpp

Typical Harmonics at RF Test Port

RF Source	Frequency	Harmonics
E6432A	0.01 – 0.3 GHz	- 35 dBc
	0.3 – 2.0 GHz	- 55 dBc
	2.0 – 8.0 GHz	- 50 dBc
E4438C	0.01 – 1.0 GHz	- 30 dBc[1)]
	1.0 – 6 GHz	- 32 dBc

1. The fundamental is about –6 dBm at 1 GHz for a single-tone stimulus at RF Channel 1.

Typical System Stimulus Third Order Two-Tone (IM3) Intermodulation

Carrier Frequency	Each Tone Power Output	System Stimulus IM3 (10 kHz signal separation)
0.4 – 6.0 GHz	- 15 dBm	- 40 dBc

7.3 Multi-Site Test Head Card

Single-Tone Stimulus

Maximum CW Power Available at Test Port

	RF Source	0.01 – 0.05 GHz (typical)	0.05 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz	6 – 8 GHz
RF Channel 1[1)]	E6432A	- 16.0 dBm	- 8.0 dBm	- 10.5 dBm	- 6.0 dBm	- 11.5 dBm	- 15.0 dBm
	E4438C	- 16.0 dBm	- 7.0 dBm	- 10.5 dBm	- 15.0 dBm	- 20.5 dBm	
RF Channel 1[2)]	E6432A	- 24.5 dBm	- 16.5 dBm	- 19.5 dBm	- 14.0 dBm	- 20.5 dBm	- 23.0 dBm
RF Channel 2[1)]	E6432A	- 10.0 dBm	- 2.0 dBm	- 4.0 dBm	0.0 dBm	- 5.5 dBm	- 8.5 dBm
	E4438C	- 10.0 dBm	- 1.0 dBm	- 5.0 dBm	- 9.0 dBm	- 14.5 dBm	
RF Channel 3[1)]	E6432A	- 12.5 dBm	- 4.5 dBm	- 6.5 dBm	- 2.0 dBm		
	E4438C	- 12.5 dBm	- 3.5 dBm	- 6.5 dBm	- 11.0 dBm		

1. Each of the three independent RF channels are multiplexed out to four ports with the Multi-Site Card. These specifications are applicable to the four ports of each channel.
2. A stimulus can be simultaneously applied to all 4 ports of this RF channel only. These specifications are applicable to all four ports of this channel when in simultaneous stimulus mode.

CW Power Accuracy at –15 dBm[3)]

RF Source	0.01 – 0.05 GHz (typical)	0.05 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz	6 – 8 GHz
E6432A	± 1.4 dB	± 1.4 dB	± 1.4 dB	± 1.5 dB	± 1.5 dB	± 1.7 dB
E4432B	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.1 dB	± 1.1 dB	

Typical Relative Power Accuracy for RF Channel 1[4)] at –30 dBm

RF Source	0.01 – 0.05 GHz	0.05 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz	6 – 8 GHz
E6432A	0.8 dBpp	0.8 dBpp	0.8 dBpp	0.8 dBpp	1.0 dBpp	1.2 dBpp

3. For this specification, RF Channel 1 is in standard multiplexing mode.
4. This is relative power accuracy for all 4 ports of RF Channel 1, when a stimulus is simultaneously applied to all four ports. All four ports are terminated in 50 ohm.

7.3 Multi-Site Test Head Card continued

Multi-Tone Stimulus

Maximum CW Power Available at Test Port for All Tones

	RF Source	0.4 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz
RF Channel 1[1)]	E6432A	- 10.0 dBm	- 14.0 dBm	-10.0 dBm	- 15.5 dBm
	E4438C	- 10.0 dBm	- 14.0 dBm	- 16.0 dBm	21.5 dBm
RF Channel 1[2)]	E6432A	- 18.0 dBm	- 22.0 dBm	- 18.0 dBm	23.5 dBm
	E4438C	- 18.0 dBm	- 22.0 dBm	- 24.0 dBm	29.0 dBm
RF Channel 2[1)]	E6432A	- 4.0 dBm	- 7.5 dBm	- 4.0 dBm	- 10.0 dBm
	E4438C	- 4.0 dBm	- 7.5 dBm	- 10.0 dBm	- 15.5 dBm
RF Channel 3[1)]	E6432A	- 6.0 dBm	- 9.5 dBm	- 6.0 dBm	
	E4438C	- 6.0 dBm	- 9.5 dBm	- 11.0 dBm	

1. Each of the three independent RF channels are multiplexed out to four ports with the Multi-Site Card. These specifications are applicable to the four ports of each channel.
2. A stimulus can be simultaneously applied to all 4 ports of this RF channel only. These specifications are applicable to all four ports of this channel when in simultaneous stimulus mode.

Typical Output Balance at –30 dBm[3)] (10 kHz signal separation)

Output balance is the peak-to-peak variance between the different tones.

0.4 – 1 GHz	1 – 2 GHz	2 – 3 GHz	3 – 6 GHz
1.0 dBpp	1.0 dBpp	1.0 dBpp	1.0 dBpp

Typical Harmonics at RF Test Port

RF Source	Frequency	Harmonics
E6432A	0.01 – 0.3 GHz	- 35 dBc
	0.3 – 2.0 GHz	- 55 dBc
	2.0 – 1.0 GHz	- 50 dBc
E4438C	0.01 – 8.0 GHz	- 30 dBc[4)]
	1.0 – 6.0 GHz	- 32 dBc

Typical System Stimulus Third Order Two-Tone (IM3) Intermodulation

Carrier Frequency	Each Tone Power Output	System Stimulus IM3 (10 kHz signal separation)
0.4 – 6.0 GHz	- 20 dBm	- 40 dBc

3. For this specification, RF Channel 1 is in standard multiplexing mode.
4. The fundamental is about –14 dBm at 1 GHz for a single-tone stimulus at RF Channel 1. RF Channel 1 is in standard multiplexing mode.

7.4 RF Receiver

Maximum Receiver Input Power

	Receiver Frequency Range (CW)	Maximum Receiver Input Power (CW)
RF Channel 1	0.75 – 8.0 GHz	+ 20 dBm
RF Channel 2	0.75 – 8.0 GHz	+ 20 dBm
RF Channel 3	0.10 – 3.0 GHz	+ 20 dBm

RF Receiver Power Accuracy

The following specifications are for an input of –2 to –40 dBm for the single-site card. For the multi-site card, –2 to –30 dBm input for RF Channel 1 and 3, and –8 to –36 input for RF Channel 2.

Single-Site Card (Receiver BW = 325.52 Hz)

	Condition	Accuracy
RF Channel 1	0.75 – 3.0 GHz	± 0.65 dB
and	3.0 – 6.0 GHz	± 0.8 dB
RF Channel 2	6.0 – 8.0 GHz	± 1.0 dB
RF Channel 3	0.05 – 3.0 GHz	± 0.9 dB

Multi-Site Card (Receiver BW = 325.52 Hz)

RF Channel 1	0.75 – 3.0 GHz	± 0.7 dB
	3.0 – 6.0 GHz	± 0.8 dB
	6.0 – 8.0 GHz	± 1.0 dB
RF Channel 2	0.75 – 3.0 GHz	± 0.7 dB
	3.0 – 6.0 GHz	± 0.7 dB
	6.0 – 8.0 GHz	± 0.9 dB
RF Channel 3	0.05 – 3.0 GHz	± 1.0 dB

7.4 RF Receiver continued

Typical Noise Floor and Dynamic Range

Instantaneous Dynamic Range is $P_{min(pk)}$ – P_{max}, where P_{max} is the maximum power that can be received (without attenuation) before 0.1 dB compression of the test system and $P_{min(pk)}$ is the minimum power that can be measured above the peaks of the system's noise floor. The noise floor, $P_{min(pk)}$, is for an absolute power measurement. To determine the noise floor at a 1 Hz BW, calculate the offset in dB at the measurement bandwidth of $P_{min(pk)}$, 10*log(BW), then subtract that from $P_{min(pk)}$.

Example: -90 dBm – 10*log(325.52) = -115.13 dBm @ 1Hz

Single-Site Card (Receiver BW = 325.52 Hz)

	Condition	$P_{min(pk)}$	P_{max}	Instantaneous Dynamic Range
RF Channel 1	0.75 – 3.0 GHz	- 90 dBm	+ 2 dBm	92 dB
and	3.0 – 6.0 GHz	- 85 dBm	+ 2 dBm	87 dB
RF Channel 2	6.0 – 8.0 GHz	- 80 dBm	+ 2 dBm	82 dB
RF Channel 3	0.05 – 3.0 GHz	- 90 dBm	+ 8 dBm	98 dB

Multi-Site Card (Receiver BW = 325.52 Hz)

RF Channel 1	0.75 – 3.0 GHz	- 80 dBm	+ 10 dBm	90 dB
	3.0 – 6.0 GHz	- 75 dBm	+ 10 dBm	85 dB
	6.0 – 8.0 GHz	- 70 dBm	+ 10 dBm	80 dB
RF Channel 2	0.75 – 3.0 GHz	- 85 dBm	+ 4 dBm	89 dB
	3.0 – 6.0 GHz	- 80 dBm	+ 4 dBm	84 dB
	6.0 – 8.0 GHz	- 75 dBm	+ 4 dBm	79 dB
RF Channel 3	0.05 – 3.0 GHz	- 85 dBm	+ 10 dBm	95 dB

7.4 RF Receiver continued

Single-Site Card (Receiver BW = 81.38 Hz, Avg =2)

	Condition	$P_{min(pk)}$	P_{max}	Instantaneous Dynamic Range
RF Channel 1	0.75 – 3.0 GHz	- 98 dBm	+ 2 dBm	100 dB
and	3.0 – 6.0 GHz	- 95 dBm	+ 2 dBm	97 dB
RF Channel 2	6.0 – 8.0 GHz	- 90 dBm	+ 2 dBm	92 dB
RF Channel 3	0.05 – 3.0 GHz	- 98 dBm	+ 8 dBm	106 dB

Multi-Site Card (Receiver BW = 81.38 Hz, Avg =2)

RF Channel 1	.075 – 3.0 GHz	- 90 dBm	+ 10 dBm	100 dB
	3.0 – 6.0 GHz	- 85 dBm	+ 10 dBm	95 dB
	6.0 – 8.0 GHz	- 80 dBm	+ 10 dBm	90 dB
RF Channel 2	0.75 – 3.0 GHz	- 95 dBm	+ 4 dBm	99 dB
	3.0 – 6.0 GHz	- 90 dBm	+ 4 dBm	94 dB
	6.0 – 8.0 GHz	- 85 dBm	+ 4 dBm	89 dB
RF Channel 3	0.05 – 3.0 GHz	- 95 dBm	+ 10 dBm	105 dB

7.5 Supplemental Characteristics

Typical CW Stimulus Power Accuracy at -15 dBm (or Maximum Power Output)

	Source	0.01 – 6 GHz	3 – 8 GHz	6 – 8 GHz
RF Channels	E6432A	± 0.4 dB	± 0.4 dB	± 0.4 dB
1,2,3[1)]	E4438C	± 0.4 dB		

1. RF Channel 1 is in standard multiplexing mode.

Available Maximum FSK Modulated RF Source Power at Test Port

The same as the available maximum CW RF source power at Test Port (for single-tone, two-tone, and three-tone)

Typical Modulated Stimulus Power Accuracy at -15 dBm Using the Multi-Site Card and GFSK Modulation

	Source	0.05 – 3 GHz
RF Channels	E6432A	± 0.5 dB
1,2,3[2)]	E4438C	± 0.5 dB

2. RF Channel 1 is in standard multiplexing mode.

GFSK Modulated Stimulus Characteristic

Conforms to Bluetooth Radio specification 1.1 (3.1)

0.5 GFSK

Minimum Deviation for 01010101 sequence

$(F_{min}) \geq \pm 115$ kHz

Maximum Deviation for 00001111 sequence

$(F_{max}) \leq \pm 175$ kHz

$| F_{min} | \geq | (0.8) * F_{max} |$

CW Stimulus Phase Noise

Source	Fundamental	Phase Noise	Offset
E6432A	0.01 – 2.0 GHz	<- 75 dBc/Hz	100 Hz
	2.0 – 5.0 GHz	<- 66 dBc/Hz	100 Hz
	5.0 – 8.0 GHz	<- 61 dBc/Hz	100 Hz
	0.01 – 8.0 GHz	<- 90 dBc/Hz	10 kHz
E4438C	1 GHz	<- 130 dBc/Hz	20 kHz
	2 GHz	<- 124 dBc/Hz	20 kHz
	3 GHz	<- 120 dBc/Hz	20 kHz
	4 GHz	<- 118 dBc/Hz	20 kHz
	6 GHz	<- 114 dBc/Hz	20 kHz

7.5 Supplemental Characteristics continued

Typical RF Receiver Power Accuracy

The following specifications are for an input of -2 to -40 dBm for the single-site card. For the multi-site card, 2 to -30 dBm input for RF Channel 1 and 3, and -8 to -36 input for RF Channel 2.

Single-Site Card (Receiver BW = 325.52 Hz)

	Condition	Accuracy
RF Channel 1	0.75 – 3.0 GHz	± 0.2 dB
and	3.0 – 6.0 GHz	± 0.3 dB
RF Channel 2	6.0 – 8.0 GHz	± 0.4 dB
RF Channel 3	0.05 – 3.0 GHz	± 0.3 dB

Multi-Site Card (Receiver BW = 325.52 Hz)

RF Channel 1	0.75 – 3.0 GHz	± 0.2 dB
	3.0 – 6.0 GHz	± 0.3 dB
	6.0 – 8.0 GHz	± 0.4 dB
RF Channel 2	0.75 – 3.0 GHz	± 0.2 dB
	3.0 – 6.0 GHz	± 0.3 dB
	6.0 – 8.0 GHz	± 0.4 dB
RF Channel 3	0.05 – 3.0 GHz	± 0.3 dB

7.6 RF General

AC power requirements

VA (rms) 2000 VA

Environmental requirements

	Operating	Storage
Temperature:	18 ° to 28 °C	-20 ° to +70 °C
Relative humidity:	5 % to 80 % (non-condensing)	5 % to 90 % (non-condensing)

Operating requirements

System warm-up time: 2 hours

Calibration period: When temperature changes greater than 1 °C from calibration temperature.

8. Miscellaneous Characteristics

8.1 Utility Lines I/O

	512 SOC TH	512 F-Style IF	1024 SOC TH
Digital output			
Number of outputs	55	55	83
Output type		OC (clamp diodes to +5 V)	
Maximum output current		50 mA (each)	
Maximum output voltage		5 V	
Digital input/output			
Number of inputs/outputs	7	7	35
Input type		TTL	
Input impedance			
10 kOhm to +5 V	6	6	30
271 kOhm to +5 V	1	1	5
Output type		OC (clamp diodes to +5 V)	
Maximum output current		50 mA (each)	
Maximum output voltage		5 V	
Digital ID input lines			
Number of inputs	n/a	5	20
Input type		TTL	
Input impedance		10 kOhm to +5 V	
Digital ID Bi-directional lines			
Number of inputs/outputs	2	2	10
Input type		TTL, 5 kOhm to +5 V	
Output type		OC (clamp diodes to +5 V)	
Minimum output current		50 mA (each)	
Maximum output voltage		5 V	
DUT board disconnect line		TTL, 10 kOhm to +5 V	
ID+5 Line (supply line for DUT board ID EEPROM)	n/a	5 V, on/off switchable	n/a

Utility power supplies		
SOC 512 TH:	supply 1	+5 V, max. 3.2 A (electronically fused)
SOC 1024 TH:	supply 1-5	+5 V, max. 3.2 A (electronically fused)
F-Style IF:	supply 1	+5 V, max. 3.2 A (electronically fused)
	supply 2	-5.2 V, max. 1 A (electronically fused)

8. Miscellaneous Characteristics continued

8.2 External Clock Input [1)]

Input impedance	50 Ohm, AC coupled
Input swing	0.5 V to 2.0 V
Input frequency range	200 MHz to 500 MHz [2)]
Input to test frequency ratio	CLK_{ext} = 2 / tester period
Input connector	N-type connector mode

1. Only available with E6991B
2. RF sinus source or square wave 45% to 55% duty cycle

8.3 Reference Clock Output

Frequency	10 MHz
Impedance	50 Ohm
Output connector	BNC
Output signal	0 V to +2 V, into open

8.4 Reference Clock Input (RF) [3)]

Frequency	10 MHz
Impedance	50 Ohm
Input connector	BNC
Input level	0 dBm to +10 dBm

3. Only available with E6991B

8.5 Reference Clock Input (TTL)

Frequency	10 MHz
Impedance	10 kOhm
Input connector	BNC
Input level	TTL

9. General

Scope of Specifications

The Agilent 93000 specifications are valid at the device with an adequate DUT board and valid calibration, i.e. system calibration (see section "Calibration and Operation" below) and fixture delay measurement (TDR). Since design and manufacturing of the DUT board is out of Agilent's control, Agilent specifies up to the pogo level. Accordingly Agilent verifies the specifications at the pogo level. Specifications describe warranted product performance. Characteristics are included as typical values to provide additional useful information by describing typical non-warranted performance.

Calibration and Operation

Warm-up time	60 minutes
Basic maintenance period	6 months
Base calibration period (traceable calibration)	6 months
Calibration period (system auto adjustment)	3 months [1)]
DC update period	1 month

1. Valid at ambient temperature within ±2.5 K of calibration temperature.
   For temperature requirements during calibration please see "Maintenance Guide".

Environmental

Operating	15°C to 30°C (59°F to 86°F)
Specification guarantee temperature	20°C to 30°C (68°F to 86°F)
Maximum humidity at 30°C	< 80% R. H., non condensing

Power Requirement (for maximum system configuration)

	512 pin TH	1024 pin TH
Line voltage 400/230 V		
Voltage	400 / 230 V ±10%	400 / 230 V ±10%
Max. current per phase	41 A	58 A
Max. power	25 kVA	38 kVA
Line voltage 200 V		
Voltage	200 V +15%, -10%	200 V +15%, -10%
Max. current per phase	73 A	110 A
Max. power	25 kVA	38 kVA

9. General continued

Power Conditioner

Input voltage	200 V to 480 V ±10% [1)]
	50 Hz to 60 Hz
Output voltage	400 V / 230 V
Maximum power	45 kVA

1. For detailed nominal voltages and for more information see "Power Conditioner Installation Guide".

Cooling Requirements [2)]

Secondary water forward temperature	30°C to 35°C (non-condensing)
Recommended	30°C
Secondary chilled water stability	±1 K

2. Details see " Site Planning and Preparation Guide"

Cooling Units [3)]

Liquid/liquid cooling unit (E2760DA)

Cooling capability	one fully configured test head, 1024 digital pins plus 4 analog instruments
Cooling medium	deionized water
Secondary chilled water stability	±0.5 K
Primary chilled water temperature range	5°C to 25°C (41°F to 77°F)

Liquid/air cooling unit (chiller) (E2759DA)

Add-on unit to the liquid-liquid cooling unit

	512 pin TH	**1024 pin TH**
Cooling capability at 50 Hz	240 pins	176 pins
Cooling capability at 60 Hz	288 pins	224 pins

Booster (E2759EA)

Add-on unit to the chiller for increased cooling capability

	512 pin TH	**1024 pin TH**
Cooling capability with one booster, 50 Hz	512 pins	576 pins
Cooling capability with one booster, 60 Hz	512 pins	672 pins
Cooling capability with two boosters, 50 Hz	n/a	976 pins
Cooling capability with two boosters, 60 Hz	n/a	1024 pins

3. For more details refer to the "Cooling System Guide".

9. General continued

Weights and Dimensions [1)]

Test system with Manipulator and Support Rack

	512 digital pins	1024 digital pins
Dimensions (height x width x depth)	1.65 m x 1.53 m x 2.51 m	1.65 m x 1.77 m x 2.86 m
Net weight (fully loaded)	1,428 kg	2,117 kg

Analog Support Rack

Dimensions (height x width x depth)	1.62 m x 0.60 m x 0.91 m
Net weight	225 kg

Power Conditioner

Dimensions (height x width x depth)	1.58 m x 0.55 m x 0.52 m
Net weight	400 kg

Cooling Units

Dimensions (height x width x depth)	
Liquid/liquid cooling unit (E2760DA)	1.14 m x 0.65 m x 1.05 m
Liquid/air cooling unit (chiller) (E2759DA)	1.14 m x 0.65 m x 1.05 m
Booster (E2759EA)	1.14 m x 0.65 m x 1.05 m
Net weight	
Liquid/liquid cooling unit (E2760DA)	300 kg
Liquid/air cooling unit (chiller) (E2759DA)	320 kg
Booster (E2759EA)	280 kg

1. Details see " Site Planning and Preparation Guide"

Specifications describe warranted product performance. Characteristics and typical values are included to provide additional useful information by describing typical (non-warranted) performance. If not stated differently, then all details given are specifications.

Specifications and Characteristics apply to all models if not otherwise mentioned.

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