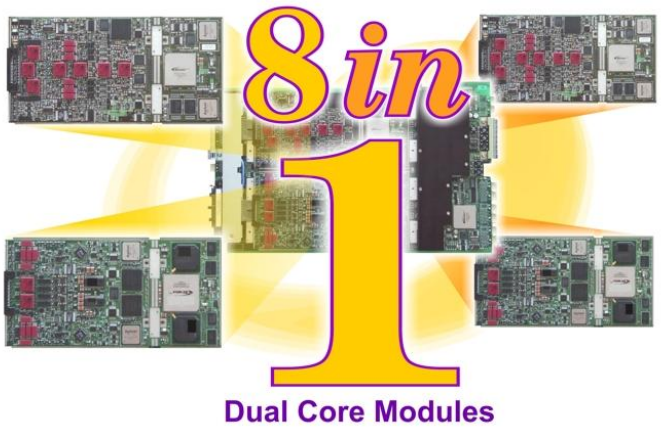
Verigy V93000 SOC
MB AV8
Analog Card

Technical Specifications

Revision 1.20



VERIGY

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MB AV8 Overview

The E9722A consists of 4 source and 4 measure units for Single Density.
The E9722B consists of 4 source and 4 measure units for Pin Scale.
The E9723A consists of 8 measure units for Single Density.
The E9723B consists of 8 measure units for Pin Scale.
The E9728A for Base Band IQ calibration of measure units of E9722A/B and multi-core analog diagnostics and calibration of E9714A/E9715A, E9722A/E9722B/E9723A/E9723B and E9726A/E9726B
The E9728B for Base Band IQ calibration of source units of E9722A/B

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, where the tests are set up via fill-in-the-blank test functions. User-specific tests are programmed with test methods in C. Links are available for design-to-test conversion. In addition, 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

The SmarTest software is compatible with Agilent 93000/V93000 Pin Scale Models, Parallel Probe 400, NP-models, P-models, C-models, C*e*-models, BIST ASSIST and analog cards.

System Controller

PC Workstation: XW 4400, XW4300, XW4100 or XW8400, XW8200, XW8000
Operating system: Linux Red Hat Enterprise, HP-UX

Scope of specifications

The Verigy V93000 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 are beyond Verigy's control, Verigy specifies up to the pogo level and verifies the specifications at the pogo level. Specifications describe warranted product performance. Characteristics, included as typical values, provide additional useful information, but do not represent warranted performance.
These specifications are valid for recommended analog configuration.
These modules require E9716A Multi-site base band analog pogo cable.
E9722A/B requires E9728A and E9728B for Base Band IQ calibration

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	2 weeks

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
Storage (without water)	–40°C to +70°C

Source Units (E9722A & E9722B only)

Selectable one of functions, either LF AWG, HF AWG, V Source or PMU

LF AWG

Specification	Value
Sampling rate	32 ksps to 1.024 Msps
Resolution	24-bit
Pin counts	2 single-ended (one at a time) or 1 differential per source unit. For Multi-site BB/VHF Analog Source & Measure: 4 source units in module. 4-parallel test
Waveform memory	15.8 M per source unit
Max. sinewave frequency	125 kHz @ 1 Msps a)
Output range	6Vpp @ 600ohm to GND w/o sinc(x) effect
Attenuation	0 to 70 dB (for DC to 40 kHz) 0.01dB step @ 0 to 20 dB
DC offset range	±3 V @ 600 ohm to GND (15bit resolution)
Independent DC offset adjustment	±0.25V > 10kohm load, 12bit resolution
Output level (AC+DC)	-4 V < AC+DC < 4 V @ 600 ohm load to GND
Output impedance	50 ohm nominal
Filter	Through(125kHz), 1.5 kHz, 30 kHz (Cut-off frequency is nominal) c)
Absolute DC accuracy	No Specified d)
THD (up to 5th harmonics) 600 ohm load (characteristic data)	-120 dBc @ 1 kHz, 5 Vpp, without offset, 1.024 Msps, 1.5 kHz filter -108 dBc @ 20 kHz, 5 Vpp, without offset, 1.024 Msps, 30 kHz filter
SFDR (100 to 100 kHz) 600 ohm load (characteristic data)	110 dBc @ 1 kHz, 5 Vpp, without offset, 1.024 Msps, 1.5 kHz filter 108 dBc @ 20 kHz, 5 Vpp, without offset, 1.024 Msps, 30 kHz filter
SNR (100 to 30kHz) 600 ohm load (characteristic data)	110 dB @ 1 kHz, 6 Vpp, without offset, 1.024 Msps, 1.5 kHz filter, EIAJ A-weighted, 30 kHz bandwidth

a) Fundamental signal at maximum sine wave frequency is 55dBc away from aliasing component.
c) Filter pass band is Fc x 0.65 and Stop band is Fc x 10. The sinc(x) effect is not included. Cutoff Frequency and Pass-band and Stop band are nominal.

d) Recommend to use V source.

HF AWG

Specification	Value
Sampling rate	8 ksps to 200 Msps
Resolution	16-bit
Pin counts	2 single-ended (one at a time) or 1 differential per source unit. For Multi-site BB/VHF Analog Source & Measure: 4 source units in module. 4-parallel test
Waveform memory	31.7 M per source unit
Max. sinewave frequency	25 MHz @ 100 Msps a)
Output range	2.5 Vpp @ 50 ohm to GND w/o sinc(x) effect
Attenuation	0 to 70dB, 0.01 resolution
DC offset range	±1.25 V @ 50 ohm to GND, 15bit resolution
Independent DC offset adjustment	±0.25V > 10kohm load, 12bit resolution
Output level (AC+DC)	-1.5 V < AC+DC < 1.5 V @ 50 ohm to GND
Output impedance	50 ohm nominal
Filter	Through(32MHz),1.5 MHz,15 MHz Cut-off frequency is nominal b)
Absolute DC Accuracy	±0.4% of setting ±8 mV ±0.2% of DC Offset @ > 10 k ohm load
THD (up to 5th harmonics) (characteristic data)	-90 dBc @ 100 kHz, 0 dBm, 1.5 MHz filter d) -97 dBc @ 1 MHz, 0 dBm, 1.5 MHz filter d) -81 dBc @ 3.5 MHz, 0 dBm, 15 MHz filter d) -80 dBc @ 10 MHz, 0 dBm, 15 MHz filter d)
SFDR (DC to 50 MHz) (characteristic data)	85 dBc @ 100 kHz, 0 dBm, 1.5 MHz filter d) 85 dBc @ 1 MHz, 0 dBm, 1.5 MHz filter d) 84 dBc @ 3.5 MHz, 0 dBm, 15 MHz filter d) 81 dBc @ 10 MHz, 0 dBm, 15 MHz filter d)
SNR (DC to 10MHz) (characteristic data)	73 dB @ 100 kHz, 0 dBm, 1.5 MHz filter d) 73 dB @ 1 MHz, 0 dBm, 1.5 MHz filter d)
SINAD (DC to 10MHz) (characteristic data)	73 dB @ 100 kHz, 0 dBm, 1.5 MHz filter d) 73 dB @ 1 MHz, 0 dBm, 1.5 MHz filter d)
Gain match between units in module (characteristic data)	±0.1 dB @ 100 kHz, 0 dBm, filter through d) ±0.15 dB @ 1 MHz, 0 dBm, filter through d) ±0.2 dB @ 10 MHz, 0 dBm, filter through d)
Phase match between units in module (characteristic data)	±5 ns fixed skew @ filter through h) ±100 ps skew uncertainty @ filter through
Differential gain (observed data) j)	0.2% @ 3.58 MHz chrominance i)
Differential phase(observed data) j)	0.1 deg. @ 3.58 MHz chrominance i)

AMC is required for all measurement at Single Density.

a) Fundamental signal at maximum sine wave frequency is 35dBc away from aliasing component.
b) Filter pass-band is Fc x 0.8 and Stop-band is Fc x 10. Cutoff Frequency and Pass-band and Stop band are nominal. The sinc(x) effect is not included.

d) These are at 100Msps, without offset, 50ohm output load.

h) Must meet trigger delay condition. Details are in the Manual.

i) Sampling frequency is 57.28MSa/s, without offset, 50ohm output load.

j) Observed data is product performance at a mean value or median that was obtained from samples.

VHF AWG

Specification	Value
Sampling rate	8 ksps to 500 Msps
Resolution	16-bit
Pin counts	2 single-ended (2 at a time) or 1 differential per source ch-module. For Multi-site BB/VHF Analog Source & Measure : 2 source ch-module in module.
Waveform memory	31.7 M per source unit
Max. sinewave frequency	125 MHz @ 500 Msps a)
Output range	2.5 Vpp @ 50 ohm to GND w/o sinc(x) effect
Attenuation	0 to 70dB, 0.01 resolution
DC offset range	-1.5 V to 2.5 V @ 50 ohm to GND, 15bit resolution
Independent DC offset adjustment	±0.25V > 10kohm load, 12bit resolution
Output level (AC+DC)	-1.5 V < AC+DC < 2.5 V @ 50 ohm to GND
Output impedance	50 ohm nominal
Filter	Through(300MHz), 58MHz, 150MHz Cut-off frequency is nominal b)
Absolute DC Accuracy	±1% of setting ±15 mV w/o DC Offset @ > 10 k ohm load ±1.3% of setting ±35 mV w/ DC Offset @ > 10 k ohm load
THD (up to 5th harmonics) (characteristic data)	-70 dBc @ 10 MHz, 0 dBm, 58 MHz filter d) -70 dBc @ 45 MHz, 0 dBm, 58 MHz filter d)
SFDR (DC to 100 MHz) (characteristic data)	70 dBc @ 10 MHz, 0 dBm, 58 MHz filter d) 70 dBc @ 45 MHz, 0 dBm, 58 MHz filter d)
SNR (DC to 100MHz) (characteristic data)	65dB @ 10MHz, 0dBm, 58MHz filter d) e) 64dB @ 45MHz, 0dBm, 58MHz filter d) e)
SINAD (DC to 100MHz) (characteristic data)	65dB @ 10MHz, 0dBm 58MHz filter d) e) 64dB @ 45MHz, 0dBm 58MHz filter d) e)
Gain match between units in module (characteristic data)	±0.2 dB @ 10 MHz, 0 dBm, filter through
Phase match between units in module (characteristic data)	±5ns @ 10MHz, filter through j) ±7.5ns @10MHz, filter through (low phase noise mode) j) ±100 ps skew uncertainty @ filter through

AMC is required for all measurement at Single Density.

a) Fundamental signal at maximum sine wave frequency is 35dBc away from aliasing component.
b) Filter pass-band is Fc x 0.8 and Stop-band is Fc x 2. Cutoff Frequency and Pass-band and Stop band are nominal. The sinc(x) effect is not included.

d) These are at 500Msps, without offset, 50ohm output load.

e) Low phase noise mode

j) Must meet trigger delay condition. Details are in the Manual.

V source

Specification		Value
Pin counts		4 (one at a time) per source unit or measure unit. 8 source or measure units in module
Voltage Force:		
	Range	±3.5V @ >=10kohm load to GND ±3.5V*RL/(RL+52) @ <10kohm load to GND
	Resolution	0.1 mV
	Absolute DC Accuracy	±0.1% of setting ±5mV @ >=10kohm load to GND a)
	Relative Accuracy (characteristic data)	2 LSB @ 16 bit resolution
	Output current range	±3 mA

a) Users need to enter the load resistance to the GUI, with which the software applies voltage correction. The accuracy displayed here is obtained after the calibration. If the entered load resistance differs from "true" value by x%, an additional error of x/ (1+RL/RO) % occurs, where RL and RO are the true load resistance and the output impedance, respectively. 52ohm is nominal value of RO.

PMU

Specification		Value
Pin counts		4 (one at a time) per source unit or measure unit. 8 source or measure units in module
Voltage Force or Measure:		
	Range	-2.0 V to +3.5 V (force/measure)
	Resolution	0.1 mV (force/measure)
	Accuracy	Force: ±0.1% of setting ±5mV ±(Ia × 60) a) Measure: ±0.1% of reading ±5mV ±(Ia × 15)[a)]
Current Measure or Force:		
	Range	±3 mA
	Resolution	0.1 µA
	Accuracy	Force: ±0.1% of setting ±5µA ±(Va × 2µA/V)[b)] Measure: ±0.1% of reading ±5µA
High Resolution Current Measurement		
	Range	HR-PMU [c)]
	Resolution	1 nA
	Accuracy	Measure: 0.1% of reading +270nA-180nA

[a)] Voltage force amplifier has nominally 60 ohm serial impedance. Voltage measure amplifier has nominally 15 ohm serial impedance. It makes a voltage error ratio to Ia. Ia is the actual current.

[b)] The current force has an error proportional to Va, the actual voltage. The scale is 2uA/V at maximum, i.e. Va*2uA/V is added to the current accuracy.

[c)] High resolution measurement mode is achieved digitally via FPGA and FW supported by SW Rev.6.1.0 or later

HPPMU Multiplex

Specification		Value			
Pin counts		32 to 1 multiplexed (one at a time) in a module			
Voltage Force: or Measure					
	Range	±4 V [a]			
	Resolution	250uV			
	Absolute DC Accuracy	±10mV – (Ia*R) [b]			
Current Force: or Measure					
	Range	± 200mA[c]	± 5mA	± 200uA	± 5uA
	Resolution	N.A	250nA	6nA	250pA
	Absolute DC Accuracy	N.A.	± 10uA ± 0.1% of reading or setting	± 200nA ± 0.1% of reading or setting	± 10nA ± 0.1% of reading or setting

[a] Output voltage is limited to 4V pp by protection diodes.
[b] Ia is the actual current, R is the wiring resistance of $\leq$ 12 ohm
[c] 200mA range is eliminated, since it exceeds the maximum allowable current of MB AV8 switch circuitry

Measure Units (E9722A/B & E9723A/B)

Selectable one of functions, either LF Digitizer, VHF Digitizer, V Source or PMU

LF Digitizer

Specification	Value
Sampling rate	32 ksps to 200 ksps
Resolution	24-bit
Bandwidth @-3 dB (characteristic data)	50 kHz
Pin counts	4 single-ended (2 at a time) or 2 differential (2 at a time) per measure unit. 2 digitizer cores per measure unit For Multi-site BB/VHF Analog Source & Measure: 4 measure units in module. 8-parallel test For Multi-site BB/VHF Analog Measure: 8 measure units in module. 16-parallel test
Waveform capture memory	7 M samples per measure unit (@ no averaging nor over sampling)
Input range	±3 V, ±1 V, ±0.2 V
DC offset range	±3 V @ ±3 V input range ±2 V @ ±1 V input range ±1.5 V @ ±0.2 V input range
Input Level (AC+DC)	-3V /+4 V @ ±3 V input range ±2 V @ ±1 V input range ±1.5 V @ ±0.2 V input range
Input impedance (nominal value)	>1 Mohm for single-ended >2 Mohm for differential center GND
Filter	50 kHz (Fixed anti-aliasing analog filter, nominal value) Digital filter: 6 kHz, 30 kHz
Absolute DC Accuracy (characteristic data)	±0.5% of reading ±10mV
THD (up to 5th harmonics) (characteristic data)	-110dBc @1kHz, -1dBFS,w/o offset,192ksps,±3V (or ±1V) input range -90 dBc @ 20 kHz, -1dBFS, w/o offset, 192 ksps [a)]
SNR (characteristic data)	125 dB @ 1 kHz, differential, EIAJ A-weighted, w/o offset, 192 ksps [a)]

[a)] Initial discard is 4096pts.

VHF Digitizer

Specification	Value
Sampling rate	1M sps to 110 Msps
Resolution	16-bit
Bandwidth @-3 dB (characteristic data)	100MHz
Pin counts	4 single-ended (1 at a time) or 2 differentials (1 at a time) per measure unit. For Multi-site BB/VHF Analog Source & Measure: 4 measure units in module. 4-parallel test For Multi-site BB/VHF Analog Measure 8 measure units in module. 8-parallel test
Waveform capture memory	14 M samples per measure unit (@ no averaging nor over-sampling mode)
Input range	±2 V, ±1 V, ±0.5, ±0.25 V, ±0.125 V
DC offset range	For ±2 V or ±1 V input range: ±3 V a) For ±0.5 V or ±0.25 V or ±0.125 V input range: ±2.8 V a)
Input Level (AC+DC)	±3 V for ±2 V or ±1 V input range ±2.8 V for ±0.5 V or ±0.25 V or ±0.125 V input range Within input range for 37.5 ohm single-ended or 75 ohm differential
Input impedance (nominal value)	Single-ended: 10 kohm, 50 ohm, 37.5 ohm Differential: 100 ohm Differential center GND: 20k ohm, 100 ohm, 75 ohm
Filter	Through(100MHz), 15 MHz, 50MHz (Cut-off frequency is nominal) Digital filter: 6.1 MHz, 13 MHz Real Time Digital Filter: 9.4kHz-4.58MHz
Absolute DC Accuracy	±0.5% of reading ±0.3% of offset ±5mV @ 10 kohm input impedance
THD (up to 5th harmonics) (characteristic data)	-85 dBc @ 100 kHz, -1 dBFS c) -85 dBc @ 1 MHz, -1 dBFS c) -78 dBc @ 3.6 MHz, -1 dBFS c) -75 dBc @ 10 MHz, -1 dBFS c) -60dB @ 30MHz, -1dBFS c)
SFDR (characteristic data)	85 dBc @ 100 kHz, -1 dBFS c) 85 dBc @ 1 MHz, -1 dBFS c) 78 dBc @ 3.6 MHz, -1 dBFS c) 75 dBc @ 10 MHz, -1 dBFS c) 60 dBc @ 30 MHz, -1 dBFS c)
SNR (characteristic data)	70dB @ 1MHz, 2Vr, 15M B.W. c) 65dB @ 10MHz, 0.5Vr, 100M B.W. c)
SINAD (characteristic data)	69dB @ 1MHz, 2Vr to 0.5Vr 15M B.W. c) 65dB @ 10MHz, 2Vr to 0.5Vr 100M B.W. c)

Specification	Value
Gain match between units in module (characteristic data)	±0.1 dB @ 100 kHz, 1 Vpp d) ±0.1 dB @ 1 MHz, 1 Vpp d) ±0.15 dB @ 10 MHz, 1 Vpp d)
Phase match between units in module (characteristic data)	±5 ns fixed skew @ 100 kHz, 1 MHz, or 10 MHz d) e) ±100 ps skew uncertainty @ 100 kHz, 1 MHz, or 10 MHz d)
Differential gain (characteristic data)	0.4% @ 3.58 MHz chrominance, ±2 V input range f)
Differential phase (characteristic data)	0.1 deg. @ 3.58 MHz chrominance, ±2 V input range f)

a) No offset for single-ended 37.5 ohm input impedance

c) These are at 100 Msps, without offset, input impedance is 10kohm.

AMC is required for the measurement at Single Density.

Continuous clock of idle channel on the same channel module must be supplied to VHF ADC.

d) Gain/phase match is measured by single-end sine signal at ±0.5 V input range, filter through and without offset. The object channels for the measurement are [unit1 and unit3], [unit2 and unit4], [unit5 and unit7] and [unit6 and unit8]

e) Must meet trigger delay condition. Details are in the Manual.

f) These are at 57.27Msps, without offset, input impedance is 10kohm.

V Source

Refer to Source Unit.

PMU

Refer to Source Unit.

HPPMU Multiplex

Refer to Source Unit.

Base Band IQ Calibration (E9722A/B, E9728A/B)

Supported Products

E9728A as MB AV8 Measure IQ Calibration Board

E9722A and E9722B

E9728B MB AV8 Source IQ Calibration Board

E9722A and E9722B

E9728A as Multi-core Analog Diagnostics and Calibration Board

E9714A	E9723A
E9715A	E9723B
E9722A	E9726A
E9722B	E9726B

I/Q Gain and Phase Balance

HF AWG and VHF Digitizer

Specification*)	Value	
Gain balance between units in module (characteristic data)	HF AWG: VHF Digitizer:	0.04dB ≤ 20MHz 0.04dB ≤ 20MHz
Phase balance between units in module (characteristic data)	HF AWG: a) VHF Digitizer: b)	1.0 degree @ 20MHz 0.4 degree @5MHz 0.7 degree @20MHz 0.3 degree @5MHz

*) Guaranteed under following conditions

User load board trace length mismatch <10mm

Tolerance of load resistance on the load board is less +-0.1%

Liquid temperature change is under ± 1 °C Calibrated in 3 month at an specific analog setup in user application

Specify the guaranteed value under a condition of MB AV8 self compensation with E9728A and E9728B, this doesn't guarantee traceable to standard.

a) 200MSa/s, input signal 0-30dB of full scale sampled more than 1024points

b) 100MSa/s, input signal 0-30dB of full scale sampled more than 1024point

Related Information

For more information about the Verigy V93000 SOC Series, please visit the following website;

www.verigy.com/soc

Contact Information

For more information about the Verigy V93000 MB AV8 analog card, please contact your local Verigy sales representative:

www.verigy.com/contactus

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www.verigy.com