X-Series CX & DX Specifications

X-Series Test System

Software Release R14.6.0

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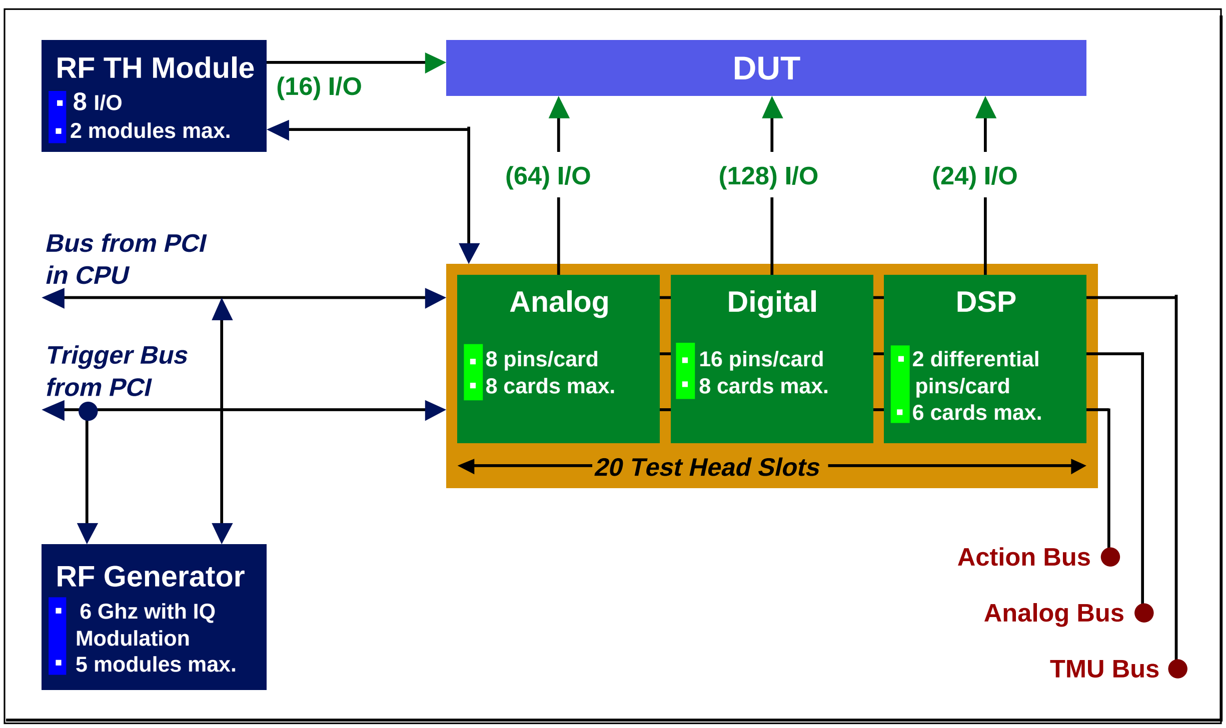
CX & DX Specifications 1

Introduction

This book provides instrument specifications for the X-Series CX & DX testers. CX is an integral part of LTX's patented scalable, single-platform, offering various scalable configurations. DX utilizes the same proven instrument set as CX. Each configuration couples leading edge technology, extreme scalability, enVision software and an advanced open platform to provide high performance, cost effective test solutions across the device spectrum.

NOTE Tester instrument specifications given are valid for DX, to the ends of LTX standard DX cables. Use of non-standard cables may effect DX system performance.

CX Tester Overview



Instrumentation

RF

- 4 to 16 RF ports
- 10 MHz to 6 GHz

For complete details, refer to RF Instrument Options on page 6-1.

DSP

- 2 to 12 source and measure synthesizer and digitizer pins
- Audio or IF options

For complete details, refer to Mixed Signal Instruments on page 3-1.

Digital

- 16 to 128 digital pins
- Data rates up to 100 Mbps
- Built-in TMU

For complete details, refer to DDP Digital Instrument Options on page 5-1.

Power

- 4 to 16 pulsed power pins
- 100 V, 10 A

For complete details, refer to DC and Pulsed Power Options on page 2-1.

DC

- 8 to 64 DC pins
- +/- 16 V, 1 A

For complete details, refer to DC and Pulsed Power Options on page 2-1.

Test Head

- Overall size: 22” W x 20” H x 28” D(55 cm x 51 cm x 71 cm)
- Air cooled
- 20 instrument slots
- 2 RF assemblies
- Industry standard manipulator and docking options

Base Infrastructure

- Overall size: 22” W x 65” H x 30” D(55 cm x 166 cm x 78 cm)
- Power distribution: 110 V to 220 VAC @ 30 A
- Sparc or Linux PC CPU
- Up to 5 RF generators

DUT Site

- 22 RF blind mate coax; 16 dedicated to RF, 6 user definable
- Over 800 general purpose I/Os, 2 mm high density connectors
- 12” diameter (305 mm) DUT board
- Simple bearing and ramp lock down mechanism

DX Overview

ATE systems often have considerable floor space, power, air, and water requirements. DX addresses these infrastructure challenges by providing desktop SOC ATE for devices with up to 64 pins. Its small size and low weight, standard power requirement, and lack of water, air or special environmental requirements provides powerful ATE performance and unprecedented versatility.

Instrumentation

Full Featured Digital

DX offers up to 64 pins of high performance digital capabilities, including:

- Full send and receive capabilities
- Parametric measurement capability
- Time measurement capability
- High voltage, 24V digital pin extension
- Data rate of 33/66 MHz

For complete details, refer to DDP Digital Instrument Options on page 5-1.

Comprehensive DSP

DSP instrumentation, all fully synchronous with the digital subsystem, includes:

- High speed digitizer
- High resolution digitizer
- High speed AWG
- High resolution AWG

For complete details, refer to Mixed Signal Instruments on page 3-1.

Voltage/Current Sources

Available sources, all with per pin DC measurement capability, include:

- 8 Channel VI: 200ma ±16V
- 16 Channel VI: 50ma ±24V
- 8 Channel high voltage VI: 100V
- 2 Channel high current VI: 10A pulsed

For complete details, refer to DC and Pulsed Power Options on page 2-1.

Software

DX is powered by LTX enVision, enabling encapsulation of test objects for easy reuse of test intellectual property, and transparent multi-site to reduce cost of test without additional design time. Used across the X-Series platform, enVision offers:

- Device oriented programming environment for test program development
- Structure management and reuse of test IP
- Transparent multisite capabilities
- Simple test program transfer between X-Series configurations

Physical

Overall size: 12.85" high x 17.18" wide x 23.5" deep

Facilities Requirements

- Electrical: 120V 20A (standard wall outlet)
- Water: none
- Compressed air: none
- Environmental: none

Architecture

- Universal slot architecture
- Total instrument slots: 7

Interfaces

- Soft dock (cables) to DUT site
- GPIB protocol interface to probers and handlers

DC and Pulsed Power Options 2

Octal VI

The Octal VI is a four Quadrant voltage and current (VI) source. Each Octal VI card has 8 independent VI channels, which can force and measure voltage and current. Each channel has its own Device Ground Sense. The Octal VI forces and measures voltage on one range and forces and measures current on six ranges.

Voltage and Current Clamps

Each channel is equipped with programmable voltage and current clamps. Current is clamped when the channel is forcing voltage and voltage is clamped when the channel is forcing current. Clamp programming has 12 bit resolution.

Ripple Input

When the instrument is in the force voltage mode the DC output voltage can be rippled from an external signal. The full-scale input range is ±10 Volts which maps to the full-scale force range of ±16 Volts. All channels share one ripple signal. Each channel can select between inverted and non-inverted versions of the ripple signal.

Differential Measurement

The Octal VI can be configured to make a true differential voltage measurement between any pair of channels or between any channel and local board ground, DUT ground, the ripple input or a +10V reference.

Octal VI Specifications

Table 2.1: Octal VI Force Voltage

Force Voltage	Condition	Specification
Ranges		±16V
Resolution		16 Bits
Accuracy		±0.05% of value, ±0.05% of range
Hi Force to Sense Voltage	Normal Operation	±2V max
	No damage	±10V max
Lo Force to Sense Voltage	Normal Operation	±0.5V max
	No damage	±20V max
Max Current Clamp		102% of current range
Current Clamp Resolution		12 bits
Current Clamp Accuracy		±5% of value
Output Impedance		2 milliOhm maximum

Table 2.2: Octal VI Measure Voltage

Measure Voltage	Condition	Specification
Ranges		±16V
Resolution		16 Bits
Accuracy		±0.05% of value, ±0.05% of range
Differential Measure Accuracy		±0.1% of value ±0.1% of range ±0.2% of common mode.
Differential Measure Modes		Two modes: True differential and relative to a reference on the same VI source.
Bias Current	Voltmeter mode	100nA max
DC Input Impedance	Voltmeter mode	1 GOhm minimum
Max Sampling Rate		200 Ksamples/second
Measure Bandwidth	200 Ksamples/second	60KHz

Table 2.3: Octal VI Force Current

Force Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 1A
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	50µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	500µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	5mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	50mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	1A range	±0.15% of value, ±0.1% of range ±0.01% of range per volt
Max Current per channel	Continuous	up to 550 mA per channel, see Table 2.5
	Pulsed	up to 1A, see Table 2.5
Max Voltage Clamp		102% of voltage range
Voltage Clamp Resolution		12 bits
Voltage Clamp Accuracy		±2% of value

For capacitive loads, to keep the overshoot less than 3%, these are the maximum capacitance values allowed for either local or remote sense, high or low BW setting:

Table 2.4: OVI Maximum Capacitive Loads

Capacitance Load	Current Range
500pF	5µA range
2nF	50µA range
10nF	500µA range
0.1µF	5mA range
1.0µF	50mA range
10.0µF	1.0A range

A series resistor in the high force connection may be required if maximum capacitive loads are exceeded.

OVI Maximum Currents per Channel

Table 2.5: OVI Maximum Currents per Channel

OVI MAX Current Output per channel [3]		MAX Duty Cycle [1]	Channel Config [2]
550mA	Continuous	-	Single
900mA	Pulsed	50%	Single
1A	Pulsed	33%	Single
450mA	Continuous	-	Dual
700mA	Pulsed	50%	Dual
900mA	Pulsed	33%	Dual
1A	Pulsed	25%	Dual

NOTE [1]
Pulsed duty cycle limits: 500ms maximum ON time

NOTE [2] **Channel Configuration**

Single — one channel per heat sink in force current mode

Dual — two channels on the same heat sink operating at identical current outputs in force current mode

Channel configuration is as follows:

Channel 1 and 3 operate on heat sink #1
Channel 5 and 7 operate on heat sink #2
Channel 2 and 4 operate on heat sink #3
Channel 6 and 8 operate on heat sink #4

NOTE [3]
The Power Supply Unit (PSU) providing rail power for the OVI output stage has a MAX available output current of 8.1 Amps. User must note there is only one PSU that provides rail power to all OVI boards in an 8 or 21 slot instrument cage.

An approximate one to one relationship exists between the rail power and the output power of the OVI channels. Therefore, the user must compare their total intended OVI output current with the MAX available output current of the PSU.

For example, three OVI boards contain 24 channels and would require approximately 8.0 Amps from the PSU to operate all 24 channels at a continuous current output of 325mA.

Table 2.6: Octal VI Measure Current

Measure Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 1A
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	50µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	500µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	5mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	50mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	1A range	±0.15% of value, ±0.1% of range ±0.01% of range per volt
Max Sampling Rate		200 Ksamples/second
Measure Bandwidth	200 Ksamples/second	60KHz

Table 2.7: Octal VI Ripple Source

Ripple Source	Condition	Specification
Channels		One per VI card (1 per 8 channels)
Input Voltage Range		±10V
Input Frequency Range		DC to 2KHz
Input Impedance		20KOhm
Ripple Gain		1.6V/V

Table 2.8: Octal VI CBITs

CBITs	Condition	Specification
Number of Bits		One per VI channel (8)
Drive Functions		Relays or TTL
Output Low Current	Continuous	200mA max
Output Low Voltage	100mA	+1.1V
	200mA	+1.3V
Internal Pull-up Voltage		+5V
Internal Pull-up Resistor		33KOhm (Note: Diode disconnected at > 5V ext. Pull-up voltage)
Max External Pull-up Voltage		+50V
Output High Clamp Voltage	Cbit Clamp Connection Voltage supplied from DUT Board	+2V to +50V
Max Clamp Current		200mA

VI 16

The VI 16 boards (VI16 & VI16B) have 16 identical source channels. Each channel can force voltage or force current. A board has one measure function with a FIFO, which can measure voltage or current on any channel. The FIFO can be used to digitize up to 4096 points of a VI 16 Channel.

Voltage and Current Clamps

Each channel is equipped with programmable voltage and current clamps. Current is clamped when the channel is forcing voltage and voltage is clamped when the channel is forcing current.

Differential Measurement

The VI 16 can be configured to make a true differential voltage measurement between any pair of channels or between any channel and local board ground, or DUT ground.

VI16 and VI16B

The VI16 & VI16B boards have similar operating capabilities. The VI16B has two modes of operation. Its Normal mode is different from the VI16 primarily in that its force voltage function is limited in the negative region to -4V on all ranges. The Extended mode of the VI16B is also limited in the negative region to -4V, yet its primary difference from the VI16 is its ability to force as high as +44V. The tables below list the operating specifications for both the VI16 & VI16B boards.

VI 16 Specifications

Table 2.9: VI16 & VI16B Force Voltage

Force Voltage	Condition	Specification
Ranges	VI16	±16V, 4V
	VI16B Normal Mode	+16V to -4V +8V to -4V ±4V
	VI16B Extended Mode	+44V to -4V +16V to -4V +8V to -4V ±4V
Resolution		16 Bits
Accuracy		±0.05% of value, ±0.05% of range
Hi Force to Sense Voltage	Normal Operation	±2V max
	No damage	±10V max
Lo Force to Sense Voltage	Normal Operation	±0.5V max
	No damage	±20V max
Max Current Clamp		102% of current range
Current Clamp Resolution		10 bits
Current Clamp Accuracy		±5% of value
Output Impedance		10 milliOhm maximum

Table 2.10: VI16 & VI16B Measure Voltage

Measure Voltage	Condition	Specification
Ranges	VI16	±16V, ±8V, ±4V, ±2V
	VI16B	+44V to -4V, +16V to -4V, +8V to -4V, ±4V, ±2V
Resolution		16 Bits
Accuracy	VI16: 16V, 8V, 4V ranges	±0.05% of value, ±0.05% of range
	VI16B: 44V, 16V, 8V, 4V ranges	±0.05% of value, ±0.05% of range
	VI16 & VI16B: 2V range	±0.05% of value, ±0.1% of range

Table 2.10: VI16 & VI16B Measure Voltage (Continued)

Measure Voltage	Condition	Specification
Differential Measure Accuracy		±0.1% of value ±0.1% of range ±0.2% of common mode.
Differential Measure Modes		Two modes: True differential and relative to a reference on the same VI source.
Max Sampling Rate		200 Ksamples/second
Measure Bandwidth	200 Ksamples/second	300KHz

Table 2.11: VI16 & VI16B Force Current

Force Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 100mA
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	50µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	500µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	5mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	100mA range	±0.15% of value, ±0.1% of range ±0.01% of range per volt
Max Current	VI16	±100 mA
	VI16B Normal Mode	±100 mA
	VI16B Extended Mode	±50 mA
Max Voltage Clamp		102% of voltage range
Voltage Clamp Resolution		10 bits
Voltage Clamp Accuracy	VI16	±2% of value
	VI16B	±5% of value

Table 2.12: VI16 Maximum Capacitive Loads

Capacitance Load	Current Range
500pF	5µA range
2nF	50µA range
10nF	500µA range
0.1µF	5mA range
1.0µF	100mA range

Table 2.13: VI16 Measure Current

Measure Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 100mA
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	50µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	500µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	5mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	100mA range	±0.15% of value, ±0.1% of range ±0.01% of range per volt
Max Sampling Rate		200 Ksamples/second
Measure Bandwidth	200 Ksamples/second	300KHz

PPVI

The PPVI is a four Quadrant pulsed power VI source. Each PPVI card has 2 independent VI channels, which can force and measure voltage and current.

Voltage and Current Clamps

Each channel is equipped with programmable voltage and current clamps. Current is clamped when the channel is forcing voltage and voltage is clamped when the channel is forcing current. Clamp programming has 10 bit resolution.

Ripple Input

When the instrument is in the force voltage mode the DC output voltage can be rippled from an external signal. The full-scale input range is ±2 Volts which maps to the full-scale force range of ±100 Volts. All channels share one ripple signal. Each channel can select between inverted and non-inverted versions of the ripple signal.

Differential Measurement

The PPVI can be configured to make a true differential voltage measurement between any pair of channels or between any channel and local board ground, DUT ground, the ripple input or a +10V reference.

Data Acquisition

Voltage and current measurements are digitized at a maximum rate of 200Ksamples/second with 16 bits of resolution.

PPVI Specifications

Table 2.14: PPVI Force Voltage

Force Voltage	Condition	Specification
Ranges		±100V, 50V, 25V, 10V, 5V, 2.5V
Resolution		16 Bits
Accuracy		±0.1% of value, ±0.1% of range
Hi Force to Sense Voltage	Normal Operation	±5V max
	No damage	±10V max
Lo Force to Sense Voltage	Normal Operation	±5V max
	No damage	±20V max
Max Current Clamp		102% of current range
Current Clamp Resolution		10 bits
Current Clamp Accuracy		±3% of value

Table 2.15: PPVI Measure Voltage

Measure Voltage	Condition	Specification
Ranges		±100V, 50V, 25V, 10V, 5V, 2.5V
Resolution		16 Bits
Accuracy		±0.1% of value, ±0.1% of range
Differential Measure Accuracy		±0.2% of value ±0.1% of range ±0.25% of common mode.
Differential Measure Modes		Two modes: True differential and relative to a reference on the same VI source.
Max Sampling Rate		200 Ksamples/second

Table 2.16: PPVI Force Current

Force Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 500mA, 10A
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range
	50µA range	±0.3% of value, ±0.1% of range
	500µA range	±0.3% of value, ±0.1% of range
	5mA range	±0.1% of value, ±0.1% of range
	50mA range	±0.1% of value, ±0.1% of range
	500mA range	±0.15% of value, ±0.1% of range
	10A range	±0.15% of value, ±0.1% of range
Max Current	Continuous	250 mA
	Pulsed	up to 10A, see Table 2.17
Max Voltage Clamp		102% of voltage range
Voltage Clamp Resolution		10 bits
Voltage Clamp Accuracy		±2% of value

Table 2.17: PPVI Max Pulsed Current Capability

Current	Maximum Pulse Width	Duty Cycle
10A	0.2ms	10%
9A	0.4ms	10%
8A	0.8ms	10%
7A	1ms	10%
6A	2ms	10%
5A	5ms	10%
4A	20ms	10%
3A	50ms	10%
2A	100ms	10%

Table 2.18: PPVI Measure Current

Measure Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 500mA, 10A
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range
	50µA range	±0.3% of value, ±0.1% of range
	500µA range	±0.3% of value, ±0.1% of range
	5mA range	±0.1% of value, ±0.1% of range
	50mA range	±0.1% of value, ±0.1% of range
	500mA range	±0.15% of value, ±0.1% of range
	10A range	±0.15% of value, ±0.1% of range
Max Sampling Rate		200 Ksamples/second

Table 2.19: PPVI Ripple Source

Ripple Source	Condition	Specification
Channels		One per PPVI card (1 per 2 channels)
Input Voltage Range		±2V
Input Frequency Range		DC to 20KHz
Input Impedance		>100MOhm
Ripple Gain		50V/V

HVVI

The HVVI is a four Quadrant High voltage VI source. Each HVVI card has 8 independent VI channels, which can force and measure voltage and current. Each channel has its own Device Ground Sense.

Voltage and Current Clamps

Each channel is equipped with programmable voltage and current clamps. Current is clamped when the channel is forcing voltage and voltage is clamped when the channel is forcing current. Clamp programming has 10 bit resolution.

Ripple Input

When the instrument is in the force voltage mode the DC output voltage can be rippled from an external signal. The full-scale input range is ±2 Volts which maps to the full-scale force range of ±100 Volts. All channels share one ripple signal. Each channel can select between inverted and non-inverted versions of the ripple signal.

Differential Measurement

The HVVI can be configured to make a true differential voltage measurement between any pair of channels or between any channel and local board ground, DUT ground, the ripple input or a +10V reference.

HVVI Specifications

Table 2.20: HVVI Force Voltage

Force Voltage	Condition	Specification
Max Output Voltage		+100V to -40V
Ranges		100V, 50V, 25V, 10V, 5V, 2.5V
Resolution		16 Bits
Accuracy		±0.1% of value, ±0.1% of range
Hi Force to Sense Voltage	Normal Operation	±2V max
	No damage	±10V max
Lo Force to Sense Voltage	Normal Operation	±2V max
	No damage	±20V max
Max Current	Continuous	50 mA
	Pulsed	500 mA 10ms, 10% Duty Cycle
Max Current Clamp		102% of current range
Current Clamp Resolution		10 bits
Current Clamp Accuracy		±3% of value

Table 2.21: HVVI Measure Voltage

Measure Voltage	Condition	Specification
Ranges	Equal to force voltage range	+100V to -40V, +50V to -40V, ±25V, ±10V, ±5V, ±2.5V
Resolution		16 Bits
Accuracy		±0.1% of value, ±0.1% of range
Differential Measure Accuracy		±0.2% of value ±0.1% of range ±0.25% of common mode.
Differential Measure Modes		Two modes: True differential and relative to a reference on the same VI source.
Max Sampling Rate		200 Ksamples/second

Table 2.22: HVVI Force Current

Force Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA,500mA
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range
	50µA range	±0.3% of value, ±0.1% of range
	500µA range	±0.3% of value, ±0.1% of range
	5mA range	±0.1% of value, ±0.1% of range
	50mA range	±0.1% of value, ±0.1% of range
	500mA range	±0.15% of value, ±0.1% of range
Max Current	Continuous	50 mA
	Pulsed	500 mA 10ms, 10% Duty Cycle
Max Voltage Clamp		-40V to 102V
Voltage Clamp Resolution		10 bits
Voltage Clamp Accuracy		±2% of value

Table 2.23: HVVI Measure Current

Measure Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA,500mA
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range
	50µA range	±0.3% of value, ±0.1% of range
	500µA range	±0.3% of value, ±0.1% of range
	5mA range	±0.1% of value, ±0.1% of range
	50mA range	±0.1% of value, ±0.1% of range
	500mA range	±0.15% of value, ±0.1% of range
Max Sampling Rate		200 Ksamples/second

Table 2.24: HVVI Ripple Source

Ripple Source	Condition	Specification
Channels		1 per HVVI card (1 per 8 channels)
Input Voltage Range		2V
Input Frequency Range		DC to 20KHz
Input Impedance		> 10K Ohm
Ripple Gain		50V/V

QFVI - Quad Floating VI

The Quad Floating V/I (QFVI) is a high voltage, high current floating programmable power supply for the X-Series testers. It is targeted for use in power management, automotive and display driver applications.

Four Supply Blocks

The QFVI is structured as four supplies that can be used as “building blocks” to construct higher voltage or higher current sources. Each of the four supplies is capable of generating up to ±60V between its positive and negative outputs in force voltage mode, or up to ±5A in force current mode. The four supplies can be used in parallel for applications up to 20A and/or “stacked” to source up to 240V.

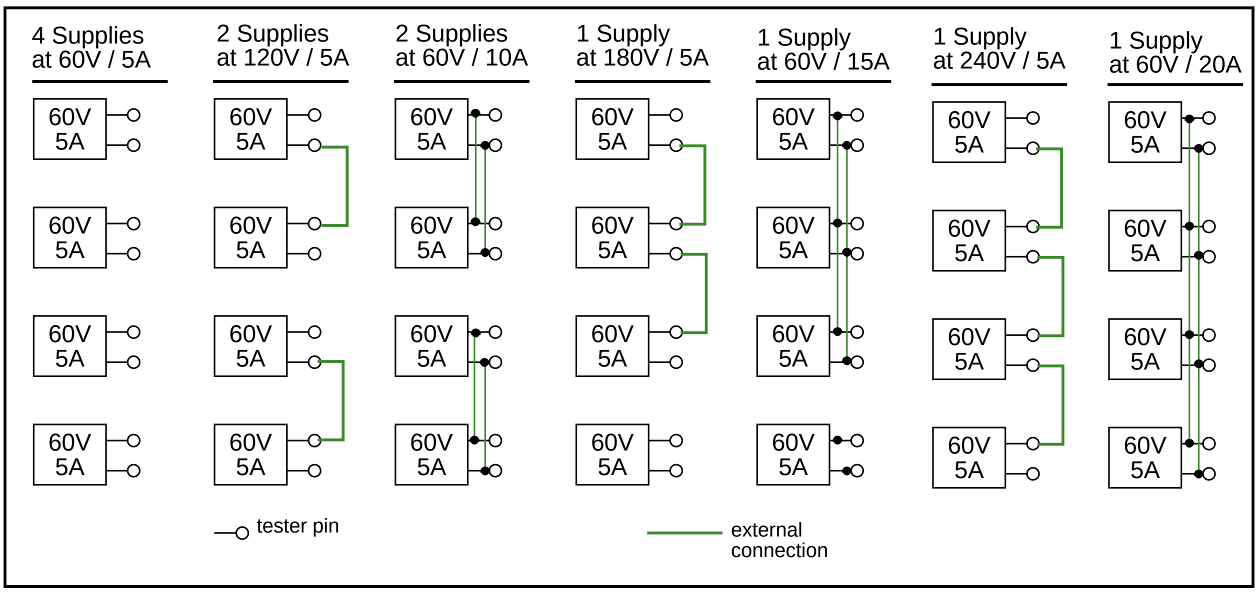


Figure 2.1: QFVI usage configurations

QFVI Features

The QFVI supports the following features:

- Four Quadrant Force Voltage (FV) or Force Current (FI) Operation
- Floating operation to 250Volts

- Pulsed current to 5A per channel
- Kelvin operation
- Supplies internally paralleled in FV mode for additional current
- Independent Measure ADCs and selectable low pass filters per pin
- Programmable voltage and current clamps
- Sequencer control with local per-channel results buffer
- Shared ripple input for non-floating FV mode supply modulation

QFVI Specifications

Table 2.25: QFVI Force Voltage Specifications

Force Voltage	Condition	Specification
Ranges		±60V, ±25V, ±10V,±5V, ±2.5V
Resolution		16 Bits
Accuracy		±0.1% of value, ±0.1% of range
Max ΔV float on test head		±250V max
Hi Force to Sense Voltage	full accuracy (I=5A)	±1.5V max
	full accuracy (I=0A)	±4V max
	No damage	±100V max
Lo Force to Sense Voltage	full accuracy (I=5A)	±1.5V max
	full accuracy (I=0A)	±4V max
	No damage	±100V max
Max Current	Continuous	1.5A
	Pulsed	up to 5A
Current Clamp Resolution		12 bits
Current Clamp Accuracy	5µA range	(-0% to +5%) of value + 120nA
	50µA range	(-0% to +5%) of value + 1.2µA
	500µA range	(-0% to +5%) of value + 12µA
	5mA range	(-0% to +5%) of value + 120µA
	50mA range	(-0% to +5%) of value + 1.2mA
	500mA range	(-0% to +5%) of value + 12mA
	5A range	(-0% to +5%) of value + 120mA
Ripple Input		
Ripple Input Range	Low Sense grounded	±2.0V max, to ground
Ripple Input Gain	Low Sense grounded	-1.0
Ripple Voltage Error	Low Sense grounded	± (0.3% of V_{ripple} + 1mV + (200e-6 * $V_{HF\ to\ LS}$))

Table 2.26: QFVI Measure Voltage Specifications

Measure Voltage	Condition	Specification
Ranges		±60V, ±25V, ±10V,±5V, ±2.5V, ±1V
Resolution		16 Bits
Accuracy		±0.1% of value, ±0.1% of range
Max Sampling Rate		300 Ksamples/second

Table 2.27: QFVI Force Current Specifications

Force Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 500mA, 5A
Resolution		16 Bits
Accuracy	5µA range	±0.3% of value, ±0.1% of range
	50µA range	±0.3% of value, ±0.1% of range
	500µA range	±0.3% of value, ±0.1% of range
	5mA range	±0.1% of value, ±0.1% of range
	50mA range	±0.1% of value, ±0.1% of range
	500mA range	±0.15% of value, ±0.1% of range
	5A range	±0.15% of value, ±0.1% of range
Voltage Clamp Range		±60V
Voltage Clamp Resolution		30mV
Voltage Clamp Accuracy		(-0% to 3%) of range, + 900mV

Table 2.28: QFVI Measure Current Specifications

Measure Current	Condition	Specification
Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 500mA, 5A
Resolution		16 Bits

Table 2.28: QFVI Measure Current Specifications

Measure Current	Condition	Specification
Accuracy	5µA range	±0.3% of value, ±0.1% of range
	50µA range	±0.3% of value, ±0.1% of range
	500µA range	±0.3% of value, ±0.1% of range
	5mA range	±0.1% of value, ±0.1% of range
	50mA range	±0.1% of value, ±0.1% of range
	500mA range	±0.15% of value, ±0.1% of range
	5A range	±0.15% of value, ±0.1% of range
Max Sampling Rate		300 Ksamples/second

FCS - Floating Current Source

Each Floating Current Source card has two independent fully-floating (0V to +100V) channels, which can force current over 4 ranges. Multiple FCS channels can be ganged in parallel to force larger currents. Systems may be configured with up to 5 boards for 10 FCS channels.

Table 2.29: FCS Max Currents

Force Mode	Maximum Current
Continuous Mode	500mA
Pulse Mode	20A
Pulse Mode, 500mA to 10A	100ms max pulse width, 33% max duty cycle
Pulse Mode, 10A to 20A	50ms max pulse width, 20% max duty cycle

Table 2.30: FCS Force Current

Force Current	Specification
Ranges (resolution)	50mA (800nA)
	500mA (8µA)
	5A (80µA)
	20A (320µA)
Accuracy, up to 5A range	±0.15% of value, ±0.1% of range
Accuracy, 20A range	±0.3% of value, ±0.1% of range
Open Circuit Voltage	9V
Compliance Voltage *	4V

NOTE * Compliance is the maximum load voltage allowed to maintain specified accuracy.

Table 2.31: FCS Measure Voltage

Measure Voltage	Specification
Ranges	5V, 2.5V, 1.25V, 625mV
Resolution	16 Bits
Sample Rate	200Ksamples/second
Accuracy	±0.1% of value, ±0.1% of range, ±0.05% of common mode voltage

High Current Octal VI (HCOVI)

The High Current Octal VI is a four Quadrant voltage and current (VI) source. Each High Current Octal VI card has 8 independent VI channels, which can force and measure voltage and current. Each channel has its own Device Ground Sense. The High Current Octal VI forces and measures voltage on one range and forces and measures current on six ranges.

Voltage and Current Clamps

Each channel is equipped with programmable voltage and current clamps. Current is clamped when the channel is forcing voltage and voltage is clamped when the channel is forcing current. Clamp programming has 12 bit resolution.

Differential Measurement

The High Current Octal VI can be configured to make a true differential voltage measurement between any pair of channels or between any channel and local board ground, DUT ground, or a +10V reference.

Parallel Operation

The High Current Octal VI is designed to support easily paralleling the outputs on a card. The outputs simply need to connected together and High Current Octal VI will equally share current between outputs.

High Current Octal VI Specifications

Table 2.32: HCOVI Force Voltage

Force Voltage	Condition	Specification
Force Voltage Ranges		-2 to +8V -2 to +4V
Force Voltage Resolution	Range = -2V to +8V Range = -2V to +4V	244 µV 122µV
Force Voltage Accuracy	Range = -2V to +8V Range = -2V to +4V	±0.05% of value ±8mV ±0.05% of value ±4mV
Hi Force to Sense Voltage	Normal Operation	±2V max
	No damage	±10V max
Lo Force to Sense Voltage	Normal Operation	±0.5V max
	No damage	±20V max
Max Current Clamp		1.02A
Current Clamp Resolution		996µA
Current Clamp Accuracy		±50mA
Output Impedance		2 mOhm
Settling Time	Load Cap < 1000pF	200uS to settle within 0.2% of final value
Voltage Drift	Full scale load current change	< ± 2 LSB DC drift over 15 sec

Table 2.33: HCOVI Measure Voltage

Measure Voltage	Condition	Specification
Measure Voltage Ranges		-2 to +8V -2 to +4V
Resolution		16 bits across -8 to 8 16 bits from -4 to +4
Accuracy		±0.05% of value ±0.05% of range
Differential Measure Accuracy		±0.1% of value ±0.1% of range ±0.2% of common mode.
Differential Measure Modes		Two modes: True differential and relative to a reference on the same VI source.

Table 2.33: HCOVI Measure Voltage (Continued)

Measure Voltage	Condition	Specification
Bias Current	Voltmeter mode	100nA max
DC Input Impedance	Voltmeter mode	1 GOhm minimum
Max Sampling Rate		200 Ksamples/second
Measure FIFO Depth		4K samples
Measure Bandwidth	200 Ksamples/second	60KHz

Table 2.34: HCOVI Force Current

Force Current	Condition	Specification
Force Current Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 1A
Force Current Resolution		16 Bits
Force Current Accuracy	5µA range	±1.5% of value, ±0.1% of range ±0.01% of range per volt
	50µA range	±1.5% of value, ±0.1% of range ±0.01% of range per volt
	500µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	5mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	50mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	1A range	±0.15% of value, ±0.1% of range ±0.01% of range per volt
Max Current per channel	Continuous	up to 1A per channel, see Note 1
Max Voltage Clamp		8.16V
Voltage Clamp Resolution		7.8125mV
Voltage Clamp Accuracy		±2% of value

Table 2.35: HCOVI recommended maximum capacitance

Range	Recommended Max Capacitance Load
1A	500µF (ceramic or organic tantalum)
50mA	1.0µF
5mA	0.1µF
500µA	10nF
50µA	2nF
5µA	500pF

The HCOVI can be tuned to support a wide range of capacitance load on any range, depending on whether optimization for voltage settling, stable voltage response to transient currents, or current measure settling.

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Table 2.36: HCOVI Measure Current

Measure Current	Condition	Specification
Measure Current Ranges		5µA, 50µA, 500µA, 5mA, 50mA, 1A
Measure Current Resolution		16 Bits
Measure Current Accuracy	5µA range	±1.5% of value, ±0.1% of range ±0.01% of range per volt
	50µA range	±1.5% of value, ±0.1% of range ±0.01% of range per volt
	500µA range	±0.3% of value, ±0.1% of range ±0.01% of range per volt
	5mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	50mA range	±0.1% of value, ±0.1% of range ±0.01% of range per volt
	1A range	±0.15% of value, ±0.1% of range ±0.01% of range per volt

Table 2.36: HCOVI Measure Current (Continued)

Measure Current	Condition	Specification
Measure Current Sample Rate		Up to 200Ks/s at 16 bit resolution
Measure Current FIFO Depth		4K samples
Measure Current Trigger		From Pattern via Sync Bus

HCOVI Maximum Currents per Crate

NOTE [1]
The Power Supply Unit (PSU) providing rail power for the HCOVI output stage has a MAX available output current of 28 Amps. There is one PSU that provides rail power to all HCOVI boards in each crate. A CX has one crate, an EX has four crates.

An approximate one-to-one relationship exists between the rail power and the output power of the HCOVI channels. Therefore, the user must ensure that their total intended HCOVI output current is less than the MAX available output current of the PSU.

For example, three HCOVI boards contain 24 channels and would require approximately 24.0 Amps from the PSU to operate all 24 channels at a continuous current output of 1A. A crate can be configured with more than three HCOVI boards, but the maximum current output from the PSU must not exceed 28.0 amps.

Table 2.37: HCOVI CBITs

CBITs	Specification
Number of Bits	One per VI channel (8)
Drive Functions	Relays or TTL
Output Low	350mA max, continuous
	r_{ON} 3 Ohms typical
	Max power dissipation for all 8 channels - 1750mW
Internal Pull-up Voltage	+5V
Internal Pull-up Resistor	33KOhm (Note: Diode disconnected at > 5V ext. Pull-up voltage)
Max External Pull-up Voltage	+50V Internal voltage clamp provided for inductive transient protection

Mixed Signal Instruments

3

DSP Instrument Family

The X-Series offers several DSP source and measure instruments, to cover a wide range of analog source and measurement needs. Any of these instruments can be used in any of the X-Series testers. All provide 2 channels per instrument.

Table 3.1: X-Series family of Arbitrary Waveform Generators

Instrument	Resolution	Sample rate	Samples
AWG-HSB	16bits	75Ms/s - 250Ms/s	8M samples
AWGHS	14 bits	25 - 125 Ms/s	2M x 14
AWG	14 bits	0 - 25 Ms/s	512K x 16
AWGHR	24 bits	768 Ks/s max	256K x 24

Table 3.2: X-Series family of Digitizers

Instrument	Resolution	Sample rate	Samples	Bandwidth
Dig-HSB	14bits	50Ms/s - 105Ms/s	16M	150MHz
DIGHS	12 bits	25 - 125 Ms/s	2M x 12	100 MHz
DIG	14 bits	0 - 25 Ms/s	512K x 16	50 MHz
DIGHR	16 bits	0 - 500 Ks/s	512K	1 MHz typical

Each memory controller can be clocked by either DDS clock module, which allows for both memories to be clock independently or synchronized by the same clock. The two upper bits of the waveform memory are used as marker bits. There is also a third DDS Clock that provides a programmable clock to the DUT site.

The DSP instruments also contain a relay matrix that allows rider board connections to the DUT, the Analog Bus or the Cal Bus.

The AWG-HSB and Dig-HSB pair is a next-generation DSP Source and Measure system for the X-Series test system.

Key AWG-HSB and Dig-HSB features:

- Vastly improved analog performance relative to AWGHS and DIGHS (X series) and SMS-HS2 (HFi).
- Can be used in all versions of X-Series testers
- Code compatibility to SMS-HS and other versions of AWG and DIG, within the specification of the instrument, using compatibility syntax that allows the same code to drive the AWG-HSB and Dig-HSB as well as previous versions of the SMS.
- High speed data link to system controller

Waveform Generator Specifications

AWG

Table 3.3: AWG Specifications

AWG	Condition	Specification
Number of Rider Cards		2
Memory per Channel		512K x 16
Direct Digital Synthesizer (DDS) Clock		2
DDS Clock Frequency		25 MHz max
DDS Clock Resolution		<1Hz
Voltage Ranges	DUT	0.5V, 2V
	Aux	1V, 4V
Resolution		14 bits
Sampling Rate		0 - 25 Ms/s
Bandwidth w/o Filter		NA
Band Pass/Reject Filters		No
Low Pass Filters	Bessel (5 pole)	2 MHz
	Chebyshev (5 pole)	5 MHz
Static DC Offset DAC Range	0.5V Voltage Range	± 0.75V
	2V Voltage Range	± 3V
Static DC Offset DAC Resolution		12 bits
Modulation Source for RF		Yes
Number of Outputs	DUT Board	2 Differential
	Auxiliary	2 Single Ended
Output Impedance		50 Ω
Max Output Current		35 mA

Table 3.3: AWG Specifications (Continued)

AWG	Condition	Specification
Accuracy	DC - 2MHz	-0.5 to -4dB (2MHz Filter)
	DC - 1.2MHz	-0.5 to -2dB (2MHz Filter)
	DC - 720KHz	-0.5 to -1dB (2MHz Filter)
	DC - 5MHz	-0.5 to +1.75dB (5MHz Filter)
	DC - 3MHz	-0.5 to +1.0dB (5MHz Filter)
	DC - 2MHz	-0.5 to +0.5dB (5MHz Filter)

AWGHR

Table 3.4: AWGHR Specifications

AWGHR	Condition	Specification
Number of Rider Cards		2
Memory per Channel		256K x 24
Direct Digital Synthesizer (DDS) Clock		2
DDS Clock Resolution		<1Hz
Voltage Ranges	DUT	0.375V, 0.75V, 1.5V, 3V, 6V
Resolution		24 bits
Source DAC Linearity		24ppm (typical)
Offset DAC Linearity		8ppm (typical)
Sampling Rate		768 Ks/s max
Band Pass/Reject Filters		1KHz Band Pass
Low Pass Filters		50 KHz 2 pole Bessel - DC accurate, low Q, low noise, linear phase response
		50 KHz 5 pole Elliptical - sharp cutoff reconstruction
Static DC Offset		±6V
Static DC Offset Resolution		16 bits
Modulation Source for RF		Yes
Number of Outputs	DUT Board	2 Differential
Output Impedance		<5 Ω
Max Output Current		±15 mA minimum

Table 3.5: AWGHR Dynamic Specifications

AWGHR	Condition	Specification	
		Balanced	**Single Ended**
THD	f = 1 KHz, 1 KHz BPF	≤ -106dB	≤ -106dB
	f = 4KHz, 50KHz LPF	≤ -93dB	≤ -92dB
	f = 10KHz, 50KHz LPF	≤ -90dB	≤ -90dB
	f = 45KHz, 50KHz LPF typical	≤ -97dB	≤ -89dB
SINAD	f = 1 KHz, 1 KHz BPF	≥ 92dB	≥ 87dB
	f = 4KHz, 50KHz LPF	≥ 90dB	≥ 85dB
	f = 10KHz, 50KHz LPF	≥ 88dB	≥ 84dB
	f = 45KHz, 50KHz LPF typical	≥ 91dB	≥ 84dB
Amplitude Accuracy (Bypass mode)	1KHz to 50kHz, gain = 1.0, typical	± 1.0dB	± 1.0dB
DC Accuracy	6V Range, gain = 1.0	± 5mV	± 2.5mV
	3V Range, gain = 1.0	± 3.5mV	± 1.75mV
	1.5V Range, gain = 1.0	± 2.75mV	± 1.375mV
	0.75V Range, gain = 1.0	± 2.375mV	± 1.188mV
	0.375V Range, gain = 1.0	± 2.188mV	± 1.094mV

Tighter AWGHR amplitude accuracy can be achieved using application-specific focus calibration techniques:

Table 3.6: AWGHR focus calibrated typical specifications

AWGHR Focus Calibrated	Condition	Specification	
		Balanced	**Single Ended**
AC Amplitude Accuracy	1-40kHz, 50KHz LPF, gain = 1.0	± 0.03dB typical	± 0.03dB typical
	1-50kHz, 50KHz LPF, gain = 1.0	± 0.06dB typical	± 0.06dB typical
DC Accuracy	0.375V Range, gain = 1.0	187µV typical	187µV typical

AWGHS

The AWGHS Source is a single board, dual channel, high speed synthesizer. It features a 200 MHz DDS clock, 2M of memory, and 14 bits of resolution.

Table 3.7: AWGHS Source Specification

AWGHS Source	Condition	Specification
Number of Channels		2
Memory per Channel		2M x 14
Direct Digital Synthesizer (DDS) Clock		1
DDS Clock Frequency		200 MHz max
DDS Clock Resolution		0.3Hz
Voltage Ranges	DUT	1V, 250mV
Resolution		14 bits
Sampling Rate		25 - 125 Ms/s
Bandwidth w/o Filter		70 MHz
Low Pass Filters		10 MHZ 7 pole Chebyshev
		22MHz 7 pole Chebyshev
Static DC Offset		±2V
Static DC Offset Resolution		12 Bits
Modulation Source for RF		Yes
Number of Outputs	DUT Board	2 Differential
	Auxiliary	1 Single Ended
Output Impedance		50 Ω
Max Output Current		35mA
Output Level	SE 50Ω Peak to Peak	2v
	Diff 50Ω Peak to Peak	4v

Table 3.8: AWGHS Dynamic Specifications

AWGHS Source	Condition (F_S = 125MHz)	Specification
THD	f = 1 MHz, 10 MHz LPF	≤ -65dB
	f = 10MHz, 10MHz LPF	≤ -58dB
	f = 30MHz, 50MHz LPF	≤ -44dB
	f = 50MHz, 50MHz LPF	≤ -44dB
SINAD	f = 1 MHz, 10 MHz LPF	≥ 65dBc
	f = 10MHz, 10MHz LPF	≥ 58dBc
	f = 30MHz, 50MHz LPF	≥ 44dBc
	f = 50MHz, 50MHz LPF	≥ 38dBc
SNR	f = 1 MHz, 10 MHz LPF	≥ 77dBc
	f = 10MHz, 10MHz LPF	≥ 77dBc
	f = 30MHz, 50MHz LPF	≥ 72dBc
	f = 50MHz, 50MHz LPF	≥ 58dBc
SFDR	f = 1 MHz, 10 MHz LPF	≥ 75dBc
	f = 10MHz, 10MHz LPF	≥ 74dBc
	f = 30MHz, 50MHz LPF	≥ 61dBc
	f = 50MHz, 50MHz LPF	≥ 49dBc
Amplitude Accuracy	f = 1-2 MHz, 10 MHz LPF	± 0.30dB
	f = 1-8MHz, 10 MHz LPF	± 1.5dB
	f = 1-10MHz, 10 MHz LPF	± 2.0dB
	f = 1-30MHz, 50MHz LPF	± 3.3dB
(Focus Calibration)	f = 1-2 MHz, 10 MHz LPF	± 0.20dB
	f = 1-8MHz, 10 MHz LPF	± 0.3dB
	f = 1-10MHz, 10 MHz LPF	± 0.4dB
	f = 1-30MHz, 50MHz LPF	± 0.6dB
DC Accuracy	1V Range	± 4mV
	250mV Range	± 1mV

AWG-HSB

Table 3.9: AWG-HSB Specification (Baseline 2 and greater)

Parameter	Min	Max	Notes
Resolution	16bits		
Memory per Channel	8M samples		
DAC Clock Rate	75Ms/s	250Ms/s	
Data Clock Rate	75Ms/s	250Ms/s	These rates are recommended given the reconstruction + interpolation filters
Point Clock Divider	1.144KHz		16bit Counter divides clock rate for converter linearity tests.
Ranging			
Coarse	0dB	18dB	Hardware Attenuator in 3dB steps
Fine	0dB	9dB	10 bits
Common Mode Offset	-5V	5V	
Common Mode Resolution	300µV		16bit Offset DAC with ±5V range
Common Mode Offset Accuracy	-25mV	25mV	* see note below
Peak Excursion HiZ load	-5V	5V	|SE+ Out| < 5V |SE- Out| <5V |(SE+ Out) – (SE- Out)| < 5V Open Circuit, Offset + Waveform Peak
load 50Ω Single Ended or 100Ω Differential	-2.5V	2.5V	|SE+ Out| < 2.5V |SE- Out| <2.5V |(SE+ Out) – (SE- Out)| < 2.5V, 50Ω load (100Ω Differential), Offset + Waveform Peak
Sinx/x Correction			Scale above Peak excursion by 0.63 (3.96dB) when enabled.
DC Accuracy		1% of range + 3mV	offset grounded *
Reconstruction Filters			100, 70 and 50MHz LPF 1dB BW
Filter Insertion Loss		1.0dB	

Table 3.9: AWG-HSB Specification (Baseline 2 and greater) (Continued)

Parameter	Min	Max	Notes
Filter Passband Ripple		0.5dB	
Filter Stop band Rejection	45dB		> 1.40 x 1dB BW
Filter Bypass 3dB BW	150MHz		
SNR		-140dBc/Hz	At max of any coarse range
SFDR			10% BW around wanted tone @ +4 dBm
DC to 1MHz		-100dB	
1 to 10MHz		-90dB	
10 to 20MHz		-80dB	
20 to 50MHz		-80dB	
50 to 100MHz		-70dB	
THD			Measured at +18dBm output SE
DC to 1MHz		-73dB	
1 to 10MHz		-61dB	
10 to 20MHz		-57dB	
20 to 50MHz		-50dB	
50 to 100MHz		-40dB	

NOTE * — The common mode offset DAC is an independent error source to the overall DC accuracy. For the DC accuracy when the offset is not locally grounded, calculate the root sum of square of error contributions of the common mode offset accuracy and the DC accuracy together.

Waveform Digitizer Specifications

The waveform digitizer A/D digital data is stored in the memory on the baseboard. The digitizer rider board has two coax inputs that can be cabled to the DUT site. It also has a differential input that is connected to the DUT site via the Relay Matrix on the BaseBoard. The digitizer has two input ranges and a selectable low pass filter.

DIG

Table 3.10: DIG Specifications

DIG	Condition	Specification
Number of Rider Cards		2
Memory per Channel		512K x 16
Direct Digital Synthesizer (DDS) Clock		2
DDS Clock Frequency		25 MHz max
DDS Clock Resolution		<1Hz
Voltage Ranges	DUT	1V, 4V, (0.25 14 Bit)
Resolution		14 bits
Sampling Rate		0 - 25 Ms/s
Bandwidth w/o Filter		50 MHz
Band Pass/Reject Filters		No
Low Pass Filters	Chebyshev (5 pole)	(2.5MHz - 14 Bit), 7 MHz
	No Filter	50 MHz
Number of Inputs	DUT Board	2 Differential
	Auxiliary	2 Single Ended Coax
DUT Input Impedance	Differential	600Ω DC each Input to GND (12 Bit)
		50Ω, Hiz (14 Bit)
Auxiliary Input Impedance	Coax	50Ω DC
AC Coupled Cut Off Frequency		2.6 KHz

Table 3.10: DIG Specifications (Continued)

DIG	Condition	Specification
Accuracy	DC - 7MHz	1.5dB (7MHz Filter)
	DC - 3MHz	1.0dB (7MHz Filter)
	DC - 2MHz	0.5dB (7MHz Filter)

DIGHR

Table 3.11: DIGHR Specifications

DIGHR	Condition	Specification
Number of Rider Cards		2
Memory per Channel		512K
Direct Digital Synthesizer (DDS) Clock		2
DDS Clock Resolution		<1Hz
Voltage Ranges	DUT	0.375V, 0.75V, 1.5V, 3V, 6V
Resolution		16 bits
Sampling Rate		0 - 500 Ks/s
Bandwidth w/o Filter		1 MHz typical
Band Reject Filter		1KHz Band Reject Filter
1KHz Notch Filter Gain typical		30dB
Low Pass Filters		50 KHz 2 pole Bessel - DC accurate, low Q, low noise, linear phase response
		50 KHz 5 pole Elliptical - sharp cutoff anti-alias
DC Offset		±6V
DC Offset Resolution		16 bits
Number of Inputs	DUT Board	2 Differential
DUT Input Impedance, typical		>100MΩ DC, 100pF
AC Coupled Cut Off Frequency		DC

Table 3.12: DIGHR Dynamic Specifications

DIGHR	Condition	Specification	
		Balanced	**Single Ended**
THD	f = 4KHz, 50KHz LPF	≤ -87 dB	≤ -87 dB
	f = 10KHz, 50KHz LPF	≤ -86 dB	≤ -86 dB
	f = 45KHz, 50KHz LPF, typical	≤ -88 dB	≤ -88 dB
SINAD	f = 4KHz, 50KHz LPF	≥ 83 dB	≥ 83 dB
	f = 10KHz, 50KHz LPF	≥ 81 dB	≥ 81 dB
	f = 45KHz, 50KHz LPF, typical	≥ 80 dB	≥ 80 dB
SNHR	f = 4KHz, 50KHz LPF	≥ 82 dB	≥ 82 dB
	f = 10KHz, 50KHz LPF	≥ 82 dB	≥ 82 dB
	f = 45KHz, 50KHz LPF, typical	≥ 80 dB	≥ 80 dB
SFDR	f = 4KHz, 50KHz LPF	≥ 90 dB	≥ 90 dB
	f = 10KHz, 50KHz LPF	≥ 89 dB	≥ 89 dB
	f = 45KHz, 50KHz LPF, typical	≥ 80 dB	≥ 80 dB
Amplitude Accuracy (Bypass mode)	1KHz to 10kHz, typical	± 1.0dB	± 1.0dB
(Focus Calibration)	1-20kHz, 50KHz LPF	± 0.015dB	± 0.015dB
	1-30kHz, 50KHz LPF	± 0.03dB	± 0.03dB
	1-40kHz, 50KHz LPF	± 0.055dB	± 0.055dB
	1-50kHz, 50KHz LPF	± 0.15dB	± 0.15dB
DC Accuracy	6V Range	± 3mV	± 3mV
	3V Range	± 1.5mV	± 1.5mV
	1.5V Range	± 750uV	± 750uV
	0.75V Range	± 375uV	± 375uV
	0.375V Range	± 187uV	± 187uV

DIGHS

The DIG HS Measure is a single board, dual channel, high speed digitizer. It features a 125 MHz DDS clock, 2M of memory, and 12 bits of resolution.

Table 3.13: DIGHS Measure Specifications

DIGHS Measure	Condition	Specification
Number of Channels		2
Memory per Channel		2M x 12
Direct Digital Synthesis (DDS) Clock		1
DDS Clock Frequency		125 MHz max
DDS Clock Resolution		0.3Hz
Voltage Ranges	DUT	0.0625V, 0.25V, 1V
Resolution		12 bits
Sampling Rate		25 - 125 Ms/s
Bandwidth w/o Filter		100 MHz
Low Pass Filters		32 MHz 7 pole Elliptical
		65 MHz 7 pole Elliptical
DC Offset		±2V
DC Offset Resolution		External Source Resolution
Number of Inputs	DUT Board	2 Differential
	Auxiliary	1 Coax per Channel
DUT Input Impedance		50 Ω
THD	f = 1 MHz, 32 MHz LPF	≤ -70B
	f = 10MHz, 32 MHz LPF	≤ -62dB
	f = 30MHz, 32 MHz LPF	≤ -62dB
	f = 50MHz, 65MHz LPF	≤ -55dB
SINAD	f = 1 MHz, 32 MHz LPF	≥ 54dBc
	f = 10MHz, 32 MHz LPF	≥ 50dBc
	f = 30MHz, 32 MHz LPF	≥ 47dBc
	f = 50MHz, 65MHz LPF	≥ 47dBc

Table 3.13: DIGHS Measure Specifications (Continued)

DIGHS Measure	Condition	Specification
SNHR	f = 1 MHz, 32 MHz LPF	≥ 63dBc
	f = 10MHz, 32 MHz LPF	≥ 50dBc
	f = 30MHz, 32 MHz LPF	≥ 47dBc
	f = 50MHz, 65MHz LPF	≥ 48dBc
SFDR	f = 1 MHz, 32 MHz LPF	≥ 77dBc
	f = 10MHz, 32 MHz LPF	≥ 56dBc
	f = 30MHz, 32 MHz LPF	≥ 51dBc
	f = 50MHz, 65MHz LPF	≥ 54dBc
Amplitude Accuracy	f = 1-2 MHz, 32 MHz LPF	± 0.04dB
	f = 1-8MHz, 32 MHz LPF	± 0.30dB
	f = 1-10MHz, 32 MHz LPF	± 0.39dB
	f = 1-30MHz, 32 MHz LPF	± 2.2dB
(Focus Calibration)	f = 1-2 MHz, 10 MHz LPF	±0.20dB
	f = 1-8MHz, 10 MHz LPF	± 0.35dB
	f = 1-10MHz, 10 MHz LPF	± 0.44dB
	f = 1-30MHz, 50MHz LPF	± 0.65dB
DC Accuracy	1V Range	± 4mV
	250mV Range	± 1mV
	62.5mV Range	± 0.25mV

Dig-HSB

Table 3.14: Dig-HSB Specification (Baseline 3 and greater)

Parameter	Min	Max	Notes
Resolution	14bits		
Memory per Channel	16M		
ADC Clock Rate	50Ms/s	105Ms/s	
3dB BW	150MHz		
Ranging	+5V to 78mV in 3dB steps		
Common Mode Offset	-5V	5V	
Common Mode Resolution	300uV		16bit Offset DAC with ±5V range
Common Mode Offset Accuracy	-10mV	10mV	* see note below
DUT Input Impedance	50 Ω nominal		
Peak Input Excursion	-5V	5V	|SE+ In| < 5V |SE- In| <5V |(SE+ In) – (SE- In)| < 5V Offset + Waveform Peak(= +18dBm)
DC Accuracy		1% of range + 1% of value + 5mV	offset grounded *
Anti-alias Filters			40, 28 and 20MHz LPF 1dB BW
Filter Insertion Loss		1.0dB	
Filter Passband Ripple		0.5dB	peak
Filter Stop band Rejection	45dB		> 40% of 1dB BW
Filter Bypass 3dB BW	150MHz		
SNR		-142dBc/Hz	At max of any Coarse Range
SFDR			10% BW around wanted tone @ +4dBm
DC to 1MHz		-100dB	
1 to 10MHz		-90dB	
10 to 20MHz		-80dB	
20 to 50MHz		-80dB	

Table 3.14: Dig-HSB Specification (Baseline 3 and greater) (Continued)

Parameter	Min	Max	Notes
50 to 100MHz		-70dB	
THD			Measured SE at +10dBm all input attenuators bypassed.
DC to 1MHz		-82dB	
1 to 10MHz		-76dB	
10 to 20MHz		-71dB	
20 to 50MHz		-64dB	
50 to 100MHz		-51dB	

NOTE * — The common mode offset DAC is an independent error source to the overall DC accuracy. For the DC accuracy when the offset is not locally grounded, calculate the root sum of square of error contributions of the common mode offset accuracy and the DC accuracy together.

AWG-HSB & Dig-HSB Auxiliary Sample Clock Output

Auxiliary Sample Clock Output Specification

NOTE Note that using the aux. Clock output will limit operation of the instrument.

Table 3.15: AWG/Dig-HSB Auxiliary Sample Clock Output Specification

Parameter	Min	Max	Notes
Frequency Span	12.5MHz	400MHz	Converter limits max/min frequency span
Resolution	1/(2^16)Hz		At 200-400MHz Octave
Amplitude	1Vpp		LV PECL
Jitter		1pS	rms @ highest octave
Phase noise		-110dBc/Hz	10KHz offset @ highest octave
Spectral Purity			Requirement based on R&S SML specification
Harmonics		-30dBc	Relative to nominal +4dBm output
Non Harmonics		-70dBc	Carrier offset > 20Khz

Time Measurement 4

QTMU

The QTMU (Quad Time Measurement Unit) provides 4 independent time measurement channels per board.

Each QTMU channel is able to perform rise or fall time, pulse width, delay, frequency or period, and duty cycle measurements.

Each QTMU channel has two signal inputs (A and B) for the signals to be measured, plus a trigger signal input for arming the measurement. Each of these inputs has front-end circuitry to optionally attenuate or filter the incoming signals. Each input has its own settings for low level, high level, and hysteresis.

QTMU Comparators

Each QTMU input has separate range selection. Each range selection includes programmable comparator levels, programmable hysteresis, and a choice of filters. 3 ranges are available.

Table 4.1: QTMU ± 2.5V Comparator Range

± 2.5V Range	Specification
Input Impedance	50Ω nominal
Bandwidth (unfiltered)	40 MHz typical
Comparator	
Level Threshold DC Accuracy	±50mV
Resolution	12 bits
Hysteresis	
Hysteresis Range	20mV to 100mV
Resolution	10 bits

Table 4.2: QTMU -5V to +25V Comparator Range

-5V to +25V Range	Specification
Input Impedance	1MΩ nominal
Bias current	-2uA typical
Capacitance	150pF typical
Max. Bandwidth	10MHz nominal
Comparator	
Accuracy	±300mV
Resolution	12 bits
Hysteresis	
Hysteresis Range	100mV to 500mV
Resolution	10 bits

Table 4.3: QTMU -15V to +100V Comparator Range

-15V to +100V Range	Specification
Input Impedance	1MΩ nominal
Bias current	-2uA typical
Capacitance	150pF typical
Max Bandwidth	10MHz nominal

Table 4.3: QTMU -15V to +100V Comparator Range

-15V to +100V Range	Specification
Comparator	
Accuracy	±1000mV
Resolution	12 bits
Hysteresis	
Hysteresis Range	400mV to 2V
Resolution	10 bits

Filters

Each QTMU input has a separate input filter selection.

Table 4.4: QTMU Input Filters

Filter	Specification
100KHz Low Pass Filter	18dB/Octave attenuation, nominal
1MHz Low Pass Filter	18dB/Octave attenuation, nominal
10MHz Low Pass Filter	18dB/Octave attenuation, nominal
Unfiltered	±2.5V / 50 Ohm range only

Measurements

All time measurement specifications refer to measurements via the unfiltered measure path, unless otherwise noted.

Table 4.5: QTMU Time Base

time base	Specification
Time base	System 10MHz oscillator
Time base accuracy	± 1ppm

Table 4.6: QTMU Acquisition Time

Acquisition Time	Specification
Max. acquisition time	1.3 seconds

Table 4.7: QTMU Pulse Width Measurements

Pulse Width Measurement	Specifications
Resolution	30ps
Measurement accuracy	±1ns typical
Min. Pulse Width	10ns
Max. Pulse Width	800ms

Table 4.8: QTMU Rise and Fall Time Measurements

Rise/Fall Time Measurements	Specifications
Resolution	30ps
Measurement accuracy	±1ns typical
Max. Rise or Fall time	800ms

Table 4.9: QTMU Delay Measurements

Delay Measurements	Specifications
Resolution	30ps
Measurement accuracy	±2ns typical
Delay measurement range	±800ms

Table 4.10: QTMU Period and Frequency Measurements

Period and Frequency Measurements	Specifications
Resolution	90ps
Period / Frequency measurement accuracy	±5ns/# periods measured + time base accuracy (1ppm)
Max. number of periods	8388608
Min. period	33ns
Max. frequency	30MHz
Max. period	1 second
Min. frequency	1Hz

Table 4.11: QTMU Duty-Cycle Measurements

Duty-Cycle Measurements	Specifications
Resolution	90ps
Measurement accuracy	5ns/# peiods measured
Min. period	66ns
Min. pulse width	10ns
Max. period	1 second
Max. number of periods	1000

Arming

The QTMU arming can be

- Immediate (minimum arming delay)
- Triggered from the SyncBus
- Self-armed (from the same pin as the measurement)
- From a different pin (on the same QTMU channel)
- Delayed by a user-specified time delay

Table 4.12: QTMU Arming Time Delay

Delay Arming	Specification
Minimum timed arm delay	25ns
Maximum arm delay	1.67 seconds
Arm time delay resolution	6.25ns
Arm time delay accuracy	±12ns

DDP Digital Instrument Options 5

DDP

The CX Dynamic Digital Pin subsystem (DDP), available in the CX, DX, & EX heads, consists of pattern memories, per-pin timing, waveform generation, and time measure capability. Key features of the CX digital subsystem include:

- Up to 128 Pins
- Data rates up to 80 Mbps
- 200 pS Timing Resolution
- 16 time sets
- On the fly time set switching
- 8 M pattern memory per pin
- Asynchronous data capture
- Embedded TMU
- Integrated DSP send and receive
- On board PMU

The CX digital subsystem also has a High Voltage Digital Pin (HVDP) option. The HVDP module consists of 16 Channels per module and is a 24V Drive and 48V Compare instrument.

CX Digital DDP Specifications

Table 5.1: CX Digital

CX Digital	Condition	Specification
Channels per Module		16
Data Rate		80 Mbps
Clock Rate		80 MHz
Pattern Generation Rate		33/66.6 MHz
Frequency Accuracy		±1 ppm
Timing		
Period Sets		16
Global Timing Sets		16
Timing Edges per Pin		6
Memory		
Vector Memory		8 M
Send Memory		256 K
Receive Memory		256 K
Asynchronous Receive Memory		256 K
Formats and Instructions		
Drive Formats		NRZ, NRZC, RZ, RZC, RO, ROC, HI, LO, OFF, CLK, CLKC, MAN, MANC
Compare Formats		Window
Micro Instructions		LCNT, ENDL, JMP, CJMP, JSR, CJSR, RTN,CRTN, HALT, CWAIT, NOP, REP, KA, RCODE, LWAL, LWAH, LWLL, LWLH, JSRI, JMPI
Edge Placement		
Edge Placement Accuracy		±1 ns
Edge Placement		0 to 2 x Period

Table 5.2: CX Digital Pincard

CX Digital Pincard	Condition	Specification
Driver		
Driver Vih	10 mA	-1 to 7 V
Driver Vil	10 mA	-2 to 7 V
Driver Accuracy	-1.5 to 7 V	±50 mV
	-2 to -1.5 V	±100 mV
Drive Current	max	±25 mA
Driver On Resistance		50 Ohms ±10%
Driver Off Leakage Current		<1 uA
Rise/Fall Time	3V (10-90%)	2ns Typ
	5V (10-90%)	3ns Typ
Comparator		
Level Voh, Vol		-1.5 to 7 V
Level Accuracy		±50 mV
Input Bias Current		<1 uA
Min. Compare Window		3ns
Active Loads		
Load Current Loh, Lol		0 to 25 mA
Load Current Accuracy		±100 uA
Commutation Voltage		-1.5 to 7 V
Commutation Voltage Accuracy		±50 mV

Table 5.3: CX Digital PMU

CX Digital PMU	Condition	Specification
Channels per Module		1 muxed to 16 Channels
Force Voltage Range		-2 to 7 V
Force Voltage Accuracy		±(0.25% of programmed value + 10 mV)
Measure Current Ranges		10uA, 100uA, 1mA, 40 mA

Table 5.3: CX Digital PMU (Continued)

CX Digital PMU	Condition	Specification
Measure Current Accuracy	10uA	±(0.4% of current + 10 nA)
	100uA	±(0.4% of current + 100 nA)
	1mA	±(0.4% of current + 1 uA)
	40 mA	±(0.4% of current + 35 uA)
Force Current Ranges		10uA, 100uA, 1mA, 40 mA
Force Current Accuracy	10uA	±(0.4% of programmed value + 170 nA)
	100uA	±(0.4% of programmed value + 1.7 uA)
	1mA	±(0.4% of programmed value + 17 uA)
	40 mA	±(0.4% of programmed value + 680uA)
Measure Voltage Range		-2 to 7 V
Measure Voltage Accuracy		±(0.25% of voltage + 10 mV)

Table 5.4: CX Digital TMU

CX Digital TMU	Condition	Specification
Channels per Digital System		1 muxed to All Channels
Reference Clock Accuracy		1 ppm
Input Bias Current	Arm	<1 uA
Input Threshold Level		Comparator Level
Input Signal Sources	Arm Start/Stop	Digital Pin,Pattern,TC Digital Pin
Pos / Edge Selection		Arm,Start,Stop
Min Pulse Width	Arm,Start,Stop	5ns
Max Number of Stop Events		1
Stop Hold Off		300ns to 429s
Overflow Flag	If no Stop Event in TM Range	Yes

Table 5.4: CX Digital TMU (Continued)

CX Digital TMU	Condition	Specification
Time Measurement Types		Rise/Fall Time, Positive/Negative Pulse, Time Interval, Frequency
Time Measurement Ranges		0 to 3.2us, 175ns to 6.5ms, 4.8us to 100ms, 400ns to 429s
Time Measurement Resolution	0 to 3.2us	215ps
	175ns to 6.5ms	215ps
	4.8us to 100ms	215ps
	400ns to 429s	100ns
Rise / Fall Time Measurement Accuracy (Averaged)	Rise Time	±700ps+/-1ppm
	Fall Time	±1.5ns+/-1ppm
Delay / Interval Time Measurement Accuracy (Averaged)	Rising to Rising	±2ns+/-1ppm
	Falling to Falling	±2.5ns+/-1ppm
	Rising to Falling	±4ns+/-1ppm
	Falling to Rising	±4ns+/-1ppm
Pulse Time Measurement Accuracy (Averaged)	Positive Pulse	±2.5ns+/-1ppm
	Negative Pulse	±2.5ns+/-1ppm
Max Frequency Measurement		100MHz
Frequency Measurement Accuracy of Reading	(ppm)	±1000*10E-6 /Gate Time ppm ±1 ppm (Time Base)

High Voltage Digital Pin

The CX Digital has a High Voltage Digital Pin (HVDP) option. The HVDP has the capability to Drive 24v and Compare up to 48 V. The maximum pattern rate is 5.0 MHz at 24V.

Table 5.5: CX High Voltage Digital PIncard

CX HVDP	Condition	Specification
Channels per Module		16
Driver		
Max Data Rate	24V Swing (typ)	5 MHz
Voltage Range		-2 to 24 V
Max Standoff Voltage	Continuous Operation	-3 to 30 V
Max Over load Current	< 1 S	100 mA
Max Transient Voltage	< 1 mS	42 V
Level Resolution	Nominal	14 mV
Level Accuracy		±(1.25% of programmed value + 250 mV)
Output Impedance		50 Ohms ±10%
Max Current	24V (Min)	15 mA
Minimum Pulse Width	50% points (typ)	100 nS
Rise Time (typ)	20 to 80% @ 24V	100 nS
Fall Time (typ)	20 to 80% @ 24V	100 nS
Settling Time	to ±5% (typ)	75 nS
Overshoot	max	500 mV
Comparator		
Max Compare Rate		5 MHz
Voltage Range		-12 to 48V
Max Standoff Voltage		-64 to 64V
Level Resolution		22.4 mV
Level Accuracy		±(1.25% of programmed value + 400 mV)
Input Impedance		100K Ohms ±0.2%
Settling Time	to ±5% (typ)	25 nS
Tristate Input Impedance		100K Ohm

RF Instrument Options

6

RF16

The RF instrumentation is offered in one version, the RF16. RF16 is fully integrated into the X-Series test heads. It provides comprehensive RF production test coverage for personal communication devices including system on a chip, single-chip transceivers, modulators, demodulators, power amplifiers, mixers, LNAs, synthesizers, PLLs, and more. Complete RF test coverage is available, including measurements such as S-Parameters, Insertion Loss and Return Loss and EVM.

RF Source Generator

The RF source is designed for high spectral purity and low phase noise signal performance. It is controlled via a standard GPIB bus connected to the test computer. The output attenuator is a mechanical design. All modulation types are supported by the Modulation Option which is an add-on set of Arbitrary Waveform Generators connected to the RF source internal modulators.

Number of RF Ports

4, 8, 12, and 16 ports for the RF16 Subsystem

RF Ports

The RF16 port module consists of a pair of Bi-Directional vector ports. The system can be configured up to 16 Bi-Directional ports.

System Modes

- Single Tone Source
- Single Tone Aux Source
- Two Tone Source From One Port (Main Source + Aux Source Combined)
- Two Tone Source From Two Ports (Main Source + Aux Source Separated)
- Modulation Source
- Scalar Measure
- Vector Analyzer
- Noise Measure
- Frequency Measure.

Measuring Instrument Type

Single Down Conversion Superheterodyne Receiver per port with multiple coherent DSP Based IF Sampling Voltmeters (allowing simultaneous RF measurement on multiple ports). The Measurement LO is dedicated.

RF16 Specifications

Table 6.1: RF16 Single Tone Source

RF16 Single Tone Source	Condition	Specification
Vector Ports	per RF System	4, 8, 12, 16
Frequency Range		10MHz to 6GHz
Frequency Resolution		0.1 Hz
Frequency Accuracy		± 1ppm
Frequency Settling Time		< 15 mS
SSB Phase Noise f_m= Carrier Offset F_c= Carrier Frequency	f_m=20KHz, F_c=20MHz f_m=20KHz, F_c=1GHz f_m=20KHz, F_c=2GHz f_m=20KHz, F_c=3GHz f_m=20KHz, F_c=6GHz f_m>5MHz, F_c>20MHz f_m>5MHz, F_c>3GHz	< -116 dBc/Hz < -126 dBc/Hz < -120 dBc/Hz < -116 dBc/Hz < -110 dBc/Hz < -136 dBc/Hz < -132 dBc/Hz
Output Impedance	Nominal	50 Ohm
Level Range (P1dB)	10MHz < F_c < 150MHz	+10dBm - ((150MHz - F_c) * 0.06dB/MHz)
	150MHz ≤ F_c < 6 GHz	+10dBm
Level Resolution		0.1 dB
Level Accuracy (Relative to external Cal Standard)	Load VSWR < 1.05:1	
	10 MHz< F_c < 2.5 GHz -80 dBm to +10 dBm	±0.5 dB
	10MHz< F_c < 2.5 GHz -100 dBm to -80 dBm	±0.75 dB
	10MHz< F_c < 2.5 GHz -120 dBm to -100 dBm	±1.0 dB
	2.5 GHz< F_c < 6.0 GHz -80 dBm to +10 dBm	±0.5 dB
	2.5 GHz< F_c < 6.0 GHz -100 dBm to -80 dBm	±0.75 dB
	2.5 GHz< F_c < 6.0 GHz -120 dBm to -100 dBm	±1.0 dB

Table 6.1: RF16 Single Tone Source (Continued)

RF16 Single Tone Source	Condition	Specification
Level Settling Time	Level + Frequency	< 15 mS
Spectral Purity		
Harmonics	Po < +9dBm	< -30 dBc
Non-harmonics (CW)	fm > 10KHz for all F_c	
	0.4 MHz to 450 MHz	< -74 dBc
	450 MHz to 1.5 GHz	< -80 dBc
	1.5 GHz to 3.0 GHz	< -74 dBc
	3.0 GHz to 3.3GHz	< -60 dBc
	3.3 GHz to 6.0 GHz	< -64 dBc
	> 6 GHz	< -58 dBc
Voltage Standing Wave Ratio (VSWR)	Frequency 10MHz to 6GHz	< 2:1

Table 6.2: RF16 Two Tone Source

RF16 Two Tone Source	Condition	Specification
Frequency Range		10MHz to 6GHz
Frequency Resolution		0.1 Hz
Frequency Accuracy		± 1ppm
Frequency Settling Time		< 15 mS
SSB Phase Noise	f_m=20KHz, F_c=20MHz	< -116 dBc/Hz
	f_m=20KHz, F_c=1GHz	< -126 dBc/Hz
f_m= Carrier Offset	f_m=20KHz, F_c=2GHz	< -120 dBc/Hz
F_c= Carrier Frequency	f_m=20KHz, F_c=3GHz	< -116 dBc/Hz
	f_m=20KHz, F_c=6GHz	< -110 dBc/Hz
	f_m>5MHz, F_c>20MHz	< -136 dBc/Hz
	f_m>5MHz, F_c>3GHz	< -132 dBc/Hz
Output Impedance	Nominal	50 Ohm
Level Range (P1dB)	10MHz < F_c < 150MHz	+10dBm - ((150MHz - F_c) * 0.06dB/MHz)
	150MHz ≤ F_c < 6 GHz	+10dBm
Level Resolution		0.1 dB
Level Accuracy (Relative to external Cal Standard)	Load VSWR < 1.05:1	Same as Single Tone Source
Spectral Purity		
Harmonics	Po < +9dBm	< -30 dBc
Non-harmonics (CW)	fm > 10KHz for all F_c	
	0.4 MHz to 450 MHz	< -74 dBc
	450 MHz to 1.5 GHz	< -80 dBc
	1.5 GHz to 3.0 GHz	< -74 dBc
	3.0 GHz to 3.3GHz	< -60 dBc
	3.3 GHz to 6.0 GHz	< -64 dBc
	> 6 GHz	< -58 dBc

Table 6.3: RF16 Modulation Source

RF16 Modulation Source	Condition	Specification
Carrier Frequency Range		10MHz to 6GHz
Carrier Frequency Resolution		0.1 Hz
Carrier Frequency Accuracy		± 1ppm
Carrier Frequency Settling Time		< 15 mS
IQ SSB Phase Noise	f_m=20KHz, F_c=20MHz	< -119 dBc/Hz
	f_m=20KHz, F_c=1GHz	< -123 dBc/Hz
f_m= Carrier Offset	f_m=20KHz, F_c=2GHz	< -120 dBc/Hz
F_c= Carrier Frequency	f_m=20KHz, F_c=3GHz	< -116 dBc/Hz
	f_m=20KHz, F_c=6GHz	< -110 dBc/Hz
Output Impedance	Nominal	50 Ohm
Carrier Level Range (P1dB)	10MHz < F_c < 150MHz	+10dBm - ((150MHz - F_c) * 0.06dB/MHz)
	150MHz ≤ F_c < 6 GHz	+10dBm
Carrier Level Resolution		Same as Single Tone Source
Carrier Level Accuracy (Relative to external Cal Standard)	Load VSWR < 1.05:1	Same as Single Tone Source
Carrier Spectral Purity		
Harmonics	Po < +9dBm	< -30 dBc
Non-harmonics (CW)	fm > 10KHz for all F_c	
	0.4 MHz to 450 MHz	< -74 dBc
	450 MHz to 1.5 GHz	< -80 dBc
	1.5 GHz to 3.0 GHz	< -74 dBc
	3.0 GHz to 3.3GHz	< -60 dBc
	3.3 GHz to 6.0 GHz	< -64 dBc
	> 6 GHz	< -58 dBc
Modulation Types		Any - AM, FM, GFSK, WCDMA, GMSK, etc.

Table 6.4: RF16 Scalar Measure

RF16 Scalar Measure	Condition	Specification
Measurement Type		CW, Wideband Spectrum
Frequency Range		10MHz to 6GHz
Frequency Resolution		0.1 Hz
Frequency Accuracy		± 1ppm
Frequency Settling Time		< 15 mS
LO SSB Phase Noise f_m= Carrier Offset F_c= Carrier Frequency	f_m=20KHz, F_c=20MHz f_m=20KHz, F_c=1GHz f_m=20KHz, F_c=2GHz f_m=20KHz, F_c=3GHz f_m=20KHz, F_c=6GHz f_m>5MHz, F_c>20MHz f_m>5MHz, F_c>3GHz	< -116 dBc/Hz < -126 dBc/Hz < -120 dBc/Hz < -116 dBc/Hz < -110 dBc/Hz < -136 dBc/Hz < -132 dBc/Hz
Input Impedance	Nominal	50 Ohm
Measurement Level Ranges (P1dB)		23 dBm (>10 MHz), 10 dBm, 4 dBm, -5 dBm, -20 dBM -30 dBm
IF Ranges		6 (6dB Range)
Measurement Resolution		14 bits
Measurement Accuracy	+10 dBm to -70 dBm	±0.5dB
	Else	±0.75dB
Measurement Time		1 / Resolution Bandwidth+ 1.5uS/ sample
Maximum Input Power		+20 dBm (Top Range)
Input 2-Tone 3rd Order Intercept Point	Pin < +10dBm Pin < + 20dBm	> +40dBm > +38dBm
Noise Figure		12 dB
IF Bandwidth (3dB)		300KHz - 100 MHz (AC Coupled)
Nominal IF Frequency		1 MHz

Table 6.4: RF16 Scalar Measure (Continued)

RF16 Scalar Measure	Condition	Specification
IF Filters	LPF	10 MHz, 5MHz, 2.5 MHz
	BPF	1.1 MHz
		External SMA for Apps specific requirements
Voltage Standing Wave Ratio (VSWR)	Frequency 10MHz to 6GHz	< 2:1

Table 6.5: RF16 Vector Analyzer

RF16 Vector Analyzer	Condition	Specification
One Port Calibration Type	Short, Open, Load	
Two Port Calibration Type	Short, Open, Load, Through	
Measurement Type		Selective CW
Measurements		■ S-Parameters (Magnitude & Phase) ■ Return Loss ■ Insertion Loss/Gain
S-Parameters	One Port Two Port (12 Term Error Correction)	S11 and S22 S11. S12, S21, S22
Frequency Range		0.1 GHz to 6 GHz
Frequency Resolution		0.1 Hz
Frequency Accuracy		± 1ppm
Source/LO SSB Phase Noise		Same as CW Measure
Input / Output Impedance	Nominal	50 Ohm
Output Range	One Port	+10dBm to -90dBm
Output Resolution		0.1 dB
Measurement Range	One Port	+10dBm to -90dBm

Table 6.5: RF16 Vector Analyzer (Continued)

RF16 Vector Analyzer	Condition	Specification
Measurement Resolution		0.1dB
S-Parameter Accuracy	S21 S11, S22	±0.2dB Effective directivity > 40dB
S-Parameter Setup and Measure Time	S11, S12, S21, S22 @ 1 Frequency	<60 mS