5000 SMART^E™

SMART ENVIRONMENT 5000 SERIES

Model 5300 General RF/Microwave Test Environment Performance Specifications

AEROFLEX
A passion for performance.

SMART^E™ 5300 Features

- The SMART^E 5300 configuration is optimized for general RF/Microwave testing of component, assemblies and subsystems.
- The SMART^E 5300 contains a core synthetic system which generates stimulus, measures response and processes data to generate the required data sets.
- The SMART^E 5300 is also capable of emulating discrete instruments.
- The SMART^E 5300 can be remotely controlled via instrument-centric IVI drivers or directly as a synthetic instrument.
- The SMART^E 5300 can be locally controlled via the Aeroflex Measurement Console (AMC) or the System Console Graphical User Interface (GUI).
  - The System Console provides an instrument-centric control via instrument soft front panels.
  - The AMC provides both instrument and measurement type panels and controls the system via TestStand™ Sequences.
- The SMART^E 5300 is delivered with complete calibration and diagnostic software.
- The SMART^E 5300 is available as a stand-alone turn key solution or as a subsystem to be included as part of a larger ATE system.

SMART^E 5300 Performance Specifications

- The stimulus, response and measurement performance of the SMART^E 5300 system is specified for typical operating conditions and the majority of the specifications apply at the system interface.
- The performance of the 5300 is specified in terms of instrument specifications.

The following instrument-centric functions are supported by the SMART^E 5300

- Stimulus (RF Signal Generator)
- Response (Spectrum Analyzer, RF Counter)
- Stimulus/Response (MTA, s-parameters)
- Noise Figure (Noise Figure Meter)
- Time Domain (MTA)
- Phase Noise (Phase Noise Analyzer)

The following IVI drivers are available for the SMART^E 5300 system

- IVI Class Compliant Specific Drivers
  - IviRFSigGen (RF Signal Generator)
  - IviSpecAn (Spectrum Analyzer)
  - IviPwrMeter (Power Meter)
- IVI Custom Specific Drivers
  - IviMTA (Microwave Transition Analyzer)
  - IviPhNoise (Phase Noise Test Set)
  - IviVNA (Vector Network Analyzer)
  - IviNoiseFigure (Noise Figure Meter)
  - IviCounter (RF Counter)
  - IviMeasAn (Measurement Analyzer)

RF Signal Generator Specifications

There are many different options for the signal generation in the SMART^E 5300 environment. These include modular synthetic signal generators, box level synthetic signal generators and traditional analog and vector signal generators. These different types of signal generators are all supported by the SMART^E 5300 environment. Specifications for the synthetic box level signal generators and traditional analog and vector signal generators are provided in the detailed data sheets for these elements. The following section provides the specifications for the Aeroflex Modular Synthetic RF Signal Generator.

Modular Synthetic RF Signal Generator Specifications

Parameter	Specification	Comments
Frequency Range	DC to 40 GHz in contiguous bands	Frequency Options: DC to 50 MHz 50 MHz to 8 GHz 8 to 12 GHz 12 to 20 GHz 20 to 26.5 GHz 26.5 to 40 GHz
Frequency Resolution Standard Fine freq resolution option	 4 Hz 0.1 Hz	
Frequency Accuracy	Same as 10 MHz frequency reference uncertainty	
Output Power Standard	RF Frequency — Output Power (dBm) 0.5 to 5 GHz — 12 5 to 8 GHz — 12 8 to 12 GHz — 12 12 to 20 GHz — 9 20 to 26.5 GHz — 5 26.5 to 40 GHz — -3	At Local Calibration Unit Output
Output Power High Power Option	RF Frequency — Output Power (dBm) 0.5 to 5 GHz — Depends on option 5 to 8 GHz — Depends on option 8 to 12 GHz — Depends on option 12 to 20 GHz — Depends on option 20 to 26.5 GHz — Depends on option 26.5 to 40 GHz — Depends on option	Depends on specific configuration and the loss between the RF Signal Generator and the plane of specification

Parameter	Specification			Comments
Output Power Setability Range Standard Extended amplitude range	 100 dB 120 dB			
Output Power Resolution	0.02 dB			
Power Level Accuracy	Freq Range 3 MHz to 50 MHz 3 MHz to 50 MHz 3 MHz to 50 MHz 50 MHz to 18 GHz 50 MHz to 18 GHz 50 MHz to 18 GHz 18 to 26.5 GHz 18 to 26.5 GHz 18 to 26.5 GHz	Power Range(dBm) +10 to -10 -10 to -70 -70 to -100 +10 to -10 -10 to -70 -70 to -100 +10 to -10 -10 to -70 -70 to -100	Unc(dB) ±0.3 ±0.5 ±0.9 ±0.3 ±0.5 ±1.0 ±0.5 ±0.7 ±1.0	At Local Calibration Unit Output
Analog Power Sweep Range	30 dB			
Instantaneous BW Narrowband Wideband Option	 20 MHz >350 MHz			
Frequency Switching Time Within Instantaneous BW Outside Instantaneous BW Std Frequency Speed High Speed Option	 < 1 μs 20 ms < 1 ms			
Modulation Types	Pulse, AM, FM, PM, Arbitrary			All modulations except pulsed require AWG option

Parameter	Specification	Comments
Pulse Modulation	Internal or external	
Output carrier Frequency	>50 MHz	
On/Off ratio	80 dB	
Minimum Pulse Width		
RF < 500 MHz	100 ns	
RF > 500 MHz	20 ns	
Pulse Rise Time		
RF < 500 MHz	50 ns	
RF > 500 MHz	10 ns	
Pulse Width Resolution	20 ns	
PRF Range	1 Hz to 10 MHz	
PRF Resolution	20 ns	
Video Feed-through		
RF < 1 GHz	2%	
RF > 1 GHz	2 mV	
Pulse Modulation Level Accuracy (relative to CW level)	±0.1 dB	Middle 90% of pulse
FM Modulation		
Mode	Internal/External	External modulation option required for external FM modulation
Maximum Deviation	±15 MHz	
Rate	100 KHz to 10 MHz	Sensitivity is programmable
Sensitivity	100 KHz, 1 MHz or 10 MHz/4 Vpp 100 KHz, 1 MHz or 10 MHz/8 Vpp	
AM Modulation		External modulation option
Modes	Internal/External	Required for external FM modulation
Depth	99%	
Bandwidth	100 Hz to 100 KHz	
Sensitivity	100% / 4 Vpp	
Spectral Purity – Non Harmonic		Typical
General spurious		
RF ≤ 26.5 GHz	-60 dBc	
RF > 26.5 GHz	-50 dBc	
Power supply related spurious	-55 dBc	
Spectral Purity – Harmonics		
Standard	-30 dBc	
Harmonic option	-50 dBc	

Parameter	Specification				Comments
Phase Noise - Standard	Freq Offset	0.05-8 GHz	8-26.5 GHz	26.5-40 GHz	
	100 Hz	-80	-78	-72	
	1 kHz	-96	-96	-90	
	10 kHz	-97	-97	-91	
	100 kHz	-116	-122	-116	
	1 MHz	-129	-132	-126	
	10 MHz	-136	-136	-130	
Phase Noise – Low Phase Noise Option	Freq Offset	0.05-8 GHz	8-26.5 GHz	26.5-40 GHz	
	100 Hz	-89	-83	-77	
	1 kHz	-109	-103	-97	
	10 kHz	-124	-118	-112	
	100 kHz	-124	-118	-112	
	1 MHz	-139	-133	-127	
	10 MHz	-141	-135	-129	

Parameter	Specification	Comments
Output VSWR	RF Freq VSWR 0.05 GHz 1.5 6 GHz 1.6 12 GHz 1.7 18 GHz 1.8 26.5 GHz 2.1	At local calibration unit output. Final system VSWR depends on RF Interface configuration
Fast Switching Sweep Capability	Auto Single Stepped	
Fast Switching Sweep Modes	Sweep up Sweep down Sweep up/down	
Fast Switching Hop Table Depth	64k	Dependant on AWG option selected
Sweep Speeds per Step Trigger mode External Internal	 10 μs 10 μs to 1 s	

Spectrum Analyzer Specifications

The Spectrum Analyzer Measurement function is implemented using the response channel including the LCU, Down converter and Digitizer. The performance specifications are listed in following table.

Parameter	Specification	Comments
Measurement Modes	Positive amplitude, negative amplitude amplitude spectrum, Harmonic positive amplitude, frequency frequency spectrum, harmonic frequency frequency envelope, bandwidth Harmonic bandwidth	These measurement modes are descriptions of data processing performed by the software application calling the SpecAn IVI driver. The SpecAn driver returns data to support these measurement modes using a combination of returned spectrum data and marker functions.
Frequency Range	100 Hz to 26.5 GHz (expandable to 220 GHz with external mixers)	
Frequency Read-out Accuracy	±[(frequency read-out x reference frequency accuracy) + 0.5 x span / (sweep points[1] – 1)]	
Frequency Span Range	0 to 26.5 GHz	
Frequency Span Accuracy	±[0.2% of span + span / (sweep points[1] – 1)]	
Frequency Resolution Bandwidth Range (-3dB)	10 Hz to 6 MHz adjustable in 1, 3, 10 sequence and 10% increments	
Frequency Resolution Bandwidth Accuracy	±0.5% from 10 Hz to 300 kHz ±1.5% from 1 MHz to 6 MHz	
Frequency Resolution Bandwidth Shape	Programmable digital filter, approximately Gaussian shape	
Video Bandwidth Range	3 Hz to 6 MHz in 1, 3, 10 sequence and 10% increments	
Video Bandwidth Accuracy	±10%	
Frequency Sweep Time Range	10 ms to 1000 s	
Trigger (single sweep)	Internal/external	
Programmable Input Attenuation Range	0 to 90 dB	
Programmable Input AttenuationDefault Value	10 dB	
Maximum Safe Input Power	30 dBm (attenuation ≥ 30 dB)	
Maximum Safe Input Power Continuous Power (max without damage)	0 dBm	No attenuation, preamplifier off, maximum input reference level ≤-30 dBm
Maximum safe input power Pulse power	100 W peak, 10 μs pulse maximum, 1% duty cycle with response attenuation	With appropriate front-end attenuation
Maximum Safe Input Power - DC	0 V	
Power Input Capability Without Attenuation Range (without preamplifier)	0 dBm max to -140 dBm (Maximum input reference level ≥ -30 dBm)	
Power Input Capability Without Attenuation Range (with preamplifier)	-20 dBm max to -160 dBm (Maximum input reference level < -30 dBm)	
Residual Response	<-110 dBm	Input terminated into 50 Ω, 0 dB response attenuation
Noise Level Preamp Bypass (0 dB attenuation with 10 Hz RBW) > 1 GHz to 7 GHz > 7 GHz to 12.5 GHz > 12.5 GHz to 22 GHz > 22 GHz to 26.5 GHz	 -138 dBm -132 dBm -132 dBm -130 dBm	

Parameters	Specification	Comments
Noise Level Preamp On (0 dB attenuation with 10 Hz RBW) >1 GHz to 7 GHz >7 GHz to 12.5 GHz >12.5 GHz to 22 GHz >22 GHz to 26.5 GHz	 -155 dBm -150 dBm -150 dBm -144 dBm	
Input VSWR	RF Freq VSWR 0.05 GHz 1.5 6 GHz 1.6 12 GHz 1.7 18 GHz 1.7 26.5 GHz 2	At Local Calibration Unit (LCU) input. Final system VSWR depends on RF Interface c onfiguration.
Reference Level Range - Log	+30 dBm to -140 dBm	
Reference Level Range - Linear	7.07 Vrms to 22 nVrms	
Amplitude Accuracy Frequency Response Peak Variation, < 18 GHz	Input level > -30 dBm ± 0.5 dB -80 dBm <Input level< –30 dBm ± 1.0 dB -100 dBm <Input Level< -80 dBm ± 2.0 dB	
Amplitude Accuracy Frequency Response Peak Variation, 18 to 26.5 GHz	Input level > -30 dBm ± 0.5 dB -80 dBm <Input level< –30 dBm ± 1.0 dB -100 dBm <Input Level< -80 dBm ± 2.5 dB	
Amplitude Accuracy IF Gain Uncertainty	N/A	Accuracy is reflected in amplitude accuracy (frequency response peak) uncertainty.
Amplitude Accuracy Scale Fidelity (log range is specified as in the table or 10 dB above average noise whichever is greater)	N/A	Accuracy is reflected in amplitude accuracy (frequency response peak) uncertainty.
Amplitude Accuracy Linear	N/A	Accuracy is reflected in amplitude accuracy (frequency response peak) uncertainty.
Amplitude Accuracy Incremental Fidelity	N/A	N/A. Accuracy is reflected in amplitude accuracy (frequency response peak) uncertainty.
Warm-up Time	30 minutes minimum	

Notes:

1. Sweep points >201

System Phase Noise Specification

There are several different receiver configurations that affect the system phase noise. The tables below show the system phase noise for the standard configuration and low phase noise option.

System Receiver Phase Noise - Standard Configuration

RF Frequency	Phase Noise (dBc/Hz) at specified offset						Comments
	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	10 MHz	
<8 GHz	-78	-96	-107	-118	-130	-136	
8 to <26.5 GHz	-78	-96	-107	-122	-132	-136	

System Receiver Phase Noise - Low Phase Noise Option[1]

RF Frequency	Phase Noise (dBc/Hz) at specified offset						Comments
	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	10 MHz	
<1.25 GHz	-95	-115	-130	-130	-145	-147	
1.25 to <2.5 GHz	-90	-110	-124	-124	-139	-141	
2.5 to <7 GHz	-89	-109	-124	-124	-133	-134	
7 to 26.5 GHz	-83	-104	-118	-118	-133	-135	

Notes:

1. Requires low phase noise down converter option

Power Meter Specifications

The Power Meter Measurement function is implemented using a standalone power meter and appropirate sensors. The performance specifications are listed in following table.

Parameter	Specification	Comments
Measurement Modes	Peak, Average	
Average Power Measurement Types	AC, AM, FM, PM, and pulsed (AC and DC)	
Frequency Range	100 KHz to 26.5 GHz	Sensor dependent

Accuracy (with sensor)
  <18 GHz
  <-20 dBm
  >-20 dBm
  18 GHz to 26.5 GHz
  <-20 dBm
  >-20 dBm
	
	±3.7% rss (±0.16 dB)
	±3.4% rss (±0.15 dB)
	
	±3.13% rss (±0.14 dB)
	±4.1% rss (±0.17 dB)
		Includes ±0.05 dB accuracy of the HP 11708A 30 dB attenuator

Input VSWR
  J2
  J5
	
	1.1 at ≤50 MHz
	1.2 1.1 at ≤50 MHz	

Power Meter Frequency Range	100 kHz to 50 GHz (with appropriate sensor)	
Power Meter Power Range	-70 to +44 dBm (100 pW to 25 W) (sensor dependent)	
Power Meter Dynamic Range	50 dB in 10 dB steps	
Power Meter Units	Watts or dBm (absolute)	
Power Meter Resolution	Selectable resolution of 1% (0.1 dB), 0.1% (0.01 dB), and 0.01% (0.001 dB) of full scale in linear or logarithmic mode	
Sensor Specifications	See chart below	

Power Sensor Specifications

The power sensor specifications are met using a series of COTS power sensors. The specifications listed in the table below. Note that several of the specified sensors are obsolete and no longer available.

Parameter	Specification			
Power Range	1 uW to 100 mW (-30 to + 20 dBm)		0 pw to 10 uW (-70 to –20 dBm)	
Part Number	N8482A	N8485A	HP 8481D	HP 8485D
Frequency Range	100 kHz to 4.2 GHz	50 MHz to 26.5 GHz	10 MHz to 18 GHz	50 MHz to 26.5 GHz
Maximum Power	300 mW Average	300 mW Average	100 mW Average	100 mW Average
	15 W Peak	15 W Peak	100 mW Peak	100 mW Peak
	300 mW Average	300 mW Average		
Zero Setting	±25 nW	±25 nW	±25 pW	±25 pW
Power Linearity (all power levels in dBm)	-70 to <-30, NA -30 to –20, ±1%	-70 to <-30, NA -30 to –20, ±2%	-30 to <+10, NA +10 to +20, + 3, -3%	-70 to <+10, NA +10 to +20, + 3, -3%
Connector Type	N (m)	APC-3.5 (m)	N (m)	APC-3.5 (m)
Total Tolerance	±5.1%	±5.1%	±3.9%	±4.66%

*Includes HP 11708A 30 dB attenuator for calibration against a 0-dBm, 50-MHz power reference. The HP 11708A 30-dB attenuator is factory set to 30 dB ±0.05 dB at 50 MHz traceable to the National Institute of Standards and Technology (NIST). The standing wave ratio is less than 1.05 to 1 at 50 MHz.

RF Probe Specifications

The RF Probe is implemented with a RF probed connected to the response subsystem. The RF Probe has the following performance specifications.

Parameter	Specification
Input Capacitance (at 500 MHz)	<0.7 pF (nominal)
Resistance	1 MΩ (nominal)
Voltage for 1 dB Compression	0.3 V peak
Maximum Safe RF Voltage	1.5 V peak (with 10:1 divider: 15 V peak)
Maximum Safe DC Voltage	±50 V (with 10:1 divider: ±200 V)
Bandwidth	300 kHz to 3 GHz (usable to 100 kHz)
Average Gain (Average gain is defined as the average of the maximum and minimum gains over the frequency range of 300 kHz to 1 GHz (maximum gain + minimum gain)/2.)	0 dB +1.25/-2.5 dB
Frequency Response (relative to average gain) 300 kHz to 1 GHz 1 GHz to 3 GHz	 ±2.5 dB +2.5/-5.8 dB
Average Noise Level (10 Hz to 10 MHz)	<1 mV
Distortion (at 0.3 V)	<-30 dBc nominal
Pulse Transition	200 ps

Microwave Transition Analyzer Measurement Specifications

The Microwave Transition Analyzer Measurement function is implemented using the response channel including the LCU, Down converter and Digitizer. The performance specifications are listed in following table.

Parameter	Specification	Comments
Measurement Modes	See separate table at the end of this section	
Single Channel Amplitude versus Frequency Response DC to 50 MHz 50 MHz to 1 GHz 1 to 18 GHz 18 GHz to 26.5 GHz	 ±1.0 dB ±1.0 dB ±1.0 dB ±1.0 dB	
dB below Reference Level 0 to 10 dB 10 to 20 dB 20 to 30 dB 30 to 40 dB 40 to 50 dB 50 to 60 dB	 ±0.05 dB ±0.2 dB ±0.5 dB ±0.5 dB ±1.0 dB ±2.0 dB	
Ratio Amplitude Range	0 to 50 dB	
Ratio Phase Accuracy DC to 100 KHz >100 KHz to 300 KHz >300 KHz to 18 GHz >18 GHz to 26.5 GHz	 ±5 degrees ±5 degrees ±10 degrees ±10 degrees	
Ratio Amplitude Accuracy DC to 100 KHz >100 KHz to 300 KHz >300 KHz to 18 GHz >18 GHz to 26.5 GHz	 ±0.3 dB ±0.3 dB ±0.3 dB ±0.5 dB	
Maximum Operating Input Voltage (>100 KHz)	30 dBm	
Maximum Operating Input Voltage (including DC offset)	0 dBm	
Nominal Input Impedance	50 Ω	
Noise Floor	-50 dBm	
Input VSWR Ch. A	<2.3 GHz 1.4 2.3 to 12.5 GHz 1.4 >12.5 to 20 GHz 1.8 >20 to 26.5 GHz 1.8	

Parameters	Specification	Comments
Input VSWR Ch. B	<2.3 GHz 1.4 2.3 to 12.5 GHz 1.4 >12.5 to 20 GHz 1.8 >20 to 26.5 GHz 1.8	
Time Interval Measurement Accuracy	For Repetitive Sampling: DeltaT(EΔt) = max((Eref + t_{total}/N), 1 ps) Where: Eref = frequency reference stability t_{total} = total capture time of waveform N = number of trace points For Direct Sampling: DeltaT($E_{\Delta t}$) = (1+Δn*Eref)/ESR Where: Δn = delta time between two frequencies of interest Eref = frequency reference stability ESR = effective sample rate of the digitizer	
Time Interval Resolution	(Time Span)/(Trace Length)	
Time Scale Minimum Baseline Configuration With Time Sampler Option	10 ns/div 5 ps/div	
Time Delay Minimum Maximum	-25 ps 1.3 seconds standard	Larger maximum time delays available as an option

Parameters	Specification	Comments
Trace Length Minimum Maximum	 32 points 65,536 points	
Frequency Domain Measurement Characteristics	Frequency domain information is derived from a Fast Fourier Transform(FFT) of the time domain information.	
Pulse Modulator Specifications Level Impedance Reference Minimum pulse width Pulse width resolution Pulse width range Pulse repetition resolution Pulse repetition period Pulse repetition rate	 TTL 50 Ω Phase locked to 10-MHz reference 20 ns 20 ns 20 ns to 1 s 20 ns 100 ns to 1 s 1 Hz to 10 MHz	
Trigger Source	Internal, channel 1 or channel 2	
External Trigger Input Minimum pulse width Functions Level	 100 ns Gate or trigger TTL	
Warm Up Time	30 minutes minimum	

Measurement Modes	Doppler	Pulsed Doppler	Ramp	Pulsed DC	Pulsed Train DC	Sup Carrier	Step	Square	Triangle	AC	FSK	MSK	AM	FM	PM	PAM	BPSK	Wave	AC Signal
Duty Cycle		x	x	x	x		x	x								x		x	
Fall Time		x	x	x	x		x	x								x		x	
Overshoot		x	x	x	x		x	x								x		x	
Preshoot		x	x	x	x		x	x								x		x	
Pulse Width		x	x	x	x		x	x								x		x	
Rise Time		x	x	x	x		x	x								x		x	
Frequency			x					x	x	x	x	x	x	x	x	x	x	x	
Period			x					x	x	x	x	x	x	x	x	x	x	x	
Voltage	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Voltage Average	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Voltage PP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Positive Voltage	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Negative Voltage	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Voltage Inst Neg	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Voltage inst Pos	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Power	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Peak Power	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
DC Offset	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Harmonic frequency										x									
Harmonic Amplitude										x									
Harmonic Phase Angle										S[1]									
Time Samples																		x	
Frequency Samples																		x	
Voltage Ratio (2 Channel)										x									
Phase (2 Channel)										x									
Forward -Xmit																			x
Reverse -Xmit																			x
Forward -Refl																			x
Reverse -Refl																			x
Vector -Power																			x
																			x

Compliance

1. With the exception of the Harmonic Phase Angle measurement, all other measurements are compliant with the Base MTA configuration. Configurations that will support the Harmonic phase angle are available as a special option.

Phase Noise Measurement Specifications

The Phase Noise Measurement function is implemented using the response channel including the LCU, RF Down converter and Digitizer. This hardware must be present and configured in the appropriate configuration to support phase noise measurements. Specifically, the frequency range of the desired measurements must be supported by the RF down converter.

The performance specifications are listed in following table.

Parameter	Specification	Comments
Carrier Frequency Range	5 MHz to 26.5 GHz	Low frequency option available to extend range down to 100 KHz
Measurement Modes	Log Plot Spot Frequency	
Minimum Offset Frequency	10 Hz	
Maximum Offset Frequency	100 MHz	
Maximum Input Signal	+30 dBm	
Maximum Minimum Input Signal	-50 dBm	
Minimum Measurement Accuracy	±0.3 dB	Measurement accuracy of carrier amplitude measurement
System Phase Noise	See table below	

System Phase Noise Specification

There are several different configurations of the system for phase noise measurements. The tables below show the system phase noise for the standard configuration, low phase noise option and cross correlation option.

Standard Configuration

RF Frequency	Phase Noise (dBc/Hz) at specified offset						Comments
	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	10 MHz	
<8 GHz	-78	-96	-107	-118	-130	-136	
8 to <26.5 GHz	-78	-96	-107	-122	-132	-136	

Phase Noise Measurement – Low Phase Noise Option[1]

RF Frequency	Phase noise (dBc/Hz) at specified offset						Comments
	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	10 MHz	
<1.25 GHz	-95	-115	-130	-130	-145	-147	
1.25 to <2.5 GHz	-90	-110	-124	-124	-139	-147	
2.5 to < 7 GHz	-89	-109	-124	-124	-133	-134	
7 to 26.5 GHz	-83	-104	-118	-118	-133	-135	

Notes:

1. Requires low phase noise down converter option

Phase Noise Measurement - Cross Correlation Option[1]

RF Frequency	Phase noise (dBc/Hz) at specified offset						Comments
	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	10 MHz	
<1.25 GHz	-105	-125	-140	-140	-155	-157	
1.25 to <2.5 GHz	-100	-120	-134	-134	-139	-151	
2.5 to < 7 GHz	-99	-119	-134	-134	-143	-144	
7 to 26.5 GHz	-93	-114	-128	-128	-143	-145	

Notes:

1. Requires second response channel

Vector Network Analysis Measurement Specifications

The Vector Network Analyzer Measurement function is implemented using a stimulus source, the response channel including the LCU, RF Down converter and Digitizer and a s-parameter test set. This hardware must be present and configured in the appropriate configuration to support s-parameters. Specifically, the frequency range of the desired measuremnets must be supported by the stimulus source, RF Down converter and s-parameter test set.

The performance specifications are listed in following table.

Parameter	Specification	Comments
Frequency Range	10 MHz to 40 GHz	Assumes that stimulus and response covers the appropriate frequency range
Ports	2	
Frequency Resolution	1 Hz	Source used for measurements must have 1 Hz resolution
CW Accuracy	Same as frequency reference	
Typical Sweep Time	50 ms/Sweep	
Measurement “Calibration” Capability	Automatic eectronic calibration, 10 MHz – 40 GHz to compensate for cable and other systematic errors at measurement runtime	Requires eCAL option
Test Port Dynamic Range 100 MHz 10 GHz -20 GHz 40 GHz	 120 dB, min 130 dB, min 111 dB, min	
Direct Receiver Access Dynamic Range 100 MHz 10 GHz -20 GHz 40 GHz	 126 dB, min 136 dB, min 125 dB, min	
Max Output Power 100 MHz 10 GHz 20 GHz 40 GHz	 +10 dBm, min +10 dBm, min +10 dBm, min -3 dBm, min	
Noise Floor (IF BW-10 Hz) 100 MHz 10 GHz – 20 GHz 40 GHz	 -110 dBm -120 dBm -114 dBm	

Parameter	Specification	Comments
Directivity 100 MHz 10 GHz – 20 GHz 40 GHz	 42 dB 42 dB 38 dB	
Source Match 100 MHz 10 GHz – 20 GHz 40 GHz	 41 dB 38 dB 33 dB	
Load Match 100 MHz – 20 GHz 40 GHz	 41 dB 37 dB	
Reflection Tracking 100 MHz 10 GHz – 20 GHz 40 GHz	 ±0.001 dB ±0.010 dB ±0.020 dB	
Transmission Tracking 100 MHz – 10 GHz 20 GHz 40 GHz	 ±0.110 dB ±0.053 dB ±0.110 dB	
Frequency Converter Application (FCA)	(Allows absolute group delay measurement of converters); embedded LO measurements	
Pulsed RF Measurement capability	The SMART^E supports pulsed RF s-parameter measurements. The software enables the IF gating, pulse generators and associate processing software to support this mode of operation.	

Noise Figure Measurement Specifications

The Noise Figure Measurement function is implemented using the response channel including the LCU, Down converter and Digitizer. In addition, an external noise diode is required. The noise figure measurement option adds the software personality, control connection to the noise diode. As an additional option a noise diode can be added to the system.

The performance specifications are listed in following table.

Parameter	Specification	Comments
Noise Source ENR, Measurement Range Frequency Range 200 KHz to 10 MHz 4 to 7 dB, 0 to 20 dB 12 to 17 dB, 0 to 30 dB 20 to 30 dB, 0 to 35 dB	Measurement Uncertainty ±0.05 dB ±0.05 dB ±0.1 dB	Instrument uncertainty[1]
Noise Source ENR, Measurement Range Frequency Range 10 MHz to 3 GHz 4 to 7 dB, 0 to 20 dB 12 to 17 dB, 0 to 30 dB 20 to 22 dB, 0 to 35 dB	Measurement Uncertainty ±0.05 dB ±0.05 dB ±0.1 dB	Instrument uncertainty[1]
Noise Source ENR, Measurement Range Frequency Range 3 GHz to 26.5 GHz Approximately 15 dB	Measurement Uncertainty ±0.3	Instrument uncertainty[1]

Notes:

1. This is the instrument uncertainty of the power measurements associated with a noise figure measurement. Absolute measurement uncertainty is dependant on DUT gain, VSWR and noise figure.

Frequency Measurement Specification

Parameter	Specification	Comments
Frequency Range	DC to 40 GHz	With appropriate options
Frequency Resolution	1 Hz	
Time Base Accuracy	See frequency reference specifications	
Sensitivity	-60 dBm	

Reference Distribution Specifications

Parameter	Specification	Comments
External Reference Input Frequency Amplitude	 10 MHz 0 ±3 dBm	
External Reference Output Frequency Amplitude	 10 MHz 0 ± 3 dBm	
Internal Reference Frequency Long Term Stability Short Term Stability	 10 MHz <1 x 10^{-12} / month 3 x 10^{-11} / s	Low phase noise rubidium standard

Environmental Specifications

Parameter	Units	Comments
Input Voltage[1] (Single Phase)	V	230 VAC, 50 Hz 110 VAC, 60 Hz
Power Consumption (excluding DUT power supplies)	VA	<3000
Temperature Range of Operation	°C	0 to 52
Humidity Range of Operation		5-95% ±5% RH (non-condensing)
Temperature Range for Storage	°C	-40 to 71 (with the exception of display)
Humidity Range for Storage		5-93% RH (non-condensing)
Altitude – Operating	Feet	15,000
Altitude – Non-operating	Feet	15,000
Shock, Functional		15 g , 11 ms half-sinusoidal wave
Bench Handling		MIL-PRF-28800F, Sect. 3.8.5.3, Class 3
Vibration, Sinusoidal		5-55 Hz, 0.33 mm double amplitude, 15 minutes per each of three orthogonal axes, resonance search and dwell times
Safety Standards		EN 61010-1, IEC 61010-1
EMC Standards		EN 61326-1, IEC61010-1

Notes:

1. LXI modules are designed to support 270 VDC operation.

SMARTE^E 5300 List of Options

The following table lists the various options available for the SMART ^ E 5300.

Option #	Name	Detailed Description
53xx	Stimulus and Response Frequency Ranges. Stimulus: 08 (8 GHz) 12 (12 GHz) 20 (20 GHz) 26 (26.5 GHz) 40 (40 GHz) Response: 08 (8 GHz) 26 (26.5 GHz) 40 (40 GHz)	
001	Extension of Synthetic Stimulus from 26.5 GHz to 40 GHz	
002	Extension of Synthetic Response from 26.5 GHz to 40 GHz	
003	40 GHz Doubler for Stimulus	
301	Stimulus Narrowband Modulation	
302	Stimulus Wideband Modulation	
303	Wideband Digitizer	
310 - 313	Optional Secondary Stimulus Sources	Contact factory for specific options
314	Agilent MXG source for primary source Low Phase Noise Option	Contact factory for frequency options
315	Fast Switching Synthesizer for Primary Source	Contact factory for frequency options
322	Second Receive Channel	
323	PN9000 Phase Noise Measurement	
340	Synthetic Phase Noise Analysis	
341	Synthetic Phase Noise Analysis	
342	Synthetic Phase Noise Analysis Cross Correlation Option	
343	MTA Measurement Option - Base	
344	MTA Measurement Option – Fine Time Resolution	
345	Noise Figure Analysis	
346	Vector Network Analysis	
347	eCAL	
348	Pulsed RF Vector Network Analysis	

Regulatory Compliance

The SMART^E 5300 system is CE marked and complies with all relevant European Directives as listed below.

Application of Council Directive	72/23/EEC (Low Voltage Directive)
Standards to which Conformity is Declared	BSEN 61010-1:2001 (LVD)
Application of Council Directive	89/336/EEC and Amending Directive 92/31/EEC
Standards to which Conformity is Declared	BSEN 61326:1998
Manufacturer Name	Aeroflex
Manufacturer Address	383 North Liberty Drive Powel, OH 43065 USA
Type of Equipment	Professional Laboratory RF Test Equipment
Model Number	SMART^E 5000
Serial Number	ALL
First Year of Manufacture	2006

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AEROFLEX
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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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