Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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SYNTHESIZED SWEEP SIGNAL GENERATOR

69A, 68B series

10 MHz to 65 GHz

A microwave synthesizer for any application

Anritsu's El Toro microwave synthesizers present 120 models, providing you the right synthesizer for your LO duty, component analysis, signal simulation, or A.T.E. applications. The 69A family, with the lowest Single Sideband (SSB) phase noise available, provides the ultimate performance at moderate cost. And includes models with unprecedented 0.01 to 65 GHz frequency coverage.

Features

- 120 models for perfect fit to any application
- Ultra-low SSB phase noise; –100 dBc at 10 kHz offset from 10 GHz
- 0.01 to 65 GHz frequency coverage in a single coaxial output
- Waveguide extensions to 110 GHz
- Economical upgrades
- +17 dBm maximum power, –125 dBm minimum power
- Internal AM, FM, øM, pulse modulation
- User down-loaded complex modulation

Applications

- **CW stimulus**

The 69000A/68000B Synthesized CW Generators feature 10 MHz to 65 GHz frequency coverage. CW or step sweep, low SSB phase noise and spurious signals, output levels to +17 dBm, and optional 0.1 Hz resolution combine to make these sources ideal for local oscillator replacement applications. To meet requirements that expand over time, economical upgrades are available to any higher performing model. For the most demanding CW requirements, the 69000A and 68000B provide the ultimate in performance.

- **Swept measurements**

The 69100A/68100B Synthesized Sweep Generators feature 10 MHz to 65 GHz analog, step, and manual sweep capability. Output levels to +17 dBm, and optional 0.1 Hz resolution are available at prices comparable to CW only sources. To meet requirements that expand over time, economical upgrades are available to any higher performing model. Features, performance, and value combine to make the 69100A and 68100B the optimum sources for your network analysis and swept A.T.E. source applications.

- **High performance modulation for signal simulation requirements**

The 69200A/68200B Synthesized Signal Generators provide AM and FM via external modulating signals or internal arbitrary waveform generators. The internal generators offer 7 modulating waveforms, including Gaussian noise, as well as user-defined arbitrary waveforms. Pulse modulation parameters can be set externally or by the internal pulse generator. Doublet, triplet or quadruplet pulses make RADAR blind spot testing easy. Simultaneous synchronized modulations let you set complex signal scenarios across the entire 10 MHz to 65 GHz frequency range.

- **Complete synthesized modulation and sweep capabilities for any signal requirement**

The 69300A/68300B Synthesized Sweep/Signal Generators provide all the capabilities of our CW generators, sweep generators and signal generators in a single package. The 69300A is the highest performance universal synthesized signal generator available today.

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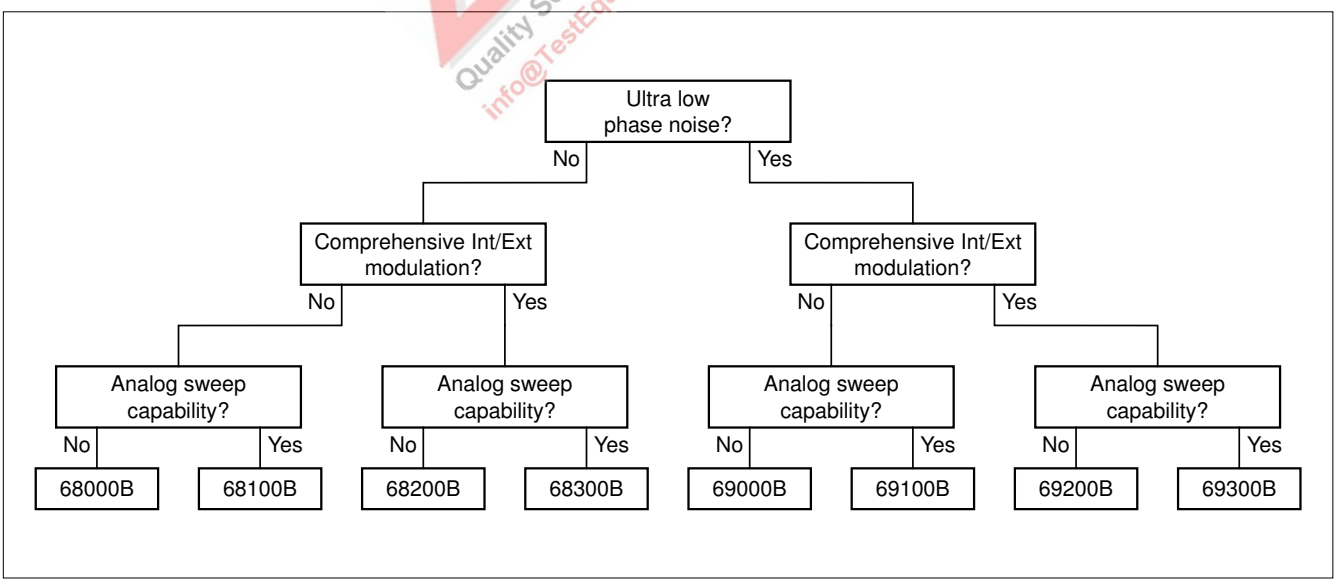
El Toro synthesizers product selection table

Model	68000B	69000A	68100B	69100A	68200B	69200A	68300B	69300A
Ultra low ø noise		√		√		√		√
Step sweep	√	√	√	√	√	√	√	√
Analog sweep			√	√			√	√
Power sweep	√	√	√	√	√	√	√	√
Alternate sweep	√	√	√	√	√	√	√	√
Master/slave	√	√	√	√	√	√	√	√
AM			Ext	Ext	Int/Ext	Int/Ext	Int/Ext	Int/Ext
FM			Ext	Ext	Int/Ext	Int/Ext	Int/Ext	Int/Ext
øM					Opt. 6	Opt. 6	Opt. 6	Opt. 6
Pulse modulation			Ext	Ext	Int/Ext	Int/Ext	Int/Ext	Int/Ext
AM scan (1 to 20 GHz)					Opt. 20	Opt. 20	Opt. 20	Opt. 20
Internal power meter					Opt. 8	Opt. 8	Opt. 8	Opt. 8
360B SS Mode			√	√	√	√	√	√

El Toro family model summary

	68000B CW Generator	69000A*1 CW Generator	68100B Sweep Generator	69100A*1 Sweep Generator	68200B Signal Generator	69200A*1 Signal Generator	68300B Sweep/Signal Generator	69300A*1 Sweep/Signal Generator
2 to 20 GHz	68037B	69037A	68137B	69137A	68237B	69237A	68337B	69337A
0.5 to 20 GHz	68045B	69045A	68145B	69145A	68245B	69245A	68345B	69345A
0.01 to 20 GHz	68047B	69047A	68147B	69147A	68247B	69247A	68347B	69347A
2 to 26.5 GHz	68053B	69053A	68153B	69153A	68253B	69253A	68353B	69353A
0.5 to 26.5 GHz	68055B	69055A	68155B	69155A	68255B	69255A	68353B	69355A
0.01 to 26.5 GHz	68059B	69059A	68159B	69159A	68259B	69259A	68359B	69359A
2 to 40 GHz	68063B	69063A	68163B	69163A	68259B	69263A	68363B	69363A
0.5 to 40 GHz	68065B	69065A	68165B	69165A	68265B	69265A	68363B	69365A
0.01 to 40 GHz	68069B	69069A	68169B	69169A	68265B	69269A	68369B	69369A
0.5 to 50 GHz	68075B	69075A	68175B	69175A	68275B	69275A	68369B	69375A
0.01 to 50 GHz	68077B	69077A	68177B	69177A	68277B	69277A	68377B	69377A
0.5 to 60 GHz	68085B	69085A	68185B	69185A	68285B	69285A	68377B	69385A
0.01 to 60 GHz	68087B	69087A	68187B	69187A	68285B	69287A	68377B	69387A
0.5 to 65 GHz	68095B	69095A	68195B	69195A	68295B	69295A	68395B	69395A
0.01 to 65 GHz	68097B	69097A	68197B	69197A	68297B	69297A	68395B	69397A

*1: Complete performance specifications for 69A synthesizers are available in the 69A Series Synthesizers Technical Data Sheet, part number 11410-00175



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Specifications

Frequency	CW mode	Output	Twenty independent, presettable CW frequencies (F0 to F9 and M0 to M9)
		Accuracy	Same as internal or external 10 MHz time base
		Internal time base stability	With aging: <2 x 10^{-8}/day (<5 x 10^{-10}/day with Option 16) With temperature: <2 x 10^{-8}/˚C over 0˚C(<2 x 10^{-10}/˚C with Option 16)
		Resolution	1 kHz (0.1 Hz with Option 11)
		Switching time	<40 ms to be within 1 kHz of final frequency (typical maximum)
	Analog sweep mode (69100A, 69300A)	Sweep width	Independently selected from 1 MHz to full range continuous sweep. For ∗100 MHz sweep width, the start, stop and bandswitching frequencies are phase-lock-corrected during sweep. For ≤100 MHz widths, the center frequency is phase-lock-corrected.
		Accuracy	The lesser of ±30 MHz or (±2 MHz widths) for sweep speeds of ≤50 MHz/ms
		Sweep time range	30 ms to 99 seconds
	Phase-locked step sweep mode	Sweep width	Independently selected, 1 kHz (0.1 Hz with Option 11) to full range. Every frequency step in sweep range is phase-locked.
		Accuracy	Same as internal or external 10 MHz time base
		Resolution (Min. step size)	1 kHz (0.1 Hz with Option 11)
		Steps	Number of steps: Variable from 1 to 10000 Step size: 1 kHz (0.1 Hz with Option 11) to the full frequency range of the instrument. (If the step size does not divide into the selected frequency range, the last step is truncated.)
		Dwell time per step	Variable from 1 ms to 99 seconds
		Switching time	<15 ms +1 ms/GHz step size or <40 ms, whichever is less (typical max.)
	Alternate sweep mode		Sweeps alternately between any two sweep ranges. Each sweep range may be associated with a different power level.
	Manual sweep mode		Provides stepped, phase-locked adjustment of frequency between sweep limits. User-selectable number of steps or step size.
	Programmable frequency agility		Under GPIB control, up to 1000 non-sequential frequencies can be stored and then addressed as a phase-locked step sweep. Data is stored in volatile memory.
	Markers	Setting	Up to 20 independent, settable markers (F0 to F9 and M0 to M9)
		Video markers	+5 V or –5 V marker output, selectable. AUX I/O connector, rear panel
		Intensity markers	Produces an intensified dot on trace, obtained by momentary dwell in RF sweep

Spectral purity*1										
Spurious signals	Frequency range	500 MHz to ≤2.2 GHz (500 MHz units)	10 to 50 MHz (10 MHz units)	>50 MHz to ≤2 GHz (10 MHz units)	>2 to ≤20 GHz (2.2 to 500 MHz units)	>20 to ≤40 GHz	>40 to ≤50 GHz	>40 to ≤60 GHz	>40 to ≤45 GHz (65 GHz units)	>45 to ≤65 GHz (65 GHz units)
	Harmonic and harmonic related	<–50 dBc	<–30 dBc	<–40 dBc	<–60 dBc	<–40 dBc	–	–	–	–
	Harmonic and harmonic related*2	<–50 dBc	<–30 dBc	<–40 dBc	<–50 dBc	<–40 dBc	<–40 dBc	<–30 dBc	<–25 dBc	<–30 dBc
	Nonharmonic		<–40 dBc				<–60 dBc			

Single-sideband phase noise, 69XXXA (dBc/Hz)

69XXXA	Offset from carrier			
	100 Hz	1 kHz	10 kHz	100 kHz
0.6 GHz (69XX5A)	–92	–112	–112	–117
0.6 GHz	–80	–98	–100	–102
2 GHz (69XX5B)	–86	–106	–106	–111
2 GHz	–80	–100	–100	–105
6 GHz	–78	–100	–100	–105
10 GHz	–74	–98	–100	–105
20 GHz	–66	–95	–100	–102
26.5 GHz	–63	–91	–94	–96
40 GHz	–60	–89	–94	–96
50 GHz	–57	–83	–88	–90
65 GHz	–54	–83	–88	–90

Single-sideband phase noise, 68XXXB (dBc/Hz)

68XXXB	Offset from carrier			
	100 Hz	1 kHz	10 kHz	100 kHz
0.6 GHz (68XX5B)	–87	–100	–98	–115
0.6 GHz	–77	–88	–86	–100
2 GHz (68XX5B)	–81	–94	–92	–109
2 GHz	–80	–88	–86	–102
6 GHz	–78	–88	–86	–102
10 GHz	–73	–86	–83	–102
20 GHz	–66	–78	–78	–100
26.5 GHz	–63	–78	–76	–96
40 GHz	–60	–75	–72	–94
50 GHz	–54	–69	–66	–88
65 GHz	–54	–69	–64	–88

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	Models		Frequency range	Output power	Output power with step attenuator
Output power	6XX37		≥2 to ≤20 GHz	+13 dBm	+11 dBm
	6XX45		≥0.5 to ≤20 GHz	+13 dBm	+11 dBm
	6XX47		≥0.01 to ≤20 GHz	+13 dBm	+11 dBm
	6XX53		≥2 to ≤20 GHz >20 to ≤26.5 GHz	+9 dBm +6 dBm	+7 dBm +3.5 dBm
	6XX55		≥0.5 to ≤2.2 GHz >2.2 to ≤20 GHz >20 to ≤26.5 GHz	+13 dBm +9 dBm +6 dBm	+11 dBm +7 dBm +3.5 dBm
	6XX59		≥0.01 to <2 GHz ≥2 to ≤20 GHz >20 to ≤26.5 GHz	+13 dBm +9 dBm +6 dBm	+11 dBm +7 dBm +3.5 dBm
	6XX63		≥2 to ≤20 GHz >20 to ≤40 GHz	+9 dBm +6 dBm	+7 dBm +3 dBm
	6XX65		≥0.5 to ≤2.2 GHz >2.2 to ≤20 GHz >20 to ≤40 GHz	+13 dBm +9 dBm +6 dBm	+11 dBm +7 dBm +3 dBm
	6XX69		≥0.01 to <2 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz	+13 dBm +9 dBm +6 dBm	+11 dBm +7 dBm +3 dBm
	6XX75		≥0.5 to ≤2.2 GHz >2.2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz	+11 dBm +10 dBm +2.5 dBm +2.5 dBm	+10 dBm +8.5 dBm 0 dBm –1 dBm
	6XX77		≥0.01 to <2 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz	+12 dBm +10 dBm +2.5 dBm +2.5 dBm	+10 dBm +8.5 dBm 0 dBm –1 dBm
	6XX85		≥0.5 to ≤2.2 GHz >2.2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz >50 to ≤60 GHz	+11 dBm +10 dBm +2.5 dBm +2 dBm +2 dBm	+10 dBm +8.5 dBm 0 dBm –1.5 dBm –2 dBm
	6XX87		≥0.01 to <2 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz >50 to ≤60 GHz	+12 dBm +10 dBm +2.5 dBm +2 dBm +2 dBm	+10 dBm +8.5 dBm 0 dBm –1.5 dBm –2 dBm
	6XX95		≥0.5 to ≤2.2 GHz >2.2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz >50 to ≤65 GHz	+11 dBm +10 dBm +2.5 dBm 0 dBm –2 dBm	–
	6XX97		≥0.01 to <2 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz >50 to ≤65 GHz	+12 dBm +10 dBm +2.5 dBm 0 dBm –2 dBm	–
	With Option 15 (high power) installed	6XX37	≥2 to ≤20 GHz	+17 dBm	+15 dBm
		6XX45	≥0.5 to ≤2.2 GHz >2.2 to ≤20 GHz	+13 dBm +17 dBm	+11 dBm +15 dBm
		6XX47	≥0.01 to <2 GHz ≥2 to ≤20 GHz	+13 dBm +17 dBm	+11 dBm +15 dBm
		6XX53	≥2 to <20 GHz ≥20 to ≤26.5 GHz	+13 dBm +10 dBm	+11 dBm +7.5 dBm
		6XX55	≥0.5 to ≤20 GHz >20 to ≤26.5 GHz	+13 dBm +10 dBm	+11 dBm +7.5 dBm
		6XX59	≥0.01 to <2 GHz ≥2 to ≤20 GHz >20 to ≤26.5 GHz	+13 dBm +13 dBm +10 dBm	+11 dBm +11 dBm +7.5 dBm
		6XX63	≥2 to ≤20 GHz >20 to ≤40 GHz	+13 dBm +6 dBm	+11 dBm +3 dBm
		6XX65	≥0.5 to ≤20 GHz >20 to ≤40 GHz	+13 dBm +6 dBm	+11 dBm +3 dBm
		6XX69	≥0.01 to ≤20 GHz >20 to ≤40 GHz	+13 dBm +6 dBm	+11 dBm +3 dBm

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RF output	Levelled output power range	Without an attenuator	Maximum levelled power to –15 dBm (–20 dBm typical). For units with Option 15 installed, minimum settable power is –5 dBm (–10 dBm typical).						
		With an attenuator	Maximum levelled power to –115 dBm (–120 dBm typical). For units with upper limit ≥50 GHz and units with Option 15 installed, minimum settable power is –105 dBm (–110 dBm typical).						
	Unleveled output power range (typical)	Without an attenuator	>40 dB below max power						
		With an attenuator	>130 dB below max power						
	Power level switching time (to within specified accuracy)	Without change in step attenuator	<1 ms typical						
		With change in step attenuator	<20 ms typical						
	Accuracy and flatness (step sweep and CW modes)		Attenuation below max power	0.01 to 0.05 GHz	0.05 to 20 GHz	20 to 40 GHz	40 to 50 GHz	50 to 60 GHz	60 to 65 GHz
		Accuracy	0 to 25 dB	±2.0 dB	±1.0 dB	±1.0 dB	±1.5 dB	±1.5 dB	±1.5 dB
			25 to 60 dB	±2.0 dB	±1.0 dB	±1.0 dB	±1.5 dB	±3.5 dB	–
			>60 dB	±2.0 dB	±1.0 dB	±1.0 dB	±2.5 dB	±3.5 dB	–
		Flatness	0 to 25 dB	±2.0 dB	±0.8 dB	±0.8 dB	±1.1 dB	±1.1 dB	±1.1 dB
			25 to 60 dB	±2.0 dB	±0.8 dB	±0.8 dB	±1.1 dB	±3.1 dB	–
			>60 dB	±2.0 dB	±0.8 dB	±0.8 dB	±2.1 dB	±3.1 dB	–
	Output power resolution		0.01 dB						
	Level offset		Offsets the displayed power level to establish a new reference level						
	CW power sweep	Range	Sweeps between any two power levels at a single CW frequency						
		Resolution	0.01 dB/step						
		Accuracy	Same as CW power accuracy						
		Step size	User-controlled, 0.01 dB to the full power range of the instrument						
		Step dwell time	Variable from 1 ms to 99 seconds. If the sweep crosses a step attenuator setting, there will be a sweep dwell of approximately 20 ms to allow setting of the step attenuator.						
	Sweep frequency/step power		A power level step occurs after each frequency sweep. Power level remains constant for length of time required to complete each sweep.						
69100A/68100B modulation	Amplitude modulation	External AM input	Log AM or linear AM input, front or rear-panel BNC, 50 Ω or 600 Ω input impedance All options selectable from modulation menu						
		AM sensitivity	Log AM: Continuously variable from 0 to 25 dB/V Linear AM: Continuously variable from 0 to 100%/V						
		AM depth	0 to 90% linear, 20 dB log (typical with RF level at 6 dB below maximum rated output)						
		AM bandwidth (3 dB)	DC to 50 kHz minimum (DC to 100 kHz typical)						
		Maximum input	±1 V						
	Frequency modulation	External FM input	Front or rear panel BNC, 50 Ω or 600 Ω input impedance. All options selectable from modulation menu						
		FM sensitivity	Variable from ±10 kHz/V to ±20 MHz/V (narrow FM modes) or from ±100 kHz/V to ±100 MHz/V (wide FM mode)*3						
		Deviation	Narrow mode: ±10 MHz, DC to 500 kHz rates Wide mode: ±100 MHz, DC to 100 Hz rates Locked mode: The lesser of ±10 MHz or rate x 300, 1 to 500 kHz rates						
	Square wave modulation*4	On/off ratio	>50 dB						
		Rise/fall time	<1 µs typical						
		Internal square wave generator	Four square wave signals (400 Hz, 1 kHz, 7.8125 kHz, and 27.8 kHz), selectable from modulation menu Accuracy: Same as internal or external 10 MHz time base Square wave symmetry: 50% ±5% at all power levels						
		External input	Front or rear-panel BNC, selectable from modulation menu Drive level: TTL compatible input Minimum pulse width: >5 µs Input logic: Positive-true or negative-true BNC, selectable from modulation menu						
69200A/69300A/68200B/68300B modulation	Amplitude modulation*5	External AM input	Log AM or linear AM input, front or rear-panel BNC, 50 Ω or 600 Ω input impedance All options selectable from modulation menu						
		AM sensitivity	Log AM: Continuously variable from 0 to 25 dB per volt Linear AM: Continuously variable from 0 to 100% per volt						
		AM depth (typical)	0 to 90% linear; 20 dB log						
		AM bandwidth	DC to 50 kHz minimum (DC to 100 kHz typical)						
		Flatness	±0.3 dB (DC to 10 kHz rates)						
		Accuracy	±5%						
		Distortion	<5% typical						
		Incidental phase modulation	<0.2 radians (30% depth, 10 kHz rate)						
		Maximum input	±1 V						

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69200A/69300A/68200B/68300B modulation	Internal AM generator	Waveforms	Sinusoid, squarewave, triangle, positive ramp, negative ramp, Gaussian noise, uniform noise, user defined (Option 10)
		Rate	0.1 Hz to 1 MHz sinusoidal, 0.1 Hz to 100 kHz squarewave, triangle, ramps
		Resolution	0.1 Hz
		Accuracy	Same as instrument timebase
		Output	BNC connector, rear panel
	Frequency modulation	External FM input	Front or rear panel BNC, 50 Ω or 600 Ω input impedance All options selectable from modulation menu
		FM sensitivity	Continuously variable from ±10 kHz per volt to ±20 MHz per volt (locked, locked low noise and unlocked narrow modes), or ±100 kHz per volt to ±100 MHz per volt (unlocked wide mode) For 500 MHz units, maximum sensitivity is divided by 2 from 1 to 2.2 GHz and is divided by 4 from 500 MHz to 1 GHz.
		Deviation	Unlocked wide: ±100 MHz, DC to 100 Hz rates Unlocked narrow: ±10 MHz, DC to 8 MHz rates Locked: The lesser of ±10 MHz or rate x 300, 1 kHz to 8 MHz rates Locked low noise: The lesser of ±10 MHz or rate x 3, 50 kHz to 8 MHz rates
		FM bandwidth (3 dB)	Unlocked wide: DC to 100 Hz Unlocked narrow: DC to 10 MHz Locked: 1 kHz to 10 MHz Locked low noise: 30 kHz to 10 MHz
		Flatness	±1 dB (10 kHz to 1 MHz rates)
		Accuracy	10% (5% typical, ±200 kHz deviation, 100 kHz rate)
		Incidental AM	<2% (±1 MHz deviation, 1 MHz rate)
		Harmonic distortion	<1% (±1 MHz deviation, 10 kHz rate)
		Maximum input	±1 V
	Internal FM generator	Waveforms	Sinusoid, squarewave, triangle, positive ramp, negative ramp, Gaussian noise, uniform noise, user defined (Option 10)
		Rate	0.1 Hz to 1 MHz sinusoidal, 0.1 Hz to 100 kHz squarewave, triangle, ramps
		Resolution	0.1 Hz
		Accuracy	Same as instrument timebase
		Output	BNC connector, rear panel
	Phase modulation (øM, Option 6)	øM deviation	Narrow mode (DC to 8 MHz rates): The lesser of ±3 radians or ±5 MHz/rate Wide mode (DC to 1 MHz rates): The lesser of ±400 radians or ±10 MHz/rate. For 6XXX5 units, maximum deviation is divided by 2 from >1.0 to ≤2.2 GHz and is divided by 4 from ≥0.5 to ≤1.0 GHz.
		øM bandwidth (3 dB, relative to 100 kHz rate)	Narrow mode: DC to 10 MHz Wide mode: DC to 1 MHz
		øM flatness (relative to 100 kHz rate)	Narrow mode (DC to 1 MHz rates): ±1 dB Wide mode (DC to 500 kHz rates): ±1 dB
		øM accuracy	10% (at 100 kHz sine wave)
		External øM input	Front or rear panel BNC (shares the FM input), 50 Ω or 600 Ω input impedance. All options selectable from modulation menu. Shares connectors with FM.
		External øM sensitivity	Continuously variable from ±0.0025 to ±5 radians per volt (narrow øM mode) or ±0.25 to ±500 radians per volt (wide øM mode), selectable from modulation menu. For 6XXX5 units, maximum sensitivity is divided by 2 from >1 to ≤2.2 GHz and is divided by 4 from ≥0.5 to <1 GHz.
		External øM maximum input	±1 V
	Internal øM generator (shares the internal FM generator)	Waveforms	Sine, square, triangle, positive ramp, negative ramp, Gaussian noise, uniform noise, user defined (option 10)
		Rate	0.1 Hz to 1 MHz for sine wave, 0.1 Hz to 100 kHz for other waveforms
		Resolution	0.1 Hz
		Accuracy	Same as instrument timebase
		Output	BNC connector, rear panel
	Pulse modulation*6	On/off ratio	>80 dB
		Rise/fall time (10 to 90%)	<10 ns (<5 ns typical). (for 6XXX5 units, rise/fall time below 1 GHz is 15 ns)
		Minimum levelled pulse width	<100 ns (≥2 GHz), <1 µs (<2 GHz)
		Minimum unleveled pulse width	<10 ns
		Pulse overshoot	<10% (for 60 and 65 GHz units, overshoot from 40 to 60 GHz is 20% typical)
		Level accuracy relative to CW	±0.5 dB (≥1 µs pulse width), ±1.0 dB (<1 µs pulse width) 100 Hz to 1 MHz PRF

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69200A/69300A modulation	Pulse modulation*6	Video feedthrough	<±10 mV, ≥2 GHz	
		Pulse width compression	<8 ns typical	
		Pulse delay (typical)	External mode: 50 ns Triggered mode: 100 ns Triggered with delay mode: 200 ns	
		PRF range	DC to 10 MHz unleveled, 100 Hz to 5 MHz levelled	
		External input	Front or rear-panel BNC, selectable from modulation menu Drive level: TTL compatible input Input logic: Positive-true or negative-true, selectable from modulation menu	
	Internal pulse generator	Frequency (selectable clock rate)	40 MHz	10 MHz
		Pulse width	25 ns to 419 ms	100 ns to 1.6 s
		Pulse period	250 ns to 419 ms	600 ns to 1.6 s
		Variable delay: Singlet	0 to 419 ms	0 to 1.6 s
		Variable delay: Doublet	100 ns to 419 ms	300 ns to 1.6 s
		Variable delay: Triplet	100 ns to 419 ms	300 ns to 1.6 s
		Variable delay: Quadruplet	100 ns to 419 ms	300 ns to 1.6 s
		Resolution	25 ns	100 ns
		Modes	Free-run, triggered, gated, delayed, singlet, doublet, triplet, quadruplet	
		Accuracy	10 ns (5 ns typical)	
		Outputs	Video pulse and sync out, rear-panel BNC connectors	
	SCAN modulator (Option 20, 6X237, 6X245, 6X247, 6X337, 6X345 and 6X347 only)	Frequency range	1 to 20 GHz	
		Attenuation range*7	0 to 60 dB	
		Flatness	±2 dB (0 to 40 dB), ±3.5 dB (40 to 60 dB)	
		Step response	<1 µs	
		Sensitivity	–10 dB/V	
		Insertion loss (when engaged)	<6 dB (1 to 18 GHz), <8 dB (18 to 20 GHz)	
		Input	Rear-panel BNC (f) connector	
Remote operation*8	GPIB address		Selectable from a system menu	
	IEEE-488 interface function subset		SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0, C1, C2, C3, C28, E2	
	Emulations		The instrument responds to the published GPIB commands and responses of the models 6XX00-series signal sources. When emulating another signal source, the instrument is limited to the capabilities, mnemonics, and parameter resolutions of the emulated instrument.	
General	Stored setups		Stores front panel settings and nine additional front-panel setups in a non-volatile RAM. A system menu allows saving and recalling of instrument setups. Whenever the instrument is turned on, control settings come on at the same functions and values existing when the instrument was turned off.	
	Memory sequencing input		Accepts a TTL low-level signal to sequence through nine stored setups. AUX I/O connector, rear panel	
	Self-test		Instrument self-test is performed when SELF TEST soft-key is selected. If an error is detected, an error message is displayed in a window on the LCD identifying the probable cause.	
	Secure mode		Disables all frequency, power level, and modulation state displays. Stored setups saved in secure mode remain secured when recalled. Mode selectable from a system menu and GPIB	
	Reset		Returns instrument parameters to predefined default states or values. Any pending GPIB I/O is aborted. Selectable from the system menu	
	Master/slave operation		Allows two 68X00B output signals to be swept with a user-selected frequency offset. One 68X00B unit controls the other via AUX I/O and SERIAL I/O connections. Requires MASTER/SAVE interface cable set (part no. ND36329)	
	User level flatness correction		Allows user to calibrate out path loss due to external switching and cables via entered power table from a GPIB power meter or calculated data. When user level correction is activated, entered power levels are delivered at the point where calibration was performed. Supported power meters are Anritsu ML4803A and HP437B, 438A, and 70100A. Five user tables are available at up to 801 points/table	
	Warm up time (standard time base)		From standby: 30 minutes From cold start (0<): 120 hours to achieve <2 x 10^{-8}/day frequency stability	
	Warm up time (option 16 time base)		From standby: 30 minutes From cold start (0<): 72 hours to achieve <5 x 10^{-10}/day frequency stability	
	Power		90 to 132 Vac or 180 to 264 Vac, 49 to 440 Hz, ≤400 VA	
	Standby		With ac line power connected, unit is placed in standby when front panel power switch is released from the OPERATE position	
	Dimensions and mass		429 (W) x 133 (H) x 597 (D) mm [5.25 (H) x 16.875 (W) x 23.5 (D) in.], ≤23 kg (50 lb)	
	RF output connector		Type K female (≤40 GHz models), Type V female (>40 GHz models)	

*1: All specifications apply to the phase-locked CW and step sweep modes at the lesser of +10 dBm output or maximum specified levelled output power, unless otherwise noted.
*2: >40 GHz units and units with Option 15 at maximum specified levelled output power
*3: For 6x1x5 units, maximum sensitivity is divided by 2 from 1 to 2.2 GHz and is divided by 4 from 500 MHz to 1 GHz.
*4: The RF output can be pulse modulated via an external modulating signal or an internal square wave generator
*5: All amplitude modulation specifications apply at 50% depth, 1 kHz rate, with RF level set 6 dB below maximum specified levelled output power, unless other-wise noted
*6: All pulse modulation specifications apply at maximum specified levelled output power, unless otherwise noted
*7: Maximum attenuation = attenuation ±flatness
*8: All instrument functions, settings, and operating modes (except for power on/standby) are controllable using commands sent from an external computer via the GPIB (IEEE-488 interface bus).

TEST EQUIPMENT SOLUTIONS
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Ordering Information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name
	Main frame
69037A	Ultra Low Noise Synthesized CW Generator (2 to 20 GHz)*1
69045A	Ultra Low Noise Synthesized CW Generator (500 MHz to 20 GHz)*1
69047A	Ultra Low Noise Synthesized CW Generator (10 MHz to 20 GHz)*1
69053A	Ultra Low Noise Synthesized CW Generator (2 to 26.5 GHz)*1
69055A	Ultra Low Noise Synthesized CW Generator (500 MHz to 26.5 GHz)*1
69059A	Ultra Low Noise Synthesized CW Generator (10 MHz to 26.5 GHz)*1
69063A	Ultra Low Noise Synthesized CW Generator (2 to 40 GHz)*1
69065A	Ultra Low Noise Synthesized CW Generator (500 MHz to 40 GHz)*1
69069A	Ultra Low Noise Synthesized CW Generator (10 MHz to 40 GHz)*1
69075A	Ultra Low Noise Synthesized CW Generator (500 MHz to 50 GHz)*2
69077A	Ultra Low Noise Synthesized CW Generator (10 MHz to 50 GHz)*2
69085A	Ultra Low Noise Synthesized CW Generator (500 MHz to 60 GHz)*2
69087A	Ultra Low Noise Synthesized CW Generator (10 MHz to 60 GHz)*2
69095A	Ultra Low Noise Synthesized CW Generator (500 MHz to 65 GHz)*2
69097A	Ultra Low Noise Synthesized CW Generator (10 MHz to 65 GHz)*2
69137A	Ultra Low Noise Synthesized Sweep Generator (2 to 20 GHz)*1
69145A	Ultra Low Noise Synthesized Sweep Generator (500 MHz to 20 GHz)*1
69147A	Ultra Low Noise Synthesized Sweep Generator (10 MHz to 20 GHz)*1
69153A	Ultra Low Noise Synthesized Sweep Generator (2 to 26.5 GHz)*1
69155A	Ultra Low Noise Synthesized Sweep Generator (500 MHz to 26.5 GHz)*1
69159A	Ultra Low Noise Synthesized Sweep Generator (10 MHz to 26.5 GHz)*1
69163A	Ultra Low Noise Synthesized Sweep Generator (2 to 40 GHz)*1
69165A	Ultra Low Noise Synthesized Sweep Generator (500 MHz to 40 GHz)*1
69169A	Ultra Low Noise Synthesized Sweep Generator (10 MHz to 40 GHz)*1
69175A	Ultra Low Noise Synthesized Sweep Generator (500 MHz to 50 GHz)*2
69177A	Ultra Low Noise Synthesized Sweep Generator (10 MHz to 50 GHz)*2
69185A	Ultra Low Noise Synthesized Sweep Generator (500 MHz to 60 GHz)*2
69187A	Ultra Low Noise Synthesized Sweep Generator (10 MHz to 60 GHz)*2
69195A	Ultra Low Noise Synthesized Sweep Generator (500 MHz to 65 GHz)*2
69197A	Ultra Low Noise Synthesized Sweep Generator (10 MHz to 65 GHz)*2
69237A	Ultra Low Noise Synthesized Signal Generator (2 to 20 GHz)*1
69245A	Ultra Low Noise Synthesized Signal Generator (500 MHz to 20 GHz)*1
69247A	Ultra Low Noise Synthesized Signal Generator (10 MHz to 20 GHz)*1
69253A	Ultra Low Noise Synthesized Signal Generator (2 to 26.5 GHz)*1
69255A	Ultra Low Noise Synthesized Signal Generator (500 MHz to 26.5 GHz)*1
69259A	Ultra Low Noise Synthesized Signal Generator (10 MHz to 26.5 GHz)*1
69263A	Ultra Low Noise Synthesized Signal Generator (2 to 40 GHz)*1
69265A	Ultra Low Noise Synthesized Signal Generator (500 MHz to 40 GHz)*1
69269A	Ultra Low Noise Synthesized Signal Generator (10 MHz to 40 GHz)*1
69275A	Ultra Low Noise Synthesized Signal Generator (500 MHz to 50 GHz)*2
69277A	Ultra Low Noise Synthesized Signal Generator (10 MHz to 50 GHz)*2
69285A	Ultra Low Noise Synthesized Signal Generator (500 MHz to 60 GHz)*2
69287A	Ultra Low Noise Synthesized Signal Generator (10 MHz to 60 GHz)*2
69295A	Ultra Low Noise Synthesized Signal Generator (500 MHz to 65 GHz)*2
69297A	Ultra Low Noise Synthesized Signal Generator (10 MHz to 65 GHz)*2

Model/Order No.	Name
69337A	Ultra Low Noise Synthesized Sweep/Signal Generator (2 to 20 GHz)*1
69345A	Ultra Low Noise Synthesized Sweep/Signal Generator (500 MHz to 20 GHz)*1
69347A	Ultra Low Noise Synthesized Sweep/Signal Generator (10 MHz to 20 GHz)*1
69353A	Ultra Low Noise Synthesized Sweep/Signal Generator (2 to 26.5 GHz)*1
69355A	Ultra Low Noise Synthesized Sweep/Signal Generator (500 MHz to 26.5 GHz)*1
69359A	Ultra Low Noise Synthesized Sweep/Signal Generator (10 MHz to 26.5 GHz)*1
69363A	Ultra Low Noise Synthesized Sweep/Signal Generator (2 to 40 GHz)*1
69365A	Ultra Low Noise Synthesized Sweep/Signal Generator (500 MHz to 40 GHz)*1
69369A	Ultra Low Noise Synthesized Sweep/Signal Generator (10 MHz to 40 GHz)*1
69375A	Ultra Low Noise Synthesized Sweep/Signal Generator (500 MHz to 50 GHz)*2
69377A	Ultra Low Noise Synthesized Sweep/Signal Generator (10 MHz to 50 GHz)*2
69385A	Ultra Low Noise Synthesized Sweep/Signal Generator (500 MHz to 60 GHz)*2
69387A	Ultra Low Noise Synthesized Sweep/Signal Generator (10 MHz to 60 GHz)*2
69395A	Ultra Low Noise Synthesized Sweep/Signal Generator (500 MHz to 65 GHz)*2
69397A	Ultra Low Noise Synthesized Sweep/Signal Generator (10 MHz to 65 GHz)*2
68037B	Synthesized CW Generator (2 to 20 GHz)*1
68045B	Synthesized CW Generator (500 MHz to 20 GHz)*1
68047B	Synthesized CW Generator (10 MHz to 20 GHz)*1
68053B	Synthesized CW Generator (2 to 26.5 GHz)*1
68055B	Synthesized CW Generator (500 MHz to 26.5 GHz)*1
68059B	Synthesized CW Generator (10 MHz to 26.5 GHz)*1
68063B	Synthesized CW Generator (2 to 40 GHz)*1
68065B	Synthesized CW Generator (500 MHz to 40 GHz)*1
68069B	Synthesized CW Generator (10 MHz to 40 GHz)*1
68075B	Synthesized CW Generator (500 MHz to 50 GHz)*2
68077B	Synthesized CW Generator (10 MHz to 50 GHz)*2
68085B	Synthesized CW Generator (500 MHz to 60 GHz)*2
68087B	Synthesized CW Generator (10 MHz to 60 GHz)*2
68095B	Synthesized CW Generator (500 MHz to 65 GHz)*2
68097B	Synthesized CW Generator (10 MHz to 65 GHz)*2
68137B	Synthesized Sweep Generator (2 to 20 GHz)*1
68145B	Synthesized Sweep Generator (500 MHz to 20 GHz)*1
68147B	Synthesized Sweep Generator (10 MHz to 20 GHz)*1
68153B	Synthesized Sweep Generator (2 to 26.5 GHz)*1
68155B	Synthesized Sweep Generator (500 MHz to 26.5 GHz)*1
68159B	Synthesized Sweep Generator (10 MHz to 26.5 GHz)*1
68163B	Synthesized Sweep Generator (2 to 40 GHz)*1
68165B	Synthesized Sweep Generator (500 MHz to 40 GHz)*1
68169B	Synthesized Sweep Generator (10 MHz to 40 GHz)*1
68175B	Synthesized Sweep Generator (500 MHz to 50 GHz)*2
68177B	Synthesized Sweep Generator (10 MHz to 50 GHz)*2
68185B	Synthesized Sweep Generator (500 MHz to 60 GHz)*2
68187B	Synthesized Sweep Generator (10 MHz to 60 GHz)*2
68195B	Synthesized Sweep Generator (500 MHz to 65 GHz)*2
68197B	Synthesized Sweep Generator (10 MHz to 65 GHz)*2
68237B	Synthesized Signal Generator (2 to 20 GHz)*1
68245B	Synthesized Signal Generator (500 MHz to 20 GHz)*1
68247B	Synthesized Signal Generator (10 MHz to 20 GHz)*1
68253B	Synthesized Signal Generator (2 to 26.5 GHz)*1
68255B	Synthesized Signal Generator (500 MHz to 26.5 GHz)*1
68259B	Synthesized Signal Generator (10 MHz to 26.5 GHz)*1
68263B	Synthesized Signal Generator (2 to 40 GHz)*1
68265B	Synthesized Signal Generator (500 MHz to 40 GHz)*1
68269B	Synthesized Signal Generator (10 MHz to 40 GHz)*1
68275B	Synthesized Signal Generator (500 MHz to 50 GHz)*2
68277B	Synthesized Signal Generator (10 MHz to 50 GHz)*2
68285B	Synthesized Signal Generator (500 MHz to 60 GHz)*2
68287B	Synthesized Signal Generator (10 MHz to 60 GHz)*2
68295B	Synthesized Signal Generator (500 MHz to 65 GHz)*2
68297B	Synthesized Signal Generator (10 MHz to 65 GHz)*2

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Model/Order No.	Name
68337B	Synthesized Sweep/Signal Generator (2 to 20 GHz)[*1]
68345B	Synthesized Sweep/Signal Generator (500 MHz to 20 GHz)[*1]
68347B	Synthesized Sweep/Signal Generator (10 MHz to 20 GHz)[*1]
68353B	Synthesized Sweep/Signal Generator (2 to 26.5 GHz)[*1]
68355B	Synthesized Sweep/Signal Generator (500 MHz to 26.5 GHz)[*1]
68359B	Synthesized Sweep/Signal Generator (10 MHz to 26.5 GHz)[*1]
68363B	Synthesized Sweep/Signal Generator (2 to 40 GHz)[*1]
68365B	Synthesized Sweep/Signal Generator (500 MHz to 40 GHz)[*1]
68369B	Synthesized Sweep/Signal Generator (10 MHz to 40 GHz)[*1]
68375B	Synthesized Sweep/Signal Generator (500 MHz to 50 GHz)[*2]
68377B	Synthesized Sweep/Signal Generator (10 MHz to 50 GHz)[*2]
68385B	Synthesized Sweep/Signal Generator (500 MHz to 60 GHz)[*2]
68387B	Synthesized Sweep/Signal Generator (10 MHz to 60 GHz)[*2]
68395B	Synthesized Sweep/Signal Generator (500 MHz to 65 GHz)[*2]
68397B	Synthesized Sweep/Signal Generator (10 MHz to 65 GHz)[*2]
	Options
Option 1	Rack mounting kit, includes one set of track slides (90˚ tilt capability), mounting ears, and front panel handles for mounting in a standard 19-inch equipment rack
Option 2A	Step attenuator (10 dB/step, high-end frequency of ≤26.5 GHz, rated output power is reduced)
Option 2B	Step attenuator (10 dB/step, high-end frequency of ≤40 GHz, rated output power is reduced)
Option 2C	Step attenuator (10 dB/step, high-end frequency of ≤50 GHz, rated output power is reduced)
Option 2D	Step attenuator (10 dB/step, high-end frequency of ≤60 GHz, rated output power is reduced)
Option 6	Phase modulation capability FM input and FM generator become FM/øM input and FM/øM generator (69200A, 68200B, 69300A and 68300B series) Not available with option 7
Option 7	Generators deletes the internal AM and FM generators (69200A, 68200B, 69300A and 68300B series). External AM and FM capability remains unchanged. Not available in combination with Option 6, 8, 10 or 20
Option 8	Internal power meter adds an internal power (69200A, 68200B, 69300A and 68300B series) compatible with 560-7, 5400-7, or 6400-71 series detectors. Not available with Option 7
Option 9	Rear panel RF output (moves RF output connector to the rear panel)
Option 10	Complex modulation (user defined modulation includes serial cable and Windows® based software) (69200A, 68200B, 69300A and 68300B series) (*Not available with Option 7)
Option 11	0.1 Hz frequency resolution (provides frequency resolution of 0.1 Hz)
Option 14	Anritsu 360B VNA compatibility (modifies rack mounting hardware to mate unit in Anritsu 360B VNA console)
Option 15	High power output (provides high-power from 2 to 26.5 GHz)
Option 16	High stability time base (adds an ovenized, 10 MHz crystal oscillator as a high-stability time base)
Option 17	Delete front panel (deletes the front panel for use in remote control applications where a front panel display and keyboard control are not needed)
Option 18	MM-wave bias (rear panel bias output to drive 54000-XX WRXX multiplier. BNC twinax: not available with Option 20)
Option 19	SCPI programmability adds GPIB command mnemonics complying with Standard Commands for Programmable Instruments (SCPI), Version 1993.0. SCPI programming complies with IEEE 488.2–1987
Option 20	SCAN modulator (adds an internal SCAN modulator for simulating high-depth amplitude modulated signals in models 68237B, 68337B, 68247B and 68347B only. Requires an external modulating signal input: not available in combination with Option 7 or Option 18)
	Accessories
34RKNF50	Ruggedized K-to-Type N Female Adaptor (DC to 20 GHz)
34VKF50	V Male-to-K Female (DC to 46 GHz)
34RVNF50	Ruggedized V-to-Type N Female Adaptor (DC to 20 GHz)
ND36329	MASTER/SLAVE interface cable
761-69	Protective front panel cover
760-177	Transit case
2300-16	69100A/68100B/68100A instrument driver for national instruments LabWindows® Ver. 2.2
2300-19	69200A/68200B/68300B instrument driver for national Instruments LabWindows® Ver. 2.2
2300-20	69000A/68000B instrument driver for national instruments LabWindows® Ver. 2.2

*1: K female output connector
*2: V female output connector

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