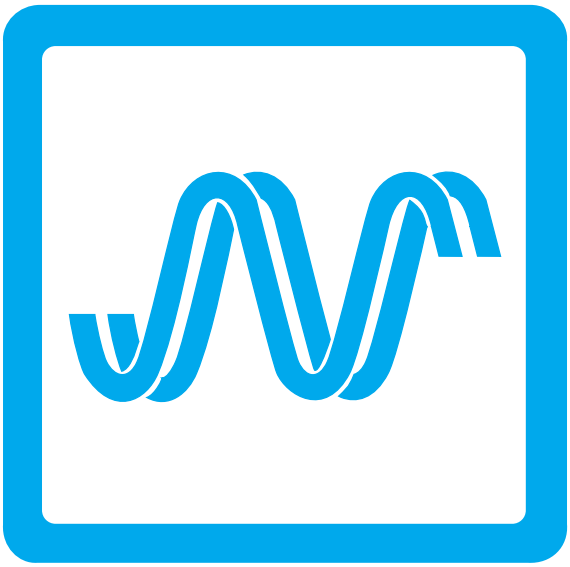

SIGNAL GENERATORS

SYNTHESIZED CW GENERATOR
MG3690A
0.1 Hz to 40 GHz

The Ideal Local Oscillator for RF and Microwave Applications

NEW

CE GPIB

A new synthesizer for a new millenium
The MG3690A leverages the proven design of the El Toro family of Anritsu synthesizers, adding new features to meet the latest needs of the new millennium. The El Toro platform gives the MG3690A excellent performance with a proven reliability record of greater-than 49,000 hours MTBF. This allows the MG3690A to offer a standard 3-year warranty. From the sleek new lines of the front panel, the larger 1/4 VGA LCD, the reduced front panel buttons and menu depth, to the 10 kg lighter and 15 cm shallower depth, the MG3690A meets the new millennium value-based needs.

Features
The 3690A basic signal sources provide accurate outputs over a wide frequency and power range for Local Oscillator duty and other CW applications.

- Broad frequency coverage including 0.1 Hz to 40 GHz in a single coax output
- Ultra-low SSB phase noise and spurious
- +17 dBm guaranteed leveled power to 20 GHz
- 0.01 Hz optional frequency resolution
- <5 ms switching time for <100 MHz sweep steps
- Digital frequency sweep and digital power sweep
- Wide dynamic range with accurate output levels
- Intuitive, menu-driven front panel

3 models, fully configurable, fully upgradable
- MG3692A 2 to 20 GHz
- MG3693A 2 to 30 GHz
- MG3694A 2 to 40 GHz

The MG3690A series offers three basic models that cover the frequency ranges of 2 to 20, 30, or 40 GHz. Options can easily be added to configure these models to meet your specific needs. As your needs change, your unit can be upgraded in frequency or options, minimizing your capital equipment investment risks. Option 3, Ultra-Low Phase Noise, adds high performance lock loops that deliver unrivaled phase noise performance. Options 4 and 5 add RF frequency coverage down to 10 MHz. Option 4 adds a Digital Down Converter with the best RF phase noise performance. Option 5 adds an Analog Down Converter. For audio frequency coverage down to 0.1 Hz, Option 22 adds a Direct Digital Synthesizer. Option 13 offers external pulse capabilities. Check the last page of the brochure for the remaining traditional synthesizer options.

Automatic test equipment applications
The MG3690A is an ideal CW generator for an A.T.E. It packs the highest performance available in a 13.3 cm (3u) package, with a 450 mm depth that minimizes rack space. High output power assures adequate signal strength to the device under test even after A.T.E. switching and cabling losses. Accurately leveled output power to -120 dBm in 0.01 dB steps facilitates receiver sensitivity measurements. For improved MTBF, an electronic step attenuator replaces the traditional mechanical step attenuator. Fast 5 ms switching time maximizes system throughput. Internal list mode frees the A.T.E. controller to perform measurement analysis tasks. Free application drivers, including the IVI-COM driver and National Instruments LabView® drivers, save you time and money in code generation and maintenance. For additional cost savings, Option 17 eliminates the complete front panel including circuitry.

Interchangeable virtual instruments standard
The IVI standard defines a standard instrument driver model that enables instrument interchangeability and interoperability without software changes. Anritsu's IVI-driver supported synthesizer minimizes instrument development and maintenance cost through the use of IVI-standard interfaces as well as instrument-specific interfaces for unique instrument features. The IVI standard provides a single driver that supports the common application development environments such as Visual Basic, Visual C++, and Labview. The flexible I/O model supports new communication technologies such as USB, Ethernet, and Firewire. Anritsu Corporation leads the way with IVI technology, having released the first COM-based IVI driver supporting the Signal Generator instrument class, and includes the driver with every MG3690A series synthesizer. As an active member of the IVI Foundation, Anritsu supports the Foundation's drive toward instrument driver

For product ordering information, see pages 4 –10

Specifications

CW mode	Output		Twenty independent, presettable CW frequencies (F0 – F9 and M0 – M9)
	Accuracy		Same as internal or external 10 MHz time base
	Internal time base stability	With aging	<2 x 10^{-9}/day (<5 x 10^{-10}/day with Option 16)
		With temperature	<2 x 10^{-8}/°C over 0°C to 55°C (<5 x 10^{-9}/°C with Option 16)
	Resolution		0.01 Hz
	External 10 MHz reference input		Accepts external 10 MHz ±100 Hz, –10 to +20 dBm time base signal. Automatically disconnects the internal high-stability time-base option, if installed. BNC, rear panel, 50 ohm impedance
	10 MHz reference output		0.5 Vp-p into 50 Ω, AC coupled. Rear panel BNC; 50 Ω impedance
	Switching time (typical maximum)		<40 ms to be within 1 kHz of final frequency
	Phase offset		Adjustable in 0.1° steps
Phase-locked step sweep mode	Sweep width		Independently selected, 0.01 Hz to full range. Every frequency step in sweep range is phase-locked
	Accuracy		Same as internal or external 10 MHz time base
	Resolution (minimum step size)		0.01 Hz
	Linear/log sweep		User-selectable linear or log sweep. In log sweep, step size logarithmically increases with frequency
	Steps		User-selectable number of steps or the step size
	Number of Steps		Variable from 1 to 10,000
	Step size		0.01 Hz 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
	Fixed rate sweep		Allows the user to set the total time of the sweep, including lock time. Variable from 20 ms to 99 seconds
	Switching time (typical maximum)		<15 ms + 1 ms/GHz step size or <40 ms, whichever is less, to be within 1 kHz of final frequency
Alternate sweep mode	Sweeps alternately in step sweep between any two sweep ranges. Each sweep range may be associated with a power level		
Manual sweep mode	Provides stepped, phase-locked adjustment of frequency between sweep limits. User-selectable number of steps or step size		
List sweep mode	Under GPIB control or via the front panel, up to 4 tables with 2000 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. One table of 2000 points is stored in non-volatile memory, all other tables are stored in volatile memory		
	Switching time (typical maximum)		<25 ms to be within 1 kHz of final frequency
Programmable frequency agility	Under GPIB control, up to 3202 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. Data is stored in volatile memory		
	Switching time (typical maximum)		<25 ms to be within 1 kHz of final frequency
Markers	Up to 20 independent, settable markers (F0 – F9 and M0 – M9)		
	Video markers		+5V or –5V marker output, selectable from system menus. AUX I/O connector, rear panel
	Marker accuracy		Same as sweep frequency accuracy
	Marker resolution		1 kHz (0.1 Hz with Option 11)
Sweep triggering	Sweep triggering is provided for step frequency sweep, list frequency sweep, and CW power sweep		
	Auto		Triggers sweep automatically
	External		Triggers a sweep on the low-to-high transition of an external TTL signal. AUX I/O connector, rear panel
	Single		Triggers, aborts, and resets a single sweep. Reset sweep may be selected to be at the top or bottom of the sweep

Continued on next page

General	Stored setups		Stores front panel settings and nine additional front-panel setups in a non-volatile RAM. A system menu allows for saving and recalling instrument setups. Whenever the instrument is turned on, control settings and values are the same as when last turned off
	Memory sequencing input		TTL low-level signal provides sequencing through ten stored setups. AUX I/O connector, rear panel
	Self-test		Instrument self-test is performed when Selftest soft-key is selected. If an error is detected, an error message is displayed in a window on the LCD identifying the probable cause and remedy
	Secure mode		Disables all frequency and power level state displays. Stored setups saved in secure mode remain secured when recalled. Mode selectable from a system menu and via GPIB
	Parameter entry		Instrument-controlled parameters can be entered in three ways—keypad, rotary data knob, or the "^" and "v" touch pads of the cursor-control key (use up/down-arrow symbol). The keypad is used to enter new parameter values; the rotary data knob and the cursor-control key are used to edit existing parameter values. The "<" and ">" touch pads of the cursor-control key move the cursor left and right one digit under the open parameter. The rotary data knob or the "<" and ">" touch pads will increment or decrement the digit position over the cursor. Controlled parameters are frequency, power level, sweep time, dwell time, and number of steps. Keypad entries are terminated by pressing the appropriate soft key. Edits are terminated by exiting the edit menu
	Reset		Returns all 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 output signals to be swept with a user-selected frequency offset. One instrument controls the other via AUX I/O and SERIAL I/O connections. Requires a Master/Slave Interface Cable Set (Part No. ND36329)
	User level flatness correction		Provides compensation for path loss due to external switchiing and cables. Compensation may come from a power table in a GPIB power meter, or it may be from 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 ML2437A, ML2438A, and ML4803A and HP 437B, 438A, and 70100A. Five user tables are available with up to 801 points/table
	Warm up time	From standby	30 minutes
		From cold start (0°C)	120 hours to achieve specified frequency stability with aging. Instruments disconnected from ac line power for more than 72 hours require 30 days to return to specified frequency stability with aging
	Power		90-264 Vac, 48-440 Hz, 250 VA maximum
	Standby		With AC line power connected, unit is placed in standby when front panel power switch is released from the OPERATE position
	Weight		14 kg maximum
	Dimensions		133 H x 429 W x 450 D mm
Remote operation	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)		
	GPIB address		Selectable from a system menu
	IEEE-488 Interface Function Subset	Source handshake	SH1
		Acceptor handshake	AH1
		Talker	T6
		Listener	L4
		Service request	SR1
		Remote/local	RL1
		Parallel poll	PP1
		Device clear	DC1
		Device trigger	DT1
		Controller capability	C0, C1, C2, C3, C28
		Tri-state driver	E2
	GPIB Status Annunciators	When the instrument is operating in remote, the GPIB status annunciators (listed below) will appear in a window on the front panel display	
		Remote	Under GPIB control (all instrument front panel keys except for the SYSTEM key and the RETURN TO LOCAL soft-key will be ignored)
		LLO (local lockout)	Disables the RETURN TO LOCAL soft-key. Instrument can be placed in local mode only via GPIB or by cycling line power
	Emulations		The instrument responds to the published GPIB commands and responses of the Anritsu Models 6600, 6700, and 6XX00-series signal sources. When emulating another signal source, the instrument will be limited to the capabilities, mnemonics, and parameter resolutions of the emulated instrument
Environmental	Storage temperature range		-40 to +75°C
	Operating temperature range		0 to +50°C
	Relative humidity		5% to 95% at 40°
	Altitude		4,600 meters, 43.9 cm Hg
	EMI		Meets the emission and immunity requirements of EN55011:1991/CISPR-11:1990 Group 1 Class A EN50082-1:1997/ EN 61000-4-2:1995 – 4 kV CD, 8 kV AD EN61000-4-3:1997 – 3 V/m ENV50204 – 3 V/m EN61000-4-4: 1995 – 0.5 kV SL, 1 kV PL EN61000-4-5:1995 – 1 kV – 2 kV L-E MIL-STD-461C Part 2 REO1, REO2, CEO1, CEO3, CSO1, CSO2, CSO6, RSO3

For product ordering information, see pages 4 –10

Special purity

All specifications apply at the lesser of +10 dBm output or maximum specified leveled output power, unless otherwise noted.

Spurious signals

Harmonic and harmonic helated

Frequency range	Standard
0.1 Hz to 10 MHz (Option 22)	<–30 dBc
10 MHz to ≤100 MHz (Option 4)	<–40 dBc
>100 MHz to ≤2.2 GHz (Option 4)	<–50 dBc
10 MHz to ≤50 MHz (Option 5)	<–30 dBc
>50 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤20 GHz	<–60 dBc
>20 GHz to ≤40 GHz	<–40 dBc

Harmonic and harmonic related (for models with Option 15, at maximum specified leveled output power)

Frequency range	Standard
10 MHz to ≤100 MHz (Option 4)	<–40 dBc
>100 MHz to ≤2.2 GHz (Option 4)	<–50 dBc
10 MHz to ≤50 MHz (Option 5)	<–30 dBc
>50 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤20 GHz	<–50 dBc
>20 GHz to ≤40 GHz	<–15 dBc*

* <–30 dBc typical >21 GHz

Nonharmonics

Frequency range	Standard
0.1 Hz to 10 MHz (Option 22)	<–30 dBc
10 MHz to ≤2.2 GHz (Option 4)	<–60 dBc
10 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤40 GHz	<–60 dBc

Power line and fan rotation spurious emissions (dBc)

Frequency range	Offset from carrier		
	<300 Hz	300 Hz to 1 kHz	>1 kHz
≥10 to ≤500 MHz (Option 4)	<–68	<–72	<–72
>500 to =1050 MHz (Option 4)	<–62	<–72	<–72
>1050 to ≤2200 MHz (Option 4)	<–56	<–66	<–66
≥0.01 to ≤8.4 GHz	<–50	<–60	<–60
>8.4 to ≤20 GHz	<–46	<–56	<–60
>20 to ≤40 GHz	<–40	<–50	<–54

Residual FM (CW and Step Sweep modes, 50 Hz - 15 kHz BW)

Frequency range	Residual FM (Hz RMS) option 3,4	Standard
≥0.01 to ≤8.4 GHz	<40	<120
>8.4 to ≤20 GHz	<40	<220
>20 to ≤40 GHz	<80	<440

AM noise floor

Typically <–145 dBm/Hz at 0 dBm output and offsets >5 MHz from carrier.

Single-sideband phase noise

Single-sideband phase noise (dBc/Hz)

Frequency range	Offset from carrier			
	100 Hz	1 kHz	10 kHz	100 kHz
≥0.1 Hz to <10 MHz (Option 22)	–90	–120	–130	–130
≥10 MHz to <500 MHz (Option 4)	–94	–106	–104	–120
≥500 MHz to <2200 MHz (Option 4)	–82	–94	–92	–108
≥10 MHz to <2 GHz (Option 5)	–77	–88	–86	–100
≥2 GHz to ≤6 GHz	–78	–88	–86	–102
>6 GHz to ≤10 GHz	–73	–86	–83	–102
>10 GHz to ≤20 GHz	–66	–78	–78	–100
>20 GHz to ≤40 GHz	–60	–75	–72	–94

Single-sideband phase noise (dBc/Hz) – Option 3

Frequency range	Offset from carrier					
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
≥0.1 Hz to <10 MHz (Option 22)	–70	–90	–120	–130	–130	–130
≥10 MHz to <15.625 MHz (Option 4)	–101	–131	–140	–142	–141	–145
15.625 MHz to ≤31.25 MHz (Option 4)	–105	–125	–135	–137	–137	–145
>31.25 MHz to ≤62.5 MHz (Option 4)	–99	–119	–134	–136	–136	–144
>62.5 MHz to ≤125 MHz (Option 4)	–93	–113	–133	–135	–133	–144
>125 MHz to ≤250 MHz (Option 4)	–87	–107	–130	–132	–130	–143
>250 MHz to ≤500 MHz (Option 4)	–81	–101	–125	–128	–124	–142
>500 MHz to ≤1050 MHz (Option 4)	–75	–95	–119	–122	–119	–138
>1050 MHz to ≤2200 MHz (Option 4)	–69	–89	–113	–116	–113	–135
≥10 MHz to <2 GHz (Option 5)	–67	–83	–100	–102	–102	–111
≥2 GHz to ≤6 GHz	–60	–80	–107	–110	–107	–130
>6 GHz to ≤10 GHz	–55	–75	–104	–107	–107	–128
>10 GHz to ≤20 GHz	–49	–69	–98	–104	–102	–125
>20 GHz to ≤40 GHz	–43	–63	–92	–98	–96	–119

For product ordering information, see pages 4 –10

RF output

Power level specifications apply at 25 ±10°C.

Maximum leveled output power

Model number	Configuration	Frequency range (GHz)	Output power (dBm)	Output power with step attenuator (dBm)	Output power with electronic step attenuator (dBm)
MG3692A	With option 4 With option 5 Standard Standard	≤2.2 GHz ≤2 GHz >2 to ≤8.4 GHz >8.4 to ≤20 GHz	+17.0 +17.0 +13.0 +13.0	+15.0 +15.0 +11.0 +11.0	+13.0 +13.0 +9.0 +3.0
MG3693A	With option 4 With option 5 Standard Standard	≤2.2 GHz ≤2 GHz >2 to ≤20 GHz >20 to ≤30 GHz	+13.0 +13.0 +9.0 +6.0	+11.0 +11.0 +7.0 +3.0	Not available
MG3694A	With option 4 With option 5 Standard Standard	≤2.2 GHz ≤2 GHz >2 to ≤20 GHz >20 to ≤40 GHz	+13.0 +13.0 +9.0 +6.0	+11.0 +11.0 +7.0 +3.0	Not available

Maximum leveled output power with option 15 (high power) installed

Model number	Configuration	Frequency range (GHz)	Output power (dBm)	Output power with step attenuator (dBm)	Output power with electronic step attenuator (dBm)
MG3692A	With option 4 With option 5 Standard Standard	≤2.2 GHz ≤2 GHz >2 to ≤10 GHz >10 to ≤20 GHz	+19.0 +19.0 +19.0 +17.0	+18.0 +18.0 +18.0 +15.0	+15.0 +15.0 +13.0 +7.0
MG3693A	With option 4 With option 5 Standard Standard Standard	≤2.2 GHz ≤2 GHz >2 to ≤18 GHz >18 to ≤20 GHz >20 to ≤30 GHz	+15.0 +15.0 +15.0 +12.0 +14.0	+14.0 +14.0 +14.0 +10.0 +12.0	Not available
MG3694A	With option 4 With option 5 Standard Standard Standard	≤2.2 GHz ≤2 GHz >2 to ≤18 GHz >18 to ≤20 GHz >20 to ≤40 GHz	+15.0 +15.0 +15.0 +12.0 +14.0	+14.0 +14.0 +14.0 +10.0 +12.0	Not available

Leveled output power range	Standard units	Without an attenuator	Maximum leveled output power to –15 dBm (–20 dBm typical)
		With an attenuator	Maximum leveled output power to –120 dBm
		With an electronic attenuator	Maximum leveled output power to –140 dBm
	Units with option 15, high power	Without an attenuator	Maximum leveled output power to –5 dBm (–10 dBm typical)
		With an attenuator	Maximum leveled power to –115 dBm (–120 dBm typical). For units with Option 15A, minimum settable power is –105 dBm (–110 dBm typical)
		With an electronic attenuator	Maximum leveled power to –115 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	<3ms typical
		With change in step attenuator	<20 ms typical
		With change in electronic step attenuator	<3 ms typical. Power level changes across –70 dB step will result in 20 ms delay

Accuracy and flatness	Accuracy specifies the total worst case accuracy. Flatness is included within the accuracy		
	Accuracy		±1.0 dB
	Flatness		±0.8 dB
Other output power specifications	Output units		Output units selectable as either dBm or mV. Selection of mV assumes 50 ohm load. All data entry and display are in the selected units
	Output power resolution		0.01 dB or 0.001 mV
	Source impedance		50 Ω nominal
	Source SWR (internal leveling)		<2.0 typical
	Power level stability with temperature		0.04 dB/°C typical
	Level offset		Offsets the displayed power level to establish a new reference level
	Output on/off		Toggles the RF output between an off and on state. During the off state, the RF oscillator is turned off. The on or off state is indicated by two LEDs located below the OUTPUT ON/OFF key on the front panel
	RF on/off between frequency steps		System menu selection of RF on or RF off during frequency switching in CW, step sweep, and list sweep modes
	RF on/off during retrace		System menu selection of RF on or RF off during retrace
	Internal leveling		Power is leveled at the output connector in all modes
	External leveling	External detector	Levels output power at a remote detector location. Accepts a positive or negative 0.5 mV to 500 mV input signal from the remote detector. EXT ALC ADJ adjusts the input signal range to an optimum value. BNC connector, front and rear panel
		External power meter	Levels output power at a remote power meter location. Accepts a ±1 V full scale input signal from the remote power meter. EXT ALC ADJ adjusts the input signal range to an optimum value. BNC connector, rear panel
		External leveling bandwidth	30 kHz typical in detector mode. 0.7 Hz typical in power meter mode
		User level flatness correction	Number of points: 2 to 801 points per table Number of tables: 5 available Entry modes: GPIB power meter or computed data
CW power sweep	Range		Sweeps between any two power levels at a single CW frequency
	Resolution		0.01 dB/step (Log) or 0.001 mV (Linear)
	Accuracy		Same as CW power accuracy
	Log/linear sweep		Power sweep selectable as either log or linear. Log sweep is in dB; linear sweep is in mV
	Step size		User-controlled, 0.01 dB (Log) or 0.001 mV (Linear) 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 the length of time required to complete each sweep		
External pulse modulation (option 13)	Pulse modulation specifications apply at maximum rated power, unless otherwise noted		
	On/off ratio		>80 dB
	Rise/fall time (10 to 90%)	10 MHz to 1.0 GHz	15 ns (<10 ns typical)
		1.0 GHz to 40 GHz	10 ns (<5 ns typical)
	Minimum leveled pulse width		100 ns, ≤2 GHz 1µs, <2 GHz
	Minimum unleveled pulse width		10 ns
	Pulse overshoot		10%
	Level accuracy relative to CW (100 Hz to 1 MHz PRF)		±0.5 dB, ≥1 µs pulse width ±1.0 dB, <1 µs pulse width
	Video feedthrough		<±10 mV, ≥2 GHz
	Pulse width compression		<8 ns typical
	Pulse delay (typical)	External mode	50 ns
		PRF range	DC to 10 MHz, unleveled 100 Hz to 5 MHz, leveled
	External input	Rear-panel BNC	
		Drive level	TTL compatible input
		Input logic	Positive-true or negative-true, selectable from modulation menu

For product ordering information, see pages 4 –10

Digital down (Option 4)

MG3690A synthesizers with option 4 DDC produce output frequencies from 10 MHz to 2.2 GHz by dividing the YTO frequency by 2 n. The divisor ranges from 2 at 2.2 GHz to 256 at 10-15.625 MHz.

Frequency range	Divide ratio, n
≥10 to ≤15.625 MHz	256
>15.625 to ≤31.25 MHz	128
>31.25 to ≤62.5 MHz	64
>62.5 to ≤125 MHz	32
>125 to ≤250 MHz	16
>250 to ≤500 MHz	8
>500 to ≤1050 MHz	4
>1050 to ≤2200 MHz	2

RF output	Frequency	10-2200 MHz
	Maximum leveled output power	+13 dBm, typically +19 dBm
Spectral purity	All specifications apply at +10 dBm output, unless otherwise noted	
	Harmonic and harmonic related	–40 dBc, ≤100 MHz –50 dBc, >100 MHz
	Non-harmonic spurious	–60 dBc
	AM noise	Typically -145 dBm/Hz at 0 dBm output and offsets >5 MHz from carrier

Power line and fan-related spurious (dBc)

Frequency range	Offset from carrier	
	<300 Hz	≥300 Hz
≥10 MHz to ≤500 MHz	–68	–72
>500 MHz to ≤1050 MHz	–62	–72
>1050 MHz to ≤2200 MHz	–56	–66

Pulse modulation	Pulse modulation specifications apply at maximum rated power, unless otherwise noted.	
	On/off ratio	>80 dB
	Minimum leveled pulse width	1 µsec
	Level accuracy relative to CW	± 0.5 dB (100 Hz to 500 kHz PRF)

Frequency range	Rise and fall time	Overshoot	Width compression	Video feedthrough
>500 to ≤2200 MHz	15 ns	10%	<12 ns*	±15 mV*
>125 to ≤500 MHz	<33 ns*	<11%*	<12 ns*	±70 mV*
>31.25 to ≤125 MHz	<90 ns*	<22%*	<12 ns*	±130 mV*
≥10 to ≤31.25 MHz	<400 ns*	<33%*	<40 ns*	±70 mV*

* Typical

Inputs and Outputs

Input/output connectors		
Nomenclature	Type	Location
PULSE TRIG IN I	BNC	Rear panel
EXT ALC IN	BNC	Rear panel
RF OUTPUT	K-Connector (female)	Standard-front panel option 9-rear panel
10 MHz REF IN	BNC	Rear panel
10 MHz REF OUT	BNC	Rear panel
HORIZ OUT	BNC	Rear panel
AUX I/O	25-pin D-type	Rear panel
SERIAL I/O	RJ45	Rear panel
IEEE-488 GPIB	Type 57	Rear panel

PULSE TRIG IN	Accepts an external TTL compatible signal to pulse modulate the RF output signal
EXT ALC IN	Provides for leveling the RF output signal externally with either a detector or power meter. Signal requirements are shown in the RF output specifications
RF OUTPUT	Provides for RF output from 50 Ω source impedance. K Connector, female. Option 9 moves the RF output connector to the rear panel
10 MHz REF IN	Accepts an external 10 MHz ±100 Hz, 0 to +10 dBm time-base signal. Automatically disconnects the internal high-stability time-base option, if installed. 50 Ω impedance
10 MHz REF OUT	Provides a 0.5 Vp-p, AC coupled, 10 MHz signal derived from the internal frequency standard. 50 Ω impedance
HORIZ OUT (horizontal sweep output)	Provides 0V at beginning and +10 V at end of sweep, regardless of sweep width. In CW mode, the voltage is proportional to frequency between 0 V at low end and +10 V at the high end of range. In CW mode, if CW RAMP is enabled, a repetitive, 0 V to +10 V ramp is provided
AUX I/O (auxiliary input/output)	Provides for most of the rear panel BNC connections through a single, 25-pin, D-type connector. Supports master-slave operation with another synthesizer or allows for a single-cable interface with the Model 56100A Scalar Network Analyzer and other Anritsu instruments
SERIAL I/O (serial input/output)	Provides access to RS-232 terminal ports to support service and calibration functions and master-slave operations
IEEE-488 GPIB	Provides input/output connections for the GPIB

Ordering information

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

Model/Order No.	Name
	Models
MG3692A	2 – 20 GHz CW Generator
MG3693A	2 – 30 GHz CW Generator
MG3694A	2 – 40 GHz CW Generator
	Options and accessories
MG3690A/1A	Rack Mount with slides. Rack mount kit containing a set of track slides (90 degree tilt capability), mounting ears, and front panel handles to let the instrument be mounted in a standard 19-inch equipment rack.
MG3690A/1B	Rack Mount without slides. Modifies rack mounting hardware to install unit in a console that has mounting shelves. Includes mounting ears and front panel handles.
MG3690A/2x	Mechanical Step Attenuator. Adds a 10 dB/step attenuator with 110 dB range. Rated RF output power is reduced. (This option comes in different versions, based on the instrument configuration.)
MG3690A/2F	Electronic Step Attenuator – 20 GHz. Adds a 10 dB/step electronic attenuator with a 120 dB range for the MG3692A. Rated RF output power is reduced.
MG3690A/3	Ultra Low Phase Noise, main band, =2 GHz. Adds new modules to significantly reduce SSB Phase Noise
MG3690A/4	10 MHz to 2.2 GHz RF coverage, Ultra-Low Phase Noise version. Uses a digital down converter to significantly reduce SSB phase noise.
MG3690A/5	10 MHz to 2 GHz RF coverage. Uses an analog down converter.
MG3690A/9K	Rear Panel Output. Moves the RF output connector to the rear panel.
MG3690A/13	External Pulse Modulation. Rear panel BNC connector for connection of external pulse modulation signal
MG3690A/15x	High Power. Adds high-power RF components to the instrument to increase its output power level. (This option comes in different versions, based on the instrument configuration.)
MG3690A/16	High Stability Time Base. Adds an ovenized, 10 MHz crystal oscillator as a high-stability time base.
MG3690A/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.
MG3690A/18	mmW Bias Output. Adds a rear panel BNC Twinax connector to bias the 54000-xWRxx millimeter wave source modules.
MG3690A/22	0.1 Hz to 10 MHz Audio coverage. Uses a DDS for coverage down to approximately DC. When adding Option 22, the output power is degraded by 1 dB for frequencies ≤20 GHz and by 2 dB for frequencies >20 GHz.

Model/Order No.	Name
	Accessories
34RKNF50	DC to 20 GHz, Ruggedized Type N female adapter for units with a K connector output
ND36329	Master/Slave interface cable set
760-212A	Transit case
2300-469	IVI Driver, includes LabView ® driver
806-97	Aux I/O cable, 25 pin to BNC: Provides BNC access to V/GHz and Sequential Sync connections and other AUX I/O data lines
	Millimeter wave accessories (requires MG3690A/18)
54000-4WR15	50 to 75 GHz, V band X4 multiplier-source module, (includes A36599 power cable and 3 filters).
54000-5WR15	50 to 75 GHz, V band X4 multiplier-Ssource module with internal reference coupler/detector (includes A36599 power cable, 3 filters, and 560-10BX-2 detector adapter cable).
54000-4WR10	75-110 GHz, W band X6 multiplier-source module (includes A36599 power cable and 3 filters).
54000-5WR10	75-110 GHz, W band X6 multiplier-source module with internal reference coupler/detector (includes A36599 power cable, 3 filters, and 560-10BX-2 detector adapter cable).
N120-6	Semi-rigid cable, N(m) to N(m), 15 cm long, connects synthesizer's RF output to multiplier's RF input. (Also requires 34RKNF50 or 34RVNF50 Adapter).
	Upgrades Economical upgrades are available to upgrade any model to any higher performing model. Consult Anritsu for details.

For product ordering information, see pages 4 –10

SYNTHESIZED SWEEP SIGNAL GENERATOR
68000C, 69000B Series
0.1 Hz to 65 GHz

Microwave Synthesizer for Any Application

CE GPIB

Uncompromising value
You need a synthesizer that precisely fits your current needs yet can be upgraded, at a reasonable cost, to satisfy your future needs without shattering your test equipment budget. The 68C/69B family of synthesizers offers 42 models to fit any stimulus application including models with the lowest SSB phase noise and broadest frequency range available today. And the economical upgrades will continue to please your engineers and technicians... and your cost accounting department!
Anritsu offers CW generators, signal generators, and high-performance signal generators ideally suited to bench top or A.T.E. applications.

Features
- 36 models for perfect fit to any application
- Ultra-low SSB phase noise: –115 dBc typical at 10 kHz offset from 10 GHz
- 0.1 Hz 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 arbitrary modulation

Applications
- **CW stimulus**

The 69000B/68000C 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 69000B and 68000C provide the ultimate in performance.

- **Swept measurements**

The 69100B/68100C Synthesized Signal Generators feature 10 MHz to 65 GHz analog, step, and manual sweep capability. The 69100B/68100C also provide AM/FM/pulse modulation via external modulating signals. 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 69100B and 68100C the optimum sources for your network analysis and swept A.T.E. source applications.

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

The 69300B/68300C Synthesized High Performance Signal Generators provide, in a single package, all the capabilities of our CW and signal generators, plus they contain an internal AM/FM/pulse modulation generator. 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. The Swept Delay feature enables moving target simulation. Simultaneous synchronized modulations let you set complex signal scenarios across the entire 10 MHz to 65 GHz frequency range. The 69300B is the highest performance universal synthesized signal generator available today.

- **One-box, ultra-clean RF and microwave signal solution**

Every 69B series synthesizer model can be equipped with the new High Spectral Purity Digital Down Converter, which offers ultra-low SSB phase noise and harmonics in the 10 MHz to 2.2 GHz frequency range. The Digital Down Converter phase noise performance is typically 30-50 dB better than other microwave synthesizers and comparable to the best RF synthesizers in the market. Phase noise at 10 kHz offset from 500 MHz is typically –132 dBc/Hz and –140 dBc/Hz at 1 kHz from 125 MHz, which is comparable to a crystal oscillator! Typical harmonic levels are less than –45 dBc below 100 MHz and –55 dBc above 100 MHz.

The smart choice
The 69B series synthesizer continues to be the microwave synthesizer of choice for spectral purity and versatility. With the new state-of-the-art digital down converter, the synthesizers are true one-box, full-band solutions for ultra-clean RF and microwave signal generation, offering unrivaled performance in applications that previously required a separate RF synthesizer.

68C/69B synthesizers product selection table

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

68C/69B synthesizers model summary

Frequency range	CW Generators		Signal Generators		High Performance Signal Generators	
0.01 to 8.4 GHz*	68017C	69017B	68117C	69117B	68317C	69317B
2 to 20 GHz	–		68137C	69137B	68337C	69337B
0.01 to 20 GHz*	–		68147C	69147B	68347C	69347B
0.01 to 40 GHz*	–		68167C	69167B	68367C	69367B
0.01 to 50 GHz*	68077C	69077B	68177C	69177B	68377C	69377B
0.01 to 60 GHz*	68087C	69087B	68187C	69187B	68387C	69387B
0.01 to 65 GHz*	68097C	69097B	68197C	69197B	68397C	69397B

*: Optional frequency extension down to 0.1 Hz is available

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 (typical maximum)	Units with maximum frequency of ≥20 GHz: <40 ms to be within 1 kHz of final frequency Units with maximum frequency of 8.4 GHz: <15 ms to be within 1 kHz of final frequency
	Analog sweep mode (68100C, 68300C, 69100B, 69300B)	Sweep width	Independently selected from 1 MHz to full range continuous sweep For 691XXB and 693XXB minimum frequency for analog sweep is 500 MHz
		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
		Accuracy	Same as internal or external 10 MHz time base
		Resolution (min. step size)	1 kHz (0.1 Hz with Option 11)
		Linear/log sweep	User-selectable linear or log sweep. In log sweep, step size logarithmically increases with frequency.
		Number of steps	Variable from 1 to 10,000
		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.)
		Step time	Step sweep: Variable from 1 ms/step to 99 seconds/steps. Dwell time begins after phase lock. Fixed rate step sweep: Variable from 20 ms/step to 99 seconds/step. Dwell time includes phase lock time.
		Switching time (typical maximum)	Units having a high-end frequency of ≥20 GHz: <15 ms + 1 ms/GHz step size or <40 ms, whichever is less Units having a high-end frequency of 8.4 GHz: <7 ms
	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.
	List sweep mode	Tables	Under GPIB control or via the front panel, up to 4 tables with 2000 non-sequential frequencies/power sets can be stored and then addressed as a phase-locked step sweep. One table of 2000 points is stored in non-volatile memory, all other tables are stored in volatile memory.
		Switching time (typical maximum)	Units having a high-end frequency of ≥20 GHz: <25 ms to be within 1 kHz of final frequency Units having a high-end frequency of 8.4 GHz: <5 ms to be within 1 kHz of final frequency
	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

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Spectral purity*1	Spurious signals	Harmonic and harmonic related (dBc)	Frequency range	Standard		With Option 15	
			≥0.1 Hz to <10 MHz (Option 22)	–30		–30	
			≥10 MHz to ≤50 MHz	–30		–30	
			>50 MHz to <2 GHz	–40		–40	
			≥2 GHz to ≤20 GHz	–60		–50	
			>20 GHz to ≤40 GHz	–40		–40	
			50 GHz units >40 GHz to ≤50 GHz	–40		X	
			60 GHz units >40 GHz to ≤60 GHz	–30		X	
			65 GHz units >40 GHz to ≤65 GHz	–25		X	
		Harmonic (Option 21)	≥10 MHz to 100 MHz	–40		–40	
			100 MHz to 2.2 GHz	–50		–50	
		Non-harmonic (dBc)	Frequency range	68XXXC		69XXXB	
			≥0.1 Hz to ≤10 MHz (Option 22)	–30		–30	
			≥10 MHz to <2 GHz	–40		–40	
			≥10 MHz to <2.2 GHz (Option 21)	–60		–60	
			≥2 GHz to ≤65 GHz	–60		–60	
	Single-sideband phase noise, 69XXXB (dBc/Hz)		Frequency range	Offset from carrier			
				100 Hz	1 kHz	10 kHz	100 kHz
			0.1 Hz to <10 MHz (Option 22)	–90	–120	–130	–130
			≥10 MHz to <2 GHz	–83	–100	–102	–102
			≥2 GHz to ≤6 GHz	–80	–107	–110	–107
			>6 GHz ≤10 GHz	–75	–104	–107	–107
			>10 GHz to ≤20 GHz	–69	–88	–104	–102
			>20 GHz to ≤40 GHz	–63	–92	–98	–96
			>40 GHz to ≤65 GHz	–57	–86	–92	–90
	Single-sideband phase noise, 69XXXB (dBc/Hz) with Option 21		≥10 MHz to ≤125 MHz	–113	–133	–135	–133
			>125 MHz to ≤250 MHz	–107	–130	–132	–130
			>250 MHz ≤500 MHz	–101	–125	–128	–124
			>500 MHz to ≤1050 MHz	–95	–119	–122	–119
			>1050 MHz to ≤2200 MHz	–89	–113	–116	–113
	Single-sideband phase noise, 68XXXC (dBc/Hz)		0.1 Hz to <10 MHz (Option 22)	–90	–120	–130	–130
			≥10 MHz to <2 GHz	–77	–88	–86	–100
			≥2 GHz to ≤6 GHz	–78	–88	–86	–102
			>6 GHz ≤10 GHz	–73	–86	–83	–102
			>10 GHz to ≤20 GHz	–66	–78	–78	–100
			>20 GHz to ≤40 GHz	–60	–75	–72	–94
			>40 GHz to ≤65 GHz	–54	–69	–64	–88

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Maximum leveled output power*2	Standard units	Model number	Frequency range (GHz)	Output power (dBm)	Output power with step attenuator (dBm)	Output power with electronic step attenuator (dBm)
		Option 21	10 MHz to 2.2 GHz	+13.0	+11.0	+9.0
		Option 22	≥0.1 Hz to <10 MHz	+13.0	+11.0	+9.0
		68X17C & 69X17B	≥0.1 to ≤8.4	+13.0	+11.0	+9.0
		68X37C & 69X37B	≥2 to ≤8.4 >8.4 to ≤20	+13.0 +13.0	+11.0 +11.0	+9.0 +3.0
		68X47C & 69X47B	≥0.01 to ≤8.4 >8.4 to ≤20	+13.0 +13.0	+11.0 +11.0	+9.0 +3.0
		68X67C & 69X67B	≥0.01 to <2 ≥2 to ≤20 >20 to ≤40	+13.0 +9.0 +6.0	+11.0 +7.0 +3.0	Not available
		68X77C & 69X77B	≥0.01 to <2 ≥2 to ≤20 >20 to ≤40 >40 to ≤50	+12.0 +10.0 +2.5 +2.5	+10.0 +8.5 0.0 –1.0	Not available
		68X87C & 69X87B	≥0.01 to <2 ≥2 to ≤20 >20 to ≤40 >40 to ≤50 >50 to ≤60	+12.0 +10.0 +2.5 +2.0 +2.0	+10.0 +8.5 0.0 –1.5 –2.0	Not available
		68X97C & 69X97B	≥0.01 to <2 ≥2 to ≤20 >20 to ≤40 >40 to ≤50 >50 to ≤65	+12.0 +10.0 +2.5 0.0 –2.0	Not available	Not available
	With Option 15 (high power) installed	Model number	Frequency range (GHz)	Output power (dBm)	Output power with step attenuator (dBm)	Output power with electronic step attenuator (dBm)
		68X17C & 69X17B	≥0.01 to <2 ≥2 to ≤8.4	+13.0 +17.0	+11.0 +15.0	+9.0 +11.0
		68X37C & 69X37B	≥2 to ≤8.4 >8.4 to ≤20	+17.0 +17.0	+15.0 +15.0	+11.0 +7.0
		68X47C & 69X47B	≥0.01 to <2 ≥2 to ≤8.4 >8.4 to ≤20	+13.0 +17.0 +17.0	+11.0 +15.0 +15.0	+9.0 +11.0 +7.0
		68X67C & 69X67B	≥0.01 to ≤20 >20 to ≤40	+13.0 +6.0	+11.0 +3.0	Not available

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RF output	Minimum leveled output power range	Standard units	Without an attenuator: Minimum leveled power to –20 dBm With an attenuator: Minimum leveled power to –120 dBm With an electronic attenuator: Minimum leveled power to –140 dBm				
		Units with Option 15, high power	Without an attenuator: Minimum leveled power to –10 dBm With an attenuator: Minimum leveled power to –110 dBm With an electronic attenuator: Minimum leveled power to –110 dBm				
	Power level switching time (to within specified accuracy)	Without change in step attenuator	<3 ms typical				
		With change in step attenuator	<20 ms typical				
		With change in electronic step attenuator	<3 ms typical: Power level changes across the –70 dB step will result in 20 ms delay				
	Accuracy and flatness (step sweep and CW modes)		Attenuation below max power	0.01 to 40 GHz	40 to 50 GHz	50 to 60 GHz	60 to 65 GHz
		Accuracy	0 to 25 dB	±1.0 dB	±1.5 dB	±1.5 dB	±1.5 dB
			25 to 60 dB	±1.0 dB	±1.5 dB	±3.5 dB typ.	–
			>60 dB	±1.0 dB	±2.5 dB typ.	±3.5 dB typ.	–
		Flatness	0 to 25 dB	±0.8 dB	±1.1 dB	±1.1 dB	±1.1 dB
			25 to 60 dB	±0.8 dB	±1.1 dB	±3.1 dB typ.	–
			>60 dB	±0.8 dB	±2.1 dB typ.	±3.1 dB typ.	–
	Output units		Output units may be selected as either dBm or mV. Selection of mV assumes 50 Ω load. All data entry and display are in selected units.				
	Output power resolution		0.01 dB (log) or 0.001 mV (linear)				
	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 (log) or 0.001 mV (linear)				
		Accuracy	Same as CW power accuracy				
		Log/linear sweep	Power sweep selectable as either log or linear. Log sweep is in dB; liear sweep is in mV.				
		Step size	User-controlled, 0.01 dB (log) or 0.001 mV (linear) to the full power range of the instrument				
		Step dwell time	Variable from 1 ms to 99 seconds. If the sweep crosses a mechanical 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.				
69100B/68100C modulation	Amplitude modulation*6	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 (typical)	0 to 90% linear, 20 dB log				
		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				
		External FM sensitivity*4	Continuously variable from ±10 kHz per volt to ±20 MHz per volt (locked and unlocked narrow modes), or ±100 kHz per volt to ±100 MHz per volt (unlocked wide mode)				
		Deviation*4	Unlocked wide: ±100 MHz, DC to 100 Hz rates Unlocked narrow: ±10 MHz, DC to 500 kHz rates Locked: The lesser of ±10 MHz or rate x 300, 1 kHz to 500 kHz rates				
		FM bandwidth (3 dB)	Unlocked wide: DC to 100 Hz Unlocked narrow: DC to 500 kHz Locked: 1 kHz to 500 kHz				
		Flatness	±1 dB (10 kHz to 500 kHz rates)				
		Accuracy	10% (5% typical, ±200 kHz deviation, 100 kHz rate)				
		Maximum input	±1 V				
	Square wave modulation*5	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				

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69300B/68300C modulation	Amplitude modulation*6	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
		Maximum input	±1 V
69300B/68300C modulation	Internal AM generator	Waveforms	Sinusoid, square, 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 for other waveforms
		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
		External FM sensitivity*4	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)
		Deviation*4	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)
		Maximum input	±1 V
	Internal FM generator	Waveforms	Sinusoid, square, 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 for other waveforms
		Resolution	0.1 Hz
		Accuracy	Same as instrument timebase
		Output	BNC connector, rear panel
	Phase modulation (øM, Option 6)	øM deviation*4	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.
		øM bandwidth (3 dB, relative to 100 kHz rate) øM flatness (relative to	Narrow mode: DC to 10 MHz Wide mode: DC to 1 MHz Narrow mode (DC to 1 MHz rates): ±1 dB
		100 kHz rate)	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*4	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
		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*7	On/off ratio	>80 dB
		Rise/fall time (10 to 90%)	10 MHz to 1.0 GHz: <15 ns (<10 ns typical) 1.0 GHz to 65 GHz: <10 ns (<5 ns typical)
		Minimum levelled pulse width	<100 ns (≥2 GHz), <1 µs (<2 GHz)
		Minimum unleveled pulse width	<10 ns
		Pulse overshoot	<10% (for 50, 60 and 65 GHz units, overshoot from 40 to 65 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
		PRF range	DC to 10 MHz unleveled, 100 Hz to 5 MHz leveled
		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

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69300B modulation	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
			Doublet	100 ns to 419 ms	300 ns to 1.6 s
			Triplet	100 ns to 419 ms	300 ns to 1.6 s
			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, 6X337C and 6X347C only)	Frequency range		1 to 20 GHz	
		Attenuation range*8		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*9	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 68xxxC or 69xxxB output signals to be swept with a user-selected frequency offset. One 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.	
	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 leveled output power, unless otherwise noted.
∗2: Specifications apply at 25°C ±10°C.
∗3: >40 GHz units and units with Option 15 at maximum specified leveled output power.
∗4: For 69XXXB units, maximum sensitivity, maximum deviation, and maximum modulation are reduced.
∗5: The RF output can be pulse modulated via an external modulating signal or an internal square wave generator.
∗6: All amplitude modulation specifications apply at 50% depth, 1 kHz rate, with RF level set 6 dB below maximum specified leveled output power, unless otherwise noted.
∗7: All pulse modulation specifications apply at maximum specified leveled output power, unless otherwise noted.
∗8: Maximum attenuation = attenuation ±flatness.
∗9: 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.

Digital downconverter specifications

FM/ϕM specifications:
69B synthesizers with Option 21 DDC produce output frequencies from 10 MHz to 2.2 GHz by dividing the YTO frequency by 2^n. The divisor ranges from 2 at 2.2 GHz to 256 at 10-15.625 MHz. In FM and ΦM modes, FM deviation is divided as well, so deviation at the YTO is greater than at the RF output.

Frequency range	Divide radio, n
≥10 to ≤15.625 MHz	256
>15.625 to ≤31.25 MHz	128
>31.25 to ≤62.5 MHz	64
>62.5 to ≤125 MHz	32
>125 to ≤250 MHz	16
>250 to ≤500 MHz	8
>500 to ≤1050 MHz	4
>1050 to ≤2200 MHz	2

Frequency modulation (for 691xxB):

Parameter	Modes	Conditions	Specification
Deviation	Locked Unlocked Narrow Unlocked Wide	Rate = 1 Hz to (Lesser of 500 kHz or 0.03* Fcarrier) Rate = DC to (Lesser of 500 kHz or 0.03* Fcarrier) Rate= DC to 100 Hz	± [Lesser of 10 MHz or 300 (mod rate)]/n ± (10 MHz)/n ± (100 MHz)/n
Bandwidth (3 dB)	Locked Unlocked Narrow Unlocked Wide	100 kHz rate 100 kHz rate DC rate	1 kHz to (Lesser of 500 kHz or 0.03* Fcarrier) DC to (Lesser of 500 kHz or 0.03* Fcarrier) DC to 100 Hz
Flatness	Locked	Rate = 10 kHz to (Lesser of 500 kHz or 0.01* Fcarrier)	±1 dB relative to 100 kHz rate
Accuracy	Locked and Unlocked Narrow	Rate = 100 kHz, Sineware, Int. or 1 Vpk Ext.	10% (5% typical)
External sensitivity	Locked and Unlocked Narrow Unlocked Wide		± (10 kHz/V to 20 MHz/V)/n ± (100 kHz/V to 100 MHz/V)/n

Frequency modulation (for 693xxB):

Parameter	Modes	Conditions	Specification
Deviation	Locked Locked Low-noise Unlocked Narrow Unlocked Wide	Rate = 1 kHz to (Lesser of 8 MHz or 0.03* Fcarrier) Rate = 50 kHz to Lesser of 8 MHz or 0.03* Fcarrier) Rate = DC to (Lesser of 8 MHz or 0.03* Fcarrier) Rate = DC to 100 Hz	± [Lesser of 10 MHz or 300*(mod rate)]/n ± [Lesser of 10 MHz or 3*(mod rate)]/n ± (10 MHz)/n ± (100 MHz)/n
Bandwidth (3 dB)	Locked Locked Low-noise Unlocked Narrow Unlocked Wide	100 kHz rate 100 kHz rate 100 kHz rate DC rate	1 kHz to (Lesser of 10 MHz or 0.03* Fcarrier) 30 kHz to (Lesser of 10 MHz or 0.03* Fcarrier) DC to (Lesser of 10 MHz or 0.03* Fcarrier) DC to 100 Hz
Flatness	Locked	Rate = 10 kHz to (Lesser of 1 MHz or 0.01* Fcarrier)	±1 dB relative to 100 kHz
Accuracy	Locked and Low-noise Unlocked Narrow	Rate = 100 kHz, Sinewave, Int. or 1 Vpk Ext.	10% (5% typical)
Incidental AM	Locked, Low-noise, Unlocked Narrow	Rate and Dev.= Lesser of 1 MHz or 0.01* Fcarrier	<2% typical
Harmonic distortion	Locked	Rate = 10 kHz, Dev.= ± (1 MHz)/n	<1%
External sensitivity	Locked Locked Low-noise Unlocked Narrow Unlocked Wide		± (10 kHz/V to 20 MHz/V)/n ± (100 kHz/V to 100 MHz/V)/n

Phase modulation:

Parameter	Modes	Conditions	Specification
Deviation	Narrow Wide	Rate = DC to (Lesser of 8 MHz or 0.03* Fcarrier) Rate = DC to (Lesser of 1 MHz or 0.03* Fcarrier)	± [Lesser of 3 rad or (5 MHz)/(mod rate)]/n ± [Lesser of 400 rad or (10 MHz)/(mod rate)]/n
Bandwidth (3 dB)	Narrow Wide	100 kHz rate 100 kHz rate	DC to (Lesser of 10 MHz or 0.03* Fcarrier) DC to (Lesser of 1 MHz or 0.03* Fcarrier)
Flatness	Narrow Wide	Rate = DC to (Lesser of 1 MHz or 0.01* Fcarrier) Rate = DC to (Lesser of 500 kHz or 0.01* Fcarrier)	±1 dB relative to 100 kHz rate ±1 dB relative to 100 kHz rate
Accuracy	Narrow and Wide	100 kHz, Int. or 1 Vpk Ext., sine	10%
External sensitivity	Narrow Wide		± (0.0025 rad/V to 5 rad/V)/n ± (0.25 rad/V to 500 rad/V)/n

For product ordering information, see pages 4 –10

Digital downconverter specifications (Option 21)

RF output
Frequency: 10 to 2200 MHz
Maximum leveled output power: +13 dBm, typically +19 dBm

Spectral purity
All specifications apply at +10 dBm output, unless otherwise noted.

Harmonic and harmonic related:
–40 dBc, ≤100 MHz
–50 dBc, >100 MHz

Non-harmonic spurious:
–60 dBc

AM noise:
Typically –145 dBm/Hz at 0 dBm output and offsets >5 MHz from carrier.

Power line and fan-related spurious (dBc):

Frequency Range	Offset from Carrier	
	<300 Hz	≥300 Hz
≥10 MHz to ≤500 MHz	–68	–72
>500 MHz to ≤1050 MHz	–62	–72
>1050 MHz to ≤2200 MHz	–56	–66

Pulse modulation
On/off ratio: >80 dB

Minimum leveled pulse width: 1 msec
Level accuracy relative to CW (100 Hz to 500 kHz PRF): ±0.5 dB

Frequency range	Rise and fall time	Overshoot	Width compression	Video feedthrough
>500 to ≤2200 MHz	15 ns	10%	12 ns*	±15 mV*
>125 to ≤500 MHz	<33 ns*	<11%*	12 ns*	±70 mV*
>31.25 to ≤125 MHz	<90 ns*	<22%*	12 ns*	±130 mV*
≥10 to ≤31.25 MHz	<400 ns*	<33%*	<40 ns*	±70 mV*

*: Typical

Ordering Information

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

Model/Order No.	Name
	Main frame
69017B	Ultra Low Noise Synthesized CW Generator (0.01 to 8.4 GHz)
69077B	Ultra Low Noise Synthesized CW Generator (10 MHz to 50 GHz)
69087B	Ultra Low Noise Synthesized CW Generator (10 MHz to 60 GHz)
69097B	Ultra Low Noise Synthesized CW Generator (10 MHz to 65 GHz)
69117B	Ultra Low Noise Synthesized Signal Generator (0.01 to 8.4 GHz)
69137B	Ultra Low Noise Synthesized Signal Generator (2 to 20 GHz)
69147B	Ultra Low Noise Synthesized Signal Generator (10 MHz to 20 GHz)
69167B	Ultra Low Noise Synthesized Signal Generator (10 MHz to 40 GHz)
69177B	Ultra Low Noise Synthesized Signal Generator (10 MHz to 50 GHz)
69187B	Ultra Low Noise Synthesized Signal Generator (10 MHz to 60 GHz)
69197B	Ultra Low Noise Synthesized Signal Generator (10 MHz to 65 GHz)
69317B	Ultra Low Noise High Performance Synthesized Signal Generator (0.01 to 8.4 GHz)
69337B	Ultra Low Noise High Performance Synthesized Signal Generator (2 to 20 GHz)
69347B	Ultra Low Noise High Performance Synthesized Signal Generator (10 MHz to 20 GHz)
69367B	Ultra Low Noise High Performance Synthesized Signal Generator (10 MHz to 40 GHz)
69377B	Ultra Low Noise High Performance Synthesized Signal Generator (10 MHz to 50 GHz)
69387B	Ultra Low Noise High Performance Synthesized Signal Generator (10 MHz to 60 GHz)
69397B	Ultra Low Noise High Performance Synthesized Signal Generator (10 MHz to 65 GHz)
68017C	Synthesized CW Generator (0.01 to 8.4 GHz)
68077C	Synthesized CW Generator (10 MHz to 50 GHz)
68087C	Synthesized CW Generator (10 MHz to 60 GHz)
68097C	Synthesized CW Generator (10 MHz to 65 GHz)
68117C	Synthesized Signal Generator (0.01 to 8.4 GHz)
68137C	Synthesized Signal Generator (2 to 20 GHz)
68147C	Synthesized Signal Generator (10 MHz to 20 GHz)
68167C	Synthesized Signal Generator (10 MHz to 40 GHz)
68177C	Synthesized Signal Generator (10 MHz to 50 GHz)
68187C	Synthesized Signal Generator (10 MHz to 60 GHz)
68197C	Synthesized Signal Generator (10 MHz to 65 GHz)
68317C	High Performance Synthesized Signal Generator (0.01 to 8.4 GHz)
68337C	High Performance Synthesized Signal Generator (2 to 20 GHz)
68347C	High Performance Synthesized Signal Generator (10 MHz to 20 GHz)
68367C	High Performance Synthesized Signal Generator (10 MHz to 40 GHz)
68377C	High Performance Synthesized Signal Generator (10 MHz to 50 GHz)
68387C	High Performance Synthesized Signal Generator (10 MHz to 60 GHz)
68397C	High Performance Synthesized Signal Generator (10 MHz to 65 GHz)

Continued on next page

Model/Order No.	Name
	Options
Option 1	Rack mounting: Rack mount kit containing a set of track slides (90˚ tilt capability), mounting ears, and front-panel handles to let the instrument be mounted in a standard 19 inch equipment rack
Option 2A	110 dB step attenuator: Adds a 10 dB/step attenuator with 110 dB range for models having a high-end frequency of ≤20 GHz. Rated RF output power is reduced.
Option 2B	110 dB step attenuator: Adds a 10 dB/step attenuator with 110 dB range for models having a high-end frequency of ≤40 GHz. Rated RF output power is reduced.
Option 2C	90 dB step attenuator: Adds a 10 dB/step attenuator with 90 dB range for models having a high-end frequency of ≤50 GHz. Rated RF output power is reduced.
Option 2D	90 dB step attenuator: Adds a 10 dB/step attenuator with 90 dB range for models having a high-end frequency of ≤60 GHz. Rated RF output power is reduced.
Option 2E	120 dB electronic step attenuator: Adds a 10 dB/step electronic attenuator with a 120 dB range for models having a high-end frequency of ≤8.4 GHz. Rated RF output power is reduced.
Option 2F	120 dB electronic step attenuator: Adds a 10 dB/step electronic attenuator with a 120 dB range for models having a high-end frequency of ≤20 GHz. Rated RF output power is reduced.
Option 6	Phase modulation (ΦM) (683xxC and 693xxB): Provides phase modulation capability. FM input, FM output and FM generator become FM/ΦM input, FM/ΦM output and FM/ΦM generator.
Option 7	Delete AM/FM generators (683xxC and 693xxB): Deletes the internal AM and FM generators. External AM and FM capability remains unchanged. (Not available in combination with Option 8 or Option 20.)
Option 8	Internal power meter (683xxC and 693xxB): Adds an internal power meter that is compatible with Anritsu 560-7, 5400-71, or 6400-71 series detectors. (Not available in combination with Option 7.)
Option 9	Rear panel RF output: Moves RF output connector to the rear panel
Option 10	Complex modulation capability (683xxC and 693xxB): Provides user-defined waveform capability for complex modulation. Requires controller (not included). Includes cable and Windows® based software
Option 11	0.1 Hz frequency resolution: Provides frequency resolution of 0.1 Hz
Option 14	Rack mounting without chassis slides: Modifies rack mounting hardware to install unit in a console that has mounting shelves
Option 15A	High power output (680xxC, 681xxC, 690xxB and 691xxB): Adds high-power RF components to the instrument in the 2 to 20 GHz frequency range
Option 15B	High power output (683xxC and 693xxB): Adds high-power RF components to the instrument in the 2 to 20 GHz frequency range
Option 16	High stability time base: Adds an ovenized, 10 MHz crystal oscillator as a high-stability time base. Derate phase noise specification at 10 Hz offset by 8 dB.
Option 17A	Delete front panel (691xxB and 693xxB): Deletes the front panel for use in remote control applications where a front-panel display and keyboard control are not needed
Option 17B	Delete front panel (690xxB): Deletes the front panel for use in remote control applications where a front-panel display and keyboard control are not needed

Model/Order No.	Name
Option 18	mmWave bias output: Adds rear-panel bias output to drive 54000-xWRxx millimeter wave source modules. BNC Twinax connector. (Not available in combination 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 69337B, 69347B, 68337C and 68347C only. Requires an external modulating signal input. (Not available in combination with Option 7, Option 18, or Option 22.)
Option 21	High spectral purity down converter: Adds CW, sweep, and pulse modulation frequency coverage from 10 MHz to 2.2 GHz for models having a low-end frequency of 10 MHz. Provides ultra-low phase noise harmonics.
Option 22	0.1 Hz to 10 MHz audio frequency: Adds CW and step sweep frequency coverage below 10 MHz for models having a low-end frequency of 10 MHz. Covers frequencies down to 0.1 Hz with Option 11 or 1 kHz without Option 11. (Not available with Option 20.)
	Accessories
34RKNF50	Ruggedized K-to-Type N female adapter, DC to 20 GHz
34RVNF50	Ruggedized V-to-Type N female adapter, DC to 20 GHz
34VKF50	V male-to-K female Precision Adapter, DC to 46 GHz,
ND36329	MASTER/SLAVE interface cable set
D37178-2	Protective front panel cover
760–177	Transit case
2300-218	Anritsu power tools: Provides comprehensive interface dll's to be used as drivers for any Windows® based application. Includes driver for National Instruments LabView® and complex modulation interface software.
806-90	Aux I/O interface cable
	Millimeter wave accessories
54000-4WR15	50 to 75 GHz, V band X4 multiplier-source module (includes A36599 power cable and 3 filters)
54000-5WR15	50 to 75 GHz, V band X4 multiplier-source module with internal reference coupler/detector (includes A36599 power cable, 3 filters, and 560-10BX-2 detector adapter cable)
54000-4WR10	75 to 110 GHz, W band X6 multiplier-source module with internal reference coupler/detector (includes A36599 power cable and 3 filters)
54000-5WR10	75 to 110 GHz, W band X6 multiplier-source module with internal reference coupler/detector (includes A36599 power cable, 3 filters, and 560-10BX-2 detector adapter cable)
N120-6	Semi-rigid cable, N (m) to N (m), 6 inches long, connects synthesizer's RF output to multiplier's RF input. (Also requires 34RKNF50 or 34RVNF50 Adapter.)
	Upgrades
	Economical upgrades are available to upgrade any model to any higher performing model or to upgrade 68xxxC synthesizers to 69xxxB synthesizers. Consult Anritsu for details.

For product ordering information, see pages 4 –10

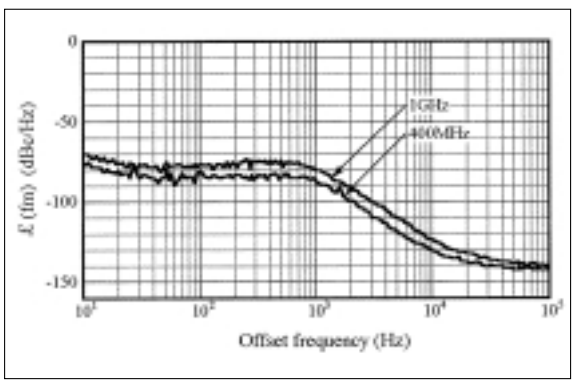
SYNTHESIZED SIGNAL GENERATOR
MG3641A/MG3642A

125 kHz to 1040/2080 MHz

Economic High-Performance Signal Sources

GPIB

New Anritsu synthesizer technology permits frequency to be set with a resolution of 0.01 Hz across the full frequency range, and the non-harmonic spurious is better than –100 dBc for reliable measurement at any frequency. A unique low-noise YIG oscillator produces a high-purity signal with SSB phase noise of better than –130 dBc/Hz (1 GHz, 20 kHz offset) making these signal generators for interference testing of radio receivers and as sources for various local and reference signals.



SSB phase noise characteristic

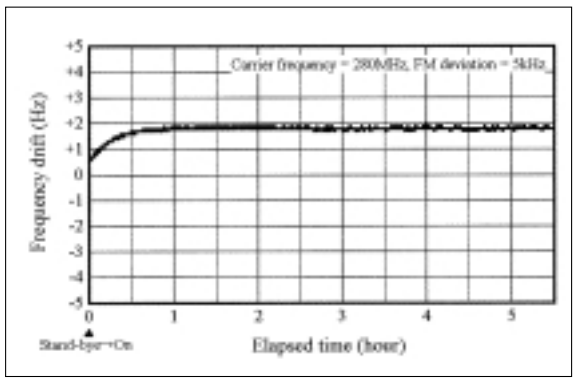
Features

- 0.01 Hz, 0.01 dB setting resolution
- High signal purity (–100 dBc spurious)
- Versatile modulation functions

Performance

• High-stable carrier frequency

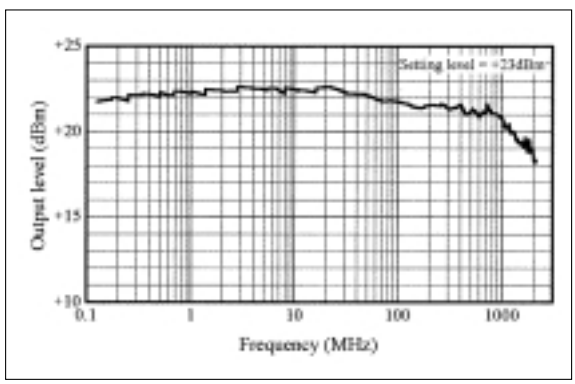
Carrier frequency is produced by a high-stability crystal oscillator. Furthermore, the carrier frequency remains phase locked even at frequency modulation. Then frequency calibration for testing FSK modulation receivers such as paging system is not necessary.



Carrier wave frequency stability at frequency modulation

• High output

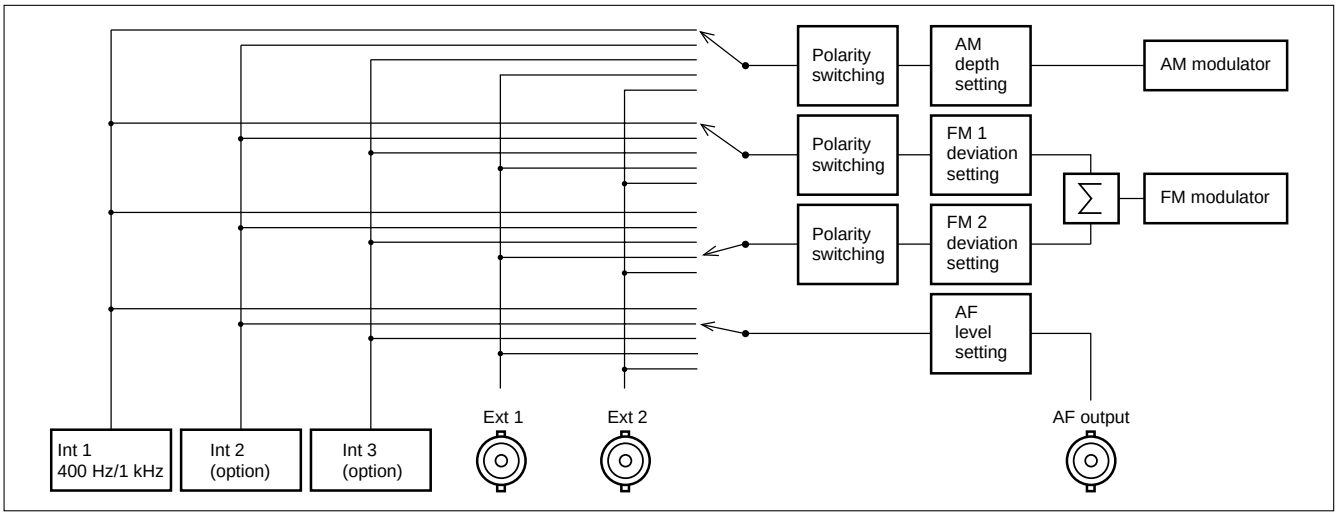
A stable signal with an output of +17 dBm can be output across the full frequency range to drive a variety of local signal sources and power amplifiers. In addition, an overdrive level up to +23 dBm can be set so as to make full use of the internal amplifier capability. If the amplifier's output power comes up to the limitation and output power does not reach the set value, a status message is displayed. This is useful for confirming the output limits.



Maximum output level

• Various modulation types

Up to three internal AF signal sources can be incorporated by adding options to the standard sine-wave oscillator (1 kHz, 400 Hz). The AF synthesizer (Option 21) is a digital synthesizer for generating sine-wave, triangular, square, and sawtooth waveforms; it can also be used as a function generator as well as a modulation signal source. In addition to permitting simultaneous one-route AM and two-route FM modulation, the modulation factor and polarity can be set independently. Installing the pulse modulator (Option 11) in the MG3641A/3642A allows them to generate high-speed pulse modulation using an external modulation signal (TTL level). The output can be used for various burst signals with an ON/OFF ratio of more than 80 dB, as well as a pseudo-random signal for radar. Installing the pattern generator (Option 23) in the MG3641A/3642A allows them to generate FSK or pulse modulation combined with FSK encoder (Option 22) or pulse modulator (Option 11) without an external instrument.

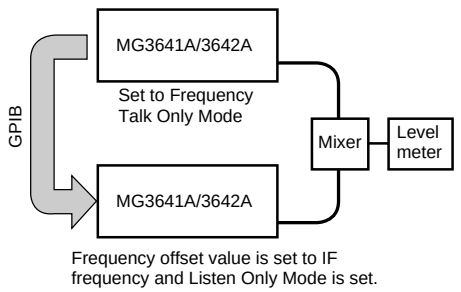


• GPIB Only-Mode linked operation

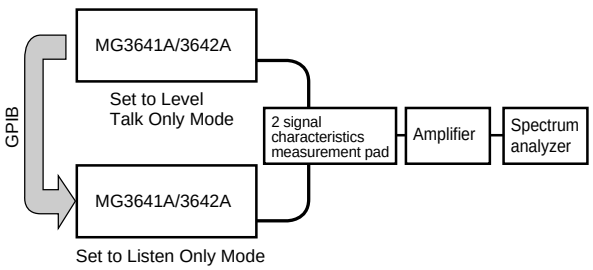
Two sets of MG3641A/3642A can be linked and operated without an external controller using the Frequency and Output Level Only Modes. The Frequency Only Mode in the frequency offset functions is used for evaluating the characteristics of mixers. The Level Only Mode is useful for evaluating the cross-modulation characteristics of non-linear devices such as amplifiers.

• Pattern generator (Option 23)

Installing the pattern generator (Option 23) in the MG3641A/3642A allows them to generate FSK or pulse modulation combined with FSK encoder (Option 22) or pulse modulator (Option 11) without an external instrument.



Measurement example of mixer characteristics using Frequency Only Mode and frequency offset



An example of amplifier IM3 measurement using Level Only Mode

Specifications

• MG3641A/3642A (main frame)

Carrier frequency	Range: 125 kHz to 1040 MHz (MG3641A), 125 kHz to 2080 MHz (MG3642A) Resolution: 0.01 Hz Accuracy: Reference oscillator accuracy; reference oscillator accuracy ±(0.3% of FM setting deviation + 5 Hz) at frequency modulation Internal reference oscillator[*1] Frequency: 10 MHz; Aging rate: ±5 x 10^{-9}/day; Start-up characteristics: 1 x 10^{-7}/10 min (for 24 h after power on), Temperature stability: ±3 x 10^{-8} (0˚ to 50˚C) External reference input: 5/10 MHz, ±10 ppm, ≥0.7 Vp-p/50 Ω (AC coupling), BNC connector (rear panel) Buffer output: 10 MHz, TTL level (DC coupling), BNC connector (rear panel) Switching time: <40 ms (external control, response time from last command until becomes within ±0.1 ppm of set frequency)

Continued on next page

<table>
<tr><td>Output</td><td>
Range: –143 to +17 dBm (settable range: –143 to +23 dBm)
Units: dBm, dBμ, V, mV, μV (dBμ, V, mV and μV switchable between termination voltage display and open voltage display)
Resolution: 0.01 dB
Frequency characteristics (at 0 dBm): ±0.5 dB, ±1.0 dB (pulse modulation: on)*2
Accuracy: ±1 dB (–127 to +17 dBm, upper limit at pulse modulation*2: +12 dBm), ±3 dB (<–127 dBm)
Impedance: 50 Ω (N connector), VSWR: <1.5 (≤–3 dBm), <2.5 (>–3 dBm)
Switching time: <50 ms (normal mode), <100 ms (level safety mode), <10 ms (continuous mode)
∗Response time from last command until becomes within ±0.5 dB of final level
Special setting mode
Continuous mode: Variable within set value ±10 dB with no interruption of output
Safety mode: Prevent large spike signal generation when operating mechanical-type attenuator
Interference radiation: <0.1 μV (at output frequency), <1 μV (over entire frequency range, multi-menu display: OFF)
∗At point 25 mm from cabinet measured with 25 mm diameter loop antenna (2 windings) terminated at 50 Ω
</td></tr>
<tr><td>Signal purity</td><td>
Spurious (CW mode, ≤+7 dBm)
Harmonics: <–30 dBc (2nd, 3rd)
Non-harmonic: <–100 dBc (≥15 kHz offset)
Those related power: <–40 dBc (<15 kHz offset)
SSB phase noise (CW Mode, 20 kHz offset):
<–140 dBc/Hz (10 to <256 MHz), <–136 dBc/Hz (256 to <512 MHz), <–130 dBc/Hz (512 to 1040 MHz),
<–124 dBc/Hz (>1040 MHz, MG3642A only)
Residual AM: <–80 dBc (≥500 kHz, CW mode, +7 dBm, 50 Hz to 15 kHz demodulation band)
Residual FM (CW mode)
300 Hz to 3 kHz demodulation band: <4 Hzrms (10 to <512 MHz), <8 Hzrms (512 to 1040 MHz), <16 Hzrms (>1040 MHz, MG3642A only)
50 Hz to 15 kHz demodulation band: <5 Hzrms (10 to <512 MHz), <10 Hzrms (512 to 1040 MHz), <20 Hzrms (>1040 MHz, MG3642A only)
</td></tr>
<tr><td>Amplitude modulation</td><td>
Range: 0% to 100%
Resolution: 0.1%
Accuracy: ±(5% of set value + 2%) ∗≥0.4 MHz, ≤+7 dBm, ≤90% AM, source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
Modulation frequency response (output: ≤+7 dBm)
<table>
<tr><th rowspan="2">Carrier frequency</th><th colspan="2">Upper limit frequency</th><th rowspan="2">Lower limit frequency</th></tr>
<tr><th>AM: 30%</th><th>AM: 90%</th></tr>
<tr><td>0.4 to <0.5 MHz</td><td>2 kHz (±1 dB bandwidth)</td><td>1 kHz (±1 dB bandwidth)</td><td rowspan="5">DC: External DC coupling (±1 dB bandwidth)
20 Hz: External AC coupling (±1 dB bandwidth)</td></tr>
<tr><td>0.5 to <2 MHz</td><td>10 kHz (±1 dB bandwidth)</td><td>5 kHz (±1 dB bandwidth)</td></tr>
<tr><td>2 to <32 MHz</td><td colspan="2">20 kHz (±1 dB bandwidth)</td></tr>
<tr><td>32 to <64 MHz</td><td colspan="2">50 kHz (±1 dB bandwidth)</td></tr>
<tr><td>≥64 MHz</td><td colspan="2">50 kHz (±1 dB bandwidth), 100 kHz (±3 dB bandwidth)</td></tr>
</table>
Distortion: <–40 dB (30% AM), <–30 dB (90% AM) ∗≥0.4 MHz, ≤+7 dBm, source: Int 1 (1 kHz)
Incidental FM: <200 Hz peak ∗≥0.4 MHz, ≤AM: 30%, ≤+7 dBm, source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
Modulation signal source: One of internal (Int 1, Int 2, Int 3) and external (Ext 1, Ext 2)
Modulation signal polarity: Positive/negative switchable
</td></tr>
<tr><td>Frequency modulation</td><td>
Range:
0 to 125 Hz (125 to <250 kHz) 0 to 25.6 kHz (16 to <32 MHz)
0 to 250 Hz (250 to <500 kHz) 0 to 51.2 kHz (32 to <64 MHz)
0 to 500 Hz (0.5 to <1 MHz) 0 to 102 kHz (64 to <128 MHz)
0 to 1 kHz (1 to <2 MHz) 0 to 256 kHz (128 to <256 MHz)
0 to 2 kHz (2 to <4 MHz) 0 to 512 kHz (256 to <512 MHz)
0 to 4 kHz (4 to <8 MHz) 0 to 1024 kHz (512 to 1040 MHz)
0 to 10 kHz (8 to <16 MHz) 0 to 2048 kHz (>1040 MHz, MG3642A only)
Resolution:
1 Hz (0 to 4 kHz deviation) 250 Hz (102.25 to 256 kHz deviation)
10 Hz (4.01 to 10 kHz deviation) 500 Hz (256.5 to 512 kHz deviation)
25 Hz (10.025 to 25.6 kHz deviation) 1 kHz (513 to 1024 kHz deviation)
50 Hz (25.65 to 51.2 kHz deviation) 1 kHz (1025 to 2048 kHz deviation, MG3642A only)
100 Hz (51.3 to 102 kHz deviation)
Accuracy: ± (5% of set value + 10 Hz) (0.4 to <512 MHz), ± (5% of set value + 20 Hz) (512 to 1040 MHz)
± (5% of set value + 40 Hz) (>1040 MHz, MG3642A only)
∗Source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
Modulation frequency response: DC or 20 Hz*3 to 20 kHz (0.4 to <10 MHz), DC or 20 Hz*3 to 100 kHz (≥10 MHz) ∗±1 dB bandwidth
Distortion: <–40 dB ∗≥16 MHz, 3.5 kHz deviation, source: Int 1 (1 kHz)
<–45 dB ∗≥16 MHz, 22.5 kHz deviation, source: Int 1 (1 kHz)
Incidental FM: <1% peak ∗≥64 MHz, ≤+7 dBm, 100 kHz deviation, source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
External modulation group delay: <30 μs ∗≥10 MHz, source: external DC coupling mode, modulation rate: ≤100 kHz
Modulation signal source (FM1, FM2): One of internal (Int 1, Int 2, Int 3), and external (Ext 1, Ext 2)
Modulation signal polarity: FM1, FM2 positive/negative switchable
</td></tr>
<tr><td>Pulse modulation</td><td>According to option specifications</td></tr>
<tr><td>Modulation signal source</td><td>
Internal modulation (Int 1)
Frequency: 400 Hz, 1 kHz
Accuracy: Same as reference oscillator accuracy
Internal modulation (Int 2, Int 3): According to option specifications
External modulation (Ext 1, Ext 2)
Proper input level: 2 Vp-p approx.
Input impedance: 600 Ω, BNC connector
Coupling: DC/AC switchable
</td></tr>
<tr><td>AF output</td><td>
Output signal source: One of internal (Int 1, Int 2, Int 3), and external (Ext 1, Ext 2)
Output level: 0 to 4 Vp-p
Output level resolution: 1 mVp-p
Output level accuracy: ± (5% of setting level + 2 mVp-p) ∗Source: Int 1 (1 kHz)
Impedance: 600 Ω, BNC connector
</td></tr>
</table>

Continued on next page

Simultaneous modulation	Excluding amplitude modulation and pulse modulation*2 combination, simultaneous modulation, modulation rate, deviation independently settable
Sweep function	Sweep parameters: Frequency, output level, memory Sweep patterns Frequency sweep (start/stop): Linear (specified step size and number of points), Log (multiplying factor: 1%) Frequency sweep (center/span): Linear (specified step size and number of points) Level sweep (start/stop, center/span): dB (specified step size and number of points) ∗Sweep: continuous mode (max. 20 dB width) Memory sweep: Start/stop Sweep mode: Auto, single, manual Sweep time Setting range: 1 ms to 600 s/point ∗Actual sweep time depends on sweep parameter (frequency, output level) Resolution: 10 µs/point Auxiliary output X-Out: Ramp waveform (sweep start point: 0 V, sweep end point: +10 V), BNC connector (rear panel) Z-Out: TTL level (H-level at sweeping), BNC connector (rear panel) Blanking-Out: TTL level (L-level at switching), BNC connector (rear panel) Maker-Out: TTL level (H-level at marker match), BNC connector (rear panel)
Functions	Relative display: Carrier frequency, output level Offset display: Carrier frequency, output level Memory: Saves/recalls 1000 panel settings; recall contents: panel, frequency, frequency/output level selection Trigger: An external trigger signal (rear panel BNC connector, TTL level) can be used to execute a previously programmed operation sequence (except power switch, preset key, local key and rotary knob operations). Max. number of sequence steps of trigger program: 20 steps Back-up: The panel settings before power-off are back-upped and displayed again at power-on, except data-input contents, GPIB data contents, remote settings, RPP operations GPIB control: All functions, except power switch, local key, rotary knobs, and resolution keys (Interface: SH1, AH1, T5, L3, TE0, SR1, RL1, PP0, DC1, DT1, C0, E2)
Reverse power protection	Max. reverse input power: ≤50 W (≤1040 MHz), ≤25 W (>1040 MHz, MG3642A only), ±50 Vdc
Power supply	*4 Vac (+10%, –15%), 47.5 to 63/380 to 420 Hz, ≤200 VA
Temperature	Operating: 0˚ to +50˚C, Storage: –30˚ to +71˚C
Dimensions and mass	320 (W) x 177 (H) x 451 (D) mm, ≤20 kg
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

∗1: Can be changed to 5 x 10^{-10}/day using reference crystal oscillator (Option 01)
∗2: Only with pulse modulator (Option 11) installed
∗3: External DC coupling: DC, External AC coupling: 20 Hz
∗4: Specify a nominal voltage of either 100 V and 240 V when ordering; the maximum operating voltage is 250 V.

• Options

Option 01: Reference oscillator	Frequency: 10 MHz Aging rate: 5 x 10^{-10}/day Temperature stability: ±5 x 10^{-9} (0˚ to 50˚C)
Option 11: Pulse modulator	Frequency: 125 kHz to 2080 MHz On/off ratio: >80 dB Rise/fall time: <100 ns Min. pulse width: <500 ns Pulse repetition rate: DC to 1 MHz Max. delay time: <100 ns Overshoot, ringing: <20% Video feed-through: <20% Pulse modulation input: 50/600 Ω, TTL (positive logic), BNC connector (rear panel)
Option 21: AF synthesizer	Frequency: 0.01 Hz to 400 kHz (sine-wave), 0.01 Hz to 50 kHz (triangular, square and sawtooth waveforms) Resolution: 0.01 Hz Waveform: Sine-wave, triangular, square and sawtooth waveforms Frequency accuracy: Same as reference oscillator accuracy
Option 22: FSK encoder	Frequency shift (Data 2^1, Data 2^0) = (0, 0): –frequency deviation setting, (Data 2^1, Data 2^0) = (0, 1): –frequency deviation setting/3, (Data 2^1, Data 2^0) = (1, 0): +frequency deviation setting, (Data 2^1, Data 2^0) = (1, 1): +frequency deviation setting/3 Frequency set Free: Frequency shift simultaneously with data input Rise trigger: Frequency shift at external clock rise time Fall trigger: Frequency shift at external clock fall time Baseband filter Filter type: 10-th order Bessel filter Cut-off frequency: 100 Hz to 30 kHz (–3 dB) Setting resolution: Upper 2 digits Frequency deviation accuracy: Depends on frequency modulation deviation accuracy of main frame (at by-pass to baseband filter) External modulation input Data $2^0/2^1$: TTL level (pull-down), BNC connector (rear panel) External clock input: TTL level (pull-up), BNC connector (rear panel)

Continued on next page

Option 23: Pattern generator	Data pattern	Free	Number of memories: 4 (defined: 1 to 4) Memory capacity: 524,288 bits/memory Pattern output Range: Top address and data bit length can be set for the respective free-pattern memories. Top address setting range: 00000 to 65,535 Data bit length setting range: 2 to 524,288 bits (Final address of output: 65,535 or less) Memory: Saves 1-byte units via GPIB interface Saves when pattern generator output off, or idle pattern being output
		Fixed	PN9 pseudorandom pattern (conforming to ITU-T V.52), PN15 pseudorandom pattern (conforming to ITU-T O.151), 01 fixed pattern
	Idle pattern		Number of memories: 1 (idle) Memory capacity: 524,288 bits Pattern output Range: The top address and data bit length can be set. Top address setting range: 00000 to 65,535 Data bit length setting range: 2 to 524,288 bits (final address of output: 65,535 or less.) Memory: Saves 1-byte units via GPIB interface Saves when pattern generator output off
	Output method		Single: Specified data pattern output once only (PN9 and PN15 are output twice.) Continuous: Specified data pattern output continuously When the data pattern is not output, the idle pattern is output continuously.
	Output rate		Range: 1 to 99,999 bps (resolution: 1 bps) Accuracy: Same as reference oscillator of MG3641A/3642A
	Output system		1-bit NRZ output (corresponding to binary data output): Data is output to the Data 2^1 Output sequentially, one bit after another starting from the top bit. The logic of Data 2^0 is fixed to 0. 2-bit NRZ output (corresponding to quadrature data output): Data is output to the Data 2^1 Output and Data 2^0 Output sequentially, two bits after another, starting from the top bit.
	Output level		Data 2^0 Output: TTL level Data 2^1 Output: TTL level Clock Output: TTL level, rising

• MX364001B Software for Pattern Generator Data Write

Read-out data format	DOS text file
Write memory	Data pattern memory (defined: 1 to 4), idle pattern memory (idle)
Contents of write data	Pattern data: 2 to 524,288 bits/memory (text format file) Top address of output: 0 to 65,535 (any settable) Data bit length: 2 to 524,288 bits (Bit length of pattern data automatically calculated and written) Data name: Maximum eight characters (Idle pattern memory cannot be named.)
PC	IBM PC/AT compatible
Supporting OS	Microsoft® Windows 95®
Interface	GPIB (National Instruments PCI-GPIB or PCMCIA-GPIB)

Ordering information

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

Model/Order No.	Name	
	Main frame	
MG3641A	Synthesized Signal Generator	
MG3642A	Synthesized Signal Generator	
	Standard accessories	
	Power cord, 2.5 m:	1 pc
B0325	GPIB connector shielded cap:	1 pc
F0013	Fuse, 5 A (for 100 Vac mains):	2 pcs
F0012	Fuse, 3.15 A (for 200 Vac mains):	2 pcs
W1137AE	MG3641A/3642A operation manual:	1 copy
W1137BE	MG3641A/3642A service manual:	1 copy
	Options	
MG364[ ]A-01	Reference oscillator (aging rate: 5 x 10^{-10}/day)	
MG364[ ]A-11	Pulse modulator (pulse repetition rate: DC to 1 MHz)	
MG364[ ]A-21	AF synthesizer (0.01 Hz to 400 kHz, resolution: 0.01 Hz)	
MG364[ ]A-22	FSK encoder (2 or 4 levels FSK)	
MG364[ ]A-23	Pattern generator	
	Application software	
MX364001B*1	Software for Pattern Generator Data Write (Microsoft® Windows 95)	

Model/Order No.	Name
	Optional accessories
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m
J0127A	Coaxial cord (BNC-P · RG58A/U · BNC-P), 1 m
J0007	GPIB cable, 1 m
J0008	GPIB cable, 2 m
MA1612A	Four-Point Junction Pad
MP721[ ]	Attenuator (DC to 12.4 GHz)
B0395C	Rack mount kit (EIA/IEC)
B0329G	Front cover (3/4MW 4U)
B0412A	Carrying case (with casters and B0329G front cover)
B0330B	Tilt bail (3/4MW 450D)

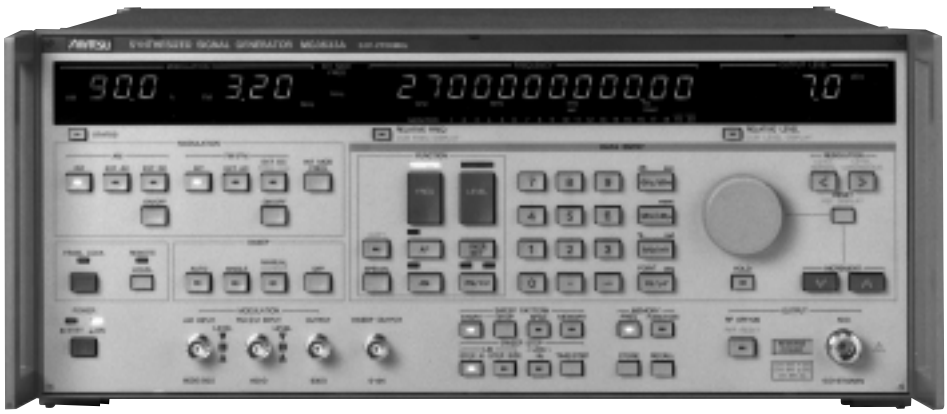
*1: The following items are required to use the MX364001B, and must be provided by the user.

IBM PC/AT® Personal computer	486DX4 (75 MHz or higher), with RAM of 32 MB or more (recommended) on which Windows 95® is installed 3.5 inch FD drive (for program installation)
GPIB interface	PCMCIA-GPIB or PCI-GPIB or equivalent GPIB interface manufactured by National Instruments Inc., supporting NI-488.2®

Microsoft Windows 95 is a registered trademark of Microsoft Corporation in the USA and other countries.
IBM AT is a registered trademark of International Business Machines.
NI-488.2 is a registered trademark of National Instruments Inc.

SYNTHESIZED SIGNAL GENERATOR
MG3633A
10 kHz to 2700 MHz

For Evaluating of Quasi-Microwaves and Measuring High-Performance Receivers



GPIB

The MG3633A has excellent frequency resolution, frequency switching speed, signal purity, and a high output level, in addition to amplitude, frequency, and phase modulation functions. Also, sweep functions are provided for carrier frequency, output level, and modulation frequency so an appropriate sweep can be performed for various devices to be measured.
Also, the MG3633A has a frequency memory that can store 1000 carrier frequencies and a function memory that stores 100 panel settings. Moreover, since the maximum output level is +17 dBm, it can be used for various local signal sources.
The MG3633A is suitable for research and development of mobile communications in the quasi-microwave band, performance evaluation, characteristics testing, and adjustment of various types of radio equipment such as digital land-based mobile communications, mobile satellite communications, satellite broadcasting, and radio LANs.

Features

• Low noise
By using both the latest synthesizer and RF-device technologies and optical data links in the internal control circuit, the SSB phase noise has been cut to –140 dBc/Hz (CW, 1.1 GHz, offset 20 kHz). In particular, the MG3633A shows its power in measurement of narrowband radio equipment S/N ratio and adjacent channel selectivity.

• High accuracy and high-output level
Low levels of –123 dBm can be set with ±1 dB accuracy by using a high-accuracy programmable attenuator. The output level can be displayed in units of dBm, dBµV, V, mV, and µV or as a relative value (dB).

• Modulation characteristics
The MG3633A has AM, FM, øM, and a combination of all three modulation functions. A DC mode is provided for FM, which makes simulation of digital transmissions for a pager possible. Also, a built-in AF oscillator with a 0.1 Hz to 100 kHz synthesizer can handle various modulations.

• Quasi-microwave output
The MG3633A covers a wide range (from 10 kHz to 2700 MHz) and is suitable for research and development, as well as production of quasi-microwave band radio equipment.

Performance

• Signal purity
The MG3633A has excellent spectral purity. As shown in the Fig. 1, the SSB phase noise at 1 GHz with 20 kHz signal offset is –140 dBc/Hz. In particular, this shows its power for generating signals used for testing radio receiver selectivity, for generating high-speed clocks of A/D converters and dividers, as well as for generating standard signals for communications links. Also, since the residual FM is 0.8 Hz rms or less (1.28 GHz or less), even the S/N ratio of narrowband mobile radio equipment can be measured with sufficient margin (Fig. 2)

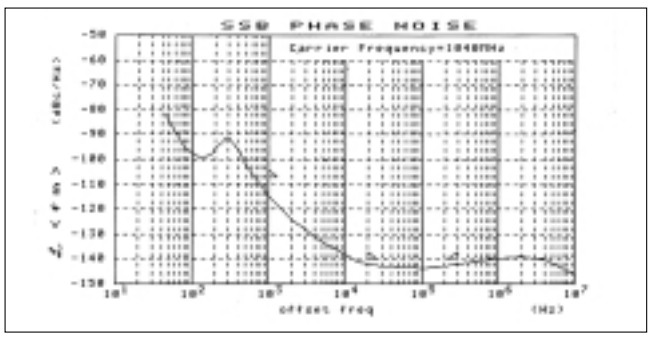


Fig. 1 SSB phase noise

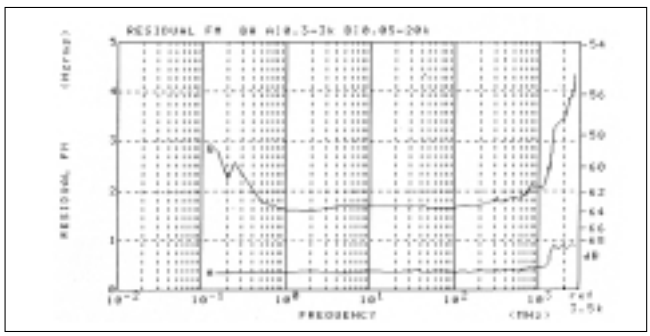


Fig. 2 Residual FM

For product ordering information, see pages 4 – 10

• Output level characteristics
A maximum output of +17 dBm can be obtained over a wide frequency range so 2-signal or 3-signal testing can be done easily. A high-accuracy highly-reliable programmable attenuator (life cycle over 3 million times) is used and, since flat output characteristics are obtained by internal calibration over a wide range from 10 kHz to 2.7 GHz, it is effective for testing antennas and cables (Fig. 3).
Moreover, compensation data for obtaining flat levels at cable ends can be input by using a power meter, GPIB, controller, and frequency-response compensation software (option).

• Continuously variable output level
The MG3633A can output continuously-variable signals in a 20 dB range with 0.1 dB steps at any level. This is especially convenient for measuring the dynamic range of magnetic tape and squelch sensitivity of radios which produce hysteresis phenomenon as a result of level variation.

• AM
A high-accuracy AM wave is generated over a wide frequency range (Fig. 4). Countermeasures against carrier-wave variation due to vibration permit even SSB radio equipment to be tested with confidence.

• FM
FM with a maximum frequency deviation of 3.2 MHz is possible (1.28 to 2.7 GHz). Also if the frequency deviation is too low, automatic operation is carried out in the stabilized DC-FM mode so even digital data transmission equipment such as papers can be tested (Fig. 5).

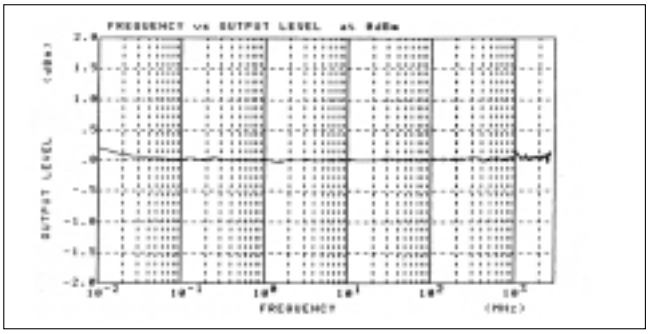


Fig. 3 Output level frequency response

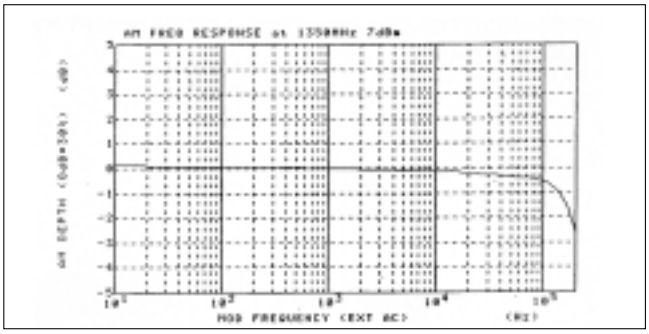


Fig. 4 AM modulation frequency characteristics

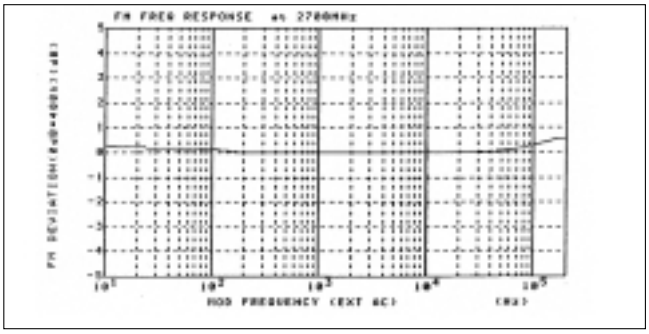


Fig. 5 FM modulation frequency characteristics

Specifications

Carrier frequency	Range	10 kHz to 2700 MHz		
	Resolution	0.01 Hz		
	Accuracy	Same as that of the reference oscillator		
	Internal reference oscillator*1	Frequency: 10 MHz Start-up characteristics: After 30 minutes of operation: ≤1 x 10^{-7}/day, after 60 minutes of operation: ≤5 x 10^{-8}/day, Aging rate: After 24 hours of operation: ≤2 x 10^{-8}/day, Temperature characteristics: ±5 x 10^{-8} (0° to 50°C)		
	External reference signal input	10 MHz, TTL Level, BNC connector on rear panel		
	Reference signal output	10 MHz, TTL Level, BNC connector on rear panel		
	Switching time	≤10 ms (time from last command until frequency has stabilized to within ±500 Hz of set frequency, during remote operation)		
Output	Range	–143 to +23 dBm		
	Units	dBm, dBμV, V, mV, μV (Terminated and open voltages are selectable for dBμV, V, mV or μV.)		
	Resolution	0.1 dB		
	Frequency response	±0.5 dB referred to 0 dBm (<1280 MHz), ±1 dB referred to 0 dBm (≥1280 MHz)		
	Accuracy	Frequency / Output level	10 kHz to <1280 MHz	≥1280 MHz
		+17.1 to +23 dBm	–	–
		+15.1 to +17 dBm	±1 dB	–
		–122.9 to +15 dBm	±1 dB	±2 dB
		–132.9 to –123 dBm	±3 dB	±4 dB
		–143 to –133 dBm	–	–
	Impedance	50 Ω, N-type connector VSWR: ≤1.5 (<1280 MHz, ≤–3 dBm), ≤1.8 (≥1280 MHz, ≤–3 dBm)		
	Switching time	Time from last command until output level is stabilized, during remote operation:≤25 ms (at LEVEL NORMAL mode) ≤80 ms (when setting level is crossing over –59 dBm, at LEVEL NORMAL mode) ≤5 ms (at LEVEL CONTINUOUS mode)		
	Interference radiation	≤1 μV (Value is voltage terminated with 50 Ω load, measured 25 mm from front panel with a two-turn 25 mm diameter loop antenna.) Except sweep mode		

Continued on next page

<table>
<tr><td rowspan="11">Signal purity</td><td>Spurious</td><td colspan="3">At +7 dBm, CW mode: (fc: carrier frequency)</td></tr>
<tr><td></td><td colspan="3">Harmonics (2nd, 3rd): ≤–30 dBc (at ≥100 kHz)
Sub-harmonics (fc/2, 3fc/2, 5fc/2): None (at <1280 MHz), ≤–30 dBc (at ≥1280 MHz)
Non-harmonics:
≤–80 dBc (fc<640 MHz, ≥10 kHz offset)
≤–74 dBc (640 MHz≤fc<1280 MHz, ≥10 kHz offset)
≤–68 dBc (fc≥1280 MHz, ≥10 kHz offset)</td></tr>
<tr><td rowspan="9">SSB phase noise</td><td colspan="3">At +7 dBm, CW mode, 0˚to 35˚C</td></tr>
<tr><td>Offset frequency</td><td>1 kHz</td><td>20 to 300 kHz</td></tr>
<tr><td>0.01 to <40 MHz</td><td>–116 dBc/Hz</td><td>–140 dBc/Hz</td></tr>
<tr><td>40 to <300 MHz</td><td>–119 dBc/Hz</td><td>–145 dBc/Hz</td></tr>
<tr><td>300 to <600 MHz</td><td>–113 dBc/Hz</td><td>–143 dBc/Hz</td></tr>
<tr><td>600 to <1100 MHz</td><td>–107 dBc/Hz</td><td>–140 dBc/Hz</td></tr>
<tr><td>1.1 to <2.4 GHz</td><td>–101 dBc/Hz</td><td>–132 dBc/Hz</td></tr>
<tr><td>2.4 to 2.7 GHz</td><td>–97 dBc/Hz</td><td>–120 dBc/Hz</td></tr>
<tr><td colspan="3">Floor noise: ≤145 dBc/Hz (40 to <1100 MHz)</td></tr>
<tr><td>Residual AM</td><td colspan="3">≤0.02% rms at ≥150 kHz (demodulation band: 300 Hz to 3 kHz)</td></tr>
<tr><td>Residual FM</td><td colspan="3">≤0.8 Hz rms at <1280 MHz (demodulation band: 300 Hz to 3 kHz)
≤4 Hz rms at <1280 MHz (demodulation band: 50 Hz to 20 kHz)</td></tr>
<tr><td rowspan="8">Amplitude modulation</td><td>Range</td><td colspan="3">0 to 100%</td></tr>
<tr><td>Resolution</td><td colspan="3">0.1%</td></tr>
<tr><td>Internal modulation frequency</td><td colspan="3">Fixed frequency: 400 Hz, 1 kHz
Variable frequency: 0.1 Hz to 50 kHz, 0.1 Hz resolution
Frequency accuracy: 100 ppm</td></tr>
<tr><td>Accuracy</td><td colspan="3">± (5% of indicated value +2%) [at ≥250 kHz, ≤+7 dBm, 0 to 90% and internal 1 kHz]</td></tr>
<tr><td rowspan="5">Frequency response</td><td colspan="3">At ≤+7 dBm, ±1 dB bandwidth</td></tr>
<tr><td>Lower modulation frequency limit</td><td colspan="2">20 Hz (EXT AC mode), DC (EXT DC mode)</td></tr>
<tr><td rowspan="4">Upper modulation frequency limit</td><td>Modulation factor / Carrier frequency</td><td>0 to 30%</td><td>30.1 to 80%</td></tr>
<tr><td>0.25 MHz≤fc<0.5 MHz</td><td>5 kHz</td><td>5 kHz</td></tr>
<tr><td>0.5 MHz≤fc<80 MHz</td><td>20 kHz</td><td>10 kHz</td></tr>
<tr><td>80MHz≤fc</td><td>50 kHz</td><td>20 kHz</td></tr>
<tr><td>External modulation</td><td colspan="3">Input level: Approx. 2 Vp-p ,600 Ω
Input Impedance: Nominal 600 Ω</td></tr>
<tr><td>Depth</td><td colspan="3">≤1% (at ≥1 MHz, ≤+7 dBm, internal 1 kHz, 30%)
≤3% (at ≥1 MHz, ≤+7 dBm, internal 1 kHz, 80%)
≤3% (at 250 kHz≤fc<1 MHz, ≤+7 dBm, internal 1 kHz, 30%)
≤10% (at 250 kHz≤fc<1 MHz, ≤+7 dBm, internal 1 kHz, 80%)</td></tr>
<tr><td>Incidental FM</td><td colspan="3">≤200 Hz peak (at ≥250 kHz, ≤+7 dBm, 1 kHz, 30%, demodulation band 0.3 to 3 kHz)</td></tr>
<tr><td rowspan="8">Frequency modulation</td><td>Range</td><td colspan="3">0 to 400 kHz (1 MHz≤fc<40 MHz) 0 to 800 kHz (320 MHz≤fc<640 MHz)
0 to 100 kHz (40 MHz≤fc<80 MHz) 0 to 1.6 MHz (640 MHz≤fc<1280 MHz)
0 to 200 kHz (80 MHz≤fc<160 MHz) 0 to 3.2 MHz (1280 MHz≤fc)
0 to 400 kHz (160 MHz≤fc<320 MHz)</td></tr>
<tr><td>Resolution</td><td colspan="3">10 Hz (0 to 9.99 kHz deviation) 1 kHz (100 to 666 kHz deviation)
100 Hz (10 to 99.9 kHz deviation) 10 kHz (1 to 3.2 MHz deviation)</td></tr>
<tr><td>Internal modulation frequency</td><td colspan="3">Fixed frequency: 400 Hz, 1 kHz
Variable frequency: 0.1 to 100 kHz. 0.1 Hz resolution
Frequency accuracy: 100 ppm</td></tr>
<tr><td>Accuracy</td><td colspan="3">± (5% of indicated value +20 Hz) [internal 1 kHz]</td></tr>
<tr><td>Modulation frequency response</td><td colspan="3">±1 dB bandwidth
Frequency range: 20 Hz to 100 kHz (EXT AC mode), DC to 100 kHz (EXT DC mode)</td></tr>
<tr><td>External modulation</td><td colspan="3">Input level: Approx. 2 Vp-p/600 Ω
Input impedance: Nominal 600 Ω</td></tr>
<tr><td>Distortion</td><td colspan="3">≤1% (internal 1 kHz, 3.5 kHz deviation)</td></tr>
<tr><td>Incidental AM</td><td colspan="3">≤0.4% (internal 1 kHz, 22.5 kHz deviation, demodulation band 0.3 to 3 kHz)</td></tr>
<tr><td>Carrier frequency accuracy in DC-FM mode</td><td colspan="3">±500 Hz for 30-minute period after calibration and 2-hour warm-up (at <1280 MHz, <10 kHz deviation)</td></tr>
<tr><td rowspan="6">Phase modulation</td><td>Range</td><td colspan="3">0 to 80 rad (1 MHz≤fc<40 MHz) 0 to 160 rad (320 MHz≤fc<640 MHz)
0 to 20 rad (40 MHz≤fc<80 MHz) 0 to 320 rad (640 MHz≤fc<1280 MHz)
0 to 40 rad (80 MHz≤fc<160 MHz) 0 to 640 rad (1280 MHz≤fc)
0 to 80 rad (160 MHz≤fc<320 MHz)
Besides radian, deg unit is also possible for phase deviation display. However, max. 999 deg.</td></tr>
<tr><td>Resolution</td><td colspan="3">0.01 rad (0 to 9.99 rad deviation), 1 rad (100 to 640 rad deviation), 0.1 rad (10 to 99.9 rad deviation)</td></tr>
<tr><td>Internal modulation frequency</td><td colspan="3">Fixed frequency: 400 Hz, 1 kHz
Variable frequency: 0.1 Hz to 5 kHz, 0.1 Hz resolution
Frequency accuracy: 100 ppm</td></tr>
<tr><td>Accuracy</td><td colspan="3">±(10% of indicated value +0.05 rad) [internal 1 kHz modulation]</td></tr>
<tr><td>Modulation frequency response</td><td colspan="3">±1 dB bandwidth
Frequency range: 20 Hz to 5 kHz (EXT AC mode), DC to 5 kHz (EXT DC mode)</td></tr>
</table>

Continued on next page

<table>
<tr><td>Phase modulation</td><td>External modulation</td><td>Input level: Approx. 2 Vp-p/600 Ω
Input impedance: Nominal 600 Ω</td></tr>
<tr><td></td><td>Distortion</td><td>≤1% (internal 1 kHz, 5 rad modulation)</td></tr>
<tr><td>Internal modulation signal</td><td>Frequency range</td><td>400 Hz, 1 kHz (fixed oscillator)
0.1 Hz to 100 kHz (variable oscillator)
DC voltage signals equivalent peak values of internal modulating sine wave can be applied as a modulating signal using the SPECIAL FUNCTION.</td></tr>
<tr><td></td><td>Resolution</td><td>0.1 Hz</td></tr>
<tr><td></td><td>Frequency accuracy</td><td>100 ppm</td></tr>
<tr><td></td><td>Distortion</td><td>≤0.03% (fixed, 400 Hz and 1 kHz), ≤0.3% (variable, 20 Hz to 50 kHz)</td></tr>
<tr><td>Memory function</td><td>Frequency memory</td><td>1000 carrier frequencies (store/recall)</td></tr>
<tr><td></td><td>Function memory</td><td>100 panel settings (store recall)</td></tr>
<tr><td>Sweep function</td><td>Sweep mode</td><td>Carrier frequency, output level, AF frequency</td></tr>
<tr><td></td><td>Sweep pattern</td><td>
<table>
<tr><th colspan="2"></th><th>Carrier frequency</th><th>Output level</th><th>AF frequency</th></tr>
<tr><td rowspan="2">Pattern</td><td>Start/stop</td><td>√</td><td>√*2</td><td>√</td></tr>
<tr><td>Center/span</td><td>√</td><td>√*2</td><td>√</td></tr>
<tr><td rowspan="3">Step</td><td>Entering number of steps</td><td>√</td><td>–</td><td>√</td></tr>
<tr><td>Entering step size</td><td>√</td><td>√*3</td><td>√</td></tr>
<tr><td>LOG 1%</td><td>√</td><td>–</td><td>√</td></tr>
</table>
<table>
<tr><th colspan="2"></th><th>Frequency memory</th><th>Function memory</th></tr>
<tr><td rowspan="3">Pattern</td><td>Continuous address</td><td>√</td><td>√</td></tr>
<tr><td>Random address</td><td>√</td><td>√</td></tr>
<tr><td>Continuous, random mixed</td><td>√</td><td>√</td></tr>
<tr><td colspan="2">Maximum number of steps</td><td>20*4</td><td>20*4</td></tr>
</table>
</td></tr>
<tr><td></td><td>Sweep time</td><td>0.1 ms to 600 s, 0.01 ms resolution (minimum time depends on the switching time of each function.)</td></tr>
<tr><td></td><td>Marker</td><td>One movable marker</td></tr>
<tr><td></td><td>Sweep signal output</td><td>Staircase (saw-tooth waveform), Start point: 0 V, Stop point: 10 V</td></tr>
<tr><td>Other functions</td><td>Modulation signal output</td><td>Modulation signal is output when modulating.
Output level: Approx. 2 Vp-p/600 Ω</td></tr>
<tr><td></td><td>Simultaneous modulation</td><td>Simultaneous modulation is possible in combinations shown below.
<table>
<tr><th></th><th>INT AM</th><th>EXT AM</th><th>INT FM</th><th>EXT FM</th><th>INT øM</th></tr>
<tr><td>EXT øM</td><td>√</td><td>√</td><td>–</td><td>–</td><td>√*6</td></tr>
<tr><td>INT øM</td><td>√*5</td><td>√</td><td>–</td><td>–</td><td></td></tr>
<tr><td>EXT FM</td><td>√</td><td>√</td><td>√*6</td><td></td><td></td></tr>
<tr><td>INT FM</td><td>√*5</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>EXT AM</td><td>√</td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td></td><td>Relative value display</td><td>Carrier frequency, output level</td></tr>
<tr><td></td><td>Continuously variable output level mode</td><td>Continuously variable within a ±10 dB range of the set level
Step size: 0.1 dB</td></tr>
<tr><td></td><td>Trigger function</td><td>Previously programmed operation procedure can be started by a trigger input through its input terminal (on rear panel, BNC connector, TTL level). Maximum program steps for triggered operation: 99 steps</td></tr>
<tr><td></td><td>Memory backup</td><td>Last settings are stored when power is turned off.</td></tr>
<tr><td></td><td>GPIB</td><td>Interface function: SH1, AH1, T5, L3, TE0, LE0, SR1, RL1, PP0, DC1, DT1, C0</td></tr>
<tr><td colspan="2">Reverse power</td><td>Maximum reverse input power: 50 W (<1000 MHz), 25 W (≥1000 MHz), ±DC 50 V</td></tr>
<tr><td colspan="2">Operating temperature</td><td>0˚ to 50˚C</td></tr>
<tr><td colspan="2">Power</td><td>*7Vac$^{+10}_{-15}$ %, 48 to 63 Hz, ≤270 VA</td></tr>
<tr><td colspan="2">Dimensions and mass</td><td>426 (W) x 177 (H) x 451 (D) mm, ≤32 kg</td></tr>
<tr><td colspan="2">EMC</td><td>EN61326: 1997/A1, 1998 (Class A)
EN61000-3-2: 1995/A2, 1998 (Class A)
EN61326: 1997/A1, 1998 (Annex A)</td></tr>
<tr><td colspan="2">LVD</td><td>EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)</td></tr>
</table>

*1: Aging rates up to 5 x 10^{-10}/day are available as option.
*2: Step width: Max. 20 dB
*3: 0.1 dB step size only
*4: One continuous address setting is counted as 3 steps.
*5: Same one internal modulation frequency is used.
*6: Different deviation settings are possible for INT and EXT modulations (using the SPECIAL FUNCTION).
*7: Specify one nominal line voltage between 100 and 240 V when ordering. However maximum operational voltage is limited to 250 V.

Options

Reference oscillators		Standard model	Option 01	Option 02	Option 03
Start-up characteristics	After 30 minutes operation	1 x 10^{-7}/day	7 x 10^{-8}/day	–	–
	After 60 minutes operation	5 x 10^{-8}/day	3 x 10^{-8}/day	2 x 10^{-8}/day	–
Aging rate	After 24 hours operation	2 x 10^{-8}/day	5 x 10^{-9}/day	2 x 10^{-9}/day	–
	After 48 hours operation	–	–	–	5 x 10^{-10}/day
Temperature characteristics (0˚ to 50˚C)		±5 x 10^{-8}	±5 x 10^{-8}	±1.5 x 10^{-8}	±5 x 10^{-9}

Option 04: Rear RF output, SMA connector

Peripheral equipment

MA1610A Pulse Modulator

The MA1610A is a pulse modulator used in combination with the MG3633A Synthesized Signal Generator to generate high-speed pulse modulated signals. The MA1610A can switch RF signals with a carrier frequency ranging from 10 kHz to 2700 MHz ON and OFF using an input modulation signal (TTL level, 50 Ω terminated). Power is supplied from the MG3633A via its rear panel AUX connector.

Frequency range	10 kHz to 2700 MHz
ON,OFF ratio	≥60 dB (<1000 MHz), ≥40 dB (≥1000 MHz)
Insertion loss	≤2 dB (<1000 MHz), ≤3.5 dB (<1000 MHz)
Rise time	≤15 ns
Fall time	≤5 ns
Minimum pulse width	20 ns
Maximum repetition rate	10 MHz
Maximum delay time	40 ns
Video feed through	≤50 mVp-p
Overshoot/ringing	≤20%
RF input/output	50 Ω, N-type connector, maximum permissible input level: AC 200 mW, DC 3.5 V
Operating temperature	0˚ to 50˚C
Dimensions and mass	131 (W) x 57 (H) x 43 (D) mm, ≤600 g
Standard accessories	J0494: Coaxial cord, 0.3 m (1 pc) J0495: Power cord, 1.0 m (1 pc) W0508AE: MA1610A operation manual (1 copy)

Ordering information

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

Model/Order No.	Name
	Main frame
MG3633A	Synthesized Signal Generator
	Standard accessories
J0025A	Coaxial cord (S-5DWP · 5D-2W · S-5DWP), 1 m: 1 pc
J0127A	Coaxial cord (BNC-P · RG58A/U · BNC-P), 1 m: 1 pc
	Power cord, 2.5 m: 1 pc
F0013	Fuse, 5 A (for 100 Vac mains): 2 pcs
F0012	Fuse, 3.15 A (for 200 Vac mains): 2 pcs
W0504AE	MG3633A operation manual: 1 copy
	Options
MG3633A-01	Reference oscillator
MG3633A-02	Reference oscillator
MG3633A-03	Reference oscillator
MG3633A-04	Rear RF output: SMA connector (however, replaces front-panel RF connector)
MX5126B	Frequency-Response Compensation Software (requires Packet IIe/III/IIIs and ML4803A)
MX5251B	Frequency-Response Compensation Software (requires Packet V series and ML4803A)
	Peripheral
MA1610A	Pulse Modulator (10 kHz to 2.7 GHz)
	Optional accessories
MP614A	Impedance Transformer (50 Ω/75 Ω, 10 MHz to 1.2 GHz)
MA1612A	Four-Port Junction Pad (5 MHz to 3 GHz)
MP659A	Four-Port Junction Pad (40 to 1000 MHz)
Z-164A	T-pad (DC to 1000 MHz)
MB24A	Portable Test Rack

For product ordering information, see pages 4 – 10

SYNTHESIZER/LEVEL GENERATOR

MG443B

10 Hz to 30 MHz

For Frequency Tracking with ML422C

GPIB

The MG443B is carefully designed. Its output level is highly stable, so it can be used for applications within the telecommunications industry without the need for a separate standard level meter.

Features

- Wide frequency range with 1 Hz resolution
- As many as 20 panel settings can be memorized; memory sweep capability
- High output level characteristics
  Flatness: ±0.07 dB (0˚ to 50˚C)
  Level accuracy: ±0.15 dB (0˚ to 50˚C)
- High precision output level setting of 0.01 dB
- Continuous output level variable within approximately 4.5 dB
- Variety of output impedances
  Unbalanced: 50, 75 Ω
  Balanced: 75, 135, 150, 600 Ω

SYNTHESIZED LEVEL GENERATOR

MG442A

10 Hz to 20 MHz

Compact and Lightweight

The MG442A is a compactly designed level generator with excellent stability and accuracy in frequency and output level. Because it is a synthesized level generator, its output frequency is highly stable. It has an excellent output level accuracy and a superb frequency response unrivaled by similar level generators.
The MG442A can be used for many applications as a measurement signal source where high frequency stability and level accuracy are required.The MG442A is best suited for use as a signal source for measuring baseband circuits from audio to video and various types of communications systems.
With its ease of operation and excellent portability, it can be utilized for many purposes as a fundamental measuring instrument in laboratories and manufacturing plants.

Features

- Universal output impedance
- Excellent operation: Digital frequency setting with 4 digits and output level with 3 digits
- Compact and lightweight