/Inritsu Advancing beyond

MG3690C
RF/Microwave Signal Generator
2 GHz to 20/40/50/67 GHz

RoHS Compliant

MG3690C Analog Synthesizer

Overview

The MG3690C series of RF/Microwave signal generators covers the audio, HF, VHF, UHF, RF, and microwave frequencies and provides coverage from 0.1 Hz to 70 GHz with a single coaxial output (up to 500 GHz with external multipliers). With excellent phase noise, fast switching speeds, and a full suite of analog modulation capabilities (including high-performance pulse modulation), the MG3690C series is an optimal signal source solution for the design and testing of components and systems for a wide variety of industries — wireless communications, aerospace and defense, and consumer and computer electronics.

Easy to operate either through its intuitive front panel controls or remotely via GPIB or Ethernet connectivity, the MG3690C series are fully configurable and enables users to tailor their signal generator to meet their application needs. These solutions provide three levels of SSB phase noise performance and a full suite of modulation capabilities (including AM, FM, phase, and pulse) to address anything from simple to complex signal simulation requirements. The MG3690C also offers very comprehensive emulation and test parameters for narrow pulse radars.

The MG3690C series of RF/Microwave signal generators is also RoHS compliant, meeting the strict guidelines of Directive 2002/95/EC that restricts the use of specific hazardous materials found in electrical and electronic products, see Figure 1.
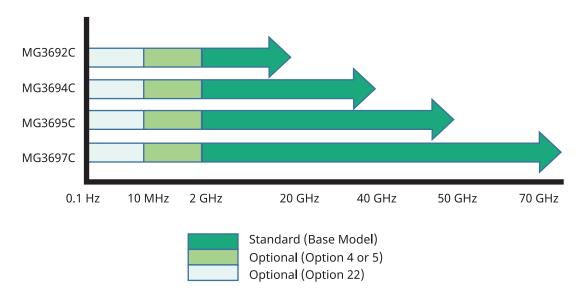

Figure 1. MG3690C Series of Broadband Signal Generators

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Key RF Specifications

Parameter	Specification
Frequency Range	2 GHz to 20/40/50/67 GHz
Frequency Resolution	0.01 Hz
Internal Time-Base Stability	< 5 x 10-10 /day with Option 16
Frequency Switching (List mode)	2 mSec min
Reference Output Frequency	10 MHz, 1V pk-pk into 50 Ohms
Output Power	-120 dBm to +19 dBm (< 40 GHz output, option 15) -120 dBm to +13 dBm (> 40 GHz, < 50 GHz, option 15) -120 dBm to +3 dBm (> 50 GHz, < 67 GHz, option 15)
Level Accuracy	± 1 dB (< 40GHz output) ± 1.5 dB (< 67 GHz output)
55B Noise Level	-119 dB/Hz (typ) @ 10 GHz output, 10 kHz offset
Harmonics (2 GHz to 20 GHz)	-60 dBc
Non – Harmonics (2 GHz to 20 GHz)	-60 dBc

Modulation Specifications

Feature	Specification
FM deviation max	± 100 MHz (Unlocked Wide Mode)
PM deviation max	400 rad (Wide mode)
AM Bandwidth	DC to 100 kHz
AM Depth	0% to 90%
Pulse Modulation On/Off Ratio	80 dB
Pulse Modulation Rise/Fall Times	5 ns (typ)
Pulse Width (min)	< 10 ns (Unleveled)

Sweep Specifications

Parameter	Specification
Frequency Sweep Operating Modes	Step, List and Ramp
Frequency Sweep Width	0.01 Hz to full frequency range (Step, List Modes) 1 MHz to full frequency range (Ramp Mode)
Power Sweep Operating Mode	Step
Power Sweep Resolution	0.01 dB/step

Application

The MG3690C series of signal generators are ideal for benchtop and rack mount use. This series can fulfill the needs of many measurement applications that require a high grade signal source.

Non-Linear Measurements
- Single tone distortion – P1dB compression point
- Two tone intermodulation (IMD) – IP2, IP3

Signal Source
- IF and RF signal injection
- LO substitution
- CW precision frequency source

Precision Clock Source
- High-speed network backhaul
- GSPS data converters (ADCs and DACs) Radar Testing
- CW or Pulsed Simulation
- Chirp simulation using FM and Pulse modulation

Swept Frequency Testing
- Scalar Network Measurements

The 1280 x 800 resolution screen offers excellent brightness with high-contrast color schemes. Switch between the standard color palate for normal use or a black and white high-contrast display for use in direct sunlight.

Complex Analog Modulation Signals

The MG3690C series of signal generators feature extensive internal waveform generation capabilities. Seven different waveform types can be generated internally that can be used to modulate the carrier in AM/FM/PM modes:
- Sine waves
- Square waves
- Positive-going ramps
- Negative-going ramps
- Triangles
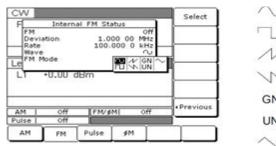- Gaussian noise
- Uniform noise

Figure 2. MG3690C Series of Signal Generators Waveforms

Simultaneous modulation of AM/FM, AM/PM, or FM/Pulse are possible. This enables generation of complex modulation waveforms such as chirps.

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Radar Testing

Military and civilian operations rely extensively on radar applications for detection and security. One popular radar application is pulse radar. Pulse radar turns on an RF source and after some time, turns off the source creating a pulse of RF energy that can be used to determine if there is an object(s) in the line of sight. Important properties for the pulse are the on/off ratio, repetition, pulse width, and pulse amplitude.

The MG3690C series of RF/Microwave signal generators has extensive simulation capability for pulsed radar applications. For simulating a target, the MG3690C series can set the start/stop delay, step size, and dwell time. With the internal pulse generator option, multiple pulse modes are also available like singlet, doublet, triplet, and quadruplet for simulating moving or multiple targets. Pulse capability includes a minimum leveled pulse width of 100 ns for 1 GHz or above or a minimum unleveled pulse width of 10 ns.

The MG3690C with the ML2495A power meter and Anritsu PowerMax™ software can be used to easily setup and capture pulse information. Figure 3.

Precision Clock Source

Digital electronics applications require a stable time base with low jitter. Jitter in the time domain translates to phase noise in the frequency domain. A precision clock source should not exhibit clock spurs or jitter as this may interfere with triggering at the clock edges and can affect timing control for interrupts and data transfer. With options for low phase noise (Options 3 or 3x) and high stability time base (Option 16), the MG3690C signal generator can provide a clean clock signal without ambiguous clock edges.

In addition to being a precision clock, Option 36 allows up to three MG3690C signal generators to have precise phase synchronization. Phase drift is typically less than ±1° over 100 seconds and ±1.5° over 24 hours. User selectable external reference loop bandwidth enables optimization of phase noise vs. tracking.

Millimeter-Wave (mmWave) Frequency Coverage

Frequency coverage beyond 67 GHz is enabled through external waveguide multipliers. The MG3692C signal generator with external waveguide multipliers can cover from 50 GHz to 500 GHz with no frequency gaps. Both pulse and FM modulations are supported.
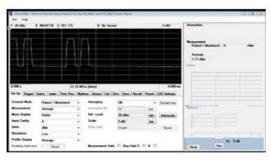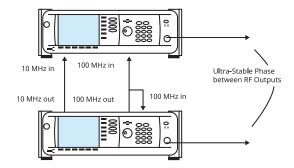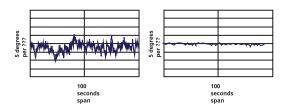

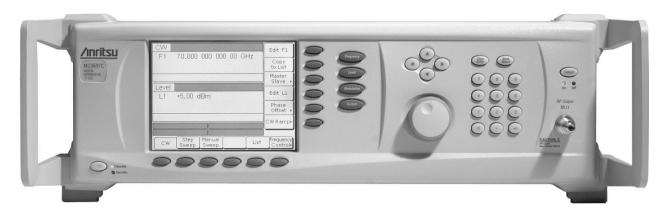*Figure 3. PowerMax Software Pulse Setup GUI*

Figure 4. Precision Clock Source Setup

Figure 5. MG3690C with External Waveguide Multipliers

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Front Panel

Rear Panel

Index	Connector Name	Connector Description
1	RF Output (Option 9)	Provides RF output at the rear panel of the instrument.
2	Mixer LO Input (Option 7) +15 VDC (Option 18)	Accepts ab external RF input from 1 to 40 GHz (Option 7) or provides a +15 VDC supply (Option 18).
3	Mixer RF Output (Option 7)	Provides an up-converted IF signal from 1 to 40 GHz.
4	Mixer IF Input (Option 7)	Accepts an external IF input from DC to 500 MHz or Scan Modulator Input (Option 20): Accepts 0 VDC to 6 VDC modulating input.
5	AUX I/O	25-pin connector that provides for single cable interface with another MG369xC (master-slave operation) or with other Anritsu instruments such as the Anritsu 56100A Scalar Network Analyzer. Pin 19 also provides a reset function for the Ethernet interface card.
6	AM OUT	Provides a video modulating signal from the internal AM generator. BNC connector.

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Front Panel

Index	Connector Name	Connector Description
7	HORZ OUT	Provides a 0V to 10V ramp during all sweep modes, regardless of sweep width. In the CW mode, provides a voltage between 0V and 10V proportional to the full frequency range of the instrument. When the CW Ramp is enabled, connector provides a repetitive 0V to 10V ramp. BNC connector, 50 Ω impedance.
8	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. BNC connector, 50 Ω impedance.
9	10 MHz OUT	Provides a 0.5 Vp-p, AC coupled, 10 MHz signal derived from the internal frequency standard of the signal generator. BNC connector, 50 Ω impedance.
10	PULSE TRIG IN	Accepts an external TTL level signal to pulse modulate the RF output. BNC connector.
11	PULSE VIDEO OUT	Provides a video modulating signal from the internal pulse generator or external pulse input. BNC connector.
12	FM/φM IN	Provides a video modulating signal from the internal AM generator. BNC connector.
13	AM IN	Accepts an external modulating signal (50 Ω) to produce AM on the RF output. AM sensitivity (Linear or Log) are selectable via the front panel menu, the GPIB, or the Ethernet port. BNC connector.
14	EXT ALC IN	Provides for leveling the RF output signal externally with either a remote detector or a power meter. The rear panel BNC connector accepts a 0 V to +1 V or a 0 V to –1 V signal.
15	Input Line Voltage Module	Contains an input receptacle for connecting line voltage to the MG369xC, two 5A, type T line fuses that provide over-voltage/current protection for the signal generator's circuits during operation and standby, and an On/Off power switch for applying line power to the MG369xC.
16	SERIAL I/O	Provides access to two RS-232 terminal ports to support service and calibration functions and master-slave operations. RJ45 connector.
17	Ethernet Port	10/100 BASE-T. Provides input/output connections for the LAN interface. Connects directly to a LAN with an RJ-45 connector using a standard CAT-7 Ethernet cable.
18	PULSE SYNC OUT	Provides a TTL compatible signal synchronized to the internal pulse modulation output. BNC connector.
19	EFC	Electronic Frequency Control input accepts an external dc signal (–4 V to +4 V) to modulate the RF output. Sensitivity: 0.2/n to 0.5/n ppm/V (typical) 0.08/n to 0.1/n ppm/V (typical, for Option 3/3X/3XA) where n is the reference multiplier and the modulation bandwidth is ≥250 Hz. BNC connector.
20	FM/φM OUT	Provides a video modulating signal from the internal FM generator. BNC connector.
21	IEEE-488 GPIB	24-pin connector that provides for remotely controlling the signal generator from an external controller via the IEEE488 bus (GPIB).

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Ordering Information

Part Number/Options	Description
MG3692C	2 GHz to 20 GHz Signal Generator
MG3694C	2 GHz to 40 GHz Signal Generator
MG3695C	2 GHz to 50 GHz Signal Generator
MG3697C	2 GHz to 67 GHz Signal Generator (operational to 70 GHz)
MG3690C/1A	Rack Mount with slides. Rack mount kit containing a set of track slides, mounting ears, and front panel handles to let the instrument be mounted in a standard 19-inch equipment rack.
MG3690C/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.
MG3690C/2A, MG3690C/2B, MG3690C/2C	Mechanical Step Attenuator. Adds a 10 dB/step attenuator. Rated RF output power is reduced. This option comes in different versions, based on instrument configuration.
MG3690C/3	Ultra Low Phase Noise. Adds new modules to significantly reduce SSB phase noise. Not available with Option 3X.
MG3690C/3X	Premium Phase Noise. Improves Option 3 < 1 kHz offset. Not available with Option 3.
MG3690C/4	8 MHz to 2.2 GHz RF coverage, Ultra-Low Phase Noise version. Uses a digital down converter to significantly reduce SSB phase noise. All specifications apply ≥ 10 MHz.
MG3690C/5	8 MHz to 2 GHz RF Coverage. Uses an analog down converter. All specifications apply ≥ 10 MHz.
MG3690C/6	Analog Sweep Capability. When used with Option 4, analog sweep capability is limited to ≥ 500 MHz.
MG3690C/9V, MG3690C/9K	Rear Panel Output Moves the RF output connector to the rear panel. This option comes in different versions, based on instrument configuration.
MG3690C/10	User-defined Modulation Waveform Software. External software package provides the ability to download user-defined waveforms into the memory of the internal waveform generator, serially or via GPIB or Ethernet. External PC and an instrument with LF Generator, Option 27, are required.
MG3690C/12	Frequency and Phase Modulation. External, via a rear panel BNC connector. For internal modulation capability, requires addition of an LF Generator, Option 27.
MG3690C/14	Amplitude Modulation. External, via a rear panel BNC connector. For internal modulation capability, requires addition of an LF Generator, Option 27.
MG3690C/15A, MG3690C/15B, MG3690C/15C, MG3690C/15D	High Power. Adds high-power RF components to the instrument to increase its output power level. This option comes in different versions, based on instrument configuration.
MG3690C/16	High Stability Time Base. Adds an ovenized, 10 MHz crystal oscillator as a high-stability time base.
MG3690C/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. Only available with Options 1A or 1B. 0.1 Hz to 10 MHz Audio coverage. Uses a DDS for coverage down to approximately DC.
MG3690C/22	When adding Option 22, the output power is derated by 2 dB. Frequency resolution below 10 MHz is 0.02 Hz. No modulation is available in the 0.1 Hz to 10 MHz band. Not available without Option 4 or 5.

Ordering Information *(Cont'd)*

Part Number/Options	Description
MG3690C/26A, MG3690C/26B	Pulse Modulation. External, via a rear panel BNC connector. For internal modulation capability, requires addition of a Pulse Generator, Option 27. This option comes in different versions, based on instrument configuration.
MG3690C/27	Internal LF and Pulse Generators. Provides modulation waveforms for internal AM (if Option 14 installed), FM (if Option 12 installed), ΦM (if Option 12 installed) and Pulse (if Option 26A/B installed). Not available without Option 12, 14, or 26.
MG3690C/28A, MG3690C/28B	Analog Modulation Suite. For ease of ordering and package pricing, this option bundles Options 12, 14, 26 and 27, offering internally and externally driven AM, FM, ΦM, and Pulse Modulation. This option comes in different versions, based on instrument configuration.
MG3690C/36	Ultra-Stable Phase Tracking. Provides the capability for ultra-stable phase tracking between instruments using the internal 100 MHz reference. Requires Option 3 or 3X.
MG3690C/CE	Rack Mount with slides. Rack mount kit containing a set of track slides, mounting ears, and front panel handles to let the instrument be mounted in a standard 19-inch equipment rack.
MG3690C/1B	CE Compliance with CE mark.
MG369X/97	Accredited Calibration to ISO17025 and ANSI/NCSLZ540-1. Includes calibration certificate, test report, and uncertainty data. Note that X is the model number of your instrument (i.e. MG3692C/97).
MG3690C/98	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Provides a calibration certificate, decal, and "Calibration void if removed" tamper seals.
MG3690C/99	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Provides everything included with Option 98 plus test report and uncertainty data.

MG3690C Option Configuration Guide

Models	OPT 1		OPT 2			OPT 3	OPT 3X	OPT 4	OPT 5	OPT 6	OPT 9		OPT 10	OPT 12	OP 14
	1A	1B	2A	2B	2C						9K	9V			
MG3692C	•	•	•			•[a]	•[a]	•[b]	•[b]	•			•[c]	•	•
MG3694C	•	•		•		•[a]	•[a]	•[b]	•[b]	•			•[c]	•	•
MG3695C	•	•			•	•[a]	•[a]	•[b]	•[b]	•		•	•[c]	•	•
MG3697C	•	•			•	•[a]	•[a]	•[b]	•[b]	•		•	•[c]	•	•

Models	OPT 15				OPT 16	OPT 17	OPT 22	OPT 26		OPT 27	OPT 28		OPT 36	OPT 98	OPT 99
	15A	15B	15C	15D				26A	26B		28A	28B			
MG3692C	•				•	•[d]	•[e]	•		•[f]	•[g]		•[h]	•	•
MG3694C		•			•	•[d]	•[e]		•	•[f]		•[g]	•[h]	•	•
MG3695C			•		•	•[d]	•[e]		•	•[f]		•[g]	•[h]	•	•
MG3697C				•	•	•[d]	•[e]		•	•[f]		•[g]	•[h]	•	•

a. Options 3 and 3X cannot be ordered together.
b. Options 4 and 5 cannot be ordered together.
c. Option 10 can only be ordered with either Options 27 or 28.
d. Option 17 can only be ordered with either Option 1A or 1B.
e. Option 22 can only be ordered with either Option 4 or 5.
f. Option 27 can only be ordered with either Options 12, 14 or 26 in any combination.
g. Option 28 cannot be ordered along with either Options 12, 14, 26, or 27.
h. Option 36 can only be ordered with either Option 3 or 3X.

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Specifications are subject to change without notice.

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