1.1 Overview

The MG3601A/MG3602A Signal Generator is a synthesized signal generator which provides amplitude, frequency, phase, and video modulation over the 0.1 to 1040/0.1 to 2080 MHz range.
In addition to its many modulation functions, its frequency stability, output level accuracy, SSB phase noise, residual FM, and other performance are excellent and it can be widely used to evaluate receivers (mobile radio, pocket pager, AM/FM radio, TV, etc.), and as a general purpose signal source. Since memory and GP-IB remote control functions are standard, it can also be used for automatic measurement and labor saving.

1.2 Composition

This paragraph describes the MG3601A/MG3602A Signal Generator standard composition and the options for expanding its functions.

..2.1 Standard composition

The MG3601A/MG3602A standard composition is listed in Table 1-1.

Table 1-1 Standard Composition

Item	Name	Qty.	Remarks
nstrument	MG3601A (or MG3602A) Signal Generator	1	
ccessories	50 Ω coaxial cable	1	S-5DWP [ ] — 5D-2W, Approx. 1 m — [ ] S-5DWP Application: Output use
	50 Ω coaxial cable	1	BNC-P [ ] — RG-58A/U, Approx. 1 m — [ ] BNC-P Application: Modulation use
	Power cord	1	
	Ac fuse	2	***A
	Operation manual	1	
	Service manual	1	

1.2.2 Options

The MG3601A/MG3602A options are listed in Table 1-2.

Table 1-2 Options

Option 01 Reference oscillator (10 MHz)	Aging rate: 2×10^{-8}/day (after 24-hour warm-up) Starting characteristics: 1×10^{-7}/day (after 30-min operation) 5×10^{-8}/day (after 60-min operation) Temperature characteristics: $\pm5\times10^{-8}$ (0° to 50°C)
Option 02 Reference oscillator (10 MHz)	Aging rate: 5×10^{-9}/day (after 24-hour warm-up) Starting characteristics: 7×10^{-8}/day (after 30-min operation) 3×10^{-8}/day (after 60-min operation) Temperature characteristics: $\pm5\times10^{-8}$ (0° to 50°C)
Option 03 Reference oscillator (10 MHz)	Aging rate: 2×10^{-9}/day (after 24-hour warm-up) Starting characteristics: 2×10^{-8}/day (after 60-min operation) Temperature characteristics: $\pm5\times10^{-8}$ (0° to 50°C)
Option 04 AF oscillator	Frequency: 20 Hz to 100 kHz Resolution: 0.1 Hz Frequency accuracy: ≦ 100 ppm
Option 05 Video modulation	See Table 1-5.
Option 06 External modulation polarity switching	The relationship between the voltage polarity of the external modulation signal and the deviation increment and decrement can be selected as reversed or non-reversed.
Option 07 External FM modulation factor display	• Display range: 0% to 102% of modulation factor set value • Accuracy: ±4% (excluding modulation accuracy)

1.3 Application Parts and Peripheral Devices

The MG3601A/MG3602A application parts are listed in Table 1-3 and the peripheral devices are listed in Table 1-4.

Table 1-3 Application Parts

Name	Application/composition	Remarks
Accessory	Protection cover, front panel handle kit, rack mounting kit	For details, see APPENDIX A(1).
MP51A, MP52A 50 Ω ⟷ 75 Ω Pad	50 Ω ⟷ 75 Ω impedance transformer	For details, see APPENDIX A(2).
MP614A 50 Ω ⟷ 75 Ω Impedance Transformer	Used when circuit under test is 75 Ω	For details, see APPENDIX A(3).
Z-164A/B T-pad 50 Ω, 75 Ω	Used in two-signal characteristics measurement	For details, see APPENDIX A(4).
MP659A Four-port Junction Pad	Used in three-signal characteristics measurement	For details, see APPENDIX A(5).
MP721[ ] Attenuator dc to 12.4 GHz	3, 6, 10 to 60 dB (10 dB steps) attenuators available	For details, see APPENDIX A(6).

Table 1-4 Peripheral Devices

Name	Application/composition	Remarks
MG442A Synthesized Level Generator	Used as external modulation signal	For details, see APPENDIX B.
MS612A Spectrum Analyzer	Transmitter and receiver automated by combining MS612A with MG3601A/MG3602A	For details, see APPENDIX C.
Packet V Personal Technical Computer	Used as controller to remotely control MG3601A/ MG3602A by GP-IB	For details, see APPENDIX D.
MH055B GP-IB Extender	Used to convert GP-IB interface to serial interface	For details, see APPENDIX E.
MS010A Multi-function Selector	Can be controlled by PTA or personal computer via GP-IB (Application) Used as various scanners	For details, see APPENDIX F.
ML422A Selective Level Meter	Accurate transmission characteristics tests performed by combining ML422A with MG3601A/MG3602A	For details, see APPENDIX G.

1.4 Specifications

Table 1-5 shows the specifications (≦1040 MHz) common to the MG3601A and MG3602A; Table 1-6 shows the specification (>1040 MHz) that are different from Table 1-5.

Table 1-5 Specifications (≦1040 MHz)

Specifications (Common to MG3601A and MG3602A, ≦1040 MHz)			
Carrier frequency	Frequency range	0.1 to 1040 MHz	
	Resolution	10 Hz	
	Accuracy	Same as those of the reference oscillator	
	Reference oscillator	Frequency	100 MHz
		Stability	Aging rate: 2×10^{-6}/year Temperature characteristics: 5×10^{-6} (for 0°C to 50°C change of temperature at reference oscillator). Note: Better aging rate of up to 2×10^{-9}/day are available as options.
	External reference input	10 MHz, >2 Vp-p into 50Ω load	
	External reference output	10 MHz, TTL level	
	Setting	Keyboard, rotary encoder or GP-IB	
Output	Level range	−133 to +13 dBm (−20 to +126 dBμV e.m.f.)	
	Resolution	0.1 dB	
	Accuracy	±1 dB (≧ −10 dBm) ±1.5 dB (≧ −123 dBm) ±2 dB (< −123 dBm)	
	Frequency characteristics	≦1 dB (at 0 dBm)	
	Impedance	50Ω, VSWR≦1.5 (at ≦ +3 dBm), N-type connector	
	Radiation interference	≦1 μV (Value is voltage-terminated with 50Ω load measured at 25 mm from the front panel with a two-turn 25 mm diameter loop antenna)	
	Setting	Keyboard, rotary encoder or GP-IB	

<table>
<tr><td rowspan="5">Signal purity</td><td>Harmonics</td><td colspan="3">≦−25 dBc (2nd or 3rd harmonics)</td></tr>
<tr><td>Non harmonic spurious</td><td colspan="3">≦−60 dBc (greater than 5 kHz from carrier)</td></tr>
<tr><td>SSB phase noise</td><td colspan="3">In CW mode, at 20 kHz offset
≦−117 dBc/Hz (0.1 MHz≦fc<130 MHz, 520 MHz≦fc≦1040 MHz)
≦−123 dBc/Hz (260 MHz≦fc<520 MHz)
≦−129 dBc/Hz (130 MHz≦fc<260 MHz)
where fc is carrier frequency</td></tr>
<tr><td>Residual AM</td><td colspan="3">≦0.03% (−76 dBc) [at>150 kHz carrier frequency, demodulation band 50 Hz to 15 kHz]</td></tr>
<tr><td>Residual FM</td><td colspan="3"><table><tr><td>Frequency range</td><td>Demodulation band
0.3 to 3 kHz</td><td>Demodulation band
50 Hz to 15 kHz</td></tr><tr><td>520 MHz≦fc≦1040 MHz
0.1 MHz≦fc<130 MHz</td><td>7 Hz (50 dB)</td><td>16 Hz</td></tr><tr><td>260 MHz≦fc<520 MHz</td><td>4 Hz (55 dB)</td><td>8 Hz</td></tr><tr><td>130 MHz≦fc<260 MHz</td><td>2 Hz (61 dB)</td><td>4 Hz</td></tr></table>Measured by r.m.s. detector
Values in parentheses are relative values compared with 3.5 kHz deviation.</td></tr>
<tr><td rowspan="6">Amplitude modulation</td><td>Modulation factor</td><td colspan="3">0% to 100% at output levels ≦+7 dBm</td></tr>
<tr><td>Resolution</td><td colspan="3">1%</td></tr>
<tr><td>Accuracy</td><td colspan="3">±(indicated value×0.04+2)% at 1 kHz internal modulation frequency, ≦90% modulation factor</td></tr>
<tr><td>Internal modulation frequency</td><td colspan="3">400 Hz, 1 kHz (20 Hz to 50 kHz modulation is possible using optional built-in AF oscillator.)
Accuracy: ≦100 ppm</td></tr>
<tr><td>External modulation</td><td colspan="3">20 Hz to 50 kHz at AC couple (±1 dB bandwidth)
DC to 50 kHz at DC couple (±1 dB bandwidth)
Input level: Approx. 1 Vrms/600Ω</td></tr>
<tr><td>Distortion</td><td colspan="3">≦1% at 30% modulation factor
≦3% at 60% modulation factor } (for 1 kHz internal modulation frequency)</td></tr>
<tr><td>Incidental FM</td><td colspan="3">≦200 Hz peak at 1 kHz modulation frequency, 30% AM, 0.3 to 3 kHz demodulation bandwidth</td></tr>
<tr><td rowspan="8">Frequency modulation</td><td>Frequency modulation range</td><td colspan="3">0 to 199 kHz
0 to 99.9 kHz (130 to 260 MHz)
FM not specified for fc-(Δfpk)<100 kHz</td></tr>
<tr><td>Resolution</td><td colspan="3">10 Hz at 0 to 9.99 kHz
100 Hz at 10 to 99.9 kHz
1 kHz at 100 to 199 kHz</td></tr>
<tr><td>Accuracy</td><td colspan="3">±5% of indicated value at 1 kHz modulation frequency except residual FM</td></tr>
<tr><td>Internal modulation frequency</td><td colspan="3">400 Hz, 1 kHz (20 Hz to 100 kHz modulation is possible using optional built-in oscillator.)
Accuracy: ≦100 ppm</td></tr>
<tr><td rowspan="2">External modulation frequency range</td><td>AC mode</td><td colspan="2">20 Hz to 100 kHz (±1 dB bandwidth)</td></tr>
<tr><td>DC mode</td><td colspan="2">DC to 100 kHz (±1 dB bandwidth)</td></tr>
<tr><td>Distortion</td><td colspan="3">≦1% at 1 kHz modulation frequency, 22.5 kHz deviation</td></tr>
<tr><td>Incidental AM</td><td colspan="3">≦0.1% (at ≧500 kHz carrier, 1 kHz modulation frequency, 20 kHz deviation)</td></tr>
<tr><td>Center frequency accuracy at DC FM mode</td><td colspan="3">≦±500 Hz (fc: 500 MHz) for 3-minute period after calibration and after 2-hour warm-up compared with frequency of AC FM mode</td></tr>
<tr><td>Calibration function</td><td colspan="3">Automatic self calibration possible</td></tr>
<tr><td rowspan="5">Phase modulation</td><td>Phase modulation range</td><td colspan="3">0 to 9.99 rad (Indicates MAX. 999 rad at internal modulation mode)</td></tr>
<tr><td>Resolution</td><td colspan="3">0.01 rad (0 to 9.99 rad)
0.1 rad (10 to 99.9 rad)
1 rad (100 to 999 rad)</td></tr>
<tr><td>Accuracy</td><td colspan="3">±5% of indicated value (at 1 kHz internal modulation frequency except residual FM)</td></tr>
<tr><td>Internal modulation frequency</td><td colspan="3">400 Hz, 1 kHz (20 Hz to 100 kHz*1 modulation is possible using optional built-in oscillator.)
*1 The MG 3601A displays phase deviation (radian) derived from frequency deviation and modulation frequency of FM. Therefore, max. phase deviation is given as (max. deviation)/(modulation frequency).</td></tr>
<tr><td>External modulation frequency</td><td colspan="3">200 Hz to 8 kHz (±1 dB bandwidth)
Input level: Approx. 1 Vrms/600Ω</td></tr>
</table>

Video modulation (option)	Input signal	Video composite signal	
	Input level	1 Vp-p/75Ω (Pedestal level: 0 V, White level: positive voltage)	
	Modulation factor	When the specified voltage video signal is applied, modulated wave includes the signal as follows. White level: Approx. 12.5% of carrier peak Pedestal level: Approx. 75% of carrier peak	
	Carrier level accuracy.	CW output level accuracy: ± 3 dB at peak level	
Functions	Modulation signal output	Output level: Approx. 1 Vrms/600Ω	
	Simultaneous modulation	INT/EXT: AM/FM (φM), FM (φM)/AM, FM (φM)/FM (φM) INT/INT, EXT/EXT: AM/FM (φM)	
	Reverse power protection	≦50 W and ≦±50 VDC	
	Other functions	Relative value indication	Relative value display of carrier frequency and level is possible
		Continuously variable output mode	0.1 dB step adjustment of output level is possible with no output interruption in a ±5 dB range around an arbitraly level.
		Frequency memory	Stores and recalls up to 100 frequencies
		Function memory	Stores and recalls up to 30 sets of panel settings
	External control	GP-IB	SH1, AH1, T6, L4, TE0, LE0, SR1, RL1, PP0, DC1, DT0, C0
General	Ambient temperature, rated range of use	0° to 50°C	
	Power	AC **V ±10% (max. 250 V), 50/60 Hz, ≦100 VA	
	Dimensions and weight	132.5H x 426W x 451D mm, <16 kg	
Options	Option 01 Reference oscillator (10 MHz)	Aging rate: 2×10^{-8}/day (after 24-hour warm-up) Starting characteristics: 1×10^{-7}/day (after 30-min operation) 5×10^{-8}/day (after 60-min operation) Temperature characteristics: $\pm5\times10^{-8}$ (0° to 50 °C)	
	Option 02 Reference oscillator (10 MHz)	Aging rate: 5×10^{-9}/day (after 24-hour warm-up) Starting characteristics: 7×10^{-8}/day (after 30-min operation) 3×10^{-8}/day (after 60-min operation) Temperature characteristics: $\pm5\times10^{-8}$ (0° to 50 °C)	
	Option 03 Reference oscillator (10 MHz)	Aging rate: 2×10^{-9}/day (after 24-hour warm-up) Starting characteristics: 2×10^{-8}/day (after 60-min operation) Temperature characteristics: $\pm1.5\times10^{-8}$ (0° to 50 °C)	
	Option 04 AF oscillator	Frequency: 20 Hz to 100 kHz Resolution: 0.1 Hz Frequency accuracy: ≦100 ppm	
	Option 05 Video modulation	See Video modulation in this table.	
	Option 06 External modulation polarity switching	The relationship between the voltage polarity of the external modulation signal and the deviation increment and decrement can be selected as reversed or non-reversed.	
	Option 07 External FM modulation factor display	• Display range: 0% to 102% of modulation factor set value • Accuracy: ±4% (excluding modulation accuracy)	

* * Specify one nominal line voltage between 100 V and 250 V when ordering.

Table 1-6 Specifications (>1040 MHz)

Specifications (MG3602A, >1040 MHz)		
Carrier frequency	Frequency range	Up to 2080 MHz
	Resolution	20 Hz
Output	Level range	Up to +7 dBm (−20 to +120 dBμV e.m.f.)
	Accuracy	±1.5 dB (≧−10 dBm) ±2 dB (≧−123 dBm) ±3 dB (<−123 dBm)
	Frequency characteristics	≦1.5 dB
	Impedance	50Ω, VSWR ≦1.8 (at ≦−3 dBm)
Signal purity	Subharmonics (½fc, ³⁄₂fc)	≦−30 dBc
	Non harmonic spurious	≦−54 dBc (greater than 5 kHz apart from carrier)
	SSB phase noise	≦−110 dBc/Hz at 20 kHz offset
	Residual FM	15 Hz (0.3 to 3 kHz demodulation) 32 Hz (50 Hz to 15 kHz demodulation)
Amplitude modulation	Modulation factor	0 to 100% (at ≦+1 dBm)
	Accuracy	±(indicated value ×0.04+2)% at 1 kHz internal modulation frequency, <60% modulation factor
	External modulation	20 Hz to 30 kHz at AC couple (±1 dB bandwidth) DC to 30 kHz at DC couple (±1 dB bandwidth)
	Distortion	≦2.5% at 30% modulation factor (at 1 kHz internal modulation frequency)
	Incidental FM	≦400 Hz peak (at 1 kHz internal modulation frequency, 30% modulation, 0.3 to 3 kHz demodulation bandwidth)
Function	Reverse power protection	≦25 W and ≦±50 VDC

Notes:

1. Other specifications not shown in Table 1-6 are the same as in Table 1-5.

2. At >1040 MHz, the video modulation does not function.