



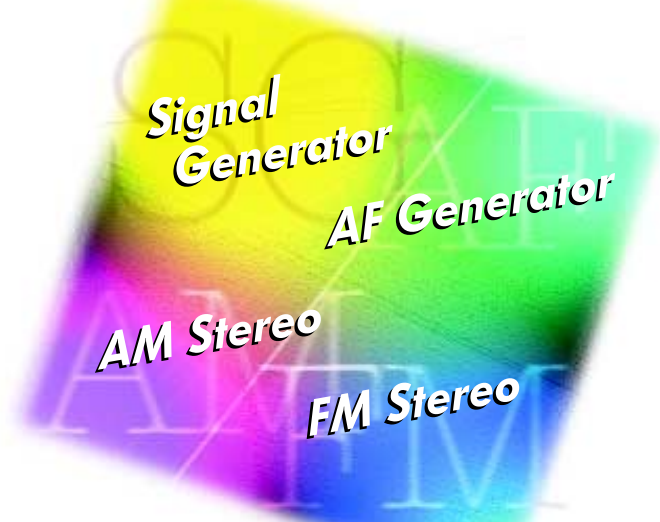
FM/AM Stereo Signal Generator KSG4310

10 kHz to 280 MHz and -133 dBm to +19 dBm.

Provision of electronic attenuators resulted in remarkably improved reliability and response.

A standard signal generator, FM stereo modulator, AM stereo modulator, and variable AF generator with a frequency range of 50 Hz to 15 kHz have been integrated into a single unit.

Serving as four instruments *And equipped with advanced electronic attenuators as standard !*

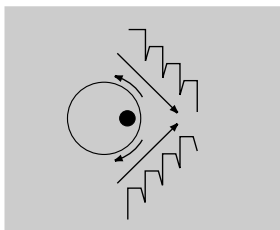


Model KSG4310 is FM/AM stereo signal generator that cover a frequency range of 10 kHz to 280 MHz. The PLL (A phase-lock loop) system is used to enable the instruments to generate signals as consistent as $\pm 2 \times 10^{-7}$ /week. Incorporating FM stereo and AM stereo (Motorola C-QUAM™ system) modulators, model KSG4310 is also highly desirable for their compact and labor-saving design. It also incorporates several new features and improvements, such as electronic attenuators for improved reliability, a variable AF generator, and a memory scan function, all added while keeping costs at low levels. As a result, the KSG4310 has become the standard in signal generators while at the same time offering superior cost performance.

Comparison of Attenuator Systems

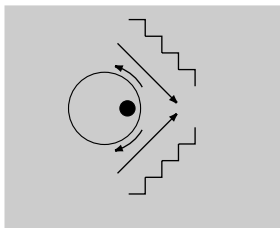
Conventional system

- All points are switched using mechanical relays.
- Durability of the relays is a issue.
- A drop in output occurs when switching a point.



KSG4310

- All points are electrified, except those between +3.1 dBm and +3.0 dBm and between -6.9 dBm and -7.0 dBm.
- Improved reliability and durability
- High-speed switching time
- Provided less signal drops when switching a point.



- Wide bandwidth of 280 MHz covering low frequency to VHF band
- High resolution of 10 Hz in a full bandwidth and 8-digit display
- Signal generator, FM stereo modulator, AM stereo modulator, and AF generator incorporated into a single unit
- High output of +19 dBm (2 V) with a setting resolution of 0.1 dB
- Improved reliability resulting from the use of electronic attenuators
- Continuous mode that forcibly stops switching of step attenuators
- Indications in eight types of units: EMFdBμ, EMFmV, EMFμV, dBμ, dBm, dBf, mV, and μV
- Internal modulation frequency can be arbitrarily set between 50 Hz and 15 kHz at resolution of 50 Hz.
- Memory capable of storing 100 different panel settings
- Memory scan that recalls memory at any time-interval for executing stored data
- ΔFREQ (frequency Deviation) function, useful for frequency selectivity characteristic tests
- ΔdB (output level Deviation) function, useful for attenuation characteristic tests
- Equipped with GPIB as standard
- EXT I/O port to expand the range of applications available



K S G 4 3 1 0

FM/AM STEREO SIGNAL GENERATOR



Improved Reliability due to the Use of Electronic Attenuators

Output Characteristics

A synthesizing method enables the instruments to generate highly stable, quality signals.

- Frequency stability:
 $\pm 2 \times 10^{-7}$ /week
- Spurious:
Non-harmonics: -60 dBc
Harmonics: -30 dBc
- FM modulation distortion factor:
0.01% or less
- AM residual modulation:
S/N 60 dB or more
- FM residual modulation:
S/N 90 dB or more

Frequency

Resolution of 10 Hz is secured across a full bandwidth of 10 kHz to 280 MHz. The display unit uses a bright, 8-digit LED.

- Frequency resolution:
10 Hz (in full bandwidth)

Output Level

A range width of -133 dBm to +19 dBm and resolution of 0.1 dB are secured across the full frequency bandwidth. Use of electronic attenuators for all points except those between +3.1 dBm and +3.0 dBm and between -6.9 dBm and -7.0 dBm ensures high instrument reliability. This feature also has the advantage of improving affinity (less data missing) for digital data such as radio data systems (RDS) and others. Output impedance can be switched 50Ω or 75Ω.

- Advantages of electronic attenuators:
Improved reliability
High-speed switching time
Affinity for digital data

Continuous Mode

This feature forcefully stops switching of step attenuators in a range of -10 dB from an arbitrary output level. This prevents the instantaneous cutoff in RF output caused upon switching of a step attenuator.

Modulation

Model KSG4310 is equipped with FM stereo, AM stereo (Motorola C-QUAM™ system), and simultaneous AM/FM modulation features.

- AM stereo modulation (C-QUAM™ system)
Model KSG4310 incorporates an AM stereo modulator from the Motorola (C-QUAM™) system. This offers the following modulation modes: MONO, MAIN (L+R), LEFT, RIGHT, SUB(L-R), and EXT L/R. The modulation factor of each channel in the MAIN and SUB modes is 0 to 100%, and the pilot signal is 0 to 10%. In addition, right and left separation of at least 36 dB has been secured.

- FM stereo modulation

The instruments have MONO, MAIN (L+R), LEFT, RIGHT, SUB (L-R) and EXT L/R as modulation modes, and right and left separation of at least 60 dB has been secured. OFF, 25 μs, 50 μs, and 75 μs are provided for pre-emphasis setting.

- Simultaneous AM/FM modulation
Simultaneous AM and FM modulation is possible at a carrier frequencies of 2.00001 MHz and above.



Memory

Model KSG4310 has enough memory to store 100 different panel setups (in addresses 00 to 99). Individual (successive) addresses may also be grouped (into 10 groups maximum), and setup data within a group can be recalled sequentially. The instruments also have a memory scan feature that allows you to set a time interval between the execution of address setups, in a range of 0.2 to 60.0 seconds. This saves time during complicated setting procedures.

●Memory scan function

This function automatically recalls and executes setup data stored in the memory addresses, using a set time interval (from 0.2 to 60.0 seconds).

Example:

Memory01	AF:1kHz RF:80.0MHz Level:40dB μ	15sec
Memory02	AF:10kHz RF:80.0MHz Level:40dB μ	23sec
Memory03	AF:10kHz RF:80.1MHz Level:40dB μ	30sec

Internal Modulation Signal Source (AF Generator)

Two independent systems for internal modulation signal sources are provided for AM and FM modulation. Oscillating frequency can be arbitrarily set, using a resolution of 50 Hz, in a range of 50 Hz to 15 kHz with $\pm 0.01\%$ output accuracy. Moreover, because output from the AF generator can be obtained from the COMPOSITE OUTPUT terminals on the rear panel, the KSG4310 can also be used as generators (in MONO mode). They also have a WIDE BAND (30 Hz to 100 kHz) external modulation signal in addition to the RIGHT and LEFT signals, allowing them to accept input of RDS and other data signals as well as external stereo modulation signals, easily.

●Internal modulation (AF generator)

Frequency range: 50 Hz to 15 kHz
Resolution: 50 Hz

Frequency Deviation Function

Model KSG4310 is capable of outputting frequencies obtained by adding or subtracting values set using the Δ FREQ key, which are referred to as "set frequencies". Because Deviation can be set by a single operation, this feature is useful for frequency-selectivity characteristic tests.

Output Level Deviation Function

Model KSG4310 is capable of outputting the level of the sum or difference of a value set using the Δ dB key, which is referred to a set output level. Because Deviation can be set by a single operation, this feature is useful for attenuation characteristic tests.

External Control

Model KSG4310 offers EXT I/O terminal-based control in addition to external control through GPIB. Control using the EXT I/O terminals allows incremental / decremental changes to data stored in memory addresses and input/output of 8-bit data. This feature is used for linking to jigs or other measuring instruments.



RF Output

●Frequency

Frequency range	10 kHz to 280 MHz
Setting resolution	10 Hz
Settling time	300 ms or less (after switching frequency)
Frequency accuracy	$\pm 2 \times 10^{-6}$
Frequency stability	$\pm 2 \times 10^{-7}$ /week (48 hours after power ON)

●Output level

Setting range	-133 dBm to +19 dBm [50Ω] -123 dBm to +13 dBm [50Ω, AM modulated] -134.8 dBm to +17.2 dBm [75Ω] -124.8 dBm to +11.2 dBm [75Ω, AM modulated]
Setting resolution	0.1 dB
Level accuracy	± 1 dB [set output at 0 dBm (50Ω), and a frequency of 400 kHz or more] ± 2 dB [set output at +19 dBm to -120 dBm, and a frequency of 400 kHz or more] ± 2.5 dB [for cases other than the above]
Setting units	EMFdBμ / EMFmV / EMFμV / dBμ / dBm / dBf / mV/μV
Output terminal	BNC connector on the front panel
Output impedance	50 Ω or 75 Ω selectable
VSWR	1:1.2 or less [50 Ω, at -10 dBm or less]

●Signal purity

Spurious	Harmonics -30 dBc or less Non-harmonics -60 dBc or less
Residual modulation	<FM component> 90 dB or more [76 MHz to 90 MHz and at 98.0±1 MHz] 87 dB or more [at 10.7±1 MHz] 80 dB or more [2 MHz to 280 MHz] S/N ratio for a modulated wave of 1 kHz and 75 kHz frequency Deviation Bandwidth of 300 Hz to 15 kHz, de-emphasis of 50 μs <AM component> 60 dB or more [400 kHz to 2 MHz] 55 dB or more [150 kHz to 280 MHz] S/N ratio for a modulated wave of 1 kHz and 30% modulation At a demodulation bandwidth of 50 Hz to 15 kHz

Modulators

●FM modulator

External modulation frequency characteristics	50 Hz to 15 kHz, within ± 0.5 dB [RF = 76 MHz to 90 MHz and 98.0 and 10.7±1 MHz] [Dev. 75 kHz for input from the front panel] 50 Hz to 100 kHz, within ± 1.0 dB [RF = 76 MHz to 90 MHz and 98.0 and 10.7±1 MHz] [Dev. 75 kHz for input via WIDE BAND terminals on the rear panel]
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.....	50 Hz to 100 kHz, within ± 1.5 dB [RF = 2 MHz to 280 MHz] [Dev. 75 kHz for input via WIDE BAND terminals on the rear panel]
Distortion factor	0.01% or less [RF = 76 MHz to 90 MHz and 98.0 and 10.7±1 MHz]
Parasitic AM	0.5% or less [75 kHz frequency Deviation, RF = 76 MHz to 90 MHz and 98.0 and 10.7±1 MHz, AF = 1 kHz]
Maximum frequency Deviation	10% of RF frequency [when 10 kHz \leq RF \leq 150 kHz] 15 kHz [when 150 kHz < RF \leq 2 MHz] 300 kHz [when 2 MHz < RF \leq 280 MHz] Setting resolution 100 Hz, 1 kHz (Dev. \geq 100kHz) Accuracy Reading x 0.08 + 1 digit

●FM stereo (Note 1)

Modulation-enable frequency	2.00001 MHz to 280 MHz
External modulation frequency characteristics	50 Hz to 15 kHz, within ± 0.5 dB, 1 kHz reference
Distortion factor	0.02% or less [when internal generator is at 1 kHz or 400 Hz] 0.05% or less [for an external input of 50 Hz to 15 kHz] Dev. 75 kHz, demodulation bandwidth of 50 Hz to 15 kHz, de-emphasis of 50 μs
Separation	60 dB or more [at AF = 50 Hz to 15 kHz]
Pre-emphasis	25 μs, 50 μs, 75 μs, and OFF
Main and Sub signals	Modulation factor: 0 to 125%, 100% = Dev. 67.5 kHz Resolution: 0.1%, 1% (\geq 100%) Accuracy: Reading \times 0.05 + 2%
Pilot signals	Frequency: 19 kHz \pm 0.01% Amplitude range: 0 to 15%, 0.1% step, 100% = Dev. 75 kHz Accuracy: Reading \times 0.05 + 1% Output terminals: BNC connector on the rear panel (shared by the AM stereo) Output amplitude: 1 Vrms, $\pm 5\%$ Output impedance: Approx. 600Ω
Composite output	Output terminals: BNC connector on the rear panel Amplitude: Approx. 3 Vp-p Output impedance: Approx. 75 Ω

Note 1: Unless otherwise specified, the specifications for the FM stereo modulation have been determined in a range of RF = 76MHz to 90 MHz and 98.0 and 10.7±1 MHz.

●AM modulator

External modulation frequency characteristics	50 Hz to 10 kHz, within ± 0.5 dB [30% modulation, RF = 400 kHz to 2 MHz, AF = 1 kHz] 50 Hz to 10 kHz, within ± 1.0 dB [30% modulation, RF = frequency other than the above, AF = 1 kHz]
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Distortion factor	0.1% or less [30% modulation, RF = 400 kHz to 2 MHz, AF = 1 kHz] 1.0% or less [30% modulation, RF = any frequencies other than the above, AF = 1 kHz] Demodulation bandwidth 50 Hz to 15 kHz
Parasitic FM	75 Hz or less [30% demodulation, RF = 400 kHz to 2 MHz, AF = 1 kHz]
Modulation factor	0 to 99.9%, 0.1% step
Accuracy	Reading \times 0.05 + 2% [400 kHz to 2 MHz, for 80% or less of AM modulator] Reading \times 0.08 + 2% [any frequencies other than the above]

●AM stereo (Motorola C-QUAM™ system)

Modulation-enable frequency	400 kHz to 2 MHz
External input terminals ...	External-signal input BNC connector for Right and Left on the front panel (shared by the FM stereo)
External modulation frequency characteristics	50 Hz to 10 kHz, within \pm 0.5 dBm, 1 kHz reference
Main signal	Modulation factor: 0 to 100%, resolution of 0.1% Modulation accuracy: Reading \times 0.05 + 2% Distortion factor: 0.2% or less [50%, AF = 1 kHz, demodulation bandwidth of 50 Hz to 15 kHz]
Sub signal	Modulation factor: 0 to 100%, resolution of 0.1% Modulation accuracy: Reading \times 0.05 + 2%
Distortion factor	1% or less [50%, AF = 1 kHz, demodulation bandwidth of 50 Hz to 15 kHz]
Right and Left signals	Modulation factor: 0 to 80%, resolution of 0.1% Modulation accuracy: Reading \times 0.05 + 2% Distortion factor: 1% or less [50%, AF = 1 kHz, demodulation bandwidth of 50 Hz to 15 kHz]
Separation	36 dB or more [AF = 400 Hz to 4 kHz]
Crosstalk	-40 dB or less [from the main to sub, AF = 1 kHz, at modulation factor of 50%] -46 dB or less [from the sub to main, AF = 1 kHz, at modulation factor of 50%]
N.P.C variable range	95% \pm 5% Resolution of 0.1%
Pilot signals	Frequency: 25 Hz \pm 0.01% Amplitude range: 0 to 10%, 0.1% step Modulation accuracy: Reading \times 0.05 + 1% Output terminals: BNC connector on the rear panel (shared by the FM stereo) Output amplitude: 1 Vrms, \pm 5% Output impedance: Approx 600 Ω

Simultaneous FM and AM modulation

RF frequency Simultaneous modulation is possible at 2.00001 MHz or higher

Modulated Signals

●Internal signals (two systems for AM and FM)

Setting frequency	50 Hz to 15 kHz sine waves
Resolution	50 Hz
Frequency accuracy	\pm 0.01%

●External signals

External input terminals ...	External signal input: Right and left, BNC connector on the front panel
	Input voltage: Specified modulation factor at 3 Vp-p
	Input impedance: Approx. 10 k Ω
	Input frequency range: 30 Hz to 15 kHz
Wide band input terminal	Wide band input: BNC connector on the rear panel
	Input voltage: Specified modulation factor at 3 Vp-p
	Input impedance: Approx. 10 k Ω
	Input frequency range: 30 Hz to 100 kHz

Others/General

●Memory feature

100 different operating status (setting status) data can be stored and recalled.

●External control interface

EXT I/O terminals	Shape: 25-pin D-SUB connector
	Signal level: TTL level
	Control contents: 8-bit input/output (can be set and read through GPIB) Memory up/down

Range-out terminals	Shape: Pins connector
	Signal level: 5 V, 50 mA (source)

GPIB interface (IEEE488.1) SH1, AH1, T4, L2, SR1, RL1, PP0, DC1, DT0, C0, E1

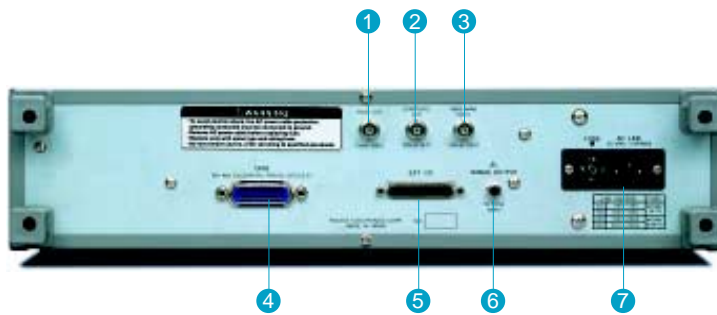
Radiation interference 1 μ V or less
[when measured using a double-loop antenna of 25 mm diameter, at a distance of 25 mm from the case]

●General

Temperature and humidity range	For assuring the specifications: 5°C to 35°C, 20% to 85% RH (no condensation) Operating: 0°C to 40°C, 20% to 85% RH (no condensation) Storage: -25°C to 70°C, 20% to 90% RH (no condensation)
External dimensions	430 (445) W \times 99 (110) H \times 380 (440) D mm Values in parentheses are maximum sizes.
Weight	Approx. 10 kg
Line voltage	100, 115, 215, and 230 V AC \pm 10% each, selectable
Power consumption	75 VA maximum (65 W)

Rear panel

- 1) Pilot signal output terminal
- 2) Composite signal output terminal
- 3) Wide band input terminal
- 4) GPIB connector
- 5) EXT I/O connector
- 6) Range-out terminal
- 7) AC inlet/fuse



Options

KRB3-KSG (inch type brackets)

KRB100-KSG (metric type brackets)



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