# **KSG4310** 280MHz FM/AM STEREO STANDARD SIGNAL GENERATOR



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.

## **Outline**

Model KSG4310 is FM/AM stereo signal generator that cover a frequency range of 10 kHz to 280 MHz. The PLL (A phaselock 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<sup>TM</sup> 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.

## **Features**

- 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: EMFdBm, EMFmV, EMFmV, dBm, dBm, dBf, mV, and mV
- 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



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## **Specifications**

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RF Output		• FM stereo (Note 1)	
<ul> <li>Frequency</li> </ul>		Modulation-enable	frequency
Frequency range	10 kHz to 280 MHz		2.00001 MHz to 280 MHz
Setting resolution	10 Hz	External modulation	n frequency characteristics
Settling time	300 ms or less (after switching frequency)		50 Hz to 15 kHz, within $\pm 0.5$ dB, 1 kHz reference
Frequency accuracy	$\pm 2 \times 10^{-6}$	Distortion factor	0.02% or less
Frequency stability	$\pm 2 \times 10^{\circ}$ /week (48 hours after power ON)		[when internal generator is at 1 kHz or 400 Hz]
Output level     Satting range	$122 \text{ dBm to } \pm 10 \text{ dBm } [500]$		0.05% of less
Setting range	-133  dBm to  +19  dBm  [5002] 122 dBm to $+12 \text{ dBm } [5002 \text{ AM modulated}]$		[10] all external input of 50 Hz to 15 kHz]
	-125  dBm to +15  dBm  [5052, AW modulated]		to 15 kHz, de emphasis of 50 ms
	-124.8  dBm to  +11.2  dBm  [7502]	Separation	60  dB  or more [at AF = 50  Hz to  15  kHz]
Setting resolution	0.1 dB	Pre-emphasis	25  µs 50 $µs$ 75 $µs$ and OFF
Level accuracy	$\pm 1$ dB [set output at 0 dBm (50 $\Omega$ ), and a frequency	Main and Sub signal	s Modulation factor: 0 to 125%, $100\% = \text{Dev. } 67.5 \text{ kHz}$
Deveraceatacy	of 400 kHz or more]		Resolution: 0.1%, 1% (≥100%)
	$\pm 2 \text{ dB}$ [set output at +19 dBm to -120 dBm, and		Accuracy: Reading $\times 0.05 + 2\%$
	a frequency of 400 kHz or more]	Pilot signals	Frequency: 19 kHz±0.01%
	$\pm 2.5$ dB [for cases other than the above]	_	Amplitude range: 0 to 15%, 0.1% step, 100% = Dev. 75 kHz
Setting units	EMFdBµ / EMFmV / EMFµV / dBµ / dBm /		Accuracy: Reading×0.05 + 1%
	$dBf / mV / \mu V$		Output terminals: BNC connector on the rear
Output terminal	BNC connector on the front panel		panel (shared by the AM stereo)
Output impedance	50 $\Omega$ or 75 $\Omega$ selectable		Output amplitude: 1 Vrms, ±5%
VSWR	1:1.2 or less [50 $\Omega$ , at -10 dBm or less]		Output impedance: Approx. $600\Omega$
<ul> <li>Signal purity</li> </ul>		Composite output	Output terminals: BNC connector on the rear panel
Spurious	Harmonics -30 dBc or less		Amplitude: Approx.3 Vp-p
	Non-harmonics -60 dBc or less		Output impedance: Approx.75 $\Omega$
Residual modulation	<pre>n <fm component=""></fm></pre>	Note 1: Unless othe	rwise specified, the specifications for the FM stereo
	90 dB or more [76 MHz to 90 MHz and at	modulation have be	en determined in a range of $RF = 76MHz$ to 90 MHz
	98.0±1 MHz]	and 98.0 and $10.7\pm$	I MHz.
	8/ dB or more [at $10./\pm 1$ MHz]	AM modulator     Entermal mandalation	· · · · · · · · · · · · · · · · · · ·
	80 dB or more [2 MHz to 280 MHz]	External modulation	50 He to 10 He mithin 10 5 dB
	S/N ratio for a modulated wave of 1 kHz and 75		50 HZ to 10 kHZ, within $\pm 0.5$ dB [20% modulation $PE = 400$ kHz to 2 MHz $AE = 1$ kHz]
	Bandwidth of 300 Hz to 15 kHz, de emphasis of 50 µs		[50% modulation, $RF = 400$ kHz to 2 MHz, $AF = 1$ kHz] 50 Hz to 10 kHz, within $\pm 1.0$ dB
	AM component>		130% modulation RE – frequency other than the
	60 dB or more [400 kHz to 2 MHz]		above $AF = 1 \text{ kHz}$
	55 dB or more [150 kHz to 280 MHz]	Distortion factor	0.1% or less
	S/N ratio for a modulated wave of 1 kHz and		[30% modulation $RF = 400 \text{ kHz}$ to 2 MHz $AF = 1 \text{ kHz}$ ]
	30% modulation		1.0% or less
	At a demodulation bandwidth of 50 Hz to 15 kHz		[30% modulation, $RF = any$ frequencies other than
Modulators			the above, $AF = 1 \text{ kHz}$
<ul> <li>FM modulator</li> </ul>			Demodulation bandwidth 50 Hz to 15 kHz
External modulation	frequency characteristics	Parasitic FM	75 Hz or less
	50 Hz to 15 kHz, within ±0.5 dB		[30% demodulation, $RF = 400 \text{ kHz}$ to 2 MHz, $AF = 1 \text{ kHz}$ ]
	$[RF = 76 MHz to 90 MHz and 98.0 and 10.7 \pm 1 MHz]$	Modulation factor	0 to 99.9%, 0.1% step
	[Dev. 75 kHz for input from the front panel]	Accuracy	Reading $\times$ 0.05 + 2%
	50 Hz to 100 kHz, within $\pm 1.0$ dB		[400 kHz to 2 MHz, for 80% or less of AM
	$[RF = 76 MHz to 90 MHz and 98.0 and 10.7\pm1 MHz]$		modulator]
	[Dev. 75 kHz for input via WIDE BAND		Reading $\times$ 0.08 + 2%
	terminals on the rear panel]		[any frequencies other than the above]
	50 Hz to 100 kHz, within $\pm 1.5$ dB	<ul> <li>AM stereo (Motoro)</li> </ul>	la C-QUAM <sup>™</sup> system)
	[RF = 2 MHz  to  280 MHz]	Modulation-enable	frequency
	[Dev. 75 kHz for input via WIDE BAND		400 kHz to 2 MHz
	terminals on the rear panel]	External input terminals	External-signal input BNC connector for Right and
Distortion factor	0.01% of less	<b>F</b> ( 1 11.4	Left on the front panel (shared by the FM stereo)
Demositie AM	$[RF = 76 \text{ MHz to } 90 \text{ MHz and } 98.0 \text{ and } 10.7\pm1 \text{ MHz}]$	External modulation	50 Hz to 10 kHz within ±0.5 dBm 1 kHz reference
Falashic Alvi	1.5% of less	Main signal	Modulation factor: 0 to 100% resolution of 0.1%
	[75  KHZ] inequency Deviation, $KF = 70  WHZ$ to $90 \text{ MHz}$ and $98.0 \text{ and } 10.7\pm1 \text{ MHz}$ . $\text{AE} = 1 \text{ kHz}$ ]	Iviani signai	Modulation accuracy: Reading × 0.05 + 2%
Maximum frequency	y Deviation		Distortion factor: $0.2\%$ or less
maximum nequelle	10% of RF frequency		[50%, $AF = 1$ kHz, demodulation bandwidth of 50
	[when 10 kHz $\leq$ RF $\leq$ 150 kHz]		Hz to 15 kHz]
	15 kHz [when 150 kHz < RF $\leq 2$ MHz]		
	$300 \text{ kHz}$ [when 2 MHz < RF $\leq 280 \text{ MHz}$ ]		
	Setting resolution 100 Hz, 1 kHz (Dev. $\geq$ 100kHz)		
	Accuracy Reading $\times 0.08 + 1$ digit	I	

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### **Specifications**

Sub signal	Modulation factor:	0 to 100% resolution of 0.1%			
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, c	lemodulation bandwidth of 50			
Right and Left signals	Modulation factor:	0 to $80%$ resolution of $0.1%$			
Right and Left signals	Modulation accuracy:	Reading $\times 0.05 + 2\%$			
Distortion factor	1% or less				
	[50%, AF = 1 kHz, c	lemodulation bandwidth of 50			
	Hz to 15 kHz]				
Separation	36 dB or more $[AF = 400 \text{ Hz to } 4 \text{ kHz}]$				
Crosstalk	-40 dB or less [from the main to sub, $AF = 1$ kHz,				
	at modulation factor	of $50\%$ ]			
	at modulation factor	of $50\%$ ]			
N.P.C variable range	95%±5% Resolution of 0.1%				
Pilot signals	Frequency:	25 Hz±0.01%			
	Amplitude range:	0 to 10%, 0.1% step			
	Modulation accuracy:	Reading $\times 0.05 + 1\%$			
	Output terminals:	BNC connector on the rear			
	Output amplitude:	1 Vrms +5%			
	Output impedance:	Approx $600 \Omega$			
■ Simultaneous FM an	d AM modulation				
RF frequency	Simultaneous modul	ation is possible at 2.00001			
	MHz or higher				
Modulated Signals					
• Internal signals (two	Internal signals (two systems for AM and FM)				
Setting frequency	50 Hz to 15 kHz sine waves				
Frequency accuracy	+0.01%				
• External signals	_0.0170				
External input terminals	ls External signal input: Right and left, BNC				
		connector on the front panel			
	Input voltage:	Specified modulation factor			
	Inputimpodence	at 3 Vp-p			
	Input Impedance.	$\sim 30 \text{ Hz to } 15 \text{ kHz}$			
Wide band input terr	ninal				
1	Wide band input:	BNC connector on the rear			
		panel			
	Input voltage:	Specified modulation factor			
	T	at 3 Vp-p			
	Input Impedance:	$\frac{Approx. 10 \text{ ks2}}{2}$			
■ Others/General	input inequency range	. 50 112 to 100 KHZ			
<ul> <li>Memory feature</li> </ul>					
100 different operating status (setting status) data can be stored and					
recalled.					
• External control inte	rface				
EXT I/O terminals	Signal level: TTL level				
	Control contents: 8-h	bit input/output (can be set			
	and	d read through GPIB)			
	Me	emory up/down/return			
Range-out terminals	Shape: Pir	is connector			
	Signal level: 5 V	/, 50 mA (source)			
OF ID IIICEITACE (IEEE400.1) STI1, AH1, 14, L2, SK1, KL1, PP0, DC1, DT0, C0, E1					
Radiation interference	1 uV or less	0, 00, 11			
	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) Dimensions (MAX)  $430W \times 99H \times 380Dmm$  ( $445W \times 110H \times 440Dmm$ ) Values in parentheses are maximum sizes. Weight Approx.10 kg Line voltage 100, 115, 215, and 230 V AC ± 10% each, selectable Power consumption 75 VA maximum (65 W) Accessories Output cable (SA550)  $\times 1$