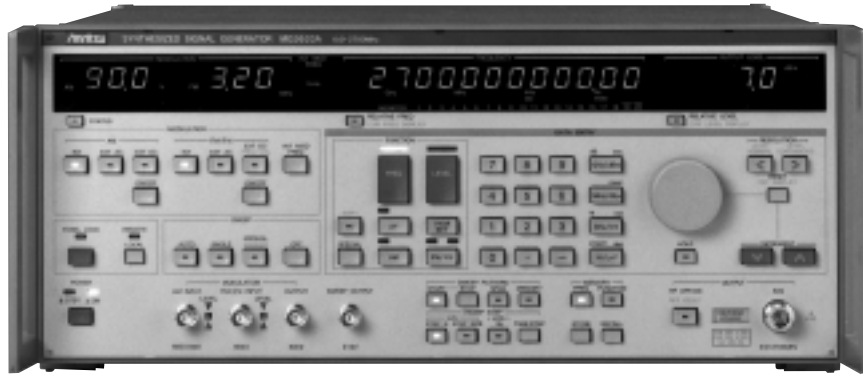


SYNTHESIZED SIGNAL GENERATOR

MG3633A

10 kHz to 2700 MHz

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



5

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 narrow-band 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, φM, 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 narrow-band mobile radio equipment can be measured with sufficient margin (Fig. 2)

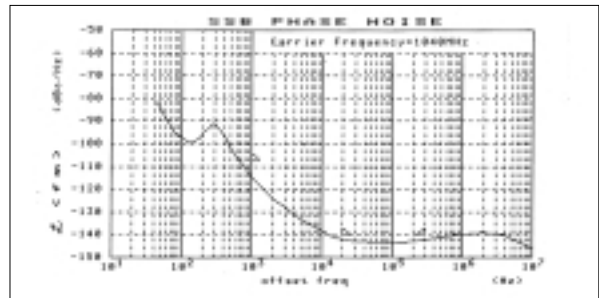


Fig. 1 SSB phase noise

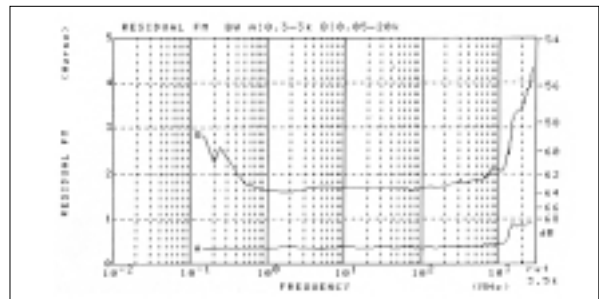


Fig. 2 Residual FM

**• 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).

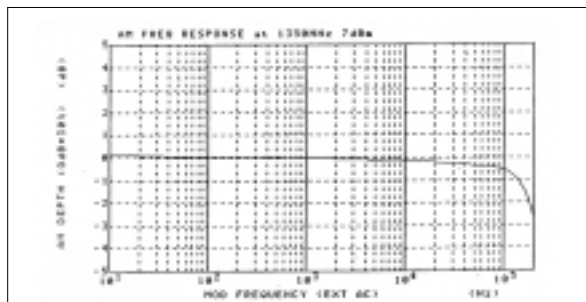


Fig. 4 AM modulation frequency characteristics

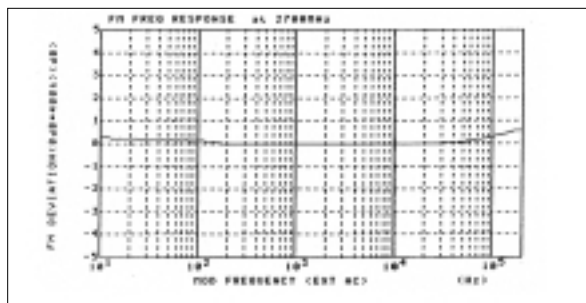


Fig. 5 FM modulation frequency characteristics

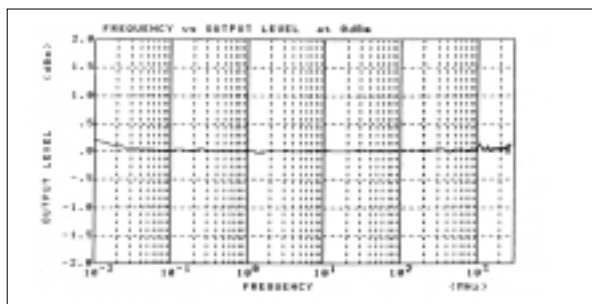


Fig. 3 Output level frequency response

**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: $\leq 1 \times 10^{-7}$ /day, after 60 minutes of operation: $\leq 5 \times 10^{-8}$ /day, Aging rate: After 24 hours of operation: $\leq 2 \times 10^{-8}$ /day, Temperature characteristics: $\pm 5 \times 10^{-8}$ /day, (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	10 kHz to <1280 MHz	≥1280 MHz
		Output level		
		+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			

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

Continued on next page

Phase modulation	External modulation	Input level: Approx. 2 Vp-p/600 Ω Input impedance: Nominal 600 Ω					
	Distortion	≤1% (internal 1 kHz, 5 rad modulation)					
Internal modulation signal	Frequency range	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.					
	Resolution	0.1 Hz					
	Frequency accuracy	100 ppm					
	Distortion	≤0.03% (fixed, 400 Hz and 1 kHz), ≤0.3% (variable, 20 Hz to 50 kHz)					
Memory function	Frequency memory	1000 carrier frequencies (store/recall)					
	Function memory	100 panel settings (store recall)					
Sweep function	Sweep mode	Carrier frequency, output level, AF frequency					
	Sweep pattern	Pattern	Start/stop	Carrier frequency	Output level	AF frequency	
			Center/span	√	√*2	√	
		Step	Entering number of steps	√	—	√	
			Entering step size	√	√*3	√	
			LOG 1%	√	—	√	
	Pattern			Frequency memory	Function memory		
		Continuous address	√	√			
		Random address	√	√			
		Continuous, random mixed	√	√			
Maximum number of steps		20*4	20*4				
Sweep time	0.1 ms to 600 s, 0.01 ms resolution (minimum time depends on the switching time of each function.)						
Marker	One movable marker						
Sweep signal output	Staircase (saw-tooth waveform), Start point: 0 V, Stop point: 10 V						
Other functions	Modulation signal output	Modulation signal is output when modulating. Output level: Approx. 2 Vp-p/600 Ω					
	Simultaneous modulation	Simultaneous modulation is possible in combinations shown below.					
			INT AM	EXT AM	INT FM	EXT FM	INT ◊M
		EXT ◊M	√	√	—	—	√*6
		INT ◊M	√*5	√	—	—	—
		EXT FM	√	√	√*6	—	—
		INT FM	√*5	√	—	—	—
	EXT AM	√	—	—	—	—	
Relative value display	Carrier frequency, output level						
Continuously variable output level mode	Continuously variable within a ±10 dB range of the set level Step size: 0.1 dB						
Trigger function	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						
Memory backup	Last settings are stored when power is turned off.						
GPIB	Interface function: SH1, AH1, T5, L3, TE0, LE0, SR1, RL1, PP0, DC1, DT1, C0						
Reverse power	Maximum reverse input power: 50 W (<1000 MHz), 25 W (≥1000 MHz), ±DC 50 V						
Operating temperature	0° to 50°C						
Power	*7Vac $\pm 10\%$ , 48 to 63 Hz, ≤270 VA						
Dimensions and mass	426 (W) x 177 (H) x 451 (D) mm, ≤32 kg						
EMC*8	EN55011: 1991, Group 1, Class A EN50082-1: 1992						
Safety	EN61010-1:1993 (Installation Category II, Pollution Degree II)						

\*1: Aging rates up to 5 x 10<sup>-10</sup>/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.

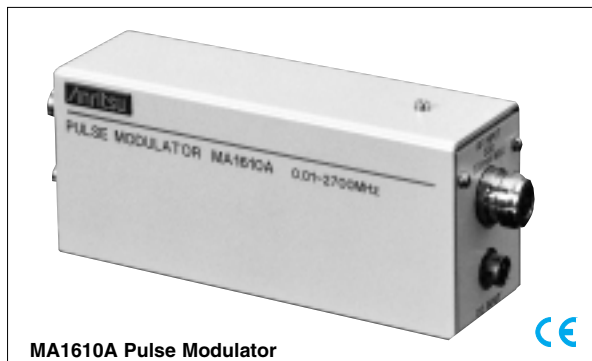
\*8: Electromagnetic Compatibility

## Options

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

Option 04: Rear RF output, SMA connector

## Peripheral equipment



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
MG3633A	<b>Main frame</b> Synthesized Signal Generator
J0025A	<b>Standard accessories</b> 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
J0017	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
	<b>Options</b>
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 (used with Packet IIe/III/IIIis and ML4803A)
MX5251B	Frequency-Response Compensation Software (used with Packet V series and ML4803A)
	<b>Peripheral</b>
MA1610A	Pulse Modulator (10 kHz to 2.7 GHz)
	<b>Optional accessories</b>
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