Agilent
8663A Synthesized Signal Generator
100 kHz to 2.56 GHz

Technical Data

Precise low noise signal simulation

Agilent Technologies

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A powerful combination of features for a variety of demanding applications

Satellite communications

The 8663A is a powerful tool for evaluating satellite systems and their components. By substituting the 8663A as one of the local oscillators in a system, you can be confident that noise contribution is reduced to a minimum. Besides low noise, other features add to the 8663A's desirability for local oscillator applications. High output power allows it to directly drive high level mixers commonly found in low noise systems. Excellent long-term frequency stability maintains carrier accuracy over time while its high frequency resolution can be used to tune out small doppler frequency offsets. Finally, the fast switching speed can be utilized for systems that employ frequency hop techniques for data security.

Automatic test systems

Features such as high output power to overcome cable losses and a simple programming format to reduce development time make the 8663A an excellent choice for automatic test systems. Furthermore, an extensive feature set minimizes the number of instruments required which conserves rack space and insures simpler system integration. The powerful total capability of the 8663A also allows future test requirements to be quickly handled by minor software changes, as opposed to major system reconfigurations.

Radar/EW

The 8663A is a particularly valuable tool for the design and maintenance of radar/EW systems. High performance pulse modulation with simultaneous FM, AM and phase modulation allows simulation of complex radar return signals. Simultaneous pulse plus FM, for example, can simulate doppler acceleration while pulse plus AM can simulate atmospheric attenuation. Pulse plus more complex modulation combinations can simulate returns needed to test signal recognition processing such as might be encountered in early warning aircraft.

Excellent close-in noise performance allows the 8663A to be used as a reference to directly measure the noise of a system's RF local oscillators or to be multiplied up and used as a reference at microwave frequencies.

Mobile radio and digital communications

Low noise, excellent output level accuracy, precise AM and FM, and GPIB make the 8663A ideal for both in-channel and out-of-channel automated receiver testing. Its frequency switching speed of less than 510 microseconds will also allow real time testing of emerging cellular mobile radio systems.

With the appropriate external drive circuitry, the Option 002 linear phase modulator can be used to simulate various digital PSK formats. This PSK capability alone is useful to simulate and align digital receivers. To further test receiver performance, the 8663A can be used to introduce perturbations such as static phase errors, while performing bit error rate tests. Simultaneous modulation capability is also important to stress the receiver while a data stream is put on the carrier using PSK. FM can be added at low rates to simulate doppler shift while AM can simulate fading along the signal path.

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8663A Synthesized Signal Generator

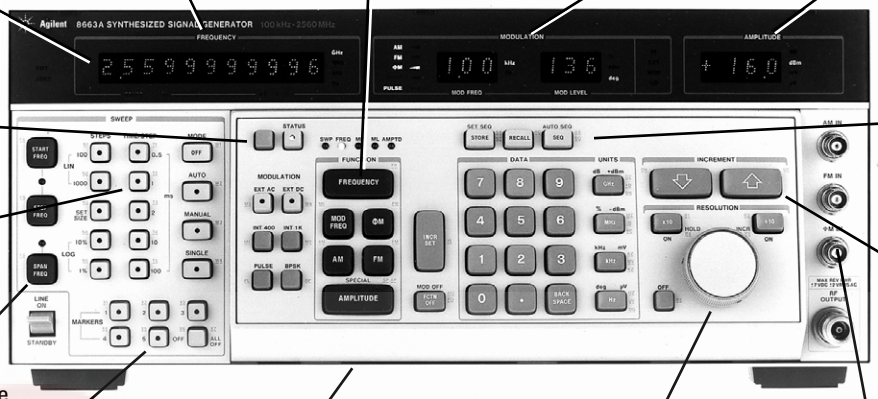
Status key flashes to indicate input errors or hardware failures. Depressing the key displays error message in frequency display.

Basic signal generator functions are controlled with function, data, and unit keys.

Modulation display indicates frequency of modulation synthesizer, AM depth, and FM or ϕM deviation.

11-digit LED display for all frequency related parameters and status messages.

Output level displayed in dBm, mV, µV, or in dB relative to any selected reference level.



Shift key to access all special functions.

Up to 9 front-panel settings can be stored, recalled, and manually or auto sequenced.

Five sweep speeds are selectable: 0.5, 1, 2, 10, and 100 ms/step.

Increment keys change all function values in user selected steps.

Either start/stop or span (Δf) is selectable.

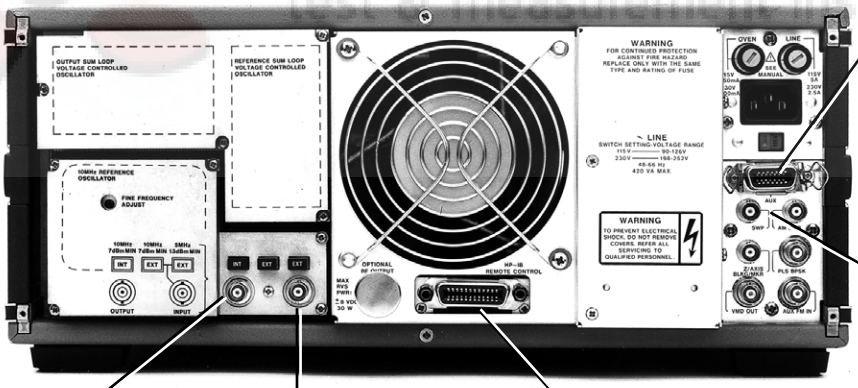
Up to five digital markers can be set with synthesized resolution and accuracy.

Operating information for quick reference on pull-out card beneath instrument.

Knob controls all function values with selectable resolution.

Separate AM, FM, ϕM and pulse modulation inputs (pulse input on rear panel) allows all four modulation types to be simultaneously selected and independently set.

(Option 001 rear panel shown)



Auxiliary control connector allows input to control increment up and down, start and stop sweep, sequence, and outputs indicating the generator's processing status.

Connectors for sweep output; amplitude markers; Z-axis markers and blanking; pulse or BPSK modulation input; modulation synthesizer output; auxiliary FM input; 640 MHz reference output; electronic frequency control input; AM IN; FM IN; and ϕM IN.

Reference output connector provides internal reference oscillator signal or external reference signal at 0.7 V into 50 Ω. Signal is always 10 MHz, even when 5 MHz reference signal is applied.

External reference input connector accepts 5 MHz or 10 MHz signal.

Standard GPIB for control of all instrument functions.

High-level, low-noise signals to 2560 MHz

Frequency

The 8663A will extend your RF signal simulation capabilities from 100 kHz to 2.56 GHz. This wide frequency range allows complete coverage of emerging RF communication bands as well as the satellite telemetry systems utilizing S band. In addition, many popular microwave IF and LO frequencies can be covered. With .1 Hz resolution for carriers less than 640 MHz (.2 or .4 Hz in higher bands), even narrowband devices such as crystal filters can be accurately characterized.

The standard internal crystal reference insures frequency accuracy and stability with an aging rate of $<5 \times 10^{-10}$/day. There is also an external output for this low noise 10 MHz oscillator so it can be used as a reference for other instruments in your ATE system.

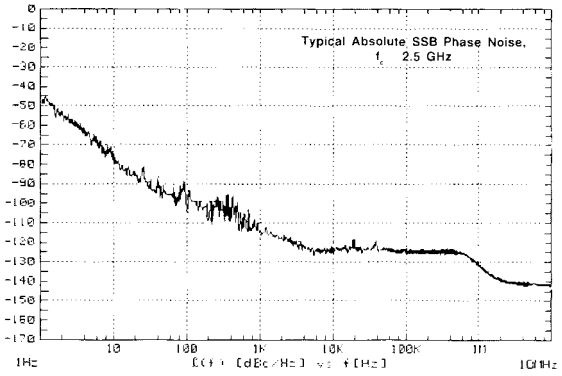
To fully utilize this frequency range, resolution, and accuracy, the 8663A provides frequency switching speeds of <510 microseconds to be within 100 Hz of the final frequency. This allows the 8663A to be used as a frequency agile source in hopped spread spectrum applications.

Low noise

Maintaining spectral purity was a major objective in the design of the 8663A. Phase noise at offsets equal to typical receiver channel spacings is comparable to high quality mechanically tuned generators. This noise performance combined with low spurious signals makes the 8663A an ideal source for automated adjacent channel selectivity measurements.

Phase noise at closer offsets to the carrier (within 1000 Hz) is also maintained at state-of-the-art levels. This performance allows the 8663A to be used as a reference to directly characterize the noise of RF sources or to be multiplied up and used as a reference at microwave frequencies. When combined with the 11729B carrier noise test set and the 3047 spectrum analyzer system, phase noise on sources up to 18 GHz can be automatically measured and plotted.

The low noise of the 8663A also makes it ideal for local oscillator substitution applications. When the 8663A is substituted for a local oscillator in a satellite communications system for example, you can be confident that the noise contribution due to that local oscillator is reduced to a minimum.



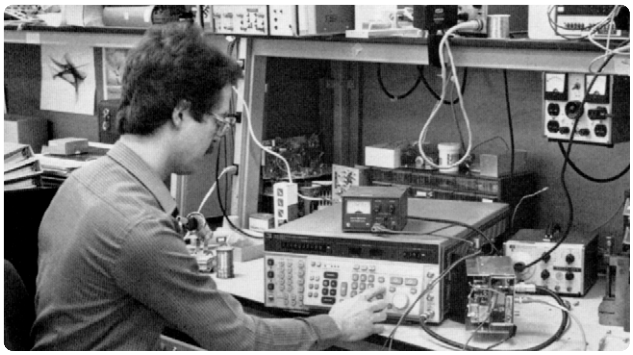
The 8663A is optimized to provide low phase noise at all offsets from the carrier.

Output

High output power of +16 dBm with the ability to obtain up to +19.9 dBm in over range often eliminates the need for external power amplifiers with the 8663A. This high power is useful for overcoming the cabling losses found in large ATE systems or when the 8663A is used to drive the high level mixers or multiplier chains found in local oscillator substitution applications.

Between the range of +16 dBm and –119.9 dBm, the absolute level accuracy is ±1 dB, making the 8663A an excellent choice for precise low level receiver sensitivity measurements. Amplitude is calibrated directly in both dBm and volts, or with the appropriate special function, other relative units like dBμ V can be obtained for your applications.

Settability of the output is enhanced by .1 dB resolution, and microprocessor correction insures the repeatability required in modern communications systems testing.



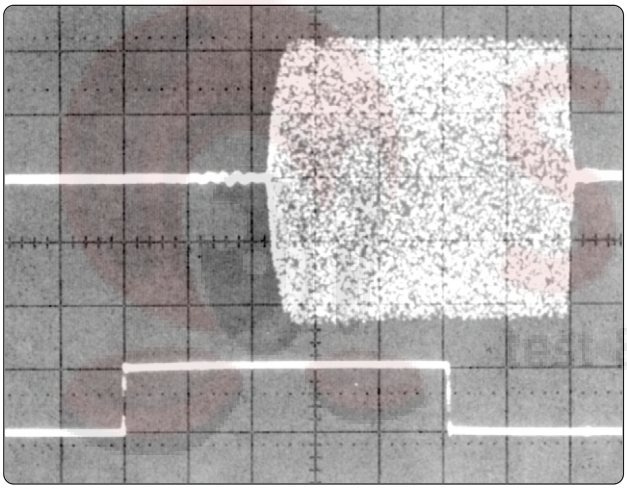
The 8663A's low noise and high output power are ideal or local oscillator substitution applications.

Simultaneous modulation enhances simulation

Modulation

The 8663A provides pulse, FM, AM and BPSK modulation formats as standard features. In addition, wide band linear phase modulation is available as Option 002. Each of these modulation types can be selected with both internal and external sources. The ability to simultaneously select and independently set these modulation types makes the 8663A a powerful complex signal simulator (pulse and BPSK are mutually exclusive).

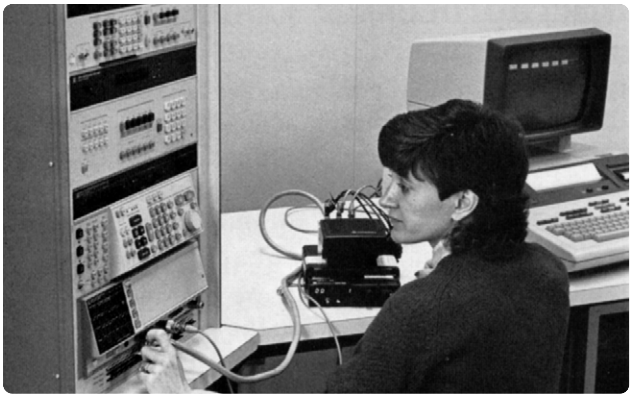
Military or commercial AM and FM receiver tests may be automated utilizing the 8663A's accurate low distortion modulation. When combined with the 8663A's exceptional spectral purity, even stringent out-of-channel tests such as selectivity and spurious response may be performed.



Radar/EW applications utilize the 8663A's high performance pulse modulation.

Complex threat returns can be simulated using the 8663A's wide dynamic range pulse modulation with AM, FM and ϕM. Rise/fall times of 100 nsec and 80 dB on/off ratios insure that state-of-the-art radar returns can be generated. Such signal simulation is also useful for testing the signal recognition and digital processing equipment associated with modern EW/ECM systems.

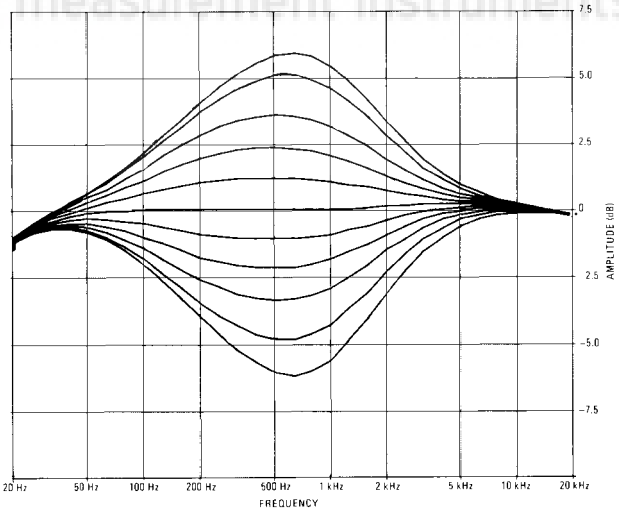
With the appropriate external drive circuitry, the Option 002 linear phase modulator can be used to simulate the digital PSK formats used in both satellite and terrestrial communication systems. The 8663A's low noise is also important in these applications to insure that there are no ambiguous phase states which would result in increased bit error rates.



The 8663A is ideal for automated transceiver test applications.

Modulation synthesizer

A standard programmable 10 Hz to 99.9 kHz modulation synthesizer is provided in the 8663A. Since it is phase-locked to the internal crystal reference, excellent accuracy with 3 digit resolution is achieved. This oscillator provides internal rate generation for all four 8663A modulation types and can be swept in either a log or linear fashion. An output is also available on the rear panel to drive external circuitry. With these internal and external source capabilities, the internal modulation synthesizer often eliminates the need for a separate audio source in ATE systems.



The internal modulation synthesizer allows precise swept modulation measurements.

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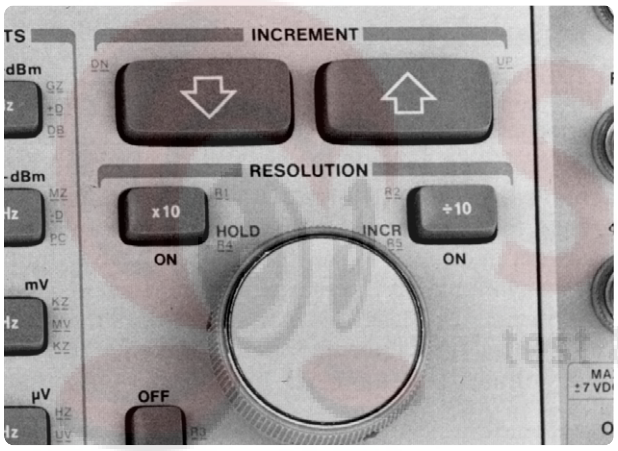
Digital sweep measurement efficiency

Microprocessor control

The 8663A uses a powerful microprocessor-based controller to provide the user with extremely flexible, efficient, and simple operation. The keys are conveniently grouped by function and the key stroke sequences go from left to right with a format of function, then data, then units to facilitate user interaction.

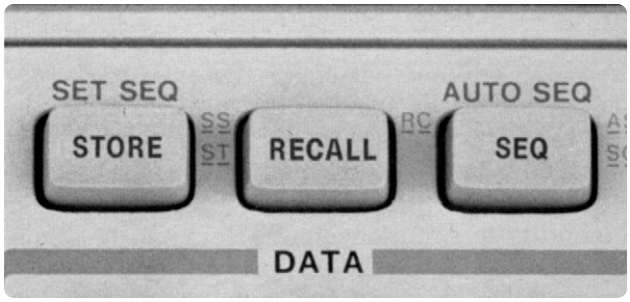
Improper keystroke inputs are safeguarded from execution and are brought to the user's attention by the illumination of the status key. Pressing the status key will display an error message that can be quickly referenced on the pullout card located beneath the front panel. This pullout card also contains basic operating instructions that make even infrequent users efficient operators of the 8663A.



Microprocessor control provides flexible and efficient operation.

Microprocessor control also allows function values to be incremented or decremented using either the increment up/down keys or the knob. The controllable functions include not only frequency, output level, and modulation but also sweep start/stop frequencies, sweep span, and the frequencies of all five digital markers. Whether the up/down keys are used for precise frequency increments such as 12.5 kHz channel spacings or the knob is used to find the 3 dB points of a filter, the incrementing capability of the 8663A saves valuable test time.

Another user convenience is the ability to store and recall up to nine complete front panel setups. These can be recalled in a defined sequence with a single keystroke or automatically cycled through a sequence by using the auto sequence mode.



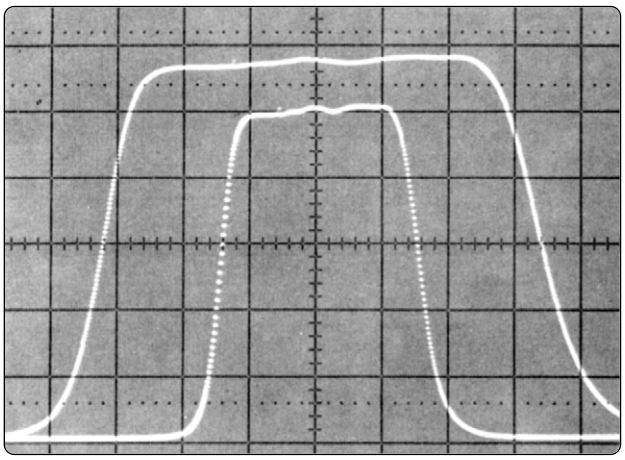
Up to nine complete front panel setups can be stored and recalled.

Sweep

Fast frequency switching combined with microprocessor control gives the 8663A powerful digital sweep capability. Synthesizer resolution, accuracy, and stability are retained in all sweep modes making the 8663A an ideal swept source for the characterization of narrow band devices such as crystal filters or wide band devices such as RF amplifiers. Two different types of sweep, start/stop and span (Δf), can be initiated via the front panel keyboard, GPIB, or the rear panel auxiliary programming connector.

Five frequency markers can be independently set and controlled with synthesizer precision. These markers can be utilized to quickly characterize points of interest of a swept response since the exact frequency of any marker can be easily displayed by pressing the appropriate marker key.

Other sweep features include a 0 to +10 volt stepped sweep output ramp to drive a recorder and alternate sweep which allows simultaneous swept displays.

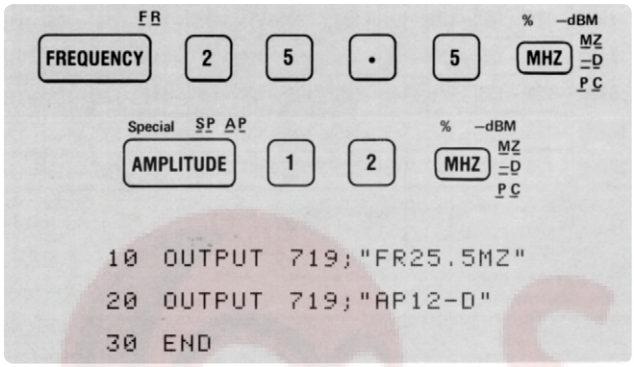


Swept response of a bandpass filter using span sweep.

Reliable performance for A.T.E. systems

Programming ease

Time required for 8663A software development is reduced due to an easy programming format. This format follows exactly the keystroke sequence that would be used for manual control, with each front panel key represented by an equivalent two-digit alphanumeric GPIB code. To aid in quickly assembling bench top systems, these alphanumeric programming codes are conveniently silk-screened next to the corresponding key.



GPIB and simplified programming reduces software development.

Serviceability

When selecting test equipment for any application, cost of ownership is an important consideration. The 8663A realizes low cost of ownership not only from its reliability, but also from built-in serviceability which includes self-diagnostics and modular design.

Self-diagnosis of hardware malfunctions is achieved by microprocessor controlled monitoring of the 8663A's phase-locked loops and output leveling loops. If a malfunction should occur, the status key on the front panel flashes and an error code describing the malfunction can either be displayed on the front panel or sent over GPIB.

With the top cover removed, each of these monitored loops also has an LED indicator to help pinpoint the circuitry containing the malfunctioning loop. The 8663A's internal modular design then allows the board to be easily accessed for testing or replacement.

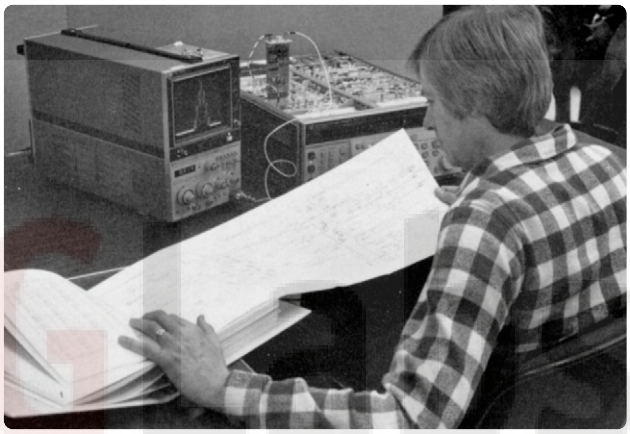
To facilitate customer servicing of the 8663A, the 11714A service accessory kit is available. This kit contains the necessary extender boards, test cables, RF test probes, and adapters for extensive in-house service.

Reliability

Designed-in reliability and careful manufacture of the 8663A insure low cost of ownership and less ATE system downtime.

As highlighted below, the 8663A has been type-tested according to rigorous Agilent Technologies standards to verify operation in harsh environments.

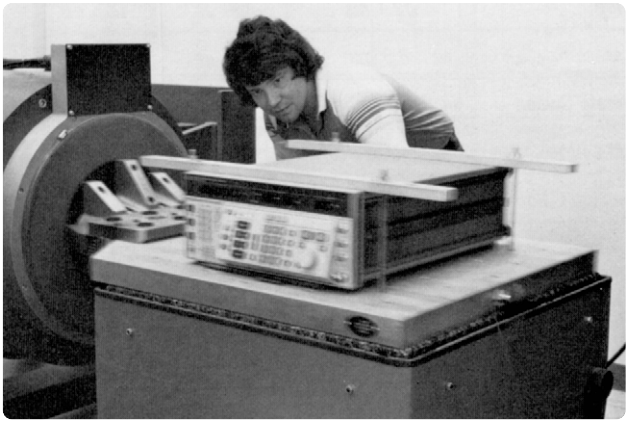
Operating temperature: 0 to +55 ˚C
Humidity: 95% RH at 40 ˚C
Altitude: Operating 15,000 feet
EMI: MIL-STD-461A



Modular design and self- diagnostics enhance serviceability.

The 8663A has also been type tested to the following shock and vibration standards to insure operation after transportation and rough handling.

Shock: 30g at 11 ms: 18 shocks
Vibration: 5–55 Hz at 0.015" P-P



Rigorous type-testing of the 8663A.

8663A Specifications

Frequency

Range: 100 kHz to 2.56 GHz (2.5599999996 GHz).

Resolution: 0.1 Hz for f_c< 640 MHz;
0.2 Hz for 640 MHz ≤f_c<1280 MHz;
0.4 Hz for 1280 MHz ≤f_c<2560 MHz.

Accuracy and stability: Same as reference oscillator.

Reference oscillator

Internal: 10 MHz quartz oscillator. Aging rate <5×10^{-10}/day after a 10 day warm-up.

Supplemental characteristics — frequency

Internal: *Internal reference oscillator accuracy is a function of calibration, ± aging rate, ± temperature effects, ± line voltage effects. Typical temperature and line voltage effects are <3.5×10^{-11}/°C and <1×10^{-10}/±10% line voltage change. Typical warm-up time is 24 hours.*

External: *Any 10 MHz (±0.005%) frequency standard at a level of 0.5 to 0.7 V_{rms} into 50 ohms (rear panel connector) or any 5 MHz (± 0.005%) frequency standard at a level of 1 V_{rms} ±0.1 V.*

Reference output (source impedance 65 ohms): *Reference signal (internal or external) available from rear panel connector at a level of >0.5 V_{rms} into 50 ohms. Output is always 10 MHz even with 5 MHz external reference frequency.*

Frequency switching speed[5]***:*** *Total switching time depends on the programming mode used. The 8663A RF settling time is 250 µs to be within 1 kHz and 400 µs to be within 100 Hz. The table below gives typical total switching time to be within 100 Hz of final frequency for various programming modes. (All data for 11-digits of frequency change).*

Programming mode	*Microprocessor time*	*Settling time*	*Total switching time*
String	*12. 1 ms*	*400 µs*	*12.5 ms*
Character	*8.3 ms*	*400 µs*	*8.7 ms*
Remote sweep	*In these modes, microprocessor*		*700 µs*
Fast learn	*time and RF time overlap.*		*510 µs*
Frequency hop	*130 µs*	*400 µs*	*530 µs*

Spectral purity

Front panel absolute SSB phase noise (dBc/Hz):

	Frequency range (MHz)											
	0.01 to 119.9[1]		120 to 159.9[2]		160 to 319.9[2]		320 to 639.9[2]		640 to 1279.9[3]		1280 to 2559.9[4]	
	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ
1 Hz	-68	-78	-66	-76	-60	-70	-54	-64	-48	-58	-42	-52
10 Hz	-98	-108	-96	-106	-90	-100	-84	-94	-78	-88	-72	-82
100 Hz	-116	-126	-115	-125	-109	-119	-103	-114	-97	-108	-92	-102
1 kHz	-126	-132	-129	-135	-124	-130	-118	-125	-112	-119	-106	-113
3 kHz	-126	-135	-129	-138	-124	-133	-118	-127	-112	-121	-106	-115
5 kHz	-128	-138	-131	-141	-126	-136	-120	-130	-114	-124	-108	-118
10 kHz	-132	-138	-142	-148	-136	-142	-131	-136	-124	-130	-118	-124
100 kHz	-132	-139	-142	-148	-136	-142	-131	-136	-124	-130	-118	-124

Residual SSB phase noise (dBc/Hz):

	Frequency range (MHz)											
	0.01 to 119.9[1]		120 to 159.9[2]		160 to 319.9[2]		320 to 639.9[2]		640 to 1279.9[3]		1280 to 2559.9[4]	
	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ
10 Hz	-108	-114	-112	-119	-106	-113	-100	-107	-93	-101	-88	-95
100 Hz	-121	-126	-122	-129	-118	-124	-112	-119	-105	-112	-100	-106
1 kHz	-128	-133	-131	-138	-127	-134	-121	-128	-115	-122	-109	-116
3 kHz	-128	-136	-131	-139	-127	-135	-121	-129	-115	-123	-109	-117
5 kHz	-129	-138	-133	-141	-129	-136	-123	-130	-117	-124	-111	-118
10 kHz	-132	-137	-142	-147	-136	-142	-131	-136	-124	-130	-118	-124
100 kHz	-132	-137	-142	-147	-136	-142	-131	-136	-124	-130	-118	-124

1 Specifications extend up to and including 119.9999999 MHz.
2 Specifications extend up to and including 0.1 Hz less than the starting frequency of the next band.
3 Specifications extend up to and including 1279.9999998 MHz.
4 Specifications extend up to and including 2559.9999996 MHz.
5 Due to bandwidth switching of the automatic internal leveling loop, brief level inaccuracies (i.e., typically <30 ms) may occur when switching through exactly 150 kHz and exactly 1 MHz RF output frequencies.

8663A Specifications

Spurious signals, CW, AM and FM modes:

	Carrier frequency range (MHz)					
Spurious signals	0.1 to 120	120 to 160	160 to 320	320 to 640	640 to 1280	1280 to 2560
Spurious non-harmonically related.[2]	<-90 dBc	<-100 dBc	<-96 dBc	<-90 dBc	<-84 dBc	<-78 dBc
Sub-harmonically related (f/2, 3f/2, etc.).	none	none	none	none	<-70 dBc	<-40 dBc
Power line (60 Hz) related or microphonically generated (within 300 Hz).[3]	<-90 dBc	<-85 dBc	<-80 dBc	<-75 dBc	<-70 dBc	<-65 dBc
Harmonics	<-30 dBc, ≤+13 dBm output <-25 dBc, +13 dBm to +16 dBm output					<-25 dBc

Spectral purity options
Option 003 specified SSB phase noise for rear panel 640 MHz output

	spec	typ
1 Hz	-54	-64
10 Hz	-84	-94
100 Hz	-104	-114
1 kHz	-121	-126

	spec	typ
3 kHz	-121	-127
5 kHz	-129	-138
10 kHz	-145	-149
100 kHz	-157	-159

Special Option H40 - enhanced absolute SSB phase noise specifications in 1 Hz BW:

	Frequency range (MHz)						
	Front Panel						Rear Panel
Offset from carrier	0.01 to 119.9	120 to 159.9	160 to 319.9	320 to 639.9	640 to 1279.9	1280 to 2559.9	640
1 Hz	-76	-74	-68	-62	-56	-50	-62
10 Hz	-106	-104	-98	-92	-86	-80	-92
100 Hz	-124	-123	-117	-111	-105	-100	-112
1 kHz	-126	-129	-124	-118	-112	-106	-121
3 kHz	-126	-129	-124	-118	-112	-106	-121
5 kHz	-128	-131	-126	-120	-114	-108	-129
10 kHz	-132	-142	-136	-131	-124	-118	-145
100 kHz	-132	-142	-136	-131	-124	-118	-157

2 In the remote mode it is possible to have microprocessor clock related spurious signals spaced 3 MHz apart at levels typically <-80 dBc.
3 At a 50 Hz line frequency, power line or microphonically related spurious signals may be up to 3 dB higher and appear at offsets as high as 1 kHz from the carrier.
4 The 8663A uses a microprocessor level accuracy enhancement routine to achieve ±1 dB absolute level accuracy and flatness for levels between +16 dBm and -119.9 dBm. This enhancement can be disabled with a special function.
5 Includes flatness, attenuator error, detector error, and measurement uncertainty.
6 In the sweep mode, the normal microprocessor level accuracy enhancement routine is defeated. Level accuracy enhancement can be selected during sweep with a special function, but minimum sweep time is limited to typically 10 ms/step.

Output

Range: +16 dBm to –129.9 dBm
(1.41 V to 0.072 μV across 50 Ω).

Resolution: 0.1 dB.

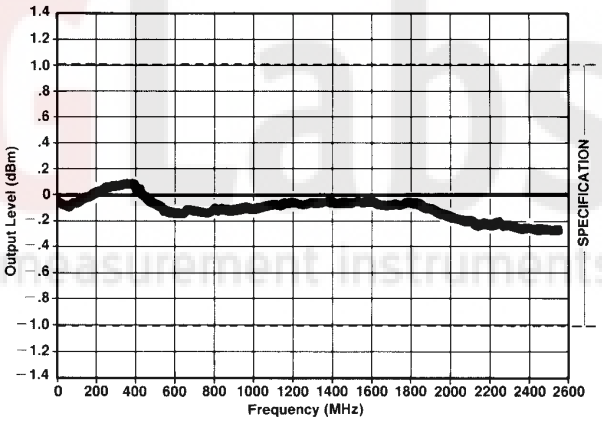
Absolute level accuracy[4,5]**:** <±1 dB, +16 dBm to –119.9 dBm; <±3 dB, –120 dBm and below.

Flatness[4]**:** Same as absolute level accuracy.

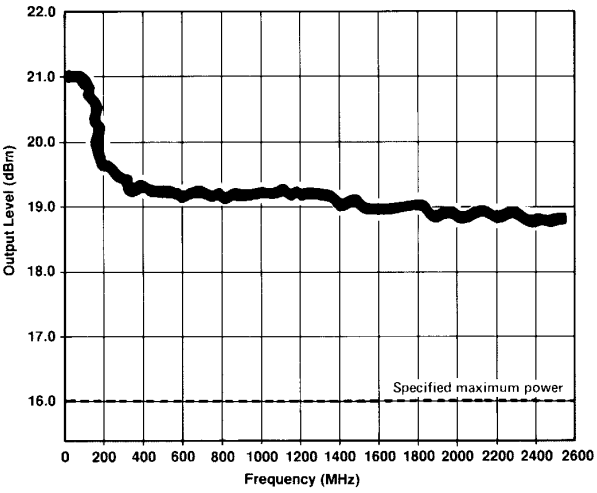
Flatness in sweep mode, +16 dBm to –119.9 dBm[6]**:**
<±1.1 dB, 0.1 MHz to 1280 MHz;
<± 1.5 dB, 0.1 MHz to 2560 MHz.

Supplemental characteristics — output

Maximum displayed output level: +19.9 dBm.
Impedance: 50 ohms.
SWR: <1.5
Level switching time: <60 ms.



Typical absolute level accuracy. 0 dBm output setting.



Typical output level. +19.9 dBm overrange setting.

8663A Specifications

Amplitude modulation

AM depth: 0% to 95%, output level ≤+10 dBm.
AM resolution: 0.1%.
AM indicator accuracy: ±(6% of setting +1% AM), 400 Hz and 1 kHz rates, depth ≤90%.
AM bandwidth (1 dB), depth ≤90%:
DC to >1.5 kHz, 0.15 MHz ≤f_c< 1 MHz;
DC to >5 kHz, 1 MHz ≤f_c ≤10 MHz;
DC to >10 kHz, ≤f_c > 10 MHz; for external dc coupling. For external ac coupling or internal modulation, low frequency limit is 20 Hz.
AM distortion for 400 Hz AND 1 kHz rates:
<2%, 0 to 30% AM;
<3%, 30 to 70% AM;
<4%, 70 to 90% AM.
Incidental phase modulation, 30% AM, 1 kHz rate:
<0.15 radians peak, 0.1 MHz ≤f_c< 640 MHz;
<0.1 radians peak, 640 MHz ≤f_c< 1280 MHz;
<0.33 radians peak, 1280 MHz ≤f_c< 2560 MHz.

Supplemental characteristics — AM

External input impedance: *600 ohms.*

External input level required for calibrated operation: *1V peak. Front panel input level annunciator indicates 1V peak ± 2%.*

Pulse modulation

On/off ratio: > 80 dB, 50 MHz < f_c< 2560 MHz[7].
Rise and fall time (10%, 90%):
<250 ns, 50 MHz f_c < 120 MHz;
<780 ns, 120 MHz ≤f_c < 640 MHz.
<100 ns, f_c ≥ 640 MHz.

Pulse repetition frequency (50% duty cycle)[8]
Internal: 10 Hz to 99.9 kHz.
External: 10 Hz to 2 MHz, 50 MHz < f_c < 640 MHz;
10 Hz to 5 MHz, f_c ≥ 640 MHz.

Supplemental characteristics — pulse modulation

Pulse delay time: *<150 ns.*
External input impedance: *50 Ω, dc coupled.*
External input level required: *>2.5 V-on, <0.5 V-off, not to exceed ±10 V.*

7 Pulse modulation is available for carrier frequencies below 50 MHz but is unspecified.
8 For duty cycle other than 50%; minimum repetition frequency = 100 Hz, minimum pulse width = 1 µs.

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Frequency modulation

FM deviation:

Center frequency (MHz)	Maximum peak deviation	
	AC mode (kHz)	DC mode (kHz)
	the smaller of	
0.1-120	100 or f_{mod} kHz × 500	100
120-160	25 or f_{mod} kHz × 125	25
160-320	50 or f_{mod} kHz × 250	50
320-640	100 or f_{mod} kHz × 500	100
640-1280	200 or f_{mod} kHz × 1000	200
1280-2560	400 or f_{mod} kHz × 2000	400

FM resolution:

Frequency range	FM deviation resolution	
	≤100 kHz dev.	>100 kHz dev.
0.1 to 640 MHz	0.1 kHz	n/a
640 to 1280 MHz	0.2 kHz	1 kHz
1280 to 2560 MHz	0.4 kHz	1 kHz

FM indicator accuracy: ±(7% of setting +10 Hz), rates 50 Hz to 20 kHz.

FM bandwidth (1 dB): dc to 100 kHz, dc coupled FM; 20 Hz to 100 kHz, ac coupled FM and internal FM.

FM distortion: <1.0% for 400 Hz and 1 kHz rates; <1.7% for rates ≤20 kHz.

Incidental AM, 20 kHz peak deviation, 1 kHz rate: <–72 dBc sidebands, 10 MHz ≤f_c<2560 MHz.

Supplemental characteristics — FM

Typical center frequency stability in dc mode.

fc(MHz)	*Center frequency accuracy*	*Measured center frequency stability*
0.1- 120	*±10 kHz*	*±200 Hz/hr*
120- 160	*±2.5 kHz*	*±50 Hz/hr*
160- 320	*±5 kHz*	*±100 Hz/hr*
320- 640	*±10 kHz*	*±200 Hz/hr*
640-1280	*±20 kHz*	*±400 Hz/hr*
1280-2560	*±40 kHz*	*±800 Hz/hr*

External input impedance: *600 ohms.*

External input level required for calibrated operation: *1 V peak. Front panel input level annunciator indicates 1 V peak ±2%.*

Auxiliary FM input: *Rear panel connector for FM modulation. Operates independently allowing simultaneous FM modulation with two tones. Input impedance: 5.1 kΩ; 4 V peak yields maximum allowable deviation.*

8663A Specifications

Binary phase shift keying[9]

Carrier null, 100 kHz square wave:
>20 dB, 120 MHz <f_c ≤640 MHz;
>17 dB, f_c ≥640 MHz, Option 002,
(+15 to +35 ˚C).

Supplemental characteristics — BPSK

External input impedance: *50 ohms, dc coupled.*

External level required: *> 2.5 V-on, <0.5 V-off, not to exceed ± 10 V.*

Phase modulation (Option 002)[9]

Phase deviation/resolution:

Carrier frequency	Maximum peak phase deviation	Resolution
0.1- 120 MHz	100 deg.	1 deg.
120- 160 MHz	25 deg.	1 deg.
160- 320 MHz	50 deg.	1 deg.
320- 640 MHz	100 deg.	1 deg.
640-1280 MHz	200 deg.	2 deg.
1280-2560 MHz	400 deg.	4 deg.

Phase modulation accuracy: ±(12% of setting +3% of full scale), for rates given in table below, (+15 to +35 ˚C).

Phase modulation rate table:

Carrier frequency	Rates	
	50 Ω	600 Ω
0.15-10 MHz	10 kHz	10 kHz
10-50 MHz	100 kHz	100 kHz
50-220 MHz	2 MHz	2 MHz
220-640 MHz	5 MHz	2 MHz
640-2560 MHz	10 MHz	2 MHz

Distortion: <10% for rates given in table.

Supplemental characteristics — phase modulation

External input impedance: *50 Ω, 600 Ω selected with a special function. AC or dc coupling.*

Low frequency ac coupling limit: *200 Hz, 50 Ω; 20 Hz, 600 Ω.*

External level required for calibrated operation: *50 ohm input: +10 dBm from source with SWR<1.21:1; 600 ohm input: 1 V peak. Front panel annunciator indicates calibrated level ±5% for rates ≤100 kHz.*

Internal modulation synthesizer

Frequency range: 10 Hz to 99.9 kHz.
Frequency resolution: 3 digits.
Frequency accuracy: Same as reference oscillator.

Supplemental characteristics — modulation synthesizer

Output level: *1 V peak into 600 Ω, available on rear panel.*
Output impedance: *600 Ω.*
Flatness: *<±1% referenced to 1 kHz.*
Distortion: *<1%.*

9 **BPSK is standard for carrier frequencies up to 640 MHz. With Option 002, BPSK is available at all carrier frequencies. For carrier frequencies up to 640 MHz, the standard BPSK is available, at rates above 100 kHz but is unspecified. BPSK can not be simultaneously selected with Option 002 phase modulation at 640 MHz and above or with pulse modulation.**

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Digital sweep

Digitally stepped sweep is available for the carrier frequency and the internal modulation synthesizer frequency.

Sweep functions

Start-stop sweep: sweeps between two selected frequencies.

Span sweep: symmetrical sweep about center frequency selected.

Sweep width: determined by frequency resolution and frequency range of instrument; i.e., 0.1 Hz to 1280 MHz.

Step size: choice of 100 or 1000 points per sweep, or settable to any value within the frequency resolution of the instrument.

Sweep speed: Carrier frequency: 0.5 ms, 1 ms, 2 ms, 10 ms and 100 ms per step. (0.5 ms is nominal value which will vary depending on use of markers or log sweep.) Modulation synthesizer: 2 ms per step is the shortest available sweep time.

Log sweep: two choices available in increasing steps of 10% or 1% of the last frequency.

Frequency markers: five digital markers. Resolution and accuracy same as RF output.

Intensity markers:[10] Z axis modulation (-5 V pulse) of CRT display coordinated with frequency markers, available at rear panel.

Amplitude markers:[10] rear panel signal (5 kHz triangle wave) can be applied to AM input connector to provide adjustable amplitude markers.

Marker sweep:[10] start/stop sweeps between any two frequency markers can be selected.

Display blanking:[10] 250 µs positive pulse (TTL levels) available at rear panel for display blanking during frequency switching.

Sweep output: 0 to 10 V nominal stepped ramp. Zero at start of sweep; approximately +10 V at end of sweep regardless of sweep width. 10,000 points maximum.

Sweep modes

Auto: sweep repeats automatically.

Single: single sweep activated by front panel key board.

Manual: sweep controlled by front panel knob.

10 Not available for modulation synthesizer sweep.

8663A Specifications

Remote programming

Interface: GPIB.
Functions controlled: All functions controlled from the front panel with the exception of the line switch are programmable with the same accuracy and resolution as in manual mode.
GPIB capability: as defined in IEEE-488-1978 is: SH1, AH1, T6, TE0, L3, LE0, SR1, RL1, PP0, DC1, DT1, C0, E1.

Rear panel auxiliary control connector

Functions controlled

Step up/step down: Same as increment keys on keyboard.
Stop sweep: Sets sweep in manual mode.
Continue sweep: Puts sweep in auto mode.
Single sweep: Initiates single sweep.
Sequence: Same as sequence key on keyboard.
Input required: Contact closure to ground or 5 µs negative true TTL pulse. Internally installed jumper determines mode.
Outputs: 5 µs negative true TTL pulse output under following conditions: 1) Change in signal parameter, for example frequency, amplitude, modulation; 2) End of sweep.
Frequency hop: A special function reconfigures the auxiliary connector allowing the generator to hop among frequencies set in storage registers 1 to 6. A 5 µs negative true TTL pulse initiates hop.
Connector: 14 pin.

General

Operating temperature range: 0˚ to +55 ˚C.
Leakage: Meets radiated and conducted limits of MILSTD461A methods RE02 and CE03 as well as BVDE 0871.
Power requirements: 115 (90-126) V or 230 (198-252) V; 48 to 66 Hz; 450 VA maximum.
Weight: Net 33.8 kg (74 lbs); shipping 40 kg (88 lbs).
Dimensions: 178mm[H] × 425mm[W] × 642mm[D]; (7” × 16.75” × 25.3”).
Note: Depth includes front panel depth of 45mm(1.75”).
System II module size: 7H × 1 MW × 23D.

Specifications describe the instrument’s warranted performance and apply after a 30-minute warm-up.

Supplemental characteristics (shown in italics) are intended to provide information useful in applying the instrument by giving typical, but non-warranted performance parameters.

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Complementary equipment

11714A service support kit. (Required for service).
11729C microwave down converter.
3048A phase noise measurement system.
9211-2662 transit case.
1490-0913 caster kit for transit case.

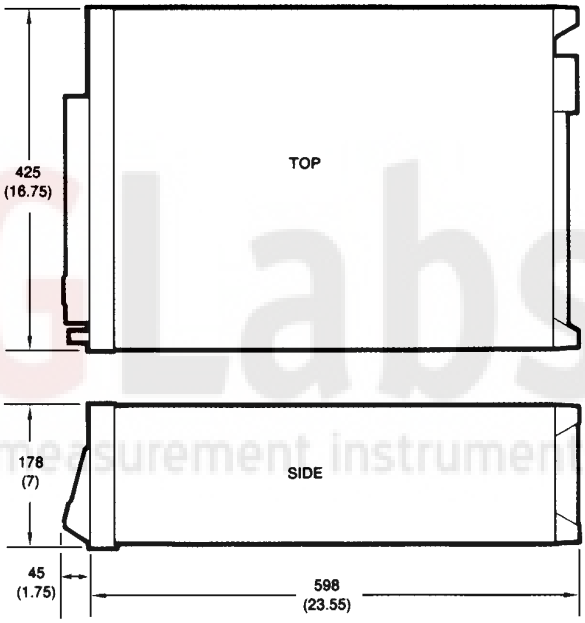
Ordering information

8663A synthesized signal generator

Options: **001** rear panel RF output and modulation inputs
002 phase modulation
003 specified SSB phase noise for rear panel 640 MHz output
700 "MATE" language compatibility
907 front handle kit
908 rack flange kit
909 rack flange kit and front handle kit
910 extra manual

11714A service support kit

Dimensions in millimeters and (inches).



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Product specifications and descriptions in this document subject to change without notice.

Printed in USA May 9, 2001
5953-8376

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