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Agilent
8643A, 8644B, 8664A, 8665A/B
High Performance RF Signal Generators

Data Sheet



A commitment to value in signal generators

Agilent Technologies

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Agilent's high performance RF signal generators – choose one for...

...Best price to performance

8643A

- 252 kHz to 1030 MHz, 2060 MHz Option 002
- For out-of-channel tests
- Electronic attenuator for high use
- Lowest cost of the "family"
- AM, FM, pulse modulation
- Built-in 2 GHz counter (Option 011)
- VOR/ILS signal simulation (Option 009)
- Ultra low leakage (Option 010)

...Best spectral purity

8644B

- 252 kHz to 1030 MHz, 2060 MHz Option 002
- Lowest SSB phase noise and spurious
- Highest output power
- Lowest residual FM
- AM, FM, pulse modulation
- Built-in 2 GHz counter (Option 011)
- VOR/ILS signal simulation (Option 009)
- Ultra low leakage (Option 010)

...High RF frequency coverage

8664A and 8665A/B

- 100 kHz to 3000 MHz - 8664A, 4200 MHz - 8665A, 6000 MHz - 8665B
- Low SSB phase noise (Option 004)
- AM and wideband FM
- High performance pulse modulation (Option 008)
- Ultra low leakage (Option 010)

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Choose one for your application...

	8643A 1 or 2 GHz	**8644B** 1 or 2 GHz	**8664A** 3 GHz	**8665A/B** A - 4.2 GHz/B - 6 GHz
RF communications				
Out-of-channel receiver testing[1]	Ideal for receivers with <90 dB selectivity and/or spurious immunity of <85 dB	Ideal for receivers with ≥90 dB selectivity and/or spurious immunity of ≥85 dB	Ideal for receivers with ≥90 dB selectivity with Option 004, and/or spurious immunity of <85 dB to 3 GHz	Same performance as 8664A but up to 6 GHz
General purpose	Electronic attenuator for increased reliability. Internal FM pre-emphasis of 750 µs	Lowest possible phase noise and spurious for R&D	Wideband FM with rates to 6 MHz for simulation of many new digital systems	Lowest noise and spurious to 6 GHz
Component test	Electronic attenuator for high volume testing	Highest output power for mixer testing	Ideal clock source with low phase jitter for high speed digital components	Best output level accuracy to 6 GHz for response testing
Radar/EW testing	Full functionality for R&D and manufacturing	Full functionality for R&D and manufacturing	Optional pulse modulation with internal delay and width adjust	Same performance as 8664A but up to 6 GHz for coverage of most surveillance radars
Avionics	Option 009 provides specified VOR/ILS signal simulation	Option 009 provides specified VOR/ILS signal simulation	Coverage of most weather and avionics radars. Option 008 provides pulse modulation capable of generating appropriate pulse width and delay internally	Same performance as 8664A up to 6 GHz

1. For FM receivers with approximately 14 kHz IF BW and 25 kHz channel spacing

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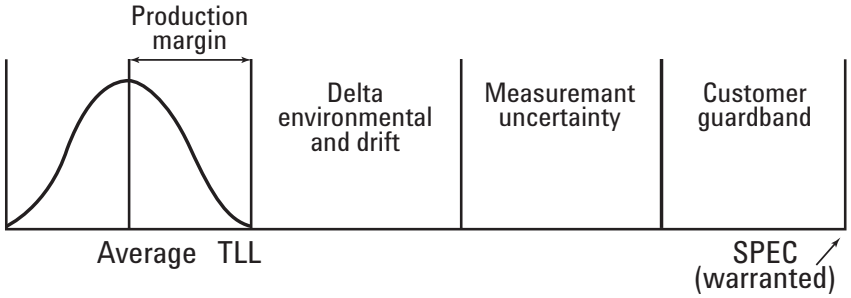
Performance backed by Agilent's reputation and manufacturing experience

Every Agilent Technologies' signal generator meets specifications that would reject most other signal generators

Before any Agilent Technologies' signal generator is introduced, specifications are set to assure that the product will perform consistently for your application. The specification setting process is reflective of the quality that Agilent has always strived to deliver. An explanation of Agilent's specification setting process will show the confidence that you can have when selecting an Agilent Technologies signal generator.

The model used for specification setting is illustrated in the above right figure. The following text defines each element in the figure.

- Production margin is the difference between the average product performance and the Test Line Limit (TLL). This TLL is the pass/fail limit used by the production line at final test under standard environmental conditions.
- Delta environmental represents the possible change in performance over the environmental extremes (e.g., temperature and humidity).



- Drift represents the change in performance over the calibration period.
- Measurement uncertainty accounts for possible measurement errors in the equipment used to characterize the signal generator.
- Customer guardband represents any additional margin necessary to ensure a worst case scenario.

This process means that whether the signal generator is placed in a high temperature environment such as at the top of a rack of equipment or a well controlled environment, the performance stated in our specifications can be relied on for your most exacting applications. This process guarantees that the signal generator is introducing the minimum error possible in the measurements you are performing.

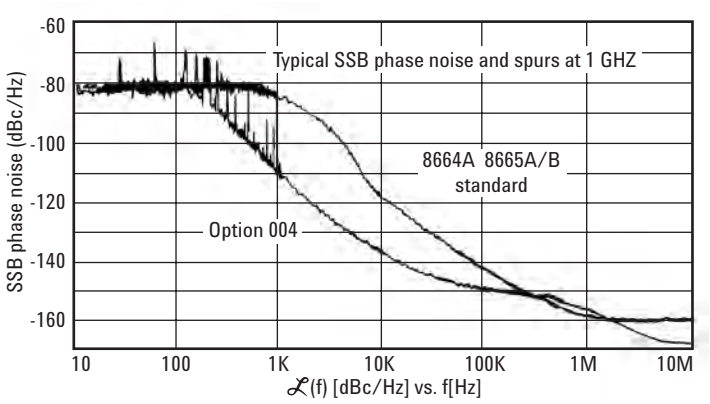
Typical performance
Since some applications push the limits of specifications, Agilent Technologies also provides data that indicates typical performance. This typical performance is generally set at the Test Line Limit (TLL), which is significantly better than the warranted specification. Use the typical data when comparing different products, or when your application pushes the limit on a given specification. The following information highlights typical performance for the most common areas of interest for the 8643A, 8644B, 8664A and 8665A/B.

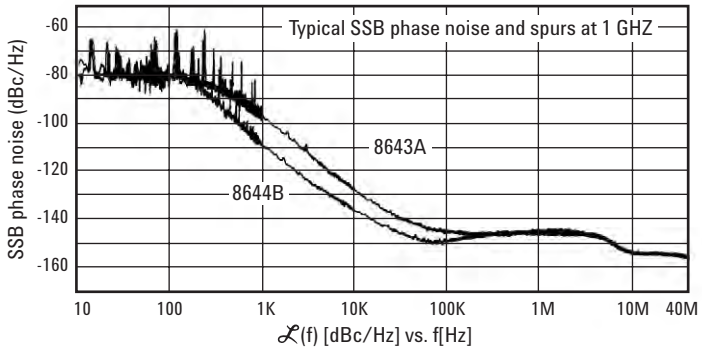
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Typical performance, for applications that push specifications

SSB phase noise

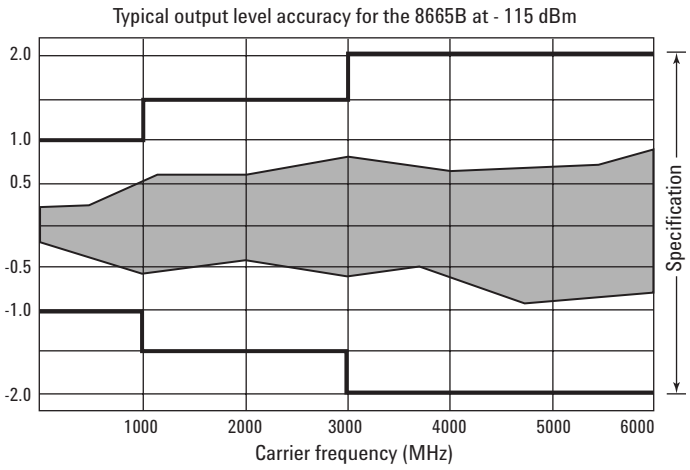
SSB phase noise is an important specification of a signal generator if it is to be used for measuring the adjacent channel selectivity of a receiver. If the phase noise of the signal generator is too high at frequency offsets equal to the channel spacing, the test results might indicate a failure of the receiver when it is actually functioning properly. For a receiver with <90 dB of selectivity the 8643A is recommended. If the selectivity is ≥90 dB, the 8644B (or 8664A with Option 004, or 8665A/B Option 004) is recommended.





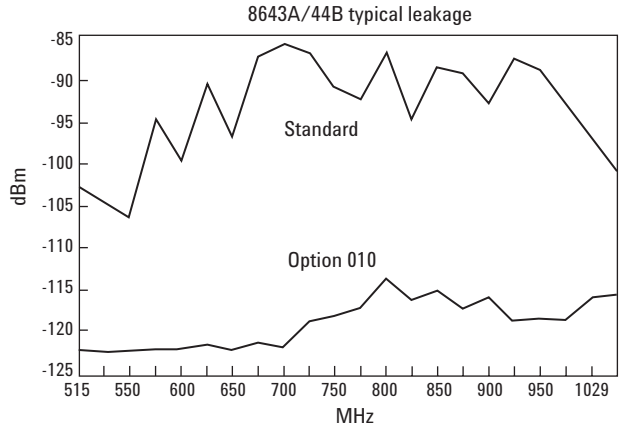
Output level accuracy

Output level accuracy is a combination of temperature variation, flatness over frequency, and the signal generator's internal attenuator and detector accuracies. The graph represents worst case output level accuracy of a sampling of 8665Bs. All of these units fall within the shaded area.



RF leakage

Due to radios becoming more sensitive and operating at higher frequencies, the traditional two-turn loop measurement of RF leakage has become inadequate. To overcome the shortcomings of the two-turn loop, Agilent has developed a new measurement technique using resonant dipole antennas, which is 20-25 dB more sensitive than the two-turn loop method. Agilent has been able to reduce the level of radiated emissions in its newer signal generators through innovative design and packaging. Understanding that not all applications require the lowest possible emissions, Option 010 is available on all of these performance signal generators.



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Features that improve the usability of Agilent's 8643A, 8644B, 8664A and 8665A/B for your application!



Internal modulation source

- Low distortion sinewaves to 400 kHz with variable phase and amplitude.
- Triangle, sawtooth and squarewaves to 50 kHz with variable phase and amplitude.
- White Gaussian noise with variable amplitude.
- Two independent sources for two-tone testing.

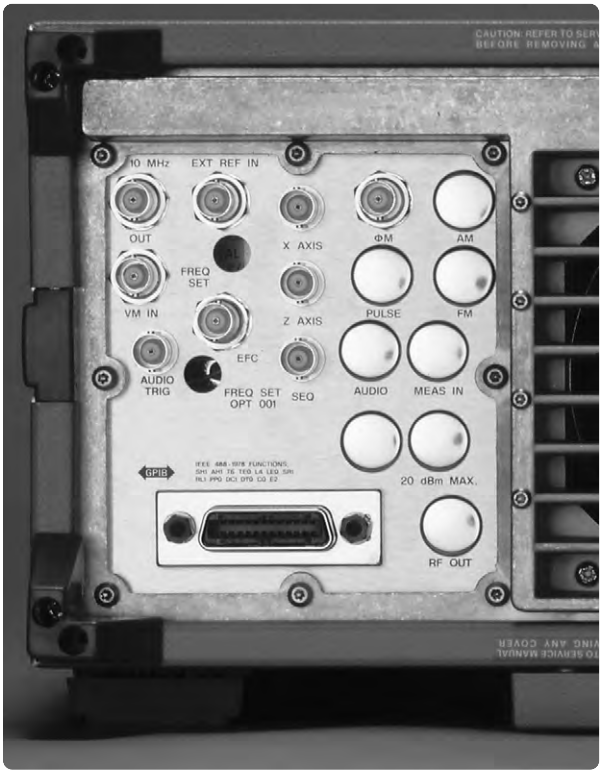
Optional pulse modulation (Option 008, 8664A and 8665A/B)

- An Agilent designed GaAs pulse modulator provides the exceptional performance that is so critical for pulsed applications.
- <5 ns rise/fall times, >80 dB on/off ratio.
- Built-in pulse generator features include variable pulse delay and width from 50 ns to 999 ms. This saves purchasing additional equipment.
- Leveled RF output maintains accuracy while in pulse modulation.

High reliability electronic attenuator on the 8643A (optional on 8644B)

For applications up to 1 GHz, the electronic attenuator used in the 8643A provides increased reliability. Instead of using mechanical relays, the electronic attenuator uses solid-state components for setting output levels accurate to within ±1.0 dB. The Agilent patented design uses PIN switching elements with three million hours of MTBF, giving the attenuator an estimated 0.2% failure rate.

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Wideband FM (8664A and 8665A/B)

- Typical rates to 5 MHz with 2 MHz of deviation, or rates to 800 kHz with 10 MHz of deviation (f_c >1500 MHz) allows testing of most wideband receivers.
- Excellent FM linearity is inherent due to YIG oscillator design.
- Stable dc-coupled FM for measurements that require low carrier drift.

Performance signal generator series features

- High stability oven controlled timebase is standard.
- Surface mount construction for improved reliability.
- Three year calibration cycle (MTBC) means less time in the calibration lab.
- Built-in self-diagnostics and calibration saves valuable time by significantly reducing down time.

2 GHz frequency counter (Option 011, 8643A and 8644B)

- 20 Hz to 2 GHz frequency counting via front panel connector.
- Cost and space efficient solution for applications involving audio frequency measurements, local oscillator, IF and transmitter testing.
- Eliminates the need to externally couple the timebase references when using an external counter.

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Specifications

	8643A	8644B	8664A 8665A/B
Frequency			
range:	.252 - 1030 MHz .252 - 2060 MHz Option 002	.252 - 1030 MHz .252 - 2060 MHz Option 002	.1 - 3000 MHz 8664A .1 -4200 MHz 8665A .1 - 6000 MHz 8665B
Resolution:	.01 Hz	.01 Hz	.01 Hz
Accuracy (std. timebase): <1 year of calibration	.375x10^{-6} times carrier in Hz	.375x10^{-6} times carrier in Hz	.375x10^{-6} times carrier in Hz
Switching speed (typical): (within 100 Hz)	<90 ms <200 ms with FM on	<350 ms	<50 ms (within .33 ppm) <100 ms Option 004

Internal reference oscillator	Standard high stability	Option 001 high stability with EFC
Aging:	+1.5x10^{-8}/day after ten days	±3x10^{-10}/day after ten days
Temperature:	+7x10^{-10}, 0 to 55° C	±6x10^{-10}, to 55° C
Line voltage:	±2x10^{-10}, (+5%, -10%)	±1x10^{-10}, ±10%
Output:	10 MHz, >0. 15 V_{rms} level into 50 Ω	10 MHz, >1 V_{rms} level into 50 Ω
External reference input:	Accepts 10 MHz ±5 ppm and a level range of 0.5 V to 2 V_{rms} into 50 Ω	
Electronic frequency control (EFC):	Option 001 only, +0.01 ppm for ±1 Vdc at rear panel connector, voltage range ±10 Vdc, input impedance 10k Ω	

Spectral purity				
SSB phase noise (dBc/Hz): (at 20 kHz offset)				
Carrier (MHz)			Standard	Option 004
4120 - 6000	N/A	NA	-105	-116
3000 - 4120	N/A	NA	-105	-122
2060 - 3000	N/A	NA	-111	-122
1030 - 2060	-124 (Option 002)	-130 (Option 002)	-111	-128
515 - 1030	-130 (-134 typical)	-136 (-142 typical)	-117	-134
257.5 - 515	-136	-142	-122	-139
128.5 - 257.5	-140	-145	N/A	N/A
.25 - 128.5	-142	-145	N/A	N/A
8664A, 8665A/B				
187.5 - 257.5	NA	NA	-128	-144
.1 - 187.5	NA	NA	-117	-131
Nonharmonics:	<-100 dBc, >10 kHz offset, .252 - 1030 MHz <-94 dBc, >10 kHz offset, 1030 - 2060 MHz	<-105 dBc, >10 kHz offset, .252 - 1030 MHz <-100 dBc, >10 kHz offset, 1030 - 2060 MHz	<-100 dBc, >10 kHz offset, 187.5 - 2060 MHz <-90 dBc, >10 kHz offset, 2060 - 6000[1] MHz, .1 - 187.5 MHz	
Harmonics:	<-25 dBc, output ≤+8 dBm	<-25 dBc, output ≤+10 dBm	<-30 dBc, output ≤+10 dBm	
Subharmonics:	None, .252 - 515 MHz <-60 dBc, 515 - 1030 MHz <-40 dBc, 1030 - 2060 MHz	None, .252 - 515 MHz <-60 dBc, 515 - 1030 MHz <-40 dBc, 1030 - 2060 MHz	<-75 dBc, .1 - 1500 MHz <-40 dBc, 1500 - 3000 MHz <-50 dBc, 3000 - 60001 MHz	

Residual FM (Hz rms):					Std./Option004	
Carrier (MHz)	3 kHz BW	15 kHz BW	3 kHz BW	15 kHz BW	3 kHz BW	15 kHz BW
2060-60001	–	–	–	–	<60/<10	<80/<32
1030-2060	<4	<8	<2	<4	<15/<2.5	<20/<8
515-1030	<2	<4	<1	<2	<7.5/<1.2	<10/<4
257.5-515	<1.2	<2	<0.5	<1	<7.5/<1.2	<10/<4
.25-257.5	<1	<1.2	<0.5	<0.5	–	–
8664A, 8665A/B						
187.5-257.5	–	–	–	–	<7.5/<1.2	<10/<4
.1-187.5	–	–	–	–	<15/<2.5	<20/<8

Residual AM: (.3 to 3 kHz post det. BW)	<0.01% AM rms	<0.01% AM rms	<0.04% AM rms
SSB AM noise floor (dBc/Hz): (offsets >100 kHz)	<-157, 10 dBm, <1030 MHz <-150, 10 dBm, <2060 MHz	<-157, 10 dBm, <1030 MHz <-150, 10 dBm, <2060 MHz	<-137, 13 dBm, <187.5 MHz <-150, 13 dBm, >187.5 MHz

1. 3000 MHz for 8664A, 4200 MHz for 8665A, 6000 MHz for 8665B.

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Specifications (continued)

	8643A	8644B	8664A 8665A/B
Output level			
Range:	+13 to -137 dBm	+16 to -137 dBm, +13 dBm, Option002	+13 to -139.9 dBm +9 dBm, Option 008
Resolution:	.01 Hz	.01 Hz	.01 Hz
Absolute accuracy:	±1 dB, output ≥-127 dBm ±3 dB, output <-127 dBm	±1 dB, output ≥-127 dBm ±3 dB, output <-127 dBm	±1 dB, output ≥-119.9 dBm, 1 - 1000 MHz ±1.5 dB, output ≥-119.9 dBm, 1000 to 3000 MHz ±2 dB, output ≥-119.9 dBm, 3000 to 6000[1], <1 MHz ±3 dB, output ≥-129.9 dBm
Reverse power protection:	50 watts	50 watts	25 watts[2], .1 - 2060 MHz 1 watt, >2060 MHz
Third order intermod: (frequencies < 1300 MHz, two signals at +8 dBm, 25 kHz apart through a resistive combiner)	<-50 dBc	<-50 dBc	<-47 dBc
Overrange:	Typically 2 dB	Typically 2 dB	Typically 2 dB
Switching speed (typical):	<50 ms	<50 ms	<50 ms
SWR:			
Output level			<3000 MHz / ≥3000 MHz
≥0 dBm	<2.2:1	<2.2:1	<1.75:1 / <2.0:1
<0 dBm	<1.5:1	<1.5:1	<1.5:1 / <1.75:1
Output impedance:	50 Ω	50 Ω	50 Ω
Amplitude modulation			
Depth:	0 - 100%, output ≤+7 dBm	0 - 100%, output ≤+7 dBm	0 - 100%, output ≤+7 dBm
Resolution:	.1%	.1%	.1%
Bandwidth (3 dB):	dc to >100 kHz, >128 MHz	dc to >100 kHz, >128 MHz	dc to >10 kHz for >10 MHz
Accuracy: 1 kHz rate	±(7% of setting +1%) up to 80% depth	±(7% of setting +1%) up to 80% depth	± (6% of setting +1%) up to 90% depth
Distortion: 30% depth, 1 kHz rate	<3%; <4% Option 002	<3%; <4% Option 002	<4%
Incidental phase modulation: (at 30% depth, 1 kHz rate)	<0.2 radians peak	<0.2 radians peak	<0.2 radians peak, ≤2000 MHz <0.2 radians peak, >2000 MHz
External input impedance:	600 Ω	600 Ω	600 Ω
Frequency modulation			
Maximum peak deviation:	2 MHz, 1030 - 2060 MHz 1 MHz, 515 - 1030 MHz 500 kHz, 257.5 -515 MHz 250 kHz, 128.5 - 257.5 MHz 125 kHz, 64 - 128.5 MHz 62.5 kHz, 32 - 64 MHz Deviation halves per lower octave (>16, >8, >4, >2, >1, >.5 MHz).	20 MHz/200 kHz[3], >1030 MHz 10 MHz/100 kHz[3], >515 MHz 5 MHz/50 kHz[3], >257.5 MHz 2.5 MHz/25 kHz, >128.5 MHz 1.25 MHz/12.5 kHz[3], >64 MHz 62.5 kHz/6.25 kHz[3], >32 MHz Deviation halves per lower octave (>16, >8, >4, >2, >1, >.5 MHz).	20 MHz, 3000 - 6000[1] MHz 10 MHz, 1500 - 3000 MHz 5 MHz, 750 - 1500 MHz 2.5 MHz, 375 - 750 MHz 1.25 MHz, 187.5 - 375 MHz 5 MHz, <187.5 MHz
Resolution:	2.5% of setting	2.5% of setting	2.5% of setting
Bandwidth (3 dB):	dc to 100 kHz	dc to 100 kHz	dc to 800 kHz
Carrier accuracy in FM:	±0.5% of setting	±0.5% of setting	±0.6% of setting
Indicator accuracy:	<5%, <30 kHz rates <10%, <100 kHz rates	<5%, <30 kHz rates <10%, <100 kHz rates	±9%, <20 kHz rates ±11%, <20 kHz rates, Option 004
Distortion:	<5%, 20 Hz to 100 kHz rates[3]	<5%, < 1%[3] 20 Hz to 100 kHz	<1%, 20 Hz to 20 kHz rates
Incidental AM:	<0.5%, deviation ≤20 kHz	<0.5%, deviation ≤20 kHz	<0.3%, deviation ≤20 kHz
External group delay:	<10 µs, <100 kHz rates	<10 µs, ≤100 kHz rates	<30 µs, ≤20 kHz rates
External input impedance:	600 Ω	600 Ω	600 Ω

1. 3000 MHz for 8664A, 4200 MHz for 8665A, 6000 MHz for 8665B.
2. One watt on 8665B.
3. Low noise mode three.

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Specifications (continued)

	8643A	8644B	8664A 8665A/B
Pulse modulation			**Option 008**
On/off ratio:		>35 dB, >80 dB, >1030 MHz	>80 dB
Rise/fall time, 10 - 90%:		<100 ns	<5 ns
Repetition rate:		dc to 1 MHz	dc to 10 MHz
Internal width/delay:		N/A	Variable from 50 ns to 1s ±5% accuracy, 0.2% of full scale resolution
Minimum width:		0.5 µs	10 ns
Video feedthrough/overshoot:		<15%	<25%
Output level accuracy:		±2 dB	Same as standard
External inputs/outputs:		Input level: On state; >3.0 V_{peak} (600 Ω input impedance) Off state; <0.8 V_{peak}	Input level: TTL into 50 Ω or Schottky TTL Sync out and video out: TTL into 50 Ω

Internal modulation source	
Number of sources:	Two sources simultaneously available through summation, independently adjustable in frequency, phase, amplitude and waveform. Source one may also be internally modulated with AM, FM, phase modulation and pulse modulation to create a subcarrier waveform.
Waveforms and rates:	Sine, white Gaussian noise; 0.1 Hz to 400 kHz Triangle, sawtooth, square; 0.1 Hz to 50 kHz
Frequency accuracy:	Same as timebase
Output level (into 600 Ω):	1 V_{peak}, 2 V_{peak} for 8643A and 8644B
Output resolution:	2 mV_{peak}
Total harmonic distortion:	<0.1%, ≤20 kHz rates

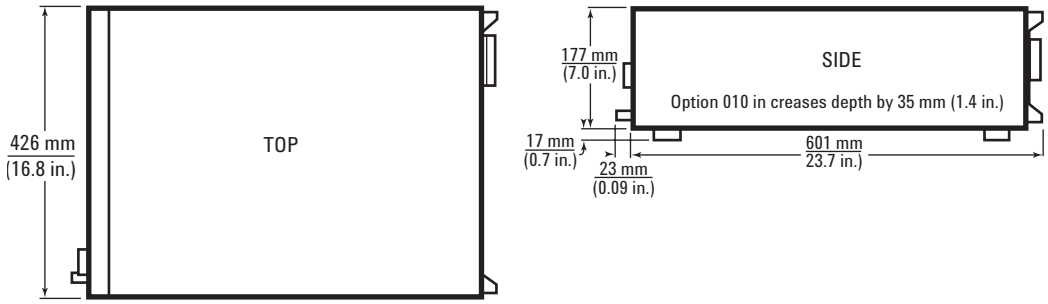
Frequency sweep	
Digital sweep:	Digitally stepped sweep over entire frequency range. Linear/log selection. .5 to 1000 sec sweeps.
Markers/Z axis output:	Three markers available /Z axis output nominally +5 V/X axis output nominally 0 to 10 V.
Phase continuous sweep:	40 MHz of span available at maximum carrier frequency. 20 ms to 10 sec sweep times.

Remote programming	
Interface:	GPIB (IEEE 488.2-1987).
Control language:	Hewlett-Packard Systems Language (HP-SL). All functions controlled except power.
IEEE-488 functions:	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2.

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Specifications (continued)

	8643A	8644B	8664A 8665A/B
Avionics Option 009	Option 009 provides the performance needed for testing VOR and ILS (localizer, glide slope and marker beacon) receivers. Option 009 provides guaranteed specifications necessary to make these demanding tests.		N/A
VOR (108 to 118 MHz)	Bearing accuracy: 0.1°, frequency accuracy: Same as timebase, AM accuracy (30%): ±5% of setting, AM distortion: 2%, FM accuracy (480 Hz dev.): ±1.5 Hz		
ILS: localizer/glide slope (108 to 112 MHz/329.3 to 335 MHz)	DDM resolution: Localizer: 0.0002 Glide slope: 0.0004 DDM accuracy: Localizer: ±0.0004 ±5% of DDM Glide slope: ±0.0008 ±5% of DDM		
Marker beacon (75 MHz):	AM accuracy: ±5% of setting AM distortion: 2% AM accuracy (95%): ±5% of setting + 1% AM distortion: 5%		
2 GHz counter Option 011			
Frequency range:	20 Hz to 2 GHz in three ranges		N/A
Sensitivity:	25 mV_{rms} (-19 dBm into 50 Ω)		
Maximum input:	2.25 V_{rms} (+20 dBm into 50 Ω)		
Impedance:	50 Ω, 10 MHz to 2 GHz; 1 M Ω shunted by <65 pf, <10 MHz		
Coupling:	ac		
Gate times:	0.1s to 1s in 0.1s steps		
Measurement resolution:	Measured frequency (Hz) x 10^{-8}/gate time or 0.01 Hz if greater		
Measurement uncertainty:	(± timebase accuracy) plus (± measurement resolution)		
General			
Power requirements:	±10% of 100 V, 120 V, 220 V or 240 V; 48 to 440 Hz; 500 VA except 8643A/44B 400 VA.		
Operating temperature:	0 to 55 °C		
Leakage:	Conducted and radiated interference meets MIL STD 461 B REO2 and FTZ 1046. Leakage is measured into a resonant dipole antenna, one inch from the instrument's surface with output level <0 dBm (all inputs/outputs properly terminated, f_c <1 GHz). Leakage is typically <16 µV or <2 µV with Option 010, measured at the front panel. The older two-turn loop method of measurement is typically <1 µV or <0. 1 µV for Option 010.		
Acoustic noise:	Typically <5.5 bels		
Storage registers:	Ten full function and 40 frequency/amplitude registers.		
Calibration/diagnostics:	Internal calibration and diagnostics functions are available to the user. Built-in test capability locates circuit malfunctions to allow repair through module replacement.		
Calibration interval:	Recommended three years (MTBC).		
Weight:	8643A; 23 kg (50 lbs). 8644B; 30 kg (67 lbs). 8664A/65A/B; 35 kg (78 lbs)		
Dimensions:	177H x 426W x 601D mm (7 x 16.8 x 23.7 in.). Option 010 adds 35 mm (1.4 in.) to depth.		



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Ordering information

	8643A	8644B	8644A 8665A 8665B
Options:			
001 High stability time base with EFC			
002 2 GHz doubled output			
003 Rear panel input/output			
004 Low noise option			
005 Electronic attenuator (N/A with Option 002)			
008 Pulse modulation			
009 Specified VOR/ILS			
010 Reduced leakage configuration			
011 2 GHz internal frequency counter			
907 Front handle kit (5061-9690)			
908 Rack flange kit (5061-9678)			
909 Combined front/rack flange kit (5061-9684)			
910 Extra manual set (includes service manual)	(08643-90001)	(08643-90001)	(08665-90078)
915 Add service manual			
Service kit	(08645-61116)	(08645-61116)	(08665-61116)
W30 Additional 3 years of return warranty			
Transit case (9211-2662)			
Transit case wheels (1490-0913)			
Non-tilting rack slide kit (1494-0059)			
Tilting rack slide kit (1494-0063)			

Agilent Technologies' Test and Measurement Support, Services, and Assistance
Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise
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Your Advantage
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