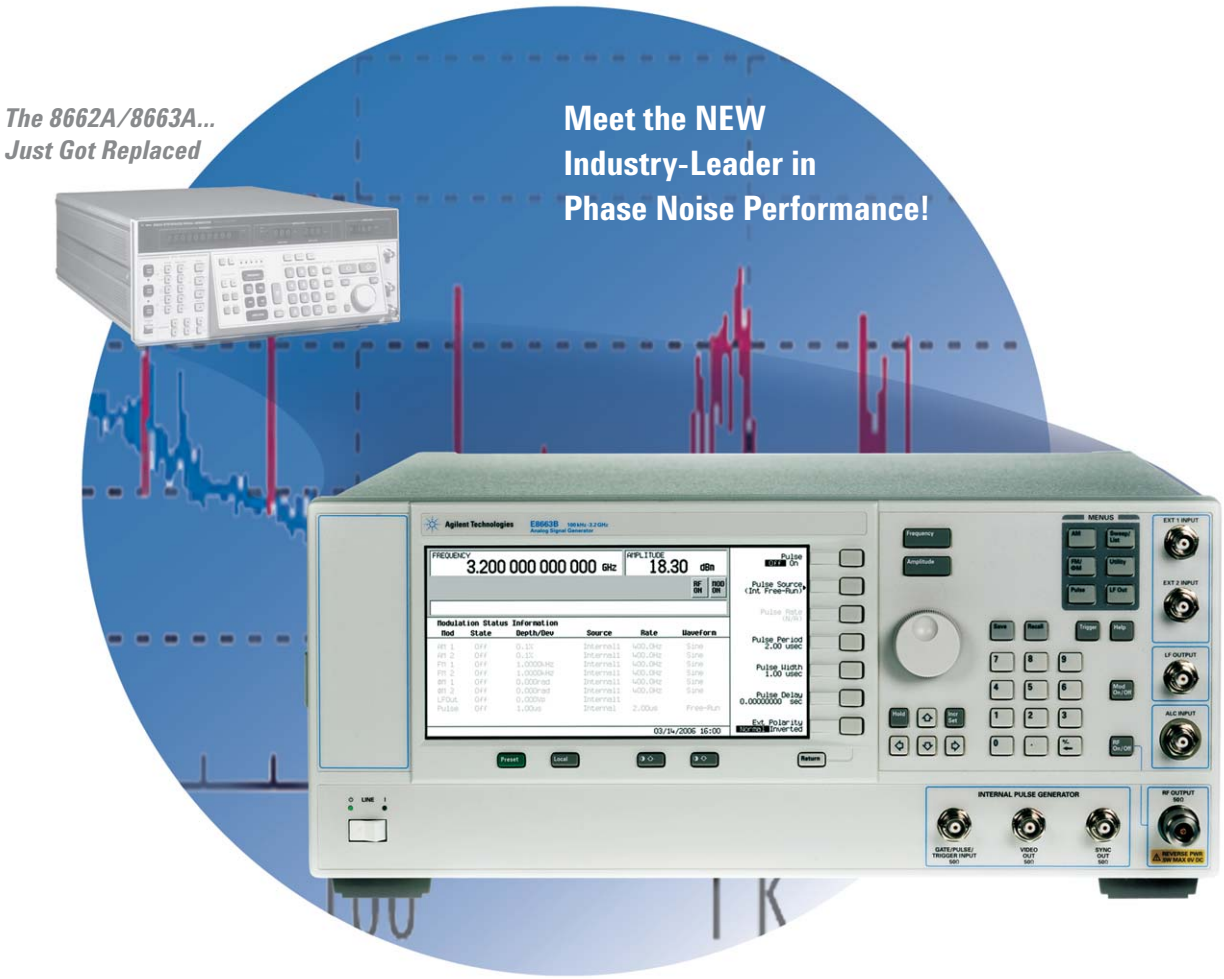
Three Reasons to Migrate From Your 8662A/8663A to the E8663B RF Signal Generator

Application Note



Agilent Technologies

A New Industry-Standard For Low Noise RF Signal Generation

For nearly 30 years, the Agilent Technologies 8662A, and later the 8663A, have been the industry-standard low noise RF signal generators providing unmatched low close-to-carrier phase noise signals for a variety of demanding RF applications, such as satellite communications, radar and EW, mobile radio and digital communications, and ATE systems. Now obsolete, the legacy 8662A and 8663A have been replaced by the Agilent E8663B – the new industry standard for low noise RF signal generation.

This application note demonstrates the advantages of the E8663B over the 8662A/63A, giving you three compelling reasons to migrate:
1. Superior performance
2. Enhanced usability
3. Modern supportability

Superior Performance

The E8663B provides performance superior to the 8662A/3A in virtually all signal characteristics, from frequency range to typical output power to close-to-carrier phase noise. Following are several measurement graphs that demonstrate this performance. You will find detailed specification comparisons in the Appendix.

Frequency

The E8663B has two frequency range options: 100 kHz to 3.2 GHz and 100 kHz to 9 GHz.[1] The frequency resolution of 0.001 Hz easily surpasses that provided by the 8662A/3A to provide a finer resolution test signal.

Output power

Figures 1 and 2 demonstrate the E8663B has higher typical maximum output power for frequencies greater than 200 MHz and better power flatness over the entire frequency range. In addition, the E8663B has a wider power range, providing power levels as low as –135 dBm over the available frequency ranges.

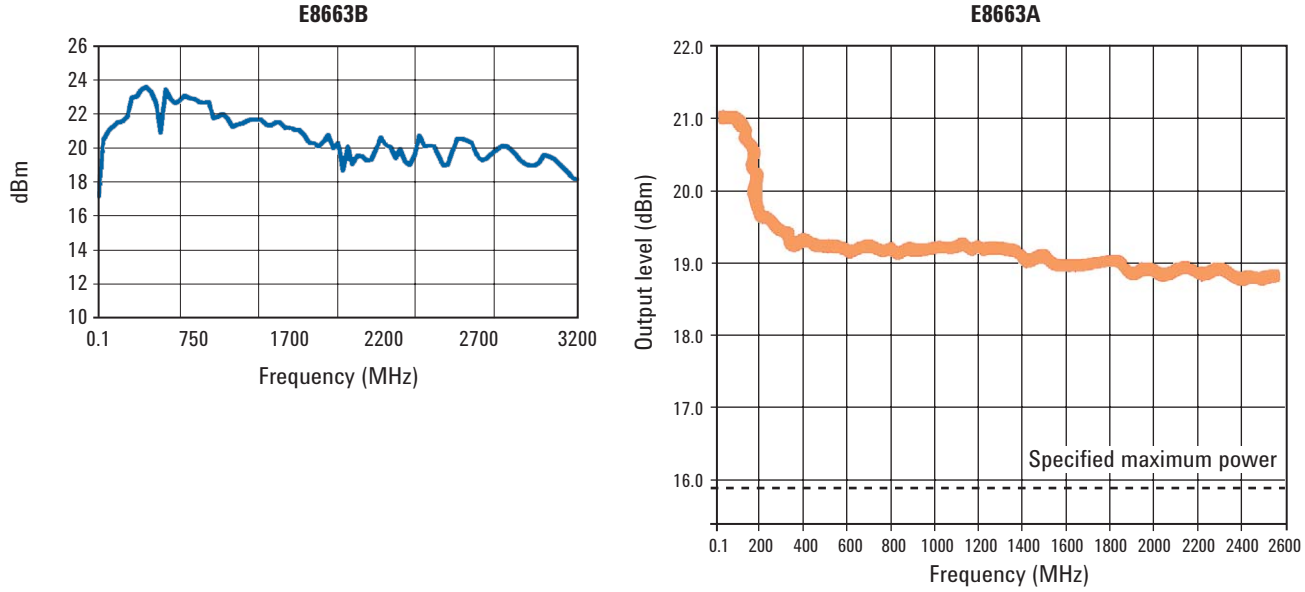


Figure 1. Typical maximum available output power versus frequency

1. Performance is unspecified below 250 kHz.

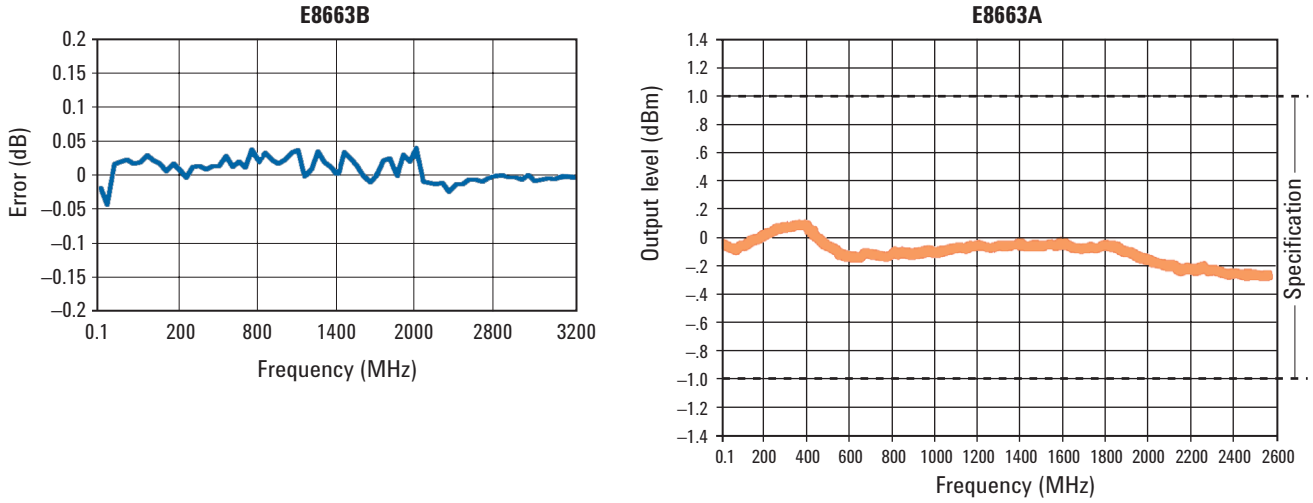


Figure 2. Power level accuracy versus frequency

Modulation

Amplitude modulation (AM) bandwidth for the E8663B is specified to 100 kHz and is useable to 1 MHz. Frequency modulation (FM) bandwidth is specified at a 1 dB bandwidth up to 100 kHz and a 3 dB bandwidth up to 10 MHz for deviations up to 8 and 16 MHz (3.2 and 9 GHz models, respectively). Phase modulation (ΦM) provides deviations up to 40 rad (approximately 2300 °) for a typical 3-dB bandwidth of 4 MHz. The E8663B also offers narrow pulse modulations (Option UNW) of 10 ns (10 ns rise and fall times) to 42 s. The internal modulation generator provides a frequency range up to 1 MHz with .5 Hz of resolution. And the standard internal pulse generator provides pulse repetition intervals (PRI) from 70 ns to 42 s (pulse repetition frequencies from 0.024 Hz to 14.28 MHz).

Spectral purity

The E8663B provides lower close-to-carrier phase noise than the 8662A/3A signal generators for carrier frequencies greater than 250 MHz. In addition, with enhanced phase noise (Option HAR), the E8663B provides lower close-to-carrier phase noise for carrier frequencies less than 250 MHz. Option HAR provides a selectable, divided low band (less than 500 MHz) that improves, or lowers, phase noise performance as the output frequency is lowered (down to 1 MHz). Figures 3 through 10 show direct residual and absolute single-sideband (SSB) phase noise measurement comparisons of the E8663B versus the 8663A using a pair of each instrument. For carriers less than 500 MHz, the performance comparison uses the enhanced phase noise provided by E8663B Option HAR.

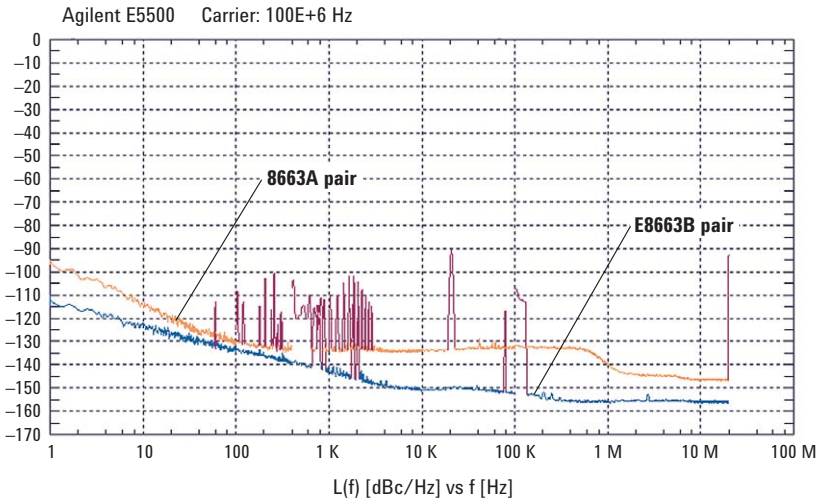


Figure 3. Residual phase noise comparison for a 100 MHz carrier, with E8663B Option HAR

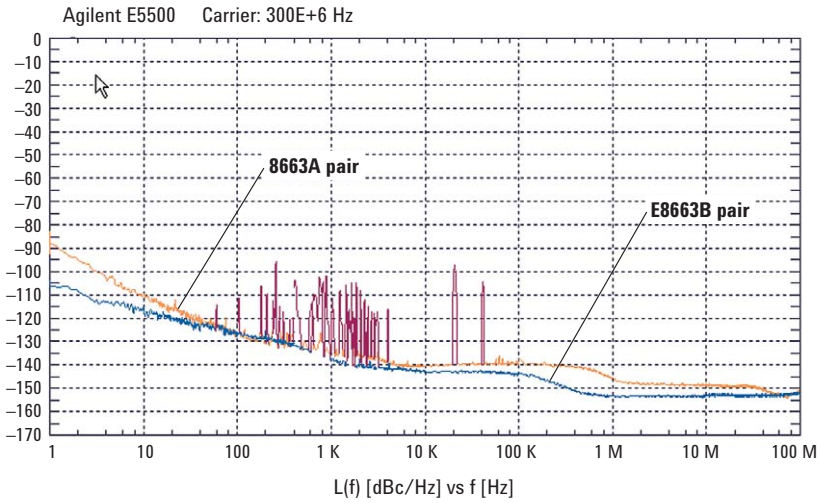


Figure 4. Residual phase noise comparison for a 300 MHz carrier, with E8663B Option HAR

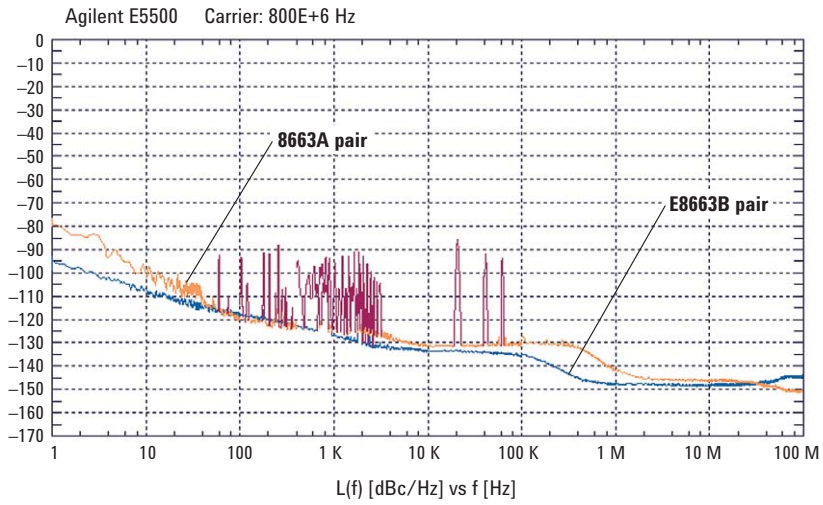


Figure 5. Residual phase noise comparison for an 800 MHz carrier

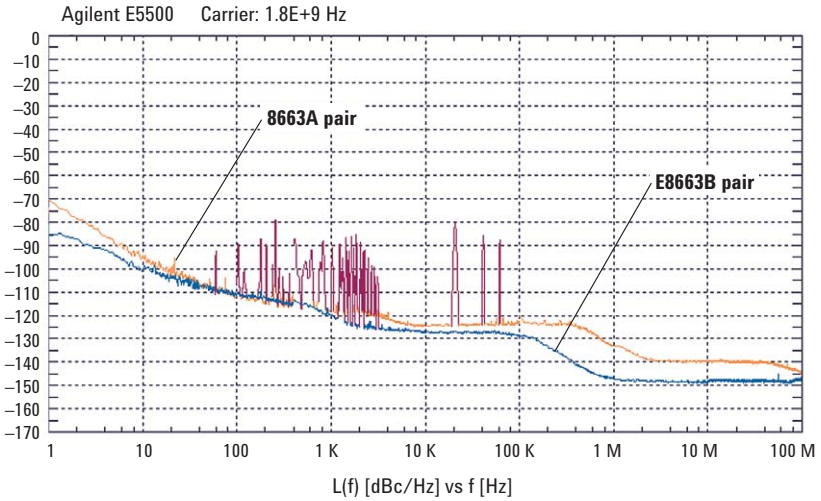


Figure 6. Residual phase noise comparison for an 1800 MHz carrier

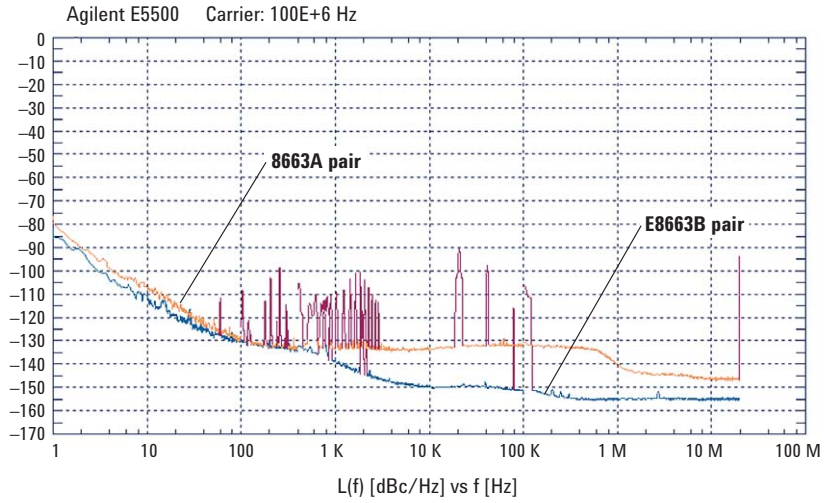


Figure 7. Absolute SSB phase noise comparison for a 100 MHz carrier, with E8663B Option HAR

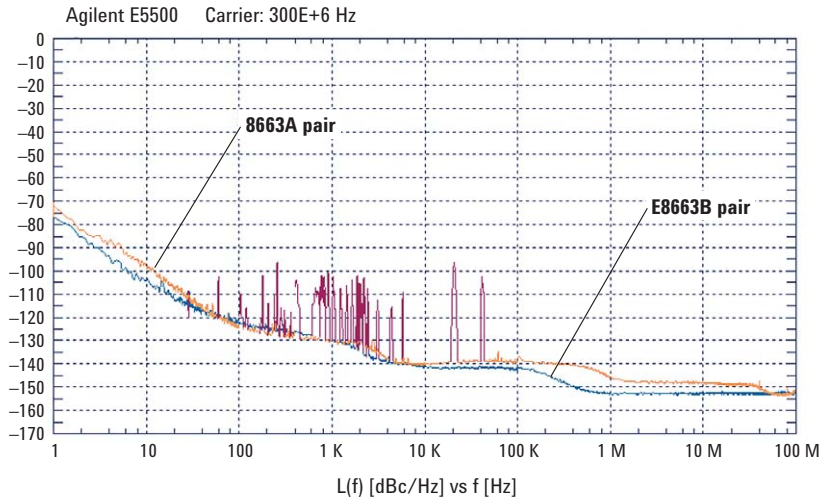


Figure 8. Absolute SSB phase noise comparison for a 300 MHz carrier, with E8663B Option HAR

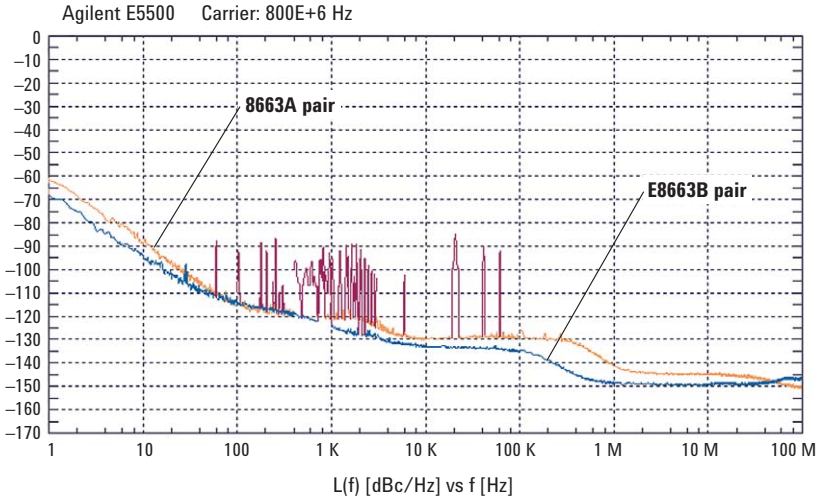


Figure 9. Absolute SSB phase noise comparison for an 800 MHz carrier

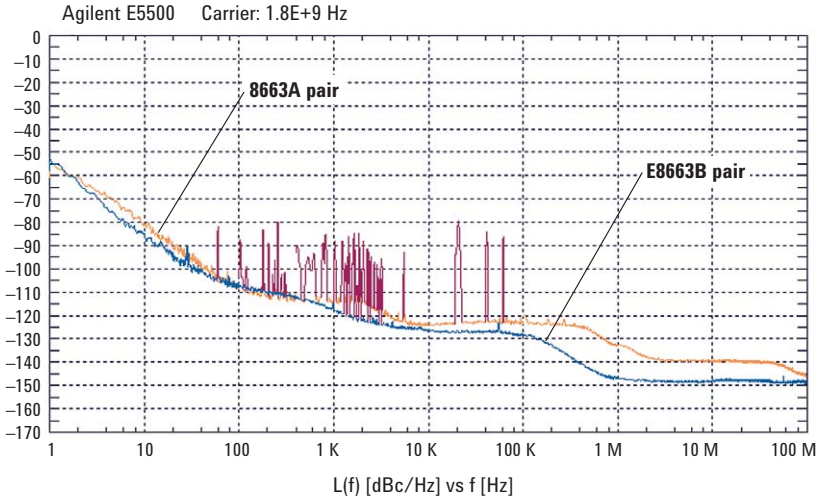


Figure 10. Absolute SSB phase noise comparison for an 1800 MHz carrier

Enhanced Usability

The E8663B provides new usability features that increase productivity and utility in your existing and new applications.

LAN connectivity

In addition to the legacy GPIB remote programming interface to support your existing ATE systems, the E8663B also provides the flexibility of LAN and serial (RS232) connectivity for your new or upgraded ATE applications that no longer rely on GPIB as the method of programming connectivity.

Web-enabled user interface

LAN connectivity also allows you to view and control from your office an E8663B signal generator located in a remote lab. You can activate this Web-enabled graphical user interface from any computer on the same LAN by simply connecting and assigning the E8663B its own IP address.

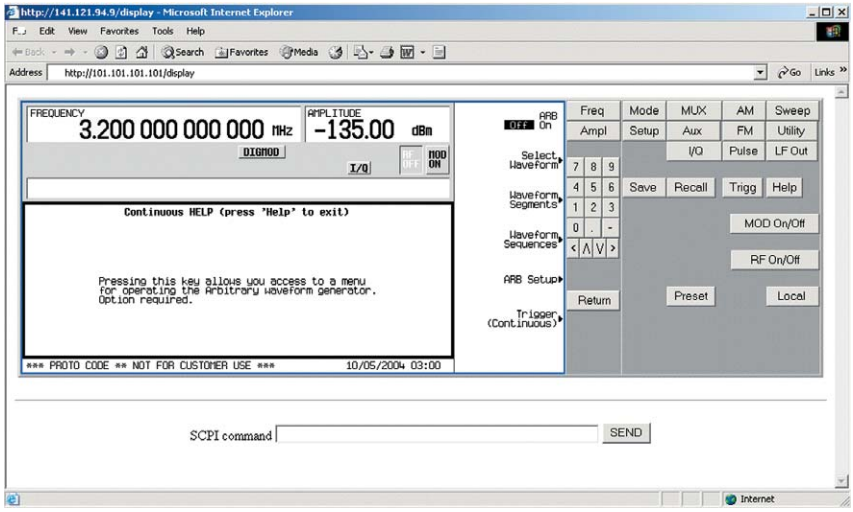


Figure 11. E8663B web-enabled graphical user interface

Power corrections

Unlike the legacy 8662A/3A, the E8663B can enhance the power accuracy of a signal at the input to a device-under-test (DUT), including cable and connector losses and external amplifier gains. These power corrections use a simple setup with an external GPIB power meter (Figure 12) and can significantly improve the accuracy of your tests.

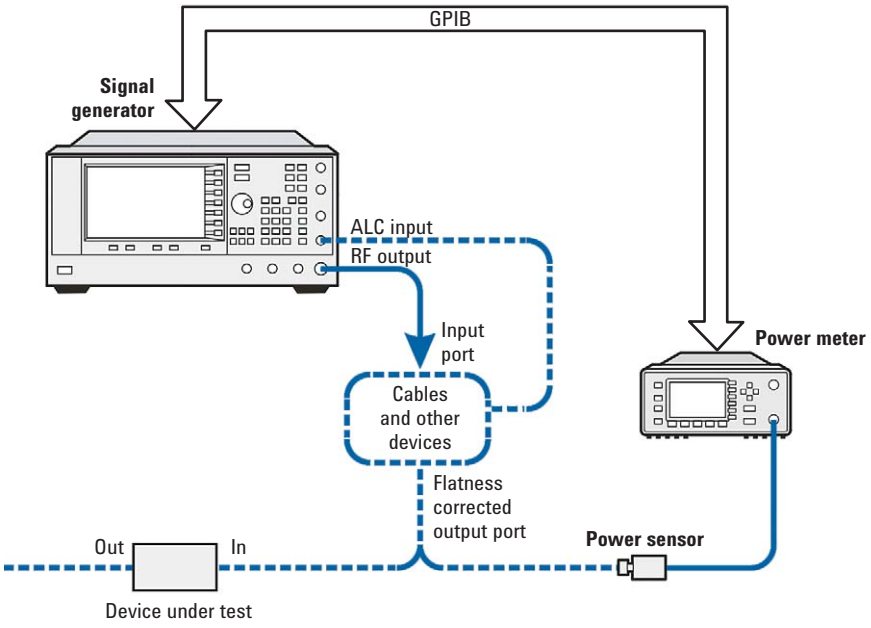


Figure 12. Typical configuration for using the E8663B to correct power at the output of a cable, coupler, or amplifier

List sweep

In addition to a full digital step sweep capability, you can configure an E8663B with arbitrary frequency and power sweep lists to perform unique sweep configurations. This can increase productivity for your applications in which you currently use an 8662A/3A.

Master/Slave source synchronization

For two-tone intermodulation distortion testing of amplifiers, two 8663As can only provide static CW signals, whereas two E8663Bs can be configured to sweep synchronously with different output frequencies to provide swept two-tone signals with high isolation to a DUT such as an amplifier.

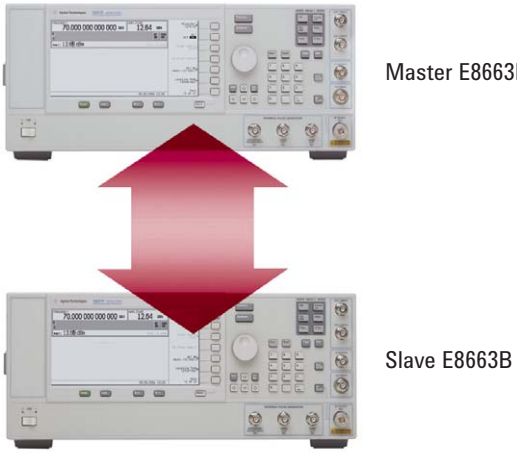


Figure 13. Master/Slave synchronization using the E8663B

Security

The E8663B offers more security features than the 8662A/3A, which allow it to be used in, and removed from, secure areas. In addition to the legacy sanitizing save/recall registers, you can place the E8663B display in a secure state that blanks all information (Figure 16) and requires an instrument power cycle to restore the display.

Figure 14. E8663B display in secure state

Enhanced Supportability

The E8663B is not only a superb performance replacement for the 8662A/3A signal generators, it also provides excellent programming code compatibility and provides a lower, long term cost of ownership.

Code compatibility

The E8663B is fully code compatible with the 8662A/3A, providing a remote programming emulation mode that allows the E8663B to be identified as and function like the legacy instruments in most remote programming and ATE applications that currently use the 8662A/3A. For example, the standard E8663B – identified remotely as an 8662A/3A – will work within existing Agilent 3048A or E5500 phase noise measurement systems.

Calibration and repair

The 8662A/3A signal generators were discontinued in April 2002 and are now obsolete instruments for which Agilent does not provide guaranteed support services. Moving forward, it will be increasingly more difficult and more expensive to calibrate and repair your existing 8662A/3A signal generators. As a member of the Agilent PSG family, the new E8663B offers a standard 1-year warranty, extendable to 3-years. The recommended calibration cycle is 2 years, with lower calibration and repair costs as compared to the legacy 8662A/3A. In addition, Agilent also offers an optional extended support life for the E8663B.

Appendix: Detailed Specification Comparisons[1]

Frequency

	8662A	8663A	E8663B
Frequency			
Range	10 kHz to 1280 MHz	100 kHz to 2560 MHz	100 kHz to 3 or 9 GHz[2]
Resolution	0.2 Hz @ 1280 MHz	0.4 Hz @ 2560 MHz	0.001 Hz
CW switching speed	~ 9 ms	~ 9 ms	~ 10 ms
Accuracy	Time base	Time base	Time base
Stability	< 5 x 10^{-10} /day	< 5 x 10^{-10} /day	< 3 x 10^{-10} /day
Digital sweep			
No. of points	100 or 1000	100 or 1000	2 to 1601
Switching speed	~ 500 µs/pt	~ 500 µs/pt	~ 8 ms/pt
Start-stop	Yes	Yes	Yes
Center span	Yes	Yes	No
Log sweep	Yes	Yes	Yes
Agile step sweep	No	No	Yes

Output power

	8662A	8663A	E8663B
Output power			
Range	+13 to –129.9 dBm	+16 to –129.9 dBm	+15 to –135 dBm
Resolution	0.1 dB	0.1 dB	0.01 dB
Level switching time	< 60 ms	< 60 ms	~ 5 ms (~ 30 ms)
Level accuracy	< 1 to –120 dBm	< 1 to –120 dBm	0.8 to –100 dBm
Flatness (sweep)	< 1.1 dB	< 1.5 dB	~ < 0.1 dB

Amplitude modulation

	8662A	8663A	E8663B
Amplitude modulation			
Depth	0 to 95% < 8 dBm	0 to 95% < 10 dBm	0 to 90%
Resolution	1%	0.1%	0.1%
Rate	dc to 10 kHz max	dc to 10 kHz max	dc to 100 kHz
Accuracy	5% of setting + 1% AM	6% of setting + 1% AM	6% of setting + 1% AM
Distortion	< 5.5%	< 4%	< 2%

Pulse modulation

	8662A	8663A	E8663B/with Opt. UNW
Pulse modulation			
On/off ratio	N/A	> 80 dB	80 dB
Rise/fall times	N/A	< 100 ns (> 640 MHz)	100 ns/10 ns
PRF	N/A	99.9 kHz max	250 kHz/5 MHz

Frequency modulation

	8662A	8663A	E8663B/with Opt. UNW
Frequency modulation			
Rate	dc to 100 kHz	dc to 100 kHz	dc to 100 kHz (10 MHz)
Deviation	200 kHz max	400 kHz max	1 to 4 MHz max
Accuracy	8% + 10 Hz	7% + 10 Hz	~ 3.5% + 20 Hz
Distortion	< 1.7%	< 1.7%	< 1%

1. E8663B specifications are subject to change.
2. Performance is unspecified below 250 kHz.

Phase modulation

	8662A	8663A with Opt. 002	E8663B
Phase modulation			
Deviation (> 640)	N/A	400 ° (7 rad)	1 to 40 rad
Rate (> 640 MHz)	N/A	10 MHz max (50 ohm)	dc to 100 kHz (1 MHz)
Resolution	N/A	2 to 4 °	0.1% of set deviation
BPSK			
Deviation	N/A	90 °	N/A

Internal modulation and pulse generators

	8662A	8663A	E8663B
Internal modulation generator			
Range	10 Hz to 99 kHz	10 Hz to 99 kHz	.5 Hz to 1 MHz
Resolution	3 digits	3 digits	.5 Hz
Accuracy	Same as time base	Same as time base	Same as time base
Single or dual	Single	Single	Dual
Internal pulse generator			
PRF	N/A	N/A	14 MHz max
Resolution	N/A	N/A	10 ns

Harmonics, subharmonics and spurious

	8662A	8663A	E8663B/with Opt. HAR
Harmonics (dBc)			
fc < 10 MHz	< –30	< –30	< –28
10 < fc < 1280 MHz	< –30	< –30	< –30/< –55
1.28 GHz < fc < 2 GHz	< –25	< –25	< –30/< –55
2 GHz < fc < max freq	< –25	< –25	< –55
Subharmonics (dBc)			
fc < 640 MHz	none	none	none
640 MHz < fc < 1280 MHz	–70	–70	none
1280 MHz < fc < max freq	N/A	–40	none
Spurious (dBc)			
fc < 2 GHz	< –84	< –84	< –74 (–82 typ)
2 GHz < fc < 3.2 GHz	N/A	< –78	< –68 (–76 typ)
3.2 GHz < fc < 9.0 GHz	N/A	N/A	< –62 (–70 typ)

Remote programming

	8662A	8663A	E8663B
Remote programming			
IEEE 488 (GPIB)	Yes	Yes	Yes
RS232	No	No	Yes
LAN	No	No	Yes
SCPI	No	No	Yes

References and Resources

E8663B Data Sheet,
literature number 5989-4866EN

E8663B Users Guide,
part number E8663B-90003

8662A/3A Data Sheet,
literature number 5953-8376

E8663B-HAR Specifications,
no part number

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