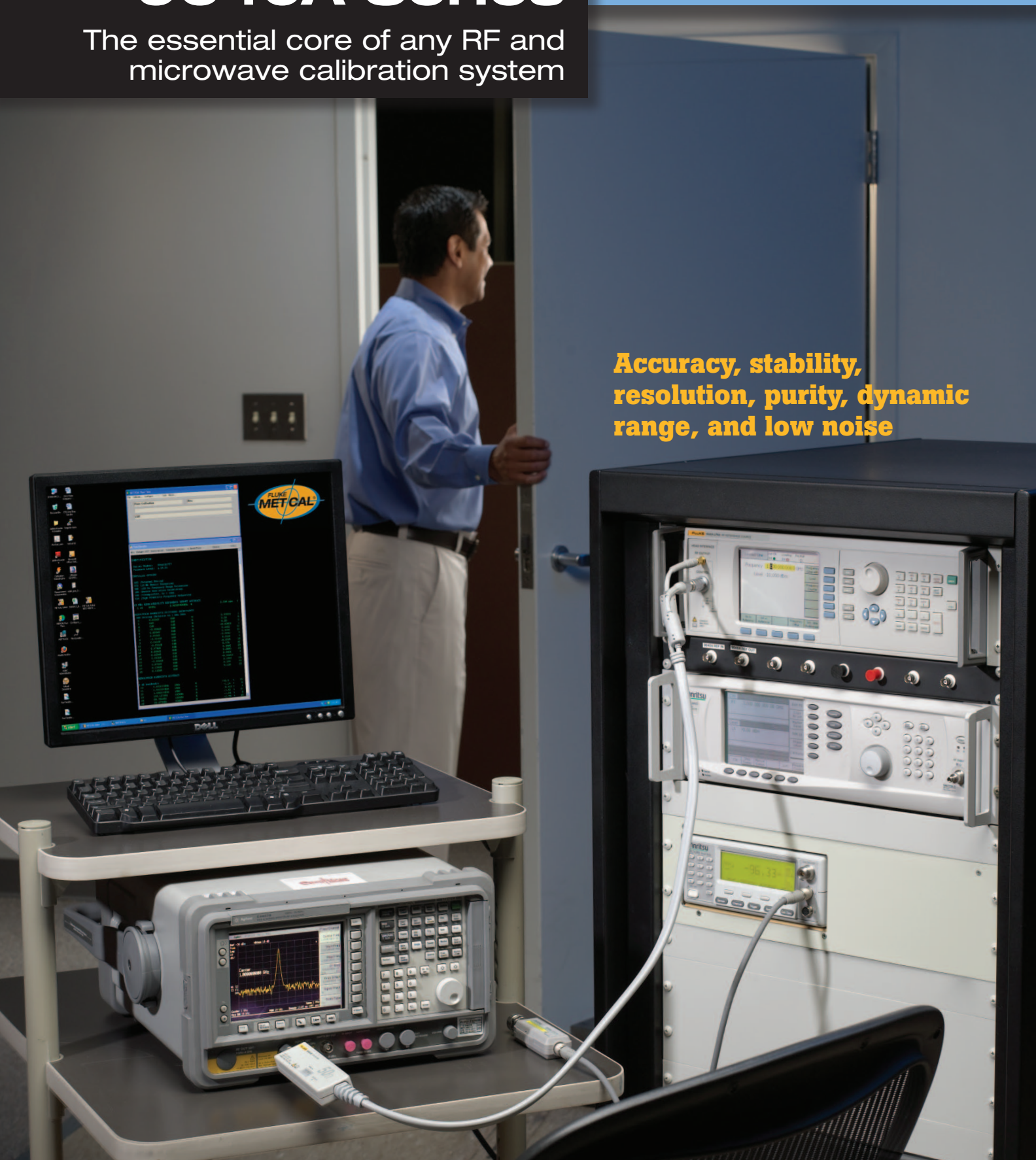
FLUKE®

Calibration

9640A Series

The essential core of any RF and microwave calibration system



Accuracy, stability, resolution, purity, dynamic range, and low noise

Simplify and speed RF calibration

The Fluke Calibration 9640A and 9640A-LPNX RF Reference Sources are designed specifically for RF calibration, featuring a calibration-oriented user interface, precision signal level and attenuation, high signal purity and precision low distortion modulation. This unique combination of features and performance makes them clearly superior to the general purpose signal generators and array of ancillary equipment often used in traditional RF calibration systems. The 9604A-LPNX low phase noise version provides superior phase noise performance.

The 9640A Series simplifies and speeds up calibration procedures, reduces opportunities for operator errors, and greatly simplifies RF metrology. As the core of an RF and microwave calibration system, the 9640A covers the majority of test points required for calibrating spectrum analyzers of any frequency range.

As RF calibration workload has grown more complex, often at reduced purchase cost, the pressures for greater efficiency and lower cost in RF calibration have also grown. Used manually, the 9640A models reduce complexity, errors and calibration times. Used with MET/CAL® Calibration Management Software and the extensive Fluke Calibration procedures library, the resulting automated system improves efficiency and dramatically increases capacity. With "walk-away" MET/CAL automation, the 9640A can perform the majority of tests without operator intervention, freeing highly skilled operators to perform other tasks.

Broad workload coverage

The 9640A and 9640A-LPNX Reference Sources can help you calibrate a broad range of RF test equipment:

- Spectrum analyzers
- Modulation meters and analyzers
- RF power sensors
- Measurement receivers
- Frequency counters
- Attenuators
- and more

..... all at either 50 ohm or 75 ohm impedence.

A cost effective, compact solution for RF and microwave calibration systems

The 9640A Series takes the central role and typically halves the cost of a high capability RF calibration system. Its unique features and performance enable it to replace up to four signal sources (from audio/function generators to RF signal and low phase noise sources), power meters and power sensors, step attenuators, filters, pads, couplers, and also a frequency counter with the 9600FC integrated counter option.

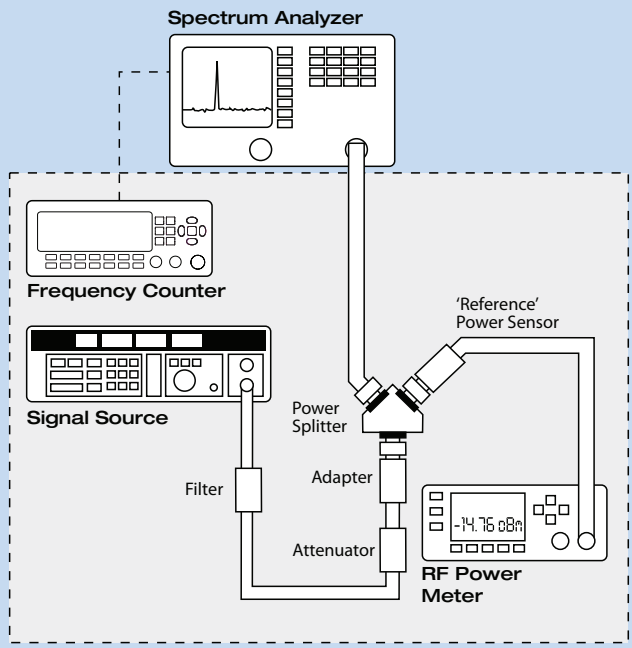
For many spectrum analyzer models operating below 4 GHz, the 9640A can perform the entire calibration with a single connection and the potential for total automation.

For high performance high frequency spectrum analyzers, the 9640A can perform more than 80 percent of all the tests required. In this case, an existing RF and microwave source is also used. All can be controlled by MET/CAL calibration automation software.

The 9640A features and performance make them ideal for calibrating other RF workload, including RF millivoltmeters, signal level meters, modulation analyzers, receivers, counter/timers and power sensor linearity.

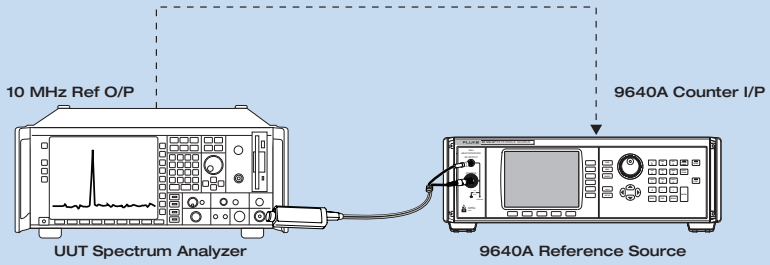
Reducing the number of instruments in a calibration system brings many benefits. Metrology is simpler with fewer error sources and uncertainty contributions to consider. System support costs are reduced, as there are fewer instruments to maintain and fewer vendors to manage. A smaller, more compact and robust system becomes a practical onsite calibration solution, with lower transport costs and setup and tear-down delays.

The 9640A models are designed to match or exceed the performance and functionality of the long obsolete HP3335A and HP8662/3A signal sources often present in existing calibration systems. HP3335A GPIB command emulation is standard in both 9640A models and HP8662/3A emulation is optional in the 9640A-LPNX. Replacing these popular but difficult-to-maintain products becomes just a plug-and-play substitution. HP8662/3A GPIB command emulation is installed on the 9640A-LPNX model as a "try before you buy" temporary license for convenient and thorough compatibility testing.



The instruments in the grey area in the above figure are typically used to deliver precision level when testing spectrum analyzer frequency response and attenuation. The Fluke Calibration 9640A Series shown in the figure below, has the level and attenuation precision, without the need for external characterization, to help simplify RF workload calibration.

Besides improving test efficiency, the multi-functional capabilities and precision leveling head attenuation of the 9640A makes it easier to use manually or automate your RF calibration system.



Designed to simplify RF calibration procedures and RF metrology

The 9640A Series provides unrivalled level and attenuation accuracy, with high signal purity, low harmonic and spurious content. A rugged, precision leveling head delivers the 9640A signals directly to the unit under test from a floating (ground isolated) signal source. This minimizes losses, noise, interference, and mismatch errors, and maintains the integrity of low-level signals. Uniquely in RF calibration, the 9640A accurately displays the applied output level and can also calculate UUT error and display it directly. This is all achieved through a single connection, eliminating the power meters and sensors, step attenuators and filters required when using general purpose signal generators in calibration applications.

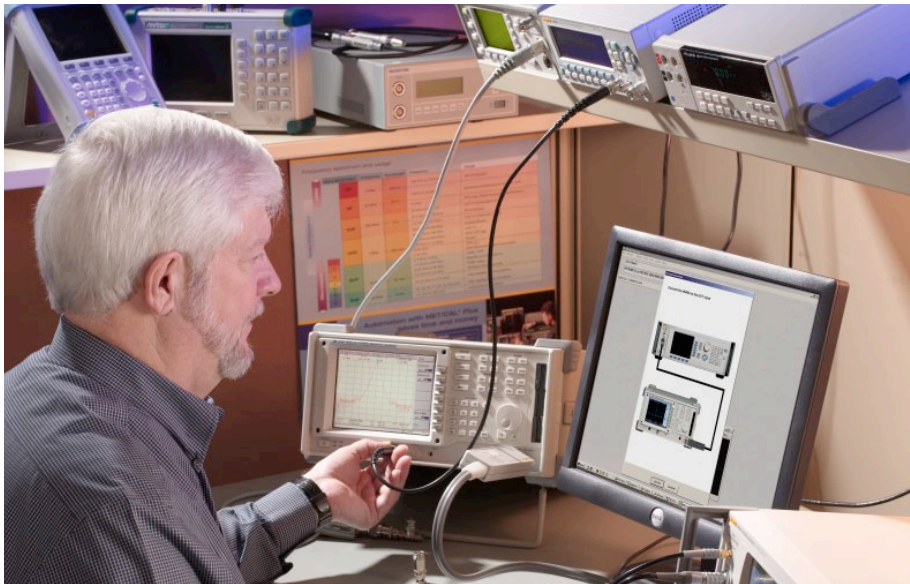
This unique "connect once, measure many" capability not only simplifies the calibration process but also greatly reduces the number of measurement error sources and uncertainty contributions. The standard 9640A and 9640A-LPNX models are supplied with a 50 ohm leveling head. The /75 models add the optional 75 ohm leveling head, bringing the same ease of use, metrology and accuracy benefits to 75 ohm calibrations, without the losses and additional uncertainties of an impedance convertor.

Each 9640A instrument is supplied with a comprehensive ISO 17025 compliant certificate of calibration with results data and uncertainties for all key parameters, including level and attenuation, output VSWR, and phase noise. In addition to providing traceability, RF metrology and uncertainty analysis become much simpler and faster. Accredited certification is available for both 9640A models and both 50 ohm and 75 ohm heads. The mainframe and heads are calibrated together as a system.

The 9640A Series user interface is designed to simplify common calibration processes for typical items in your workload, such as spectrum analyzers, RF level meters and receivers. Parameter offset, stepping, relative and UUT error readout modes allow RF calibration technicians and metrologists to work quickly, accurately and efficiently, using facilities that have long been available on dc and lf calibrators. Even in fully automated applications, the simple calibration-oriented user interface makes troubleshooting easier.

Use MET/CAL® software for "walk-away" automation

In a typical automated RF calibration process, the operator must frequently intervene to change test setups, thus limiting the benefits that can be realized by the automation. Walk-away



automation will increase calibration system capacity by 25 % and will free up operator capacity of 50 % or more to other value-adding tasks rather than waiting for the next system setup change.

For example, the manufacturer's calibration procedure for calibrating the Agilent E4407B 26.5 GHz spectrum analyzer requires 27 different and complex test setups.

On the other hand, the 9640A Series, used with MET/CAL Calibration Management Software, performs the major core of required tests with a single setup. Only four additional setups are needed to complete the MET/CAL procedure.

MET/CAL procedures created by Fluke Calibration for the 9640A models optimize operator time and efficiency by maximizing the time available for the operator to leave the system running unattended, with any required lead changes occurring at the beginning or end of the calibration process. For example, the E4407B MET/CAL procedure for the 9640A-LPNX allows more than 90 minutes of "walk-away" time within the total two-hour runtime.

Use MET/CAL software's Flexible Standards feature to automate the other instruments in your system. This capability allows you to substitute equivalent standards within the procedures, so you aren't locked into a specific reference model.

By using MET/CAL, Fluke Calibration has been able to develop calibration procedures for a wide variety of RF instruments and calibration standards supporting a wide variety of manufacturers. New procedures and supported Flexible Standards are released regularly. A current list of procedures and supported Flexible Standards is available on the Fluke Calibration web site at **www.flukecal.com/9640A**.

MET/CAL procedures for RF calibration

The following list shows only some of the procedures available for use with the 9640A Series. For a more complete and current list, visit the Fluke Calibration website at **www.flukecal.com/9640A**. If you cannot find the procedure that you need in this listing, MET/CAL software allows you to modify any procedure to meet a similar requirement. Alternatively you can now request a custom designed procedure from Fluke Calibration.

Product family	Models
Agilent & HP E4400 (ESA) series	E4401B E4402B, E4403B, E4404B, E4405B, E4407B, E4408B, E4411B
Agilent E4440A (PSA) series	E4440A, E4443A, E4445A, E4446A, E4447A & E4448A
Agilent 8490 series	8495A (Opt001), 8496A (Opt001),
HP / Agilent 8560 series	8560A/E/EC, 8561B/E/EC, 8562A/E/EC, 8563A/E/EC, 8568B
HP / Agilent 8590 series	8594E, 8590A, 8591C
R&S FSH series	FSH3, FSH6, FSH13, FSH23, FSH26
R&S FSU / FSQ series	FSU3, FSU8, FSU26, FSQ3, FSQ8, FSQ26
R&S FSP / FSV series	FSP3, FSP7, FSP13, FSV3, FSV7, FSV13
Anritsu MS2600 series	MS2661C/N
Anritsu MG3690B series	MG3691B, MG3692B, MG3694B, MG3696B
Aeroflex IFR 2390 series	2394, 2395
Tektronix RSA3000 series	3408B

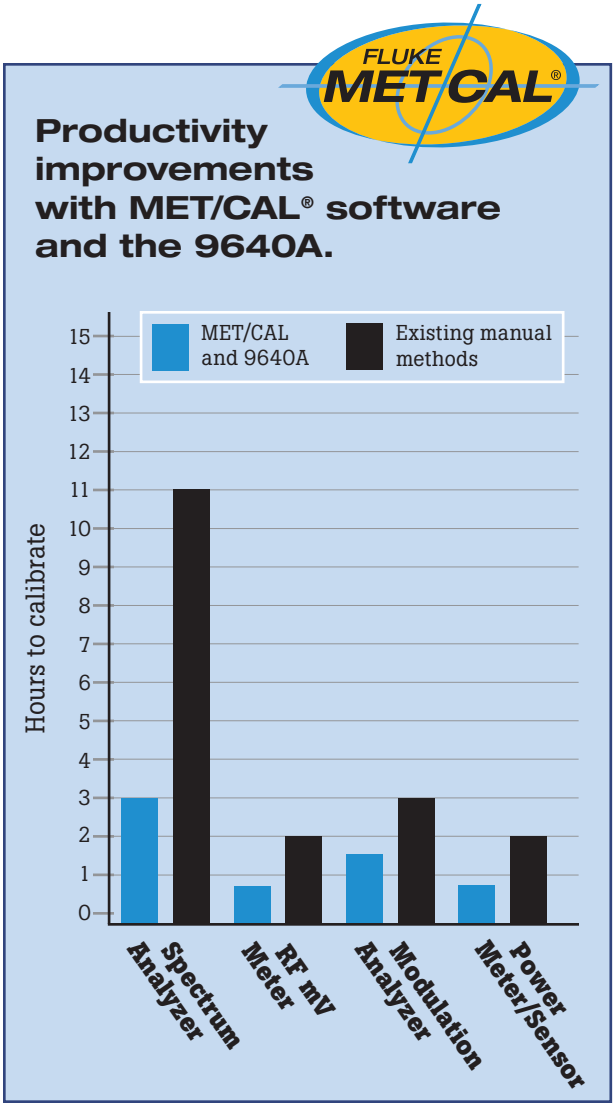
MET/CAL Flexible Standards and Sensor FSCs

The following examples are available to be used with procedures developed for the 9640. Visit the Fluke Calibration website at **www.flukecal.com/9640** for a more complete listing. If the microwave source that you own is not currently available, please request that it be added by contacting your local Fluke Calibration sales representative.

Product family	Models
HP/Agilent MW Signal Generators	8362X, 8363X, 8364X, 8365X, 8340, 8341, 8254, 8257, 8267
R&S MW Signal Generators	SMF100A
Anritsu MW Signal Generators	MG3691B, MG3692B, MG3696B

Manual MET/CAL® Software

Not every calibration can be automated. Passive workload such as attenuators, pads, adapters, filters and cables are probably calibrated manually. Other applications for manually entered data may be low volume workload, for which an automated procedure does not exist, or instruments that do not feature a suitable remote control interface. Manual MET/CAL software is designed for these types of applications. Manual MET/CAL software supports manual data entry, testing against limits and calibration certificate generation. Most importantly, Manual MET/CAL software interfaces this data directly to the same database used by MET/CAL software. And it's fully compatible with Fluke Calibration MET/TRACK® asset management software.



The software support you need, when you need it

Enroll in the annual MET/SUPPORT Gold program and you will receive premium support and services to help keep you as productive as possible. In addition to priority support by telephone, fax or email, you get free access to the Fluke Calibration library of Warranted Procedures, software updates and upgrades, discounts on training courses and more. Even if you use only a few of the Gold services, you can easily recover more than the cost of your membership fee.

If you need to arrange for training for yourself or your staff, Fluke Calibration can help there too, with a broad range of classes on metrology principles, lab management, software use, procedure writing and more.

The Fluke Calibration commitment to support provides additional benefits as well, including invitations to software user group meetings and conferences, web seminars, and periodic informational email bulletins.

Why buy an RF calibration system from Fluke Calibration?

Custom 9640A RF calibration systems and MET/CAL procedures: designed, built and supported by Fluke Calibration

By basing a solution on a 9640A Series reference source and MET/CAL calibration software, Fluke Calibration can meet your RF calibration needs with a cost effective solution. Currently to a maximum frequency of 50 GHz, Fluke Calibration will specify system instruments, standards and components from the Fluke product line, as well as from other leading suppliers. We may even be able to integrate equipment that you already own.

When Fluke or partners are specified, we can supply the equipment in floor-standing, bench-top or ruggedized portable 19-inch rack frames, including convenient and secure drawers or cases for any required RF components (pads, adapters, cables, bridges, splitters, etc—also specified and supplied). Experienced Fluke Calibration technicians will even come to your site, train your staff, and install your new system for you.

RF systems can be complex to define. Sourcing instruments and components from multiple manufacturers is time consuming, and integrating everything into a working and traceable system can be tricky, especially if the system also needs to be rugged and easily transportable. Conflicting requirements can lead you to compromise on a solution that doesn't do everything you need, or, on the other hand, cause you to spend too much. Automation, metrology and accreditation, and training has also been costly and time consuming.

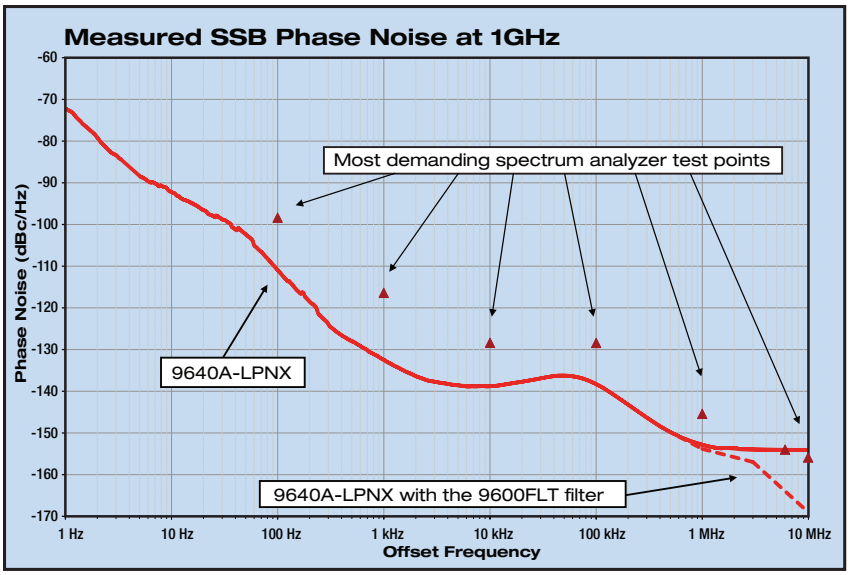
- Reduce your definition cost, purchase cost, metrology and accreditation costs, plus cost of ownership.
- Automate your calibration and inventory management tasks and maximize operator "walk away" time.
- Automate to your specific requirements and for more unusual workload using custom designed MET/CAL procedures.
- Reduce human error, required training and intervention.
- Greatly improve calibration station capability—typically a 25 % improvement over other automated solutions.
- Greatly improve operator/operational efficiency—typically a 50 % improvement over other solutions.

If you would like to explore the design of a new RF calibration system and/or custom MET/CAL procedures, please contact your Fluke Calibration sales office to begin discussion of options and the specification process.

What can you calibrate with a Fluke RF calibration system?

- Measuring instruments and components to 50 GHz
- Bench and handheld spectrum analyzers (typically < 20 minutes for a modern handheld)
- High performance spectrum analyzers (typically < 2.5 hours)
- Measuring receivers, modulation analyzers or meters and signal generators
- Power Sensors
- Oscilloscopes and RF millivolt meters
- Timer and frequency counters
- RF and microwave components

Performance and flexibility to meet a variety of needs



9640A-LPNX with 9600FLT

9640A-LPNX state-of-the art phase noise performance

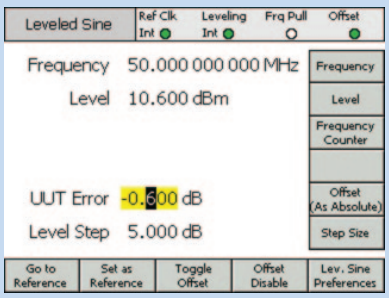
With reduced phase noise levels at low offset frequencies and now specified at offsets from 1 Hz to 10 MHz from the carrier frequency, the 9640A-LPNX offers exceptional phase noise performance right across its operating frequency range.

With more than ample capability for today's high performance spectrum analyzer workload, there is performance margin for future workload enhancements. Phase noise data is included in the 9640A certificate of calibration. Instead of relying only on the more conservative guaranteed specifications, users have actual performance data and Fluke's measurement uncertainty for their unit.

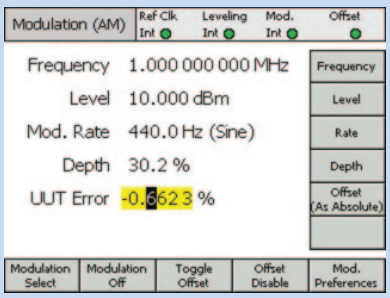
Even with the best low phase noise signal generators, filters are occasionally used during very high performance spectrum analyzer phase noise calibration tests to reduce noise levels at wide (high) offset frequencies and improve test margins. The 9600FLT 1 GHz bandpass filter accessory is purpose-designed for high performance spectrum analyzer wide-offset phase noise testing and connects easily to 9640A models in either benchtop or rack-mounted applications.

Using the 9640A Series with other automation solutions

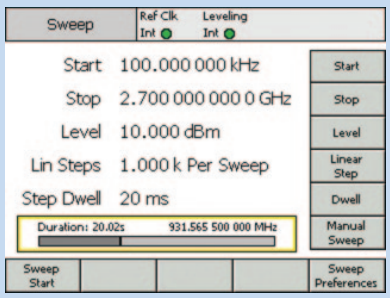
The 9640A Series integrates easily into existing automated systems and software. The time savings and efficiency gains offered by the 9640A



Leveled sine and display of calculated UUT level error.



Amplitude modulation and display of calculated UUT depth error.



Sweep frequency and sweep progress indication.

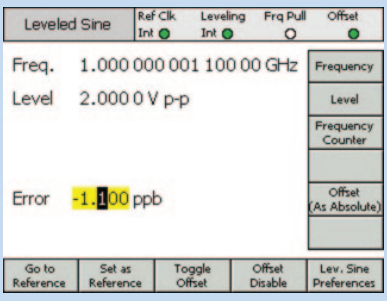
Series can be realized by structuring test sequences to take full advantage of its "connect once, test many" capabilities. Alternatively, the 9640A Series' HP3335A and HP8662/3A emulation provides a drop-in replacement solution overcoming reliability and support problems with these obsolete products.

General purpose applications

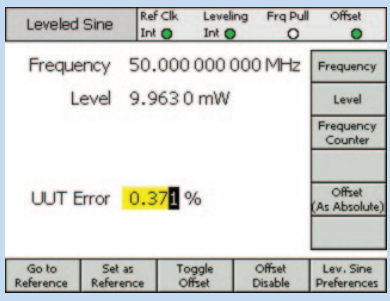
Many applications in R&D, manufacturing test and ATE need better performance than a general purpose signal generator can provide. If critical parameters include wide frequency coverage, fine frequency or sweep resolution, low harmonics and spurious content, signal level and attenuation accuracy, or dynamic range, the 9640A could very likely be the ideal solution and the 9640A-LPNX model for applications requiring frequency resolution, low phase noise, jitter or modulation residuals. Replacement of HP3335A and HP8662/3A level and signal generators in ATE systems is made easy by the 9640A Series GPIB emulation of these aging obsolete products.

New features included in the 9640A Series

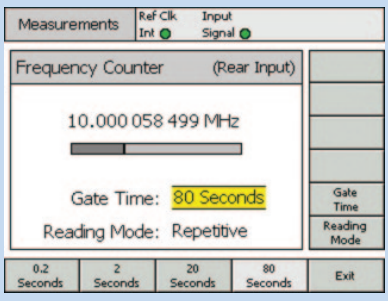
- **Improved level accuracy and attenuation**
  Specifications for better test uncertainty ratios against the most demanding workloads
- **9640A-LPNX model improved phase noise**
  Reduced close-in phase noise and specifications to 1 Hz offsets
- **Optional integrated 50 MHz frequency counter**
  Reducing the number of instruments needed in an RF calibration system in the lab or onsite for UUT frequency reference testing
- **Extended leveled sine frequency setting resolution**
  An enhanced mode with 10 uHz resolution at all frequencies, giving a maximum display and setting resolution of 4.023 999 999 999 99 GHz.
- **Leveled sine minimum output frequency of 1 mHz**
  Replacing a function generator in many multipurpose calibration systems, enhancing the 9640A Series versatility
- **External phase modulation**
  Also with 1 MHz bandwidth for phase and frequency modulation
- **Narrow range-locked sweep**
  Enables faster, smoother frequency sweep across a narrow channel or filter characteristic.
- **9600FLT 1 GHz wide offset phase noise filter**
  A bandpass filter designed to reduce wide offset phase noise at 1 GHz carrier frequency. Used to enhance performance margin (TUR) when calibrating the very best spectrum analyzer workload.



Leveled sine with high resolution frequency mode enabled.



Leveled sine, wutput in watts and display of UUT error in percent.

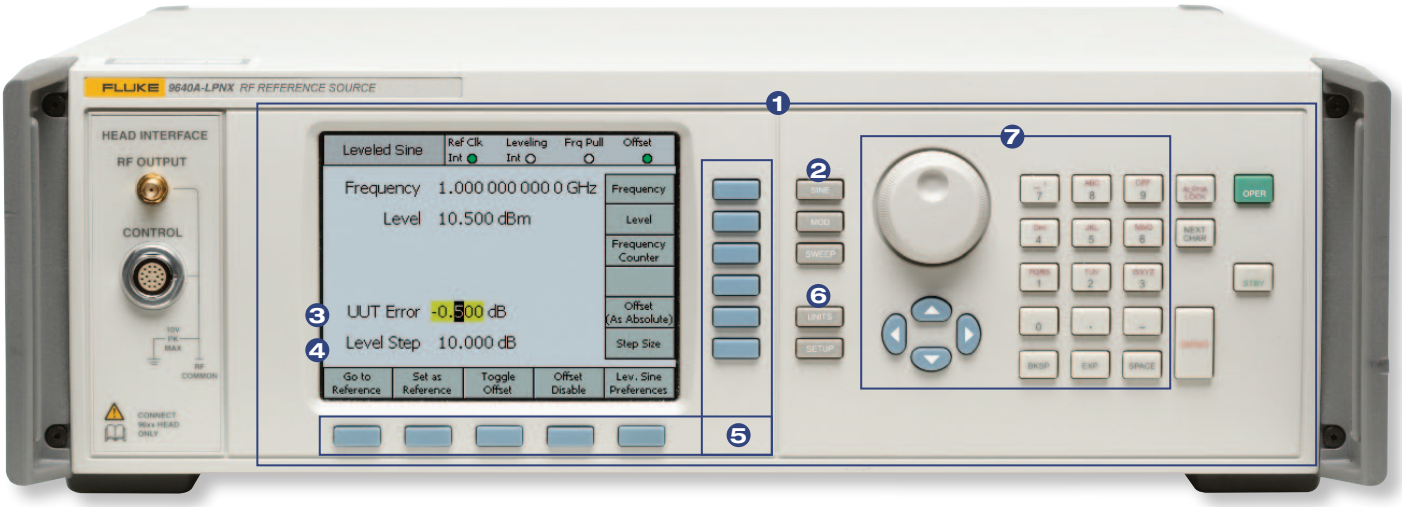


Optional frequency counter with reading progress.

An RF calibration solution that sets new standards for usability

The 9640A Series front panel is equipped with dedicated function keys, context-sensitive soft-keys, and a bright, easy-to-read color display that makes it easy to learn and operate. Output parameters may be set using multiple units; for example, output level may be set in terms of power watts (or dBm), voltage (RMS, peak to peak or dB uV) and using familiar multipliers and exponent forms. Useful as a ready reckoner, you can move easily between voltage, power and dB units without losing entered values or accuracy.

The user interface is designed by metrologists to simplify common calibration processes for typical items in your workload, such as spectrum analyzers, RF level meters and receivers. Offset, stepping, relative and error modes allow calibration technicians and metrologists to work quickly, accurately and efficiently, following familiar calibration procedures and making it easy to determine performance and tolerances of units under test.



1 Clean, simple front panel with a large display screen makes the 9640A Series easy to learn and straightforward to use. The color LCD display clearly indicates output conditions and simplifies operator execution.

2 Primary function keys select sine, modulation or sweep.

3 Level offset function provides UUT error or source offset.

4 Level step function enables repetitive measurements to be performed quickly.

5 Soft menu keys adapt to required function.

6 User defined context sensitive measurement units.

7 Operator can select from spin-wheel, cursor keys or use direct numeric entry.

The 9640A system includes a 50 Ohm or optional 75 Ohm precision leveling head. The head delivers fully floating signals directly to the UUT to ensure the accuracy and integrity of the reference generator's output signals at the device under test input.

Support for your hardware when you need it

Fluke Calibration operates global calibration and repair facilities to keep your hardware in top working order. A variety of service programs are available, including the Priority Gold CarePlan, which features:

- Annual calibration included (standard or accredited) with guaranteed three-day in-house turnaround[1,2]
- Free repairs with guaranteed ten-day in-house repair (includes calibration)[2,3]
- Pre-paid, priority freight on return of instrument
- Special Priority Gold telephone help line or web support for member assistance
- Free product updates
- Terms: one-year, three-year and five-year plans available
- 10 % off on calibration product upgrades
- 20 % off any Fluke metrology training for any of your personnel
- Automatic 45-day and 15-day calibration due notification
- Free transit case for your instruments (Europe only)

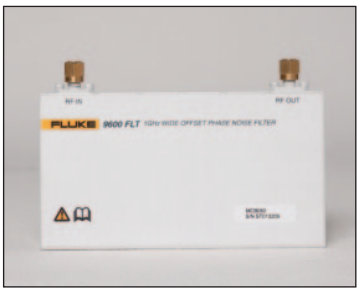
[1] Three-day in-house turnaround not available in all countries; contact your local Fluke representative for details. Priority shipping times vary by country.
[2] One-year and three-year Priority Gold CarePlans do not cover instrument repairs in the first 30 days after plan purchase. Five-year plans are eligible for immediate repair services covered under the program.
[3] Instruments showing signs of failure due to physical abuse, improper operation or application do not qualify for free repair and will be repaired at standard repair rates.

Summary specifications

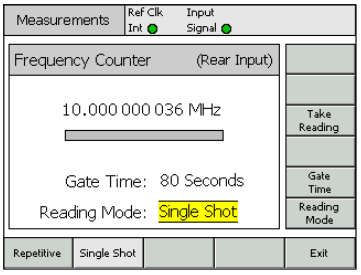
Key specifications summary (Refer to the extended specifications for full and detailed specifications).		
Range	**Frequency specifications**	**Level specifiications** (50 Ω output, see extended specifications for 75 Ω)
	1 mHz to 4 GHz	-130 to +24 dBm to 128 MHz, 14 dBm at 4 GHz (leveled)
Resolution	10 uHz	0.001 dB
Accuracy	0.05 ppm + 5 uHz	**Down to -48 dBm** 0.03 dB to 100 kHz, 0.05 dB to 128 MHz, 0.3 dB at 4 GHz **10 MHz to 128 MHz** 0.05 dB to -48 dBm, 0.1 dB to -84 dBm, 0.7 dB at -130 dBm
Attenuation		0.02 dB to 55 dB, 0.15 dB at 110 dB Relative to 16 dBm and in 10 MHz to 128 MHz
VSWR		≤500 MHz: ≤1.1, ≤1 GHz: 1.2, ≤3 GHz: 1.3, ≤4 GHz: 1.4
Harmonics and spurious	–60 dBc harmonics, –70 dBc spurious to 1 GHz	
Phase noise at 1 GHz	**9640A**: –122 dBc/Hz, typical, at 10 kHz offset **9640A-LPNX:** –138 dBc/Hz, typical, at 5 kHz to 100 kHz offset	
Modulation	AM, FM, PM, internal and external. Frequency pull and external leveling.	
Frequency sweep	1 mHz to 4 GHz. Linear or Logarithmic. Stop-Start or Center-Span, Sawtooth and Triangle	
Frequency counter	Optional internal 50 MHz frequency counter, 1 mHz (0.1 ppb) resolution at 10 MHz	
Temperature	**Operating:** 0 °C to 50 °C, 23 °C ± 5 °C for specified performance **Storage:** -20 °C to +70 °C	
Standard interfaces	IEEE488.2 (GPIB)	
GPIB command emulation	**9640A, 9640A-LPNX:** HP3335 **9640A-LPNX + Opt 8662/8663 GPIB:** HP3335, HP8662A, HP8663A	
Dimensions (HxWxD)	146 mm x 433 mm x and 533 mm (5.8 in x 17.0 in x 21.0 in) Industry-standard 19 in (483 mm) rack mounting when fitted with Y9600 rack mounting kit	
Weight	18 kg, (40 lbs)	

Ordering information

Models	Description
9640A-STD	4 GHz RF Reference Source including 50 Ω leveling head and HP 3335A GPIB command emulation
9640A-STD/75	4 GHz RF Reference Source including 50 Ω and 75 Ω leveling head and HP 3335A GPIB command emulation
9640A-LPNX	4 GHz RF Reference Source with low phase noise, including 50 Ω leveling head and HP 3335A GPIB command emulation
9640A-LPNX/75	4 GHz RF Reference Source with low phase noise, including 50 Ω and 75 Ω leveling head and HP 3335A GPIB command emulation
Options	
8662/8663 GPIB*	8662 & 8663 Emulation (not available for 9640A-STD)
9600FC*	Integrated 50 MHz Frequency Counter
*Options are License Key enabled, also available as user-installable upgrades. Contact your local Fluke sales office for information.	
Accessories	
9600FLT	1 GHz Wide Offset Phase Noise Filter
Y9600	Rack Mount Kit (slides)
9600CASE	Rugged Transit Case
9600CONN	Adaptor/Torque Kit
Upgrades	
9640A-STD->9640A-LPNX	Upgrade 9640A-STD to 9640A-LPNX
9640A-LPN->9640A-LPNX	Upgrade 9640A-LPN to 9640A-LPNX
9640A/75UPG	Upgrade any 9640A to 75 Ohm head
Software	
MET/BASE-8	Workstation or Server Based Calibration Software Database System (Requires a license to enable components)
MET/TRACK-L	License to enable MET/TRACK inventory management component only
MET/CAL-L	License to enable MET/CAL calibration automation and MET/TRACK components
MET/SUPPORT Gold	Annual subscription access to premium support services and extensive calibration procedures library
Manual MET/CAL	Manual data entry, testing to limits and certificate generation software and license for non-automated calibration workload. Pressure, Flow and Temperature automated calibration components are also available, for full details of available MET/CAL software products, license packages , upgrades and training packages; contact your local Fluke Calibration sales office.
Hardware and calibration CarePlans	
Hardware and calibration Gold CarePlans are available for the 9640A-STD or 9640A-LPNX and 9640A/75 models in one-year, three-year or five-year plans with accredited or standard calibration. Contact your local Fluke sales office for information.	



9600FLT: 1 GHz Wide Offset Phase Noise Filter



Optional 9600FC Integrated 50 MHz Frequency Counter

9600CONN: Adaptor/ Torque Kit

Visit Fluke Calibration online for more information

Go to **www.flukecal.com** for detailed product and application information, plus:

- Publications
- Product demonstration videos
- Recorded web seminars

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