Anritsu

ME7840A

Power Amplifier Test System (PATS)

Base Stations: 100 Watts, 800 to 2400 MHz
Handsets: 5 Watts, 10 MHz to 6 GHz

See The True Performance of Your Base Station or Handset Power Amplifier

SEE THE TRUE PERFORMANCE OF YOUR POWER AMPLIFIER WITH A SINGLE CONNECTION

ME7840A Power Amplifier Test System (PATS)

The powerful ME7840A is an easy-to-use measurement solution for thoroughly characterizing next generation base station and handset power amplifiers. Utilizing the Scorpion® Vector Network Measurement System (VNMS), the ME7840A includes a powerful suite of measurements including the industry's fastest compression and intermodulation distortion (IMD) tests. Best of all, the Scorpion Navigator™ user-interface is the result of working closely with power amplifier designers and manufacturers so it's both powerful and easy-to-use.

Key Benefits

- Consolidate Test Stations and Connections to Increase Productivity
- Easy-to-Use Scorpion Navigator Accurately Characterizes Power Amplifiers
- Real-time Compression and IMD Measurements Improve Time-to-Market
- Auxiliary Paths Supports Adjacent Channel Power Ratio (ACPR) Measurements

A side-by-side comparison shows the similarities between the handset (ME7840/4) and base station (ME7840A) power amplifier measurement single connection solutions. Both solutions consist of the Scorpion VNMS, test set and Scorpion Navigator software (computer not included), but the handset version (on the left) is rated to 5 Watts whereas the base station version (on the right) is rated to 100 Watts.

Handset and Base Station Power Amplifier Configurations

The ME7840A is available in two popular configurations to satisfy both handset and base station power amplifier requirements. These two configurations offer single connection convenience and easy-to-use software, but the test set designs are slightly different. The following tables summarize the key differences in these two test set designs.

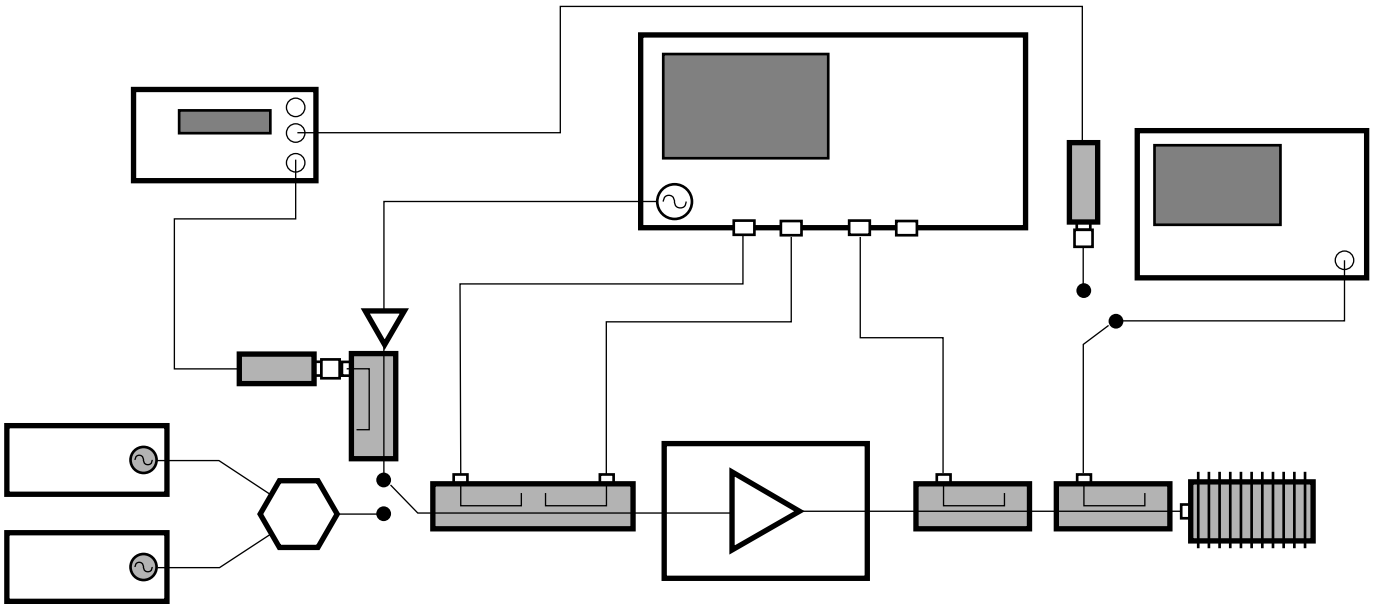
ME7840/4: Handset MN4783A Test Set
5 Watts, 10 MHz to 6000 MHz
+13 dBm AUT Input Power (with integrated preamplifiers)
Noise Figure 50 MHz to 6 GHz
Integrated Two-Tone Combiner
Internal Termination Not Required
Auxiliary Paths Included
Front Panel Preamplifier Loop

ME7840A: Base Station MS4782D Test Set
100 Watts, 800 MHz to 2400 MHz
+5 dBm AUT Input Power (add external preamplifiers for additional power)
Consult Factory for Noise Figure
Integrated Two-Tone Combiner
100 Watt Internal Termination
Auxiliary Paths Included
Rear Panel Preamplifier Loop

For custom requirements, you can delete the test set and use your own test set (reference MS7840/3) or contact the factory for additional custom configurations.

Consolidate Test Stations

A typical power amplifier measurement solution requires “rack and stack” test equipment to perform basic measurements. These measurements include S-parameters, noise figure (for handsets), harmonics, compression, and intermodulation distortion. Although straightforward to configure, the effort required for automation and single connection hides the true cost of this approach.



The rack and stack approach requires a lot of effort before it’s ready to perform measurements. Besides purchasing the network analyzer, two synthesizers and a spectrum analyzer, you must also design and optimize test sets and signal levels to ensure accuracy and to protect the instruments. In addition, this approach requires automation to minimize the amount of resources necessary to characterize power amplifiers.

PATS Offers Comprehensive Power Amplifier Measurement Capabilities

Power Amplifier Measurement	CW	Swept Frequency	Swept Power
S-Parameters:	Yes	Yes	Yes
Hot S22	Yes	Yes	Yes
Pulse (e.g., GSM)	Yes	Yes	Yes
Modulated S-parameters (using Probe Tone)*	Yes	Yes	Yes
Adjacent Channel Power Ration (ACPR):*			
Single Tone	Yes	Yes	Yes
Two Tone	Yes	Yes	Yes
IMD, TOI (two tone):			
3rd, 5th, 7th, and 9th	Yes	Yes	Yes
Pulse (e.g., GSM)*	Yes	Yes	Yes
Noise Figure (Available in ME7840/4 Only)	Yes	Yes	N/A
Gain Compression:			
P_1dB	Yes	Yes	Yes
AM/PM	Yes	N/A	Yes
Pulse (e.g., GSM)*	Yes	Yes	Yes
Harmonics:			
Magnitude	Yes	Yes	Yes
Phase	Yes	Yes	Yes
Drain Current and Power Added Efficiency*	Yes	Yes	Yes

* Scorpion Navigator™ Software supports a variety of external instruments including sources, analyzers, pulse generators, power meters and power supplies to satisfy these measurements.

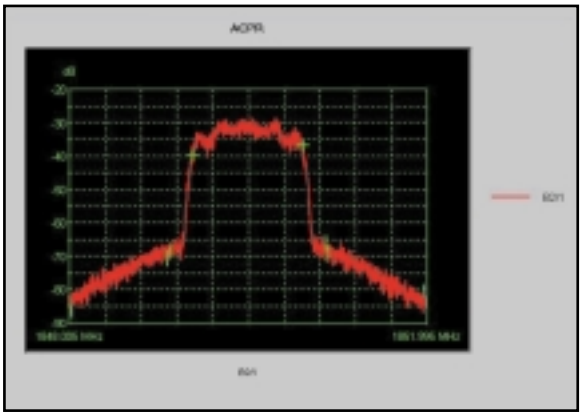
A typical PATS station with optional power meter, AutoCal® module and computer can easily replace a rack of instruments when performing the measurements shown in this table.

In design, production or verification stages, the ME7840A is a comprehensive measurement tool that provides the data you need to see the true performance of your power amplifier. The accuracy and automation capabilities can simplify your power amplifier tests so your resources can more efficiently design and manufacture power amplifiers.

EASY-TO-USE SCORPION NAVIGATOR ACCURATELY CHARACTERIZES POWER AMPLIFIERS

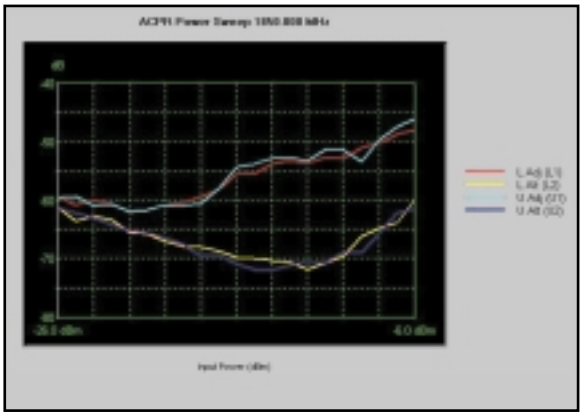
The user-friendly Scorpion Navigator handles all the time-consuming setup, calibration, measurement and reporting requirements for a variety of standard power amplifier measurements. Simply install the Scorpion Navigator on any computer with Windows® and you will have immediate control of these single-tone, two-tone and modulated measurement tools.

ACPR-CW



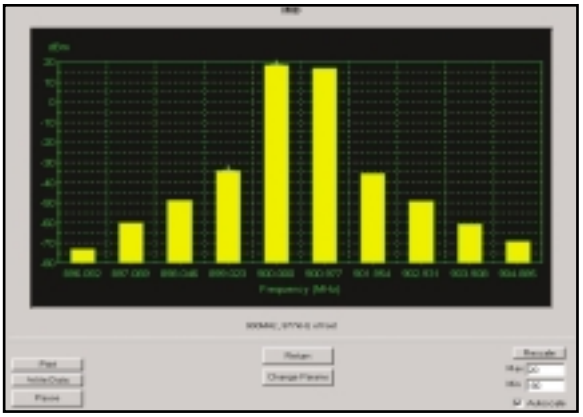
The Scorpion® Vector Network Measurement System (VNMS) receiver can be used to accurately measure ACPR. Typical ACPR dynamic range is 85 dB and 70 dB for Narrowband CDMA and Wideband CDMA, respectively.

ACPR-Versus Power



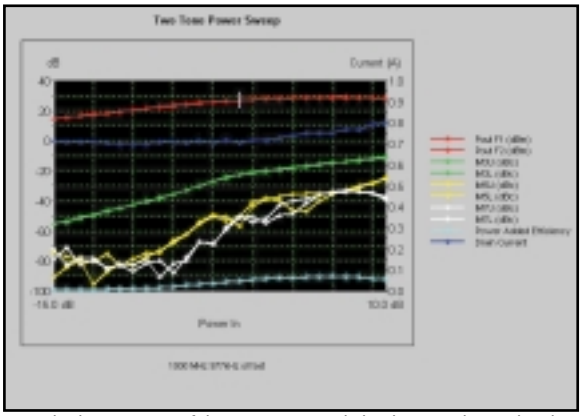
To see real-world performance, PATS can orchestrate the ACPR measurement versus power. An overlayed display of Adjacent and Alternate channel measurements versus power allows you to see the true ACPR performance of your power amplifier.

IMD-CW



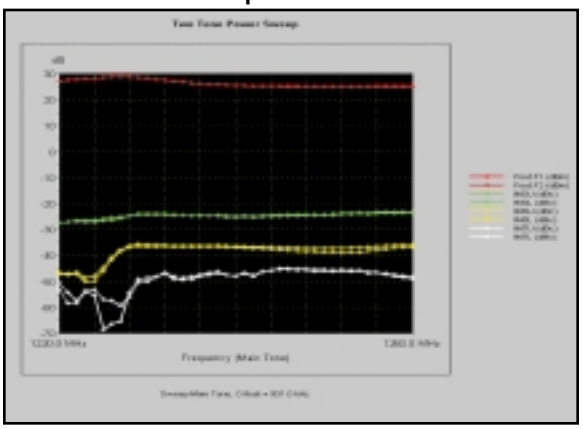
The Scorpion Navigator can easily perform the simple two-tone IMD measurement so you can see the 3rd, 5th, 7th, and 9th order products.

IMD-Versus Power



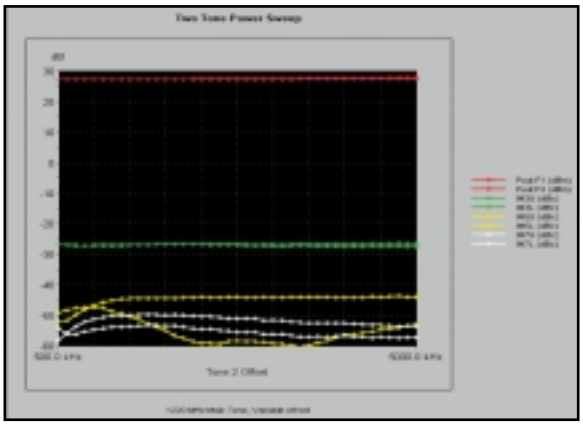
Vary the input power of the two tones and simultaneously overlay the IMD products with gain, output power, or input power to see the power amplifier performance at a specified frequency and offset. Add drain current, and the Scorpion Navigator automatically calculates and displays Power Added Efficiency (PAE), too.

IMD-Versus 1-dB Compression



See the IMD performance versus frequency for a fixed offset. Specify number of points, start and stop frequency and see your two-tone performance at compression. A similar measurement can be shown for specified input or output power.

IMD-Versus Offset

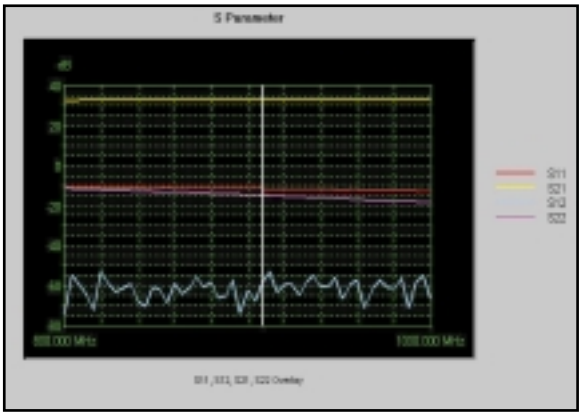


See the IMD performance versus offset, too. Specify the start and stop offset (i.e., tone spacing) frequencies and the Scorpion Navigator orchestrates this measurement and displays the results for your selection of compression, input power, or output power.

THE ME7840A MEASURES POWER AMPLIFIERS WITH A SINGLE CONNECTION

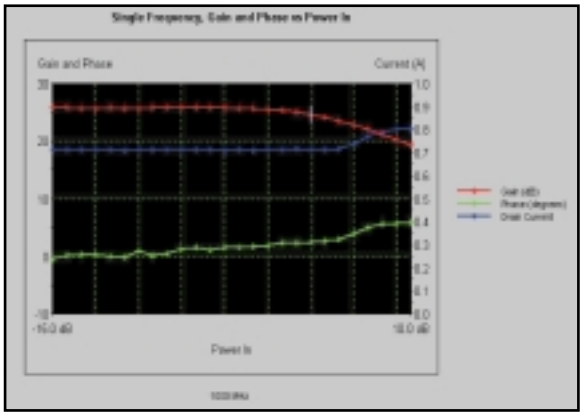
The standard ME7840A configuration supports S-parameters, Intermodulation Distortion, Harmonics and Compression measurements. The ME7840/4 also supports Noise Figure measurements. Adjacent Channel Power Ratio measurements can also be performed using an optional modulated signal generator and analyzers. In most cases, the Scorpion Navigator already includes drivers for these instruments, so contact the factory for the most recent list of supported instruments.

S-Parameters



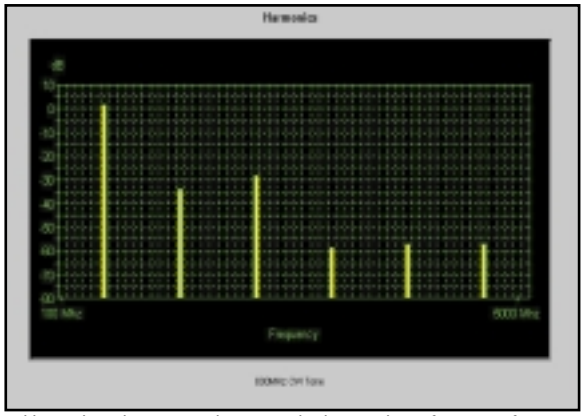
The Scorpion Navigator can easily perform S-parameters versus frequency with unparalleled accuracy and repeatability.

Gain Compression



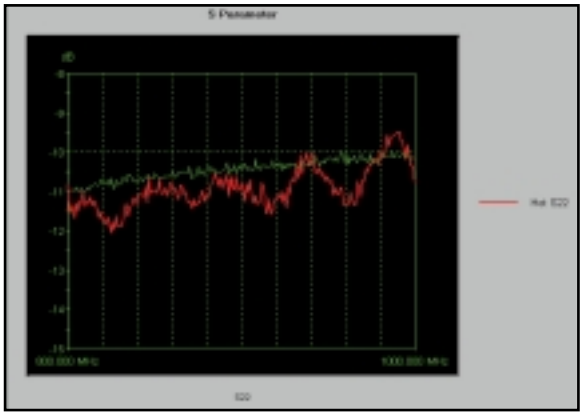
See gain, phase and drain current versus input power for compression measurements.

Harmonics



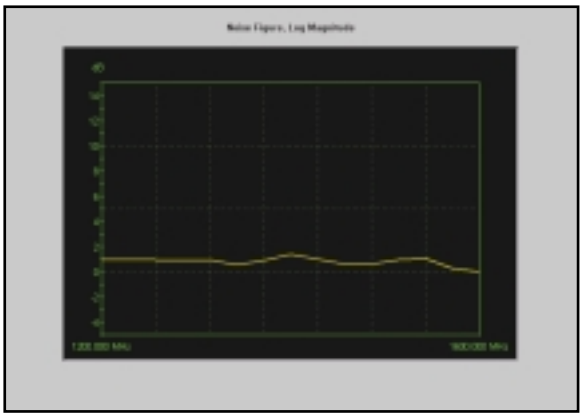
Without changing connections, see the harmonic performance for your power amplifier.

Hot S_{22}



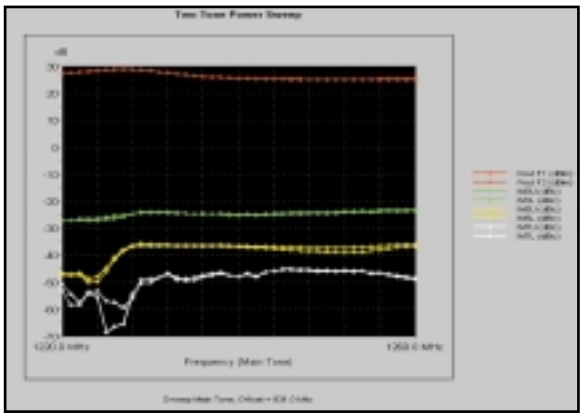
See the output match of your power amplifier, termed Hot S_{22}. Using the two integrated synthesizers, vary the input power and see the effect on output match.

Noise Figure (ME7840/4 Only)



For handset power amplifiers (i.e., ME7840/4), the Scorpion Navigator also performs Noise Figure measurements. The setup and calibration are flexible and accurate so you can easily perform this critical measurement with repeatability.

IMD versus Frequency



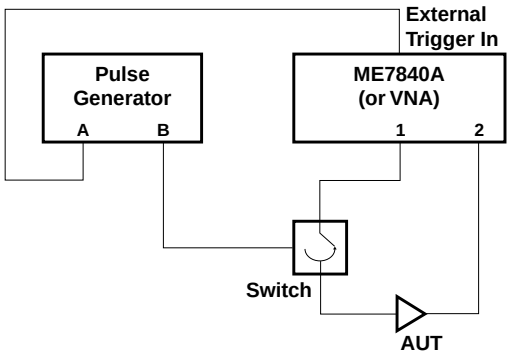
Select start and stop frequencies and the Scorpion Navigator orchestrates your IMD versus Power measurements and displays the results at 1 dB compression point, fixed input power, or fixed output power. Observe output power (or gain) and IMD products versus frequency so you can thoroughly characterize your power amplifier.

THE ME7840A ALSO SUPPORTS PULSE AND MODULATED MEASUREMENT REQUIREMENTS

Simple Setup, Valuable Performance Insights

A dual channel pulse generator provides both the trigger pulse for the ME7840A and the RF pulse for the amplifier under test (AUT). Once synchronized, this system can not only perform S-parameters, but compression, harmonics and intermodulation distortion measurements.

Using this setup and these measurements, it's easy to design and characterize power amplifiers for optimum match, gain, efficiency and spectral purity performance. This single connection solution ensures that when you bring your power amplifier to market, it will both satisfy the performance and the margins needed in manufacturing.

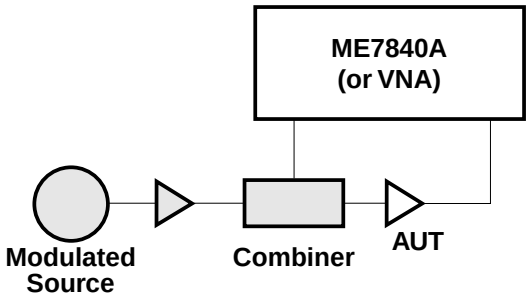


An example setup for a triggered measurement is shown here. A dual channel pulse generator is used to create the trigger pulse for the VNA as well as the RF pulse for the AUT. In other tests, a control line to the AUT may be pulsed instead of the RF itself.

As shown here, the ME7840A also supports pulse measurement conditions (e.g., GSM) when using an external dual pulse generator (as shown here). Using this setup, you can more thoroughly characterize the performance of your power amplifier in terms of match, gain, linearity, efficiency and spectral purity.

Modulated S-parameters

Measuring S-parameters in the presence of realistic modulated signals (e.g., IS-95) is an emerging measurement requirement for next generation power amplifiers. By simply applying an external modulated signal to the ME7840A auxiliary port, this measurement is possible using a "probe-tone" technique. With this technique, you can measure both in-band and out-of-band behavior with accuracy since the setup relies upon full (traceable) vector calibrations. Contact the factory for more details on this powerful new measurement capability.



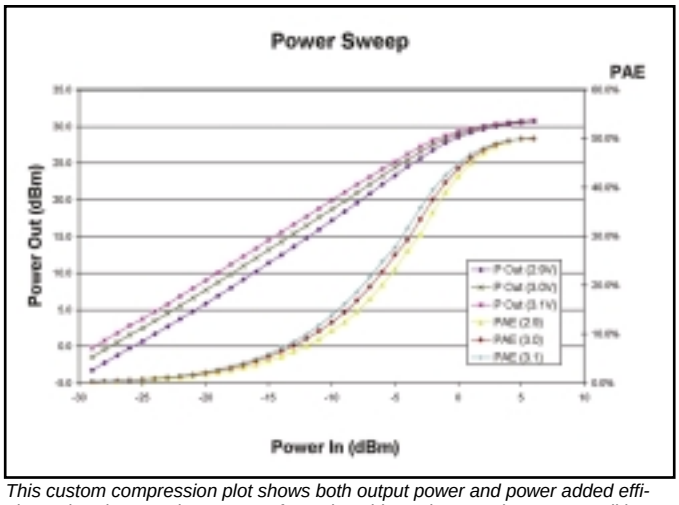
In probe-tone measurements, the modulated signal (possibly amplified) always drives the AUT while simultaneous S-parameter measurements are performed.

Custom Measurements are Easy to Implement Using the Scorpion Navigator

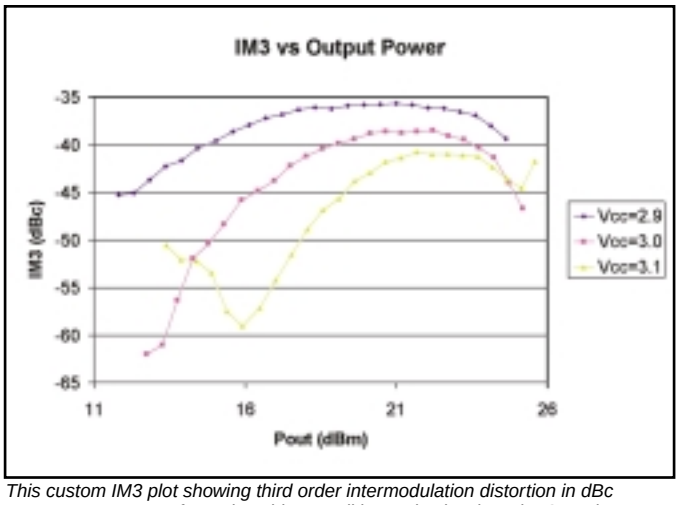
Software engineers who are already familiar with the ActiveX® controls within the Scorpion Navigator know that automation is easy. For those less familiar with this technology, ActiveX controls are intelligent modules that enable plug-and-play with a wide variety of popular software development environments. Simply choose nearly any comfortable environment and you can quickly integrate the Scorpion Navigator's ActiveX controls to simplify the toughest and most time-consuming measurement requirements.

These environments include all the popular software development tools such as Visual Basic®, Microsoft® Excel (including any Visual Basic® for Applications (VBA) enabled software), VBScript, JavaScript™, Visual C++®, National Instrument's LabView®, LabWindows, Test Stand and HP-Vee.

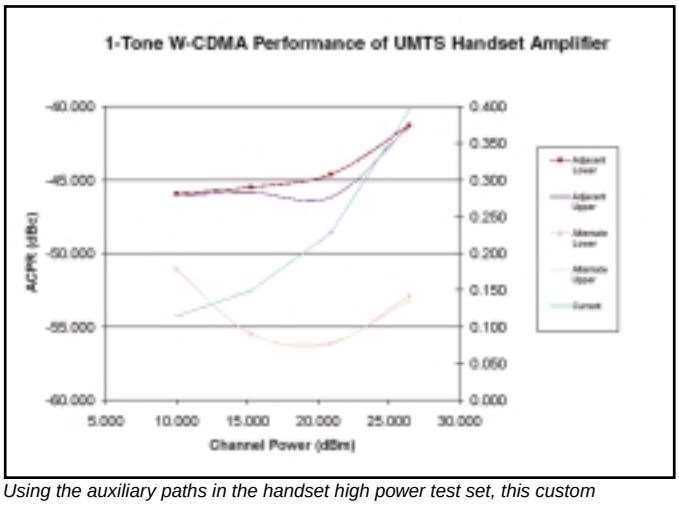
With one point and click of the mouse, the Scorpion Navigator reveals the source code that allows the simple integration of additional test equipment to further enhance productivity. Whether you want to integrate sources, analyzers, power supplies, pulse generators or power meters, this task is easy to do with little software development experience. In addition, if you have any questions you can count on us to help answer them.



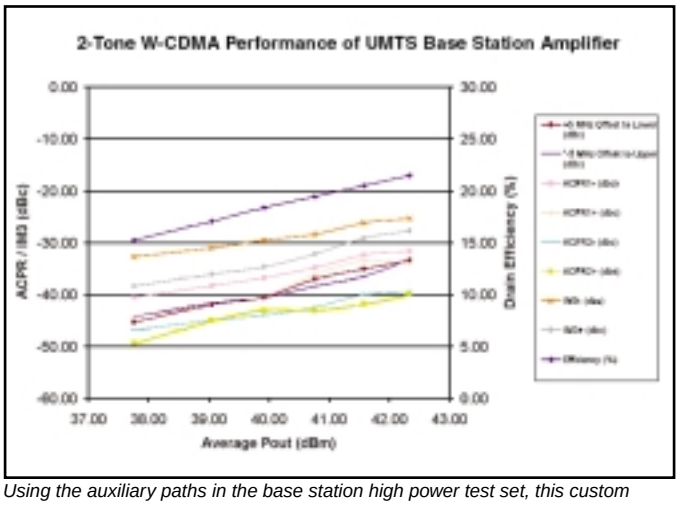
This custom compression plot shows both output power and power added efficiency (PAE) versus input power for various bias voltage and current conditions. The Scorpion Navigator synchronizes the measurements with an external GPIB power supply.



This custom IM3 plot showing third order intermodulation distortion in dBc versus output power for various bias conditions, also involves the Scorpion Navigator orchestrating the IM3 measurement with an external GPIB power supply.



Using the auxiliary paths in the handset high power test set, this custom measurement shows single-tone W-CDMA performance versus output power. Without changing connections, the Scorpion Navigator also can control external modulation sources and analyzers.



Using the auxiliary paths in the base station high power test set, this custom measurement shows two-tone W-CDMA performance versus output power. With the Scorpion Navigator's capability to control external sources and analyzers, one connection can provide both CW and Modulated measurements to further enhance productivity.

BASE STATION POWER AMPLIFIER CONFIGURATION (100 WATTS, 800 TO 2400 MHz)

Base Station PATS Specifications (Scorpion VNMS + MS4782D Test Set)

These specifications describe warranted performance at 23 ± 3˚C when the ME7840A system is appropriately calibrated. A warm-up time of ninety minutes is recommended prior to verifying system specifications. For further specifications, refer to the Scorpion VNMS brochure (part number 11410-00212).

Characteristics	Value	Notes
Amplifier Under Test Power Output	100W max	Without Hot S_{22} provision (Contact Anritsu for custom designs for higher power)
Bandwidth through Test Set	800 MHz to 2400 MHz	Without S_{22} provision (Contact Anritsu for custom designs for different frequency ranges)
Amplifier Under Test Input Power Range Available from PATS	-85 dBm to +10 dBm	This value is for each tone, at combiner input. Provision for external preamplifiers is provided for higher power levels
IMD (3^{rd} order) Dynamic Range	70 dB min	With 10 Hz IF bandwidth @ 300 kHz tone separation and –20 dBm tone levels
IMD Accuracy	±1 dB max	@ > –60 dBc levels
Port Power Accuracy	±0.1 dB typical	With flat power calibration
	±1 dB max	Without flat power calibration
Dynamic Range	80 dB min	Over-all system including Test Set
Port Match 800 to 2400 MHz	40 dB (corrected) 13 dB (uncorrected)	Uncorrected match for Test Port 2 is typically 20 dB
Directivity	40 dB	800 MHz to 2.4 GHz, corrected value

ME7840A Ordering Configuration

When ordering the ME7840A Base Station PATS, you will receive the following system configuration that provides measurement capabilities up to 100 Watts from 800 MHz to 2400 MHz.

Part Number	Description
MS4623C	Scorpion, S-Parameter Configuration, 10 MHz to 6 GHz
MS4600/3D	Scorpion 6 GHz Internal Second Source with 3rd Test Port
MS4600/8	Scorpion Harmonic Measurement Application
MS4600/13	Scorpion Intermodulation Distortion Application
MS4600/24	Scorpion Processing Upgrade
MS4782D	PATS Test Set (100 Watts, Auxiliary Path)
ND43425	Accessories, Interconnect Kit and Scorpion Navigator™ Software

Other Ordering Options

Choose from one of the following alternate ordering options or contact the factory for other custom configurations and measurements.

Model	Description
ME7840/1	Replace MS4623C with MS4622C (3 GHz Option)
ME7840/3	Delete Test Set

These photos show the typical front and rear views of the ME7840A Base Station PATS (computer not included). A more detailed system block diagram is provided on page 9.

BASE STATION POWER AMPLIFIER CONFIGURATION (100 WATTS, 800 TO 2400 MHz)

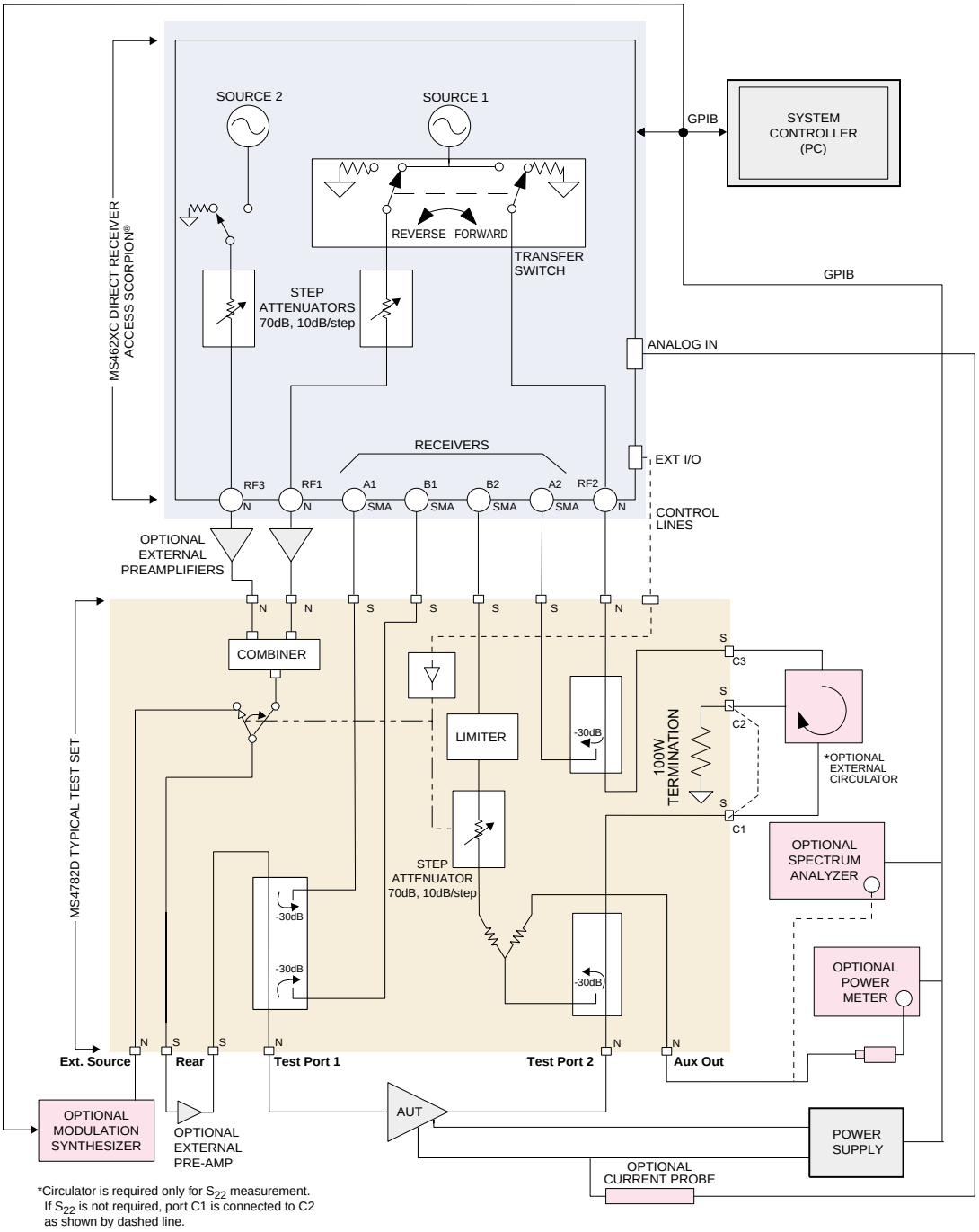
Base Station 100 Watt Test Set Offers Single Connection Convenience

The following Base Station PATS (i.e., ME7840A) block diagram shows internal paths when measuring the amplifier under test (AUT), which is connected between Test Port 1 and Test Port 2 of the standard MS4782D test set. Note the additional Auxiliary Connections that enable signal flow through the test set while maintaining single connections to the AUT.

The Scorpion Navigator software further simplifies operation by referencing this block diagram during calibration to optimize power levels, setup preamplifiers and avoid damaging situations.

ME7840A: Base Station MS4782D Test Set

- 100 Watts, 800 MHz to 2400 MHz
- +5 dBm AUT Input Power (add external preamplifiers for additional power)
- Integrated Two-Tone Combiner
- 100 Watt Internal Termination
- Auxiliary Paths Included
- Rear Panel Preamplifier Loop
- Consult Factory for Noise Figure



*Circulator is required only for S_{22} measurement. If S_{22} is not required, port C1 is connected to C2 as shown by dashed line.

HANDSET POWER AMPLIFIER CONFIGURATION (5 WATTS, 10 TO 6000 MHz)

Handset PATS Specifications (Scorpion VNMS + MN4783A Test Set)

These specifications describe warranted performance at 23 ± 3˚C when the ME7840/4 system is appropriately calibrated. A warm-up time of ninety minutes is recommended prior to verifying system specifications. For further specifications, refer to the Scorpion VNMS brochure (part number 11410-00212).

Characteristics	Value	Notes
Amplifier Under Test Power Output	5W max	Without Hot S_{22} provision (Contact Anritsu for custom designs for higher power)
Bandwidth through Test Set	10 MHz to 6000 MHz	(Contact Anritsu for custom designs for different frequency ranges)
Amplifier Under Test Input Power Range	-65 dBm to +13 dBm	This value is for each tone, at test port connectors of MN4783A test set. Provision for external preamplifiers is provided for higher power levels
IMD (3rd order) Dynamic Range	70 dB min	With 10 Hz IF bandwidth @ 300 kHz tone separation and –20 dBm tone levels
IMD Accuracy	±1 dB max	@ > –60 dBc levels
Port Power Accuracy	±0.1 dB typical	With flat power calibration
	±1 dB max	Without flat power calibration
Dynamic Range	80 dB typical 70 dB typical	10 MHz to 3 GHz 3 GHz to 6 GHz
Port Match 10 to 3000 MHz	40 dB (corrected) 13 dB (uncorrected)	Uncorrected match for Test Port 2 is typically 20 dB
Port Match 3000 to 6000 MHz	37 dB (corrected) 13 dB (uncorrected)	Uncorrected match for Test Port 2 is typically 18 dB
Directivity	40 dB	50 MHz to 6000 MHz, corrected value
Noise Figure	50 MHz to 6000 MHz	

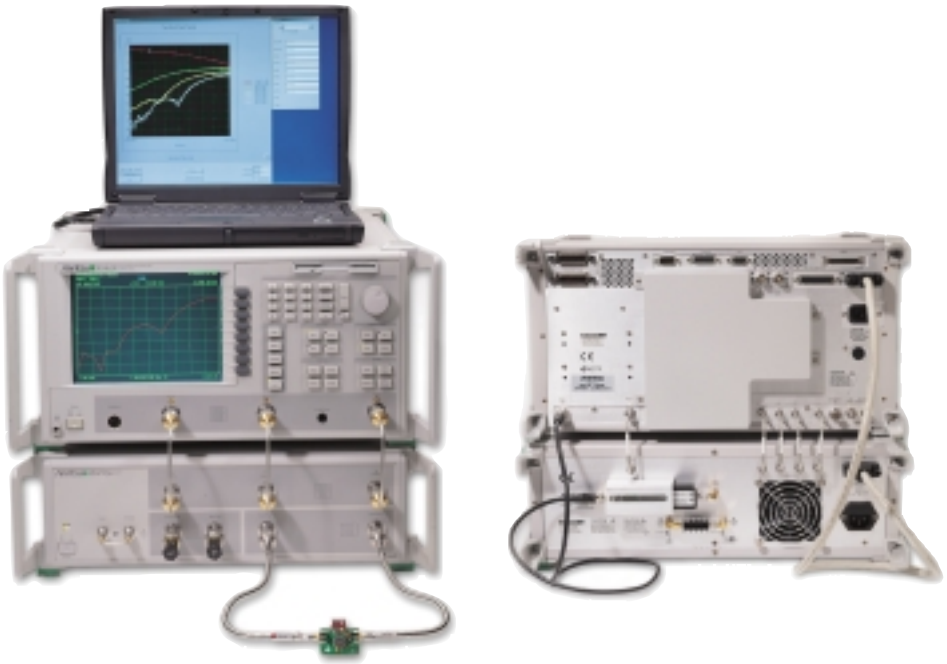
ME7840A/4 Ordering Configuration

Part Number	Description
MS4623C	Scorpion, S-Parameter Configuration, 10 MHz to 6 GHz
MS4600/3D	Scorpion 6 GHz Internal Second Source with 3rd Test Port
MS4600/4E	Scorpion 6 GHz Noise Figure Application
MS4600/8	Scorpion Harmonic Measurement Application
MS4600/13	Scorpion Intermodulation Distortion Application
MS4600/24	Scorpion Processing Upgrade
MN4783A	PATS Test Set, Handset Configuration (5 Watts, Auxiliary Path)
ND57611	Accessories, Interconnect Kit and Scorpion Navigator™ Software

Noise Source is not included. Choose from NC346A or NC346B.

Other Ordering Options

Contact the factory for other custom configurations and measurements.



These photos show the typical front and rear views of the ME7840/4 Handset PATS (computer not included). A more detailed system block diagram is provided on page 11.

HANDSET POWER AMPLIFIER CONFIGURATION (5 WATTS, 10 TO 6000 MHz)

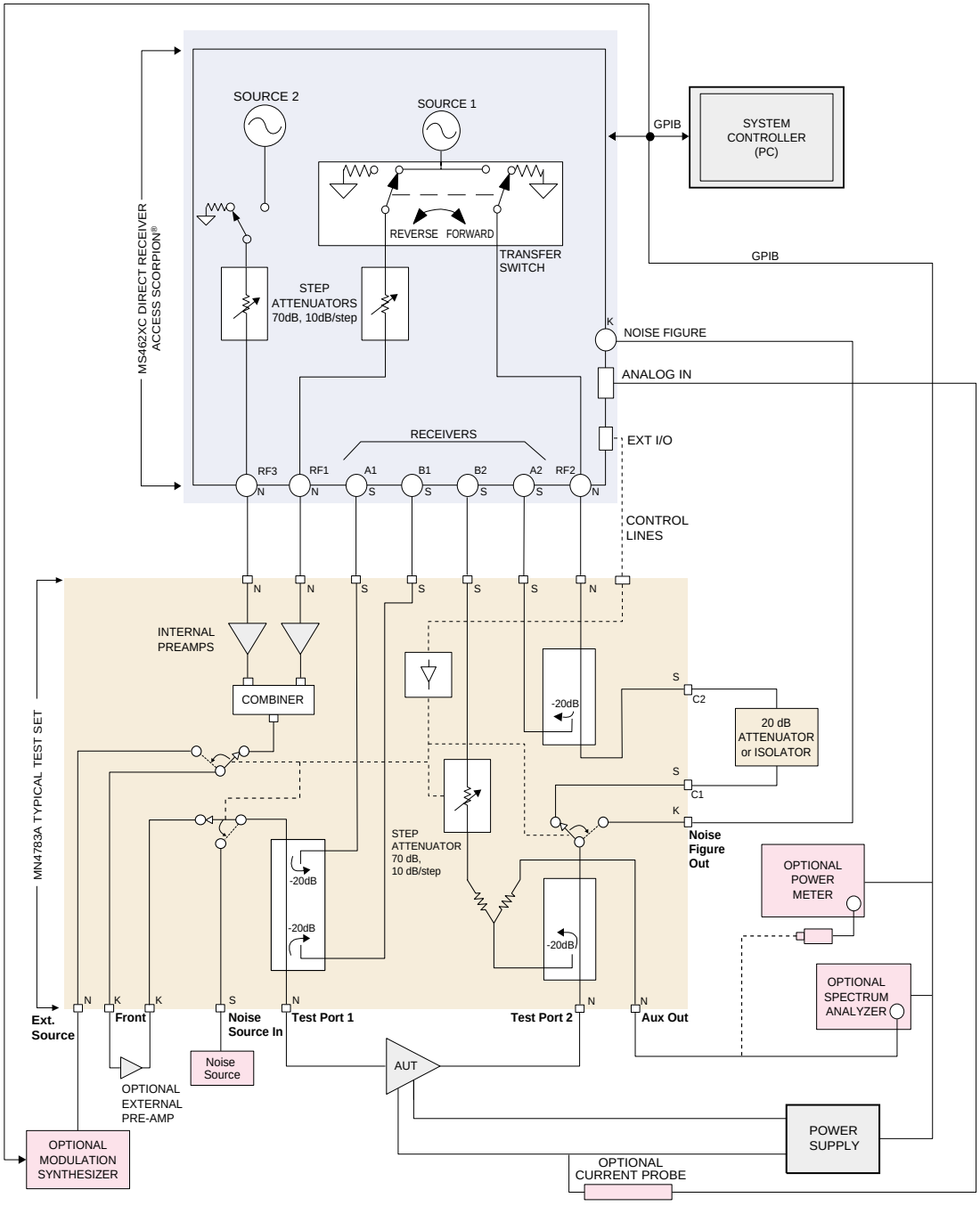
Handset 5 Watt Test Set Offers Single Connection Convenience

The following Handset PATS (i.e., ME7840/4) block diagram shows internal paths when measuring the amplifier under test (AUT), which is connected between Test Port 1 and Test Port 2 of the standard MN4783A test set. Note the Noise Figure path and additional Auxiliary Connections that enable signal flow through the test set while maintaining single connections to the AUT.

The Scorpion Navigator software further simplifies operation by referencing this block diagram during calibration to optimize power levels, setup preamplifiers and avoid damaging situations.

ME7840/4: Handset MN4783A Test Set

- 5 Watts, 10 MHz to 6000 MHz
- +13 dBm AUT Input Power (with integrated preamplifiers)
- Noise Figure 50 MHz to 6 GHz
- Integrated Two-Tone Combiner
- Internal Termination Not Required
- Auxiliary Paths Included
- Front Panel Preamplifier Loop



PATS Measurement Accessories

The following accessories are recommended to increase the measurement capability of PATS.

Calibration Kits and Cables:

Model/Order No.	Name
	Calibration Kits
3750R	SMA/3.5 mm RF Calibration Kit (6 GHz)
3750LR	Type N RF Calibration Kit (6 GHz)
3750R/1	Adds a set of 5 Phase Equal Insertables (PEIs)
3750R/3	Adds additional 3.5 mm(f) and 3.5 mm(m) terminations required for 4 port calibrations
3751R	GPC-7 Calibration kit
3751R/2	Adds a third GPC-7 termination required for 3 port calibrations
3751R/3	Adds 2 additional GPC-7 terminations required for 4 port calibrations
3753R	Type N (50Ω) Connector Calibration Kit (9 GHz)
3753R/1	Adds a set of five Phase Equal Insertables (PEIs)
3753R/3	Adds additional Type N(f) and Type N(m) terminations required for 4 port calibrations
	AutoCal®
36581KKF/2	AutoCal, 2-Port K(m) to K(f), 10 MHz to 9 GHz
36581NNF/2	AutoCal, 2-Port N(m) to N(f), 10 MHz to 9 GHz
36584KF	AutoCal, 4-Port K(f), 10 MHz to 9 GHz
36584NF	AutoCal, 4-Port N(f), 10 MHz to 9 GHz
36583S	Test Port Cable Converter set, SMA
36583L	Test Port Cable Converter set, 3.5 mm
36583K	Test Port Cable Converter set, K
760-208	Transit Case for AutoCal
	Economy Cables
15LL50-0.3A	3.5 mm Cable, male to male, 30 cm
15LL50-0.6A	3.5 mm Cable, male to male, 60 cm
15LLF50-0.3A	3.5 mm Cable, male to female, 30 cm
15LLF50-0.6A	3.5 mm Cable, male to female, 60 cm
15NN50-0.3A	Type N Cable, male to male, 30 cm
15NN50-0.6A	Type N Cable, male to male, 60 cm
15NNF50-0.3A	Type N Cable, male to female, 30 cm
15NNF50-0.6A	Type N Cable, male to female, 60 cm
15NN50-0.3B	Type N Male to Male Cable, 30 cm
15NN50-0.6B	Type N Male to Male Cable, 60 cm
15NNF50-0.3B	Type N Male to Female Cable, 30 cm
15NNF50-0.6B	Type N Male to Female Cable, 60 cm
	Noise Sources
NC346A	5 dB ENR Noise Source, 3.5 mm connector
NC346B	15 dB ENR Noise Source, 3.5 mm connector

Accessories:

Circulators may be required for measurements of Hot S_{22}

Anritsu P/N	Description
1000-50	Circulator, 800 to 1000 MHz, 20 dB min. isolation, 50 Watts Max AUT Power
1000-52	Circulator, 1.8 to 2.5 GHz, 20 dB min. isolation, 50 Watts Max AUT Power
1000-53	Circulator, 1.8 to 2.5 GHz, 22 dB min. isolation, 79 Watts Max AUT Power

Current Probes are required for drain current and Power Added Efficiency (PAE) calculations:

Anritsu P/N	Description	Max Current	Accuracy (at lesser current range setting)
2000-1067	Current Probe	100mV/A : 10A 10mV/A : 100A	3% of reading ±50 mA
2000-1085	Current Probe	1mV/mA : 1A 10mV/A : 80A	2% of reading ±5 mA

Related Literature	Part Number
Brochures	
Scorpion Family Brochure	11410-00289
Scorpion Technical Specifications	11410-00288
Synthesizer MG3690A Brochure	11410-00262
PATS Brochure	11410-00263
2-Port AutoCal Brochure	11410-00189
4-Port AutoCal Brochure	11410-00294
Power Meter Brochure	15000-00004
Application Notes	
CDROM, Scorpion Literature	10920-00040
2-Port AutoCal Automatic Calibrator	11410-00258
4-Port AutoCal Automatic Calibrator	11410-00298
Noise Figure	11410-00210
Noise Figure Accuracy	11410-00227
Noise Figure Corrections	11410-00256
Intermodulation Distortion	11410-00213
Harmonics	11410-00222
Frequency Translated Group Delay	11410-00236
Global Power Sweep	11410-00243
Multiple Source Control	11410-00244
Reflectometer Measurements-Revisited	11410-00214
Time Domain	11410-00206
Frequency Accuracy	11410-00208
Adjacent Channel Power Ratio (ACPR)	11410-00264
What is Your Measurement Accuracy?	11410-00270
Embedding/De-embedding	11410-00278
Three and Four Port S-parameter Measurements	11410-00279
Arbitrary Impedance	11410-00284
Hot S22 and Hot K-factor Measurements	11410-00295
Pulse S-parameters Measurements	11410-00300
Manuals	
MS462XX Operation Manual	10410-00203
MS462XX Programming Manual	10410-00204
MS462XX Maintenance Manual	10410-00205
MS462XX GPIB Quick Reference Guide	10410-00206
Measurement Guide	10410-00213
Application Guide	10410-00214
PATS Operation Manual	10410-00225
TMATS Operation Manual	10410-00244
MN4790A Maintenance Manual	10410-00245
ME7840/4 Operation Manual	10410-00247
MN4783A Maintenance Manual	10410-00248
Scorpion Navigator Software User's Guide	10410-00249
Software Utilities and Drivers	
Scorpion Command Encyclopedia	2300-364
Power Tools	2300-218
Exact Uncertainty	2300-361
Mixer Measurements Assistant (NxN)	2300-232

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