Anritsu

MS4622A/B/C/D
MS4623A/B/C/D
MS4624A/B/C/D

Vector Network Measurement Systems

10 MHz to 9 GHz

Versatility to Completely Characterize
Wireless Components and Systems

SCORPION® IS A COMPLETE RF MEASUREMENT SOLUTION THAT . . .

Convenient RF Frequency Ranges…

Frequency Range	Model
10 MHz - 3 GHz	MS4622x
10 MHz - 6 GHz	MS4623x
10 MHz - 9 GHz	MS4624x

Performance Highlights…

- Measurement Speed of 150 µsec/point
- Dynamic Range of 125 dB
- Source Power to +10 dBm
- Receiver Noise as Low as –115 dBm
- S-Parameter Uncertainty < 0.05 dB

Flexible Configurations…

Ports	Configuration
2	MS462xA or MS462xB
3	MS462xB
4	MS462xD
n	MS462xB, MS462xC, or MS462xD

Improved Measurement Accuracy…

- Mixed Mode S-Parameters
- Embedding/De-embedding
- Arbitrary Impedance

Optimized for Your Manufacturing Process…

- AutoCal® Simplifies 2,3 and 4-Port Calibrations
- N-type, 3.5 mm, or GPC-7 Connectors
- Sequences Automate Repetitive Keystrokes
- Enhanced Markers Simplify Data Collection
- Overlay Displays to Customize Data Viewing
- External SCSI Interface for Massive Storage

Single Connections to Test Devices Accurately and Thoroughly…

- S-Parameters, 10 MHz to 9 GHz
- Time Domain, Distance to Fault Testing
- Compression, 20 dB Power Sweeps
- Harmonics, 2nd through 9th Automatically
- Noise Figure, 50 MHz to 6 GHz
- IMD, 3rd, 5th, 7th, and 9th Automatically
- FTGD, Group Delay through Frequency Translation

See the True Performance of Your…

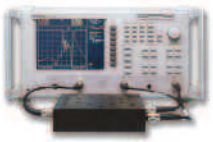
- Antennas, Isolators, Filters, Duplexers, Couplers
- SAW Filters, Baluns
- Amplifiers
- Mixers
- Power Amplifiers
- Tower Mount Amplifiers
- Multiport Components

Fast and Accurate Results While Stretching Your Test Budget!

"The One Analyzer That Does It All"

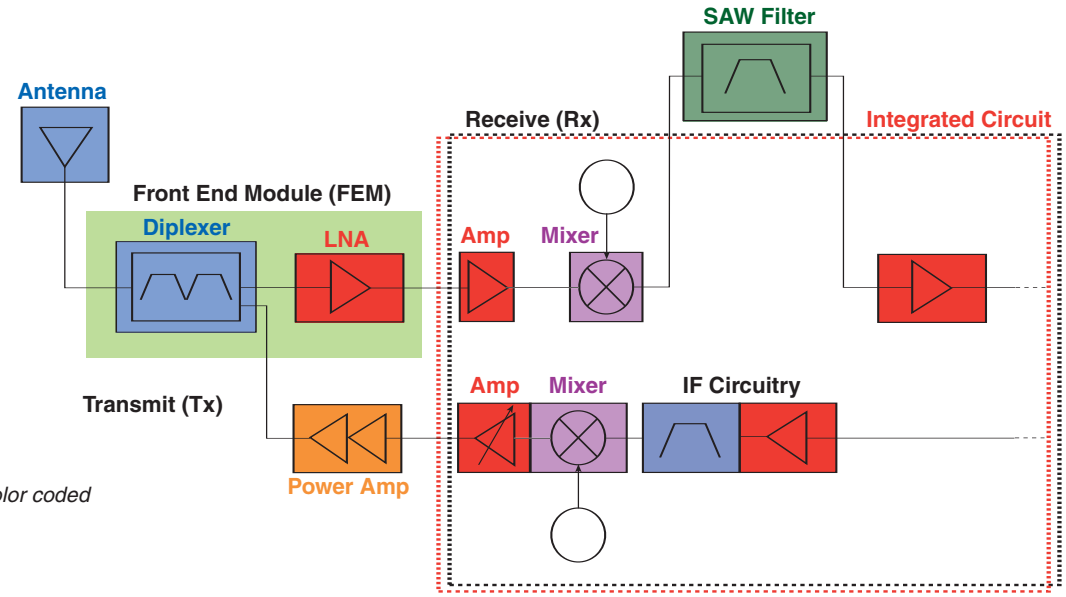
SCORPION® VECTOR NETWORK MEASUREMENT SYSTEM (VNMS) SOLUTIONS THAT . . .





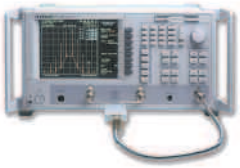
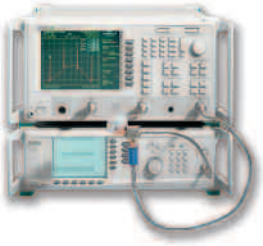
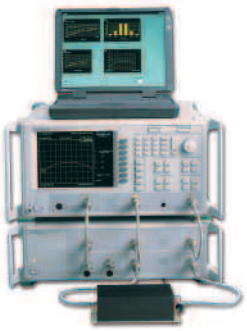

	Transmission/ Reflection	2-Port VNA	Economy 3-Port VNA	3-Port VNA	4-Port VNA
Typical Test Components	Antenna Filter	Isolator Filter	Duplexer	Duplexer Circulator Power Divider Coupler	SAW Filters, FEM, Baluns Multiport Integrated Circuits
Scorpion® Models	MS462xA	MS462xB	MS462xB	MS462xB	MS462xD
Measurements	S_{11}, S_{21} Measurements ***Plus*** Fault Location	2-Port S-Parameters ***Plus*** Embedding/ De-embedding Arbitrary Impedance	2-Port VNA ***Plus*** S_{11}, S_{21}, S_{31} Measurements	2-Port VNA ***Plus*** 3-Port S-Parameters and Mixed-Mode S-Parameters	3-Port VNA ***Plus*** 4-Port S-Parameters and Mixed-Mode S-Parameters

Handset Block Diagram



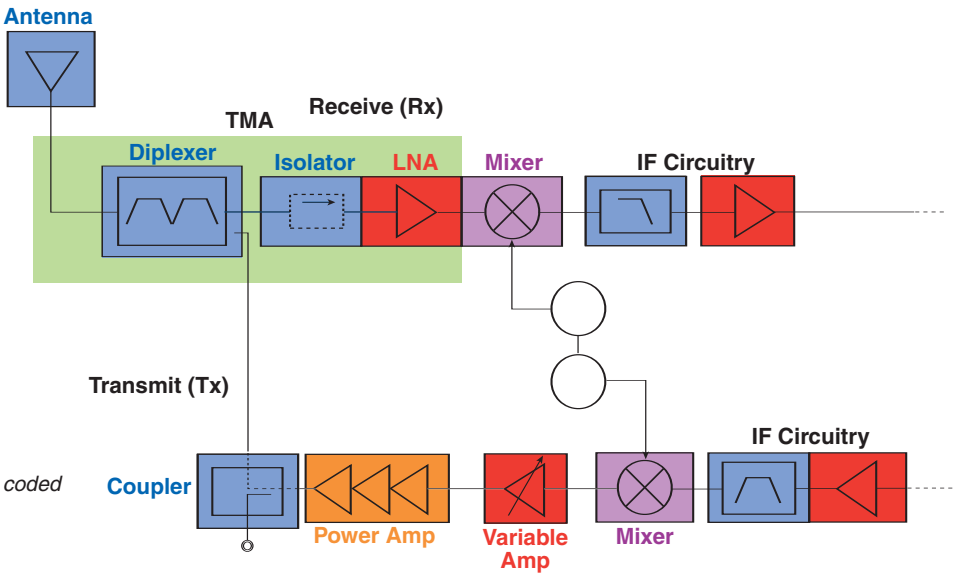
Diagrams are color coded to table above.

TEST THE COMPLETE RANGE OF YOUR COMPONENTS AND SYSTEMS


Amplifier	Mixer	Power Amplifier	Multiport and More…
Low Noise Amplifiers Medium Gain Amplifiers Amplifiers plus Filters 3-Port Components, too	Integrated Circuit Mixer plus Amplifiers Modules	Base Station Handset	Integrated Components Tower Mount Amplifiers Antenna System Control SAW Filters Front End Modules
MS462xB or MS462xD	MS462xB or MS462xD	ME7840A (MS462xC)	Contact Anritsu for More Details
S-Parameters ***Plus*** Compression Harmonics Noise Figure IMD and TOI 2nd Order Intercept Sweep Frequency Sweep Power	S-Parameters Amplifiers Measurements ***Plus*** Conversion Loss/Gain Mixer Compression Mixer Noise Figure IMD or TOI Mixer Group Delay Fixed LO or Fixed IF	S-Parameters Amplifiers Measurements ***Plus*** Compression 3rd, 5th, 7th, 9th IMD Sweep Power ACPR and PAE "Hot S_{22}" Noise Figure k-Factor	***Any of the following…*** S-Parameters Balanced/Differential Embed/De-embed Amplifier Measurements Mixer Measurements

Infrastructure Block Diagram



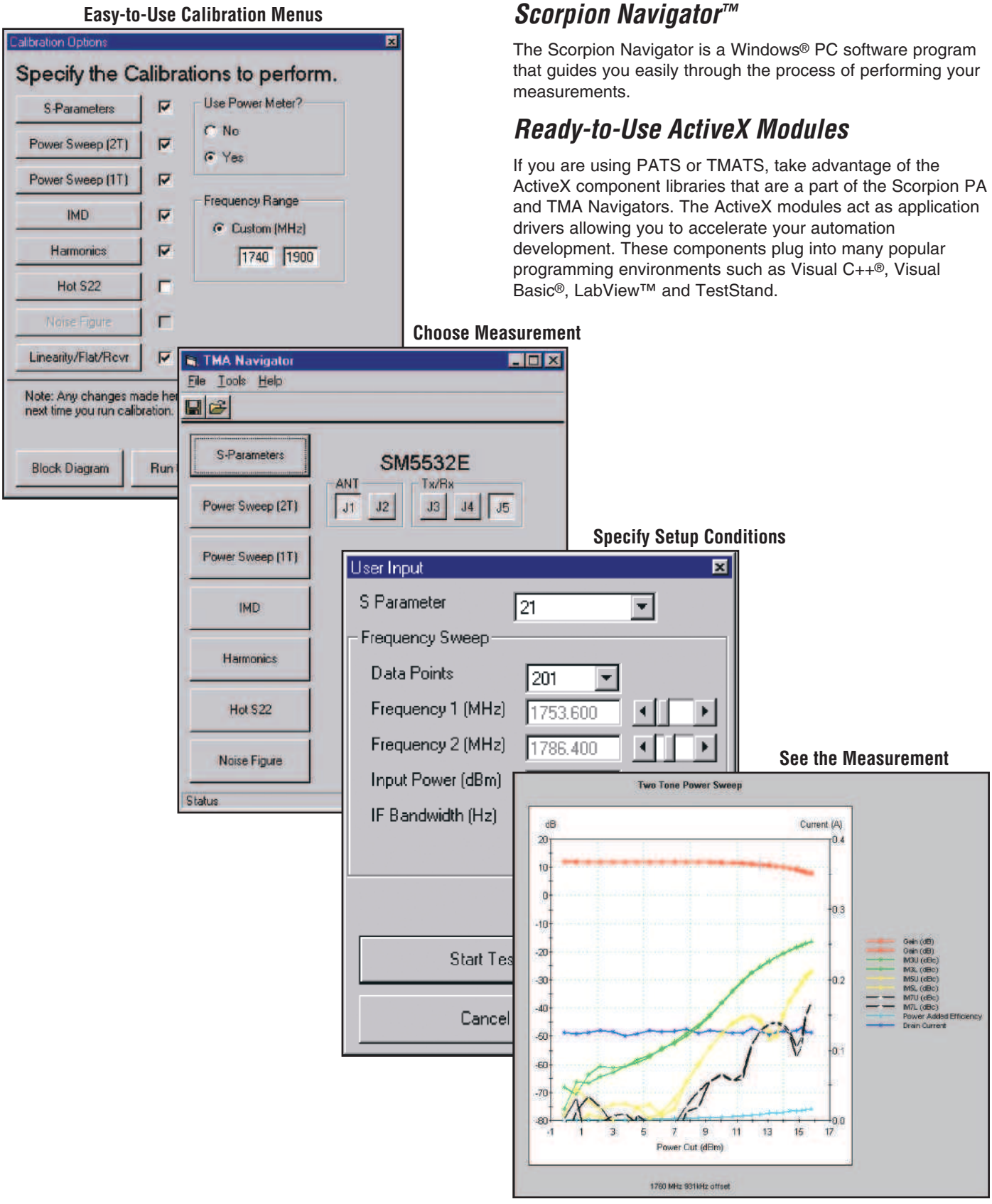
Diagrams are color coded to table above.

Scorpion Navigator™

The Scorpion Navigator is a Windows® PC software program that guides you easily through the process of performing your measurements.

Ready-to-Use ActiveX Modules

If you are using PATS or TMATS, take advantage of the ActiveX component libraries that are a part of the Scorpion PA and TMA Navigators. The ActiveX modules act as application drivers allowing you to accelerate your automation development. These components plug into many popular programming environments such as Visual C++®, Visual Basic®, LabView™ and TestStand.

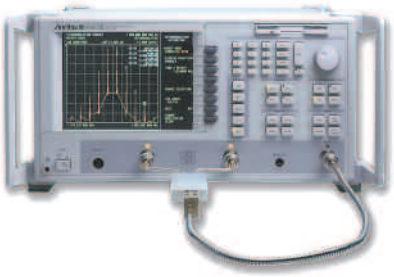


VNMS Upgradeability Paths

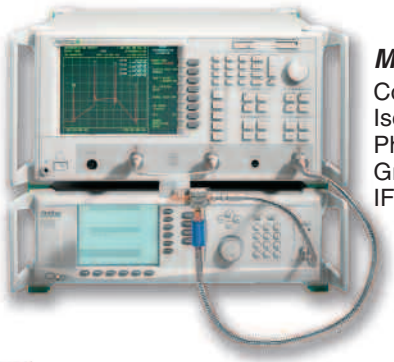
Get the most out of your capital equipment budget by selecting only the frequency range, number of ports, and options for today's requirements. Your investment is safe because you can always upgrade as your requirements change.

Satisfy Today's Requirements and have an Upgrade Path to Support Tomorrow's Requirements.

Passive Components
S-Parameters
Mixed-Mode S-Parameters
Embedding/De-embedding
2, 3 and 4-Port Configurations



Amplifiers
AM-PM
Gain Compression
NF
IMD
Harmonics
Swept Power and Frequency



Mixers
Conversion Loss
Isolation
Phase
Group Delay
IF Frequency to 10 kHz

Multiport and Tower Mounted Amplifiers
S-Parameters
NF
IMD
Harmonics
Swept Power and Frequency

Power Amplifiers
ACPR
IMD
PAE
Hot S_{22}
Hot K-factor
Swept Power
Swept Frequency
Noise Figure

MEASUREMENT SOLUTIONS FEATURING. . .

The Economy "A" Family Network Analyzers

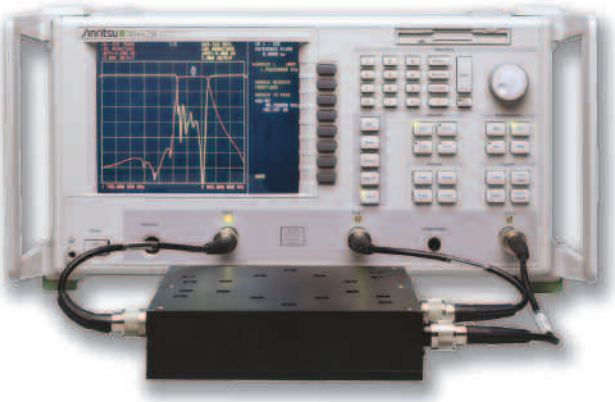
Transmission/Reflection (T/R) Measurements, 2-Ports

This economical family of network analyzers utilize one-path two-port configurations to satisfy high volume passive RF requirements for speed, dynamic range and accuracy.

- Typical Dynamic Range of 125 dB
- Fast Measurement Speed of 150 µsec/point
- N-Type, 3.5 mm, or GPC-7 Connectors
- Accuracy and Repeatability using AutoCal®

The 3658 series AutoCal® modules satisfy demanding manufacturing requirements for fast, repeatable and high-quality coaxial S-parameter calibrations up to 9 GHz.

Easy 2-port calibrations using AutoCal®.



Diplexers and other 3-port devices are easily and accurately tested using the "B" Family of Scorpion products.

The Full-Featured "B" Family Network Analyzers

S-Parameter Measurements, 2 and 3-Ports

For passive, active, and frequency translating RF components, these powerful S-parameter configurations offer the performance, ease-of-use and versatility you demand of a vector network analyzer.

- True 2 and 3-Port Calibrations
- Mixed-Mode S-Parameters, Arbitrary Impedance
- Embedding/De-embedding
- Source Power Between +7 and –85 dBm
- Typical Receiver Noise of –115 dBm
- N-Type, 3.5 mm, or GPC-7 Connectors
- Time Domain Analysis
- Accuracy and Repeatability using AutoCal®

The "D" Family Network Analyzers

Balanced/Differential Measurements, 4-Ports

Introducing the "D" Family of network analyzers that satisfies both R&D and manufacturing requirements for balanced/differential measurements.

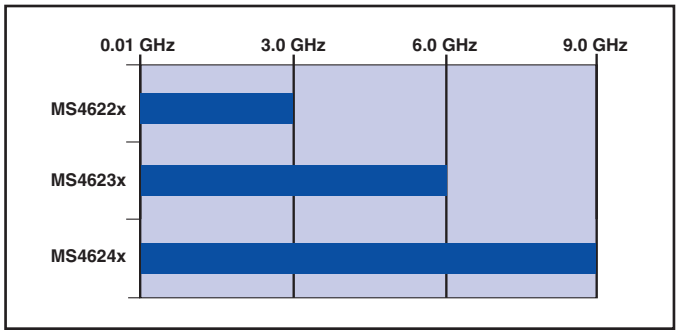
- True 2, 3, and 4-Port Calibrations
- Mixed-Mode S-Parameter
- Arbitrary Impedance
- Embedding/De-embedding
- Time Domain Analysis
- Accuracy and Repeatability using AutoCal®

The 3658 series 4-Port AutoCal® modules enable 2, 3, and 4-Port S-parameter calibrations without the time-consuming opens, shorts, loads, and thru-lines.

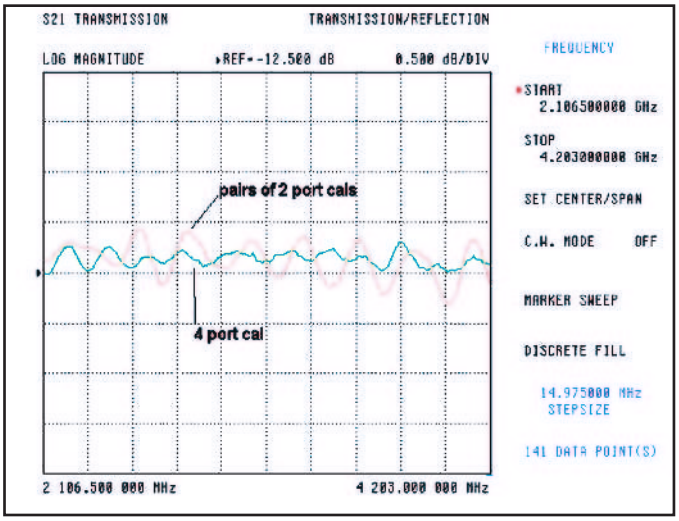
The new "D" Family simplifies calibration for 2, 3, and 4-port measurements with new 4-Port AutoCal Module.

Frequency Range and Test Ports

Get the most out of your capital equipment budget. Scorpion® is available in three popular frequency ranges; within each frequency range, you can specify the number of ports depending upon your requirements. **Your investment is safe because you can always upgrade as your requirements change**.



Three frequency ranges offered; 3 GHz, 6 GHz and 9 GHz.



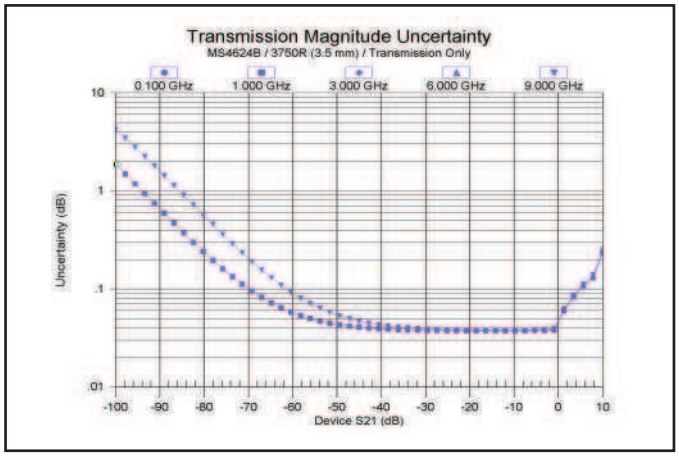
Uncertainty increases when pairs of 2-port calibrations are used instead of a true 4-port calibration. It can exceed 0.5 dB uncertainty.

Accuracy in Terms of Uncertainties

Measurement uncertainties influence many aspects of R&D and manufacturing processes, especially in light of demanding ISO requirements. For S-parameters, Scorpion® minimizes these uncertainties with superior raw and corrected test port characteristics. Anritsu's commitment to accuracy ensures all your Scorpion measurements will be repeatable, accurate and stable.

True 2, 3 and 4-Port Calibrations

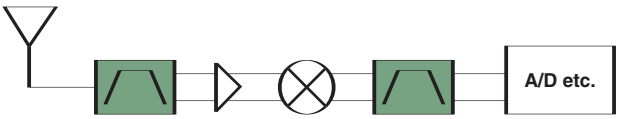
True n-port calibration takes into account all load match terms so you can see the actual performance of your RF components. Tighten your specifications and maximize your manufacturing yield with improved measurement uncertainties from Scorpion's 12, 24, and 40-term error models.



Transmission uncertainty curves show < 0.1 dB uncertainty for critical passband measurement requirements.

Frequency (MHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Directivity Raw (dB)	Port Match Raw (dB)
10-1000	>46	>44	>46	23 dB	15 dB[1]
1000-3000	>44	>41	>44	23 dB	15 dB
3000-6000	>38	>39	>38	20 dB	15 dB
6000-9000	>37	>36	>37	15 dB	9 dB

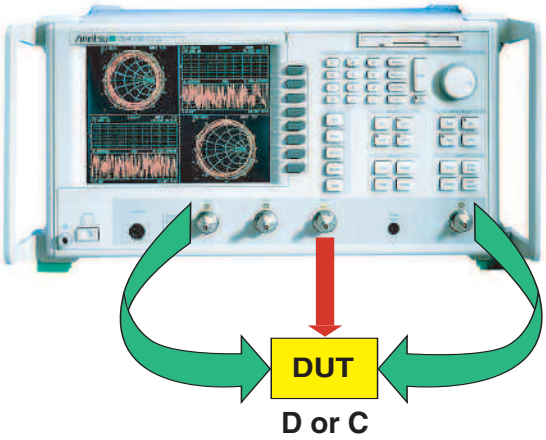
[1] *MS462xD models with Noise Figure Options 4F or 4G, degraded below 100 MHz.*
Corrected and raw VNA performance specifications that guarantee the highest level of measurement accuracy and calibration stability.

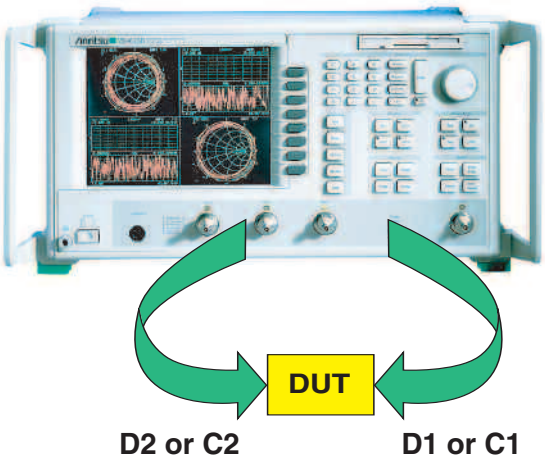


Balanced/Differential Measurements

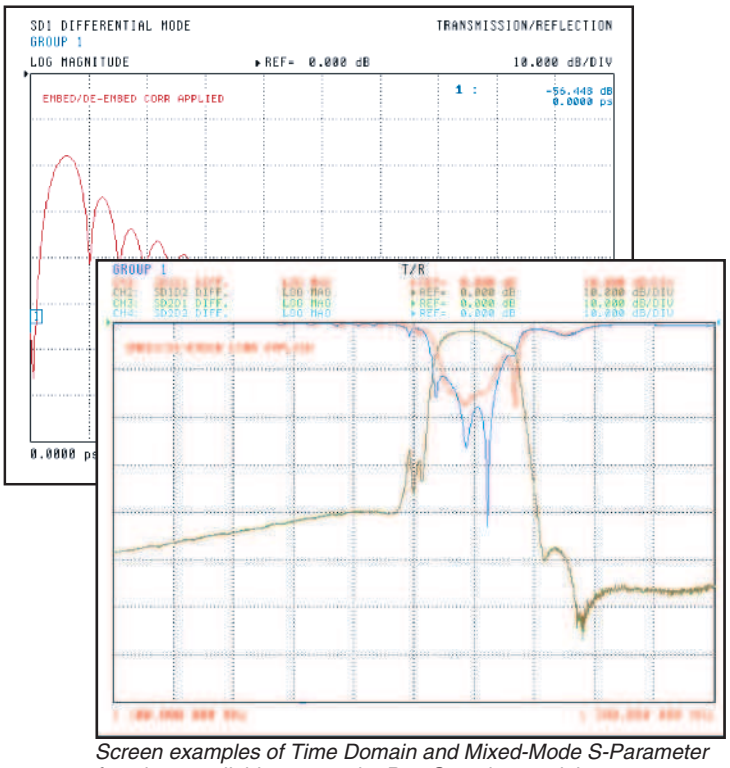
Mixed-mode S-parameter measurements are a standard feature in 3 and 4-port configurations of Scorpion. Characterizing components with balanced/differential structures is fast, accurate, and easy-to-use.

- To handle differential impedance, Scorpion includes arbitrary impedance features.
- To handle test fixtures, Scorpion offers standard de-embedding features.
- To handle matching simulations, Scorpion introduces powerful embedding features which include support of circuit elements and SnP data files.
- Further optional analysis is possible with Time Domain.





Connection diagrams for 3 and 4-port testing.



Screen examples of Time Domain and Mixed-Mode S-Parameter functions available on 3 and 4-Port Scorpion models.

Standard and Mixed-Mode S-Parameters:

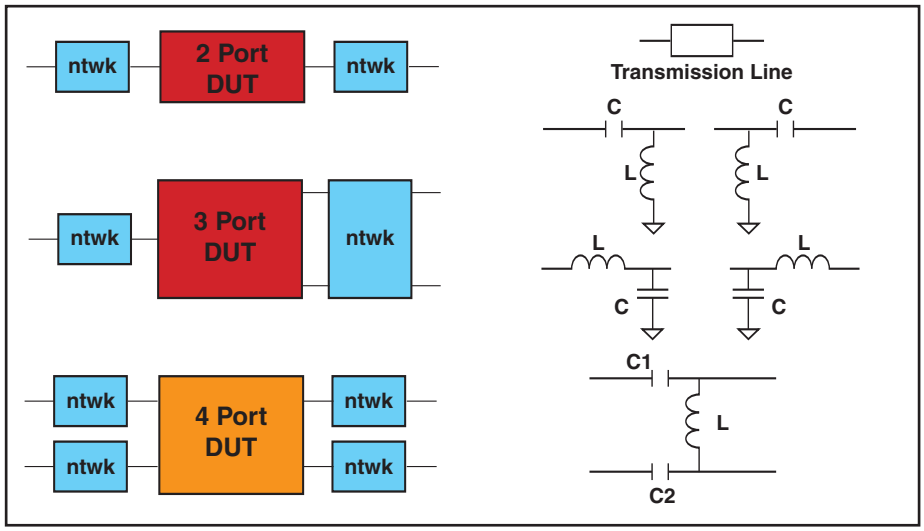
Connections are straightforward for 3 and 4-port devices. Once connected, quickly configure displays for both standard and Mixed-Mode S-parameters.

Ports	S-Parameters	Mixed-Mode
2	$S_{11}, S_{12}, S_{21}, S_{22}$	
3	S_{11}, S_{12}, S_{13} S_{21}, S_{22}, S_{23} S_{31}, S_{32}, S_{33}	S_{11}, S_{1D}, S_{1C} S_{D1}, S_{DD}, S_{DC} S_{C1}, S_{CD}, S_{CC}
4	$S_{11}, S_{12}, S_{13}, S_{14}$ $S_{21}, S_{22}, S_{23}, S_{24}$ $S_{31}, S_{32}, S_{33}, S_{34}$ $S_{41}, S_{42}, S_{43}, S_{44}$	$S_{D1D1}, S_{D1D2}, S_{D1C1}, S_{D1C2}$ $S_{D2D1}, S_{D2D2}, S_{D2C1}, S_{D2C2}$ $S_{C1D1}, S_{C1D2}, S_{C1C1}, S_{C1C2}$ $S_{C2D1}, S_{C2D2}, S_{C2C1}, S_{C2C2}$

S-parameters selections for 2, 3 and 4-port measurements; single-ended and mixed-mode.

Embedding/De-embedding and Arbitrary Impedance

The Scorpion® incorporates a variety of standard embedding and de-embedding functions and some utilities to make these tasks easier. As shown in these simplified block diagrams, the Scorpion can (depending upon the configuration) remove the effects of networks (ntwks) or virtually add in the effects of other networks (e.g., matching) for 2, 3, or 4-port devices. Network elements can consist of transmission lines, L-C circuit primitives and SnP data files. Multiple cascading of network elements is also supported.

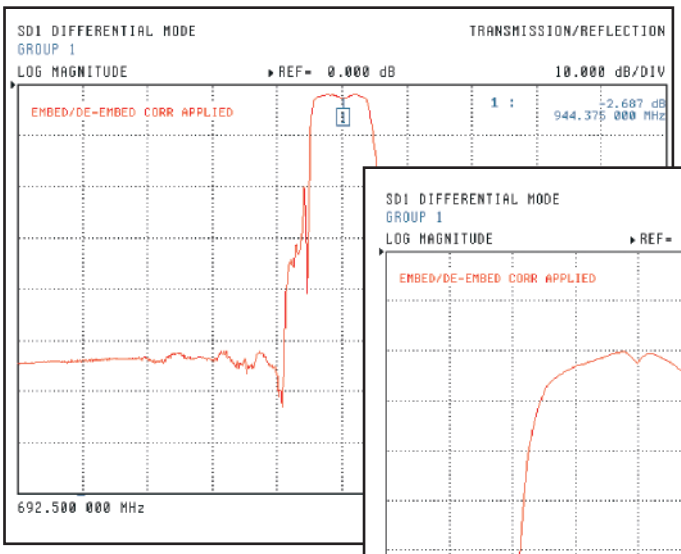


Use Embed/De-embed functions to increase accuracy and productivity. Choices include transmission lines, circuit primitives or SnP data files, which can be easily cascaded.

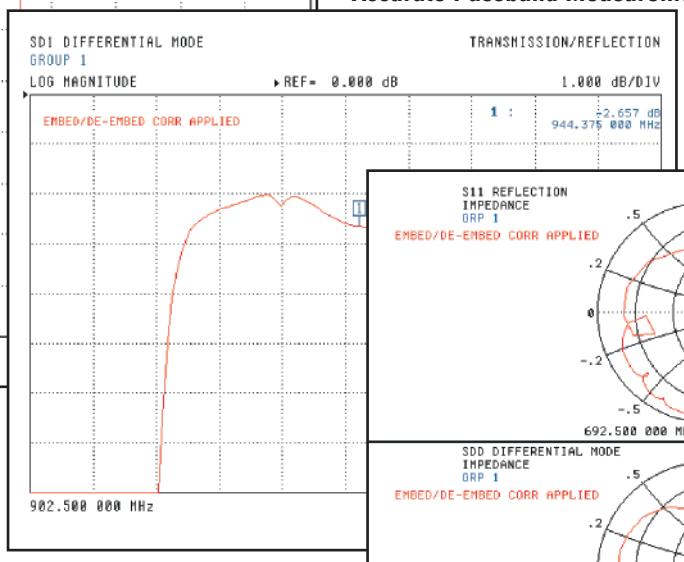
Balanced/Differential Measurements

- *Mixed-Mode S-Parameters*
- *Embedding/De-embedding*
- *Arbitrary Impedance*

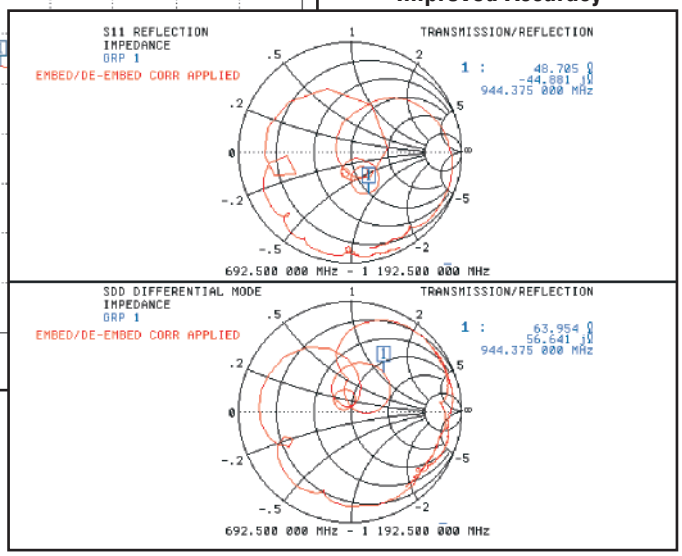
Real-time Mixed-Mode Measurements



Accurate Passband Measurements



Improved Accuracy



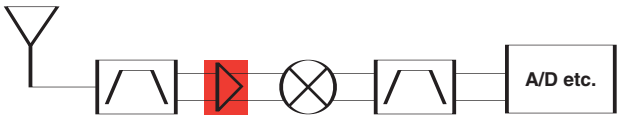
Do You Want to Know More?

Contact Anritsu for Three New Scorpion Application Notes:

Three and Four Port S-parameter Measurement, 11410-00279

Embedding/De-embedding, 11410-00278

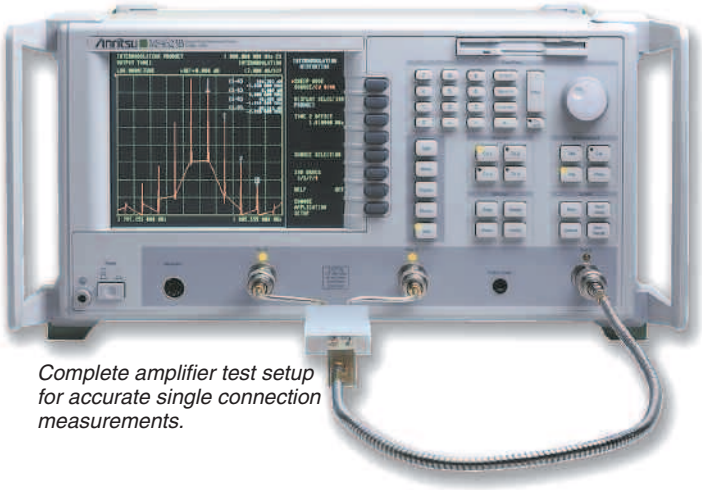
Arbitrary Impedance, 11410-00284



Amplifiers and Integrated Circuits

See the true performance of your active components when using Scorpion. The single connection to your component dramatically simplifies the complexity of routine active measurements: S-parameters, gain compression, harmonics, noise figure, and intermodulation distortion. As you might expect, these VNA-based measurements are fast and extremely accurate.

Amplifier Parameter	MS462xx Measures
S-Parameters	< ± 0.05 dB Accuracy
Gain Compression	As High As +16 dBm
Noise Figure	Less than 0.5 dB, 50 MHz to 6 GHz
Third Order Intercept	Up to +40 dBm

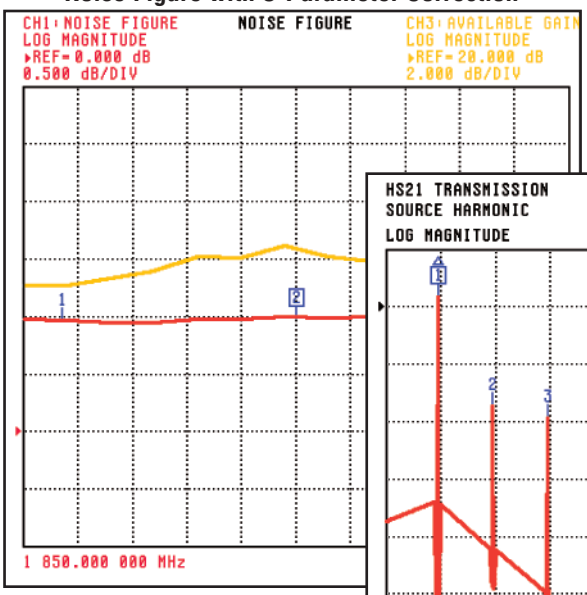


Complete amplifier test setup for accurate single connection measurements.

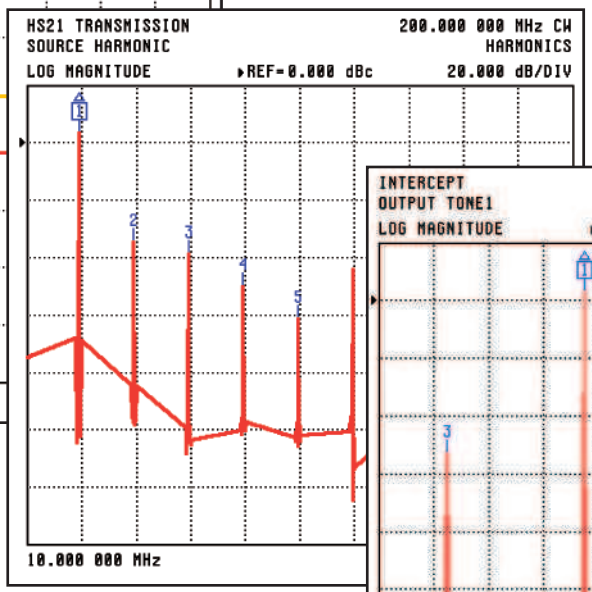
Amplifier Measurements

- ***Low Noise to Medium Power***
- ***Single Connection, Vector Accuracy***
- ***Mixed-Mode S-Parameters***

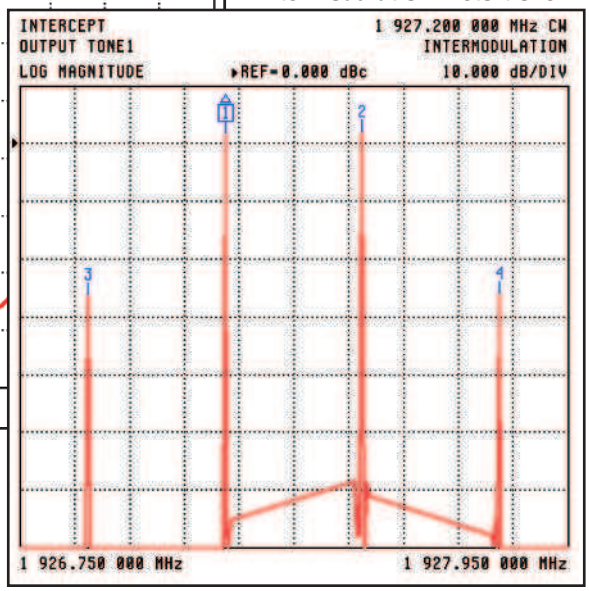
Noise Figure with S-Parameter Correction



Scalar or Vector Harmonics



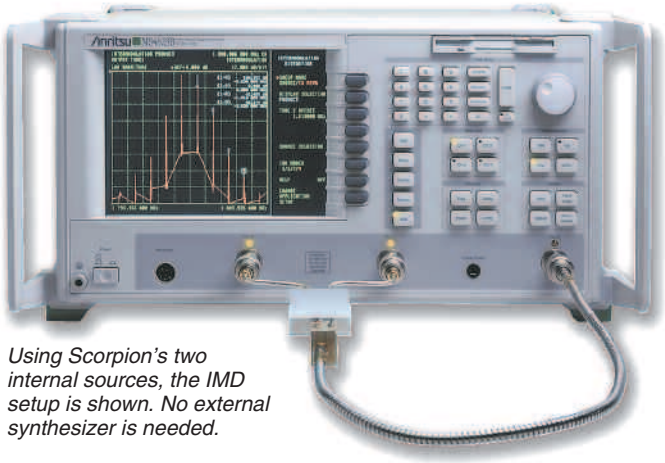
Intermodulation Distortions



Noise Figure, 50 MHz to 6 GHz

For low noise amplifiers, Scorpion takes noise figure measurement accuracy to a revolutionary new level. By combining S-parameters and Scalar Noise Figure measurements, these measurements can compensate for imperfections in your test setup. With settings for both wide and narrow measurements, you can see the noise figure and S-parameter performance without changing connections.

External and internal connections for the Noise Figure measurements choices using Scorpion.



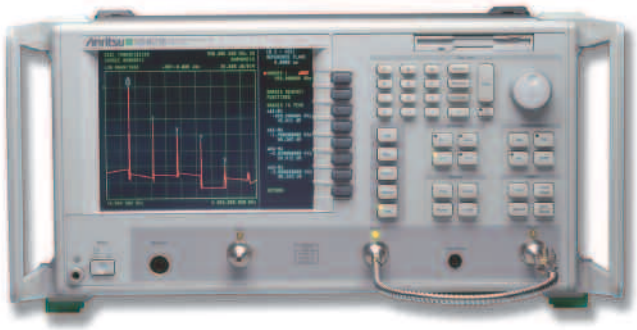
Using Scorpion's two internal sources, the IMD setup is shown. No external synthesizer is needed.

Intermodulation Distortion (IMD)

Scorpion can easily perform 3rd, 5th, 7th, or 9th order IMD measurements through the simple connection of an external power combiner. You can take advantage of built-in swept frequency or swept power measurements without writing a single line of code. For additional convenience, Scorpion can display the corresponding Third Order Intercept (TOI).

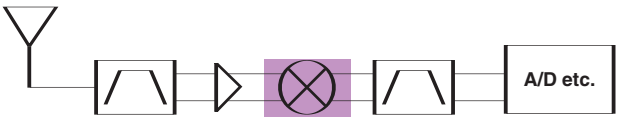
Harmonics, 2nd to 9th

Without changing connections, you can see the harmonic performance in magnitude or delta format for your amplifier or integrated circuit. Like our noise figure solution, Scorpion can combine S-parameters and Harmonic measurements for unparalleled accuracy. For the 2nd or 3rd harmonic, you can also see the phase relative to the fundamental (i.e. vector harmonics) for an even clearer view of harmonic performance.



An example of Harmonics measurement using Scorpion.

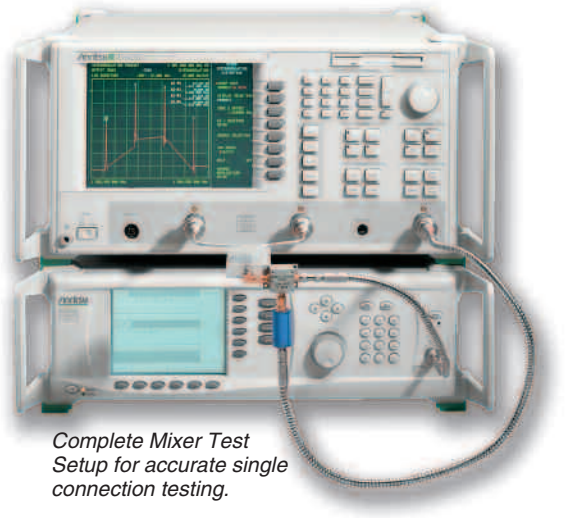
MIXER TEST SOLUTIONS THAT . . .



Mixer Characterizations

In addition to Scorpion's amplifier measurement capabilities, you can access the integrated, powerful, turnkey mixer measurement features to thoroughly characterize your frequency translating components. With an external Anritsu MG3690A synthesizer providing LO drive, Scorpion easily orchestrates elaborate measurements, including IMD.

Mixer Parameter	MS462xx Measures
S-Parameters	± 0.05 dB Accuracy
Compression	20 dB Power Sweep, +7 dBm Source Power
Noise Figure	Less than 0.5 dB, 50 MHz to 6 GHz
Group Delay Trace Noise	Up to 100 nS peak-to-peak Resolution
Third Order Intercept	Up to +40 dBm

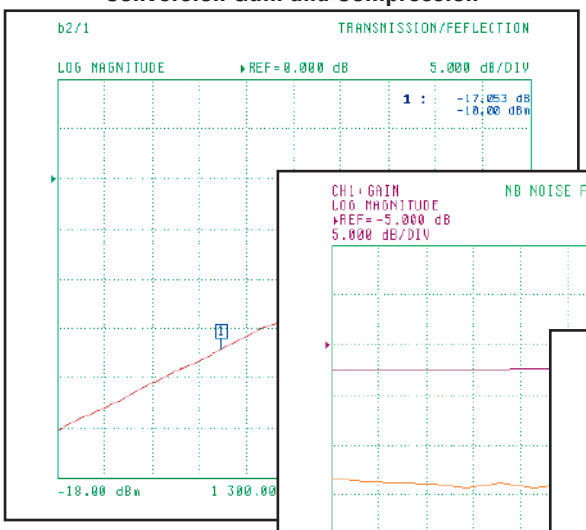


Complete Mixer Test Setup for accurate single connection testing.

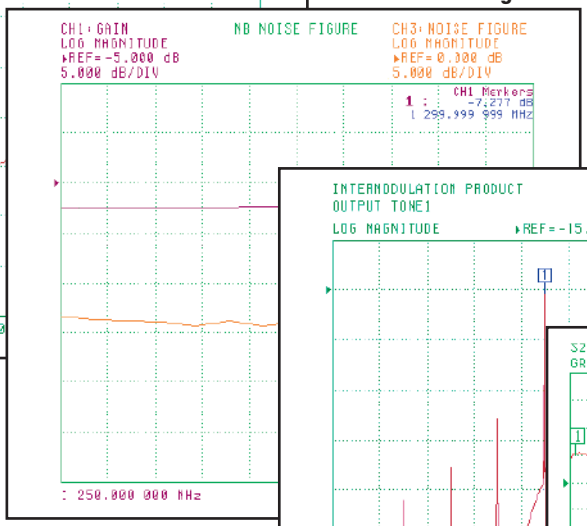
Mixer Measurements

- ***Fixed LO, Fixed IF, or Fixed RF***
- ***Single Connection***
- ***Real-time, Scorpion Accuracy***

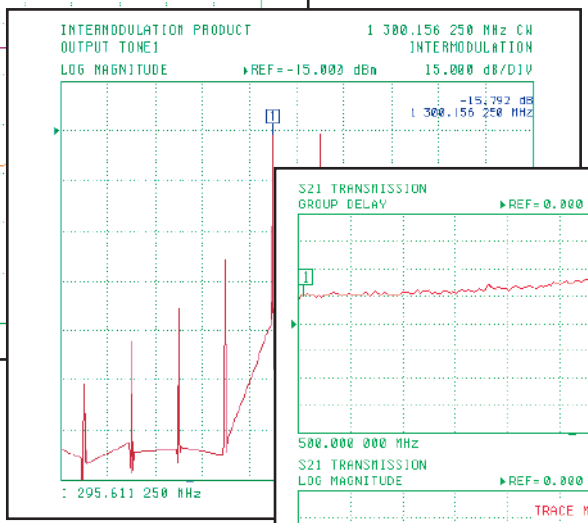
Conversion Gain and Compression



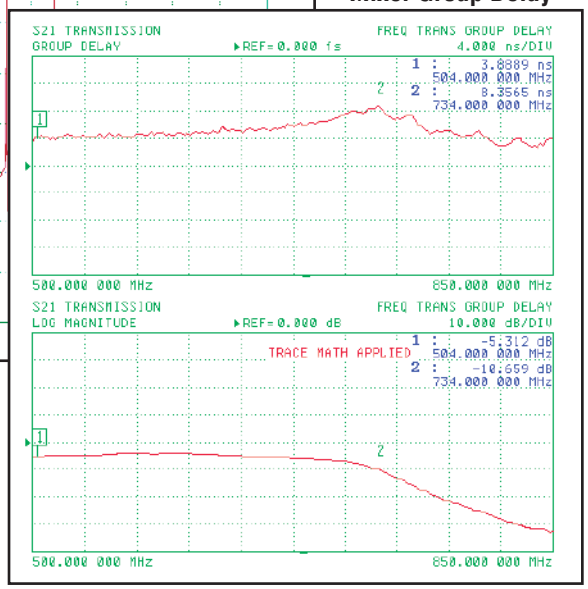
Mixer Noise Figure



Mixer IMD



Mixer Group Delay

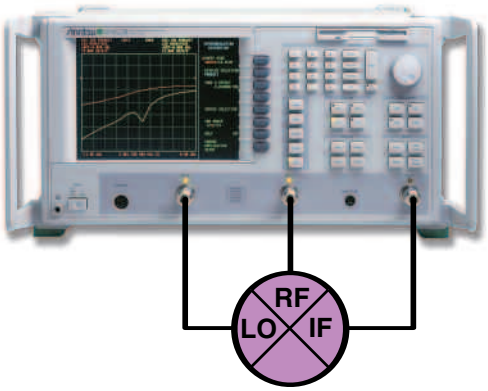


Comprehensive Mixer Measurements

For R&D, Scorpion provides sophisticated and elegant measurement choices for your mixers. See S-parameters, conversion loss, compression, noise figure, and group delay with a single connection. Without writing a single line of code, you'll be able see Fixed LO, Fixed IF, and even Fixed RF measurements.

For IMD measurements, you may even want to add an external Anritsu MG3690A synthesizer; in fact, you could add two. With Multiple Source Control, Scorpion easily manages up to four synthesizers to satisfy your toughest requirements for mixers, up/down converters, multipliers, and other frequency translating components.

To support mixers with low IF frequencies, the Scorpion receivers may be optionally extended down to 10 kHz.



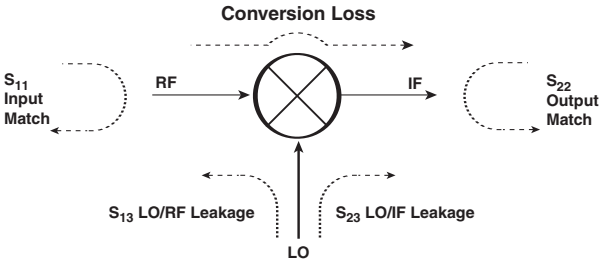
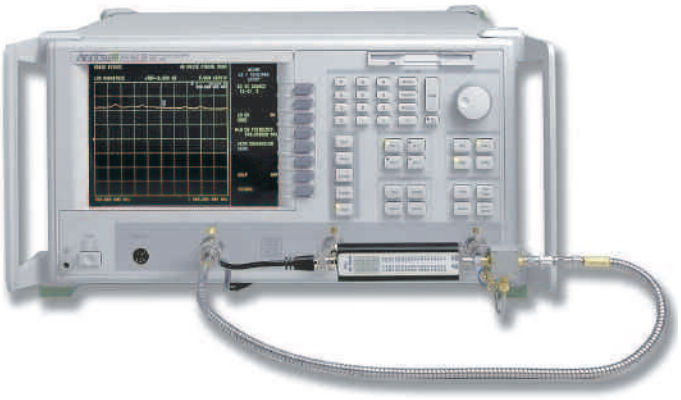


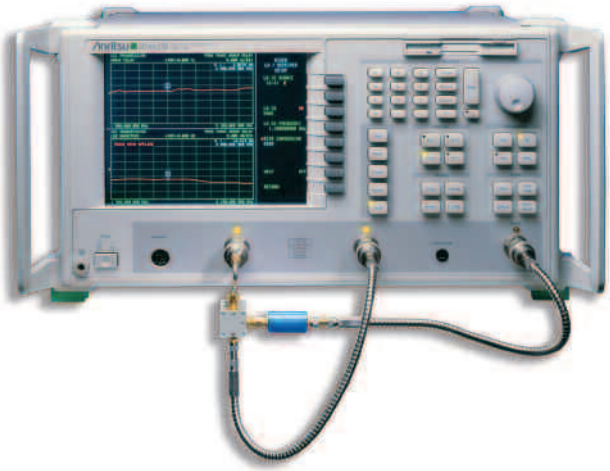
Diagram showing typical mixer measurements easily tested using Scorpion.



An example of an external Noise Figure measurement on a mixer. With 2 internal sources, Scorpion can provide both the RF and the LO signals to the mixer.

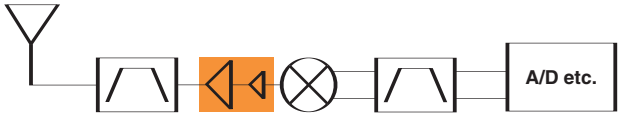
Noise Figure and Group Delay

These complex measurements can tax other measurement approaches, but for Scorpion it's just another measurement... single connection, routine calibrations and accurate measurement results.



An example of the Frequency Translated Group Delay measurement on a mixer using Scorpion.

POWER AMPLIFIER TEST SOLUTIONS THAT . . .



Power Amplifier Measurements

Scorpion's innovative and comprehensive amplifier measurement features can also satisfy the toughest power amplifier requirements. A single connection with the flexible Direct Receiver Access (DRA) configuration and a high power test set reveals the true performance of your handset or base station power amplifier.

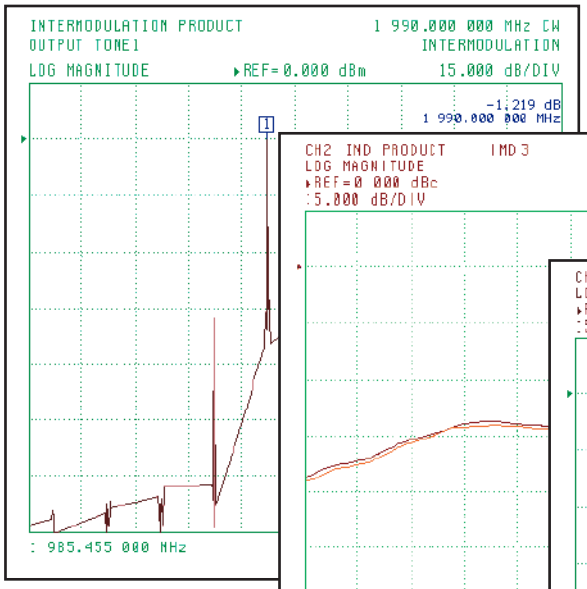
For an integrated turnkey solution check out our ME7840A. Or you can mix and match your existing high power test sets with Scorpion. Scorpion can satisfy your needs for accurate power sweep, input power and output power levels. Add integrated power meter calibrations for the ultimate in accuracy.

The complete test setup for power amplifier measurements with a single connection.

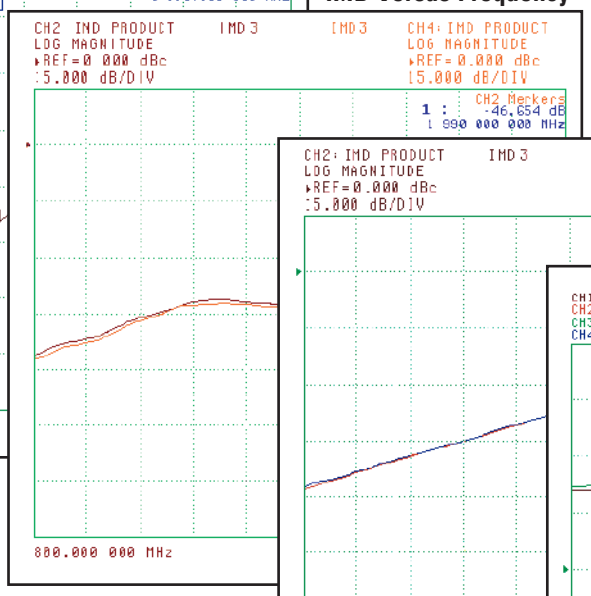
Power Amplifier Measurements

- ***Handles 100 Watts***
- ***Handset or Base Station***
- ***Accurate, Single Connection***

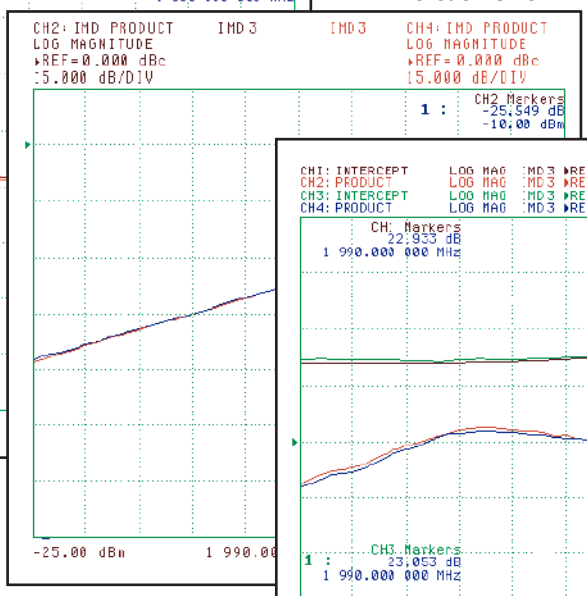
3rd Order Intermodulation Distortion



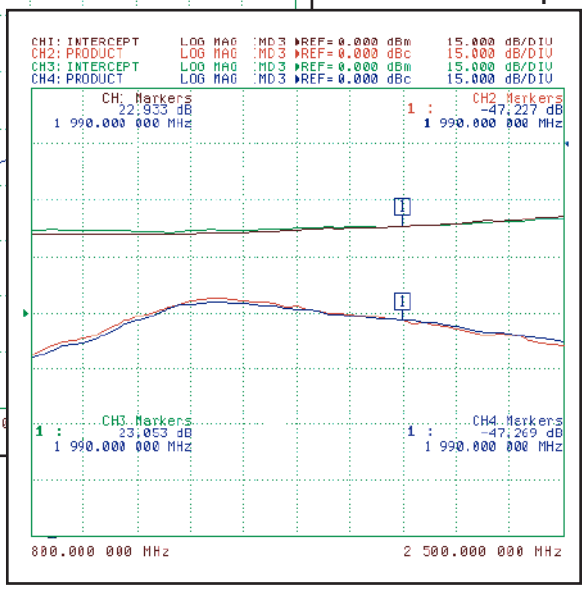
IMD Versus Frequency



IMD Versus Power



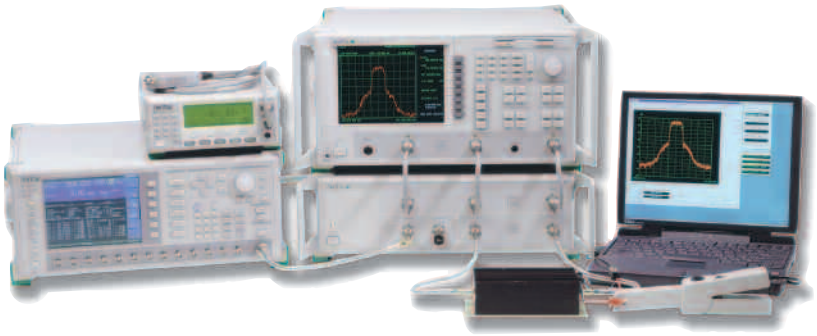
Third Order Intercept



PA Test Solution, ME7840A

Anritsu has an amazing Scorpion-based RF Power Amplifier test solution. PATS, the ME7840A Power Amplifier Test System, provides fast and accurate measurements in one easy-to-use system.

With a single connection to your power amplifier, see Adjacent Channel Power Ratio, Intermodulation Distortion, Power Added Efficiency and S-Parameter performance in minutes instead of hours. With two integrated sources, Scorpion can perform additional innovative measurements like "Hot S_{22}" and k-factor.



The complete test setup including ACPR measurements.

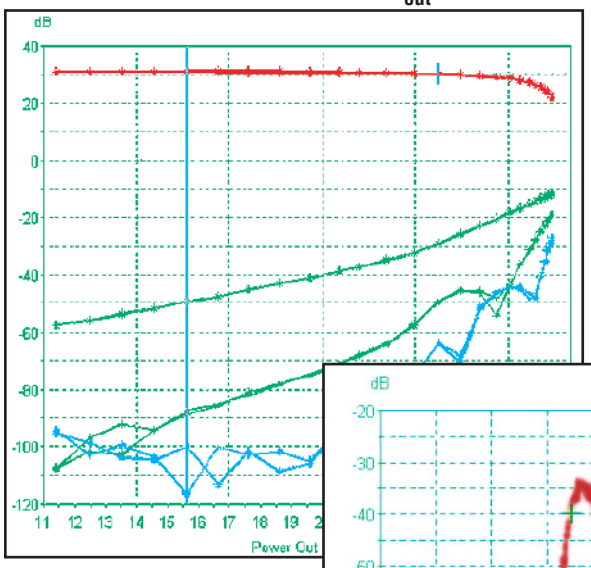
PATS is a ready-to-use measurement solution that shows you the true performance of your power amplifier.

Power Amp Parameter	ME7840A Measures
S-Parameters	800 MHz to 2400 MHz (100W) 10 MHz to 6000 MHz (5W) ±0.1 dB Accuracy
Compression	20 dB Power Sweep, +7 dBm Source Power
Harmonics	800 MHz to 6 GHz
Third Order Intercept	Up to +40 dBm
ACPR (W-CDMA)	Dynamic Range to 70 dB

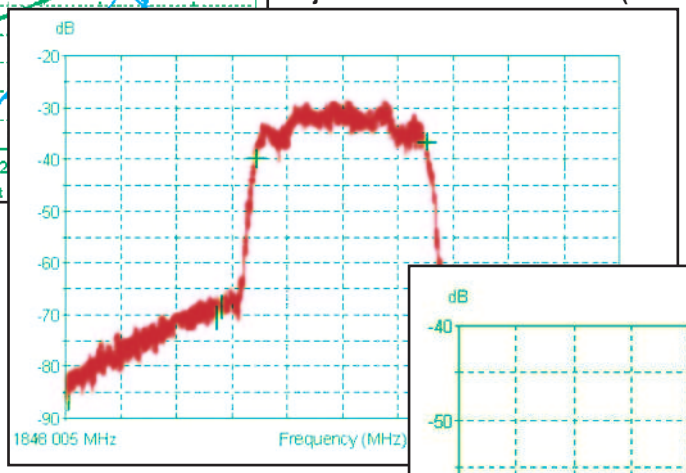
Power Amplifier Measurements

- *Scorpion Navigator™*
- *Comprehensive PA Testing*
- *Fast, Flexible, and Friendly*

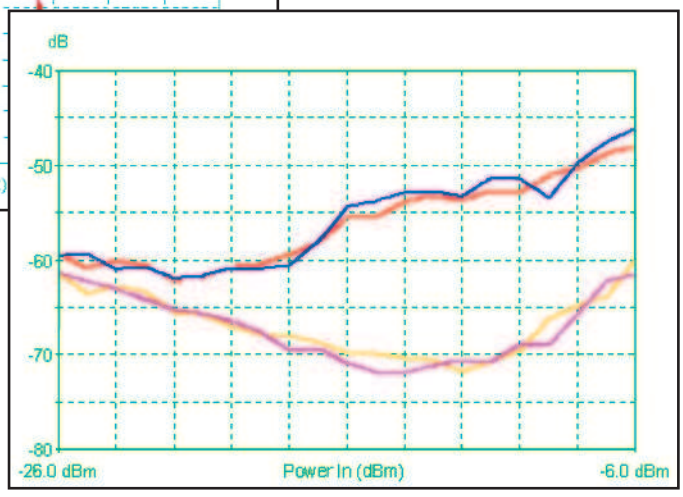
Gain and IMD versus P_{out}



Adjacent Channel Power Ratio (ACPR)



ACPR Versus Power



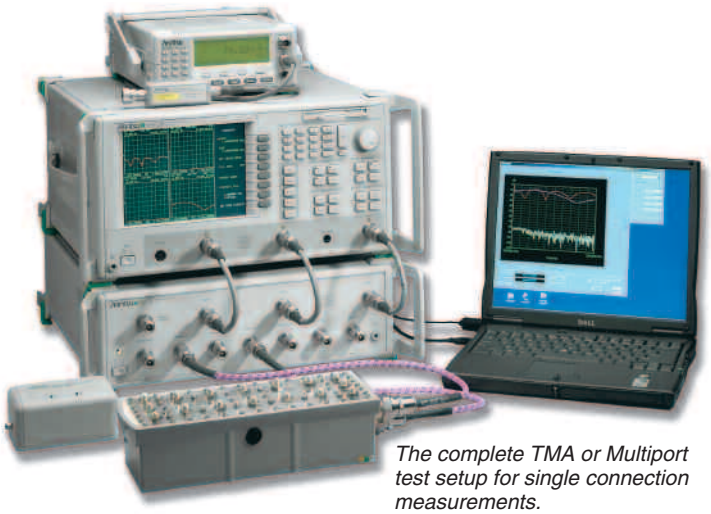
An example of the ACPR measurement result as seen on the Scorpion Navigator.

Multiport Measurements

Apply the extensive set of Scorpion measurement features to tame your toughest multiport requirements. Use Scorpion to measure a Tower Mount Amplifier (TMA), Front End Module (FEM) or any other multiport component. Contact Anritsu for custom multiport designs.

As an example reference the new ME7842B Tower Mount Amplifier Test System.

In manufacturing, you can always develop your own software, but Anritsu can provide you time-saving ActiveX modules for your integrated test executive environments. Whatever you choose, Scorpion is ready to integrate seamlessly into your existing manufacturing process.

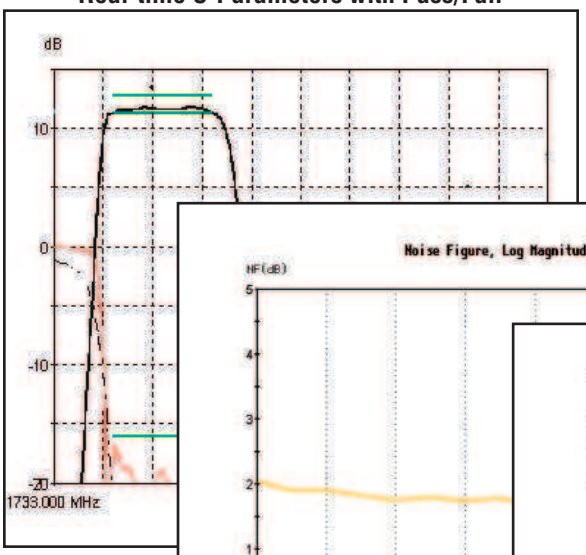


The complete TMA or Multiport test setup for single connection measurements.

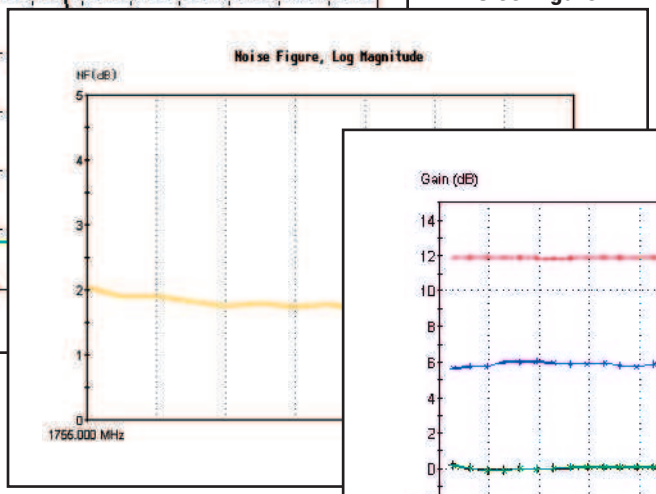
And More . . .

- ***Scorpion Navigator™***
- ***Fast, Flexible, and Friendly***
- ***Contact Factory for Details***

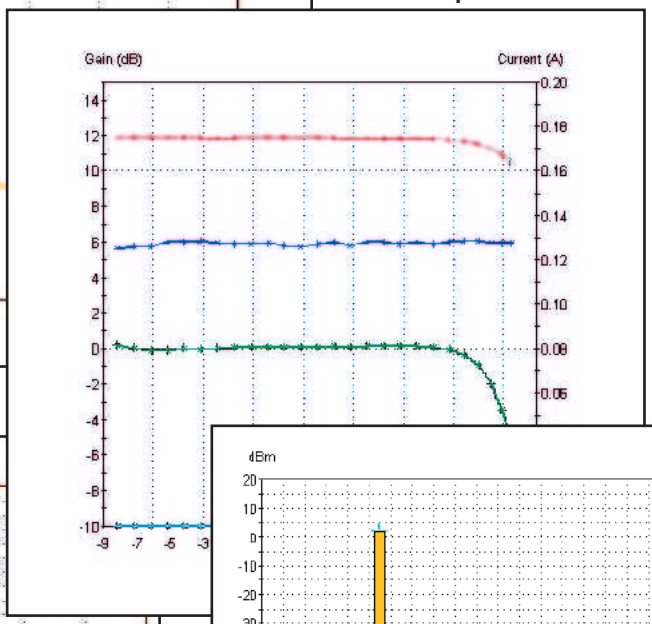
Real-time S-Parameters with Pass/Fail



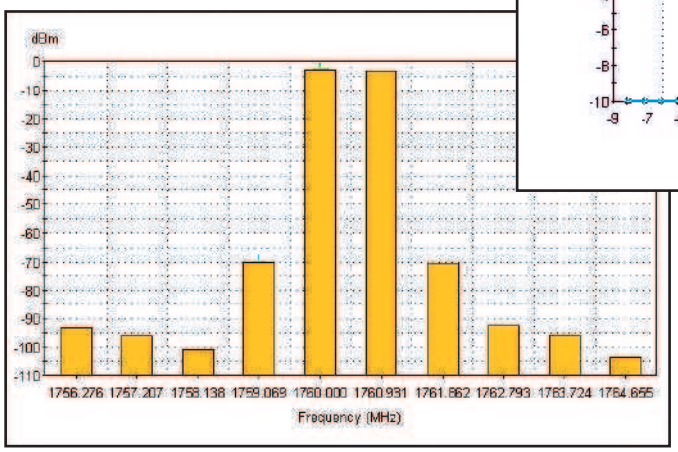
Noise Figure



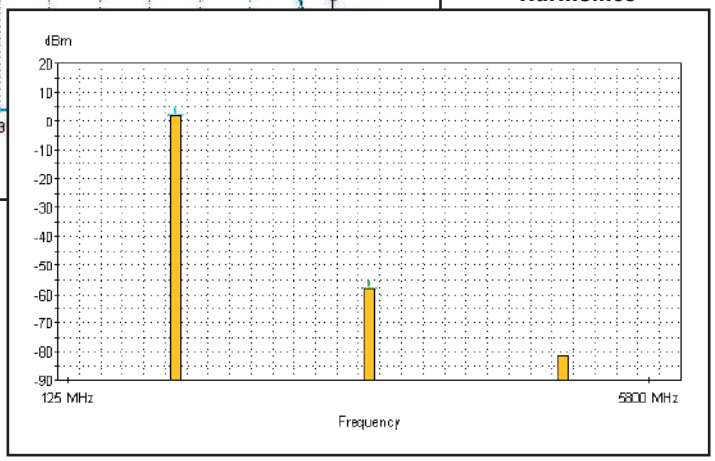
Compression



Intermodulation Distortion



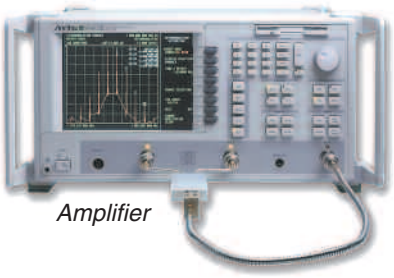
Harmonics



CHOOSE YOUR DEMONSTRATION TODAY!

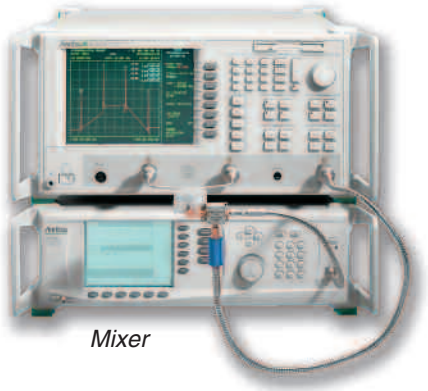
Are You Ready for a Demonstration?

To see the true performance of your RF component, simply contact your Anritsu representative and ask for any of the following popular and immediately available demonstration configurations. See these measurements first-hand and you will understand the compelling reasons to use Scorpion for all of your RF component measurements.



Amplifier

S-Parameter and Balanced/ Differential Measurements



Mixer

Power Amplifier

For Higher Frequency, Look at Anritsu's 37000 Family of Microwave Vector Network Analyzers.

Multiport and More

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