Keysight Technologies
Solutions for Achieving High-Quality Microwave Measurement with the Right Test Accessories

Application Note
Overview

RF and microwave test accessories—which can include everything from blocks, attenuators and couplers, to switches and system amplifiers—play an integral role in completing a test system. The accessories complement the system’s instrumentation by helping to simplify test setups and maximizing the instrumentation’s full potential. With high-performance instrumentation and accessories pushing the envelope of today’s advanced high-frequency applications, it is now more crucial than ever for engineers to select the right test accessories for use in their test systems.

Problem

In the RF and microwave domain, high frequencies and stringent application specifications have become the norm, challenging engineers to be able to make precise measurements with accurate data and obtain repeatable results. Test accessories offer an ideal way for engineers to address these challenges. Using a wrong accessory will result in a weak link in the test system’s measurement path, further complicating its setup and limiting its measurement ability. However, selection of the right test accessories, with the highest quality, will improve the test system’s utility and automation, ensure an optimized, more reliable test setup, and allow engineers to achieve the highest quality microwave measurements.

Solution

The trick to selecting the right test accessory lies in knowing which accessory to use in a given application. Some of the more common test accessories and their key applications are as follows.

Test Accessory: Electromechanical (EM) Switch

Application: Increasing Efficiency

In signal routing schemes, EM switches enable multiple measurements with a single connection. The ability to test multiple devices-under-test (DUTs) with a single instrument or to make multiple types of measurements on a DUT maximizes the test system’s throughput.

When selecting an EM switch, engineers must:

– Read the datasheet carefully. Watch for words like ‘typical’ or ‘guaranteed’ following a specification, which may indicate a need to investigate the specification further.

– Pick a switch with good reliability and a long operating life (specified by the number of cycles it can complete while still meeting performance/repeatability specifications).

– Determine the switch’s true cost by breaking down its price into units based on its specified lifetime. Remember, having a test system go down to replace a switch can be a costly proposition. When working with non-latching switches, it may be worthwhile to break down the switch’s cost based on power consumption.

– Select a switch with an effective solution to debris accumulation and therefore, better switch repeatability (Figure 1).

FIGURE 1: Keysight switches employ a patented design with a curved top center conductor that produces friction between the jumper contact and center conductor during switch closure. The friction mimics a wiping action that removes contact point debris. Because of this wiping, Keysight is able to specify a switch repeatability of 0.03 dB (variation in insertion loss) over the guaranteed life of the switch.
Test Accessory:  
Step Attenuator  
Application:  
Enabling Reliable Signal Conditioning  
A variable step attenuator ensures reliable signal conditioning by eliminating power nonlinearity and inaccuracies from the source. As an example, consider adding an external attenuator and directional coupler to a conventional test setup for a mobile receiver sensitivity test used to measure real-time power. Doing so enables easy one-time power calibration, allows the source to stay at a single power level, frees the user from power-level nonlinearity and accuracy issues from the source, and makes it easier to obtain accurate and calibrated low power levels.

Test Accessory:  
Power Limiter  
Application:  
Protecting Investments  
Power limiters with ESD provide engineers with an inexpensive way to protect their measurement system investments against high repair costs or significant test system downtime caused by damaged or mishandled instruments or components (Figure 2).

FIGURE 2: Shown here is a typical application using a power limiter to protect an RF instrument. In this case, the input of a spectrum analyzer is protected from an inadvertent overload due to high-level signals from an antenna.

Test Accessory:  
RF Active Probe  
Application:  
Optimizing RF Circuit Design  
An active RF differential probe provides an effective way for designers to optimize and troubleshoot their circuit designs. It can be used to measure a design’s harmonics, power levels and frequency, as well as its modulation, to identify faulty or problem areas (Figure 3). When used with a high dynamic range signal/spectrum analyzer, the probe’s high sensitivity and low distortion levels enable even the smallest signals to be detected. It can also be used with a signal source analyzer to measure the phase noise and jitter of a clock in a high-speed digital board design.

FIGURE 3: An active RF differential probe can be used to perform general RF and microwave troubleshooting work, as shown in this example. With this solution, accurate troubleshooting in a greater dynamic range of the instrument is possible.
Summary of Results

While use of low-quality RF and microwave test accessories can result in inefficient, unreliable test systems, use of the right accessories can ensure test system optimization and minimize measurement uncertainty. Moreover, use of high-quality test accessories helps engineers protect their investment in expensive instrumentation. The best way to achieve these goals is by purchasing accessories from a premium vendor with unmatched reliability and repeatability.

The accessories should have a proven long operating life and require minimal maintenance throughout their lifetime. Additionally, the right accessory must be used for the right application in question. By following these tips, today’s engineers can simplify their test setups and maximize their equipment’s full potential to ensure the best possible measurement results. Refer to Keysight Technologies, Inc. RF & Microwave Test Accessories Catalog to complete your measurement solutions.
myKeysight
www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

www.axiestandard.org
AdvancedTCA® Extensions for Instrumentation and Test (AXIe) is an open standard that extends the AdvancedTCA for general purpose and semiconductor test. Keysight is a founding member of the AXIe consortium. ATCA®, AdvancedTCA®, and the ATCA logo are registered US trademarks of the PCI Industrial Computer Manufacturers Group.

www.lxistandard.org
LAN eXtensions for Instrument puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.

www.pxisa.org
PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
Keysight’s commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

www.keysight.com/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001-2008
Quality Management System

Keysight Channel Partners
www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight’s measurement expertise and product breadth, combined with channel partner convenience.

Free catalog: www.keysight.com/find/mtacatalog
www.keysight.com/find/ad

For more information on Keysight Technologies’ products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

Americas
Canada (877) 894 4414
Brazil 55 11 3351 7010
Mexico 001 800 254 2440
United States (800) 829 4444

Asia Pacific
Australia 1 800 629 485
China 800 810 0189
Hong Kong 800 938 693
India 1 800 112 929
Japan 0120 (421) 345
Korea 080 769 0800
Malaysia 1 800 888 848
Singapore 1 800 375 8100
Taiwan 0800 047 866
Other AP Countries (65) 6375 8100

Europe & Middle East
Austria 0800 001122
Belgium 0800 58580
Finland 0800 523252
France 0805 980333
Germany 0800 6270999
Ireland 1800 832700
Israel 1 809 343051
Italy 800 599100
Luxembourg +32 800 58580
Netherlands 0800 0233200
Russia 8800 5009286
Spain 0800 000154
Sweden 0200 882255
Switzerland 0800 805353
United Kingdom 0800 0280637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-07-10-14)