Keysight Technologies

USB Coaxial Switches for RF & Microwave Test and Measurement Applications

Application Note

KEYSIGHT TECHNOLOGIES

Abstract

Coaxial switches are commonly used in applications where RF signal routing is required between one or more locations, via some form of switch driving hardware (to power the switch) and software/firmware (to navigate the various switch paths). Depending on the complexity of the switching matrix, a considerable amount of setup and configuration will be required. With the advent of USB, widely recognized for its capability to power up and having a standard set of embedded drivers in most operating systems (OS), creating a fully standalone USB switch provides an economically viable alternative for everyday switching needs. This solution which is literally a pure plug-and-play device, will save precious development time and hardware setup costs especially for R&D and design validation groups.

This application note describes features and application examples of a USB coaxial switch, and various options for measuring multiple devices under test (DUT) or performing multiple tasks with a single connection.

Introduction

In RF and microwave test systems, coaxial switches are used extensively for signal routing between instruments and DUTS. Switching matrices allows multiple tests to be performed with the same setup, eliminating the need for frequent connects and disconnects. Naturally, this configuration can also be easily automated and thus increases throughput and efficiency.

Conventional coaxial switches consist of solenoid coils where DC voltages are needed to bias the coils to latch the RF contact blades to required positions, typically via an external hardware driver. In the ATE environment, most switch system integrators will provide a complete driving solution for ease of control and convenience. A switch driver typically consists of an integrated power supply with a set of driving interface to support a variety of switching options, as well as software programmability to facilitate quick design validation and automated testing.

The U1810B USB SPDT DC to 18 GHz coaxial switch, presents a novel approach for general switching needs with its standard USB plug-and-play functions that provide fast and easy setup. Users can conveniently power up the switch via one of the multiple USB ports on the instrument or PC, without the need for an external power supply. Precious time can be saved in integrating complex switch setups (the driving method and pin configuration) as compared to a conventional coaxial switch.

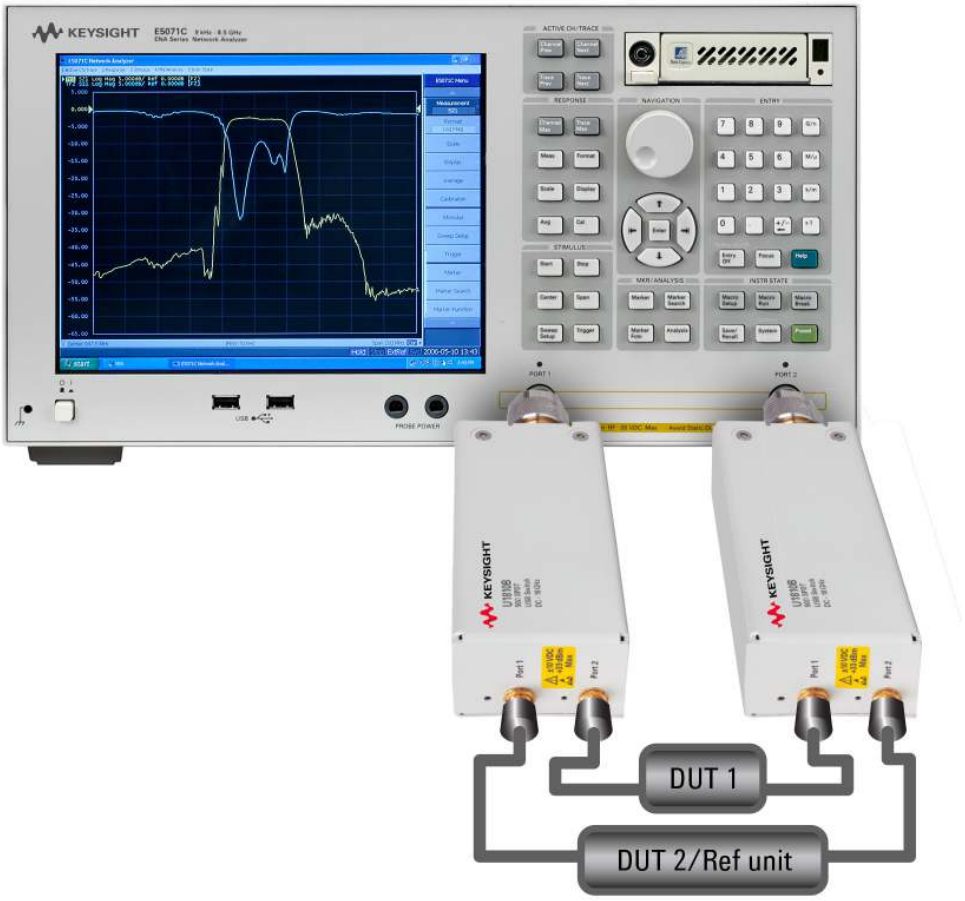
Inheriting Keysight Technologies, Inc. unique switch technology, the U1810B is designed to operate for more than 10 million cycles. The exceptional 0.03 dB insertion loss repeatability is warranted for 5 million cycles. This excellent RF characteristic significantly reduces downtime for recalibration, improves testing efficiency, and ultimately maximizes test throughput.

Applications Examples

Most of the instruments offered by Keysight have built-in USB ports, such as network analyzers, spectrum analyzers, and oscilloscopes. The U1810B USB switch can be used easily with any of these instruments, and it's USB 2.0 compliant. Below are some application examples of the USB switch with Keysight's test instruments.

Using with a network analyzer

Below is an application example where the U1810B is used with a network analyzer to measure two DUTs with one connection either in frequency or time domain. Similarly, the U1810B can be used to switch between the DUT and the reference unit for calibration or compensation. In a traditional test calibration process, the user needs to remove the reference unit from the network analyzer after the calibration and connect the DUT to the network analyzer to complete a measurement. The U1810B helps to eliminate the time and resource to change the connection between the DUT and the reference unit.

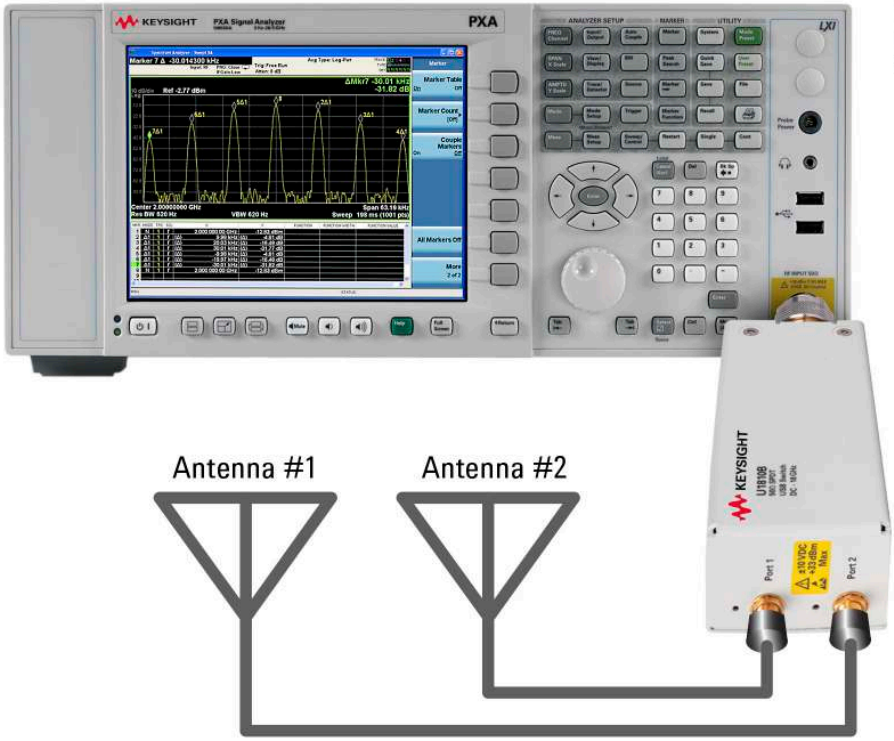


Using with Keysight's FieldFox Handheld RF Analyzer

At a cell site, Keysight's FieldFox handheld RF analyzer is used to perform cable and antenna analysis. With the USB switch, users can extend the capability of the handheld analyzer to perform return loss, cable loss, and distance-to-fault (DTF) measurements on two cables. The USB switch can be powered up by the USB port of the handheld RF analyzer, and hence represents the ultimate mobility at installation and maintenance sites.

Using with a spectrum analyzer

Spectrum analyzers are commonly used in antenna measurements to measure the strength of the received signal. With two antennas connected to the USB switch, the U1810B can be easily toggled to switch between them to perform the relevant measurements. Once again, this USB switch increases test efficiency by eliminating the need to disconnect and reconnect the antenna.



U1810B features
Switch topology

Compared to conventional switch designs where all the connector ports are on the same plane, Keysight's U1810B helps users to simplify the test setup without using additional RF cables. Figure 1 below shows a conventional switch connected to an instrument. Both methods require extra RF cable(s) to be connected between the switch and the instrument. If a rigid cable is used, the length and bend angle of the cable has to be taken into consideration. If a semi-rigid or flexible cable is used, the cable has to be fixed during measurement, any slight movement of the cable will change the mismatch and affect the measurement accuracy. Inconsistent cable length pairs may also compromise the system phase accuracy.

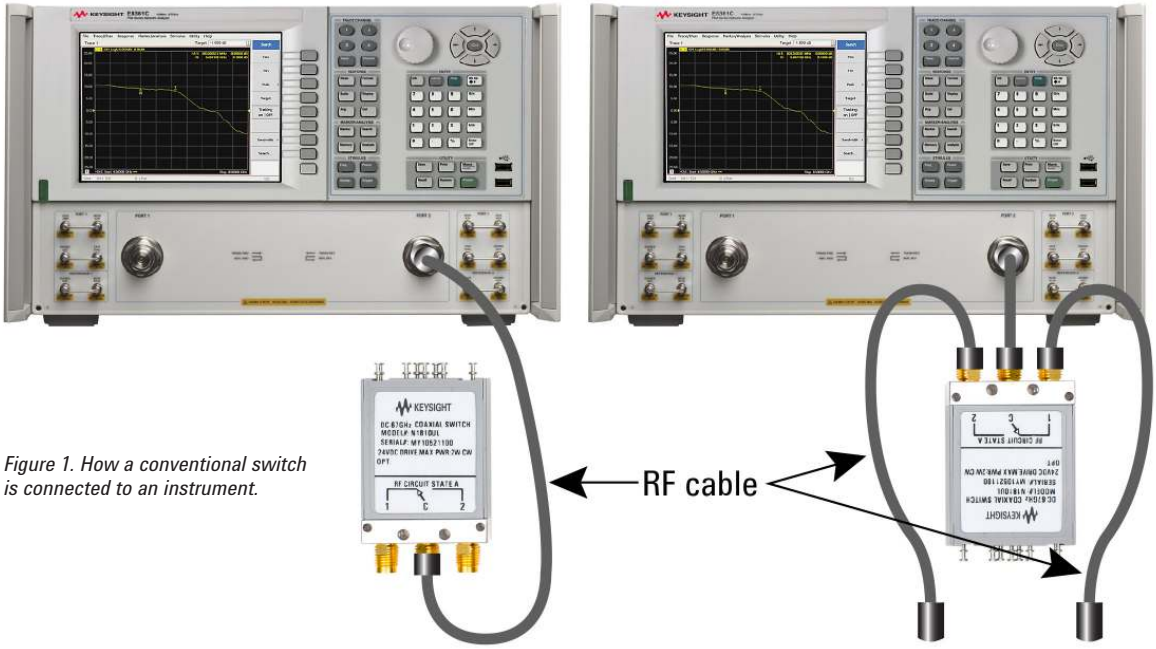


Figure 1. How a conventional switch is connected to an instrument.

With Keysight's U1810B, the user can perform the same measurement without any additional RF cables (Figure 2), thus, avoiding the various test setup and maintenance issues as highlighted earlier.

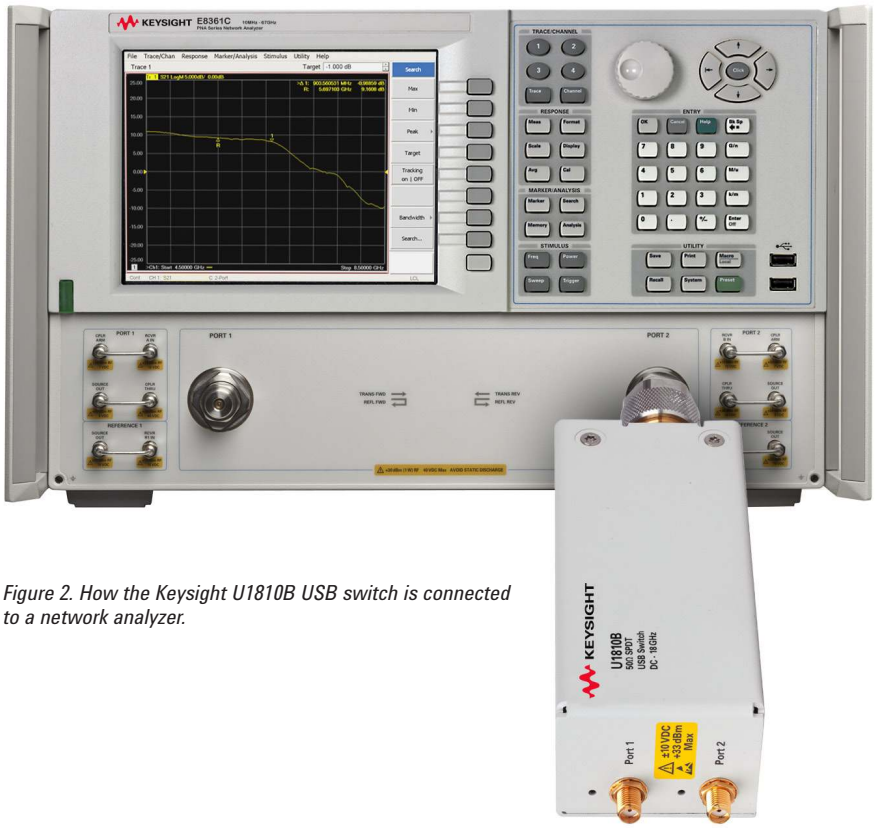


Figure 2. How the Keysight U1810B USB switch is connected to a network analyzer.

Soft front panel (SFP)

To facilitate ease-of-control of the switches, a fully functional soft front panel (SFP) provides an alternative virtual interface. With the SFP, users can verify the device installation and monitor the switch trigger sequence in real time. This provides a very intuitive way for users to debug and setup their systems, especially during the initial install. One important additional feature incorporated is the User Defined Sequence program. It provides an extended user interface to key in specific switching sequences and delays, especially when more than one U1810B is connected to the same host. In the User Defined Sequence window (shown in Figure 3), users can set the individual switch to Port 1 or 2 and the delay before the second sequence. The generated programmed sequence can then be either saved for re-access later, or duplicated onto another system. Another built-in feature is the ability to access the log commands of the switch executions – users can retrieve the codes of their programmed sequence and paste them into the master program codes. This eliminates the additional need for programmers to master the switch command syntax.

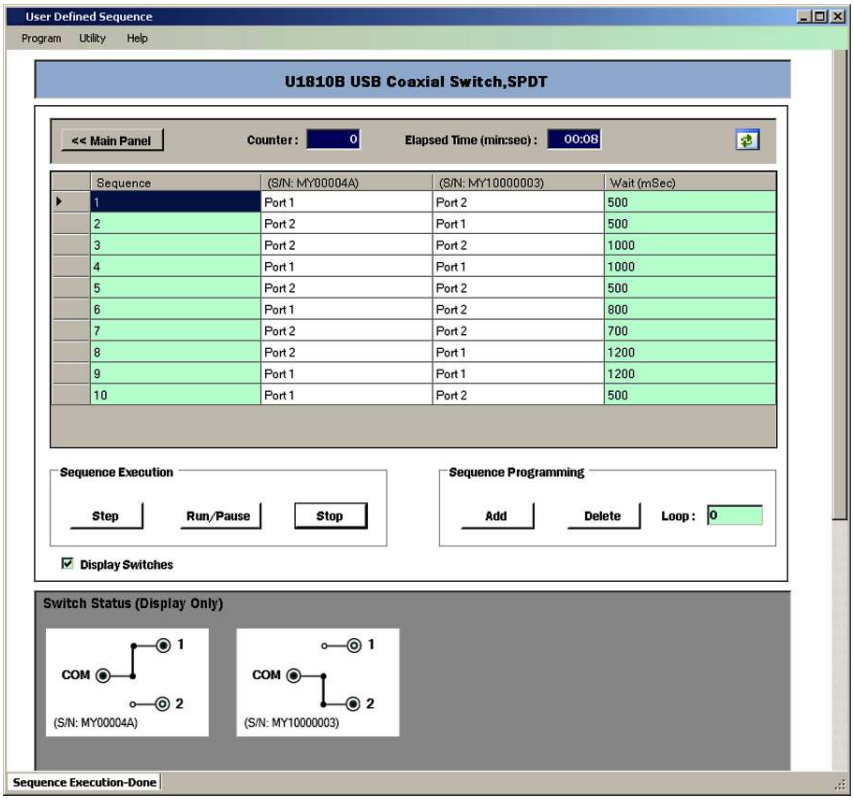


Figure 3. User Defined Sequence window for U1810B USB coaxial switch SFP.

Conclusion

In summary, the USB is designed to provide convenience to not only computer users, but also for test and measurement applications. The U1810B USB coaxial switch, with its unique combination of excellent RF performance with the convenience of USB connectivity presents an invaluable alternative for users to increase the setup and programming efficiency of their test systems.

myKeysight

www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

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.

www.keysight.com/find/USBswitch

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 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

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

KEYSIGHT TECHNOLOGIES

This information is subject to change without notice.
© Keysight Technologies, 2012 - 2014
Published in USA, August 2, , 2014
5991-1596EN
www.keysight.com