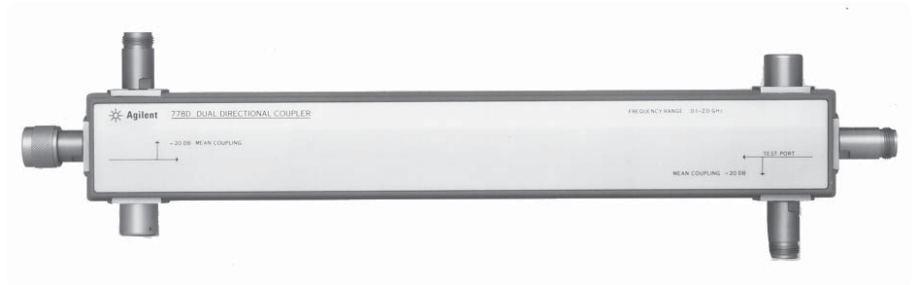


Agilent 778D Dual Directional Coupler 100 to 2000 MHz

Data Sheet



Features

- Multi-octave frequency range: 100 to 2000 MHz
- High directivity: 36 dB to 1 GHz, 32 dB to 2 GHz
- Reflection coefficient measurement: Over 4 octaves with 1 coupler

Broadband 20 dB Dual Directional Coupler

This dual directional 20 dB coupler has a frequency range extending over 4 octaves from 100 MHz to 2 GHz. The multi-octave capability makes measurements easier—setup and calibration time are reduced, since normally several couplers are required over this frequency band. The coupling factor increases about 6 dB per octave below 100 MHz; thus, usefulness below this frequency is restricted only by the amount of signal source power and/or the sensitivity of the RF detector connected to the coupler. Figure 1 shows typical coupling and directivity characteristics of the 778D.



Agilent Technologies

Simultaneous Reflection and Transmission Measurements

The 778D is ideal for measuring the reflection and transmission characteristics of a device from 100 MHz to 2000 MHz. Figure 2 shows a test configuration in which a 778D dual directional coupler is used to separate and isolate the incident, reflected, and transmitted signals in a swept-frequency measurement. These signals are detected and their ratio displayed on a CRT. This coupler is an ideal companion for the Agilent 8755 frequency response test set, a detection and display system operating from 15 MHz to 18 GHz.

The high directivity and close tracking of the auxiliary arms of this coupler make it particularly useful for this type of broadband measurement. The high directivity insures accurate measurements by a true separation of the forward and reflected signals. Close tracking of signal variation from the auxiliary arms gives a flat frequency response that makes display readings easy to interpret.

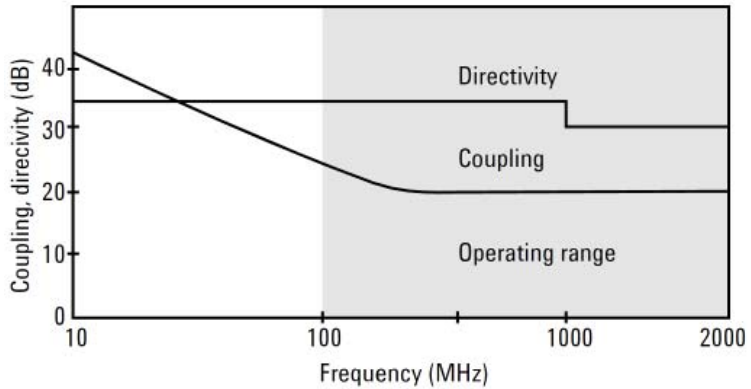


Figure 1. Coupling and directivity characteristics of the 778D coupler.

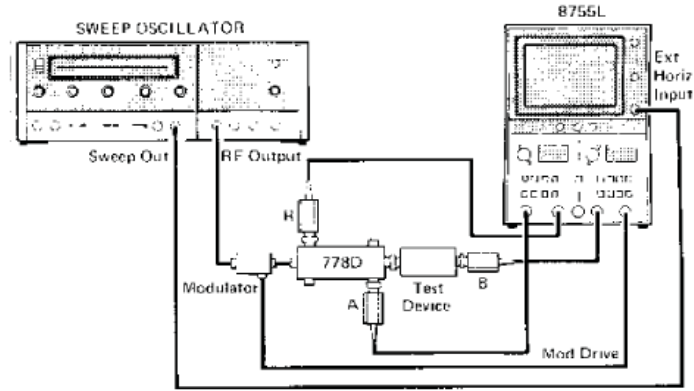


Figure 2. Setup diagram for simultaneous measurements of insertion and return loss.

Maximum amplitude errors in a reflection measuring system are shown in the following table

Frequency range	Maximum magnitude error $\Delta\Gamma_L$	
	Swept frequency	Fixed frequency
0.1 to 1 GHz	$\pm (0.015 + 0.02 \Gamma_L + 0.05 \Gamma_L ^2)$	$\pm (0.015 + 0.05 \Gamma_L ^2)$
1 to 2 GHz	$\pm (0.025 + 0.02 \Gamma_L + 0.05 \Gamma_L ^2)$	$\pm (0.025 + 0.05 \Gamma_L ^2)$

Maximum phase error = $\pm \sin^{-1}(\Delta\Gamma_L/\Gamma_L)$

$|\Gamma_L|$ = reflection coefficient of unknown

Error components include a fixed term due to coupler directivity, and several Γ_L -dependent terms relating to source match and reference setting (detection errors are not included). These errors apply over broad swept-frequency bands. Somewhat improved accuracy can be achieved by simple recalibration at the frequency of interest.

Impedance Measurements

The 778D is also well suited for measurements of impedance when used with the Agilent 8405A vector voltmeter. The technique is described in Application Note 77-3, Measurement of Complex Impedance, available at your nearest Agilent sales office. Again, a reflectometry technique is used. With the vector voltmeter, however, both magnitude and phase angle of the reflection coefficient can be measured. This setup is shown in Figure 3.

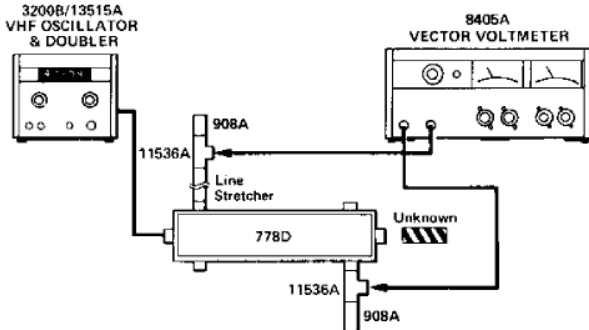


Figure 3. Setup of impedance measurement of coaxial devices from ~10 to 1000 MHz.

Data can be read from the two meters of the vector voltmeter and transferred directly to a Smith Chart to provide impedance of such devices as antennas or other passive components. In addition, with an appropriate bias supply, active components, such as transistors, can also be quickly measured and characterized with this setup. The 778D is well-suited for these types of measurements since both the phase and the magnitude variation between the two coupling arms have been closely controlled in the design of the coupler.

System Monitoring

Because of the high power capability of the dual directional coupler, it can be permanently installed in coaxial systems to monitor the power traveling in both directions simultaneously. This enables a system to be continually monitored to indicate whether the system is in need of adjustment or maintenance due to excessive standing-wave ratios on the transmission lines.

Choice of Output Connectors

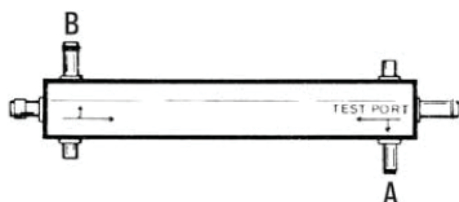
To achieve its broad frequency coverage, the 778D's directivity is optimized for mainline energy flowing in one direction. Thus, the test device or system should be connected where the 778D is labeled TEST PORT. To accommodate test devices with type-N or APC-71 connectors, a choice of connectors is available on the TEST PORT; see the options outlined under Specifications.

The APC-7 precision sexless connector is recommended on the output, since the coupler can be conveniently converted to other types of connectors by use of an adapter. Adapters are available to OSM, TNC, GR900, and others, so that the coupler becomes a versatile device for making measurements on many different types of connector configurations. The Amphenol, APC-7 is a sexless connector with very low SWR. This precision connector makes possible the construction of adapters with the lowest possible SWR.

The type-N connectors are stainless steel for long wear and are compatible with connectors whose dimensions conform to MIL-C-39012, or MIL-C-71.

Specifications

Frequency range 100 MHz to 2000 MHz (usable below 100 MHz)



Directivity	Auxiliary arm	0.1 to 1 GHz	1 to 2 GHz
	A		36 dB
B		30 dB	30 dB

Coupling factor 20 dB nominal ± 1 dB cyclic variation with frequency (coupling ~ 23 dB at 100 MHz. 6 dB rolloff per octave below 100 MHz).

Tracking Auxiliary outputs typically track within 0.7 dB.

Phase tracking typically 4° .

SWR Primary line: 1.1; auxiliary arms: 1.1.

Insertion loss 0.6 dB

Maximum power 50 W average; 500 W peak (peak power duration of 10 μ s).

Connectors Choice of mainline connectors (see options); auxiliary arms have type-N female connectors. All type-N connectors stainless steel, compatible with MIL-C-39012 and MIL-C-71.

Dimensions 16.75 inches long, 4.375 inches high, 1.189 inches wide (425 x 111 x 30 mm).

Weight Net, 3.75 lb (1,5 kg). Shipping, 5 lb (2,3 kg).

Accessories available

Adapters Part number

APC-7 to OSM[®] male 11533A

APC-7 to OSM female 11534A

APC-7 to type-N male 11525A

APC-7 to type-N female 11524A

(Adapters from APC-7 to TNC, GR-900, GR-874 as well as the above are available from Amphenol RF Division, Danbury, Conn.)

778D (type-N female output, type-N male input connectors)

Option 11 (APC-7 output, type-N female input connectors)

Option 12 (type-N male output, type-N female input connectors)

Remove all doubt

For more information on repair and calibration services, go to:

www.agilent.com/find/removealldoubt



Agilent Email Updates

www.agilent.com/find/emailupdates

Get the latest information on the products and applications you select.

www.agilent.com
www.agilent.com/find/mta

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

www.agilent.com/find/contactus

Americas

Canada	(877) 894-4414
Latin America	305 269 7500
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
Thailand	1 800 226 008

Europe & Middle East

Austria	01 36027 71571
Belgium	32 (0) 2 404 93 40
Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*

*0.125 €/minute

Germany	07031 464 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201

Other European Countries:

www.agilent.com/find/contactus

Revised: July 2, 2009

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2004, 2009
 Printed in USA, September 11, 2009
 5952-8133



Agilent Technologies