

Microwave Multiport Measurement System

40 MHz to 67 GHz*

12-Port Mixed-Mode and Balanced/Differential Multiport System

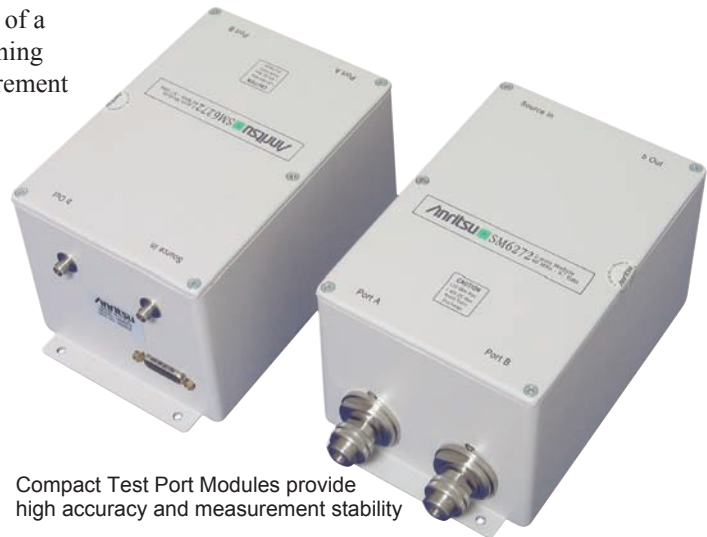
*Operational to 70 GHz



Microwave Multiport Measurement System

Anritsu's Microwave Multiport Measurement System consists of a VectorStar family Vector Network Analyzer (VNA), a switching matrix test set, dual-port modules, and calibration and measurement software. The multiport system provides the capability of configuring a 4, 8, or 12 port balanced/differential or mixed-mode measurement utilizing the intuitive HFE calibration and measurement software program. The multiport system provides the most accurate measurements up to 67 GHz* through the use of high performance couplers and state-of-the-art solid state switches. The critical components reside within external test port modules for high reliability, repeatability and low insertion loss.

*Operational to 70 GHz



Compact Test Port Modules provide high accuracy and measurement stability

The compact Mobile Port Module is ideal for on-wafer and other probing applications because test ports can now be positioned close to the DUT for optimal performance. Locating the switches and RF routing cables inside the Mobile Port Modules and behind the couplers provide improved raw directivity and best calibration stability. High performance solid state switching is used for high reliability and minimum insertion loss. The system is controlled by flexible, configurable software that is both dynamic and intuitive. The software automatically converts the measurement connection plan into the best multi-port calibration scenario including compensation for external fixtures.

Key Features and Benefits

- 4, 8 or 12 port configuration available depending on the number of SM6272 test port modules used.
- The compact test port modules contain high directivity couplers and can easily be positioned close to the DUTs, in coaxial or on-wafer environments, for minimum loss.
- The SM6374 interface module provides the switch matrix path between the VNA and the test port modules.
- Switch matrix located behind the couplers for best raw directivity and maximum calibration stability.
- Calibration software dynamically adapts to multiport DUT configuration and produces the best sequence of standards connection.
- System Interface Module contains the switch matrix and interface between the VNA and the test port modules
- Each Mobile Port Module contains two test ports with Ruggedized V (male) Connectors and internal couplers

Accurate, intelligent software automatically reduces connections and calibration time

HFE's MMSNT Calibration Software adapts to unique test port configurations providing the best accuracy with a minimum number of connections. The software has powerful graphic capabilities, 12 port differential parameters, TDR, EyeDiagram, custom macro capabilities, direct link to Excel for fast data processing and data exports as a Touchstone file. Using the MMSNT software in conjunction with the connection matrix, a 12 port measurement system can be calibrated with as few as 16 connections and in as little as 20 minutes!

The calibration software contains internal algorithms and data structures that automatically computes and manages the error coefficients of the multi-port measurement system. Once the multiport connection plan is defined (Figure 1 and Table 1), the software determines the optimum, most efficient connection scheme for calibration of all defined ports. The software automatically:

- Defines the system ports and connector organization
- Describes the proper set of calibration standards
- Optimizes the sequence of calibration standard connections
- Minimizes the number of required connections
- Computes the error coefficients
- De-embeds the measurement data

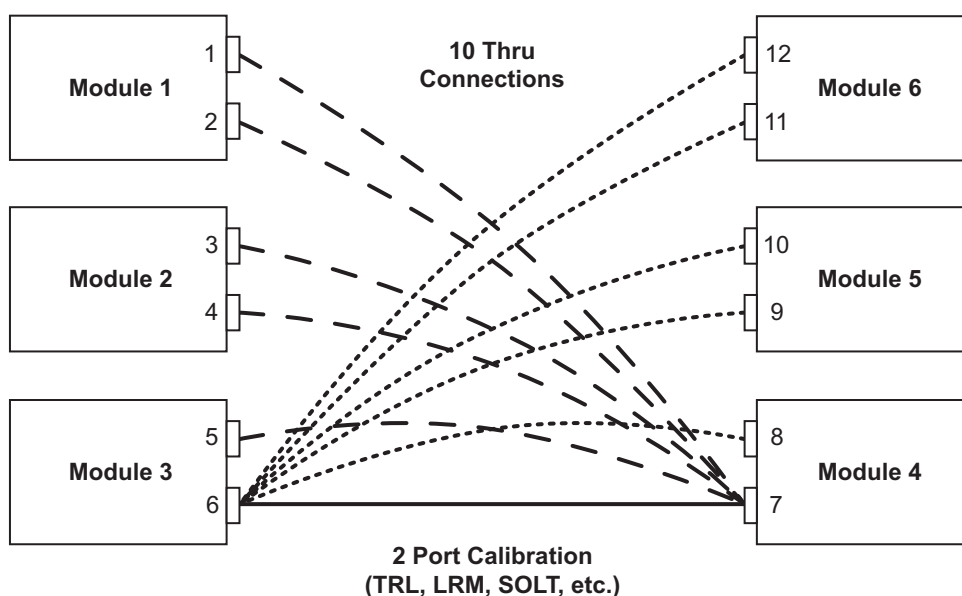
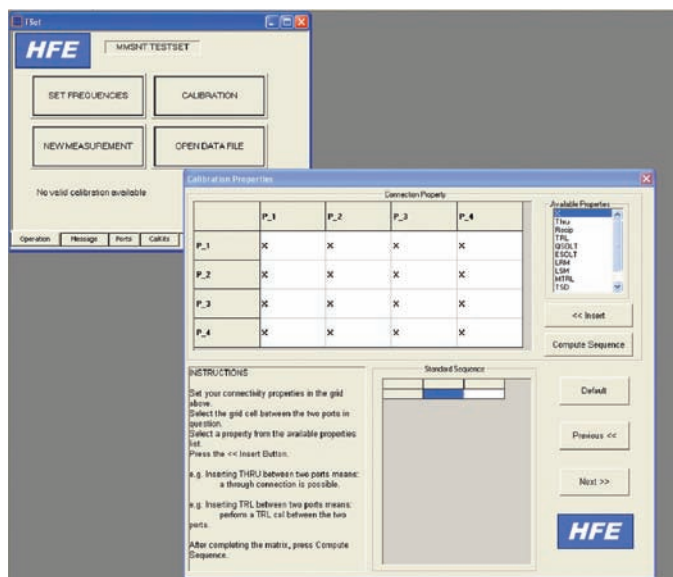


Figure 1. Physical Port Connection Map

Ports	1	2	3	4	5	6	7	8	9	10	11	12
1	-	-	-	-	-	-	Thru	-	-	-	-	-
2	-	-	-	-	-	-	Thru	-	-	-	-	-
3	-	-	-	-	-	-	Thru	-	-	-	-	-
4	-	-	-	-	-	-	Thru	-	-	-	-	-
5	-	-	-	-	-	-	Thru	-	-	-	-	-
6	-	-	-	-	-	-	LRM	-	-	-	-	-
7	-	-	-	-	-	LRM	-	-	-	-	-	-
8	-	-	-	-	-	Thru	-	-	-	-	-	-
9	-	-	-	-	-	Thru	-	-	-	-	-	-
10	-	-	-	-	-	Thru	-	-	-	-	-	-
11	-	-	-	-	-	Thru	-	-	-	-	-	-
12	-	-	-	-	-	Thru	-	-	-	-	-	-

Table 1. The Connectivity Matrix

The Physical Port Connectivity Matrix (Table 1) indicates the intended port connection during the calibration process. In this example, ports 1 through 6 are to be connected via the DUT to ports 7 through 12. It is not intended that ports 1 through 6 are connected to each other. Using the connectivity matrix, the connection path between any port 1 through 6 to any port 7 through 12 can be calibrated by simply applying a 12-term calibration between ports 6 and 7 (in this case LRM) and applying through connections between the remaining ports. If a through connection is difficult to achieve, then an SOLR calibration can be used as an alternative between the ports. The multi port calibration algorithm produces the best sequence of the standards connection and determines the logical mapping of the group ports (Figure 2).

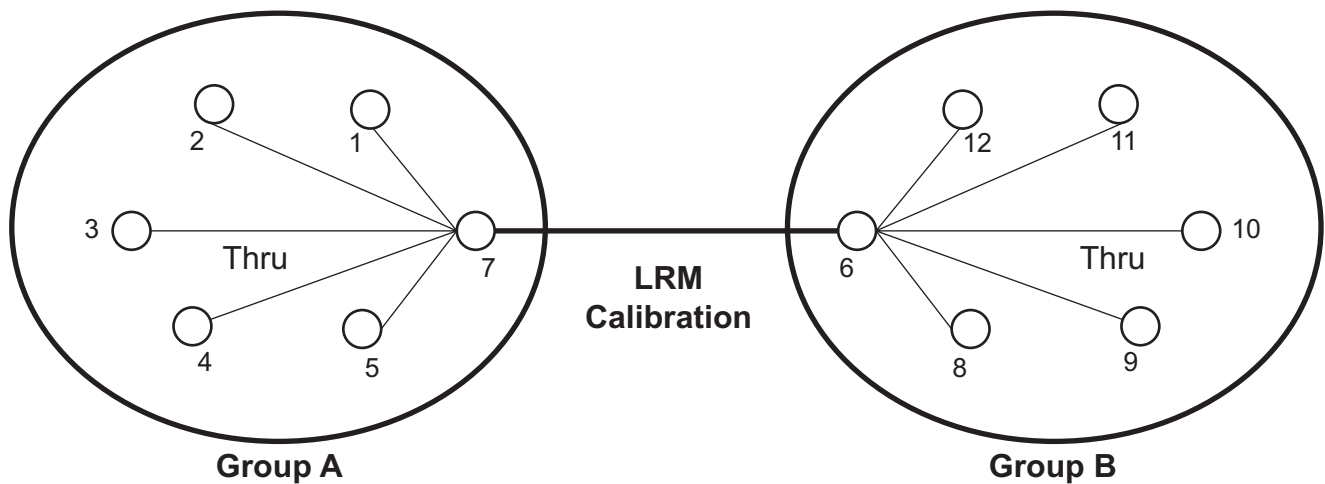


Figure 2. Group mapping of ports during calibrations process

Microwave Multiport Balanced-Differential Block Diagram

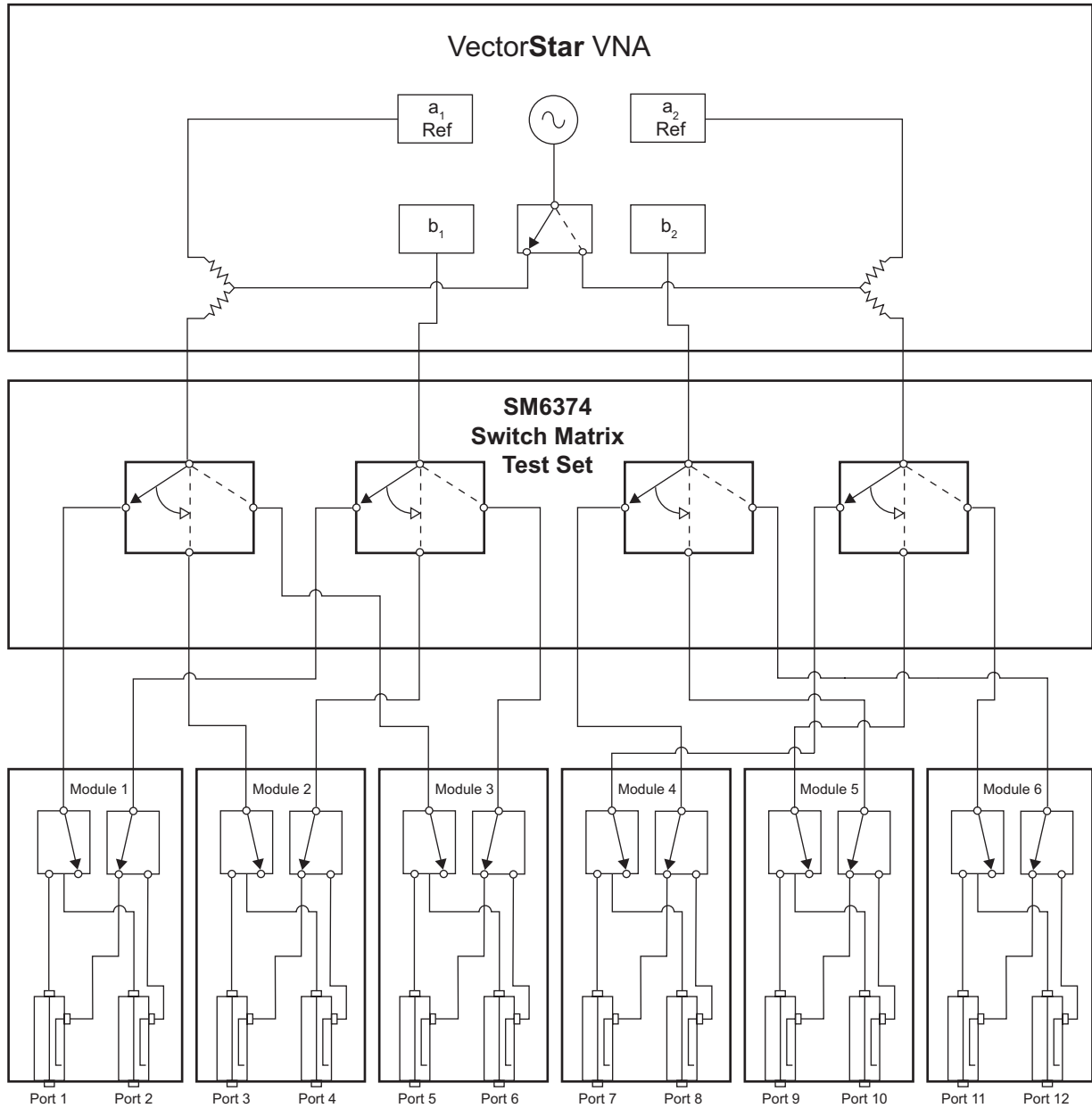


Figure 3. Block diagram of multi-port switching matrix

Unlike traditional multi-port systems, the unique switching matrix (Figure 3) locates the switches behind the couplers thereby ensuring maximum performance of raw directivity and calibration stability.

System Performance and Configuration

SM6374, Interface Module:

One required per system. 19" unit, 3u height. Includes power cord, GPIB cable to VNA, and 4 each semi-rigid V cables (male-male) to VNA. Controlled by an external PC, via GPIB cable, running PAF's MMSNT. The PC and GPIB cables are provided by the customer.

Insertion Loss of Interface Module:

-12 dB max at 60 GHz (-8 dB typical)

SM6272, Port Module:

2 each needed for 4-Port, 4 each for 8-Port, and 6 each for 12-Port solutions. Test Ports are Ruggedized V (male). Test port cables supplied by customer.

Each module includes a control cable. Each module requires 2 each 36" V flexible cables (male-male), SC7543, sold separately, for connection to the SM6271 Interface Module.

Module size: 4.5" height, 5" width, 7" depth.

Insertion Loss of Port Module:

Source Path: -12 dB max at 60 GHz (-10 dB typical)

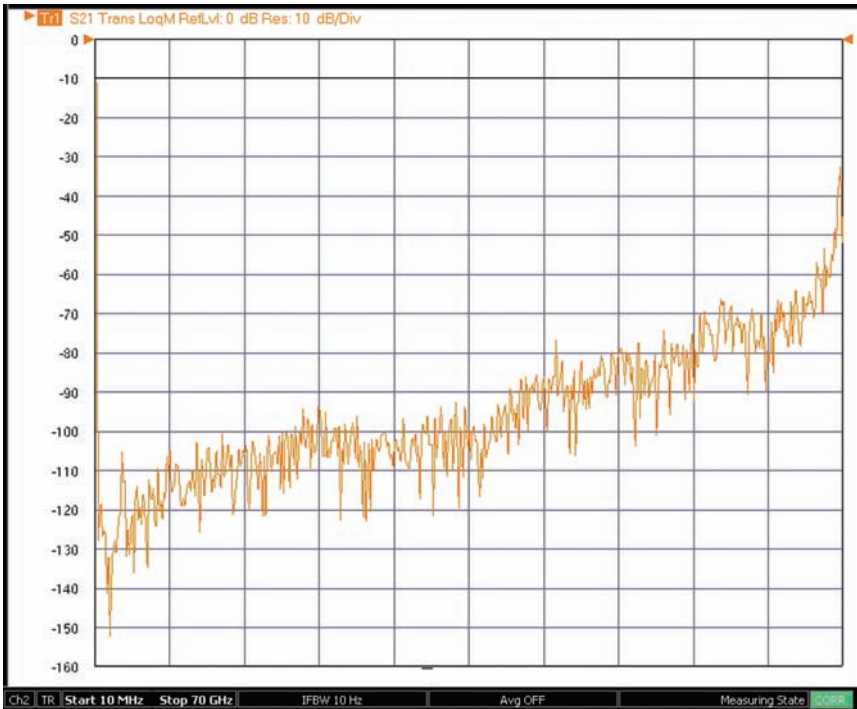
Test (b) Path: -24 dB max at 60 GHz (-22 dB typical)

Overall System Performance* (typical):

Frequency	Port Power (dBm)	Dynamic Range (dBm)**
40 MHz	8	87
2 GHz	10	107
10 GHz	-3	100
20 GHz	-8	90
40 GHz	-10	85
50 GHz	-13	75
60 GHz	-17	65
67 GHz	-25	55

* Based on a system configured with an MS4647A-051.

** Dynamic Range at 10 Hz IFBW and no averages, after Transmission Cal with a Thru adapter and isolation, at max power available, with ports terminated. (RMS)



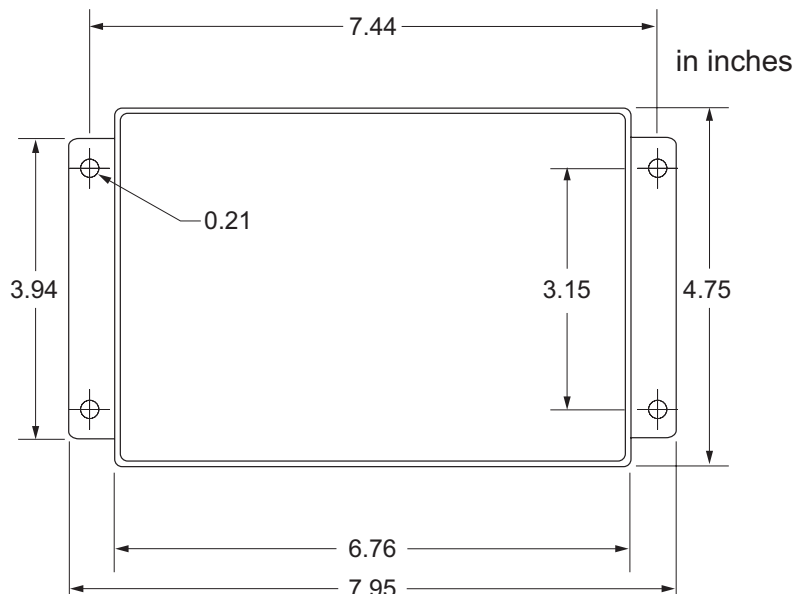
Measured Dynamic Range with conditions specified in System Performance table.

Typical 12-Port System Configurations

MS4647A	1 each	VectorStar VNA, 70 GHz
MS4647A-051	1 each	VNA Direct Access Loops Option
SM6374	1 each	Interface and Switch Matrix Module (includes power cord, GPIB cable, 4 VNA interface cables)
SM6272	6 each	Mobile Port Module, with 2 Ruggedized V Connector test ports (includes control cable)
SC7543	12 each	V(m-m) flexible cable, 36", for connection to interface module (2 needed per SM6272 port module)
SM6340	1 each	MMSNT Measurement software from HFE*

* External PC with GPIB module and GPIB cord supplied by customer.
 HFE also offers a one week on-site training class, followed by one year of phone support.
 This training can only be purchased from HFE at www.hfemicro.ch.
 MMSNT can also be purchased directly from HFE.

Footprint drawing of Mobile Port Module. Each module provides two V Connector test ports and contains the high performance RF switches and couplers for optimum calibration and measurement stability





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