Agilent

N4421BH67 S-Parameter Test Set
10 MHz to 67 GHz

Technical Overview

Expand your 2-port PNA Series network analyzer to a complete 4-port solution

- Compatible with the E8361A Agilent PNA network analyzer
- Solid-state switches for fast and reliable measurement
- Balanced measurement capability
- Control via network analyzer with PNA Option 550

Agilent Technologies
Multiport Measurements — An Introduction

Many of today’s wireless communications and broadband components have four or more ports. These components require multiple connections for complete characterization with a network analyzer. However, time-to-market pressures require that today’s components be tested quickly while maintaining high levels of accuracy and high repeatability to achieve production volumes.

Network analyzer sweep speed is only one factor that contributes to the overall throughput that can be achieved in measuring multiport components. The overall throughput depends on how quickly the component can be connected and the system can transition from one measurement path to the next and process that data. Multiport test sets dramatically reduce overall tune and test times because the DUT only needs to be connected once to test multiple signal paths. Minimizing the number of connections also reduces operator fatigue and lowers the chance of connection to the wrong port. In addition, fewer connections mean less wear on cables, connectors, fixtures, and DUTs. A multiport test set is especially valuable in manufacturing applications where the time required for device connection, handling, and/or configuration is significantly greater than the test time. In these situations, a test set provides a solution that supports operators or part-handlers in increasing throughput.

The Agilent N4421BH67 S-parameter test set, combined with the 2-port E8361A PNA network analyzer and Option 550, offers a complete solution for 4-port measurements.

Features:

• Compatible with Agilent E8361A PNA network analyzer
• Solid-state switches for fast and reliable measurement
• Balanced measurement capability
• Control via network analyzer with PNA Option 550
Agilent’s Physical Layer Test Systems (PLTS) solutions provide the highest accuracy and most comprehensive tool set for model extraction and characterization of single-ended and differential physical-layer interconnects, or balanced-RF and microwave components with frequency coverage up to 67 GHz. These test solutions offer single-ended, balanced, and mixed-mode measurements in both frequency and time-domain, and eye-diagram analysis with a simple to use graphical user interface.

**Features**

- Analyze eye diagram for high bit rates
- Extract RLCG for differential transmission line modeling
- Improve design with spatial resolution of 10.7 ps

For additional PLTS information, please visit: www.agilent.com/find/plts

Multiport applications can quickly increase calibration complexity. Connecting mechanical standards to multiple ports requires intensive operator interaction, which is prone to error. With ECal, a full one- to four-port calibration can be accomplished with a single connection to the ECal module with minimal operator interaction. The operator simply connects the ECal module via a single USB cable to the network analyzer. The network analyzer controls the calibration process. Easy-to-use operation of the multiport system minimizes measurement setup time and results in faster and more repeatable calibrations.

**Features:**

- Fast 2-, 3- and 4-port calibrations up to 67 GHz with a single connection (2-port up to 67 GHz and 4-port up to 20 GHz)
- NIST traceable, accurate calibration
- Direct control via single USB interface
- Reliable solid-state switching
- Reduced connector wear and less error prone (compared to mechanical calibration)
- Nine connector types available and mixed connectors options

For additional Electronic Calibration and ECal information, please visit: www.agilent.com/find/ecal
**System Performance Characteristics**

**N4421BH67 4-port Test Set with PNA**

10 MHz to 67 GHz

*The following characteristics are applicable for a system in the following configuration:

Network analyzer: Agilent E8361A, Option 014
Test set: Agilent N4421BH67
Calibration technique: Four-port SOLT

**Dynamic range**

Transmission measurements at 10 Hz IF bandwidth, with four-port error correction.

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>Dynamic range</th>
<th>Max power</th>
<th>–7 dBm</th>
<th>Max power</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 45 MHz</td>
<td>47</td>
<td>47</td>
<td>–7</td>
<td>–7</td>
</tr>
<tr>
<td>45 to 500 MHz</td>
<td>71</td>
<td>71</td>
<td>–7</td>
<td>–7</td>
</tr>
<tr>
<td>500 to 750 MHz</td>
<td>97</td>
<td>93</td>
<td>–3</td>
<td>–3</td>
</tr>
<tr>
<td>750 MHz to 2 GHz</td>
<td>98</td>
<td>91</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2 to 10 GHz</td>
<td>95</td>
<td>88</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10 to 24 GHz</td>
<td>90</td>
<td>83</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24 to 30 GHz</td>
<td>82</td>
<td>75</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30 to 40 GHz</td>
<td>76</td>
<td>71</td>
<td>–2</td>
<td>–2</td>
</tr>
<tr>
<td>40 to 45 GHz</td>
<td>65</td>
<td>64</td>
<td>–6</td>
<td>–6</td>
</tr>
<tr>
<td>45 to 50 GHz</td>
<td>60</td>
<td>59</td>
<td>–6</td>
<td>–6</td>
</tr>
<tr>
<td>50 to 60 GHz</td>
<td>58</td>
<td>55</td>
<td>–4</td>
<td>–4</td>
</tr>
<tr>
<td>60 to 67 GHz</td>
<td>52</td>
<td>52</td>
<td>–7</td>
<td>–7</td>
</tr>
</tbody>
</table>

**Measurement port characteristics**

Residual uncertainties for corrected data. These apply for 25 °C with less than 1 °C variation from calibration.
### System Performance Characteristics – Continued

<table>
<thead>
<tr>
<th>Calibration kit: N4694A Ecal</th>
<th>Description</th>
<th>45 MHz to 2 GHz</th>
<th>2 to 20 GHz</th>
<th>20 to 40 GHz</th>
<th>40 to 67 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directivity (dB)</td>
<td>50</td>
<td>50</td>
<td>44</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Source match (dB)</td>
<td>38</td>
<td>39</td>
<td>34</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Load match (dB)</td>
<td>37</td>
<td>38</td>
<td>33</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Refl. tracking (mag)</td>
<td>0.040</td>
<td>0.040</td>
<td>0.060</td>
<td>0.090</td>
<td></td>
</tr>
<tr>
<td>Refl. tracking (phase)</td>
<td>0.264</td>
<td>0.264</td>
<td>0.396</td>
<td>0.594</td>
<td></td>
</tr>
<tr>
<td>Trans. tracking (mag)</td>
<td>0.071</td>
<td>0.060</td>
<td>0.133</td>
<td>0.339</td>
<td></td>
</tr>
<tr>
<td>Trans. tracking (phase)</td>
<td>0.469</td>
<td>0.397</td>
<td>0.881</td>
<td>2.238</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calibration Kit: 85058B</th>
<th>Description</th>
<th>45 MHz to 2 GHz</th>
<th>2 to 20 GHz</th>
<th>20 to 40 GHz</th>
<th>40 to 67 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directivity (dB)</td>
<td>35</td>
<td>38</td>
<td>37</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Source match (dB)</td>
<td>34</td>
<td>40</td>
<td>42</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Load match (dB)</td>
<td>35</td>
<td>37</td>
<td>36</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Refl. tracking (mag)</td>
<td>0.019</td>
<td>0.033</td>
<td>0.020</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td>Refl. tracking (phase)</td>
<td>0.125</td>
<td>0.218</td>
<td>0.132</td>
<td>0.198</td>
<td></td>
</tr>
<tr>
<td>Trans. tracking (mag)</td>
<td>0.098</td>
<td>0.060</td>
<td>0.072</td>
<td>0.129</td>
<td></td>
</tr>
<tr>
<td>Trans. tracking (phase)</td>
<td>0.649</td>
<td>0.398</td>
<td>0.472</td>
<td>0.850</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calibration Kit: 85058E</th>
<th>Description</th>
<th>45 MHz to 2 GHz</th>
<th>2 to 20 GHz</th>
<th>20 to 40 GHz</th>
<th>40 to 67 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directivity (dB)</td>
<td>30</td>
<td>30</td>
<td>28</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Source match (dB)</td>
<td>28</td>
<td>27</td>
<td>24</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Load match (dB)</td>
<td>30</td>
<td>30</td>
<td>27</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Refl. tracking (mag)</td>
<td>0.023</td>
<td>0.029</td>
<td>0.052</td>
<td>0.055</td>
<td></td>
</tr>
<tr>
<td>Refl. tracking (phase)</td>
<td>0.152</td>
<td>0.191</td>
<td>0.343</td>
<td>0.363</td>
<td></td>
</tr>
<tr>
<td>Trans. tracking (mag)</td>
<td>0.180</td>
<td>0.186</td>
<td>0.296</td>
<td>0.481</td>
<td></td>
</tr>
<tr>
<td>Trans. tracking (phase)</td>
<td>1.187</td>
<td>1.227</td>
<td>1.955</td>
<td>3.174</td>
<td></td>
</tr>
</tbody>
</table>

### Test set typical performance

- **Frequency range**: 10 MHz to 67 GHz
- **Transition time (10 to 90%)**: 10.7 ps
- **Impedance**: 50 Ohms (nom)
- **Maximum operating level**: +20 dBm
- **Damage level**: +30 dBm
- **Test port connectors**: 1.85 mm (m)
- **RF connectors**: 1.85 mm (f)
- **Weight**: 9 kg
Microwave 4-port Block Diagram

2-port E8361A PNA network analyzer utilizing the 2-port N4421BH67 Test Set.

N4421BH67 block diagram.
Configuration Options for N4421BH67 Test Set (10 MHz to 67 GHz)

Recommended network analyzers:

E8361A PNA Network Analyzer with Option 014 and 550
Highest performance network analyzer with capabilities for advanced applications.

Options descriptions:

Option 014:
Provides front panel access to source output, receiver inputs and couplers to configure a custom test set. Compatible network analyzers: E8361A

Web Resources

The N4421BH67 S-parameter test set is one of many Agilent multiport solutions from 2 to 16 ports.

Agilent multiport solutions are designed to test a variety devices; from simple duplexers, for both front-end passive and active and wireless infrastructure components, to more complex integrated modules. These solutions optimize key hardware, firmware, and software features, which provide the best accuracy with the convenience of multiport connections and electronic calibration to achieve exceptionally fast measurement speeds.

*For a complete list of Agilent multiport solutions, view or download the “Agilent Test Solutions for Multiport and Balanced Devices” Selection Guide (literature number 5988-2461EN) from our Web site.

Visit our Web sites for additional application and product information:

*Multiport Measurements
www.agilent.com/find/multiport

PNA and PNA-L Network Analyzers
www.agilent.com/find/pna

Electronic Calibration Modules (ECal)
www.agilent.com/find/ecal
Remove all doubt

Our repair and calibration services will get your equipment back to you, performing like new, when promised. You will get full value out of your Agilent equipment throughout its lifetime. Your equipment will be serviced by Agilent-trained technicians using the latest factory calibration procedures, automated repair diagnostics and genuine parts. You will always have the utmost confidence in your measurements.

Agilent offers a wide range of additional expert test and measurement services for your equipment, including initial start-up assistance onsite education and training, as well as design, system integration, and project management.

For more information on repair and calibration services, go to www.agilent.com/find/removealldoubt

www.agilent.com

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

Phone or Fax

United States:
(tel) 800 829 4444
(fax) 800 829 4433

Canada:
(tel) 877 894 4414
(fax) 800 746 4866

China:
(tel) 800 810 0189
(fax) 800 820 2816

Europe:
(tel) 31 20 547 2111

Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Korea:
(tel) (080) 769 0800
(fax) (080) 769 0900

Latin America:
(tel) (305) 269 7500

Taiwan:
(tel) 0800 047 866
(fax) 0800 286 331

Other Asia Pacific Countries:
(tel) (65) 6375 8100
(fax) (65) 6755 0042
Email: tm_ap@agilent.com
Revised: 09/14/06

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

© Agilent Technologies, Inc. 2006
Printed in USA, September 20, 2006
5989-5661EN

Remove all doubt

www.agilent.com/find/removealldoubt