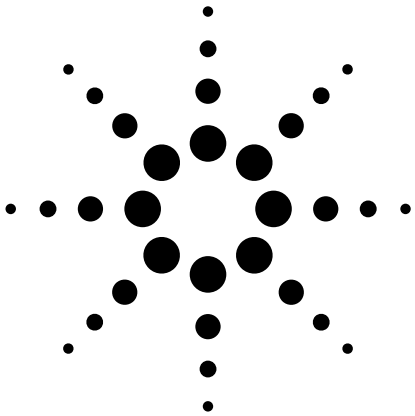

Comparing the Agilent 8703A & 8703B 20 GHz Lightwave Component Analyzers

Agilent Technologies

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Introduction

The purpose of this white paper is to provide detail into the many differences between the Agilent 8703A and the Agilent 8703B 20 GHz lightwave component analyzers.

The 8703A was a truly remarkable instrument for its time. It pushed the envelope in measurement capability, giving the optical scientist or engineer the ability for the first time to make calibrated frequency modulation domain measurements on optical devices. The 8703A made use of the best technology available. It could perform calibrated optical, electrical and unique electro-optical measurements, such as receiver and transmitter slope responsivity tests.

As devices moved from the laboratory to the manufacturing line, where the demands on a test instrument changed from one of careful characterization to that of accelerated and continuous testing, it became apparent that the capability of the 8703A was limited. Hence the need for a new generation instrument was recognized. The Agilent 8703B improves on the measurement capability of its predecessor, while focusing on the needs of the state of the art manufacturing environment.

A list of the 8703B improvements that are described more fully includes:

- Specified performance
- Improved measurement stability and repeatability
- Overall accuracy improvement
- Improved product reliability
- Robust GPIB programmability
- Backward compatible firmware
- Measurement sequencing
- Longer support life
- Access to the internal laser
- Four channels
- Wider bandwidth
- Five markers
- Limit lines
- Verification kit

Specified performance

The architecture of the 8703A did not permit performance levels to be fully specified. While adequate for characterizing device performance, the instrument could not be used to guarantee performance. This meant that as the instrument was used more and more in the manufacturing environment some limitations became apparent as tests at times had to be repeated.

The design of the 8703B allows the performance of the instrument to be specified. The calibration of the internal photodiode is traceable to NIST. All of the optical components in the test set which include the photodiode, the laser and the modulator, are temperature compensated. The instrument can now be specified to perform within guaranteed limits. The details of the architecture can be seen in the block diagram in Figure 1.

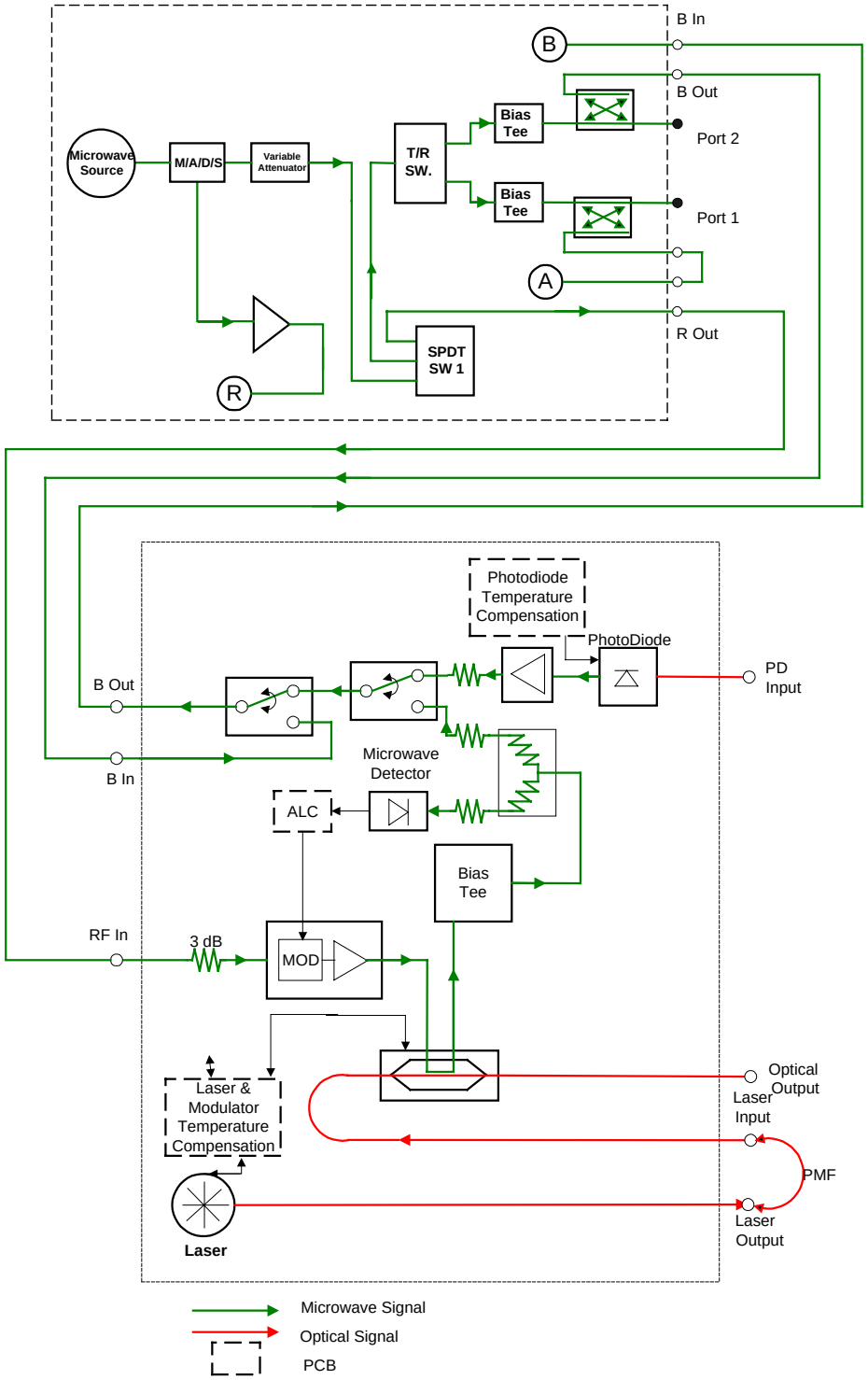

Figure 1. Agilent 8703B block diagram.

Improved measurement stability and repeatability

The 8703A was subject to variations in performance caused by the thermal rise in system devices, as well as variations in ambient temperature. This resulted in potentially non-repeatable measurements over time and between instruments and workstations. Consequently, performance parameters on the 8703A could not be specified, only characterized or described as typical. The 8703B, with its improved architecture incorporating internal connections between systems and components, as well as temperature compensation feedback circuitry, can maintain guaranteed measurement performance from day to day. Therefore, the key parameters of the 8703B are specified, resulting in high measurement repeatability from device to device, from day to day, within the specified limits and operating conditions[1]. The characterized performance of the device will be similar from instrument to instrument. This can be seen from Figure 2, which shows the worst case instrument-to-instrument repeatability for an E/O measurement made on the 8703B.

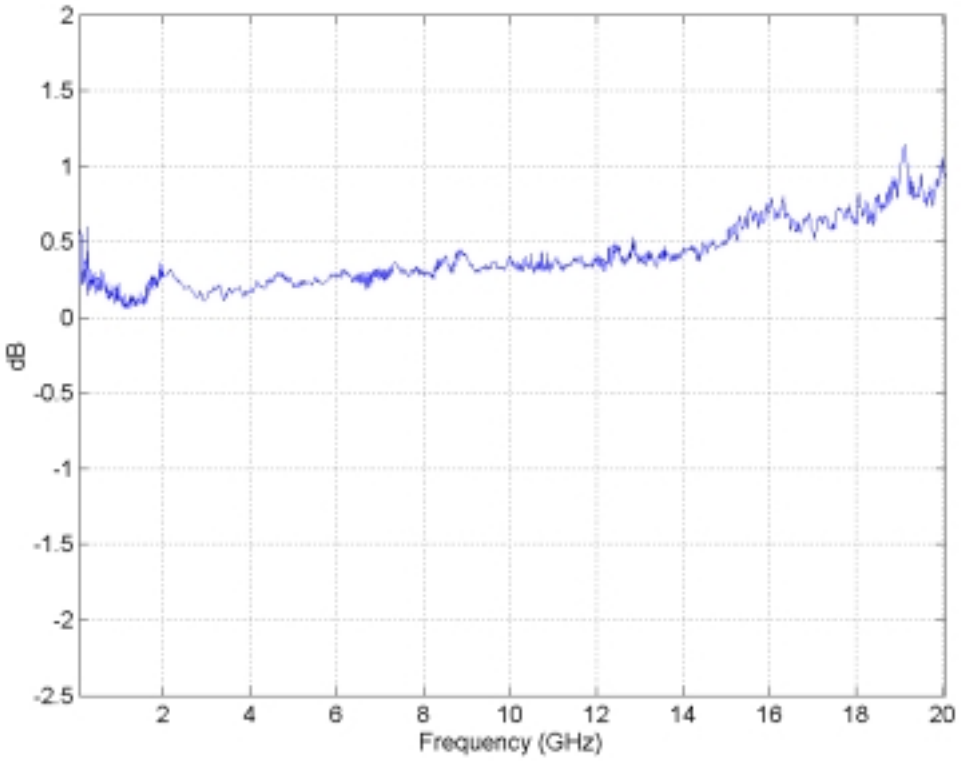

Figure 2. 8703B E/O Port 1 Characteristic Pk-to-Pk Repeatability

Overall accuracy improvement

With the improvements in the design of the components and in the architecture of the system, and by doubling the trace data points from 801 to 1601, the accuracy of the 8703B system performance has been greatly enhanced over that of the 8703A.

[1] These operating conditions can be found in the 8703B Technical Specifications

Improved product reliability

When the 8703A was designed, many of the components were called upon to perform at the upper end of their capability. This resulted in a high degree of manual alignment for the optical test set. Improved 8703B manufacturing processes result in an increased reliability due to lower touch time and more extensive automated testing of performance parameters. Therefore, the annualized predicted failure rate for the 8703B is less than half that of the 8703A.

Robust GPIB programmability

Because the 8703A was designed for a lab environment where manual measurements are more the rule, the programmability of the 8703A was limited. Time-consuming programming techniques were often used to circumvent these limitations. These techniques, however, generally slowed the device throughput rate of the instrument.

The 8703B incorporates robust GPIB programmability into the system firmware. The 8703B has been run through many programming stress tests that have pushed the limits of the instrument without failure. These tests were performed at Agilent under an extensive software quality control process and were also run at several customer sites.

Backward compatible firmware

The 8703B firmware is backward compatible with the of 8703A. This allows the 8703A user to port all of the code used to automate 8703A tests over to the 8703B. This conversion has been tested by both Agilent and by several 8703A users who have taken the 8703A software and applied it directly to the 8703B with no adverse affects. In fact, test throughput rates were improved when the techniques used in circumventing the limitations of the 8703A were removed from the code.

Measurement sequencing

The 8703A had an interface that would guide the user through the calibration process. The 8703B does not have this, instead it uses a traditional model of menu-driven calibration. A noted improvement in the 8703B, however, is its measurement sequencing capability. This feature gives the instrument the ability to memorize the steps the user is taking to, for example, calibrate the instrument. Included in these capabilities is a pause step that allows the user to change connections while the instrument waits. A sequence can be saved as an instrument state or called from within an automated routine.

Longer support life

The 8703A was based on the 8720B, a now obsolete network analyzer. Many of the components within the 8703A optical test set itself are obsolete as well. The 8703B is based on the more modern 8720ES network analyzer. This analyzer, as well as the components contained within the optical test set, will have a longer support life.

Access to internal laser

The 8703A gave the user the ability to input an external laser to the internal modulator, as does the 8703B. The 8703B, however, has an additional optical port that gives the user direct access to the internal laser. Because this is a direct path, there is no insertion loss due to the internal modulator or other optical

components. This results in improved E/O measurements for such devices as modulators, which do not utilize the 8703B internal modulator for accurate measurements.

Four channels

With the ability to make measurements on four channels rather than the two available on the 8703A, the 8703B gives the user the capability to make several measurements simultaneously, thus enhancing device throughput.

Wider bandwidth

The bandwidth of the frequency has been increased from the .13 to 20 GHz on the 8703A, to the .05 to 20.05 GHz on the 8703B.

Markers and limit lines

The number of markers has been increased from the two on the 8703A to five on the 8703B. The user can now add markers for comparing amplitude versus frequency beyond the traditional 3 dB bandwidth point, which also has been made easier to use on the 8703B through a dedicated soft key on the marker menu.

A new feature on the 8703B is limit line capability, which can be automated, allowing the user to quickly see in or out specification conditions.

Other improvements

The 8703B has wider and more capable printer support. A VGA port is available in the back for use with external monitors.

Verification kit

The N1011A verification kit is an important new accessory available for the 8703B. The 8703A did not have a verification kit. This kit includes a "golden" 83440C photodiode that is shipped with factory-measured amplitude data. The device is used to verify proper operation of the 8703B and to indicate when recalibration of the instrument is needed. A single N1011A kit can be used to verify multiple 8703B instruments at the same site.

8703A capability not on the 8703B

Time Domain

The 8703B does not have the capability to make time domain measurements, as the 8703A did. It is possible that this feature may be included in future revisions of the firmware.

Optical Coupler

The 8703B does not have an internal optical coupler. Agilent has an external optical coupler that can be used to make reflection measurements.

1310 nm laser

The 8703B does not currently have a 1310 nm laser. This option will be available shortly.

Conclusion

While the 8703A was a groundbreaking analysis instrument when first introduced, the demands of today's manufacturing environment require a more accurate and more robust test instrument. Designed specifically to meet these manufacturing test requirements, the 8703B retains the Agilent passion for measurement accuracy. With specified accuracy and defined repeatability, the 8703B is a general-purpose instrument that improves the overall cost of test for the component manufacturer.

Upgrading from the 8703A to the 8703B

If you currently have an 8703A and would like to upgrade to an 8703B, contact your Agilent sales representative.

By internet, phone, or fax, get assistance with all your test & measurement needs.
Online assistance:
www.agilent.com/comms/lightwave

www.agilent.com/find/emailupdates
Get the latest information on the products and applications you select.

Phone or Fax
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