APPLICATION NOTE 299

TEGAM

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Comparing the TEGAM 8850 Attenuation Measurement System to the HP (Agilent) 8902A

When it comes to attenuation measurement, there are two instruments that lead the field in commercial off-the-shelf solutions…the discontinued Hewlett-Packard (HP) 8902A and the TEGAM 8850 formerly manufactured by Weinschel. Both of these instruments have enjoyed success in the production test and calibration environments by offering users various levels of speed, accuracy and range. However, the HP 8902A has been recently discontinued and many are seeking newer, faster, more accurate and less expensive solutions and there are none available from Agilent Technologies. TEGAM's 8850 system fills this need.

The TEGAM 8850 Attenuation Measurement System consists of a Model VM-7 Precision 30 MHz Receiver, an 8852 Frequency Converter, and an 8853 Frequency Converter. The VM-7 is the actual attenuation measuring device so it can be used without the 8852 or the 8853, but its frequency is limited to 30 MHz. The output frequency of both the 8852 and 8853 is 30 MHz. The 8852 has a 10 MHz to 18 GHz frequency range and the 8853 has an 18 GHz to 40 GHz range; so combining these instruments with the VM-7 creates a 10 MHz to 40 GHz attenuation measurement system. The 8850 is also available without the 8853 as a 10 MHz to 18 GHz attenuation measurement system.

The HP 8902A Measuring Receiver is a multifunctional instrument for characterizing signal generators. The 8902A has a frequency range of 150 kHz to 1.3 GHz, but for attenuation measurements its range is 2.5 MHz to 1.3 GHz. It also requires an 11722A Sensor Module to detect power. The Sensor Module has a thermocouple power sensor built into it for detecting RF power levels and must be calibrated like an RF power sensor. An 11792A Sensor Module can be used with an 11793A Microwave Converter in place of the 11722A to measure signals in the 50 MHz to 26.5 GHz range. The 11793A down converts the frequency of the 50 MHz to 26.5 GHz signal to a frequency in the 150 kHz to 1.3 GHz range.

Here are some comparisons between the two systems:

Frequency Range: The TEGAM 8850 has a greater frequency range than the HP 8902A.

	TEGAM 8850	**HP8902A**
Min. Frequency	10 MHz	2.5 MHz
Max. Frequency	40 GHz	26.5 GHz*

Power Range: The power range of the TEGAM 8850 exceeds that of the HP 8902A.

	TEGAM 8850	**HP 8902A**
10 to 300 MHz	0 to –103 dBm	0 to –100 dBm
300 to 1000 MHz	0 to –112 dBm	0 to –100 dBm
1 to 12.5 GHz	0 to –117 dBm	+5 to –80 dBm*
12.5 to 18 GHz	0 to –117 dBm	+5 to –75 dBm*

* With the 11792A Sensor Module and 11793A Microwave Converter

Accuracy at 30 MHz: The TEGAM VM-7 is more accurate than the HP 8902A.

	TEGAM VM-7	**HP8902A**
0 to –100 dBm	+/-0.02 dB per 10 dB	+/-0.03 dB per 10 dB
-100 to -110 dBm	+/-0.04 dB per 10 dB	N/A
-110 to -120 dBm	+/-0.12 dB per 10 dB	N/A

Attenuation Measurement Speed: The TEGAM 8850 is dramatically faster than the HP 8902A. One of the disadvantages of the 8902A is that it has three internal ranges associated with its measurement process. At each transition point, the junction must be characterized, or calibrated, prior to making a measurement. This characterization process must be done for every single measurement of interest. Though this calibration need only be done once for several hours of measurement time, the user must download cal factors for each measurement frequency each time a measurement is made. In comparison, the 8850 has one range and requires only a button push to acquire a reference before starting the measurement.

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Tests measuring three different attenuators at a single discrete frequency resulted in the following time comparisons:

UUT Value (dB)	8850 (sec)	8902A (sec)
10	10.0	15.5
30	10.0	53.5
70	10.0	90.3

Then each attenuator was tested at 6 discrete frequencies; here are some of the total testing times:

UUT Value (dB)	8850 (sec)	8902A (sec)
10	60	93
70	60	542

Horizontal Versus Vertical Functional Design: The TEGAM 8850 is horizontally oriented when it comes to its measurement functionality. An instrument with horizontal functionality is designed to measure a particular parameter at many different points. The parameter in this case is attenuation and the points are frequencies. The HP 8902A, on the other hand, is vertically oriented. An instrument with vertical functionality is designed to measure several parameters at a single point. The 8902A was designed to characterize signal generators at a particular frequency and one of those characteristics happens to be attenuation. The 8902A is a very effective device for characterizing signal generators, but attenuators are usually characterized at several frequencies. The TEGAM 8850 was designed specifically to measure attenuation at many different frequencies making it better suited for calibrating all types of attenuators.

Programmability for Remote Control: The 8850 was designed to calibrate attenuators efficiently and accurately via the front panel and over the GPIB bus. The 8850's programming command set is designed to take advantage of the 8850's speed and accuracy by completing multiple measurement steps for every command. In contrast, the 8902A's command set is designed to duplicate any-and-all front panel controls. This causes large numbers of command lines and huge files just to program the 8902A for very basic measurements.

The 8850 is simpler and easier to control remotely; there is less code required and, thus, faster integration time.

Summary: The TEGAM 8850 was designed to make attenuation measurements quickly and accurately. Due largely to its hardware design and the simplicity of its user-programming interface, the 8850 is extremely productive in automated applications. The 8850 is much faster that the 8902A even when used in the manual mode. The 8850 has a wider dynamic range than the 8902A and is more precise in its measurements. Because of these capabilities, the 8850 is a viable alternative to the 8902A for precision measurement of attenuation, gain, amplifier compression, return loss and linearity. Contact TEGAM at 440-466-6100 or visit our website at www.tegam.com for more information.

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