

Agilent N1913/1914A EPM Series Power Meter

Technical Overview

Introduction

Agilent Technologies is introducing the new N1913/1914A EPM Series power meter. It is a replacement for the E4418/4419B EPM Series power meter, and is based on the N1911/1912A power meter platform.

The N1913/1914A offers all average measurement capabilities, comparable to those of the E4418/4419B. However, the N1913/1914A is equipped with a faster digital signal processor (DSP) and microprocessor. Therefore, the N1913/1914A provides better performance than the E4418/4419B. One of the improvements is the measurement speed. When operated with Agilent E-Series power sensors, the N1913/1914A is able to achieve measurement speed up to 400 readings/second, compared to only 200 readings/second on the E4418/4419B.

The N1913/1914A provides enhanced features such as four-channel power measurement (with two additional Agilent USB power sensors connected to the USB master inputs), more connection flexibility (USB slave and LAN [LXI-Class C], on top of the existing GPIB), VGA video output, and smart battery pack.



Figure 1. N1913A and N1914A EPM Series power meters

Key Specifications and Features

- Frequency range: 9 kHz to 110 GHz (sensor dependent)
- Power range: -70 dBm to $+44$ dBm (sensor dependent)
- Agilent E441x, E930x, 848x, N848x, and U2000 Series USB power sensors compatibility
- Up to four channels for power measurement (with optional USB host)
- Up to 400 readings/second measurement speed with Agilent E-Series power sensors
- Instrument I/O connectivity such as GPIB, USB, and LAN (LXI-Class C)
- High-resolution color LCD display
- Automated frequency/power sweep measurement with optional trigger in/trigger out
- Smart battery pack



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N1913/1914A Operation Overview

The N1913/1914A operation block diagram shown in Figure 2 is applicable to all Agilent power meters. The meter works with both thermocouple and diode detector mounts, providing accurate RF average power measurement. The sensor converts the high frequency power to a DC or low frequency signal that the meter can then measure and relate to a certain RF power level.

The DC or low frequency signal from the sensor will be chopped, amplified in AC-coupled system, and sent to the meter through the sensor cable. This process is necessary because it is difficult to transmit the DC signal across the cable, as the external DC noise will be easily coupled into the original signal. The chopper and AC amplifier are embedded in the sensor itself. In the meter, the chopped signal is synchronously detected, de-chopped, and amplified again. The calibrator precisely calibrates the signal measured by the meter to a power reference level.

The signal is fed into one of the multi-path blocks after the calibration process. Since most of the Agilent power sensors come with multi-path design, the low path and high path require different gain adjustments for accurate signal measurements. The signal will then be routed to data acquisition where the analog-to-digital converter (ADC) will execute the digital sampling. The essential measurement task is mostly done by the DSP. The microprocessor is the heart of the whole power meter operation, supervising not only data acquisition portion but also all the external interfaces (such as keypad input) and connectivity (remote communication and external triggering).

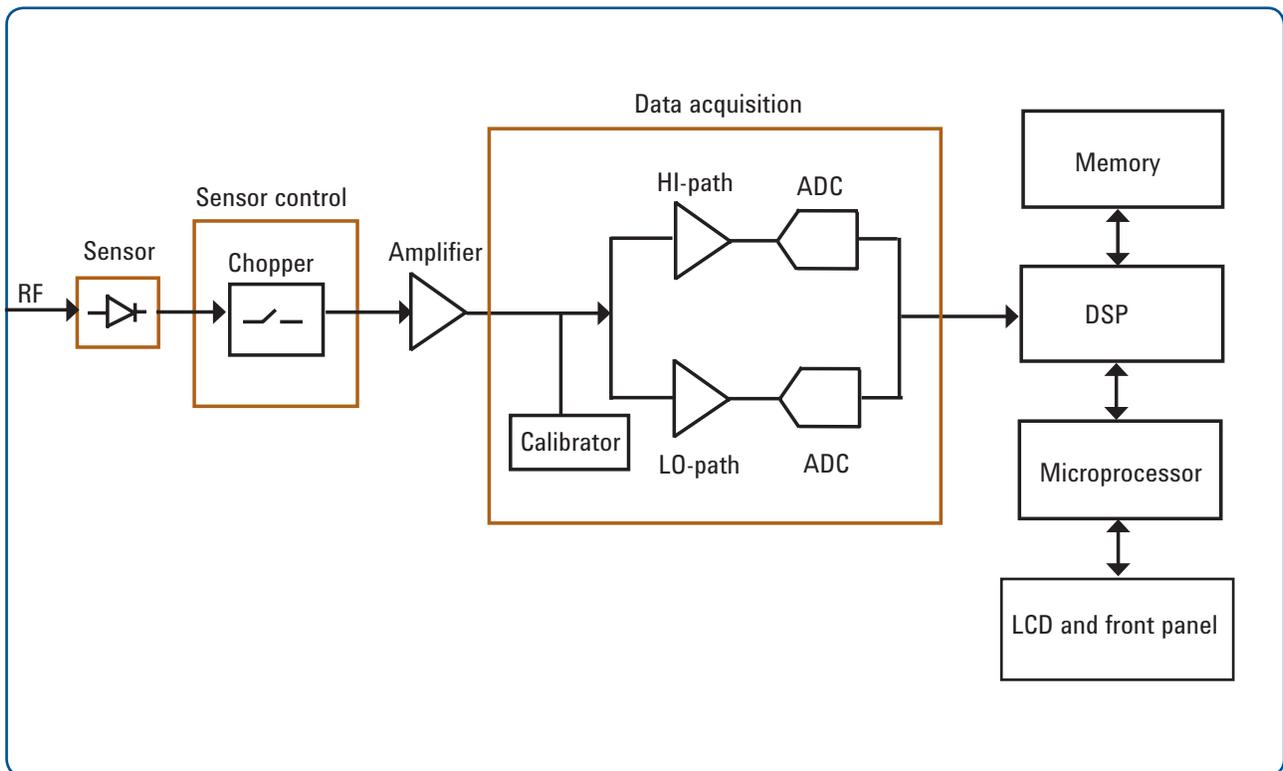


Figure 2. Operation block diagram of N1913/1914A

Faster Measurement Speed

High measurement speed is essential in high-volume manufacturing of RF and microwave components and systems. Faster testing time will improve your productivity by enabling you to test more devices in a shorter time.

Like all the Agilent power meters, there are three types of measurement speed settings for N1913/1914A: normal (by default), double (x2), and fast. In normal and double modes, full sensor functionality is available. In fast mode, averaging limits are disabled and set to 1 that allows fast measurement with uncompromised accuracy.

When the N1913/1914A operates with the E9300 or E4410 Series power sensors, the maximum achievable measurement speed is 400 readings/second in fast mode. The E4418/4419B can only achieve up to 200 readings/second. See Table 1 for specific comparisons of measurement speed.

Because of the SCPI backward compatibility, the same SCPI command for fast measurement mode can be used between the N1913/1914A and the E4418/4419B. Therefore, the N1913/1914A can be used directly by current E4418/4419B users without needing software recoding. For example, using the SCPI command of `SENS1 : SPE 200` sets the measurement speed on Channel 1 to 200 readings/second. But in reality, the N1913/1914A can achieve up to 400 readings/second in fast measurement mode while the E4418/4419B achieves 200 readings/second only.

Table 1. Measurement speed comparison between N1913/1914A and E4418/4419B

Power Sensor	Measurement Speed (readings/second)					
	E4418/4419B			N1913/1914A		
	Normal	x2	Fast	Normal	x2	Fast
8480 Series	20	40	-	20	40	-
N8480 Series	20	40	-	20	40	-
E9300 Series	20	40	200	20	40	400
E4410 Series	20	40	200	20	40	400
U2000 Series	-	-	-	20	40	110

Four-Channel Power Measurement

The new N1914A supports up to four channels for power measurement. There are two optional add-on channels for use with the Agilent U2000 Series USB power sensors in addition to the two channels for conventional Agilent power sensors. The additional two USB power sensors can be connected to the front and rear panel USB ports of the N1913/1914A.

The N1914A is able to display four power measurement (average only) readings if all four channels are connected with power sensors. By default, the power meter will display Channel A on the upper window and Channel B on the lower window when two sensors are connected to the meter. Channel C and Channel D will be displayed when the two USB power sensors are connected to the meter. The meter also can measure and display mathematical results from any channel, such as A/B and B/C. This feature is especially useful when the user needs to directly obtain the values of parameters such as gain, return loss, and other network-analysis measurements.

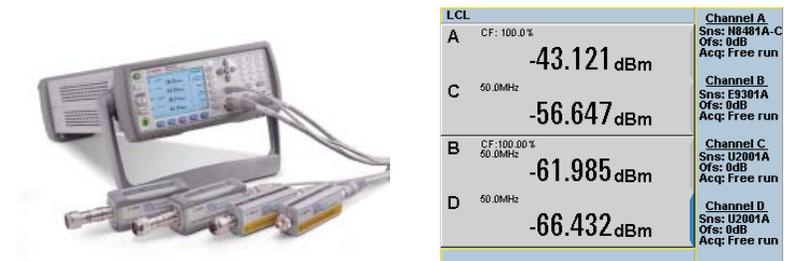


Figure 3. Four-channel setup on N1914A (with two additional USB power sensors)

One of the application examples for multiple-channel power measurement is the two-port load-pull system shown in Figure 4. Channel A shows the incident power to the device under test (DUT), Channel B represents the reflected power, and Channel C shows the output power from the DUT. While monitoring all the power measurement results on the meter (Channels A, B, and C), the output tuner is adjusted until the reflected power is zero (Channel B). The gain and the power-added efficiency (PAE) can then be directly measured and displayed on the meter.

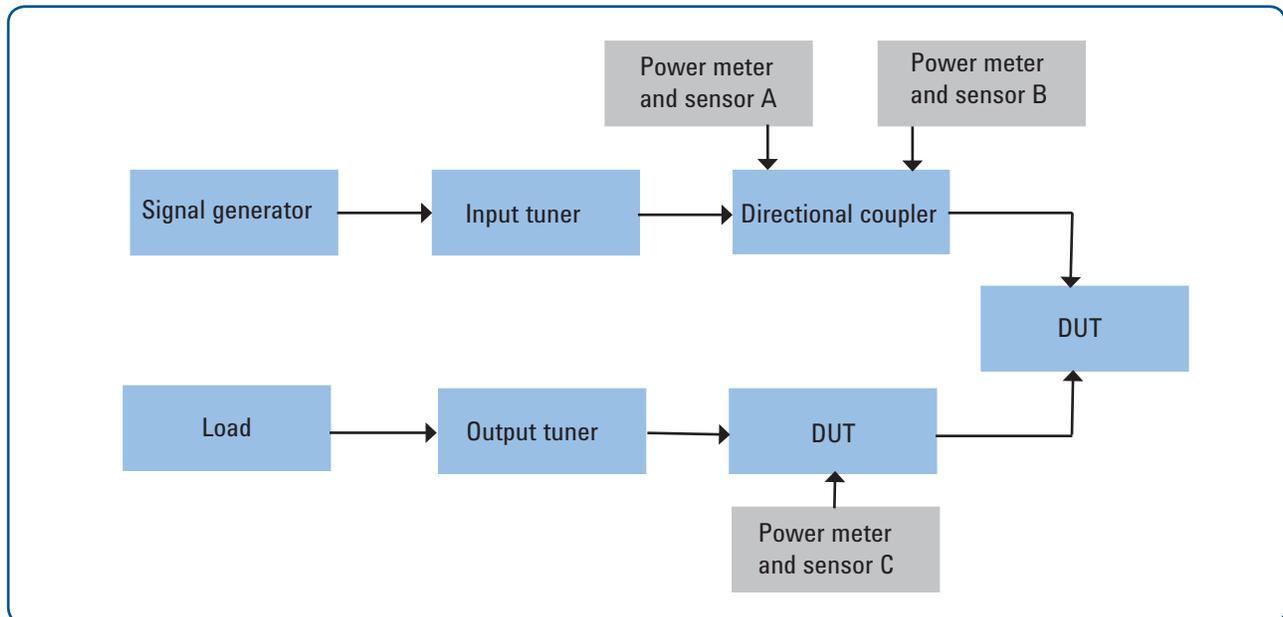


Figure 4. Typical load-pull application with three channels of power measurement

Smart Battery Pack

Like the E4418/4419B, the N1913/1914A also comes with a battery pack option, allowing users to take measurements in remote areas where AC outlets are not available. The battery pack used in the N1913/1914A is a smart-type battery capable of communicating with the FPGA system and the smart battery's charger controller. The battery pack uses a system-level approach to optimize the performance of the battery. There are additional safety features such as protection from over-charging and over-discharging as well as passive safety devices for short-circuit and thermal protection.

The new battery pack also has one-push-button activation with an LED indicator (as shown in Figure 5) that displays information about battery capacity without requiring the user to turn on the power meter.



Figure 5. Smart battery's one-push button on N1913/1914A (optional)

The indicator is a four-level LED system, with each level representing different battery power capacity as shown in Table 2.

Table 2. LED power level indicator provides information about battery capacity

Battery Capacity	LED Indicator				Remarks
	1	2	3	4	
10% or below	Red				Blinks for 3 seconds
10% to 25%	Green				Lit for 5 seconds
26% to 50%	Green	Green			Lit for 5 seconds
51% to 75%	Green	Green	Green		Lit for 5 seconds
76% to 100%	Green	Green	Green	Green	Lit for 5 seconds

For the single-channel N1913A, the operation duration of the battery pack is 330 minutes with backlight off and 210 minutes with backlight on. The maximum charging time of the battery pack is approximately two hours when the N1913/1914A is in standby mode with the AC power connected.

Faster Frequency/ Power Sweep Measurement

Frequency/power sweep measurement is typically used to achieve flatness calibration of signal sources. The signal source can be simply the signal generator. In conventional applications, users must manually change the frequency/power of signal source before the measurement is taken and displayed on the front panel of the meter. The setup process is very tedious and time-consuming. An N1913/1914A optional feature utilizes the physical external trigger in/trigger out (via BNC cables) for both power meter and signal generator to reduce the testing time dramatically.

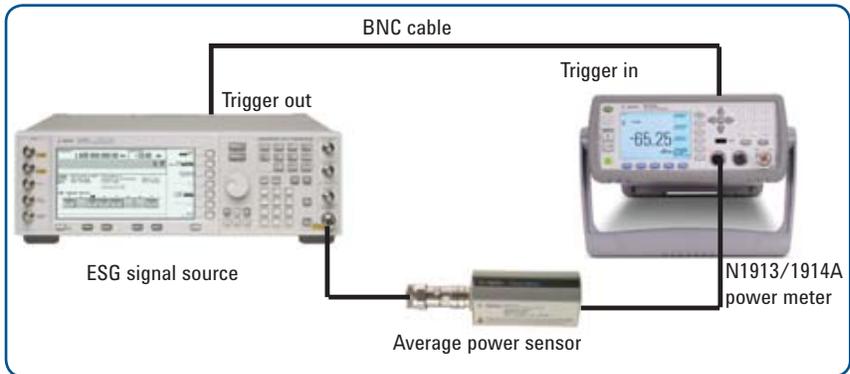


Figure 6. N1913/1914A frequency/power sweep measurement setup with the Agilent E4438C ESG signal source

A setup example is shown in Figure 6, where the N1913/1914A is connected to Agilent E4438C ESG signal source. The trigger out of the signal source is connected to the trigger in of the power meter. The trigger out of the power meter is connected to the trigger in of the signal source. Users must define the start, stop, and step frequency for signal source and power meter. The signal source will step to the first frequency point and then generate a trigger out signal to the power meter. The power meter will start data acquisition. Once the measurement is settled, the power meter will output a trigger to the signal source so that the signal source will step to the next frequency point. This process continues, repeating itself for every frequency step.

Every triggered measurement will be stored in a buffer in the power meter, the size of which is user-defined (1 to 2,048). Once the measurement cycle is completed, the data stored in the buffer can be retrieved by using SCPI.

Conclusion

The N1913/1914A EPM Series power meter is an enhanced version of the E4418/4419B EPM Series power meter. The additional features and the improved user interface make the new N1913/1914A the best choice for any type of average (CW or modulated) power measurement.

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