Agilent N4371A
RIN Measurement System

- *Accurate, high-speed and easy measurements of RIN frequency characteristics*
- *Reduced uncertainty by using Agilent original characterization technique (patent pending)*
- *High-speed measurement (5 seconds or less for 20 GHz span, 2000 point, 10 average)*
- *Analysis on multiple traces by various markers*

Agilent provides accurate, high-speed and easy-to-use spectral RIN measurement system by combination of a sensitive, low-noise optical receiver, a industry-standard x-series spectrum analyzer and a digital multi-meter.

RIN (Relative Intensity Noise) is a parameter representing temporal intensity fluctuations of a laser signal and is used as an evaluation index of the noise characteristic of the laser devices. RIN is an indispensable item for indicating the signal quality of both digital and analog optical transmission systems.

N4371A Agilent RIN measurement system provides accurate RIN measurements with a specially developed characterization technique (patent pending) for the photoelectric frequency response of the entire system. Agilent RIN measurement system also reduces uncertainties by removing the interference by thermal noise and shot noise precisely.

The measurement speed of N4371A RIN measurement system is very fast by special control of the spectrum analyzer. The measurement time is less than 5 seconds with the condition of a 20 GHz frequency span, 2,000 frequency points and 10 times average. The high-speed measurement enables a real-time observation of RIN frequency characteristics with varying parameters of the DUT.

The user interface of N4371A RIN measurement system shown in figure 2 is easily accessible from the spectrum analyzer display. The user interface provides functions of displaying up to 5 traces, placing up to 5 markers and searching minimum or maximum RIN values in specific frequency range.

Figure 1. N4371A RIN Measurement System

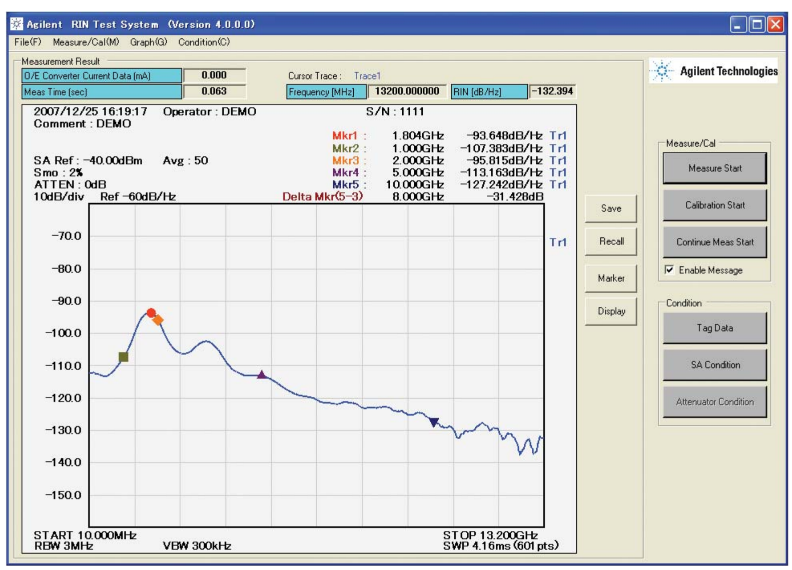

Figure 2. RIN Measurement User Interface

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System Configuration

Optical Receiver	See Figure 3 Block Diagram
System Software	See Figure 2
X-Series Spectrum Analyzer	See Table 1 (Option: Including PFR, KYB, MSE, and DVR)
Digital Multi Meter	Agilent 34410A
Options	
Optical attenuator	Agilent 81576A or 81577A
Optical multi meter mainframe	Agilent 8163B
GP-IB Interface	Agilent 82357B USB/GP-IB interface

Table 1 N4371A Frequency Range and Product Number of MXA-Series Spectrum Analyzer

Frequency Range	100kHz to 3GHz	10MHz to 6.7GHz	10MHz to 13.2GHz	10MHz to 20GHz
MXA Series Option	N9020A-503	N9020A-508	N9020A-513	N9020A-526

System Block Diagram

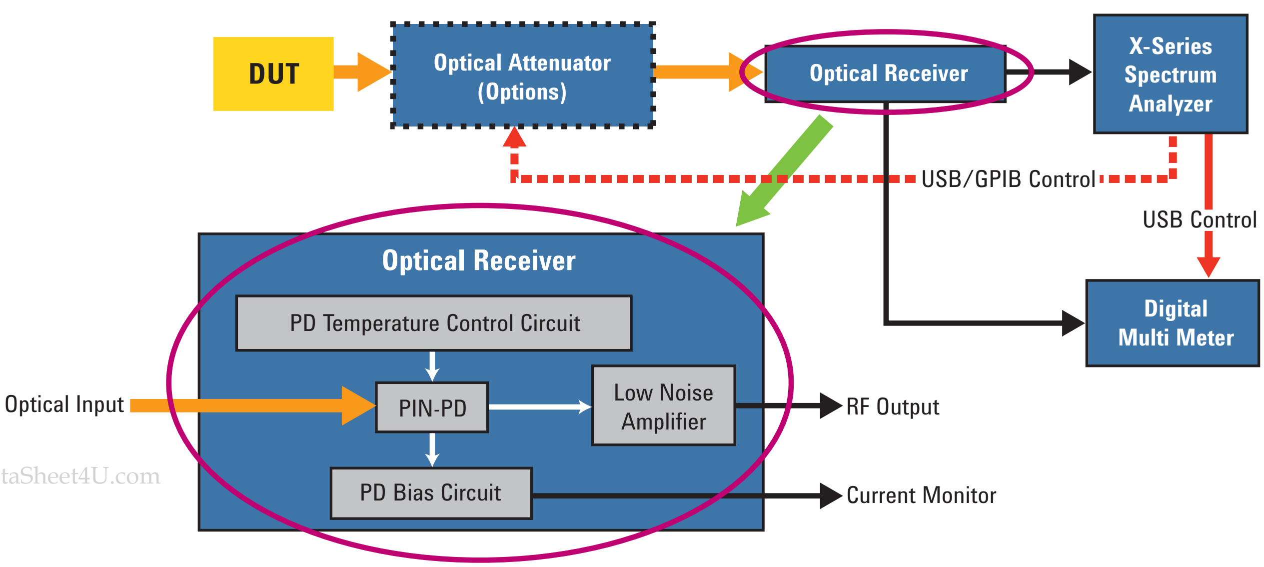

Figure 3. RIN Measurement System Block Diagram

Measurement Example

In the RIN measurement system, laser signal from DUT is converted to electric signal by the PIN-PD in the optical receiver. The electric signal is amplified by the low noise amplifier and measured with the Spectrum analyzer. The average photocurrent of PIN-PD is monitored by the digital multi meter.

The amplified electric signal contains thermal noise and shot noise as well as laser intensity noise. The RIN measurement isolates the amplified laser intensity noise from other noise components. The shot noise is calculated from the average photocurrent and the thermal noise is obtained as a noise without laser signal. The RIN measurement system calculate the laser intensity noise current before amplification by use of the photoelectric frequency response of the system. The accuracy of the photoelectric frequency response significantly affects measurement results. Agilent characterizes the response value precisely by originally developed methodology. The RIN value is derived from the laser intensity noise current and the average photocurrent.

The measurement results are saved as table data of the frequency and the RIN value in CSV file format and as graphical profiles in PNG file format.

Optionally 81576A/81577A optical attenuator, 8163B optical multimeter mainframe and 82357B USB/GP-IB interface can be included in the system configuration if the input optical power control is required for more than 10 dBm optical source power.

Figure 4 shows a RIN measurement example of a 1550nm DFB-LD. The RIN measurement system provides accurate, fast and easy RIN measurement of a very low RIN value of -160dB/Hz or less in a wide frequency range from 10MHz to 20GHz.

The smoothing aperture is selectable form 0% to 10% in displaying the measurement results. This function achieves a high resolution RIN evaluation with small smoothing aperture, which enables to capture peaked fluctuation of RIN characteristics.

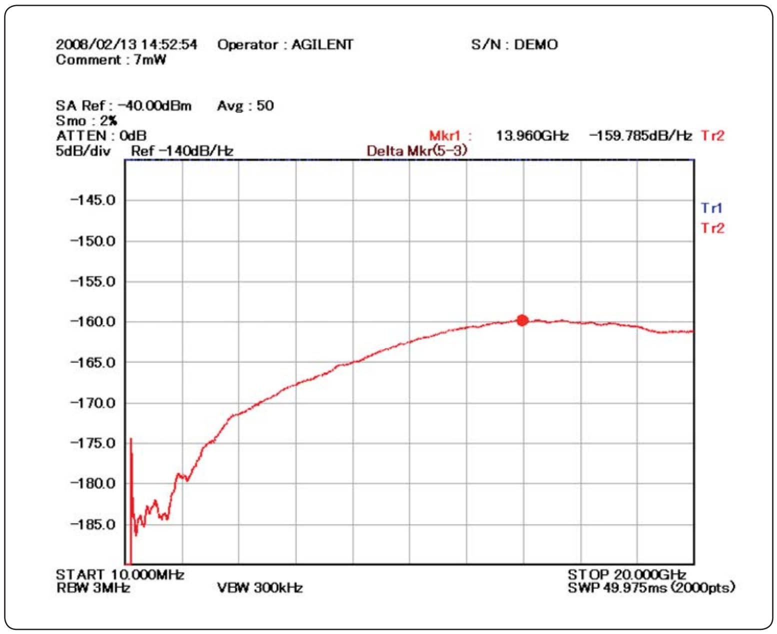

Figure 4. RIN Measurement Example

Performance Characteristics

Corresponding Wavelength	1265 nm – 1625 nm
Frequency Range	100 kHz to 3 GHz, 10 MHz to 6.7 GHz/13.2 GHz/20 GHz
Maximum input optical power	≤ +10 dBm @1310 nm and 1550 nm
Minimum RIN Measurement Value	≤ –160 dB/Hz @0 dBm received optical power; 1310 nm and 1550 nm

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