Agilent N4371A RIN Measurement System

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

Agilent provides an accurate, high-speed and easy-to-use spectral RIN measurement system by integrating of a sensitive, low-noise optical receiver, an industry-standard X-series spectrum analyzer and a digital multimeter.

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

The N4371A Agilent RIN measurement system provides accurate RIN measurements with a specially developed characterization technique Agilent's RIN measurement system also reduces uncertainties by precisely removing the interference from thermal noise and shot noise.

The measurement time is less than 5 seconds with the conditions 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 the, N4371A, shown in Figure 2, is easily accessible from the spectrum analyzer display. The user interface provides functions for displaying up to 5 traces, placing up to 5 markers and searching for minimum or maximum RIN values in specific frequency range.

Figure 1. N4371A RIN Measurement System

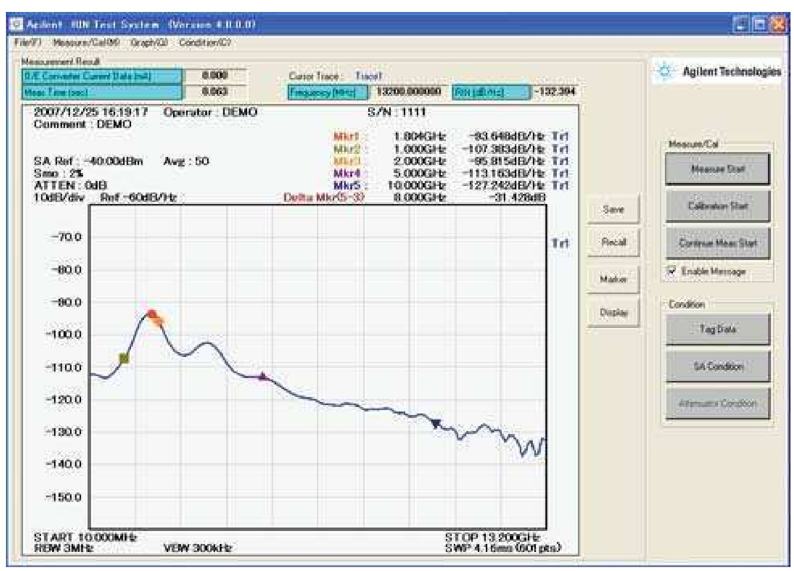

Figure 2. RIN Measurement User Interface

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System Configuration

RIN Measurement System N4371A-301 (7G) or N4371A-302 (20G)	
Optical Receiver	See Figure 3 Block Diagram
System User Interface	See Figure 2
X-Series Spectrum Analyzer	See Table 1
Digital MultiMeter	Agilent 34410A
Options for input power control N4371-221(straight connector) or N4371A-222 (angled connector)	
Optical attenuator	Agilent 81576A or 81577A
Optical multimeter 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

Option	#301	#302
Frequency Range	10MHz to 6.7GHz	10MHz to 20GHz
MXA Series Option	N9020A-508 N9020-PFR	N9020A-526 N9020A-PFR

System Block Diagram

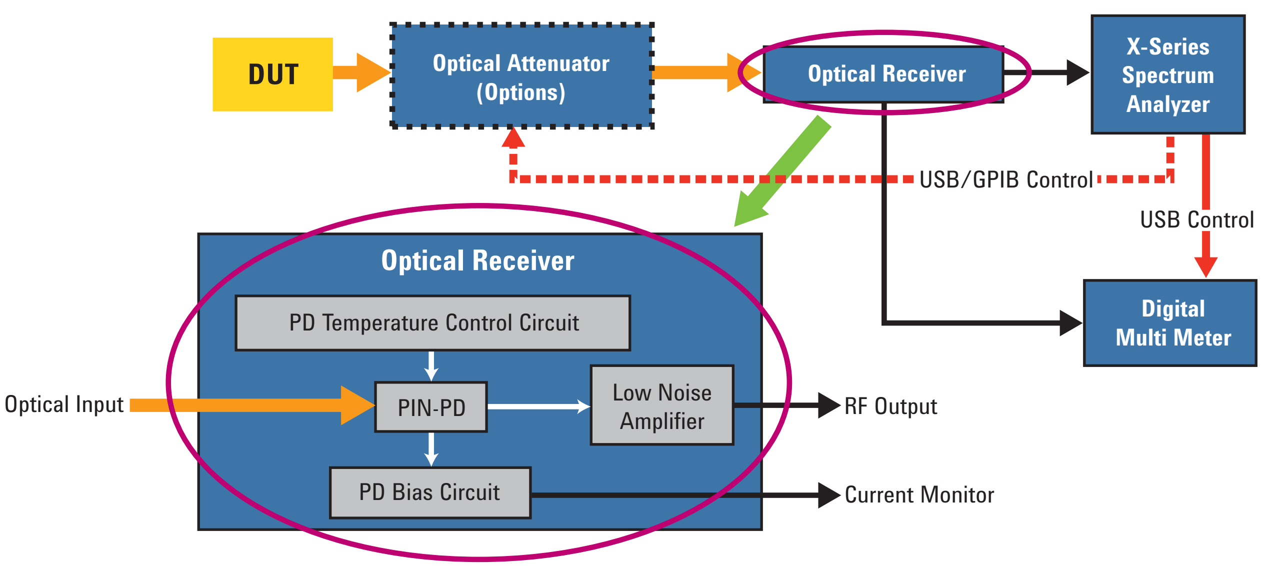

Figure 3. RIN Measurement System Block Diagram

Measurement Example

In the RIN measurement system, an laser signal from the DUT is converted to an electric signal by the PIN-photodiode in the optical receiver. The electric signal is amplified by the low noise amplifier and measured with the spectrum analyzer. The average photo-current of the PIN-PD is monitored by the digital multimeter.

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 calculates the laser intensity noise current before amplification using the factory calibration data of of the photoelectric frequency response of the system. The accuracy of the photoelectric frequency response significantly affects the measurement results. Agilent characterizes the response value precisely by an originally developed methodology. The RIN value is derived from the laser intensity noise current and the average photocurrent.

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

Optionally an 81576A or 81577A optical attenuator, 8163B optical multimeter mainframe and 82357B USB/GP-IB interface can be included in the system configuration, if 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-laser. The RIN measurement system provides accurate, fast and easy RIN measurement to a very low RIN value to -160dB/Hz or less, in a wide frequency range from 10MHz to 20GHz.
The smoothing aperture is selectable from 0% to 10% for displaying the measurement results. This function achieves a high resolution RIN evaluation with small smoothing aperture, which shows the full frequency dependence of the RIN characteristics.

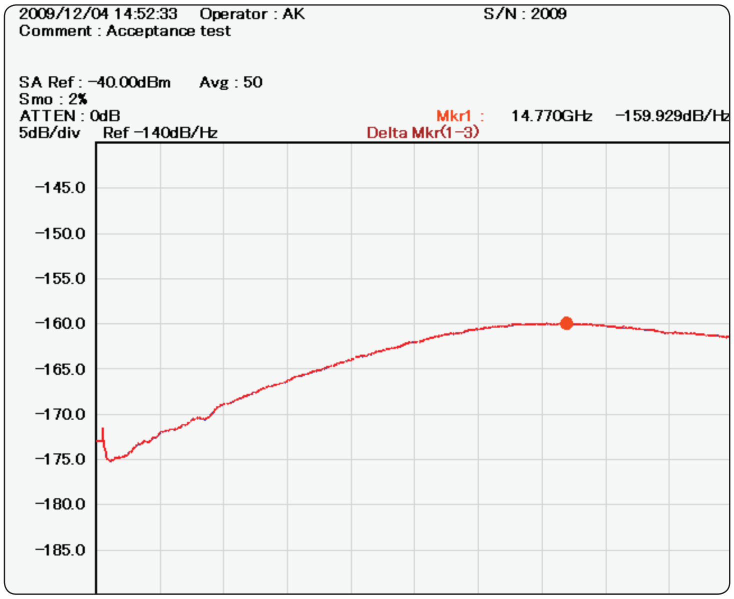

Figure 4. RIN Measurement Example

System Performance Characteristics

Parameter	Min.	Nom.	Max.	Option
Wavelength Range	1265nm	1550nm	1625nm	
Frequency Range	10 MHz		7 GHz	301
			20 GHz	302
Minimum RIN Measurement Value[1]	-160dB/Hz			
Optical Power Range[2]			10 dBM	
Operqating Temperature	+15^{0}C		+35^{0}C	
Humidity[3]	20%RN		80%RN	
Operating Altitude			2000 m	

1. 1550 nm, 0 dBm input to optical receiver, 5% smoothing; The "Minimum RIN Measurement Value" specification is defined such that when this RIN value of -160 dB/Hz is measured on a +10dBm signal, then the measured RIN value when the signal is attenuated to 0dBm is the same within a deviation of -2.2 to 1.4 dB.
2. Input to the optical receiver
3. From +15 to +35°C

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