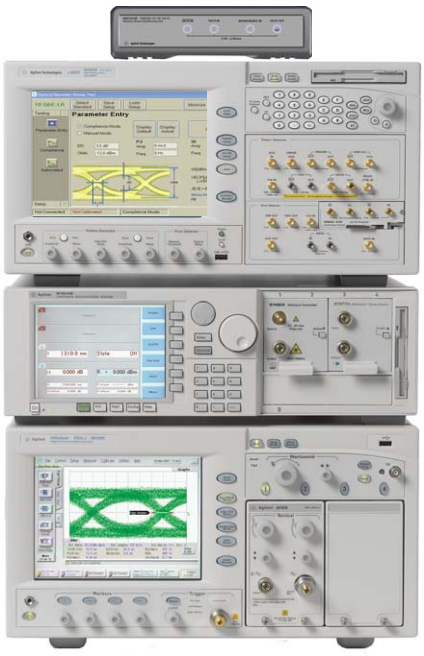
Agilent N4917A Optical Receiver Stress Test Solution

Data Sheet

Version 1.11

Repeatable optical receiver stress tests according to 10GbE IEEE 802.3ae and 10 GFC standards

- **Targets 10 GbE - LR/- ER, 10 GFC**
- **One E/O reference transmitter for 1310 nm and 1550 nm, single mode**
- **One O/E reference receiver for 850 nm, 1260 nm, and 1640 nm, single mode and multi mode**
- **Data rates at standard's target and up to 12.5 Gb/s in reference transmitter mode**
- **Automation and adjustments included in the software**
- **Conformance tests and characterization**
- **Adjustable ER, OMA, sinusoidal interference (SI), periodic jitter (PJ)**
- **Jitter tolerance and receiver sensitivity (BER vs OMA) result screens**
- **Repeatable results**



Optical reference transmitter and receiver stress test solution

Agilent Technologies

Optical Receiver Stress Test

The calibrated optical receiver stress test solution provides accurate signal stress for receiver tolerance and compliance testing. It is available for the popular standards of 10 Gb Ethernet IEEE 802.3ae for -LR and -ER, and for 10 G Fibre Channel. The parameters of ER, OMA, SI and PJ are calibrated and can be dialed so VECP and total jitter are be precisely set.

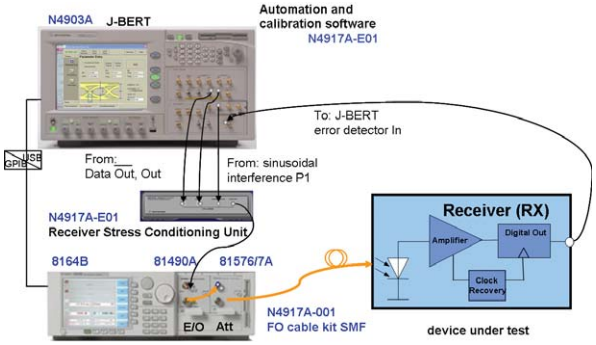


Figure 1: Optical receiver stress test setup

The stress signal is generated from the J-BERT N4903A with help of the N4917A-E01 Receiver Stress Conditioning Unit. The output of the N4917A-E01 drives the 81490A Optical Reference Transmitter, which connects to the 81576A Optical Attenuator. The output of the Optical Attenuator connects to the Device under Test (DUT). The DUT electrical output connects to the J-BERT N4903A Error Detector input.

This closes the loop for BER measurement, which is the base for the highest level measurements of receiver sensitivity or jitter tolerance. If the DUT output is available only as optical signal, the conversion of the optical signal for electrical BER measurement can be performed with the help of the 81495A reference receiver, which can be added to the setup, but is not mandatory.

10 GbE/10 GFC Stressed Eye Test Signals

Table 1: Stressed eye signal impairment resources

Stressed eye signal		Required	Notes
Jitter	Sinusoidal jitter (SJ)	Yes	Provided by J-BERT N4903A
	Random jitter (RJ)	Optional	
Amplitude impairments	Sinusiodal interference (SI)	Yes	Provided by J-BERT N4903A and N4917A-E01 Receiver Stress Conditioning Unit
	Intersymbol interference (ISI)	Yes	

User Interface

The N4917A software runs on the J-BERT N4903A (with option J12), or a PC with Windows XP®. It controls the instrument setup over a USB to GPIB interface.

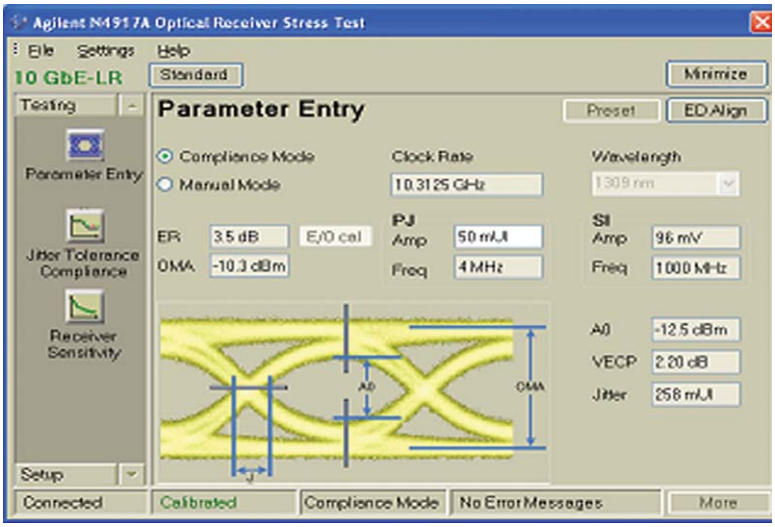


Figure 2: Parameter Entry for ER, OMA, PJ and SI. For the defined standards the values for A0, VECP and total jitter will be displayed.

The user interface operates the instruments interactively, runs the compliance test automating various measurements (such as jitter tolerance) and controls the instrument's setup and calibration. Interactive operation lets the user vary the optical parameters using dials. The automated measurements provide the generation of a report file.

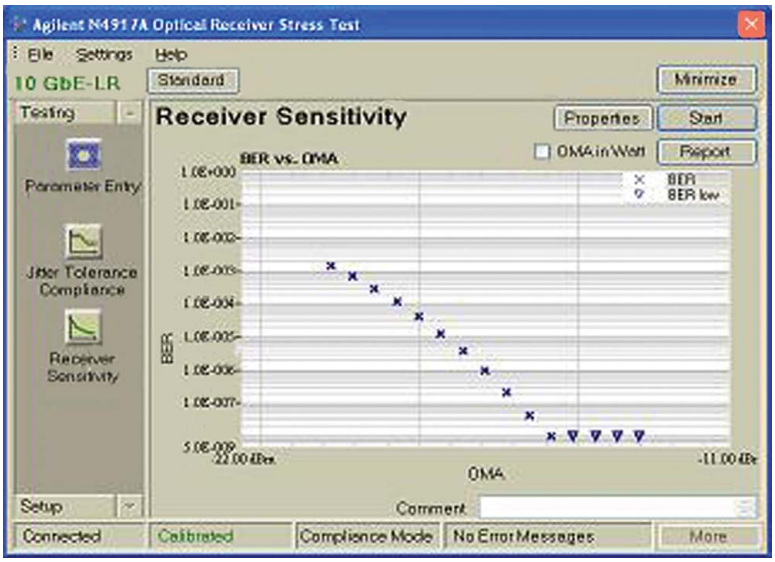


Figure 3: Jitter receiver sensitivity compliance measurement

Definitions

Optical receiver stress is defined by a compliance eye and a jitter tolerance curve (the standard calls it “mask”)

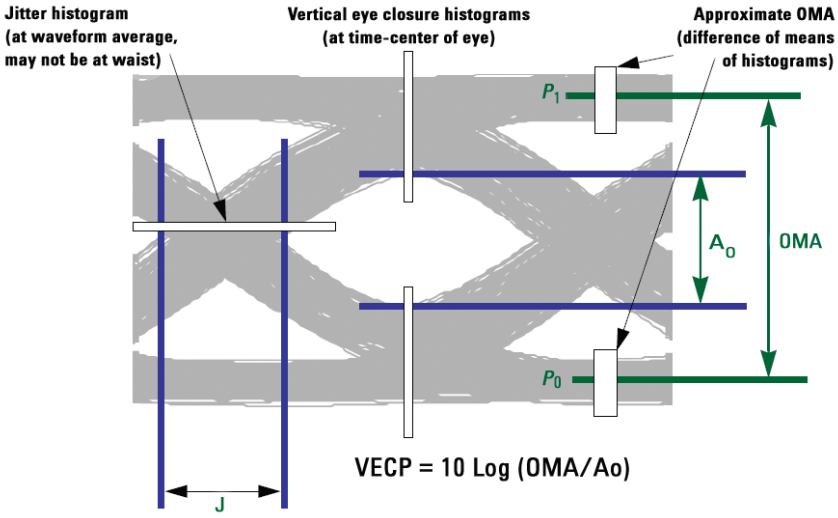


Figure 4: Compliance Eye: definition of OMA, A0 and VECP according IEEE 802.ae

Applied sinusoidal jitter peak-to-peak amplitude (UI)

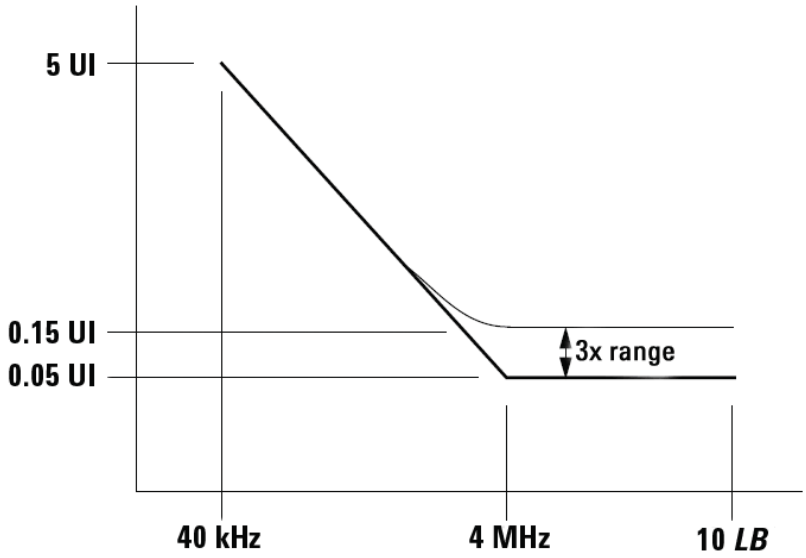


Figure 5: Jitter tolerance curve for 10 GBASE - LR/ - ER

Specifications

Table 2: Receiver stress test solution

Optical wavelength	1310 nm and 1550 nm
Optical fiber	Single-mode fiber (SMF) 9/125 µm
Extinction ratio	Adjustable from 1.5 to 10.0 dB @ 1310 nm, 1.5 to 7.5 dB @ 1550 nm
OMA	Up to 1 dBm (1 mW) @ ER = 3 dB, adjustable 0 to -60 dB by 0.01 dB
VECP from filter (no jitter added)	1.5 dB typ at ER = 3
Eye mask margin, according to IEEE 802.3ae 2002 definition	.15 UI typ
Random jitter	1 ps rms typ
Periodic jitter (PJ)	According Periodic and Sinusoidal Jitter of N4903A-J10
Sinusoidal interference (SI)	0 to 400 mV @ 500 MHz to 3.2 GHz, 1 MHz resolution VECPmax 7dB typ at ER = 3
Repeatability of the sensitivity measurement	0.5 dB typ

Specification assumption

The specifications in this document describe the solution's warranted performance. Non-warranted values are described as typical. More specifications are available in the data sheets of the individual instruments (N4903A, 81490A, 81576A). All specifications are valid after a warm-up phase as specified for the individual instruments. If not otherwise stated, all electrical inputs and outputs need to be terminated with 50 Ohm to ground. All specifications, if not otherwise stated, are using the recommended N4917A accessories.

For the verification of the specifications a 86100C DCAj with either 86105B or 86105C optical module is recommended. A PRBS pattern of 2^11-1 is recommended if not otherwise stated. For the measurement of ER the use of the Extinction Ratio Correction Factor is recommended [1]. For the measurement of OMA a pattern of ..1100.. is recommended. For the measurement of RJ the use of the 86107A Precision Timebase Module is recommended, which is not mandatory for the N4917A setup.

Typical Signals Provided by the Optical Receiver Stress Test Solution

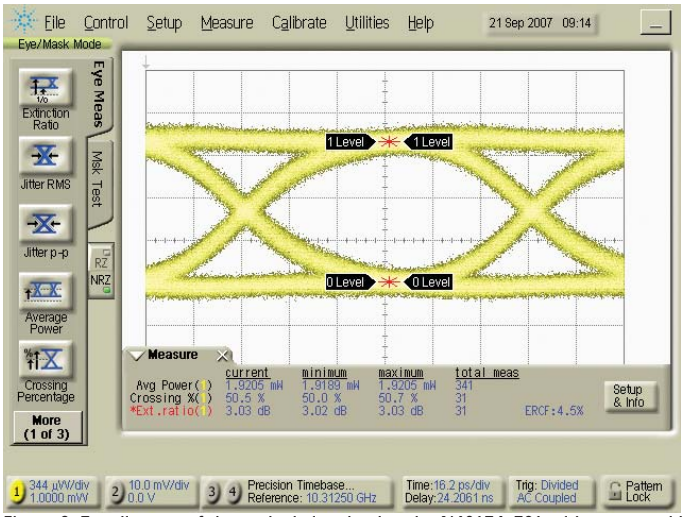


Figure 6: Eye diagram of the optical signal using the N4917A-E01 without any additional jitter added, measurement of ER and crossing point (PRBS 2^11-1 pattern)

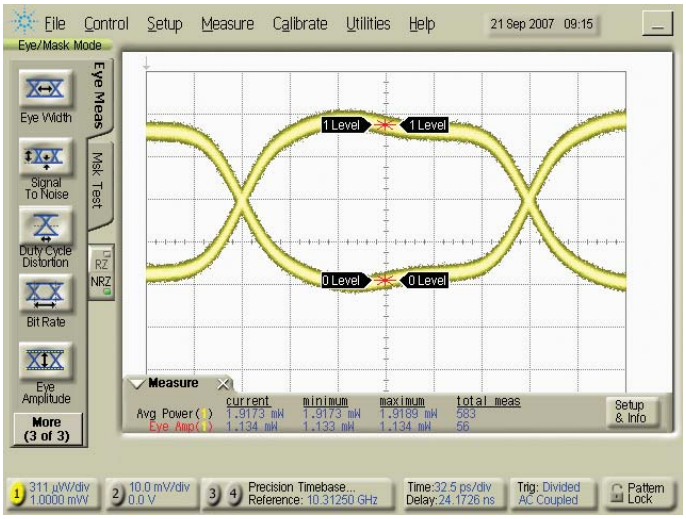


Figure 7: Eye diagram of the optical signal using the N4917A-E01 without any jitter added, measurement of OMA (..1100.. pattern)

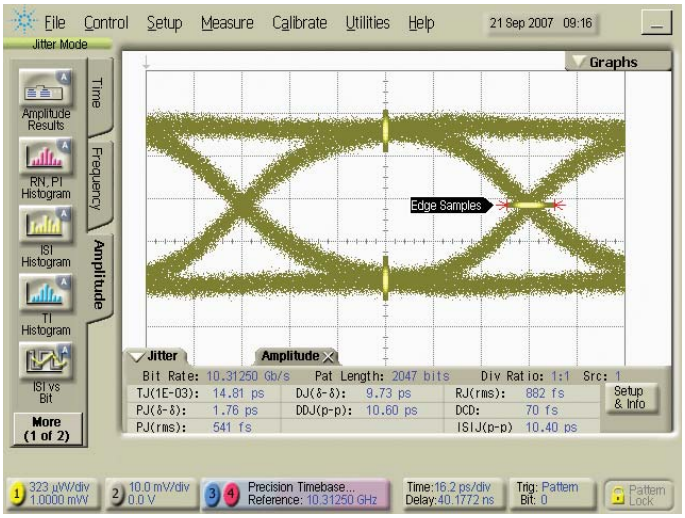


Figure 8: Jitter measurement of the optical signal using the N4917A-E01 without any jitter added (PRBS 2^11-1 pattern)

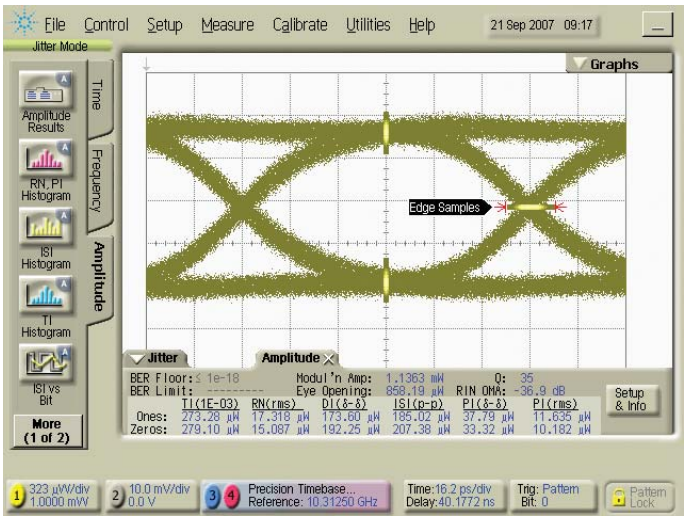


Figure 9: Amplitude measurement of the optical signal using the N4917A-E01 without any jitter added (PRBS 2^11-1 pattern)

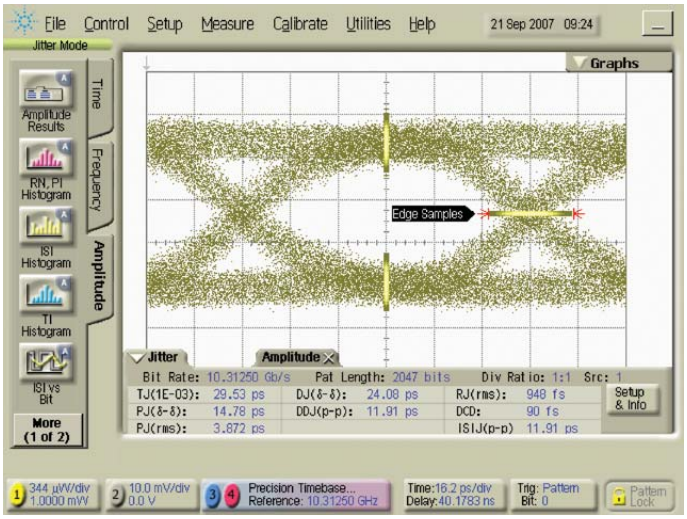


Figure 10: Jitter measurement of the optical signal using the N4917A-E01 with 50 mUI periodic jitter and sinusoidal jitter added for a VECP of 2.2 (PRBS 2^11-1 pattern)

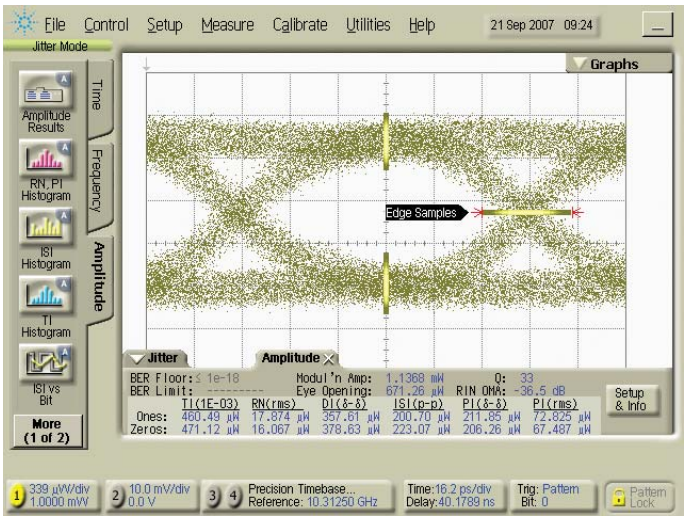


Figure 11: Amplitude measurement of the optical signal using the N4917A-E01 with 50 mUI periodic jitter and sinusoidal jitter added for a VECP of 2.2 (PRBS 2^11-1 pattern)

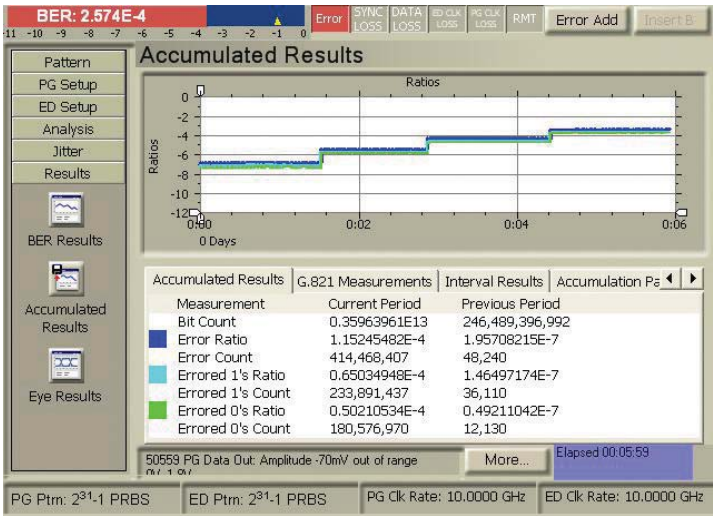


Figure 12: Short term stability: the OMA is varied that an actual DUT delivers finite BER, the measurement runs for 6 minutes and the BER is continuously recorded (x-axis is time, y-axis is BER)

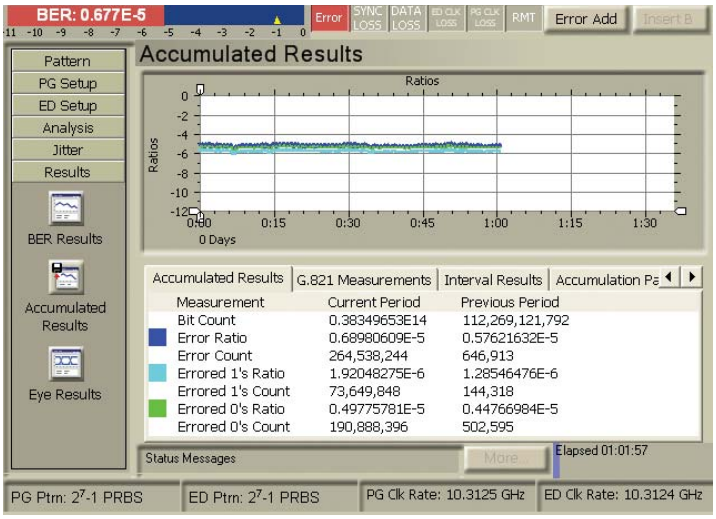


Figure 13: Long term stability: the OMA is set that an actual DUT delivers a BER = .6e-5, the measurement runs for 1 hour and the BER is continuously recorded (x-axis is time, y-axis is BER)

Optimization, Adjustments and DUT Configuration

The setup to run the N4917A software with the necessary accessories is described in figure 14. The N4917A automation and calibration software provides adjustable parameters for ER, OMA, SI and PJ. At the standard compliance settings it displays the values for A0, VECP and the total jitter (TJ) according to the definition of IEEE802.3ae 2002 with help of an extrapolation from measured point gathered during a calibration process.

The software performs a cabling check, including an optimization for the phase matching of the differential data connection between N4903A data out and N4917A-E01 data in. This optimization is recommended the first time after setup, or whenever the cabling was removed.

Beside the base points for the above parameters, it optimizes the operating point of the 81490A reference transmitter and it optimizes the crossing point of the optical signal for a minimum amount of duty cycle distortion (DCD).

The gathered information is stored in a file with reference to date and standard, which can be loaded any time later, multiple files can be generated, per default the latest is in use. Beside the optimization and the adjustments, the software stores in the second step the setup of the DUT.

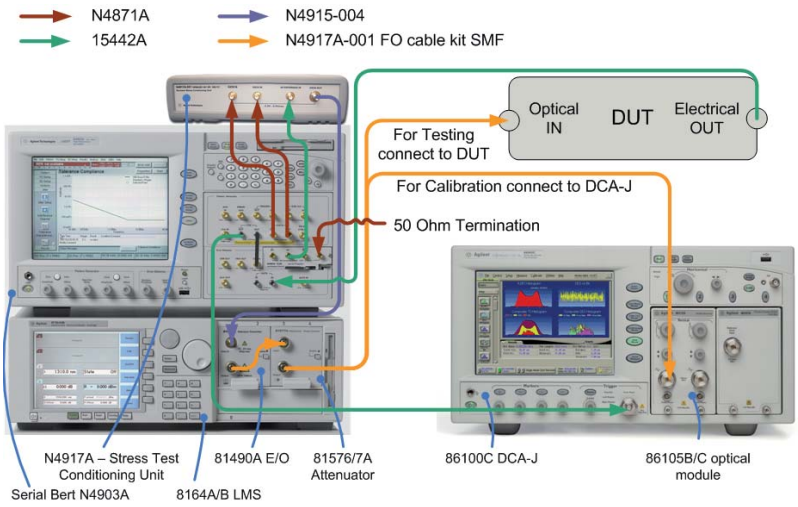


Figure 14: Setup for calibration including the recommended accessories

Software/PC Requirements

N4917A software runs on the J-BERT N4903A or an external PC/MS Windows® XP

Requirements:
VGA (640 x 480), MS Windows® XP operating system with SP2, Microsoft.NET Framework 2.0.

Agilent IO Libraries Suite rev. M. or later, Agilent N490X IVI - COM Driver 1.2.7

Interfaces: USB

Instruments firmware requirement:
N4903A rev. 4.8 or higher to run N4917A software on an external PC
N4903A rev. 4.9 or higher to run N4917A software on N4903A
81600C rev. 7.0 or higher
8164B rev. 5.01 or higher

Order Instructions

N4917A-001 Single mode fiber kit containing:
2x patch cords FC/PC - FC/PC Single Mode
1x patch cord LC/PC - FC/PC Single Mode
4x 81000FI connector interface FC/PC/SPC
1x 81000LI connector interface LC (DUT)

N4917A-E01 Receiver stress conditioning unit and calibration and automation software CD ROM
10 Gb Ethernet - LR, - ER and 10 GFC

Recommended accessories (not included in N4917-E01):
1x 82357B USB/GPIB interface or 1x E5810A LAN/GPIB Gateway
2x 10833A/B GPIB cable, 1/2m
1x N4871A matched cable pair
1x 15442A four SMA cables
1x N4915A-004 2.4 mm cable
1x 8710-1765 torque wrench

Recommended instrument models and options
- N4903A, - C13 - J10 - J12 - J20
- 81490A - 135
- 81495A - 135/ - 085
- 8164B
- 81576A
- 86100C - 001 - 200 - 300
- 86105B - 101/ - 102/ - 103/ - 111/ - 112/ - 113

Other usable instrument models and options
- N4903A - CTR - A01 - J11
- 8163A, 8164A, 8163B, 8166A, 8166B
- 81577A (the fibers with angled connectors are not provided with the N4917A-E001)
- 86100C - 201 - 202
- 86105C - 100 - 200 - 300
- 86107A

Not supported instrument models and options
- N4903A - C07 - G07 - G13

Productivity assistance:
Remote or on-site (R1380-N49xx)
Productivity assistance (PS-S20 and PS-S20-02)

Warranty extension:
1 year Return-to-Agilent warranty extended to 3 years (R-51B-003-C)

Related Agilent Literature	Pub.No.
[1] Improving the Accuracy of Optical Transceiver Extinction Ratio Measurements	**5989-2602EN**
Agilent J-BERT N4903A High-Performance Serial BERT with Complete Jitter Tolerance Testing Data Sheet	**5989-2899EN**
Agilent J-BERT N4903A High-Performance Serial BERT Brochure	**5989-3882E**N
BERT Family Brochure Brochure	**5988-9514EN**
Agilent 86100C Wide-Bandwidth Oscilloscope Mainframe and Modules Technical Specifications	**5989-0278EN**
Agilent 8163B Lightwave Multimeter, 8164B Lightwave Measurement System, 8166B Lightwave Multichannel System Technical Specifications	**5988-3924EN**
Agilent 86105B 15 GHz Optical and 20 GHz Electrical Plug-In Module Data Sheet	**5989-6929EN**
Agilent 86105C High Sensitivity, Broad Wavelength Plug-In Module Data Sheet	**5989-1604EN**
Agilent 81490A Reference Transmitter 1310 & 1550 nm Data Sheet	**5989-7326EN**
Agilent 81495A Reference Receiver Data Sheet	**5989-7526EN**

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