

Agilent

N7751A 1-Channel Optical Attenuator and Power Meter

N7752A 2-Channel Optical Attenuator and Power Meter

N7761A 1-Channel Optical Attenuator

N7762A 2-Channel Optical Attenuator

N7764A 4-Channel Optical Attenuator

Data Sheet

Preliminary Version 0.9



Agilent Technologies

Introduction

The Agilent N775xA and N776xA series compact multi-channel attenuators and power meters are a new class of remote controlled fiberoptic instruments for optical transceiver and network integration test. High setting speed of attenuation and power and power measurement capability, combined with USB, LAN and GPIB interfaces provides increased throughput and operational efficiency to meet today's challenges in manufacturing.

Operation Modes

All attenuators feature both attenuation mode and power control mode.

In attenuation mode, the calibrated value of attenuation in dB can be set. The rate of attenuation change during setting can also be adjusted between 0.1 and a very fast 1000 dB/s.

The power control functionality allows you to set the power level at the attenuator output. The instrument uses the feedback signal from a photodiode after a monitor tap, both integrated in the instrument, to set the desired power level at the output of the module (Figure 1).

When the power control mode is enabled, the module automatically corrects for power changes at the input so that the output power level you set is maintained. Absolute power levels can be set with high accuracy after an initial offset calibration for the uncertainties at connector interfaces.

Power measurements

In addition, the Agilent N7751A and N7752A attenuators include two extra optical power meter channels for convenient power measurements and setup calibration.

User calibration processes

Comprehensive offset functionality allows you to calibrate the optical path in various test set-ups. There is an offset for the attenuation factor, and an independent offset for the output power level, to calibrate for losses due to patch cords, connectors and switches. Additionally, wavelength and offset value pairs can be stored in a table to compensate for wavelength-dependent effects in the optical path of the set-up. This allows you to precisely set the optical power level directly at the input interface of your device under test. With the extra optical power meter channel, calibration is even easier and more convenient. All power related offsets can be determined by a firmware function that reads a value from the reference power meter. The difference between the power value read by the reference power meter and the actual value of the attenuator is automatically stored as the offset.

Key specifications and features

- Settling time: 20 ms attenuation, 100 ms power
- 0.1 to 1000 dB/s attenuation transition speed (selectable)
- +23 dBm max. input power
- ≤ 1.2 dB insertion loss
- One half-width rack unit
- 45 dB attenuation range (typ.)
- -50 dBm to +20 dBm power setting range
- Fully compatible with setups and programs developed using the Agilent 8157x modular attenuators
- Powerful and user-friendly GUI software
- Two instrument configurations can be stored and recalled

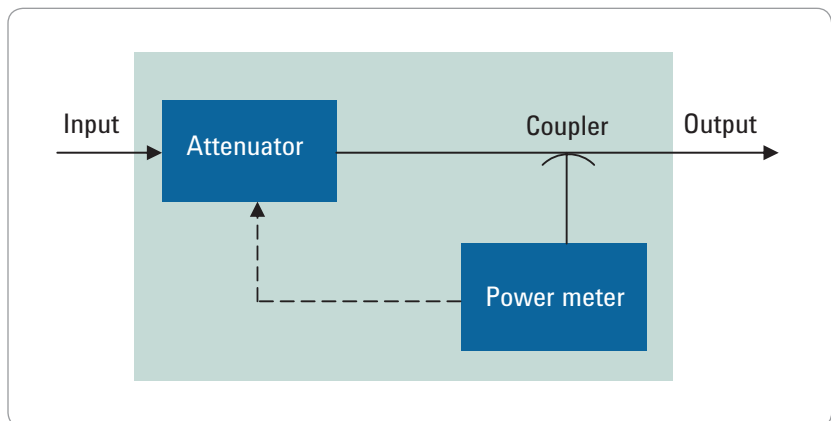


Figure 1. Optical Attenuator with power control

The Multi-Channel Attenuator Series – Product Configurations

N776xA multi-channel optical attenuators with internal power control

The Agilent N776xA multichannel optical attenuators with 1, 2 and 4 attenuator channels in one unit provide an excellent combination of versatility and density.

1-channel variable attenuator N7761A



2-channel variable attenuator N7762A



4-channel variable attenuator N7764A



N775xA multi-channel optical attenuators with internal power control and external power meter channels

The Agilent N775xA multichannel optical attenuators offer 1 or 2 attenuator channels combined with two power meter channels in one unit.

1-channel attenuator with two power meter channels N7751A



2-channel attenuator with two power meter channels N7752A



Benefits

- Compact instrument combines and integrates multiple functions for setting attenuation and power levels and optical power measurement to reduce CAPEX and floor space.
- Fast and precise setting of optical power levels in parallel with settling times of 100 ms for improved throughput.
- The multichannel attenuator sets and measures several ports at the same time, saving significant time characterizing multiport and multi-channel components and network equipment.
- Active power control keeps output power constant.
- The instrument can be controlled via LAN and USB, as well as GPIB for compatibility with existing equipment.
- An easy-to-use and intuitive graphical user interface speeds up the integration process.



The N77xx-Viewer: An easy-to-use graphical user interface

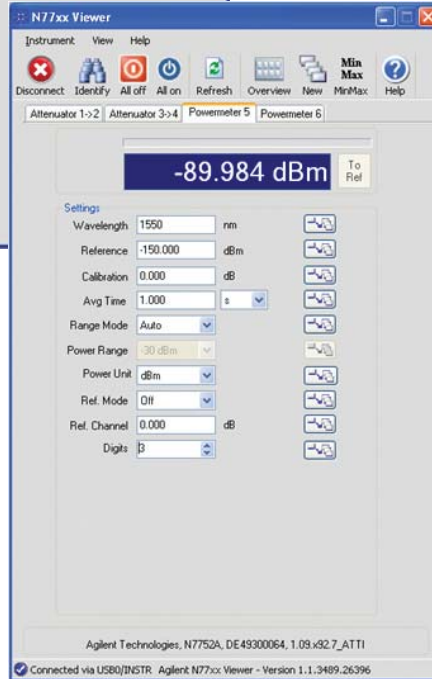
The N77xx Windows-based graphical user interface offers flexible and convenient control of the instrument

- Easy switching between channels with tabs
- Overview window with all channels at a glance
- Two instrument configurations can be stored and recalled
- Enable or disable the attenuator's output with one click
- Choose between setting an attenuation or an output power

Applications

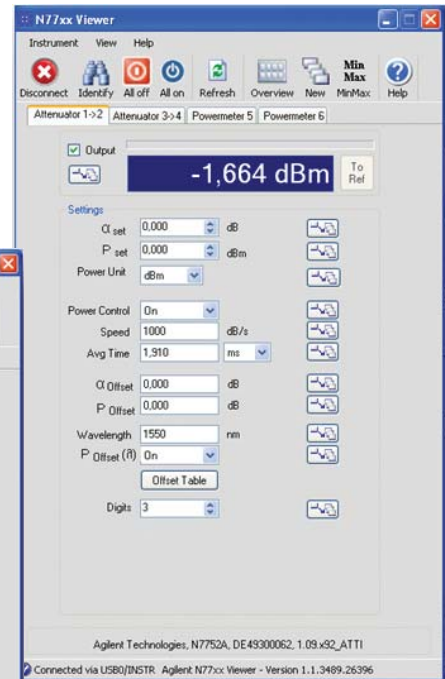
Optical transceiver testing

One of the challenges in testing transceivers is parallelization of bit-error-ratio measurements for multiple-device and multichannel device measurements. Sensitivity measurements require fast and precise setting of optical power levels in parallel at the receiver inputs with settling times like 100 ms for improved throughput.



Optical network integration testing

When integrating and testing network equipment to test network transmission performance and network management, including meshed networks using ROADMs, attenuators represent link spans between network nodes or amplifier stages. The very fast attenuation and power setting response of the Agilent N775xA and N776xA attenuators allows simulation of many network configurations in a short time. In the path-blocking mode, fiber network cuts are emulated. With the attenuation and power ramp feature, the attenuation and/or the output power is changed at a defined rate of 0.1 dB/s to 1000 dB/s. This feature simulates slow and fast changes in the fiber network for testing the network management system.



Definitions

Generally, all specifications are valid at the stated operating and measurement conditions and settings, with uninterrupted line voltage.

Specifications (guaranteed)

Describes warranted product performance that is valid under the specified conditions. Specifications include guard bands to account for the expected statistical performance distribution, measurement uncertainties changes in performance due to environmental changes and aging of components.

Typical values (characteristics)

Characteristics describe the product performance that is usually met but not guaranteed. Typical values are based on data from a representative set of instruments.

General characteristics

Give additional information for using the instrument. These are general descriptive terms that do not imply a level of performance.

Technical Specifications

Table 1. Optical attenuator

| N7751A, N7752A, N7761A, N7762A, N7764A | | |
|---|--|--------------------------------------|
| Connectivity | FC/APC angled (Option -022) or FC/PC straight (Option -021) contact connector interface | |
| Fiber type | 9/125 μm SMF 28 | |
| Wavelength range | 1260 nm to 1640 nm | |
| Attenuation range | 0 dB to 40 dB (45 dB typ.) | |
| Attenuation resolution | 0.01 dB | |
| | Attenuation setting mode | Power setting mode |
| Range | 0 dB to 40 dB | -50 dBm to +20 dBm |
| Resolution | 0.01 dB | 0.01 dB |
| Repeatability ¹ | ± 0.05 dB typ. | ± 0.025 dB |
| Accuracy (uncertainty) ^{1, 2, 3} | typ. ± 0.10 dB for attenuation 0 dB to 10 dB | ± 0.05 dB ⁴ ± 300 pW |
| | typ. ± 0.15 dB for attenuation 10 dB to 20 dB | |
| | typ. ± 0.50 dB for attenuation 20 dB to 40 dB | |
| Settling time ¹⁰ | typ. 20 ms | typ. 100 ms ⁴ |
| Polarization dependency ⁵ | typ. ≤ 0.15 dB _{pp} for attenuation 0 dB to 10 dB | ≤ 0.15 dB _{pp} ⁹ |
| | typ. ≤ 0.25 dB _{pp} for attenuation 10 dB to 20 dB | |
| | typ. ≤ 0.5 dB _{pp} for attenuation 20 dB to 40 dB | |
| Insertion loss ^{2, 6} | typ. ≤ 1.2 dB (excluding connectors) ≤ 2.2 dB (including connectors) ⁷ | |
| Attenuation transition speed | selectable from 0.1 to 1000 dB/s | |
| Relative uncertainty of monitor power meter ^{2, 8} | ±0.05 dB ± 300 pW | |
| Averaging time of monitor power meter | 2 ms to 1 s | |
| Return loss | typ. 45 dB | |
| Maximum safe input power | +23 dBm | |
| Optical path blocking | typ. 45 dB | |

1. At constant operating conditions.

2. For unpolarized light. Temperature constant and between (23 ± 5) °C.

3. For (1310 ± 15) nm, (1490 ± 10) nm and (1550 ± 15) nm.

4. For 2 ms averaging time. Output power > -40 dBm, input power < +10 dBm.
For input power > +10 dBm add typ. ± 0.02 dB.

5. For (1550 ± 15) nm. Add typ. 0.05 dB for (1310 ± 15) nm and (1490 ± 10) nm.

6. For (1550 ± 15) nm. Add typ. 0.20 dB for (1310 ± 15) nm and (1490 ± 10) nm.

7. Measured with Agilent reference connectors.

8. For (1550 ± 15) nm.

9. For 2 ms averaging time. Output power > -30 dBm, input power < +10 dBm.

10. For 20 dB step.

Table 2. Optical power meter

| N7751A and N7752A | |
|---|---|
| Sensor element | InGaAs |
| Wavelength range | 1260 nm to 1640 nm |
| Specification wavelength range | (1310 ±15) nm, (1490 ±10) nm, (1550 ±15) nm |
| Power range | –80 dBm to +10 dBm |
| Maximum safe power | +16 dBm |
| Averaging time | 2 ms to 1s |
| Applicable fiber type | Standard SM and MM ≤ 62.5 μm core size, NA ≤ 0.24 |
| Uncertainty at reference conditions ^{1,3} | ±2.5% |
| Total uncertainty ^{2,5,6} | ±4.5% |
| Linearity ^{5,6} at (23 ± 5)°C over operating temperature | ±0.02 dB ± 3 pW ±0.04 dB ± 5 pW |
| Polarization dependent responsivity (PDR) ^{3,7} | typ. < ±0.01 dB (1260 nm to 1580 nm) |
| Spectral ripple (due to interference) ⁹ | typ. < ±0.01 dB |
| Drift (dark) ⁴ | ±9 pW |
| Noise pp (dark) ³ , (1s averaging time, 300s observation time) | < 7 pW _{pp} |
| Return loss ⁸ | typ. > 57 dB |

1. Reference conditions:
Single mode fiber SMF 9 μm. Power Level: –20 dBm to 0 dBm.
On day of calibration (add ±0.3% for aging over one year; add ±0.6% for aging over two years).
Spectral width of source < 10 nm FWHM.
Wavelength setting of power sensor corresponds to source wavelength ± 0.4 nm.
2. Operating conditions:
Single mode fiber SMF. For multimode fiber, typical.
Within one year of calibration; add ± 0.3% for second year.
Spectral width of source < 10 nm FWHM.
Wavelength setting of power sensor corresponds to source wavelength ± 0.4 nm.
3. Ambient temperature (23 ±5) °C
4. Temperature constant within ±1 K after zeroing
5. Excluding noise and offset drift
6. Power range –60 dBm to +10 dBm
7. Straight connector, SMF
8. Angled connector 8°, ceramic ferrule, SMF
9. For constant state of polarization, source linewidth < 100 MHz, angled connector 8°, wavelength range 1260 nm to 1625 nm. Add ±0.01 dB typ. within specification wavelength range for straight connector with ceramic ferrule.

General Characteristics

Dimensions (H x W x D):

1U half-rack

372 mm x 212 mm x 43 mm (excluding front and back rubber cushions)

Weight:

Approx. 3 kg

Recommended recalibration period

24 month

Operating temperature

+5 °C to +40 °C

Operating humidity

15% to 95%, non-condensing

Altitude

The maximum operating altitude is 2000 m.

Pollution protection

The Agilent N775xA/6xA is designed for pollution degree 2.

Warm-up time

20 minutes

Interfaces

The instruments can be controlled via LAN, USB or GPIB interfaces

Power consumption

Line power: AC 100 - 240 V \pm 0%,
50/60 Hz, 60 VA max.

Ordering Information

All systems have 1 year warranty

| Model number | |
|--------------|---|
| N7751A | Optical Attenuator (1 Channel) with Optical Power Meter (2 Channels) |
| N7752A | Optical Attenuator (2 Channels) with Optical Power Meter (2 Channels) |
| N7761A | Optical Attenuator (1 Channel) |
| N7762A | Optical Attenuator (2 Channels) |
| N7764A | Optical Attenuator (4 Channels) |

| Connector interface option | |
|----------------------------|----------------------------|
| -021 | Straight contact connector |
| -022 | Angled contact connector |

| Accessories | |
|-------------|---------------------------------|
| N7744-100 | Rack Mount Kit for 1 or 2 Units |

| Warranty | |
|----------------------------------|---|
| All systems have 1 year warranty | |
| R-51B-001-3C | 1 year Return-to-Agilent warranty extended to 3 years |
| R-51B-001-5C | 1 year Return-to-Agilent warranty extended to 5 years |

| Calibration | |
|-------------|--|
| R-50C-011-3 | Agilent calibration upfront support plan 3 year coverage |
| R-50C-011-5 | Agilent calibration upfront support plan 5 year coverage |



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