Noise Figure of Optical Module

Overview

The noise figure is the difference in decibel (dB) between the noise output of the actual receiver to the noise output of an "ideal" receiver with the same overall gain and bandwidth when the receivers are connected to matched sources at the standard noise temperature T0 (usually 290. The noise figure is the difference in decibel (dB) between the noise output of the actual receiver to the noise output of an "ideal" receiver with the same overall gain and bandwidth when the receivers are connected to matched sources at the standard noise temperature T0 (usually 290. Electrical noise figure (NF) is standardized since many decades. Traditional optical noise figure Fpnf was defined in 1990ies, for optical direct detection receivers (DD RX). These figures of merit are used to evaluate the performance of an amplifier or a radio receiver, with lower values indicating. The noise factor F of an (electronic or optical) amplifier is a measure of how much excess noise the amplifier adds to the signal. Learn how to calculate NF, measure it with the Y-Factor and Gain Methods, and apply it in design.

Article Content

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It is thus determined ONLY by: The optical input power for the useful signal The EDFA noise figure Typical values Pin=-35dBm F=5 dB OSNR=-35-5+58=18 dB

Dec 31, 2025

Noise figure

OverviewGeneralDefinitionNoise factor of cascaded devicesOptical noise figureExternal links

The noise figure is the difference in decibel (dB) between the noise output of the actual receiver to the noise output of an "ideal" receiver with the same overall gain and bandwidth when the receivers are connected to matched sources at the standard noise temperature T0 (usually 290 K). The noise power from a simple load is equal to kTB, where k is the Boltzmann constant, T is the absolute temperature of the load (for example a resistor), and B is the measurement bandwidth.

Mar 18, 2026

Lecture 8: Intro to Optical Amplifiers

Gain Flatness Is a function of inversion level. Typically 40%-60% inversion leads to broadest gain with lowest ripple Gain Bandwidth: Can be enhanced using optical filtering and composite gain media

Oct 13, 2025

Noise Figure and Homodyne Noise Figure

Traditional optical noise figure Fpnf was defined in 1990ies, for optical direct detection receivers (DD RX). Problematic aspects, in conflict with electrical NF: Optical signals have in-phase and quadrature

Mar 21, 2026

Noise Figure and Homodyne Noise Figure

A „noise figure“ without special name is expected to be the SNR degradation factor in a linear system with 2 available quadratures (and Gaussian noise?!), like Fe.

Dec 01, 2025

(PDF) Balanced receiver external modulation fiber-optic

The authors describe a fiber-optic link architecture which minimizes noise figure by combining the two complementary outputs of a Y-fed coupler

Oct 26, 2025

Frequency-resolved noise figure measurements of phase (in)sensitive ...

Abstract: We measure the frequency-resolved noise figure of fiber optical parametric amplifiers both in phase-insensitive and phase-sensitive modes in the frequency range from 0.03 to 3 GHz. We also

Mar 16, 2026

Optical Noise

Optical systems can be subject to shot noise and optical noise, in addition to the standard thermal noise. These require somewhat different models and performance expressions. Receiver

Mar 31, 2026

Noise figure of vertical-cavity semiconductor optical amplifiers ...

The narrow bandwidth also filters out out-of-band noise, making VCSOAs ideal as preamplifiers in receiver modules. The vertical cavity is circularly symmetric around the axis perpendicular to the two

Apr 30, 2026

Noise measurements in optical amplifiers

We describe an experiment that allows advanced master students in optical science and engineering to understand noise measurements in optical amplifiers (e.g. Erbium Doped Fiber

Jul 28, 2025

Noise Figure

Application in Optical Fiber Communications Noise figure is a critical parameter in optical fiber communications, affecting the performance of erbium-doped fiber

Mar 31, 2026

Optical amplifier noise figure in a coherent optical transmission ...

Two important aspects of optical amplifier noise figure as measured with a heterodyne detection receiver are investigated. First, differential mode gain will result in polarization-dependent degradation of the

Feb 28, 2026

Quantum noise figure of fiber OPAs (Chapter 9)

Fiber Optical Parametric Amplifiers, Oscillators and Related Devices - November 2007

Oct 06, 2025

Optical and Unified Noise Figure, and Homodyne Noise Figure

A „noise figure“ without special name is expected to be the SNR degradation factor in a linear system with 2 available quadratures (and Gaussian noise?!), like Fe.

Jul 11, 2025

Consistent Optical and Electrical Noise Figure

Noise figures in coherent optical receivers are derived in Section V. How the foregoing changes for phase- sensitive amplifiers is discussed in Section VI.

Dec 13, 2025

Noise Figure and Homodyne Noise Figure

Abstract: The traditional optical noise figure Fpnf of E. Desurvire takes as powers the squares and variances of photocurrents, proportional to 4th powers of amplitudes (fields).

Feb 26, 2026

Consistent optical and electrical noise figure

Consistent optical and electrical noise figure The noise figure is the factor by which the signal-to-noise ratio is degraded from input to output of a device. The optimum noise figure of an electrical amplifier

May 16, 2026

Noise Principles in Optical Fiber Communication

Abstract: This chapter contains sections titled: Introduction Receiver Thermal Noise Dark Shot Noise Signal Shot Noise Multiplication Shot Noise Optical Amplification and Beat Noises Optical Noise and

Feb 24, 2026

Noise Figure – noise factor, quantum noise, electronic or

Noise figure measures excess noise added by an amplifier. It is unavoidable in phase-insensitive optical amplifiers.

Oct 19, 2025

Tutorial Fiber Amplifiers, Part 9: Noise of Fiber Amplifiers

Tutorial on fiber amplifiers. The ninth part discusses excess noise generated by fiber amplifiers. This is a quantum-mechanical phenomenon, and it is made stronger

Jun 22, 2026

New model of noise figure and RIN transfer in fiber Raman amplifiers

A new and complete analysis of noise figure and pump noise transfer in fiber Raman amplifiers is reported. Our approach is based on vacuum fluctuation which is the minimum level of the optical

May 24, 2026

RF-Over-Fiber Links With Very Low Noise Figure

The electrode thermal noise has a fre-quency dependence matching that of the link''s noise figure, such that predictions using the improved model match the measured 1–12 GHz performance of a link with

Dec 08, 2025

Optical Noise

The shot noise results from the discrete nature of photons, and it can be modeled in one of two ways. Under the shot noise limit, the photodetection process can be analyzed using the

Mar 03, 2026

Noise Figure

The concept of noise figure is crucial in understanding the performance of both electronic and optical amplifiers. It quantifies the additional noise introduced by

Jan 23, 2026

Noise Figure (NF) – Definition, Formula, and Application

Noise Figure (NF) quantifies signal-to-noise degradation in RF systems. Learn how to calculate NF, measure it with the Y-Factor and Gain

Jan 10, 2026

Unified Optical and Electrical Noise Figure

An optical amplifier (such as EDFA) has a gain G and an expectation value ~ = nsp (1 − 1 G) of equivalent input-referred detectable noise photons per mode where nsp is the spontaneous emission

Feb 15, 2026

(PDF) Investigation of electrical noise figure for fiber

Abstract Electrical measurements of the noise figure of a fiber optical parametric amplifier are presented and compared with optical measurements.

May 16, 2026

Understanding Noise Figure in Amplifiers: Definition

Can noise figure be negative? No, the noise figure is always greater than or equal to 0 dB. How can I reduce the noise figure in my amplifier design?

Oct 20, 2025

OSA: Characterization of Optical Amplifier Gain and

The applicable models are equipped as standard with an optical amplifier analysis function (EDFA-NF) that automatically calculates the gain and noise figure (NF) of

Mar 18, 2026

Optical Signal to Noise Ratio (OSNR)

Optical Signal to Noise Ratio (OSNR) is the measure of the ratio of signal power to noise power in an optical channel. OSNR is important because it suggests a degree of impairment when the optical

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