Abstracts

Input impedance conditions for minimizing the noise figure of an analog optical link (Dec. 1998, Part I [T-MTT])

E.I. Ackerman, C. Cox, III, G. Betts, H. Roussell, F. O'Donnell and K. Ray. "Input impedance conditions for minimizing the noise figure of an analog optical link (Dec. 1998, Part I [T-MTT])." 1998 Transactions on Microwave Theory and Techniques 46.12 (Dec. 1998, Part I [T-MTT]): 2025-2031.

We use an equivalent-circuit model to derive the minimum noise figure (NF) for an amplifierless optical analog link with a perfect lossless input impedance-matching circuit. This minimum, which is 3 dB, is called the lossless passive match limit. We contrast the link model with an analogous equivalent-circuit model for a transistor amplifier, which does not have the same limiting NF under this impedance-matching condition. It turns out that the link's 3-dB limit arises from the ohmic nature of the impedance of the device that modulates the light, and not from the electro-optic conversion processes in the link. In a prior experimental link, with near-perfect impedance matching, dissipative loss in our input circuit precluded achieving a measured NF of less than 4 dB. Investigation of the effects of input impedance mismatch indicates that mismatch can actually lower the NP to below 3 dB even when dissipative loss is present in the input circuit. We have used this mismatch effect to reduce the measured NF of our link to 2.5 dB at 130 MHz. We believe this is the first demonstration of amplifierless-link NF of less than 3 dB.

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