SYSTEM NOISE ANALYSIS FOR PHOTONIC PHASED-ARRAY ANTENNAS*

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Abstract

In this paper, the total noise of a phased-array antenna system employing a photonic feed network is analyzed using a model for the individual component noise including both additive and multiplicative equivalent noise generators, Additive noise is present independent of signal amplitude, whereas multiplicative noise is only present in proportion to the signal amplitude. Thermally-generated amplifier noise and laser relative-intensity-noise (RIN) are examples of additive noise; gain or phase instabilities are examples of multiplicative noise. It is shown that uncorrelated multiplicative noise of equal amplitude in the individual feeds is mitigated by a factor of 10log(N) in the output of an N-clement linear array. However, the uncorrelated additive noise of the individual feed paths is not mitigated, and therefore will determine the minimum noise floor of a large phased-array. We believe this analysis resolves previously reported discrepancies between theoretical and experimental results for phased-array antenna noise performance.

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