

## Comments on "Accuracy Improvements in Microwave Noise Parameter Measurements"

Arthur Uhler, Jr.

The above article<sup>1</sup> contains an incorrect description of the contents of a much earlier article [1], of which I am one of the authors. The statement is made that [1] "points out that only one measurement of noise figure is necessary together with several 'cold' noise power measurements." While that important point is made in the abstract, the paper contains much more.

For example, equation (4) of this earlier paper calls for five measurements of output power with five known source admittances  $Y_s$ , each with a known relative noise temperature  $t_s$ , where  $s = 1, 2, 3, 4, 5$ . It is neither stated nor implied that two of the  $Y_s$  values must be the same.

What is important is that the measurements be sufficiently different so that the five resulting equations are independent enough to determine the five parameters of the noise characterization of a linear receiver. It is noted following our equation (4) that at least one of the noise temperatures must be different from the others.

Our paper does continue by considering the special case of two identical source admittances with different noise temperatures, because subsequent calculations then can be reduced to a solution of linear equations. Further, our paper goes on to note the important practical case when two of the admittances are approximately equal but have different noise temperatures. Thus, Fig. 8 of the paper in question illustrates a procedure advocated in [1].

The teachings of [1] were consciously dedicated to world knowledge in 1973. Ordinarily it is gratifying to see one's ideas put to use, even when credit is only partial. However, such inaccuracy must be challenged when it is used to obtain a U.S. Patent [2]. The corporate apology [3] for a previous omission of reference to [1] similarly fails to acknowledge its full content.

**Reply<sup>2</sup> by Andrew C. Davidson and Eric Strid<sup>3</sup>**

Equation (4) in [1] describes a useful general formulation for noise power measurements with a variety of source admittances and temperatures. Reference [1] goes on to describe a solution for the special case of  $Y_1 = Y_2$  and  $T_1 \neq T_2$ , because, as Professor Uhler suggests in his comments, the authors felt such condi-

tions were necessary to reduce subsequent calculations to a solution of linear equations. The authors also contribute the idea that such a solution "can give a starting point for an accurate solution of (4) by successive trials" for the case where  $Y_1$  is approximately equal to  $Y_2$ . Our paper failed to recognize their mention of such an iterative solution and we apologize for the omission.

It was the point of our work, however, to show that the special case of two identical source admittances with different noise temperatures is *not* needed to reduce subsequent calculations to a solution of linear equations. Thus our method for determining noise parameters, as given in the appendix of our paper, represents a general solution and avoids both the disadvantages of an iterative solution and the restriction that the admittances  $Y_1$  and  $Y_2$  be approximately equal.

In this light our Fig. 8 illustrates a procedure which in fact is not mentioned in [1], although because our noise source happened to have  $Y_1$  approximately equal to  $Y_2$  the iterative approach suggested in [1] would have yielded similar results.

We appreciate Professor Uhler bringing his thoughts to our attention and hope that this explanation will help allay his concerns.

## REFERENCES

- [1] V. Adamian and A. Uhler, Jr., "A novel procedure for receiver noise characterization," *IEEE Trans. Instrum. Meas.*, vol. IM-22, pp. 181-182, June 1973.
- [2] A. C. Davidson, U.S. Patent 4905308, Feb. 27, 1990.
- [3] Cascade Microtech, "Reply from the authors," *Microwaves & RF*, p. 13, Aug. 1989.

## Corrections to "Optical Control of Microwave Semiconductor Devices"

A. J. Seeds and A. A. de Salles

In the above paper,<sup>1</sup> the following corrections should be made:

- 1) On page 577, in the 18th line of the Introduction, the word *simulated* should be *stimulated*.
- 2) On page 581, in the 15th line of the left column, "530 MHz" should be "5-30 MHz."

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<sup>1</sup>A. J. Seeds and A. A. de Salles, *IEEE Trans. Microwave Theory Tech.*, vol. 38, pp. 577-585, May 1990.

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<sup>1</sup>A. C. Davidson, B. W. Leake, and E. Strid, *IEEE Trans. Microwave Theory Tech.*, vol. 37, pp. 1973-1978, Dec. 1989.

<sup>2</sup>Manuscript received July 18, 1990.

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