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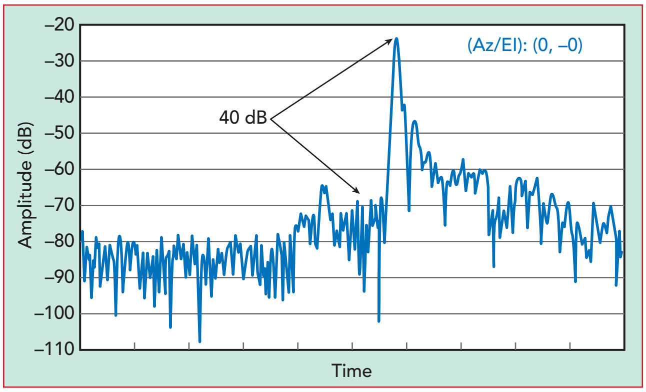

Fig. 10 **AUT time domain response.**

From Equation (22), the smaller $\frac{\lambda}{W}$ the less error is present. The constant, k, may be determined from a data set where it can be assumed L is small enough to ensure accuracy, 1 meter in this example. The corrected data then becomes

$$S'_{21} = S_{21} - k * L\frac{\lambda}{W} \quad (23)$$

When Equation (23) is solved for k,

$$k = \left(S_{21} - S'_{21}\right) + \frac{W}{\lambda L} \quad (24)$$

While a least squares algorithm would be most useful for the determination of k, a simple value can be determined by adjusting k until the lowest frequency S_{21} at 3 meters matches S_{21} at 1 meter. This is applied to data of Figure 13. ***Figures 14*** and ***15*** plot the results with k = 3.8.

CONCLUSION

The work of Purcell has been re-derived in vector form to take advantage of a modern VNA's vector calibration capabilities. The resulting derivation is in good agreement with the classical 3-point method. The methodology enables antenna phase determination and a resulting S-parameter matrix. The matrix can then be used in system simulators to determine antenna bit rate error versus pointing angle. The reflection method has the advantage that only a single antenna is required; however, limitations determined by the wavelength to reflector ratio are not addressed here. The measurement is real-time, non-invasive and enables rapid antenna calibration with only a single port S_{11} measurement. It is shown that accurate measurements can be made down to two wavelengths (half the reflector width/height). ■

ACKNOWLEDGMENTS

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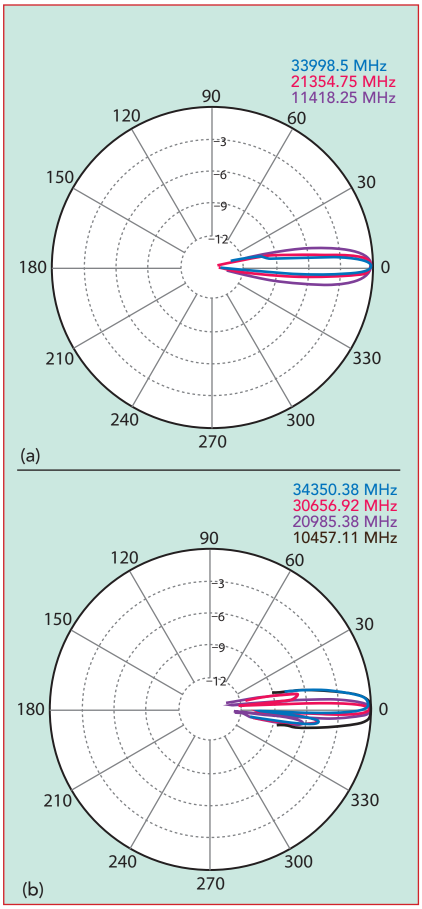

Fig. 11 **Elevation (a) and azimuth (b) beam measurements at several frequencies.**

References

1. E. M. Purcell, *A Method for Measuring the Absolute Gain of Microwave Antennas*, Radiation Laboratory, Massachusetts Institute of Technology, Report No. 41-9, 1943.