

COMMERCIAL MICROWAVE HAZARD METERS: A LABORATORY EVALUATION



A test protocol has been devised to evaluate the performance of selected commercially available microwave hazard meters used in determining compliance with standards and for laboratory measurements. The protocol was designed to yield a comprehensive analysis of instrument errors associated with the more significant environmental variables and source characteristics, as well as with the instrument design and production tolerances. Among the parameters considered were calibration accuracy, response linearity, frequency response, polarization ellipticity, temperature response, near-field characteristics, RFI susceptibility, response to amplitude-modulated fields, probe receiving pattern, drift, response time, and sensitivity to changes in battery supply voltage.

Using five different laboratory test systems, procedures have been developed to evaluate the effect of each parameter. The uncertainty of each test has been analyzed.

The procedures of the test protocol have been employed in the evaluation of selected commercial hazard meters in current use. Error values for each parameter have been computed for each instrument, and a composite error has been calculated. Techniques for assessing composite uncertainties in special measurement situations have been outlined.

Based on experience in the laboratory, and in field surveys, a test protocol has been devised to evaluate the performance of commercially available microwave hazard meters. The protocol was designed to yield a comprehensive analysis of instrument errors associated with the most significant environmental variables and source characteristics, as well as with the instrument design and production tolerances. The use of such instruments in biological research has necessitated a meaningful assessment of measurement uncertainty. The protocol was designed to yield information of practical value to such researchers, and to enable a straightforward evaluation of the meaning of hazard-meter measurements in real-life situations. Among the parameters included were calibration accuracy, response linearity, frequency response, polarization ellipticity, temperature response, near-field characteristics, RFI susceptibility, response to amplitude-modulated fields, probe receiving pattern, drift, response time, and sensitivity to battery supply voltage.

Five different absorber-lined laboratory test systems were designed and built for the implementation of the test protocol. The systems were tested, and the uncertainty associated with each evaluation was quantified. Particular attention has been paid to the meter-to-meter variation in key parameters such as calibration and polarization ellipticity. A computer-based system was designed to collect and reduce laboratory data and to perform relevant statistical analyses.

The procedures of the test protocol have been employed in the evaluation of commercial hazard meters in current use. Error values for each parameter have been computed for each instrument, and a worst-case composite uncertainty is calculated for each model. Special tests were devised and implemented for each model to complement the general protocol. These included an evaluation of the parasitic interaction of E-field probes with the H-field, and the impedance loading of meters. Results are compiled and presented in such a way as to allow individual experimenters to compute the appropriate uncertainty levels in specific measurement environments.