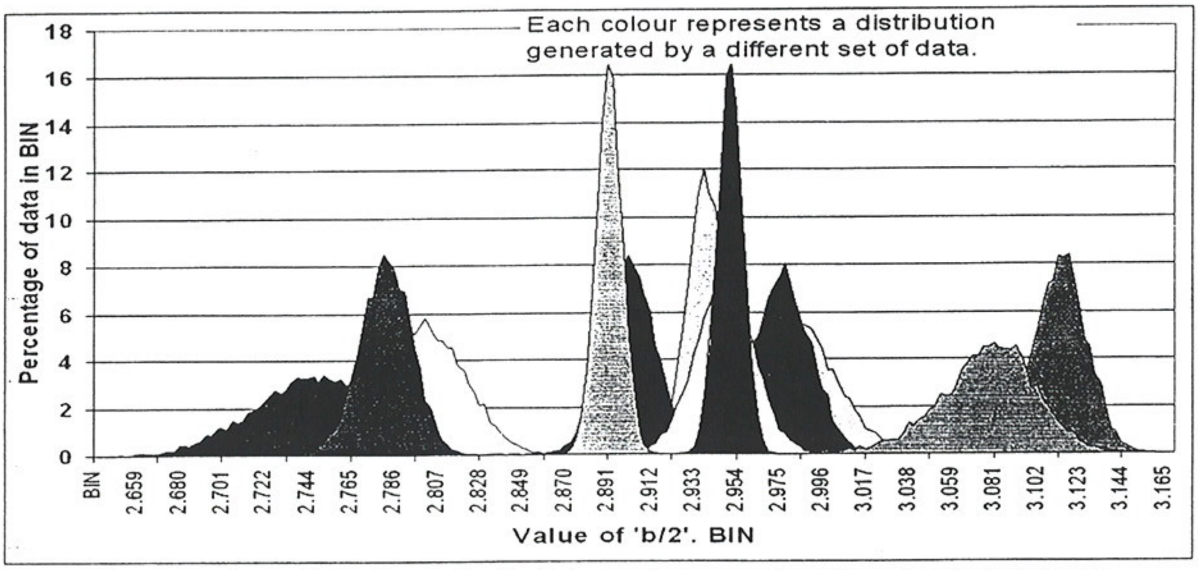

Figure 4. **Showing the distribution of values for the b coefficient as generated by the random sampling process.**

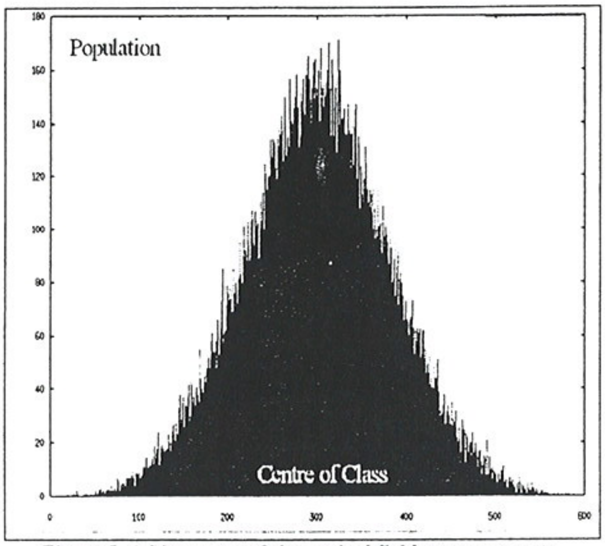

Figure 5. **A histogram of theoretical field measurements.**

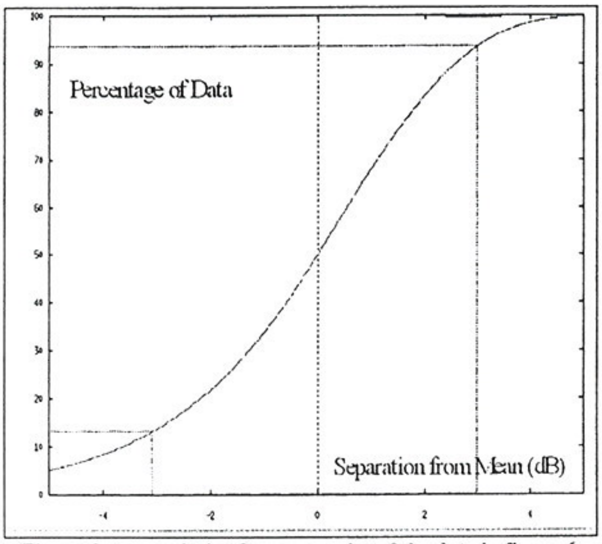

Figure 6. **A cumulative frequency plot of the data in figure 6.**

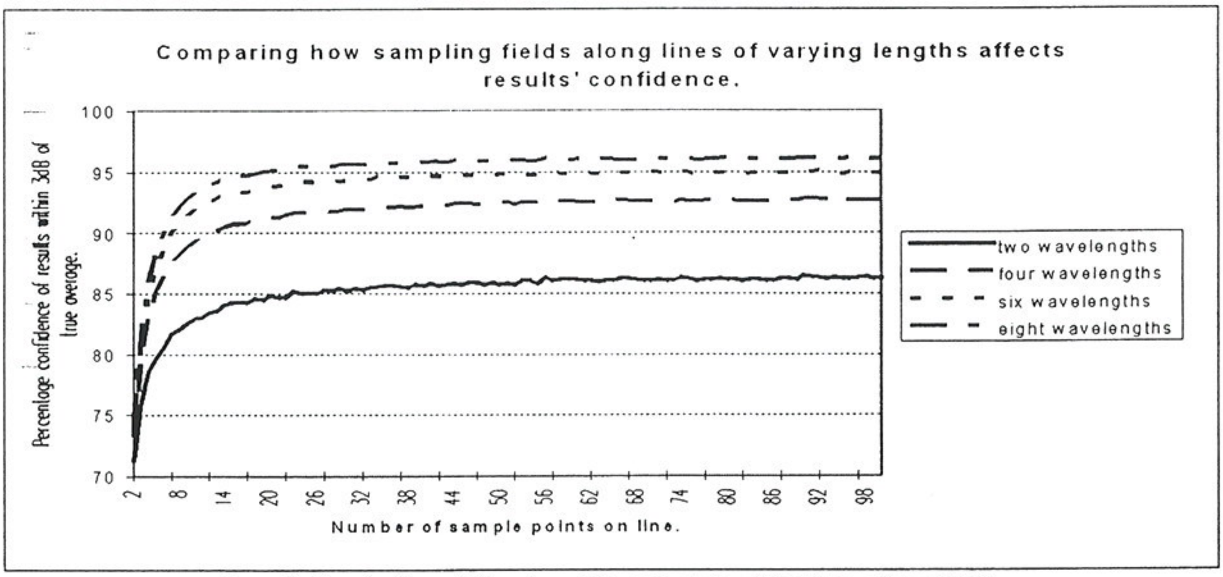

Figure 8. **Showing the variations in confidence levels for different sampling methods.**

Stadium Reverberation Chamber for High-Intensity Isotropic Field EMC Testing at Microwave Frequencies

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Abstract

Measurement results, statistical data analysis and chamber characteristics are reported for the *NPL* untuned 3D stadium reverberation chamber at 2.5, 8.2 and 18GHz. Coefficients for field anisotropy and field inhomogeneity enable the quality of the reverberant field to be quantified. Spectral analysis is used to calculate the normalized spectral bandwidth and the characteristics of the underlying stochastic model for the stirring process. Statistics of level crossings and excursion lengths show reasonable agreement with theoretically predicted values.

INTRODUCTION

Conventional EM reverberation chambers are typically rectangular or cubic cavities in which one or more rotating paddle wheel(s) produce(s) changes in the EM boundary conditions (mechanical stirring) so as to generate a statistically isotropic and homogeneous field of high intensity (> 100V/m). Alternatively, a CW source can be swept in phase or frequency to the same effect (electronic stirring). In contrast, the *NPL* untuned 3D stadium reverberation chamber has been designed around an intrinsically ergodic stadium cavity, with supporting untuning wave diffractors. It thus combines properties of well-known untuned cavity resonators with characteristics of regular ergodic ('chaotic') cavities, as recently studied in the theory of quantum chaos ('quantum billiards').

CONFIGURATION

The chamber consists of two aluminium concave hemispheres of average radius 350mm, connected by a central octagonal cylindrical section of height 175mm (Fig 1). On the inner wall, smaller convex hemispherical corrugations of various sizes exist with radii ranging between 5mm and 40mm. These corrugations establish the inner radius of the cavity as a spatially random variable ('untuned cavity'). By making the lower hemisphere rotatable, the corrugations provide a mechanical stirring capability ('wall stirring'). As convex diffractors, the corrugations also reduce the field inhomogeneity. Their wave dispersing properties enhance the ergodic properties of the chamber considerably because their randomized positions and sizes help to preserve the ergodicity in three dimensions.

The central cylindrical section transforms the otherwise integrable (spherical) cavity into a nonintegrable 3D Bunimovich stadium [1, 2]. The value of the stadium parameter, i.e. the ratio of the height of the cylindrical section to the cavity diameter, can be increased at will and optimized by inserting an extra cylindrical section at the equator. The upper hemisphere, the coupling plates in the cylindrical section and the positions of the horns remain fixed at all times during a scan by the lower hemisphere with respect to an inertial frame of reference. Reverberation is achieved by spinning the lower hemisphere around a vertical axis. The present set-up allows for this in both discrete ('mode tuned') or continuous ('mode stirred') mode. Here we report on results for discrete (mode tuned) operation only. For frequencies in excess of 2.5GHz, wall stirring has been found to produce an efficient change in the EM boundary conditions. It also provides a comparatively large usable volume relative to the physical volume because obstructive paddle wheels are no longer required.

AUTOCORRELATION STATISTICS

A total of $M = mN = 1,500$ samples at angular equidistant wall steps of 2.60mrad were taken at 8.2GHz in mode tuned operation. The autocorrelation function (acf) $\rho(\tau)$ for wall stirrer positions τ is typically used to analyze tuner sweep data for linear