We report the recent progress in developing 2D-ELDOR (2D electron-electron double resonance) analysis method. The new “full Sc- method”, which corrects the spectral analysis for the phase distortion effects present in the experiments, is demonstrated to enhance the sensitivity of 2D-ELDOR in reporting on molecular dynamics in complex membrane environments. That is, instead of performing spectral fitting in the magnitude mode, our new method enables simultaneous fitting of both the real and imaginary components of the Sc- signal. The phase corrections applied to the Sc- spectrum enable the extraction of the pure absorption-mode spectrum, which is characterized by much better resolution than the magnitude-mode spectrum. In the absorption mode, the variation of homogeneous broadening, which reports on the dynamics of the spin probe, can even be observed by visual inspection. This new method is illustrated with results from model membranes of DPPC-Cholesterol binary mixtures, as well as with results from plasma membrane vesicles of mast cells. Thus we find that 2D-ELDOR is greatly improved with the new “full Sc- method” especially for exploring the complexity of model and biological membranes.