SUMMARY  This paper investigates the modeling of non-linearity on the generation of the single trial evoked potential signal (s-EP) by means of using a mixed radial basis function neural network (M-RBFN). The more emphasis is put on the contribution of spontaneous EEG term to s-EP signal. A M-RBFN neural network model is trained simultaneously with the different segments of EEG/EP data. The resulting both fitted and reduced (optimized) nonlinear model then provides a global representation of the passage dynamics between pre- and post-stimulus periods.