Lithium ion battery performance at high charge/discharge rates is largely determined by the ionic resistivity of an electrode or separator which are filled with electrolyte. Key to understand and to model ohmic losses in porous battery components are porosity as well as tortuosity. In the first part, we use impedance spectroscopy measurements in a new experimental setup to obtain the tortuosities and MacMullin numbers of some commonly separators, demonstrating experimental errors of < 8%. In the second part, we present impedance measurements of electrodes in symmetric cells using a blocking electrode configuration, which is obtained by using a non-intercalating electrolyte. The effective ionic resistivity of the electrode can be fit with a transmission-line model, allowing us to quantify the porosity dependent MacMullin numbers and tortuosities of electrodes with different active materials and different conductive carbon content. Best agreement between the transmission-line model and the impedance data is found when constant-phase elements rather than simple capacitors are used.