***Abstract*—Ensuring a correct signal integrity within the entire FlexRay network and for all the possible environmental situations is mandatory for reliable operation of the distributed application. However, this is a goal difficult to reach due to the large number of parameters that influence the signal integrity. The use of simulation is a natural answer to efficiently support space exploration. We discuss in this work how the TEODACS test approach supports the validation process of the simulation models for FlexRay topologies and provides trustfulness for the simulation results even if hardware reference is not available. Further, we introduce a new method for the advanced analysis and evaluation of signal integrity in FlexRay networks.**