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FlexRay ECU mission critical parameters measurement

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Abstract

Network operation of FlexRay Electronic Control Unit (ECU) in passenger cars is influenced by the significant number of parameters that have to be written into the ECU FlexRay controller. To keep the FlexRay network robust, the correct parameter values must be set in all ECUs of the FlexRay communication cluster. This is not a trivial task since particular ECUs are supplied by different manufacturers and any manufacturer can change some parameter either by mistake or even intentionally. The effect of such a change is generally unpredictable and can often be observed under specific operational conditions only. The most serious effect is a global FlexRay network failure, which usually leads to the fatal vehicle malfunction. Hence it was necessary to develop, implement and validate new dedicated measurement methods, enabling the evaluation of actual values of the most critical FlexRay parameters at the Open Systems Interconnection (OSI) data-link layer and thus the ECUs individual acceptances testing for system integrator verification purposes. As the mass production of FlexRay controllers is not applicable due to a lack of test specific features, deployment of these methods is enabled by utilization of unique FPGA-based FlexRay controller implementation. Proposed measurement methods are focused on parameters specifying the FlexRay wakeup protocol, FlexRay startup procedure, and the FlexRay synchronization mechanism. Each measurement method is described in detail, including its limits and prerequisites. All the developed methods were validated by experiments on real FlexRay networks and results are included in the paper. Two different types of FlexRay controller core (Freescale and Bosch E-Ray) were used in ECU under test (EUT) to eliminate the risk of measurement method dependence on a specific controller implementation.

Keywords

FlexRay, ECU, parameter, synchronization, startup, testing

1. Introduction

Passenger car manufacturers play a role of a system integrator today, as a substantial part of vehicle subsystems is supplied by their contractors. This is especially true for vehicle electronics, where particular ECUs are supplied by different manufacturers. Nevertheless, the ECUs have to collaborate

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