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## "Need for full-fledged EMI/ EMC Testing & HIL Software Testing for AES/ Sub-Systems"

**Suresh D**  
CEO, Spark Minda Technical Centre

Spark Minda, the Ashok Minda Group is a leading Tier-1 Auto Components Supplier to all major OEM's in India & having an outstanding international presence in R&D, Manufacturing and Marketing. With more than 20 years of rich experience in the field of Engineering, Business Solutions, Research & Development and Product Development Mr. Suresh heads Spark Minda Technical Centre.

He was previously associated with Bosch Limited, Bengaluru as a Chief of R&D Gasoline Systems and two wheeler power train solutions. His expertise includes Automotive Embedded Systems, Power Train Systems, Electronic Fuel Injection & Transmission Systems, ECUs, BCMs, Control Units, Various Sensors, Genset Control Systems, Infotainment & Instrument Clusters, Telematics & Fleet management Systems etc. In a detailed discussion with MART, Mr. Suresh shares his views on testing and measuring in the automotive segment, Excerpts:-

### How do you see the automotive trends in India?

Government of India aims to make automobiles manufacturing the main driver of "Make in India" initiative, as it expects passenger vehicles market to triple to 9.4 million units by 2026, as highlighted in the Auto Mission Plan (called AMP) 2016-26. Government has formulated a scheme for Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India (called FAME), under the National Electric Mobility Mission 2020 to encourage the progressive induction of reliable, affordable and efficient electric and hybrid vehicles in the country.

In what can be seen as perhaps India's boldest move to curb air pollution, the government has decided to advance the standard for cleaner cars and leapfrog to Bharat Stage-VI emission (emission level similar to Euro VI) norms countrywide by April 2020. This step shows perhaps the strong initiative of India towards the vehicle emission reduction still ahead of the majority of the developed nations in the world.

Last but not least is the safety related, no one could have imagined that this country

will bring the introduction of Antilock Braking System (called ABS) mandatory for two wheelers of engine capacity 125 cc and above so soon. These systems are complex in nature in terms of its hardware and software architecture.

### What does the complexity mean to automobile OEM's and buyers?

Proliferation of electronic systems in automobiles will increase the technical complexity, however the challenge is not only in the compatible design solution, much tougher is the detection of such faults early in development phase to avoid the safety critical risks in the field. Reliability of these electronic devices is key for safe driving.

General environmental tests are not able to detect the complex problems which are associated with either software or hardware or both. The latest cars have multiple microcontrollers / microprocessors working monolithic mode or with real time operating systems. Hence a reliable hardware testing and a proven software validation is important in achieving the overall reliability of the electronic systems.

### What are the basis of electromagnetic interference and its influences?

Electromagnetic compatibility (EMC) is the branch of electrical engineering concerned with the unintentional generation, propagation and reception of electromagnetic energy which may cause unwanted effects such as electromagnetic interference (EMI) or even physical damage in operational equipment. The goal of EMC is the correct operation of different equipment in a common electromagnetic environment.

EMC pursues two main classes of issue. Emission is the generation of electromagnetic energy, whether deliberate or accidental, by some source and its release into the environment. EMC studies the unwanted emissions and the countermeasures which may be taken in order to reduce unwanted emissions. The second class, susceptibility is the tendency of electrical equipment, referred to as the victim, to malfunction or break down in the presence of unwanted emissions, which are known as Radio frequency interference (RFI).

Immunity is the opposite of susceptibility, being the ability of equipment to function correctly

in the presence of RFI, with the discipline of "hardening" equipment being known equally as susceptibility or immunity. A third class studied is coupling, which is the mechanism by which emitted interference reaches the victim.

New technologies and communication systems in vehicles demands an extensive testing and evaluation, before electronic modules are used in real-time installations, in order to ensure complete safety and reliability. EMC intended to avoid malfunctioning of the vehicles and their sub-systems due to electromagnetic interference between the different components and sub-systems, within the vehicle and its environment.

In view of the criticality of EMC compliance, worldwide full-vehicle EMC tests have become mandatory. Additionally, components and sub-systems are also subjected to regulations and need to be tested separately (Component level testing). Achievement of Electro Magnetic Compatibility (EMC) requirements shall be a time consuming and expensive Endeavour for the organizations. EMC compliance is highly critical for products' success and also



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for company's future. Some of the observations in day to day which might be due to the EMC issues as follows:-

- Car audio getting interference during switching on of electric horn

- Mobile phone interference with television & radios

- Interference to electronic equipment's near transformer/ current carrying lines

- Mobile phone interfering with aircraft electronics & communication.

- Non-operation of electronic devices when the vehicle battery (charging) is low

- Failure of electronic devices during heavy rains/thunder storms

**Does EMI/ EMC have any harmful effects like safety issues in automotive application?**

These disturbances are very critical in applications such as Aerospace applications, Military equipment's, Medical devices,

Automotive etc., where the malfunction of electronic modules have graves of consequences. For example, a serious consequence can occur if a signal interferes with the operation of medical equipment that is being used to monitor a patient in intensive care or if the air bag pops up in a car without any incident due to influence of a radar pulses from airport. While the effects of EMI are most cases minor like momentary interference, rare cases the effect may be more catastrophic even leading to life threat.

**How to prevent these failures and improve the reliability?**

New technologies and communication systems in vehicles demands an extensive testing and evaluation to ensure complete safety and reliability. In view of the criticality of EMC compliance, EMC tests have become mandatory in vehicle level and component level. International EMC Standards (CISPR25, ISO11452, ISO16750, ISO7637

and ISO10605) been framed to regulate the same. These tests are executed broadly under the category of conduction and radiation to test the emission levels and Immunity levels.

**What is embedded software mean to automobiles?**

Embedded software is computer software, written to control machines or devices that are not typically thought of as computers. It is typically specialized for the particular hardware that it runs on and has time and memory constraints. Manufacturers 'build in' embedded software in the electronics in cars, telephones, modems, robots, appliances, toys, security systems, pacemakers, televisions and set-top boxes, and digital watches. In modern cars a millions of such software codes runs and makes the complexity degree to a higher level.

At the same time, modern vehicles comes with more and more safety-related systems such as Adaptive Cruise Control, Electronic Stability Program, Power Assisted Steering, and Integrated Chassis Management. To establish a uniform and commonly accepted approach for developing automotive safety-related electric/electronic

simulation is now a standard component in the vehicle development process as a method for testing electronic control unit (ECU) software. HIL simulation is used for all aspects of development, naturally including safety-relevant functions and systems. This applies to all test tasks (from function testing to release tests, testing a single ECU or an ECU network, and so on) and also to different vehicle domains. Every electronic systems are equipped with microcontrollers / microprocessors like powertrain, body control, vehicle dynamics, driver assistance systems, Interior/comfort systems and infotainment etc. are all tested by HIL simulation.

Hardware-in-the-loop (HIL)

systems, the safety standard ISO 26262 ("Road vehicles - Functional safety") has been developed by OEMs, suppliers and service providers and released in late 2011. ISO 26262 explicitly names HIL as a suitable test environment for software unit tests and integration tests, even recommends HIL for the verification of safety requirements at component level, and also names it as a suitable method for testing single ECU's components and for testing ECU networks up to an entire virtual vehicle.

HIL setup with automated testing feature will improve the efficiency, productivity and quality of delivered software. Usage of HIL enhances the quality of the testing by increasing the scope of the testing and finally improves the product quality. Ideally, an embedded system would be tested against the real plant, but most of the time the real plant itself imposes limitations in terms of the scope of the testing. For example, testing an engine control unit as a real plant can create the following dangerous conditions for the test engineer.

- Testing at or beyond the range of the certain ECU parameters (e.g. Engine parameters etc.)

- Testing and verification of the system at failure conditions

In the above-mentioned test scenarios, HIL provides the efficient control and safe environment where test or application engineer can focus on the functionality of the controller.

**Tell about your company involvement in this challenging automotive arena?**

Spark Minda, the Ashok Minda

Group is a leading Tier-1 Auto Components Supplier to all major OEM's in India & having an outstanding international presence in R&D, Manufacturing and Marketing. Group CEO, Mr. Ashok Minda has a clear vision, clarity of thought and focused approach towards the future, this has resulted as a New R&D facility called Spark Minda Technical Centre (SMIT).

SMIT is expected to do the advanced engineering and research activities in automotive domain to bring the modern technologies to India, have acquired highly talented professionals and located in Chakan, Pune. SMIT is installing the state of art design and development infrastructure having test facilities catering to EMI/EMC testing as per CISPR 25, JASO, AIS, SAE, ISO11452, ISO16750, ISO7637 and ISO10605 Standards. A semi anechoic chamber to test the automotive systems components being installed in this facility, expected to be operational by Oct'2016.

In order to improve safety, efficiency and sustainability in road transport, driver support systems and fully automated intelligent transport systems are among the most promising developments on the market. Extensive development and testing processes are necessary to ensure that these systems are safe and reliable. Until now the full-scale road tests have been expensive, time-consuming and possibly hazardous. SMIT brings a radical change to this landscape. With its Hardware-In-Loop laboratory, we offer a unique environment for the development and testing of intelligent vehicles and transport systems; safely, cost-effectively and manageably.



Typical EMC testing of a Car

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