

## **2- day Seminar:**

### **EMC COMPETENCE “AUTOMOTIVE LV” (12/24/48V systems)**

- EMC requirement according to ECE Regulation No.10
- Classical test methods of transient interference and ESD
- "LV124" (12 V, 24 V mains) and "LV148" (48 V mains)
- Sinusoidal RF-interferences like magnetic fields, BCI
- Emission of transient disturbances and CISPR 25

#### **From the topics: Overview**

##### **Test method of immunity of transient disturbances – LV range**

**Range: ISO 7637-2, ISO 7637-3, ISO 10605**

- / The disturbing phenomena, their cause and their effects
- / Changes due to current version and outlook on future versions
- / The test equipment: Interference generator and its verification
- / The test setup and the test procedure
- / Practical tips and hints for avoiding sources of error during testing

##### **Test method of immunity to voltage anomalies in on-board electrical systems – LV range**

**Standard range: ISO 16750-2, LV124, LV148**

- / The disturbing phenomena, their cause and their effects
- / The test equipment: controlled voltage source – 4-quadrant amplifier, variable internal resistances, power fail generator
- / The test methods for the on-board power supply phenomena such as voltage dips & drops, overvoltage, superimposed alternating voltage, Voltage variations, reset behavior, pin interruption, reverse polarity, etc.
- / Practical tips and hints for avoiding sources of error during testing

##### **Test methods of immunity to conducted and radiated AF and RF disturbances**

**Range: ISO 11452-4, ISO 11452-8, ISO 11452-10**

- / The phenomenon and the generation of disturbances
- / The test methods, the test setup, verification of disturbances, closed-loop and substitution methods
- / Practical tips and hints for avoiding sources of error during testing

##### **Emission test methods for components in vehicles**

**Range: CISPR 25**

- / Requirements for measurement technology, test setups and test execution
- / Relevant parameters of the receiver setting such as detector, bandwidths, step size, measurement time
- / The measurement methods for detecting interference voltage, interference current and field strength

#### **Seminar Agenda:**

- Overview EMC in the field of automotive and ECE R10 Rev. 06

##### **LV - Testing Transient & ESD**

- ISO 7637-2:2011
- Voltage transient Emission ISO 7637-2:2011
- Immunity ISO 7637-2:2011 Electrical transient along supply lines
- Verification ISO 7637-2:2011
- Immunity ISO 7637-3:2016 Electrical transient along signal lines
- Immunity ISO 10605:2008+AMD1:2014 and new. ISO 10605:2023 Electrostatic discharge

##### **Battery- / Voltage- Abnormalities**

- Immunity ISO 16750-2 Battery voltage variations
- Immunity LV124 / LV148 Electrical requirements and testing's

##### **RF- Testing**

- Immunity ISO 11452-4 Bulk Current Injection
- Immunity ISO 11452-8 Radiated magnetic fields in the LF range 15 Hz – 150 kHz
- Immunity ISO 11452-10 Conducted disturbances fields in the LF range 15 Hz – 250 kHz

##### **Emission- Testing**

- EN55025, Emission test method for vehicle components
- ECE R10 and CISPR12 Emission requirements for components and

## **1- day Seminar:**

### **EMC COMPETENCE “AUTOMOTIVE HV” (High-voltage systems)**

- Test requirements and phenomena for components on the high-voltage electrical system
- Voltage variations
- Voltage ripple - ripple
- Measurement of generated disturbances

#### **From the topics: Overview**

##### **Introduction to HV Component Tests**

##### **Stress Variations - Stress Profiles**

- / Test methods and requirements according to ISO 21498-2, LV123, VW 80300
- / Voltage ranges
- / Requirements for the source and measurement technology
- / present transients like voltage slope, overvoltage, load dump
- / HV offset tests

##### **Voltage ripple - ripple**

- / Ripple phenomenon, applied voltage ripple
- / Test methods, test setup and requirements according to ISO 21498-2, LV123, VW 80300, MBN 11123, ISO/TS 7637-4
- / Relevant factors such as: DUT impedance, technical realization, control factors, Requirements for frequency range and amplitude
- / Coupling methods
- / Ripple generator (application, functionality, selection)
- / Testing of typical HV components (battery, inverter, auxiliary units)

##### **Measurement of generated disturbances**

- / Phenomenon of generated voltage ripple and stress dynamics
- / Test methods, test setup and requirements according to ISO 21498-2, LV123, VW 80300, ISO/TS 7637-4
- / Load Dump Emission according to ISO 21498-2
- / HV network replicas

##### **Other HV pulses and phenomena**

- / ISO 7637-4: Pulse A – pulsed sinusoidal disturbances 1 MHz – 10 MHz
- / Load dump according to ISO 21498-2 and similar
- / Load Dump #2 according to VW 80300
- / EHV-16 HV pulse according to VW 80300

#### **Seminar Agenda:**

- Overview EV /HV Testing acc. to ISO 21489-2, ISO/TS 7637-4 and LV123
- Immunity „present“ Voltage variations and Voltage profiles
- Immunity „present“ Voltage Ripple
- Emission „generated“ Ripple, voltage dynamics, load dump
- Immunity pulsed sinusoidal disturbances ISO/TS 7637-4