Electromagnetic compatibility – an extremely important issue!

The amount and complexity of electronic devices and components are increasing significantly. Concurrently, the well-known problems involved are also of significant importance: Electronic devices and components are interacting via electromagnetic radiation. Within a wide range of frequencies the radiation is absorbed and emitted via electric leads as well as via electromagnetic fields. However, the disturbance-free operation of electronic devices in close proximity to each other depends entirely upon their electromagnetic compatibility (EMC).

EMC means:

- Every electronic device emits a minimum of radiation to assure that other nearby devices remain operational without disturbance.
- Every electronic device will not be influenced by the radiation disturbance of any other device and will therefore display a sufficient immunity to disturbance.

In automotive applications, ignoring the demands for EMC may result in a disturbance of the radio reception or electronically controlled fuel injection system. Even more severe consequences may occur if the airbag is activated by electromagnetic radiation.

In Europe, the electromagnetic compatibility is legally defined by the EMC Directive 89/336/EWG – up-to-date 2014/30/EU –, introduced by the European Community on January 1, 1996. Compliance with this directive is of utmost importance and provides a fundamental benefit for the customer who expects reliability, i.e. the simultaneous, disturbance-free operation of his equipment.

Furthermore: only those electronic devices which are in compliance with or exceed the EMC regulations can be marketed in Europe.

Products and equipment which are in accordance with the EMC Directive must be testified by a „CE declaration of conformity“ which is provided by the manufacturer. The product must be properly labeled with the standardized CE label and accompanied by a corresponding entry in the end user’s manual.

Examples for the TE Connectivity Test and Measurement Equipment

Radio interference suppression of a vehicle in the EMC Service Center
EMC Test – the principle

In our Service Center in Neckartenzlingen, all types of electronic devices, e.g. an industrial production unit, vehicles, or even an electric shaver, can be tested with respect to their electromagnetic compatibility according to the EMC Directive. Measurement is performed by advanced computer-controlled equipment which allows very short measuring times.

Our service team will perform any kind of measurements during the entire development phase of your electronic product as well as standardized measurements to obtain the CE certification. We will also perform spot checks on your production line to assure constant quality during the lifetime of your product. In our most sophisticated EMC Service Center we can measure disturbances emerging from leads or radiators as well as the immunity of both against electromagnetic disturbances.

The EMC Service Center offers the most professional measurements to all manufacturers of electric devices or production units. We will also provide assistance in finding your way through the legal demands required to obtain the CE certificate and – upon request – provide you with valuable advice for product modifications to obtain full electromagnetic compatibility.

Let us help you on your way through standards and specifications. No matter what kind of electric product you have – talk to our service team about EMC tests! Our assistance can help you to satisfy your customers in the future. Examine our multifunctional test equipment – we look forward to solving your EMC problem.
### Technical Equipment

**Semi-Anechoic Chamber**
- Frequency range: 10 kHz - 20 GHz
- Size (LxWxH): 14 m x 11 m x 4.4 m (45.93 ft x 36.09 ft x 14.44 ft)
- Pneumatic sliding door (WxH): 3 m x 3 m (9.84 ft x 9.84 ft)
- Hybrid RF-absorber (ferrite base and matching layer and pyramidally shaped resistive top part)
- Groundplane (can be covered partially with groundplane absorbers)
- Turntable: diameter 4 m (13.12 ft)
  - load-carrying capacity 3000 kg (6613.87 lbs)
- Lead-through filters for signal- and control-lines
- Lead-through for coaxial cables and fibre optic cables
- Filtered power supply 230 V, 16 A and 400 V (three-phases), 16 A
- Monitoring of the equipment under test via an EMC hardened video and audio system
- Exhauster
- Fire- and air-observation
- Air condition

**Shielded Cabin**
- Size (LxWxH): 3 m x 2 m x 2.2 m (9.84 ft x 6.56 ft x 7.22 ft)
- Door (WxH): 0.95 m x 2 m (3.12 ft x 6.56 ft)
- Lead-through for coaxial cables and fibre optic cables
- Filtered power supply 230 V, 16 A

**Open Area Test Site**
- Design according to CISPR 16-1-4
- Measuring distance: 3 m and 10 m (9.84 ft and 32.81 ft)
- Positioning mast for the variation of antenna heights and polarisation
- Turntable
- Metallic groundplane

### Test Equipment

**Equipment for Emission Tests**
- EMI receivers (also time domain), R&S, up to 44 GHz
- Test system to measure harmonic current emissions and voltage fluctuations or flicker
- Digital oscilloscope
- Special software to control the automatic measurement of disturbance field strength and disturbance voltage or current including automatic documentation
- Calibrated reference antennas, line impedance stabilisation networks, transducers, accessories

**Equipment for Immunity Tests**
- Signal generators up to 40 GHz
- Power amplifiers from 9 kHz to 6 GHz, up to max. 500 W
- Field monitoring system, E and H field
- Directional couplers, power meters
- Antennas
- Special software to control the immunity test including automatic documentation
- Burst generator, capacitive coupling clamp
- Surge/hybrid generator, coupling decoupling networks
- Stripline 90 Ω according to ISO 11452-5
- Road vehicle testpulse generators
- ESD generator
- Mains interference simulator
# EMC Testing Capabilities: Immunity Tests

<table>
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<tr>
<th>Tests</th>
<th>Parameters</th>
<th>Standards</th>
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</thead>
<tbody>
<tr>
<td><strong>Electrostatic discharge immunity test (ESD)</strong></td>
<td>Contact discharge: up to 30 kV Air discharge: up to 30 kV <strong>RC-combination:</strong>&lt;br&gt;• 330 Ω / 150 pF&lt;br&gt;• 2 kΩ / 150 pF&lt;br&gt;• 2 kΩ / 330 pF&lt;br&gt;• 330 Ω / 330 pF&lt;br&gt;• 1.5 kΩ / 100 pF</td>
<td>IEC 61000-4-2&lt;br&gt;EN 61000-4-2&lt;br&gt;ISO 10605</td>
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<tr>
<td><strong>Radiated, radio-frequency electromagnetic field immunity test</strong>&lt;br&gt;80 MHz - 6 GHz</td>
<td>&lt;br&gt;• up to 10 V/m (3 m distance)&lt;br&gt;• up to 20 V/m (1.5 m distance)</td>
<td>IEC 61000-4-3&lt;br&gt;EN 61000-4-3&lt;br&gt;Antenna</td>
</tr>
<tr>
<td><strong>10 kHz - 400 MHz (1 GHz)</strong>&lt;br&gt;400 V/m</td>
<td></td>
<td>ISO 11452-5&lt;br&gt;Stripline 90 Ω</td>
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<tr>
<td><strong>Electrical fast transient / burst immunity test</strong>&lt;br&gt;up to 4.5 kV</td>
<td>&lt;br&gt;5 kHz or 100 kHz on DC/AC supply lines&lt;br&gt;on signal lines</td>
<td>IEC 61000-4-4&lt;br&gt;EN 61000-4-4</td>
</tr>
<tr>
<td><strong>Surge immunity test</strong>&lt;br&gt;up to 7 kV / up to 3.5 kA</td>
<td>&lt;br&gt;1.2/50 µs (open-circuit voltage)&lt;br&gt;8/20 µs (short-circuit current)&lt;br&gt;on DC/AC supply lines&lt;br&gt;on signal lines</td>
<td>IEC 61000-4-5&lt;br&gt;EN 61000-4-5</td>
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<tr>
<td><strong>Immunity to conducted disturbances, induced by radio frequency fields</strong>&lt;br&gt;150 kHz – 80 / 230 MHz</td>
<td>&lt;br&gt;up to 10 V (20 V) EMK&lt;br&gt;on DC/AC supply lines&lt;br&gt;on signal lines</td>
<td>IEC 61000-4-6&lt;br&gt;EN 61000-4-6</td>
</tr>
<tr>
<td><strong>100 kHz – 400 MHz</strong>&lt;br&gt;depending on the method (substitution or closed-loop) up to 350 mA</td>
<td></td>
<td>ISO 11452-4&lt;br&gt;BCI</td>
</tr>
<tr>
<td><strong>Pulse magnetic field immunity test</strong>&lt;br&gt;up to 1000 A/m</td>
<td>&lt;br&gt;6.4/16 µs&lt;br&gt;max. dimensions of test sample: 0.6 m x 0.6 m x 0.5 m (L x W x H)</td>
<td>IEC 61000-4-9&lt;br&gt;EN 61000-4-9</td>
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<tr>
<td><strong>Voltage dips, short interruptions and voltage variations immunity tests</strong>&lt;br&gt;( U_{\text{dips}} ): (0 - 100) % of ( U_{\text{nominal}} )&lt;br&gt;( U_{\text{Variations}} ): (0 - 115) % von ( U_{\text{nominal}} )&lt;br&gt;( U_{\text{nominal}} ): max. 300 V&lt;br&gt;Phase: (0 – 360) °</td>
<td></td>
<td>IEC 61000-4-11&lt;br&gt;EN 61000-4-11</td>
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<tr>
<td><strong>Electrical transient conduction along supply lines and electrical transient transmission by capacitive and inductive coupling via lines other than the supply lines in vehicle on-board electrical systems, ...</strong>&lt;br&gt;Test pulses 1 to 5,&lt;br&gt;Jump start,&lt;br&gt;Load Dump,&lt;br&gt;Electrical Requirements, ...</td>
<td></td>
<td>ISO 7637-2&lt;br&gt;ISO 7637-3&lt;br&gt;ISO 16750-2&lt;br&gt;LV 124-1</td>
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</table>

Customer specific tests on request
### EMC Testing Capabilities: Emission Tests

<table>
<thead>
<tr>
<th>Tests</th>
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</tr>
</thead>
</table>
| **Conducted emission** | 150 kHz – 30 MHz  
Artificial mains network (AMN)  
• and current probe  
• and impedance stabilisation network (ISN) | CISPR 11 / 22 / 32  
EN 55011 / 55022 / 55032  
EN 61000-6-3 and -6-4  
... |
|  | **Artificial mains network (AMN)**  
150 kHz – 120 MHz | CISPR 25  
EN 55025 |
|  | **Current probe**  
150 kHz – 250 MHz |  |
|  | **Measurement vehicle (antenna)**  
100 kHz – 6 GHz |  |
| **Radiated emission**  
(Electric and magnetic field) | 150 kHz – 6 GHz  
Antenna  
Measurement distance 3 m | CISPR 11 / 22 / 32  
EN 55011 / 55022 / 55032  
EN 61000-6-3 and -6-4  
... |
|  |  | CISPR 25  
EN 55025 |
|  | **Antenna**  
150 kHz – 6 GHz |  |
|  | **Stripline 90 Ω**  
150 kHz – 1 GHz |  |
| **Screening attenuation** | Triaxial method  
300 kHz – 3 GHz  
radio-frequency cables and connectors  
300 kHz – 1.2 GHz  
screened balances pairs 100 Ω | EN 50289-1-6 |
| **Transfer impedance** | 50 Hz – 2 kHz  
(Harmonics of 50 Hz)  
230 Vac equipment | IEC 61000-3-2  
EN 61000-3-2 |
| **Coupling attenuation** | Determination of  
P_{s}, P_{f}, T_{max}, d_{c}, d_{max}  
230 Vac equipment | IEC 61000-3-3  
EN 61000-3-3 |
| **Harmonic current emissions** |  |
| **Voltage fluctuations and flicker in low-voltage supply systems** |  |

Customer specific tests on request
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