Study of vehicle BCI test for UN R10

1. Outline
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5. Conclusion

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Japan Automobile Manufacturers Association, Inc.
1. Outline

Vehicle immunity method of UN-R10-05 is defined ALSE method as reference test method. And vehicle BCI test method is defined as alternating method limited only large vehicle. However, if test vehicle has a little objective items(components) for the test, BCI test will be very efficient test method.

JAMA proposes that vehicle BCI test can be applied not only large vehicle but also whole vehicles with demonstration by comparison between ALSE and BCI test method.
1.3. Alternative test methods

The test may be alternatively performed in an outdoor test site for all vehicles. The test facility shall comply with (national) legal requirements regarding the emission of electromagnetic fields.

If a vehicle is longer than 12 m and/or wider than 2.60 m and/or higher than 4.00 m, BCI (bulk current injection) method according to ISO 11451-4 shall be used in the frequency range 20 to 2,000 MHz with levels defined in paragraph 6.8.2.1. of this Regulation.
3. Method

a. Set up
   - Measurement inside ECU voltage as actual influence by both immunity test method.

Field strength 30V/m

Injection current 60mA

**ALSE Method**

**BCI Method**
3. Correlation method

b. Test ECU and Optical link

Test ECU
3 measurement port (SMA) is installed.
Port 1: Power line
Port 2: Analog sensor
Port 3: CAN line

Optical transmitter system

Connected to Test ECU

Optical receiver
3. Correlation method

c. About optical link

To avoid influence the metallic cable, test was used a optical RF transmitter system.

OPTICAL FEEDING RADIO OVER FIBER RECEIVAR SYSTEM

Make : TAMAGAWA ELECTRICS
Optical receiver : EOS-1000
Controller : OAL-1000

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<tr>
<th>Items</th>
<th>Specifications</th>
<th>Remark</th>
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<tr>
<td>Frequency range</td>
<td>100kHz〜6GHz</td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td>-10dB以上</td>
<td>@1GHz</td>
</tr>
<tr>
<td>Flatness</td>
<td>100kHz〜6GHz : ±6dB</td>
<td>Reference of gain@1GHz</td>
</tr>
<tr>
<td></td>
<td>10MHz〜6GHz :+6dB/-3dB</td>
<td></td>
</tr>
<tr>
<td>Harmonics distortion</td>
<td>25dBC以上</td>
<td>2 and 3 times of fundamental at input level -22dBm</td>
</tr>
<tr>
<td>SNR</td>
<td>40dB以上</td>
<td>Conversion by RBW=1Hz、@Transmitter input level =-72dBm</td>
</tr>
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</table>
4. Result

<table>
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<tr>
<th>Circuit load</th>
<th>Location</th>
<th>Instrument panel</th>
<th>Chassis mount</th>
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<tr>
<td>Power line</td>
<td>Figure 1.</td>
<td>Figure 2.</td>
<td>Figure 3.</td>
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<td>Analog sensor</td>
<td>Figure 4.</td>
<td>Figure 5.</td>
<td>Figure 6.</td>
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<tr>
<td>CAN line</td>
<td>Figure 7.</td>
<td>Figure 8.</td>
<td>Figure 9.</td>
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**ALSE method**

**Meter cluster**

**Instrument panel**

**Chassis mount**
Figure 1. Around a Meter cluster / Power line
4. Result

**Figure 2. Instrument panel / Power line**
4. Result

Figure 3. Chassis mount / Power line
4. Result

Figure 4. Around a Meter cluster / Analog sensor
4. Result

Figure 5. Instrument panel / Analog sensor
4. Result

Figure 6. Chassis mount / Analog sensor
4. Result

Figure 7. Around a Meter cluster / CAN line
4. Result

Figure 8. Instrument panel / CAN line
4. Result

Figure 9. Chassis mount / CAN line
5. Conclusion

- BCI test is more strict than ALSE method at all ECU locations and circuit loads. That means BCI test can cover the ALSE test method.

- When number of objective components (systems) is little, vehicle BCI test method will be very efficiency test method. (Time, Cost, Location…)

- Vehicle BCI test method is suitable as alternative immunity test method.