EMI-Tight Rectangular Connector Assemblies
SPCD, the 11th of October 2018
Connector problematic

- Radio frequency interference,
- High speed with fast edge signals,
- Electromagnetic interference,
- Sensitive receivers,
- Radio frequency compatibility.
Identified problem

3 area of leakages:

- Fix connector
- Equipment’s chassis
- Mobile connector
- Backshell
Sub-D technologies

Panel mount connectors:

D*Sub female connector, machined shell with RF gasket in groove

D*Sub standard female connector with surrounding EMI gasket
Sub-D technologies

Panel mount connectors:

D*Sub female connector with integrated absorbing epoxy
Sub-D technologies

Mobile connectors:

D*Sub male connector, machined shell with dimples

D*Sub Standard male connector with dimples
Sub-D technologies

Mobile connectors:

D*Sub Standard male connector with bi-material interfacial seal
Sub-D technologies

Backshells:

- EMI flat gasket between backshell and connector with C&K haloring
- Encompassing backshell with C&K haloring
Micro-D technologies

Panel mount connectors:

Rear mounting female connector with EMI gasket.
Micro-D technologies

Mobile connectors:

- Plug with integrated funnel + screw
- Plug with EMI gasket
- Plug with EMI spring
Micro-D technologies

Backshells:

Backshell with EMI gasket
DEFENCE AND SPACE

Two types of vehicle

- Connectic DUT vehicle

- Connector assemblies vehicle
Test campaign for connectic DUT

- **Voltage Proof**
- **Insulation Resistance**
- **Contact resistances**
- **Transfer impedance LF**
  - Triaxial method
- **Endurance**
  - As per ESCC 3401§ 9.18
- **Contact resistances**
- **Transfer impedance LF**
  - Triaxial method
Test campaign for connector assemblies DUT

1. Voltage Proof
   - Insulation Resistance
   - Continuity Test
   - Radiated Emission
   - Contact resistances
   - Transfer impedance HF
     - ZT micro strip
   - Shielding effectiveness

2. Vibrations
   - As per ESCC 3401 § 9.11
3. Shock or Bump
   - As per ESCC 3401 § 9.12
4. Rapid change of temperature
   - As per ESCC 3401 § 9.16
5. High-temperature storage
   - As per ESCC 3401 § 9.21
6. Shielding effectiveness
7. Radiated Emission
8. Contact resistances
9. Transfer impedance HF
   - ZT micro strip

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ADS  AXON  Manufacturer
AXON and C&K have tested their connectors according to the following standard:

<table>
<thead>
<tr>
<th>Standard of test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Proof</td>
<td>IEC Publication 512-2, Test 4a, Method 8 (rectangular connectors)</td>
</tr>
<tr>
<td>ELECTRICAL TESTS</td>
<td>IEC Publication 512-2, Test 4a, Method 8 (rectangular connectors)</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>EC Publication 512-2, Test 3a, Method 8 (rectangular connectors)</td>
</tr>
<tr>
<td>Contact Resistances</td>
<td>ESCC Generic Specification N°3401</td>
</tr>
<tr>
<td>Endurance</td>
<td>ESCC</td>
</tr>
<tr>
<td>Continuity</td>
<td>NA</td>
</tr>
<tr>
<td>Shock or Bump</td>
<td>IEC Publication No. 512-4, Test 6c</td>
</tr>
<tr>
<td>High temperature storage</td>
<td>IEC Publication 512-6, Test 11i</td>
</tr>
<tr>
<td>Rapid change of temperature</td>
<td>IEC Publication 512-6, Test 11d</td>
</tr>
</tbody>
</table>

Radiated emission test were performed according to ECSS-E-ST-20-07C standard.
RE test setup
Comparaison of radiated emission test results

Sample 1

Sample 2
Comparaison of radiated emission test results
Comparaison of Micro-D connector assemblies

The comparison is realized on the average of the difference between the samples and the reference E0P0B0 integrated all frequency band. Since, these differences are similar in polarization V and H, the whole is averaged.

<table>
<thead>
<tr>
<th>Solution from best to worst</th>
<th>Name</th>
<th>Difference between sample (dB)</th>
<th>Shielding improvement (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E1P3B1</td>
<td>6,9 I 0,8</td>
<td>13,9 &amp; 20,8 I 21 &amp; 22</td>
</tr>
<tr>
<td>2</td>
<td>E1P0B1</td>
<td>1,6 I 22</td>
<td>21 I 20 &amp; -2</td>
</tr>
<tr>
<td>3</td>
<td>E1P2B1</td>
<td>0,6 I 3</td>
<td>9,2 I 12 &amp; 16</td>
</tr>
<tr>
<td></td>
<td>E1P1</td>
<td>11,9 I 6</td>
<td>17 &amp; 5,1 I 3 &amp; -3</td>
</tr>
</tbody>
</table>

Rear mounting female connector with EMI gasket.

Plug with integrated funnel + screw

Plug with EMI gasket

Plug with EMI spring

Backshell with EMI gasket
Comparaison of Sub-D connector assemblies

The comparison is realized on the average of the difference between the samples and the reference E0P0B0 integrated all frequency band. Since, these differences are similar in polarization V and H, the whole is averaged.

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<th>Name</th>
<th>Shielding improvement (dB)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>E0P0B2</td>
<td>30.7</td>
</tr>
<tr>
<td>2</td>
<td>E1P1B1</td>
<td>24.9</td>
</tr>
<tr>
<td>3</td>
<td>E0P1B1</td>
<td>22.3</td>
</tr>
<tr>
<td>4</td>
<td>E2P2+OP1B0</td>
<td>13.6</td>
</tr>
<tr>
<td>5</td>
<td>E2P3+OP1B0</td>
<td>8.8</td>
</tr>
<tr>
<td>6</td>
<td>E3P0B0</td>
<td>4.6</td>
</tr>
<tr>
<td>7</td>
<td>E1P0B1</td>
<td>3.0</td>
</tr>
<tr>
<td>8</td>
<td>E1P2B0</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Conclusion

Solutions to improve EMI shielding at connector and backshell level have been developed and tested. Good improvement regarding radiated emission test have been measured.

Sub-D best solutions to prevent electromagnetic interference:
– Encompassing backshell but it requires the chassis of the equipment to be sufficiently flat and spacious,
– Machined fix connector with an RF gasket in a groove, machined mobile connector with dimples and a backshell with an EMI flat gasket.

Micro-D best solutions to prevent electromagnetic interference:
– Fix connector with a groove and an EMI gasket, mobile connector with an EMI spring and a backshell with EMI gasket,
– Fix connector with a groove and an EMI gasket, standard mobile connector and a backshell with EMI gasket.

Tests still need to be performed on C&K samples after environmental tests. Some AXON samples will be tested again to check the reproducibility of the EMI improvement.
Thank you
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Questions?