Developing Testing Facilities for Power Supply Interface Tests According to EN 300 132 Standards
Project schedule

1. Planning: Spring 2003
2. Developing the test methods: Summer & autumn 2003
3. Actual testing (pilot projects): October 2003
4. Reporting: Spring 2004

Contribution of the author:
Almost everything has been performed by the author
Only some help from Nemko colleagues
Objectives of the study

1. Detail the appropriate requirements according to ETSI EN 300 132-2 V2.1.2 (2003) and ETSI EN 300 132-3 V1.2.1 (2003).

2. Develop the test methods and define the investments needed to perform all tests according to ETSI EN 300 132-2 V2.1.2 and ETSI EN 300 132-3 V1.2.1.

3. Conduct the testing in practice for one DC and AC equipment.
Requirements

Telecommunication equipment

Legal requirements:
- Radio & Tele Terminal Equipment Directive
- EMC Directive
- Low Voltage Directive

Other requirements:
- EN Standards
- ETSI Standards
- ITU-T Recommendations
- Technical Requirements
- Other Specifications
ETSI EN 300 132 Standards

- Several different national network operator’s requirements existed to ensure ability of telecommunication equipment to operate in telecommunication centres
- ETSI EN 300 132 series standards establish common requirements for Member States of EU
- Most Member States have endorsed EN 300 132 series standards
ETS 300 132 Standards

Requirements for power supply interface at the input to telecommunications equipment:

• **ETS 300 132-1, September 1996**
  Operated by alternating current (AC) derived from direct current (DC) sources

• **ETSI EN 300 132-2 V2.1.2 (2003-09)**
  Operated by direct current (DC)

• **ETSI EN 300 132-3 V1.2.1 (2003-08)**
  Operated by rectified current, AC or DC source up to 400V
# ETSI EN 300 132 Standards

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Part 1</th>
<th>Part 2</th>
<th>Part 3</th>
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<tbody>
<tr>
<td>Nominal voltage / frequency</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Normal service voltage range</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Abnormal serv. voltage range</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Voltage changes due to regulation of PSU / voltage</td>
<td>X</td>
<td>X</td>
<td>–</td>
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<tr>
<td>Supply protection</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Maximum current drain</td>
<td>–</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Surge current on connection of interface</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Conducted immunity requirements</td>
<td>–</td>
<td>X</td>
<td>–</td>
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<tr>
<td>Conducted emission requirements</td>
<td>–</td>
<td>X</td>
<td>–</td>
</tr>
</tbody>
</table>

X = Applicable  
– = Not applicable
Developing testing facilities

- Nemko Oy had already the most expensive measuring equipment, e.g. measuring receiver, audio analyzer, digital oscilloscope and signal generator
- Some investments and components were missing and they had to be acquired or constructed
Developing testing facilities

• Normal service voltage range:
  -40.5 … -57.0V DC (ETSI EN 300 132-2)
  188Vrms … 375Vp (ETSI EN 300 132-3)

• Abnormal service voltage range:
  0 … -40.5V DC, -57.0 … -60.0V DC (ETSI EN 300 132-2)
  0 … 188Vrms (ETSI EN 300 132-3)
Developing testing facilities

- Voltage transients (ETSI EN 300 132-2)

- Voltage changes due to regulation of the PSU
Developing testing facilities

- AC/DC 6-pulse diode rectifier:

[Diagram of an AC/DC 6-pulse diode rectifier with labels: Control computer, AC power source, T1, T2, T3, D1, D2, D3, D4, D5, D6, C1, DC out, +, -]
Developing testing facilities

- (Maximum current drain) and surge current on connection:

![Diagram showing testing facilities]

- Power supply
- LISN
- DC power cables
- Analogue current probe
- Digital Oscilloscope
- Interface A
- EUT
Developing testing facilities

• **Conducted immunity**

![Diagram](image)

- Audio amplifier
- LF/RF generator
- Coupling network
- PSU
- 2x220µF
- EUT
Developing testing facilities

• Conducted emissions
Pilot projects

- One AC and one DC powered equipment was tested
- The equipment under test (EUT) was a 3G Base Station
- The rated current for the DC powered option (-48 V) was 80 A DC
- The rated current for the AC powered option (230 V) was 20 Arms
Conclusions

• Requirements from standards were quite clear, however, some issues were missing

• Duration and magnitude of voltage transients are not defined and they were not found anywhere

• Exact values of limits for surge current on connection were not found; only graphs from stds were available
Conclusions

- **Needed investments ~2000 EUR**
- Six-pulse rectifier
- RF (BNC-, N-type) connectors
- Passive components, DC connectors, conductors, circuit board
- Fuses (100A, 160A & 200A)
Conclusions

• Testing facilities & methods were developed, with a good success

• Too low change speed in voltage changes (DC)

• Too high voltage drop in surge current on connection, when testing the DC powered BS

• Too high test level in conducted immunity test
Conclusions

- Both AC and DC powered BSs were tested
- AC powered BS passed all tests
- DC powered BS passed all tests except conducted emissions of broadband noise
- It has been argued, that the slight deviations in testing methods do not affect the test result
Further areas of study

- Command order for the programmable power sources needs to be changed ➔ higher change speed of DC
- Considering alternative power feeding applications
- More accurate test arrangement for conducted immunity testing. More accurate measuring of disturbing signal, feedback and control of the signal level is needed.
Thank you for your attention!