Proximity IC Cards Interoperability

Implementation Standards & Development
by NMDA

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DENSO
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NMDA : New Media Development Association
Features of Proximity IC Cards

- Remote function
- No metal contacts
- Alternative to IC card with contacts

Communication Distance (cm)

Remote function + No metal contacts

Alternative to IC card with contacts
Features of Proximity IC Cards

1. Remote operation
   - with the user’s intention

2. No metal contacts

3. 13.56MHz worldwide availability

4. 106 kb/s high-speed

5. Card antenna designing flexibility
   - operable between 1.5 A/m~ 7.5 A/m
Variety of ISO Proximity Cards
Variety of Proximity PICCs & PCDs

- Operating Field of Remote PCD
- Card Antenna Center for Remote Use
- Card Antenna for Surface-reading
- Operating Field of Surface-reading PCD
- Dead Zone
1. Encryption coprocessor embedded in PICC
   - support public key encryption (ex. RSA)

2. Single card operation and/or Two cards operation
   - considering adjacent cards in PCD or a wallet

3. Open type PCD or Slot-in type PCD
   - support user’s requirement

4. Obtaining interoperability & preventing interference
Set the conditions to PICC

1. PICC Antenna size
   - considering surface-reading

2. PICC Resonance frequency
   - considering adjacent cards in a wallet or R/W

Add Evaluation tools to ISO/IEC 10373-6

3. Two Reference PICCs added
PICC Antenna Area

Minimal PICC Antenna
R = 5mm
in ISO/IEC 14443-2

PICC Antenna shall encircle
Shadow area

Dimensions (in mm):
- Width: 85.6
- Height: 65.6
- Diagonal: 53.98

- R8 (radius)
Resonance frequency

(1) One PICC alone:
   > 19MHz recommended

• Two PICCs coexistence:
  > 13.56MHz recommended
Developed Evaluation Tools – Test PICC

Two Reference PICCs added

Reference PICC - S
Reference PICC - M
Reference PICC - L
Calibration Coil - M

= ISO/IEC 10373-6
Reference PICC Antenna Size

Antenna S
(66.6 x 31, R8.5)

Antenna M
(72 x 42, R5)
ISO/IEC 10373-6

Antenna L
(83.6 x 52, R5)
### NMDA Implementation Standards: Version up from 1.0 to 1.1

<table>
<thead>
<tr>
<th>Item</th>
<th>Version 1.0 December 2000</th>
<th>Version 1.1 July 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICC</td>
<td>• One or two cards operation</td>
<td>• One or two cards operation</td>
</tr>
<tr>
<td></td>
<td>• Single card operation</td>
<td>• Single card operation</td>
</tr>
<tr>
<td>PCD</td>
<td>• Slot-in type</td>
<td>• Slot-in type</td>
</tr>
<tr>
<td></td>
<td>• Open type</td>
<td>• Open type</td>
</tr>
<tr>
<td>Referenced ISO/IEC</td>
<td>14443-1 FDIS 14443-2 FDIS 14443-3 FCD 14443-4 FCD 10373-6 FCD</td>
<td>14443-1 1st edition 14443-2 FDIS 14443-3 1st edition 14443-4 1st edition 10373-6 FDIS</td>
</tr>
</tbody>
</table>
## Functional Test - PICC

<table>
<thead>
<tr>
<th>ISO/IEC</th>
<th>Item</th>
<th>Measuring conditions</th>
<th>Specification</th>
<th>Card type</th>
</tr>
</thead>
<tbody>
<tr>
<td>10373-6</td>
<td>Operating field</td>
<td>one</td>
<td>-</td>
<td>✔</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>two</td>
<td>card + card</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>card + Reference PICC M/S/L</td>
<td>✔</td>
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<tr>
<td>14443-1</td>
<td>Maximum Applied Magnetic Field</td>
<td>one</td>
<td>-</td>
<td>✔</td>
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<tr>
<td>4.3.5</td>
<td></td>
<td>two</td>
<td>card + card</td>
<td>✔</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>card + Reference PICC M/S/L</td>
<td>✔</td>
</tr>
<tr>
<td>10373-6</td>
<td>Load modulation</td>
<td>one</td>
<td>-</td>
<td>✔</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>two</td>
<td>card + card</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>card + Reference PICC M/S/L</td>
<td>✔</td>
</tr>
<tr>
<td>-</td>
<td>Influence to Other card</td>
<td>two</td>
<td>card + Reference PICC M/S/L</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Measuring conditions
- Supply power to Reference PICC
  - > 50mW
  - > 30/H1.2 mV peak
  - 4 ~ 7.5A/m rms
  - 10A/m rms
  - 12A/m rms
  - (30 seconds)
<table>
<thead>
<tr>
<th>ISO/IEC</th>
<th>Item</th>
<th>Measuring conditions</th>
<th>Specification</th>
<th>PCD type</th>
</tr>
</thead>
<tbody>
<tr>
<td>10373-6</td>
<td>Field strength</td>
<td>Reference PICC M/S/L</td>
<td>Calibration coil</td>
<td>Slot-in</td>
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<tr>
<td>8.1</td>
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<td></td>
<td>4 ~ 7.5A/m rms</td>
<td>✓</td>
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<td>One Reference PICC M/S/L</td>
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<td>Open</td>
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<tr>
<td>8.2</td>
<td>Power transfer</td>
<td>One Reference PICC M/S/L</td>
<td>6.8V at R_L=910Ω (50mW)</td>
<td>✓</td>
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<tr>
<td></td>
<td>PCD to PICC</td>
<td>Two Reference PICC's M/S/L</td>
<td></td>
<td>✓</td>
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<tr>
<td></td>
<td>Modulation index and</td>
<td>Calibration coil</td>
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<td>✓</td>
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<tr>
<td></td>
<td>waveform</td>
<td>One Reference PICC M/S/L</td>
<td>&gt; 30/H_{1.2} mV peak</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two Reference PICCs M/S/L</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>8.4</td>
<td>Load modulation reception</td>
<td>Reference PICC M/S/L</td>
<td>Correct reception</td>
<td>✓</td>
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</tbody>
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**Functional Test - PCD**

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14
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