Passive RFID sensor solutions

Dipl.-Phys. Peter Peitsch
Microsensys GmbH
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RFID system structure

RFID = Radio Frequency IDentification

**AIR Interface**
- **SENSOR**
  - TAG
- **ENERGY**
- **DATA**

ISO 18000-3, ISO 18000-6
ISO 15693, ISO 14443 A/B
different systems: TagIt,
SLI, my-D, iID, LEGiC,
TELID, mic3, NFC …

**HOST Interface**
- **HOST COMPUTER**
- **DRIVER**
- **DATA**

USB, RS232, I²C, CAN,
Ethernet, WLAN,
Bluetooth …

**RFID Transponder:**
- TAGs, LABELs, COINs, CARDs …
- memory from 64 bit RO up to 512 kbit RW
- TELID®: RFID with integrated sensors
- HF and UHF frequency bands

**RFID Read/Write Units:**
- for mobile, stationary or industrial solutions
- various antenna types and sizes
- iID® PEN, DESKTOP, POCKET, Modules
- HF and UHF frequency bands

**RFID Software Tools:**
- for PCs, notebooks, tablets, PDAs, handhelds,
  mobile phones, control units
- Windows, Android
- iID® driver engine, iID® Tray Appli,
- iID® RFID DEMOsoft, TELID®soft 5.0,
- iID® POCKETmini DataLoad …
Why combine RFID and sensor technology?

**Purpose:**
- contactless measurement on moving and rotating objects
- contactless measurement in closed containers / no cables, no openings
- contactless measurement in explosive areas / approvals
- reduction of wiring / system costs

**Further advantages:**
- identification of the measuring point
- memory for calibration data, access data etc.
- cost effective because of RFID volume markets

**Sensor requirements:**
- low power / <10mW
- low voltage / <3V
How combine RFID and sensor technology?

Passive RFID Transponder

identify and measure

Semi-Active RFID Logger

Energy Storage (internal voltage source)
## Choice of carrier frequencies

<table>
<thead>
<tr>
<th>RFID Frequency</th>
<th>ISO / IEC</th>
<th>Coupling</th>
<th>Reading distance</th>
<th>Data rate</th>
<th>Influence of metal</th>
<th>Influence of water</th>
<th>Sensor integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;135 kHz (LF)</td>
<td>18000-2 11784 11785</td>
<td>inductive</td>
<td>5-100cm</td>
<td>1…4 kbaud</td>
<td>middle</td>
<td>no</td>
<td>marginal (power)</td>
</tr>
<tr>
<td>13.56 MHz (HF)</td>
<td>18000-3 14443 15693</td>
<td>inductive</td>
<td>1-50cm</td>
<td>25…848 kbaud</td>
<td>great</td>
<td>small</td>
<td>passive and semi-passive</td>
</tr>
<tr>
<td>820-960 MHz (UHF)</td>
<td>18000-6 EPC</td>
<td>em. wave</td>
<td>0.5-8m</td>
<td>40…640 kbaud</td>
<td>great</td>
<td>great</td>
<td>passive and semi-passive</td>
</tr>
<tr>
<td>2.45 GHz (microwave)</td>
<td>18000-4</td>
<td>em. wave</td>
<td>&gt;5m</td>
<td>25…100 kbaud</td>
<td>great</td>
<td>great</td>
<td>marginal (market)</td>
</tr>
</tbody>
</table>
Temperature measurement / HF

**TELID®211.01**

- **function:** passive temperature transponder
- **assembly:** COB, SMD
- **temperature sensor:** PN junction
- **measuring range:** -40°...+125°C (+180°C)
- **measuring accuracy:** +/-1°C
- **data memory:** up to 256kbit
- **size:** Ø14mm / thickness 1.5mm
- **mounting:** gluing
- **application:** probe management, electric motors and pumps
Temperature measurement / UHF

**TELID®412**

- **function:** passive temperature transponder
- **assembly:** Flip-Chip, SMD
- **temperature sensor:** PN junction
- **measuring range:** -40...+125°C (180°C)
- **measuring accuracy:** +/-1°C
- **data memory:** 4 kbit
- **size:** 72mm x 18mm x 2mm
- **mounting:** gluing, screwing
- **application:** asphalt core temperature, gearbox bearings

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Dipole antenna
Sensor

Reading distance: up to 0.5m
Pressure measurement / HF

**TELID241**
size: Ø14mm

**TELID242**
size: 33mm x 33mm

**TELID243**
for industrial application

**TELID®241 / 242 / 243**

function: passive pressure transponder
assembly: COB, SMD
pressure sensor: piezo-resistive
temperature sensor: for calibration
measuring range: 1bar / 14bar / up to 1,000bar
data memory: up to 256kbit
ambient media: air / water / oil
application: closed containers pipelines
Measurement of accelerations / HF

TELID28x
- function: passive acceleration transponder
- acceleration sensor: MEMS
- measuring range: +/-2g | +/-4g | +/-8g
- data memory: up to 256kbit
- size: Ø14mm / thickness 2.5mm
- weight: 0.5g
- application: vibration measurement on electric motors and pumps

TELID282i
- function: 3D tilt sensor
- size: 43mm x 27mm
- accuracy: +/-0.5°

TELID283
- size: Ø14mm
- without encapsulation

RFID-ASIC (COB)
Antenna
3D acceleration sensor
Controller + Memory
thermal pad
Measurement of analogue electrical signals / HF

**TELID®251**

- **function:** passive voltage transponder
- **circuitry:** op-amp, A/D converter
- **ADC resolution:** 16 bit
- **data memory:** 256 bit
- **size:** Ø14mm / thickness 2mm
Advantages of the RFID technology for the contactless sensor measurement

► Cost effective manufacturing of sensor modules because of the existing volume market for RFID chips
► Standardized interfaces and thus existing infrastructure
► High data transmission rate
► High data safety through already implemented checksum tests
► Availability of a non-volatile memory for additional information like ID number of the sensor module or the measuring point, calibration parameters and ownership marking
► Possibility for encryption of the data transmission to prevent unauthorized use
► ground-free measurement because of the inductive coupling
► Possibility to assembly miniaturized modules because of the availability of ASICs
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Thank you VERY MUCH for your attention

Vielen Dank für Ihre Aufmerksamkeit

www.microsensys.de

Microsensys GmbH
In der Hochstedter Ecke 2
D-99098 Erfurt
Germany