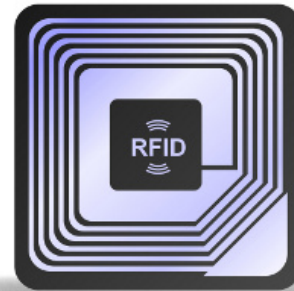




About RFID technology

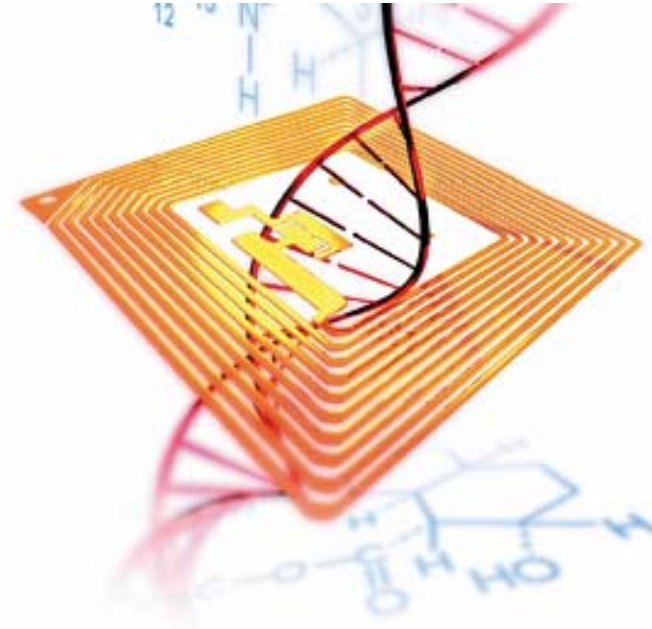


09. October 2013

Content



- *RFID basics*
- *Operating frequencies*
- *RFID standards*
- *Technical considerations*
- *How to build a successful RFID applications*
- *Technology outlook*



RFID makes

elincom

iDTRONIC

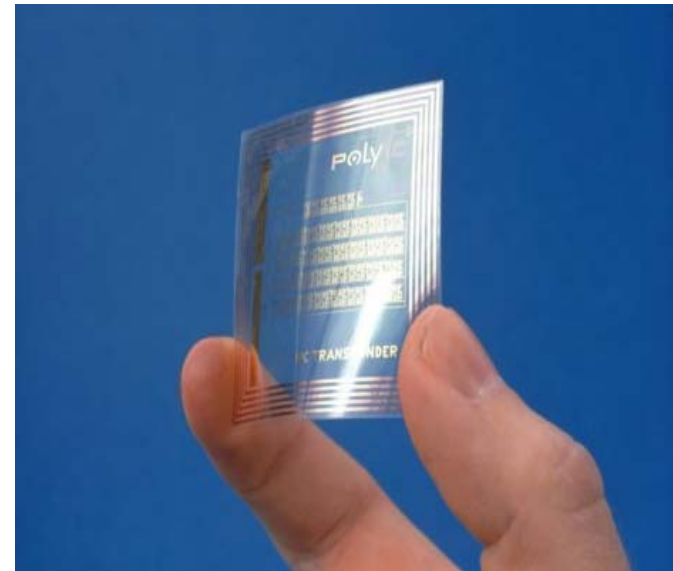
- *Quiet objects become speaking*
- *Stupid objects become intelligent*
- *Unknown objects become known*



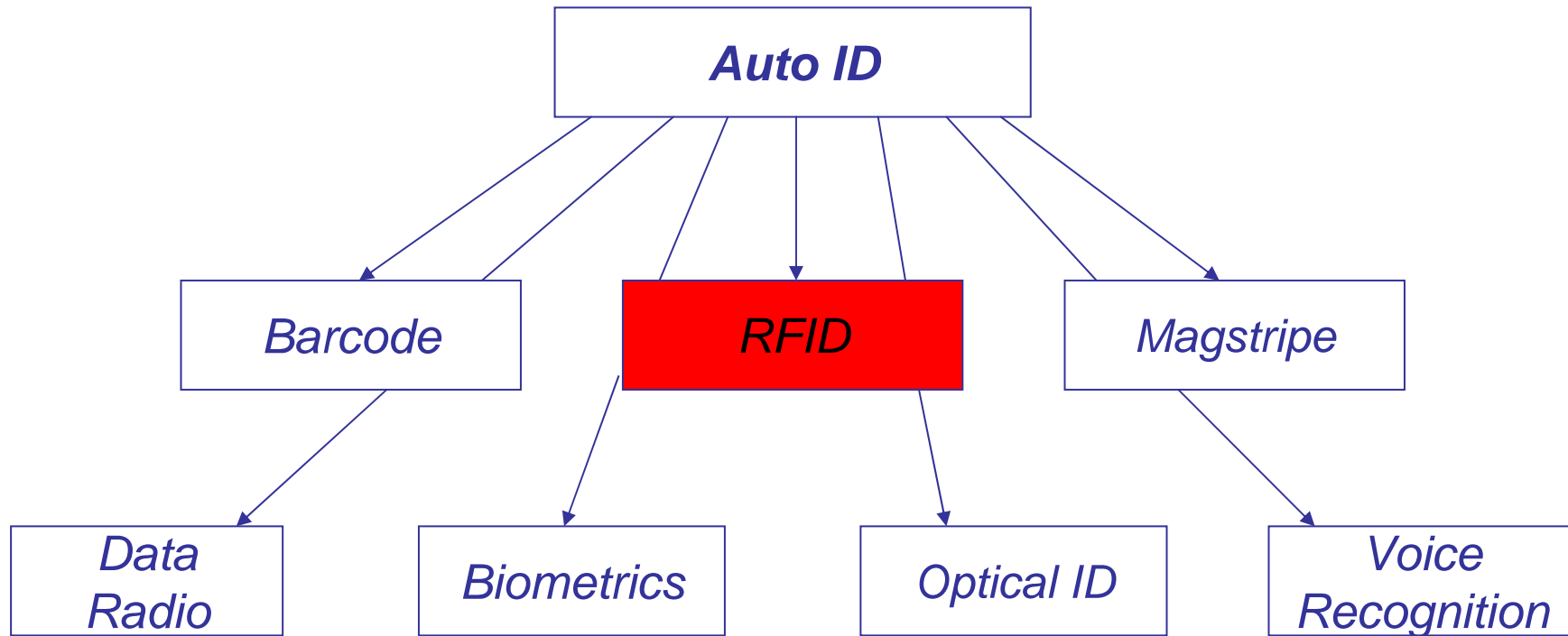
Advantages of RFID



- *Identification without sight*
- *Can read through materials*
- *Fast detection*
- *Large reading distances*
- *Writable data carriers*
- *Re-usable data carriers*
- *Detection of groups of products*
- *High lifetime*
- *Resistant against environment*
- *No maintenance needed*



Positioning

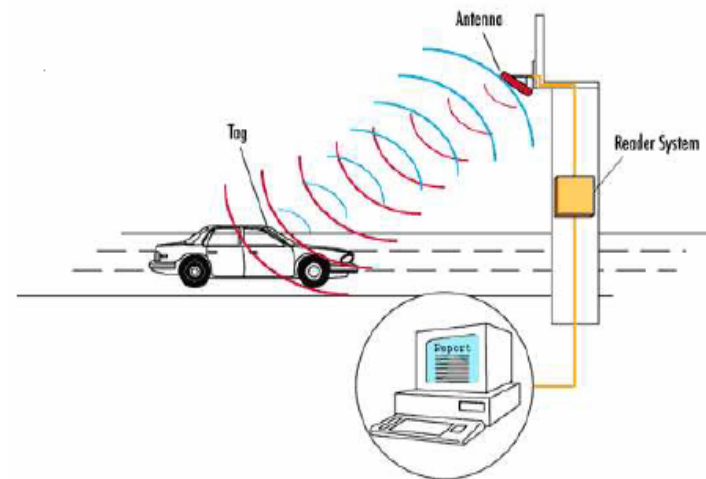


RFID operation frequency

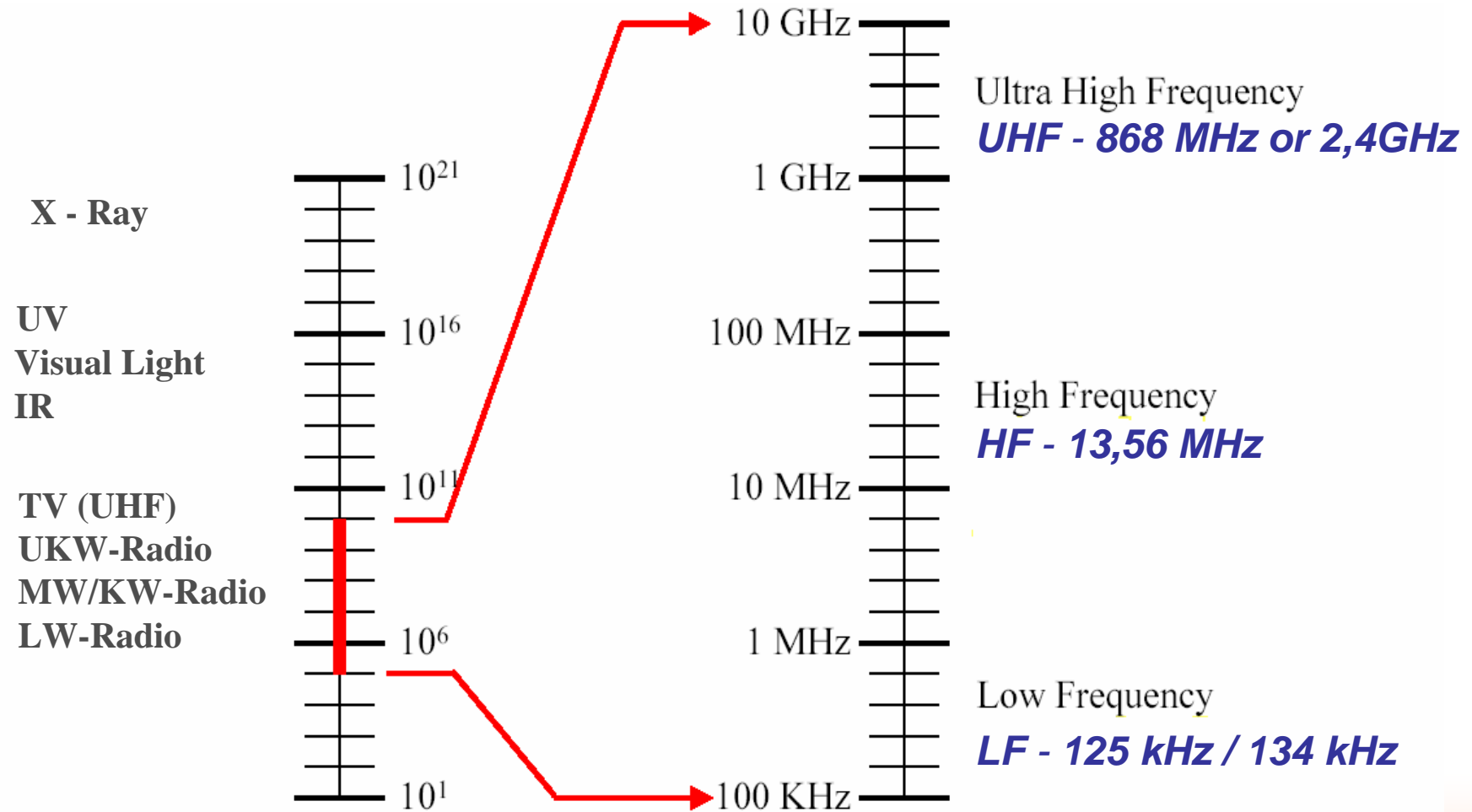


The operating frequency defines the characteristics of the system and the parameters for the RFID application.

- *Reading distance*
- *Reading capability through materials*
- *Reading field*
- *Reading speed*
- *Functionality im metal environment*
- *Anticollision*
- *Tag form factors*
- *Price of tag / system*



RFID Frequencies



Reading distances



<i>Title</i>		<i>Frequency range</i>	<i>Read range (passive)</i>	<i>Used for RFID</i>
<i>Long waves</i>	<i>LF</i>	<i>30 KHz – 300 KHz</i>	<i>Up to 1 m</i>	<i>100 – 135 KHz</i>
<i>Medium waves</i>	<i>MF</i>	<i>300 KHz – 3 MHz</i>	<i>-</i>	<i>-</i>
<i>Short waves</i>	<i>HF</i>	<i>3 MHz – 30 MHz</i>	<i>Up to 1.5 m</i>	<i>13,56 MHz</i>
<i>Ultra short waves</i>	<i>VHF</i>	<i>30 MHz – 300 MHz</i>	<i>-</i>	<i>-</i>
<i>Decimeter waves</i>	<i>UHF</i>	<i>300 MHz – 3 GHz</i>	<i>Up to 10 m</i>	<i>2,45 GHz, 868 MHz</i>
<i>Centimeter waves</i>	<i>SHF</i>	<i>3 GHz - 30 GHz</i>	<i>-</i>	<i>5,8 GHz</i>

RFID applications LF (125 / 134,2 kHz)



- *Animal Identification*
- *Industrial Automation*
- *Car Immobilizer*
- *Access Control*

RFID applications HF (13,56 MHz)



- *Credit Card, Payment*
- *Ticketing (Public transport, Skilift, Events)*
- *Passport, ID Card*
- *Libraries*
- *Laundry*
- *Near Field Communication NFC*

RFID applications UHF (860-960 MHz)



- *Asset Tracking*
- *Highway toll*
- *Logistics, Warehouse*
- *Industry*
- *Automation*

RFID market



Frequency	Turnover	2008	2009	2010	2011	2012	2013	2014
<i>LF (car immobilizer)</i>	<i>(\$ Millions)</i>	955	849	846	826	800	781	765
<i>LF (125 / 134,2 kHz)</i>	<i>(\$ Millions)</i>	511	543	633	692	810	962	1122
<i>HF (13,56 MHz)</i>	<i>(\$ Millions)</i>	1523	1613	1974	2258	2614	2906	3344
<i>UHF passiv</i>	<i>(\$ Millions)</i>	498	560	772	983	1232	1517	2131
<i>UHF activ</i>	<i>(\$ Millions)</i>	33	38	45	55	66	76	96
<i>Mikrowave</i>	<i>(\$ Millions)</i>	10	13	17	73	32	43	57
Total	<i>(\$ Millions)</i>	3530	3616	4287	4887	5554	6285	5515

ABI-Research: Tag/Reader Revenue by Operating Frequency, World Market Forecasts 2008 to 2014

ISO standards



LF	125-134kHz
<i>ISO 11784/85</i>	<i>Animal ID (Read Only)</i>
<i>ISO 14223/1</i>	<i>Animal ID (R/W)</i>
<i>ISO 18000-2</i>	<i>Item management</i>
HF	13,56MHz
<i>ISO 10356</i>	<i>Close Coupling Smart Card</i>
<i>ISO 14443</i>	<i>Proximity Smart Card</i>
<i>ISO 15693</i>	<i>Vicinity Smart Card</i>
<i>IATA 1740C</i>	<i>Baggage Handling</i>
<i>ISO 18000-3</i>	<i>Item management</i>
UHF	868MHz, 2,45GHz
<i>ANSI MH 10.8.4</i>	<i>Transport, Item management</i>
<i>ISO 18000-4 / -5 / -6</i>	<i>Item management</i>

Transponder properties



<i>Transponder</i>		
	<i>Passive</i>	<i>Active</i>
<i>Communication</i>	<i>Via inductive field (sender / receiver)</i>	<i>Generates own EM-waves</i>
<i>Energy</i>	<i>Energy from the inductive field</i>	<i>Own power source (battery or accu)</i>

The different combinations of transponder properties define active, passive and semi-active systems.

Limits of using RFID



Passive RFID systems have problems if applied directly on metal or / on liquid containers. In this case they reach only limited or unacceptable reading distances / performances.



Active RFID systems are too expensive for most applications. Battery change is necessary every aprox. 3 – 4 years.

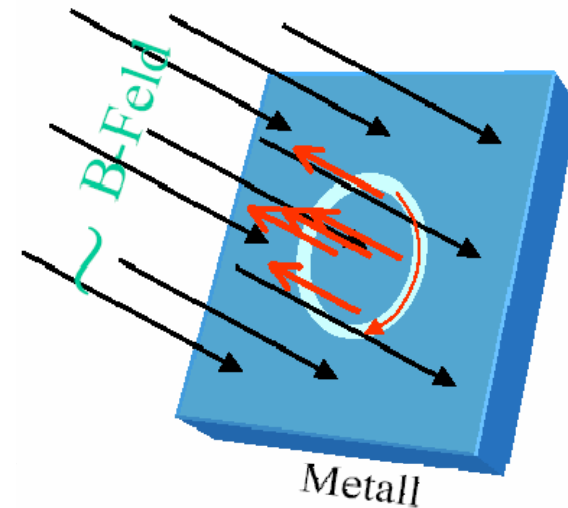


Influence from metal

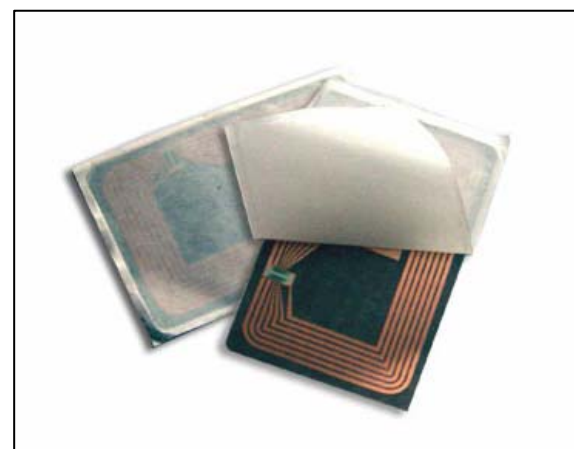
Metal highly influences LF and HF systems (Antenna detunes due to capacitive coupling).

UHF waves can not go through metal. But metal surface effects can be managed.

Active and semi-active systems don't have problems with metal environment.



Influence from metal

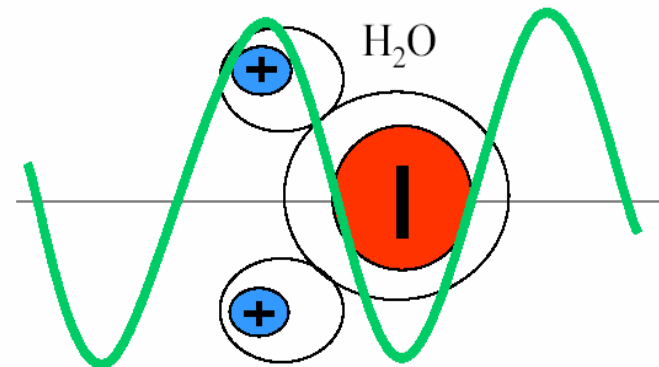


Influence from water



LF and HF systems get little influence due to water.

Water influences UHF systems quite a lot (mainly on 2,45 GHz).

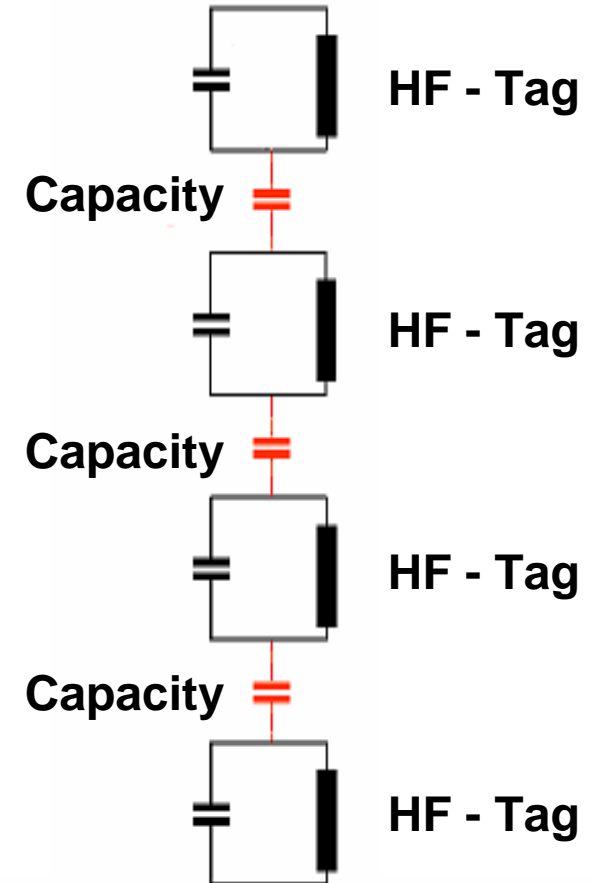


Anticollision



Dense quantities of transponders give problems, because they influence / disturb each other.

LF and HF systems are more influenced than UHF systems, because the transponders detune.



Summary



	<i>LF</i>	<i>HF</i>	<i>UHF</i>
<i>Frequency</i>	<i>125kHz</i>	<i>13,56MHz</i>	<i>868MHz</i>
<i>ISO Standard</i>	<i>ISO 18000-2</i>	<i>ISO 18000-3</i>	<i>ISO 18000-6</i>
<i>Reading distance</i>	<i>Up to 1,0m</i>	<i>Up to 1,5m</i>	<i>Up to 10m</i>
<i>Data rate</i>	<i>--</i>	<i>+</i>	<i>++</i>
<i>Memory size</i>	<i>Up to 2k bit</i>	<i>Up to 64k byte</i>	<i>Up to 1k bit</i>
<i>Form factors</i>	<i>++</i>	<i>++</i>	<i>-</i>
<i>Anticollison</i>	<i>--</i>	<i>+</i>	<i>++</i>
<i>Metal influence</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>Water influence</i>	<i>+</i>	<i>+</i>	<i>--</i>
<i>Organic influence</i>	<i>+</i>	<i>+</i>	<i>-</i>

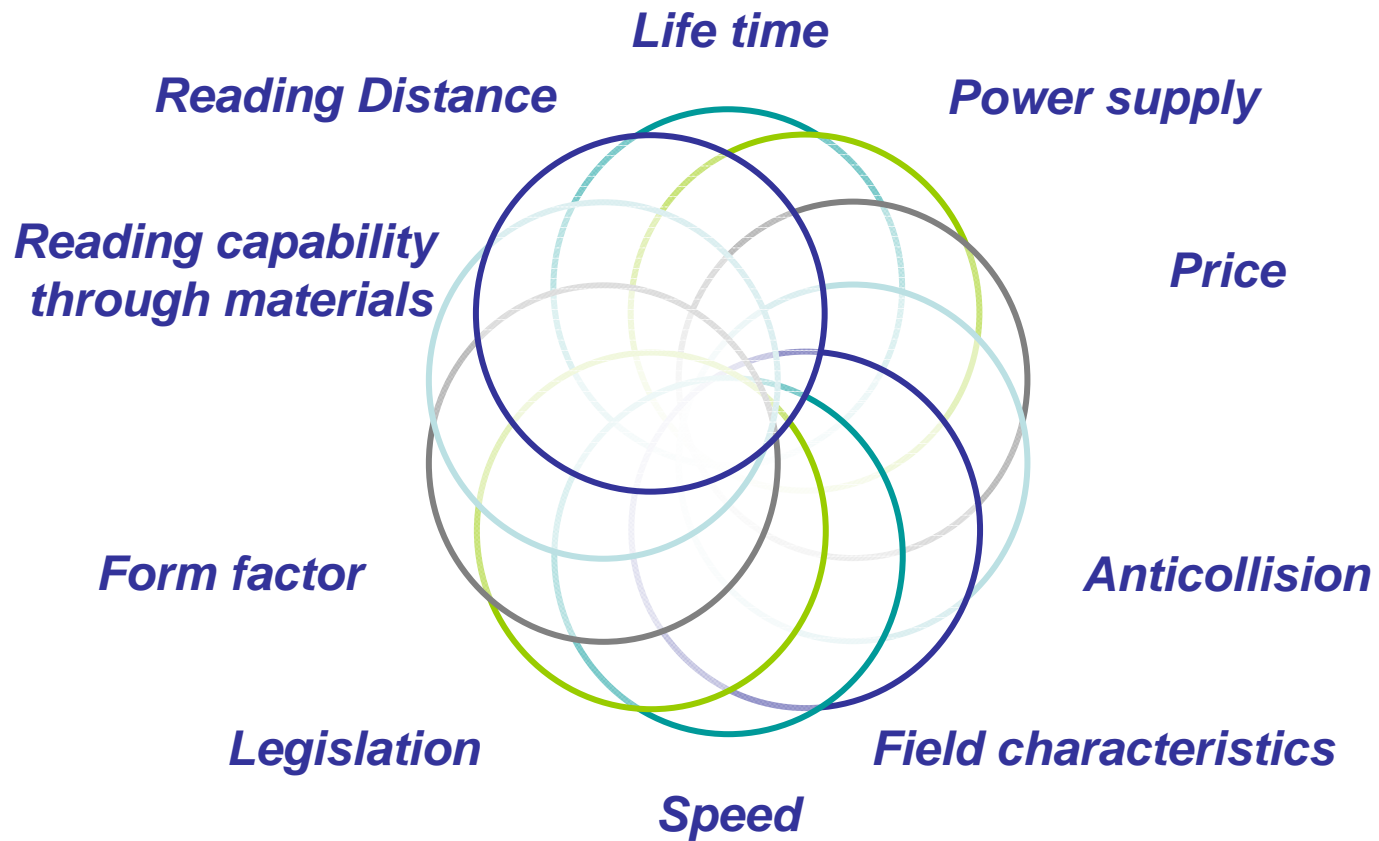
RFID trends



- *ISO Standard (ISO 18000)*
- *Technical News (NFC, Passport, Payment)*
- *Minimize cost*
- *Anticollision rates*
- *Reading distances*
- *Security levels*
- *Combination with sensors*
- *New RFID / NFC applications*

AutoID / RFID is the base technology for the future!

The right RFID system



Transponder form factors



Keyfob



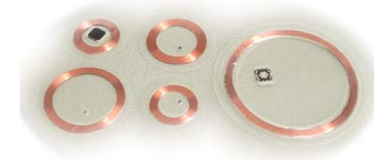
High temp. tag



Glass tag



Epoxy disctag



PET disctag

Transponder form factors



ISO card



Pigeon ring



DVD label

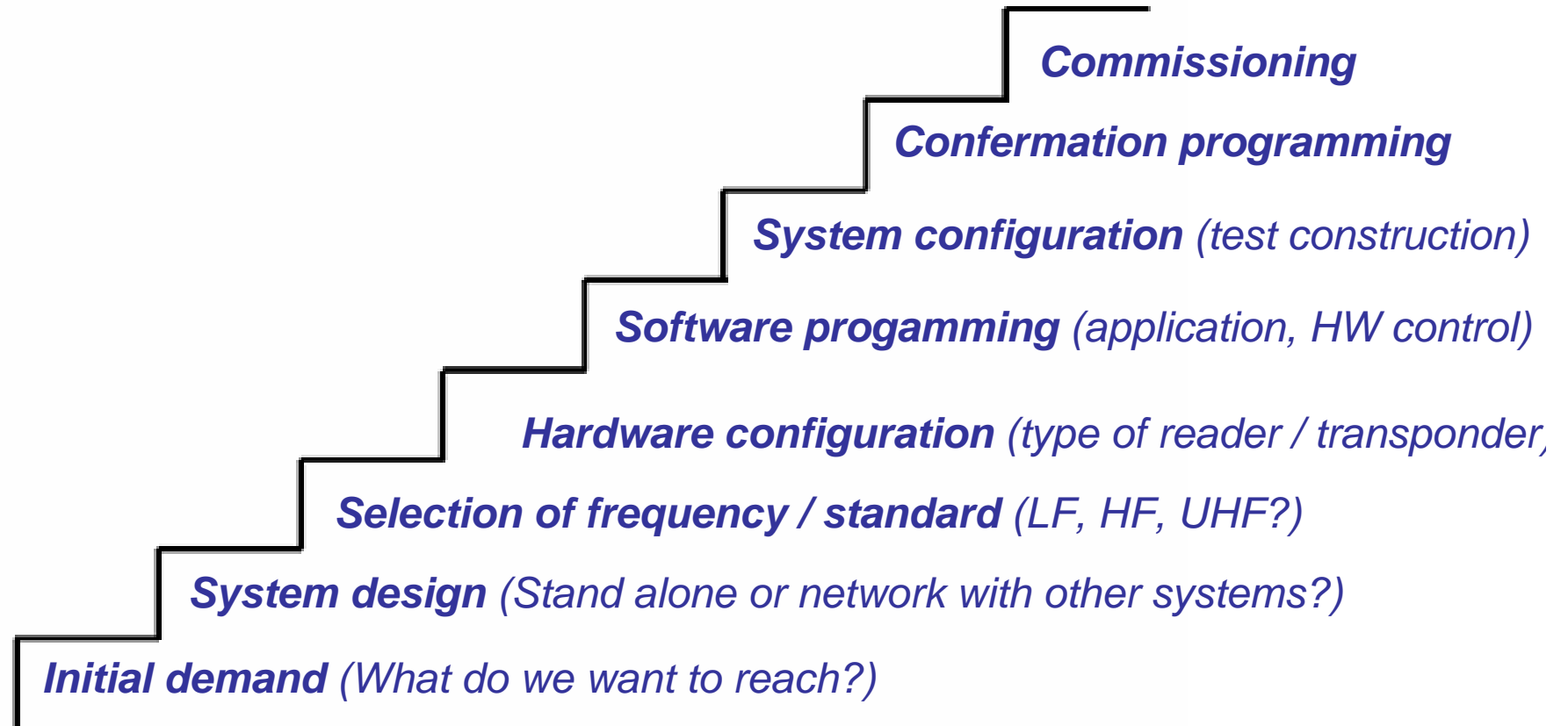


Wristband



Smart label

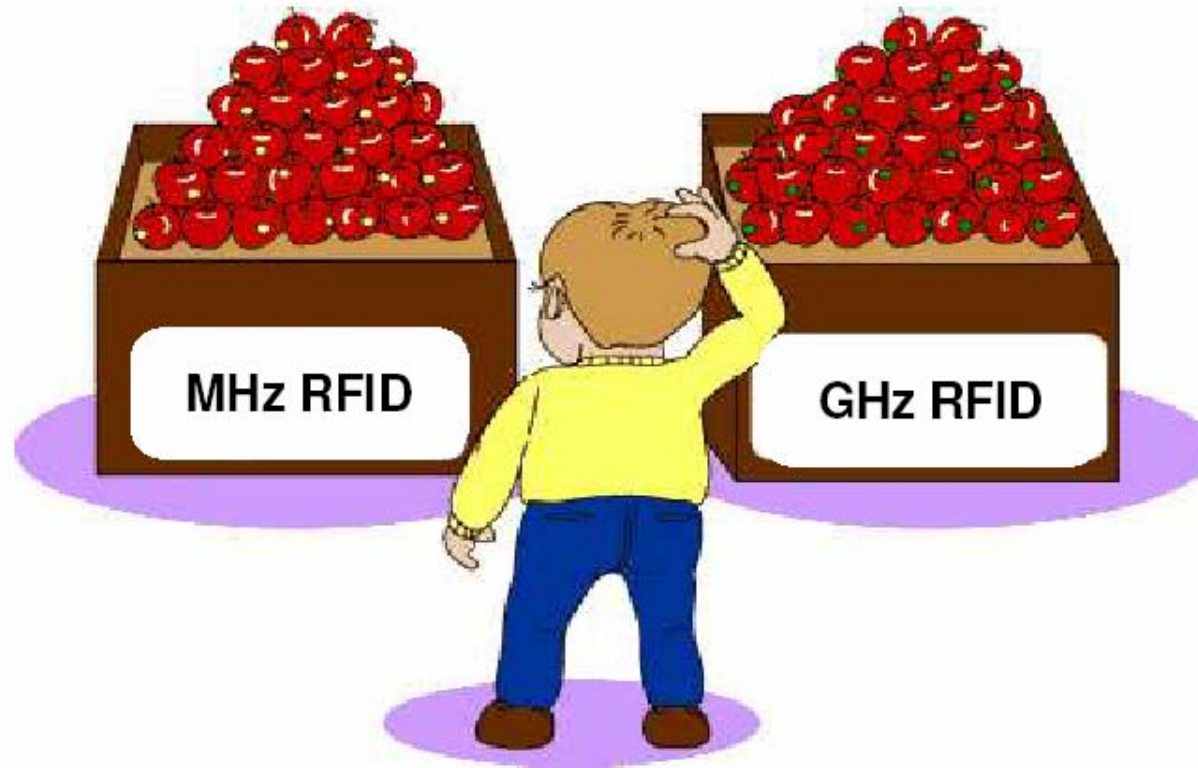
How to design RFID systems



Content



Be careful not to compare apples with pears!



Questions and answers



Thank you for your interest!