

**INFORMATION SOCIETY TECHNOLOGIES  
(IST)  
PROGRAMME**



**Best Practice Action**

***D2.2 SIDCOM Training Material  
Design Considerations - Slides  
Period 1: 01. July 2001 – 31. December 2001***

Project acronym: SIDCOM  
Project full title: Network on Sensing, Identification and Data Communications with passive Non-Contact Technologies  
Proposal/Contract no.: 29551  
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## Design Considerations

- **Tag Selection**
- **Inductive**
- **Back Scatter**
- **Active / Passive**
- **Alternative Suppliers**

**Which solution?**

## Economic Assessment

| <b>APPLICATION VALUE PER TAG</b> | <b>ECONOMIC IF THE FOLLOWING CONDITIONS ARE TRUE:</b>   |
|----------------------------------|---|
| More than 10 Euro                | Application probably makes sense unless the tag must survive extremely demanding environmental conditions or provide very large data capacity |
| 5 to 10 Euro                     | Annual tag volume greater than 1000   |
| 2 to 5 Euro                      | Moderate environmental challenges. Annual tag volume greater than 1000  |
| 0.75 to 2 Euro                   | Moderate environmental challenges. Annual tag volume greater than 100,000   |
| 0.50 to 0.75 Euro                | Moderate environmental challenges. Annual tag volume greater than 1,000,000   |
| Less than 0.50 Euro              | Application probably not economically feasible at this time   |

## **System Requirement Specification**

- **Define User Features**
- **Define Application Environment**
- **Define Commonality Required**
- **Consider Regulations & standards**

## Memory Sizing

- **Amount of Data to be Stored**
- **Unique Address (including customer ID)**
- **Costs of Data Processing**
- **Data Transfer Rate**

## Memory Type

- **ROM - requires database processing / highly secure**
- **WORM - User configurable (once) / flexible/ good security**
- **R/W - Low Security / high flexibility -**

## **Interrogation Space / Orientation**

- **Define space Envelope of detection**
- **Define if Reader is movable**
- **Can orientation of transponder be fixed?**

## Size Definition

- **Tag Size**
- **Tag Shape**
- **Reader Size**



## Tag Speed

- **Defines read time**
- **Allowance for contention handling**
- **Allowable antenna size**

## Multiple Device Scanning

- **Number of devices in read volume?**
- **Anti-collision protocols**
- **Higher frequency**
  - extended read range
  - more devices
  - quicker protocol handling

## Future Proofing

- **Compatibility**
- **Use of other tags with reader?**
- **Applicable Standards**

## **Environmental Conditions**

- **Temperature Range**
- **Humidity**
- **Shock and Vibration**
- **Dust / Chemicals**

## **Metallic & Other Objects**

- **Shielding Effects**
- **Reflection Effects**
- **De-tuning of RFID receivers**
- **Absorption Effects**
  - 2.4 GHz systems in water

## Standards

- **Rapidly evolving**
  - Compatibility Standards
  - EMC & RTE Approvals
- **National / Regional Variations**

## ISO Standards

- **ISO 18000**
  - Air Interface Standards at 4 different frequencies
    - 135 KHz
    - 13.56 MHz
    - 2.45 GHz
    - 5.8 GHz

## ISO Standards

- **ISO 15961**
  - Protocols for data handling
- **ISO 15962**
  - Data transmission protocols
- **ISO 15963**
  - Numbering System
    - Registration Procedures



## ISO Standards

- **ISO 11784**
  - Animal tagging applications - data codes
- **ISO 11785**
  - Animal tagging applications -RF system
- **ISO 14233**
  - Animal tagging applications -Air Interface

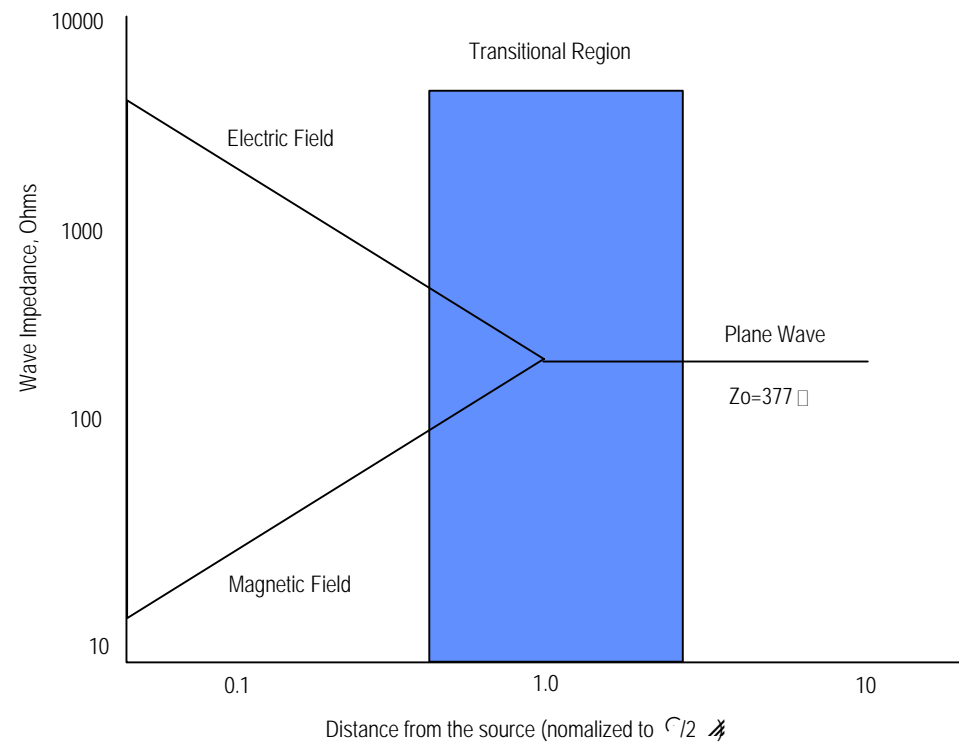
## ANSI Standards

- **ANSI 256**
  - API for Reader Units
    - Compatibility of reader systems
- **Other**
  - Radio Band Use & Power Levels
    - Consult Telecommunications Standards

## Technology Selection

- **Frequency Selection?**
  - Induction systems (generally < 100 MHz)
    - 135 KHz and below
    - 13.65 Mhz
  - E-Field Systems
    - 850-950 MHz.
    - 2.45 GHz

## Near Field / Far Field



## Near Field

- Near/far field boundary =  $\frac{l}{2p}$
- Magnetic Field
  - Predominant H vector rate of fall off at  $1/r^3$

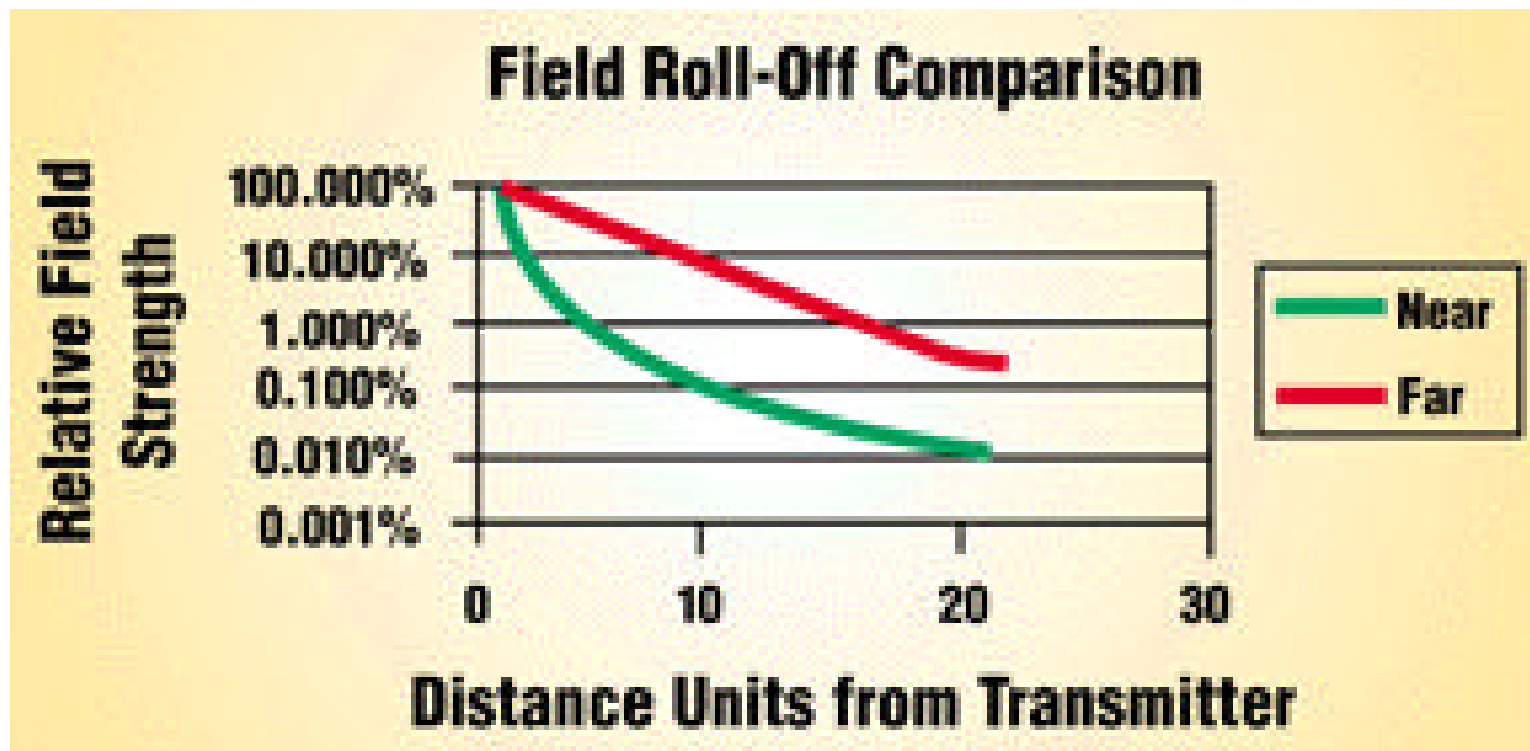
## Near Field

- **Implications**
  - Localised Field
  - Short Range
  - Low possibility of contention problems
  - Known item position

## Far Field

- **Field Strength fall off at  $1/r^2$**
- **Longer Range**
  - Potential Interference Issues
  - Compliance to Radio Frequency Regulations
  - Unknown Transponder Location
  - Potential for Contention

## Near / Far Comparisons





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## Antenna Design Implications

| <b>FREQUENCY RANGE</b>                               | <b>ANTENNA CONSIDERATIONS</b>   |
|--|---|
| LOW (less than 1 MHz) near field, inductive coupling | Many turns required, sometimes several hundred, typically wound around an air or ferrite core |
| MEDIUM (1 to 500 MHz) near field, inductive coupling | Fewer wire turns required, typically printed or etched on a flat surface                      |
| HIGH (more than 500 MHz) far field radio signal      | Single loop   |

## Magnetic Induction Range

|                 |            | Transponder Size |                  |                  |                 |              |           |
|-----------------|------------|------------------|------------------|------------------|-----------------|--------------|-----------|
|                 |            | 12<br>Round      | 18 - 20<br>Round | 28 - 32<br>Round | 80 x 50<br>Card | 75 x 50 x 20 | 230 x 140 |
| Antenna<br>Size | 150 Rod    | 95               | 130              | 155              | 220             | 365          | 455       |
|                 | 100 Circle | 125              | 155              | 195              | 240             | 390          | 485       |
|                 | 100 x 125  | 125              | 175              | 215              | 280             | 425          | 535       |
|                 | 300 x 300  | 130              | 200              | 280              | 395             | 545          | 745       |
|                 | 300 x 375  | 140              | 245              | 345              | 450             | 740          | 940       |
|                 | 375 x 550  | 110              | 225              | 330              | 445             | 810          | 1015      |

## E Field Ranges

- **Limited by :**
  - Power Regulations
  - Antenna Capture Area
- **Ranges of Several Metres Possible**

## Combinational Tags

- **Examples:**
- **Road Toll Tagging**
  - Low Power Tag Wake Up system
    - Localisation
  - High Frequency Retransmission
    - High Data Rate

## Active Tags

- **Two Way Radio System**
- **Disadvantages:**
  - Additional Cost
  - Limited Life
  - Increased Size
  - Increased Unreliability
  - Disposal Problems?

## Semi-Active Tags

- **For example:**
  - Passive RFID system
  - Active Data Logger
- **ATMEL 88RF001 device**
  - Enables interface to microcontroller

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