



# **Radiation-proof Passive RFID**

**(RFID: Radio Frequency Identification)**

**International Partnership for Nuclear Disarmament  
Verification (IPNDV) Working Group 3**

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**Integrated Support Center for Nuclear Nonproliferation  
and Nuclear Security**

**Japan Atomic Energy Agency**

# Monitoring system using radiation-proof Passive RFID

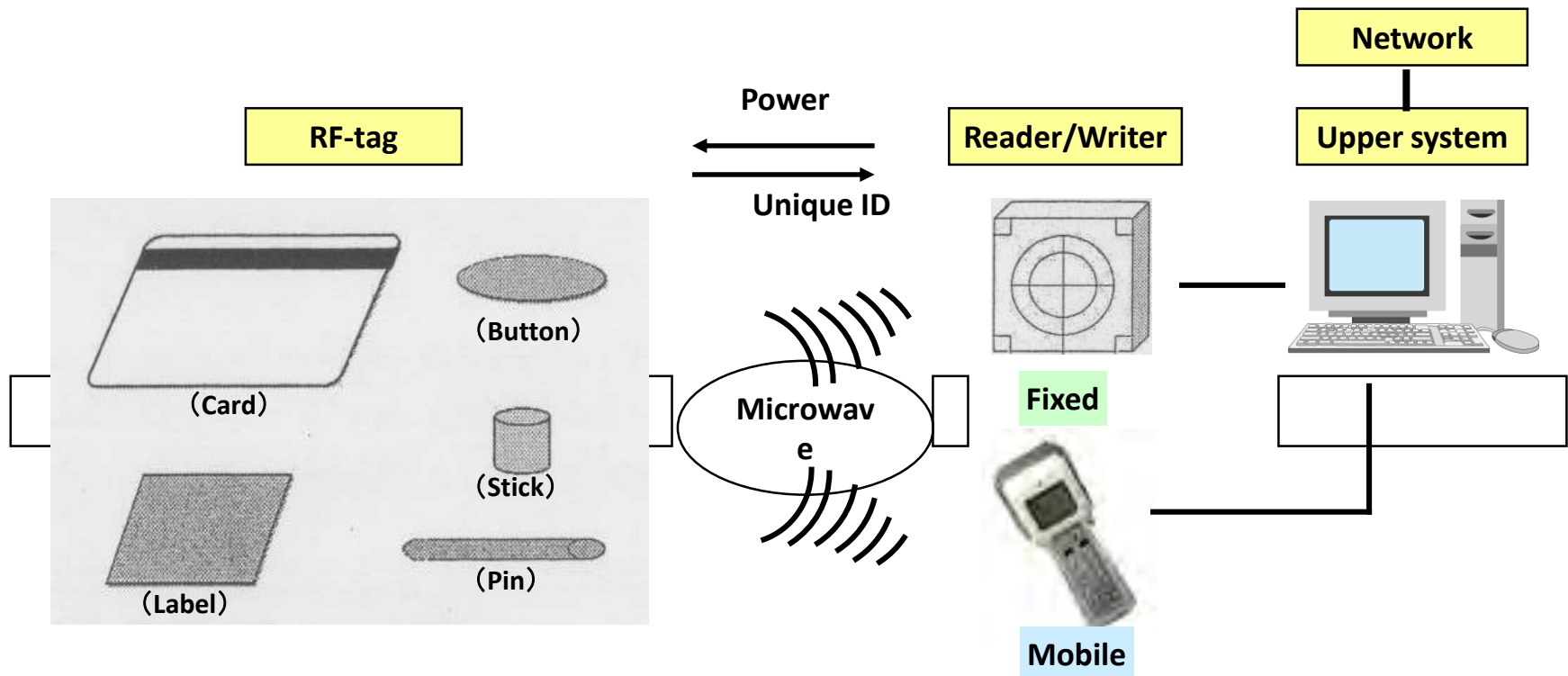


## ■ Feature of Radiation-proof Passive RFID

Small IC tag with unique ID, No electricity needed, tamper proof (difficult to duplicate)

## ■ Physical Principles

IC in the RF-tag is empowered by the microwave emitted from a reader/writer and it sends back unique ID to the reader via microwave.



# Monitoring system using radiation-proof Passive RFID



## ■ Potential use

This system can be applied to chain of custody and monitoring storage of NM.

(Example of RFID use; Decommissioning management)



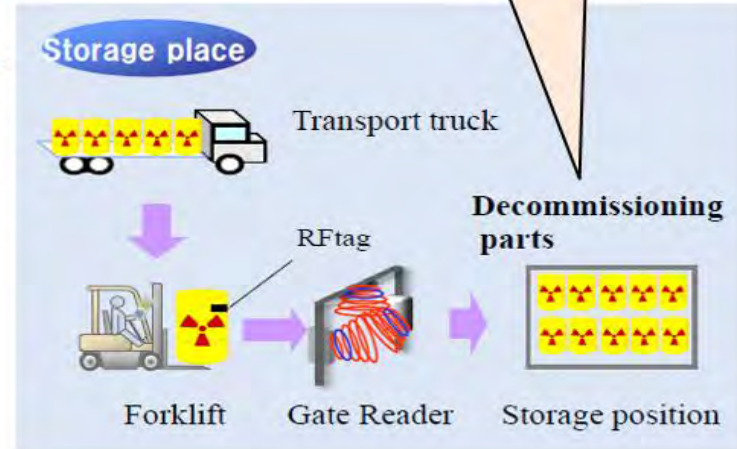
RFtag

Data

1. Position
2. Parts
3. Date, Time
4. Dose rate
5. Container ID

Separate by

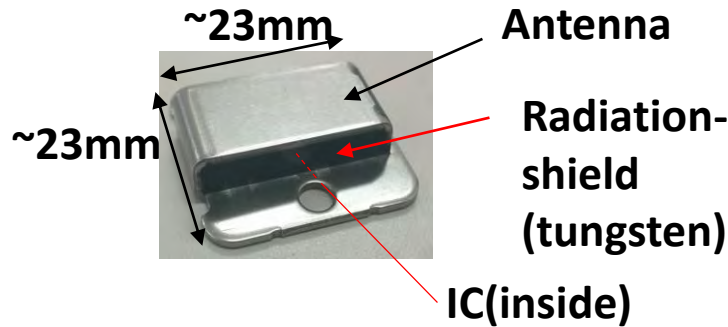
1. Position
2. Parts
3. Date, Time
4. Dose rate



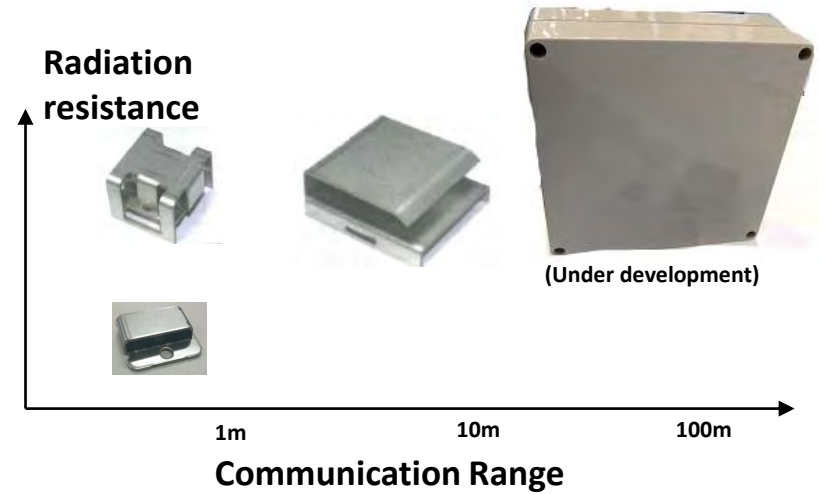
# Monitoring system using radiation-proof Passive RFID



## Radiation-proof Passive RFID



Terara Code Research Institute. Inc.






## Variation of RF-tags

<http://biz.nikkan.co.jp/news/nkx0320151014bfai.html>

## Limitation

Communication range is dependent on tag design and RF power.

## Specification

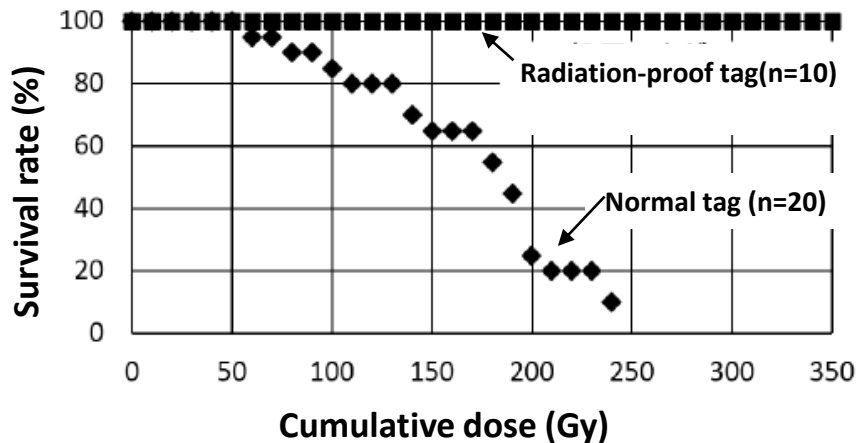
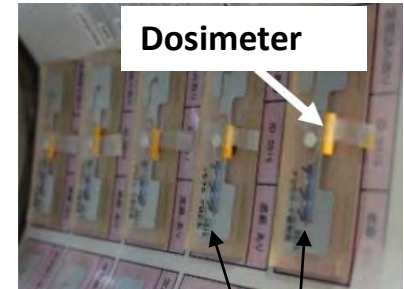
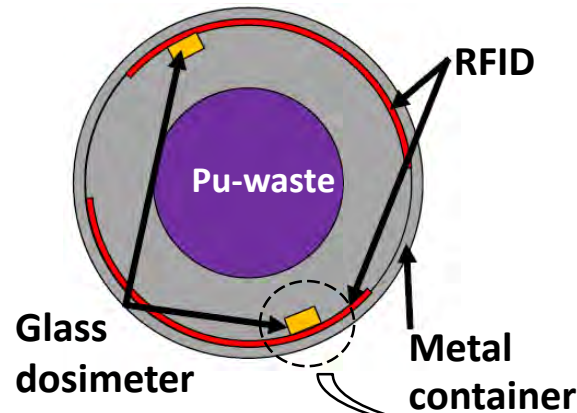
|                           | TCH-1  | TCH-2  | TCH-3  |
|---------------------------|---|--|--|
| Size (mm)                 | 23 (W) * 23 (D) * 5 (H)   | 25*25*16   | 50*45*20   |
| Radiation resistance (Gy) | 1000  | 10000  | 10000  |
| Communication range (m)   | 0.5   | 0.5  | 5  |

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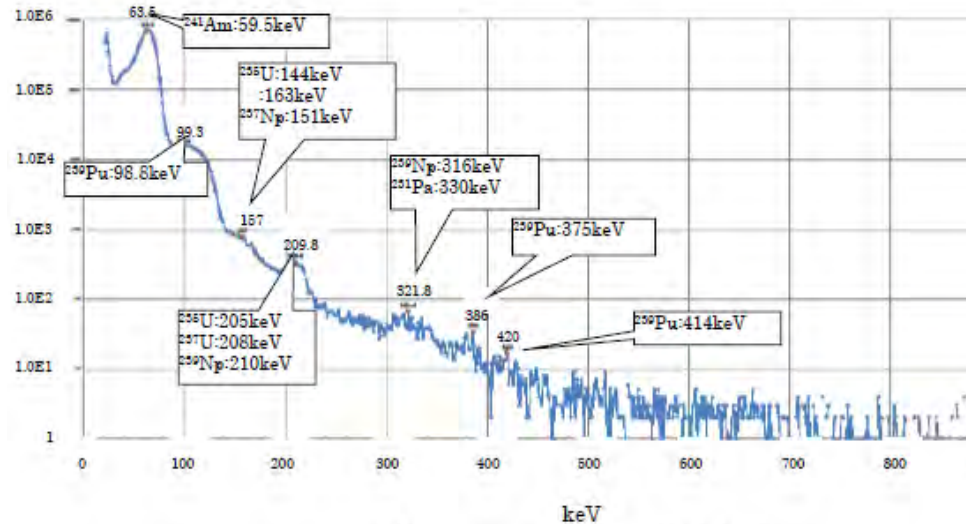


## Exposure test

- Radiation-proof tags were tested under  $\gamma$ -ray environment (60keV: $^{241}\text{Am}$ , 30mSv/h).
- All the radiation-proof tags survived against 350Gy exposure.



Test result



Radiation source(Pu-waste) spectrum

# Monitoring system using radiation-proof Passive RFID



- **Amount of time required to use the technology**

  - Measurement time: 20 msec/sample

  - Installation time: ~3 hours /system

- **Additional infrastructure**

  - AC100V for R/W and PC

- **Commercial availability**

  - Available

- **Estimated cost**

  - RF-tag : \$10-25/tag (1000/lot)

  - Reader/Writer : \$3,000

  - Antenna : \$500

  - Laptop PC : \$2,000

  - Installation : \$3,000 (including cabling)

  - System price : \$20,000 (1 R/W, 4 Antennas, 100 RF-tags, Software)

# (Backup slide) Inside RFID-tag

