

**Commission nationale de l'informatique et des libertés, France**

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## **Address by Mr. Philippe Lemoine relating to Radio-Tags (RFIDs)**

*«In the future world, one will wonder about the time when men had libraries and where books did not talk to one another» . (M. Minsky)*

### **I- INTRODUCTION TO RADIO-TAGS**

The principle of radio-tags was used for the first time by the Royal Air Force during WWII to identify / authenticate airborne plane (*Identify Friend or Foe System*). The idea was not to recognise aeroplane shapes on a radar but in a highly modern approach, to read the fixed identifier of allied aircraft on remotely-initiated requests. However, there is one major difference from current radio-tags : the energy supply

Devices have become more sophisticated and standardised in two or three years. Applications with potential major economic impacts are experimented. Powerful research organisations have been formed. There is string controversy around the implications on privacy, including in the United States.

#### **Operating principles**

Currently RF-ID is miniature silicon / copper tags, referred to as « Smart Tags » or RF-ID (Radio-Frequency Identifier) that could shortly reach very low unit prices (10 to 20 cents) owing to a very broad scope of use. These tags combine and include three technical functions :

- A memory that can reach a large capacity, organised around a microprocessor ;
- A contact-less communication system based on a distant transmission aerial linked to the microprocessor ;
- An energy producing mechanism based on the reactions of the aerial coiling crossing an electromagnetic field, requiring no battery and providing for unlimited lifetime ;

## II- TECHNICAL BASIS OF RADIO-IDENTIFICATION

### The micro-processor

Several words are used : Radio-Identifier, Tag, Label, chip-radio or RFID. However, the term RF-ID should be used only when the tag includes a microprocessor. This leaves out electromagnetic devices such as simple off-the-shelf anti-theft devices that do not have identifiers.

In the world of RFIDs, there are different levels of intelligence, based on the use of the micro-processor :

- Passive radio-tags : returns a fixed identifier
- Read-Writes Radio-tags : returns an identifier that can be re-written by the player
- Smart tags : complete dialogue between the player and the tag, with a variety of data exchanges.

A few economic parameters should be reminded. The production and usage cost for a micro-processor is going down. This is the industrial area, and that area is expanding. Many manufacturers are competing : Philips, Texas Instruments, Atmel, Sony... Over 200 million tags may have been made in 2002.

The most simple tags are worth as little as 10 cents a piece while playing and activation devices can be found at a price of 5 \$. Therefore, it is a certain fact that the RF-ID technology will become very popular due to its low cost.

### Energy production : technical principles

Radio-identifiers (RFIDs) are also referred to as TRANSPONDER (TRANSMitter/resPONDER). The TRANSCEIVER (TRANSMitter/reCEIVER) is the player / transmitter.

What is the energy source ? The magnetic radiation of the Transceiver creates an induced electric current in the Transponder coiling, which also acts as an aerial.

There are two radiation types :

- *Forward Channel* : the player's (Transceiver), magnetic
- *Backward Channel* : the du radio-identifier's, radio

A tag is often less than a millimetre (long or thick) !

## The aerial

Four main carrying frequencies are considered for the return channel :

<b>Band</b>	<b>Air electro-magnetic protocol</b>	<b>Playing capacity and speed</b>
<b>125-135 kHz</b>	<b>ISO 18000-2</b>	<b>60 bytes, low speed (playing only)</b>
<b>13.56 MHz</b>	<b>ISO 14443 (A/B) &amp; ISO 15693 (ISO 18000-3 in progress)</b>	<b>2 K bytes and more, quick speed</b>
<b>860-930 Mhz (UHF)</b>	<b>ISO 18000-6 in progress</b>	
<b>2, 45 GHz (same band as Bluetooth &amp; Wifi)</b>	<b>ISO 18000-4 in progress</b>	<b>Over 512 K octets, Very quick speed</b>

However, there are many RFIDs outside those international frequencies and standards.

The scope of « standardised » playing on the Backward Channel (the radio-identifier's) is variable as shown in the table below. It should be noted that all frequency bands correspond to opacifying or reflecting matters that disturb the radio-electric operation.

<b>125-135 kHz</b>	<b>10 cm</b>	
<b>13.56 MHz</b>	<b>1 metre (2 to 3 metres at most, theoretical, non standard)</b>	<b>Disturbed by some metals including aluminium</b>
<b>860-960 MHz</b>	<b>2 metres in Europe (0.5 watts), from 1 to 5 metres in the United State (4W watts authorised)</b>	
<b>2.45 GHz</b>	<b>Some ten meters in theory</b>	<b>Disturbed by water</b>

As shown above, the ranges are very low, all the more since the 2.45 Ghz one in terms of RF-ID is still in the research phase. A more appropriate name than distant transmission would be contact-less recognition. However, the limitation to two metres of the playing capacities can be overcome by the proliferation of players, each of which, using an internet address, will help trace

information at no cost. Sending requests to billions of readers attached in a bunch around an object will become possible.

### III- RADIO-TAG APPLICATIONS

#### Radio-tags and distribution

Distribution is the great area of application for RFID. Self-services and the relationships between manufacturers and distributors are now organised according to the bar-code technology. This technology relies on a symbolisation mode suited to the technology of optical reading and on a 12 digit codification mode in North America (UCC code) and a 13 digit mode in the rest of the world (EAN code for European Article Number).

Switching from the « optical reading » symbolisation to the « Smart-tag » symbolisation is done for convenience and productivity. For instance, when cashing out, the tag does not require a good position or even moving the product, unlike bar codes.

Switching from the 12/13 digit codification to a richer codification is a way to globalise codes (UCC/EAN integration) in an information enrichment context. An ePC identifier (electronic Product Code) with 96 bytes will allow to add a serial number to the current EAN-13 :

Functions	Header (2)	ePC Manager (7)	Object Class (6)	Serial Number (9)
	<b>aa</b>	<b>aaaaaaa</b>	<b>aaaaaa</b>	<b>aaaaaaaaa</b>
Bytes	0 to 7	8 to 35	36 to 59	60 to 95
Example :	nationality	company	product type	product number

In this example, if the product type is « can of soda light », each can is identified by a number differentiating it from other similar cans. Switching to ePC codes will allow identifying industrial objects on a unit level.

This ability answers four problems in the distribution area :

- No inventory (*Supply-chain*)

A product receives an identifier when it is manufactured, that will follow it throughout the whole logistic chain. Manufacturing and transport operations can be triggered automatically based on the collected data.

- Stores without cashiers and theft (*Billing*)

A cart going under an arch can be read and inspected to prevent non paying exits or the exit of an item covered by the tag of another item.

- Store service development (*cross-selling* for instance)

A client tries clothes on in a fitting room. Item recognition during the trying on will allow to offer other matching items.

- Client support over time (Maintenance, replacement, loyalty)

As long as an item can be followed throughout its lifetime, new service prospects open up

We are currently in the experimentation phase. Generalisation is scheduled for 2010.

### **Radio-Tags and health**

The American *Food and Drug Administration* (FDA) has initiated a drug counterfeit detection programme based on the use of RFIDs in the packaging (*FDA & Drugs Counterfeit Program*).

Experiences are being conducted in the area of radio tag implants. Applied Digital Solutions offers Verichip : some twenty human guinea pigs of the company are tagged behind the ear. Bio-sensors for diabetes patients are being studied at Toshiba/Sysmex.

The FDA only regulates comparable materials for the moment, and forbids applications on man (source AFNET/Les Echos).

### **Radio-Tags and transports**

Radio-tags help manage tyres maintenance, an area where Michelin is ahead (based on specific American regulations). In the future, tags will be coupled with temperature and pressure sensors (ISO/TC22-SC3 TPMS).

Baggage management is being tested at Orlando Airport with Delta Airlines (to replace barcodes).

*SpeedPass* is used by six million drivers in the United States at *Mobil* gas stations. FYI, three hundred million car keys using that technology [car immobiliser] may be driving around in the world, with no ISO standard.

Like the contact-less pass Navigo of the RATP (ISO 14443-B « local » standard), public transportation companies are big users.

### **Radio-Tags and safety**

Theft detection (without an identifier) has been used in supermarkets for a long time.

A study is underway on Euro bill security at the European central bank scheduled to begin in 2005. It may be another family of  $\mu$ -chips (0.4 x 0.4 mm surface area) with a reported playing range in the region of one millimetre.

Inserting radio-tags in access badges is being experimented. Thus, Aéroport de Paris is currently studying an RFID and biometry combination for restricted access areas. In that architecture, the identifying n° refers to an index of the central base. The RFID was used to control the access to the last Chinese communist party convention. In that case, the badge referred to an index on a central base and the picture of the holder was sent to a security department screen.

### **Radio-Tags and passports**

A study is in progress at the ICAO (International Civil Aviation Organisation) which could result in implementing contact-less chip passports. The integration of two biometrics is under consideration (a digital 12 k-octets picture and a biometry to be chosen between the fingerprint

and the eye) and the signature of the issuing body.

A 32 k octets memory could be enough, but the ISO standards do not meet the requirements yet (10 cm distance and reading time under 3 seconds, issue of the identification of the issuing body ...)

### **Radio-Tags and payments**

The idea is to design payment cards that can be recognised from a distance at the time of payment.

## IV) THE STAKES OF RADIO-TAGS

### Prospective

The implementation of the ePC (*electronic Product Code*) relies on the « AUTO-ID » programme, headed by a manager seconded by Procter-and-Gamble to the MIT. That programme co-ordinates six world research centres : MIT (Boston and Dublin), Cambridge, Saint-Gall, Tokyo, China, Australia and gathers 103 « sponsors » (61 technological, 42 industrial and distribution) including the five largest distribution groups.

The research is centre around miniaturisation (objective : 300 $\mu$  - 0.3 mm), cost (objective :  $\pm$  5 cents) and innovative applications : contact-less payments (Sony/Philips), house automation (smart washing machine for delicate fabrics with « radio-tags »), sport (arrival order calculation at the Berlin Marathon) etc...

The programme was entrusted framework licence to UPC/EAN. The purpose is to develop experiments by 2005 and generalise them by 2010 (see [www.autoidcenter.org](http://www.autoidcenter.org)). There are very large forecast volumes, consistent with the new internet addressing plans (IPV6). The sponsors alone account for 500 billion *items* in the *supply chain* and 10% of world production. On a world scale, the stake is to code 50 to 100 000 billion items, knowing that one human being is surrounded by an average 2 000 items.

### Vigilance

Do radio-tags involved privacy and personal data protection ? Four traps could conceal the crucial significance of the « privacy » aspects of this technology.

The trap related to « data insignificance » : why does it matter to have the serial number of a box of corn-flakes ? The problem is the volume of information (thousands of items followed) that can be crossed in « smart environments » using a very thick meshing, or analysed through « scanners » (radio profiling of all an individual's tags).

The trap of « priority to items » : are they really personal data ? The fact that applications relating to individuals (payment, geo-location, etc...) are further away results meets an economic logic : there are only 6 billion human beings compared with 50 000 billion items. Objective : this helps dull watchfulness.

The trap of a « globalisation logic » : the sponsors and main research centres are in the United States. It is over there, far from the European « privacy » tradition, that standards are being defined. Because of the huge economic stakes of the operational process reorganisation, standards set in the United States will spread to the rest of the world.

The trap of « individual non-watchfulness » : with RFIDs, data are entered from a distance (without any « move » by the carrier) and without any possibility to stop the communication (like a GSM on standby). They are always actuatable. In addition, as there is no battery, the potential radiation of an RFID is unlimited in time.

## **Mobilisation**

Activism against RFIDs developed mainly in the United States, which is only apparently paradoxical. The lack of protective laws results in citizens being very watchful of new risks in terms of « privacy » protection.

A association, CASPIAN (*Consumer Against Supermarket Privacy Invasion*) was created solely for this purpose. A federal law bill aimed at neutralising « tags » at the store was brought before Congress and a debate over the need to pass a law has been established.

The Benetton project introducing RFIDs in American stores (Philips technology) resulted in a great deal of controversy on the other side of the Atlantic, among privacy associations including the EPIC, and in the end was interrupted. The same applies to Gillette who conducted a few trials for tagged razors. The large distributor Wal-Mart says it wants to restrict RFIDs upstream of the sales chain, i.e. to logistics

The sensitivity is so high that the Auto-ID Centre says it is taking into account the « privacy » aspect.

## **Priorities for privacy protection**

There are two basic priorities required from the CNIL and from liberty protection bodies :

- Stating the principle that the data processed is personal, even though it is data covering items only, if the RFID technology helps establish a dense analysis meshing for the thousand items surrounding a person ;
- Demand the implementation of « smart tags » disabling systems in some situations and with the free choice of individuals.

The subject of individual process control should be thoroughly discussed with the research centres. Apart from the « disabling » concept (which poses a problem as it neutralises complete aspects of important applications such as anti-theft devices), a simple display of the active or inactive status of a smart tag should be promoted (colour code ?). Based on volumes, a revision of the rules for exercising access and rectification rights should be conducted (will one be charged for exercising that right ?)

Lastly, the emphasis should be put on the interest of conducting work on an international level. In a very timely manner, the subject was discussed at the international convention data protection officers (Sidney, September 2003 ) and formed the subject of a resolution (see <http://www.privacyconference2003.org> ).

Apart from those talks between authorities, a dialogue should be conducted with European standardisation organisations (EAN). Their influence capacity should be strengthened, in the face of American organisations.