

# NFC Tags & Tag Types

Near Field Communications NFC defines four different tag types - each intended for different applications.

## **NFC, Near Field Communication Includes:**

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NFC tags are a key element of the overall NFC system. One of the key elements of NFC, near field communications technology is the ability for NFC enabled devices to be able to be touched onto passive "NFC tags." This facility of NFC technology is a key enabler for many applications.

NFC tags are now incorporated into many different items and they are being manufactured in vary large volumes and they are being deployed in a number of areas of the world. Already many millions have been deployed and as NFC gains further momentum, tags will be seen in many new areas.

With the vast numbers of tags being foreseen for the future, the definitions for the tags must be clear so that NFC tags from any manufacturer can be used with other equipment from any manufacturer.

## **NFC tag basics**

NFC tags are passive devices that can be used to communicate with active NFC devices (an active NFC reader/writer). The NFC tags can be used within applications such as posters, and other areas where small amounts of data can be stored and transferred to active NFC devices. Within the poster the live area can be used as a touch point for the active NFC device.

The stored data on the NFC tag may contain any form of data, but common applications are for storing URLs from where the NFC device may find further information. In view of this only small amounts of data may be required. NFC tags may also be used.

In order that the communication between the active NFC reader/writer and the passive NFC tag was defined. The NFC forum introduced their first standardised technology architecture and standards for NFC compliant devices in June 2006. This included the NFC Data Exchange Format, NDEF, and three Record Type Definitions, RTD. These are for smart poster, text, and Internet resource reading applications.

## **NFC tag type definitions**

There are four basic tag types that have been defined. These are given designations 1 to 4 and each has a different format and capacity. These NFC tag type formats are based on ISO 14443 Types A and B which is the international standard for contact-less smartcards) and Sony FeliCa which conforms to ISO 18092, the passive communication mode, standard).

The advantage of keeping the NFC tags as simple as possible is that they may be deemed to be disposable in many instances, often embedded in posters that may only have a short life, etc.

The different NFC tag type definitions are as follows:

- **Tag 1 Type:** The Tag 1 Type is based on the ISO14443A standard. These NFC tags are read and re-write capable and users can configure the tag to become read-only. Memory availability is 96 bytes which is more than sufficient to store a website URL or other small amount of data. However the memory size is expandable up to 2 kbyte. The communication speed of this NFC tag is 106 kbit/s. As a result of its simplicity this tag type is cost effective and ideal for many NFC applications.
- **Tag 2 Type:** The NFC Tag 2 Type is also based on ISO14443A. These NFC tags are read and re-write capable and users can configure the tag to become read-only. The basic memory size of this tag type is only 48 bytes although this can be expanded to 2 kbyte. Again the communication speed is 106 kbit/s.
- **Tag 3 Type:** The NFC Tag 3 Type is based on the Sony FeliCa system. It currently has a 2 kbyte memory capacity and the data communications speed is 212 kbit/s. Accordingly this NFC tag type is more applicable for more complex applications, although there is a higher cost per tag.
- **Tag 4 Type:** The NFC Tag 4 Type is defined to be compatible with ISO14443A and B standards. These NFC tags are pre-configured at manufacture and they can be either read / re-writable, or read-only. The memory capacity can be up to 32 kbytes and the communication speed is between 106 kbit/s and 424 kbit/s.

From the definitions of the different NFC tag types, it can be seen that type 1 and 2 tags are very different to type 3 and 4 tags, having different memory capacity and makeup. Accordingly it is expected that

there is likely to be very little overlap in their applications.

Type 1 and type 2 tags are dual state and may be either read/write or read-only. Type 3 and Type 4 tags are read-only, data being entered at manufacture or using a special tag writer.

## NFC tag operation

The NFC tag is a passive device with no power of its own. Accordingly when one is used, the users touches an NFC enabled device onto the tag. A small amount of power is taken by the NFC tag from the reader/writer to power the tag electronics. The tag is then enabled to transfer a small amount of information to the reader/writer.

The data stored in the tag memory is transferred to the NFC enabled device. Although normally only a small amount of data, this may be used to direct the device to a website URL, it may be a small amount of text, or other data.

## NFC tag design and manufacture

There are many design and manufacturing considerations to be taken into account for NFC tags. They are intended to be manufactured for very low cost in very large quantities, while maintaining their performance. There are a number of key performance parameters and elements that need to be considered when designing an NFC tag.

- **Read speed:** This issue is important because it is necessary for the NFC tag to be able to pass all its data over while the two NFC devices are within range. If the NFC tag can only transfer data at a slow rate then there is a real danger that all the data may not be

transferred in time resulting in a poor level of reliability.. In turn this will affect the user and the user, who not understanding the technology will easily be turned off from using the system if they have to keep re-trying to successfully transfer the data. NFC tag type 1 allows all the data to be transferred in one block which enables the read performance of the tag to be maintained.

- **Die size:** The die size is of particular importance in the design of an NFC tag. A smaller die, results in lower cost and also the in the NFC tag being less obtrusive - an important factor for tags used in posters, etc. Smaller memory sizes naturally lend themselves to smaller die sizes.
- **Unit price:** The unit price of the NFC is a very important factor in their design as many NFC tags will be aimed for very low cost applications such as smart posters. Here cost is of great importance. The cost of the tag is influenced by a number of factors. These include factors such as the memory size and general IC complexity resulting from additional features that need to be included, By keeping the memory and features as simple as possible the cost can be kept down.

With manufacture of NFC tags likely to run into billions when the system fully takes off, the design of tags will need to be undertaken very carefully so that the correct balance of cost and performance can be obtained.

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