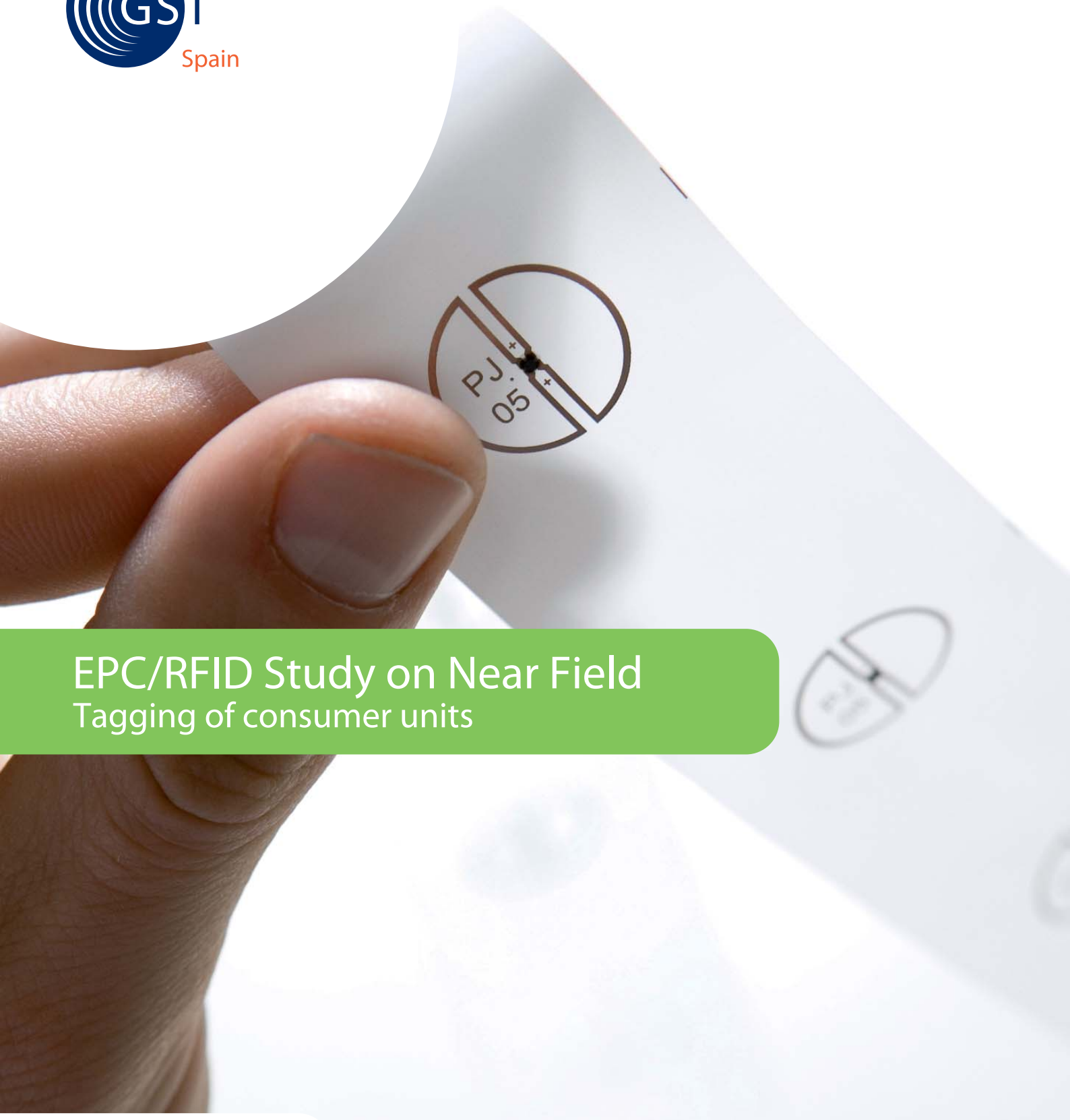
GS1 Spain



EPC/RFID Study on Near Field
Tagging of consumer units

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EPC/RFID STUDY ON NEARFIELD:
Tagging of consumer units

Until now, most tags or EPC/RFID labels on the market have been based on the Far Field concept, i.e., on the use of plane electromagnetic waves emitted by UHF antennas for sending and receiving information from the tag. Far Field is the perfect solution for labelling **boxes and pallets**, but this is not the case when it comes to labelling individual items, which requires small tags that can be reliably read in bulk.

For this reason, we put forward the Near Field concept as a completely valid solution for the identification of individual items. Furthermore, it complies with the current EPC UHF Gen2 standard, thus **allowing for a single technological infrastructure**. Near Field makes it possible to considerably reduce the size of the tags, as well as **allowing groups of tags to be read, even when in liquids and metals**.

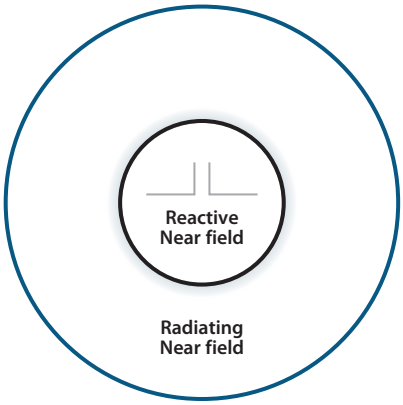
Tests carried out

AECOC, jointly with the company TRACE Tecnologías, an EPCglobal suscriber, has carried out various tests to try out the reliability of Near Field communications. In order to do this, an EPC UHF Gen2 reader and a Near Field antenna were used, as well as different formats of Near Field EPC UHF Gen2 tags.

Following a logical order, single readings were carried out to test the response of the tags in different liquid and solid products. The reliability and response time were analysed by reading several elements at the same time.

What is Near Field?

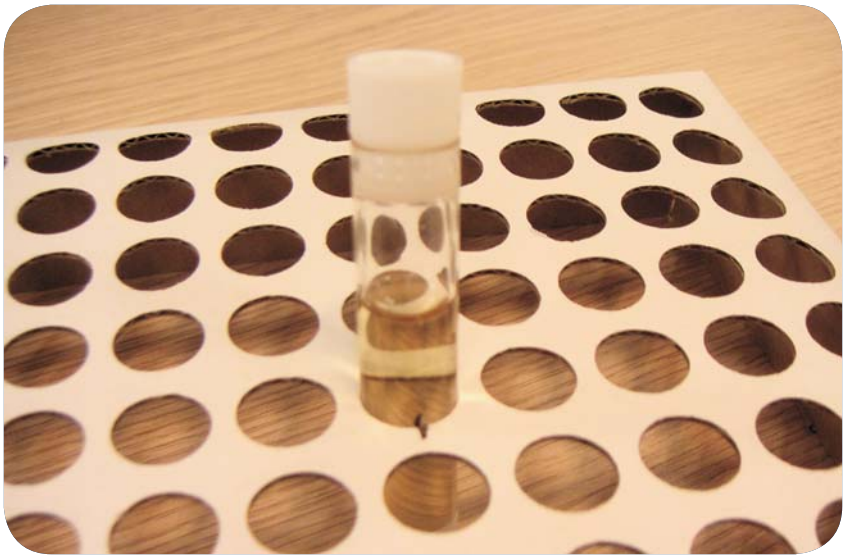
Near Field in a UHF RFID system is the field around an antenna that makes use of the principles of magnetic coupling. Two magnetic fields are created around the antenna: a reactive one that touches the antenna and a radiating one that surrounds the antenna. When the wave becomes plane, the magnetic field is transformed into an electromagnetic field, the so-called Far Field.
Optimum reading results can be obtained by making use of the nearby magnetic field. This field is less sensitive to the different types of materials that surround the tag, such as metal or dielectric materials (poor conductors of electricity) thus allowing the tags to be read even in liquids.



With this theory as a starting point, it is possible to emulate the communication method of LF or HF systems, as Near Filed reading distances are limited to a range of 2 cm to 30 cm from the centre of the antenna. In some occasions, the tag may be placed in contact with the antenna or the reading base.

Test 1:
Item level - Description of the test and results

In order to check whether the Near Field can be read in liquid and solid products, a minimum reading power test has been designed. A single test tube is used, labelled with a tag and filled with various common everyday products, such as liquids with different densities and solids. When the test tube is full, it is put in a fixed position with tag always in the same position and orientation to carry out the test.



The following results were obtained:

	Minimum reading power (W)	Minimum reading dBm	% of correct readings
Oil	0.320 W	25.00 dBm	**100% of readings**
Water	0.360 W	25.50 dBm	
Sugar	0.285 W	24.50 dBm	
Cocoa powder	0.225 W	23.50 dBm	
Liquid coffee	0.285 W	24.50 dBm	
Ground coffee	0.285 W	24.50 dBm	
Instant coffee	0.320 W	25.00 dBm	
Liquid detergent	0.400 W	26.00 dBm	
Whole milk	0.285 W	24.50 dBm	
Skimmed milk	0.250 W	24.00 dBm	
Salt	0.320 W	25.00 dBm	
Vinegar	0.360 W	25.50 dBm	

As shown above, it is possible to obtain readings from 250 mW, even in liquids.

By focussing on the type of product, solid or liquid, the main conclusion drawn is that the technology is completely independent from the type of material to be read.

This phenomenon is due to the little influence that the dielectrics have on the magnetic field used to transmit and receive the tag information.

Test 2:
Health industry - Description of the test and results

Unlike in liquid environments, communication in metals is possible if certain precautions are taken regarding the design and position of the tag. These precautions are especially important in the pharmaceutical industry, as the end products have a wide range of containers and content types.

For this reason, with a good design of the solution, **100%** reliable readings are achieved in various pharmaceuticals with different capsules. For example, tubes of cream, foil blister packs, powder sachets and ampoules of liquid.

Test 3:
Bulk readings - Description of the test and results

In view of the capacity of Near Field for reading in liquids, 96 test tubes full of water ara labelled, each with a tag attached to the outside bottom, so that the tag is completely covered by the liquid.

The test consists of passing the box with the 96 labelled test tubes over the Near Field antenna until 100% of the expected readings are obtained. The operation is repeated 10 times for each of the different reading power levels planned for the test. The total time for reading the entire group is measured.

The reading time for all the units is checked:

Inventory Statistics		Rate
Unique Tags:	96	
Tags Rdr1:	96	
Total Reads:	1324	270.2
Tot Rdr1:		1324
Test Time:	0: 00: 04	
Peak Rate:	414.0	178.4

The following times were obtained:

W	dBm	*t1*	*t2*	*t3*	*t4*	*t5*	*t6*	*t7*	*t8*	*t9*	*t10*	tm
1	**30**	3″	1″	3″	2″	1″	2″	1″	1″	1″	2″	**1,7s**
0,640	**28**	3″	3″	3″	3″	3″	2″	2″	2″	2″	2″	**2,5s**
0,500	**27**	2″	3″	2″	2″	1″	1″	2″	2″	3″	2″	**2s**
0,250	**24**	5″	7″	6″	2″	2″	1″	4″	3″	3″	4″	**3,7s**
0,125	**21**	12″	21″	15″	8″	11″	18″	15″	5″	4″	10″	**11,9s**

By adjusting the reader to a power level of 500mW it is possible to obtain a complete set of results in a minimum of time, similar to when working with 1W.

With a minimum power level well below the permitted maximum, 100% of the readings are achieved in times of less than 4 seconds.

General conclusions from the tests

The tests carried out have demonstrated that Near Field technology is reliable in **100% of cases**, and that it can finally resolve existing problems with **liquids and metals**.

It is important to stress that **not all Near Field tags are suitable for all applications**. For this reason, it is essential to carry out tests and trials to determine the most suitable tag for each product or application.

Furthermore, as it complies with EPC UHF Gen2, Near Field has been able to make use of all the recent improvements that have been made since UHF became the favoured supply chain technology.

This is why **it is put forward as a solid solution for labelling at item level, leaving aside other technologies that could increase implementation costs in information systems**.

We would like to invite all interested companies to carry out tests at the EPC Competence Centre and to make use of the available structures and the latest equipment of the technology supply companies that work with the Centre.

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