

2 The Overview of Certification in the Telecommunications Industry and the NOL RFID Performance Test Centre in Singapore



This article begins with an introduction on EPCglobal RFID System and its key unique functionalities. It continues with an overview of the certification requirements in the telecommunications industry covering three preliminary determinations that must be made for any certification test, namely test environment, test equipment and test performer. It also gives examples of CTIA cellular phone protocol testing, Bluetooth and WiFi Conformance testing etc. as well as describes EPCglobal Certification Test Considerations in respect to the Test Environment, Test Equipment and Test Performer and the setting up of the ASEAN's first RFID Advanced Technology Performance Testing Centre in Singapore by the NOL in collaboration with Sun Microsystems. It concludes that during the next 18 to 24 months EPCglobal will be widely adopted by multi-industries including Aerospace, Defence, Electrical & Electronics, Footware, FMCG, Healthcare, Transportation & Logistics and Textile & Garment. The NOL-Sun Microsystem RFID Advanced Technology Performance Testing Centre's current established leadership in the RFID testing field will certainly contribute towards the further growth and development of Singapore as the RFID Hub of the region.

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1 Introduction

RFID is now more than 60 years old but until recently it failed to take off on a large scale. This is mainly the fault of solution providers that created proprietary systems that focused on how to make the tag bigger in order to encode more information on the tags. This resulted in larger tags, different tag sizes, more expensive tags, no global standards and difficulty in achieving economies of scale for mass production of RFID tags to reduce costs.

The arrival of EPCglobal system developed by MIT USA in 2002 changed this situation. The EPCglobal system combines the RFID and the Internet technology. The EPCglobal Gen2 is now an ISO standard under ISO 18000-6-C. With the EPCglobal system, the RFID tags only encode the product identification with its unique serial number and stores all products attributes in the database accessible through the Internet. This enables the mass production

of very small RFID tags and achieves economies of scale. In 2002, the price of RFID tags was one US dollar per unit. Now, the price has dropped to US\$0.05 per tag and is projected to reach US\$0.03 per tag in 2007 and US\$0.01 per tag in 2008.

The EPCglobal system has now been adopted by Wal-Mart, Target and Best Buy in the United States, Tesco in the UK, Metro of Germany, the US Department of Defence, shipping and logistics companies such as NOL and also aircraft manufacturer Boeing. In fact, Boeing has called a meeting in Tokyo in October 2006 to mandate all their suppliers of components to supply the parts with EPCglobal tag.

The prediction is that in the not to distant future, multi-industries will adopt EPCglobal System because of the following reasons:

- (1) It is an International Standard.
- (2) The EPCglobal Gen2 tag meets industry's requirements especially its Dense-reader mode which allows hundreds of readers to operate simultaneously.
- (3) The availability of frequencies in Asia/Europe/USA allowing the same tag to operate in all regions.
- (4) The EPCglobal Gen2 readers can read pallets, cases and items. It can operate in both Near-Field UHF RFID for items and Far-Field UHF RFID for pallets.
- (5) The 96 bit EPC tag has 10-metre read range and 8-metre write range.
- (6) The EPC writer can write 800 tags per minute.
- (7) EPCglobal Gen2 works well on stacks of DVDs and racks of clothes.

Another advantage of EPCglobal System is that this is the only system that requires all manufacturers of RFID hardware and software to undergo the following mandatory tests:

- Conformance Testing: testing conducted to measure a device's compliance to EPCglobal standard;
- Interoperability Testing: testing conducted to measure a device's ability to operate with other devices according to EPCglobal Gen2 specification; and
- Performance Testing: testing conducted to measure a device's performance under real world conditions and within specified environments.

2 Overview of Certification in the Telecommunications Industry

The telecommunications industry has well developed certification for its products, like mobile phone, Bluetooth, and WiFi devices. The EPCglobal Network utilises radio frequency technology. Therefore, it is appropriate to look into the telecommunications industry certification to leverage on their experience and learning in the development of the EPCglobal Hardware Certification.

There are three preliminary determinations that must be made for any certification test: test environment, test equipment and test performer.

2.1 Certification

The International Organization for Standardization (ISO) defines certification as a 'procedure by which a [neutral] third party gives written assurance that a product, process or service conforms to specified requirements'. This written assurance often comes in the form of a certification mark or label applied to a product or its documentation, and/or a listing in a publicly available registry.

All of those options mentioned above are used throughout the telecommunications industry. For example, in terms of test environment, CTIA cellular phone protocol testing, Bluetooth, and WiFi conformance testing is done in labs, while Global Certification Forum GSM interoperability testing is done in the actual field environment. For test devices, Bluetooth software certification utilises validated reference devices, and Bluetooth RF hardware certification utilises a validated Bluetooth tester as well as standard test equipment. For the test performer, there are notable examples in telecommunications industry for each option. Cable Labs created their own lab for certification of cable modems. CTIA qualifies independent 3rd party labs, whereas Bluetooth Special Interest Group established a test facility qualification lab for accrediting 1st party labs and independent 3rd party labs. WiFi Alliance contracted its process to a single global certification lab to manage both the testing and the overall process.

2.2 EPCglobal Certification Test Considerations

The EPCglobal Inc, having studied the telecommunication industry's certification requirements, has adopted its three preliminary determinations as stated below.

Although the scope and parameters of tests vary depending on the device(s) being tested, these three preliminary determinations must be made for any certification test. The various options for each of these determinations are presented below:

Test Environment

Where will the tests be conducted?

- Lab;
- Simulated field environment;
- Actual field environment.

Test Equipment

What equipment will be used to conduct the test?

- Standard test equipment,
- Validated reference devices;
- Actual devices.

Test Performer

Who will perform the tests?

- Certifying organisation's own lab;
- Accredited 1st party lab (i.e. lab owned and operated by an End User company);
- Accredited 3rd party lab (i.e. lab owned and operated by either an independent testing company or an accredited solution partner).

In the case of EPCglobal, the EPCglobal's Conformance Testing and the EPCglobal's Interoperability Testing can only be conducted by the MET lab facilities in Sante Clara, California as specified by EPCglobal Inc.

All hardware (tags, printers/encoders and readers) having passed the EPCglobal Conformance Testing and EPCglobal Interoperability Testing are awarded the EPCglobal 'Seal of Compliance' to be applied to the product. This will facilitate the users in the purchase of EPCglobal Gen2 hardware.

The Performance Testing can be carried out by all performance testing labs set up in the country or in the region. In Singapore, the NOL-Sun Microsystem Performance Testing Lab is the first Performance Testing Lab set up in ASEAN according to the specification of EPCglobal for Performance Testing lab. GS1 Singapore provided all the technical specifications for EPCglobal Performance Testing lab.

3 The NOL-Sun Microsystem RFID Performance Testing Centre

The RFID mandates by some of the major global retailers such as Wal-Mart and Government agencies such as Department of Defense in US have really put a lot of manufacturing and logistics professionals in a major dilemma. As a global transportation and logistics company who has many of its customers who are affected by these mandates, it is imperative that NOL is able to help its customers to meet these RFID mandates while helping them to minimise cost, risk and disruptions to their current operations. Thus, NOL in collaboration with Sun Microsystems, setup a NOL-Sun Advanced Technology Centre on 22 July 2005 to:

- Raise regional and national awareness about the RFID technology;
- Position Singapore as a world-class RFID Hub and a leader in RFID technology;
- Create a community for industry players to come together for testing and collaborations;
- Provide a one-stop shop and RFID services for customers interested in piloting or testing the latest logistics technologies;
- Provide professional RFID training in partnership with world-class training providers to the public; and
- Further enhance our technology capabilities in RFID to widen our business areas and break into new business.

Since the launch, the Centre has not only created new business opportunities for the company, but has also positioned Singapore as a world-class RFID centre of excellence. It has also helped develop a vibrant RFID ecosystem in Singapore.

4 Impact to Singapore

The Centre has reaffirmed Singapore's position as the region's premier technology hub. Since the Centre's launch, it has made significant contributions to the development of several international standards. For example, the centre led the first implementation pilot of the draft ISO 18185 Electronic Seal standard to ensure the technical feasibility of the standard when used in a real-life port environment. The Centre is also a very active member of the EPCglobal Applied Tag Performance Standard where new tag application standards are being developed.

The Centre is acknowledged as a thought leader in the application of RFID in logistics and it was invited to share its research findings in numerous industry and technology conferences and forums in the region. For example:

- EPCGlobal Singapore/Malaysia/India Conference;
- ECR Singapore/Malaysia;
- China Global RFID Forum;
- Taiwan Industrial Technology Research Institute's (ITRI) RFID Seminar;
- RFID Connect;
- RFID World Asia;
- MPA (Maritime and Port Authority of Singapore) Maritime ICT Workshop;
- E-Logistics Techforum; and
- Supply Chain Management & Logistics Conference, etc.

The Centre has also become a "must see" destination of many government agencies in the region. Over the past year, it has hosted visits for many senior government officials including:

- Singapore Minister for Information, Communications & the Arts;
- Brunei Deputy Minister for Information & Communications;
- Thailand President of Software Industry Promotion Agency (SiPA);
- China Shenyang Bonded Logistics Zone Administrative Committee; and
- Korea's Ministry of Culture and Tourism.

In addition, two major international groups have also visited the Centre. They are the ISO/IEC JTC1/SC31 delegates and the Asia Pacific GS1 Forum delegates.

In 2005, the EPCglobal Gen2 Air Interface specification was included in the ISO Standard under ISO/IEC 18000 Part 6 Type C. When the ISO RFID Air Interface Ballot Review Meeting was conducted in Singapore in conjunction with the hosting of the Plenary meeting of ISO/IEC JTC1/SC31 in Singapore, key members of the ISO delegates from Asia, Europe and USA visited the Centre to have a better understanding of the physics of EPCglobal RFID field environment, the read range, the varying read rate of different RFID tags when read by different readers, the impact of EPCglobal/RFID tags when applied to cartons of products, the location of the placement of EPCglobal/RFID tag, especially liquid based products and products packed in metal tubes/metal cans etc.

In November 2005, it also opened its door to more than 80 delegates from EPCglobal member organisations from 15 Asia-Pacific countries including: Australia, China, Japan, Korea, Hong Kong, Indonesia, Malaysia, New Zealand, Philippines, Singapore, Taiwan, Thailand, Vietnam, Belgium and USA. To many delegates, this is the first time they saw the various physical behaviour of RFID tags, readers, and the performance of the readers and the tags by

placing the tags at the specific locations on the carton depending on the content inside the carton. This visit gave the delegates from the region a better understanding of the workings of RFID tags and readers. It also created a wide awareness amongst the regional delegates on this first RFID Performance Test Centre in ASEAN. The delegates were very impressed by the various performance tests.



Figure 1: RFID Performance Test Centre

5 Impact to the Logistics & IT Industry

The Centre has helped to create a vibrant RFID community in Singapore by bringing together best-in-class RFID technology providers under one roof. Partners in the Centre include Alien Technologies, BEA Systems, Intermec Technologies, Paxar, Printronix, Sato, Sun Microsystems, Sybase, Symbol Technologies, Tyco, UPM Raflatac, Zebra Technologies, EPCglobal Singapore, GS1 Singapore, eSCM and Singapore Manufacturers' Federation (SMA).

It has also collaborated with the Infocomm Development Authority of Singapore (IDA) to conduct field tests which eventually led to the expansion of the regulated RFID frequency spectrum from 923 - 925 MHz, to the current 920 - 925 MHz.

6 Impact to NOL Business and Its Customers

Since the launch, the Centre has developed several new RFID related products and services that can potentially help increase or create new business opportunities for NOL. It has also helped improve the relationship with our existing customers, many of whom are Fortune 500 companies and top suppliers to Wal-Mart and US Department of Defense, by enabling them to comply with the RFID mandates. Furthermore, the publicity and recognition of the Centre's achievement has helped to position NOL's IT leadership in the industry. The Centre has helped our customers develop new capabilities and ease the compliance for RFID mandates through a '4-T' process:

- **Tour**

We conduct regular educational tours in the Centre to demonstrate to our customers how RFID can be applied to different logistics processes. Since the launch, over 600 visitors from all around the world have toured the centre.

- **Train**

The majority of the professional RFID courses in Singapore are now conducted at the NOL-SUN Advanced Technology Center with our academic partners namely, Alien Technology, Singapore Manufacturers' Federation and The Logistics Institute - Asia Pacific. The Centre provides the participants a hands-on approach for the training.

- **Test**

The most important contribution to our customers is to provide them with ease of mandate compliance using our testing services for the latest RFID technologies. Testing is very important because there is no one particular RFID solution that can fit all applications or products. The design of an RFID system is optimised with the correct reader power, antenna positioning, tag choice and tag placement to suit a specific application or product type. We provide vendor neutral advice based on our vast testing experiences and their requirements. This will cut short their implementation timeline as well as lower their overall implementation costs with better system performance. Customers can also work with the Centre on proof of concept projects before introducing RFID into their businesses.

- **Tag**

For customers who do not have the economies of scale to implement a full suite of RFID system for tagging and tracking, the Centre is also able to collaborate with NOL's logistics subsidiary, APL Logistics, to offer a suite of RFID logistics services ranging from printing of labels, application of labels, data management, and information visibility to reports and analysis. This will provide our customers a means to meet customer mandates immediately without the high upfront investment costs.

7 Conclusion

After more than 60 years since the first application of RFID by the British Royal Air Force during the 2nd World War, the EPCglobal RFID system has made a big breakthrough by standardising on the RFID tags to produce low costs tags and by making the available radio frequencies in USA/Europe and most of Asia for EPCglobal tags to operate in all regions, and increase in the read range, write range and high write speed etc. The following industries have expressed interests to adopt EPCglobal during the next 18 to 24 months:

- Fast Moving Consumer Goods (FMCG);
- Defence;
- Aerospace;
- Motorcar component;
- Textiles and Garment;
- Footwear;
- Electrical and Electronic Equipment;
- Healthcare; and
- Transportation and Logistics.

Multi-industries are choosing to adopt EPCglobal/RFID system, because it is a system which combines RFID technology with the Internet technology resulting in low cost tags. Besides it is a system developed and designed by users and therefore it meets all requirements by users including 10-metre read range, 3-metre write range, 800 per minute write rate and its unique feature of Dense-Reader Mode which allows hundreds of readers to operate simultaneously and effectively.

Companies in Singapore and the region will soon be mandated by key drivers of the above-mentioned industries to supply goods with EPCglobal tags. Singapore, with the establishment of the first RFID Performance Testing Centre in the ASEAN region, will be in an excellent position to help these companies to implement EPCglobal/RFID system to meet business requirements and at the same time get benefits through the developments and applications of new production processes by incorporating EPCglobal/RFID system and improve their competitive edge.

The NOL-Sun Microsystem RFID Performance Centre will certainly contribute in the growth and development of Singapore as the RFID Hub of the Region.

8 References

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