

RF identification Future Outlook

Sub Group 1 - Technical

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Version History

Release reference	Distribution	Version Date	Purpose?
Version 1.0, draft	All, RFID in Europe Members & also non - Members	02/11/2012	Initial draft template to gather contributions
Version 1.1, draft	All, RFID in Europe Members & also non - Members	16/11/2012	Updated draft reflecting changes to the milestones in plan
Version 1.3 Published	Public	08/02/2013	Final Document Format

Related Documents

Title	Version	Version date	Author
RF identification Future Outlook - Project Definition	1.0, Published Draft	02/11/2012	Trevor Peirce
RF identification Future Outlook - Sub Group 2 Application	1.3, Published	08/02/2013	Trevor Peirce
RF identification Future Outlook - Sub Group 3 Public Policy	1.2, Published Draft	13/12/2012	Trevor Peirce
RFID in Europe - RF identification future outlook - Conf call 14 Nov.	0.1, Published Draft	16/11/2012	Trevor Peirce

Introduction

RFID in Europe¹ engages in promoting the European adoption of RFID, related technologies and solutions. RFID in Europe offers a technology neutral and independent European network which is free to join, offering all stakeholders an accessible trusted source of information to build widespread confidence in RFID use.

Today an apparent gap exists which is considered by a number of RFID in Europe group members to be possibly influencing European demand. The void referred to is the lack of a documented vision as to how the broad domain of RF identification (RFID, NFC, IoT, etc.) may look like in the future. Without such a reference many stakeholders including policy makers, potential and existing technology end users and others lack any kind of reference collective vision as to the future direction of RF identification. This initiative aims to stimulate investment confidence, whether that is within R&D or within application deployment.

The selection of RF identification as the initiative title fulfils two principle motivations. Firstly it is to encourage the broadest consideration of aspects directly influencing RFID, related technologies and applications. Secondly to convey to the end reader an initial engaging message that the document offers a comprehensive vision as to how RFID, related technologies and solutions may evolve in the future and the factors affecting such a future.

Future outlooks in general depict a vision which may be inaccurate in scale, timing and direction. Nevertheless an important value of a future outlook is from the grouping together of ideas of how the future might look in order to bring together interested parties who share a common vision, bringing greater chance of successfully achieving their vision through fostering collaboration. It also allows a wider shared consideration of the influencing factors to minimize potential 'blind-spots' slowing or diminishing progress. The dialogue which this project encourages can contribute to overcoming unnecessary divisions in opinions through shared understanding, promoting harmonization beyond certain irreconcilable economic interests.

All deliverables of this initiative are owned by RFID in Europe. RFID in Europe will not be held responsible for the content of the final published document, but will make every effort to ensure that the document is readable and interesting through the participation of content providers. It is planned that the final document will be made available to all members of RFID in Europe contributing content to this project. The published document will be in English, although through RFID in Europe's network opportunities for translations into local European languages will be supported and encouraged.

¹ RFID in Europe AISBL is a not-for-profit organization established in 2012. RFID in Europe's principle goal is to promote the adoption of Radio Frequency Identification and related technology solutions enabling small and medium sized organizations throughout Europe to gain competitive advantage through their best use. RFID in Europe connects with European end-users, operators, solution providers, universities, research establishments, non-government and government organizations and all other European stakeholders through own initiatives and promotion of national projects via our international network. RFID in Europe is an extension of a European Commission FP7 Thematic Network called RACE networkRFID initiated in 2009. <http://www.rfidineurope.eu/>

Sub Group 1 Scope:

All RF identification is in scope. There is no intention to place unnecessary boundaries on the breadth of knowledge of contributors, nor their interests. RF identification is an extremely broad area and it is acknowledged that the final report may not have sufficient contributions across all areas.

There are two target horizons, one of between 3-5 years (2016-2018) and a second between 5-10 years (2018-2023).

- 1. Technologies convergence & evolutions (hardware & software)**
2. Applications developments and changes to requirements
3. Services and Turn-Key solutions evolutions
4. Market sizes, legacy and new and likely impacts upon growth
5. Technology and Solution Supply-base market outlook
- 6. Radio spectrum opportunities and challenges**
- 7. IPR, IPR ownerships and influences upon adoption**
8. Health & Safety studies anticipated outcomes and effects upon adoption
9. Privacy and Security
- 10. Standards and the future role of standards organizations in RF identification**
- 11. Interoperability**
- 12. Testing and compliance**
- 13. R&D**
14. European Government Policies and Governance

SUB GROUP 1 & **SUB GROUP 2** & **SUB GROUP 3**

Sub Group 1 Preliminary Considerations:

1. Technologies convergence & evolutions (hardware & software)

There exist many technologies exploited within the boundaries of RFID and across the broader area of RF identification. Technologies often converge driven by many different factors from market forces, co-operations driven by opportunities to address new markets, technology provider mergers, etc.. Convergence can apply both to hardware and software and indeed consideration of the evolution of bar codes provides evidence of what might be ahead for RF identification too.

What convergence is likely across hardware and software within RF identification? What factors will affect these changes and the pace of change?

6. Radio spectrum opportunities and challenges

Radio spectrum including bands for commercial uses faces increasing demands. Higher data rates create pressures for greater band width, longer read ranges can create a drive to push the legal boundaries radiated power and reliability/interoperability can place demands upon channel tolerances and noise. The migration of people to urban areas, the density of retail spaces and the concentration of manufacturing and logistics centres across Europe means that concentrations of RF identification device use is likely to be greater than in North America for example. Considering that

market demands will drive continued growth in the number of RF identification devices how will we assure radio spectrum does not become a market limiting factor? Will the future see a more structured use of RF identification frequency bands by application type to avoid over-loading particular channel bands? Will new radio spectrum channels become more or less regulated as Governments seek new ways to pay-back public debt? Which organizations will lead the drive for regulatory changes and using which mechanisms? Which areas of the spectrum offer the greatest opportunities and in which ways? When is it likely that these changes will take effect?

7. IPR, IPR ownerships and influences upon adoption

Intellectual Property Rights (IPR) plays an important and influential role across most technology including RF identification. IPR is time bounded. Will patent expiry result in more innovation and allow more market competition in the future? Which key patent expires offer the most significant opportunities for some form of change in the market and when? Asian technology providers have been particularly vocal about the costs of IPR embedded within some RF identification standards offered under Reasonable and Non-discriminatory (RAND) terms. IPR it has been claimed stifles innovation and limits access to competition. Will new IPR claims affect innovation within RF identification?

10. Standards and the future role of standards organizations in RF identification

There exist many, many standards issued by different standards development organizations (SDOs), some technical, some semi-technical sector specific and some which lean towards best-practice guidelines. These standards can be found in the RF identification area across all levels of architecture. Standards often are associated with interoperability but this is not always the case and sometimes where interoperability is achieved through a standard it does not translate to interoperability in application. Use of the word 'standard' in some conversation is used to refer to de-facto adoption of a particular product or solution. Such instances do not rule-out interoperability.

SDO published standards are frequently closely related to IPR. Nor do standards always disclose their use of critical or essential IPR.

Standards sometimes link with regulations. However it is also true that standards are mentioned when incorrectly referencing a regulatory requirement.

As a general guidance this section 10 should refer to technical and industry sector standards in preference to regulations.

So what future for standards in RF identification? Will standards evolve or will new standards replace those that we have today? What standards need revisions or need replacing? Which SDOs will play the most important roles? Will standards become simpler or increasing more complex? Will older more mature standards become popular due to the expiry of royalty rights to embedded critical IPRs?

11. Interoperability

Having mentioned that interoperability is frequently related to standards there are two ways to consider this topic. Firstly there is co-existence, can two or more RF identification systems/solutions operate without interference. Secondly there is inter-connectivity, where two or more RF identification systems/solutions talk to each other.

Co-existence is arguably more important than inter-connectivity. Within RF identification how will interoperability evolve for different air-interfaces, for 'reader' protocols, for application semantics, for identifier/addressing/data exchanges, for discovery services, for enterprise-to-enterprise/enterprise-to-consumer/etc. information services? Which are the key interoperability factors holding back RF identification adoptions?

12. Testing and compliance

Testing is often classified into conformance, interoperability and performance categories. Testing can also be specifically orientated to certain applications. Do existing tests meet the requirements of RF identification adoptions and if not how will they evolve? What will tests test in the future and what issues will they address?

13. R&D

Research and Development within RF identification offers the promise of new technological features, new approaches and a widening opportunity for applications. Which areas of RF identification R&D will deliver what sort of results in the future? Which R&D offers the greatest opportunities for the future? Is such R&D started or planned, or is it a candidate for future work? Which past R&D has progressed RF identification perhaps insufficiently, but may merit further consideration in the future and, when in the future and, why?

Contribution Template:

Sections key:

1. Technologies convergence & evolutions (hardware & software)
6. Radio spectrum opportunities and challenges
7. IPR, IPR ownerships and influences upon adoption
10. Standards and the future role of standards organizations in RF identification
11. Interoperability
12. Testing and compliance
13. R&D

Contribution Text		
<p>It is good to have a variety of technologies such that one chooses the best applicable but all these must have the possibility of being combined in a cost and performance effective way; something like ‘Lego’ or ‘plug-en-play’.</p> <p style="text-align: right;">‘Variety’ should allow flexibility and not incongruity.</p>		
Contributor Name	Section	Future Horizon
Cristina Rusu, Acreo	1. Technologies convergence & evolutions (hardware & software)	2016-2018

Contribution Text		
<p>Technology convergence is highly likely due to rapidly evolving customer expectations (market pull) and the challenges of meeting these requirements in any other way. Convergence may include a variety of technologies beyond RFID, examples of which can be seen today by examining the scopes of some of the broadest definitions of Internet of Things (IoT).</p> <p>While such convergence may be most readily apparent within hardware it is software compatibility which will have the biggest impact upon opportunities. Here there will be an orientation towards system and application optimizations within a common platform. This will address the frequently inherent middleware application performance barriers. Additionally a major factor impacting software will be “mobile”. With increasingly capable mobile devices which connect more and more different devices a critical component will become efficient software optimised around a variety of application requirements and user experiences.</p>		
Contributor Name	Section	Future Horizon
Trevor Peirce	1. Technologies convergence & evolutions (hardware & software)	2018-2023

Contribution Text		
<p>It is not much of a secret that RFID's performance can be increased opening new application opportunities through accessing greater width of radio spectrum and regulated maximum power. Increased resources however do not always mean an improvement in RFIDs application suitability and especially where either existing performance is suffice or where such increases may undermine other critical aspects such as application security or privacy provisions. Spectrum is more critical to passive UHF RFID which consequently receives the greatest attention due mainly to the fact that UHF tags are particularly prone to significant detuning when applied and, thereafter by what they come into proximity with during use including other UHF tags. However it would be an oversight not to mention that there are potential opportunities from greater spectrum and power for other devices using the other commonly used RFID frequencies too, including active and wireless sensors/actuators. There are however a number of challenges to spectrum changes not least from the broad range and large number of stakeholders from industry and governments alike.</p> <p>Put briefly the future for RFID radio spectrum is complex and while IoT may provide some opportunities to get generally more favourable conditions for RFID there are equally some potential risks from other wireless technologies and others not least from enterprising governments. Overall the radio spectrum used by RFIDs may see some moves towards greater global harmonization especially for UHF range boundaries, central frequencies, emitted powers and channel plans. UHF is the RFID frequency where there is the greatest disparity but other changes are unclear and difficult to predict. The NFC movement may lead to some HF regulatory changes in Japan bringing closer alignment with the rest of the world.</p> <p>Longer term with RFIDs greater and greater presence there may come a point when all of the radio spectrum resources available to RFID will need to be exploited in order to meet performance characteristics such as resilience, reliability and speed. This may be accompanied by some form of capability convergence possibly similar to that today within mobile devices such as smart phones and some tablets.</p>		
Contributor Name	Section	Future Horizon
Trevor Peirce	6. Radio spectrum opportunities and challenges	2016-2018

Contribution Text		
<p>Market consolidation and IPR expiry are likely to mean that intellectual property related barriers become less of an obstacle to performance, interoperability and low cost. This is neither likely to result in huge technological leaps forward nor be particularly visible to end user. Market consolidation being the poorer contributor to technological progress and market adoption.</p>		
Contributor Name	Section	Future Horizon
Trevor Peirce	7. IPR, IPR ownerships and influences upon adoption	2016-2018

Contribution Text		
<p>Mobil apps developed on NFC will spread to traditional RFID technologies with significant challenges regarding standards and numbering schemes, because the NFC development will be driven by user/consumer adoption without any consideration regarding interoperability.</p> <p>The 'consumerisation' combined with the ease to develop and deploy software through the apps markets (Apple, Google) will become a growing challenge to traditional international standardisation bodies. We expect the move towards 'de facto' standards set by popular apps, to be accelerating in the near future.</p>		
Contributor Name	Section	Future Horizon
Henrik Granau	10. Standards and the future role of standards organizations in RF identification	2016-2018

Contribution Text		
<p>On-going standardization initiatives within CEN TC225 will start seeing deployment in the 2016-2018 timeframe and depending upon their success in meeting market needs. These standards will have been developed under the EC Mandate M/436 Phase 2 funded by the EC. These standards promise potential</p>		

opportunities for NFC as well as LF, HF & UHF RFIDs.
 It is anticipated that the UHF Gen2 or somewhat equivalent ISO/IEC 18000 – 6C specifications will evolve or become something sufficiently different to be officially or popularly labelled “Gen 3” or “Gen 4”. From the publishing of the first version of the “Gen 2” and ISO technical specification it has always been known there were a number of opportunities for significant improvements, sometimes blocked by IPR. There have been a number of updates to the established specifications already but a major step forward or a market orientated drive to rejuvenate interest in passive UHF may see a change of name is likely in the next five years.
 NFC is likely to bring the greatest contribution to standards at HF. The focus of these standards will undoubtedly be security with likely positive contributions to privacy protection too.
 In many ways the NFC standards will come closest to the objectives of many of the anticipated new IoT standards efforts although they also take many aspects of other technologies including M2M, WSN and not least Future and Real World Internet. While IoT standards will likely address interoperability of application and technology verticals a common and principle challenge is access control, authentication, user controls, privacy, discoverability, identification, threat mitigation, device and application protections, interoperability, etc.. Senior internationally respected pro-business leaders have publically highlighted their fears of the potential for disasters impacting societies globally from not providing suitable protection. Ultimately failure to address such concerns undermines trust and limits adoptions with a knock-on effect on Big Data, Open Data, Smart Cities, Smart Infrastructure, Smart Homes, Intelligent Vehicles, etc., etc..

Contributor Name	Section	Future Horizon
Trevor Peirce	10. Standards and the future role of standards organizations in RF identification	2016-2018

Contribution Text
 As RFID technology will become more and more widespread implemented, interference issues will be growing. An example which is easy to understand for most people is in the Hospitals, where RFID technologies in many variations will be implemented due to the huge potential in effectiveness to be harvested. But, when the RFID communication will start interfering with miscellaneous vital equipment in the Hospital, the consequences will be severe.

Contributor Name	Section	Future Horizon
Henrik Granau	11. Interoperability	2016-2018

Contribution Text
 Official test beds offering testing and consultancy for i) different applications, ii) various protocols / communication / localization techniques , iii) infrastructure (devices), iv) for each stage necessary for implementation / adoption of RF infrastructure, and allowing for flexibility in testing new emergent technologies. It will be good if this ‘accredited’ test beds are backed up by regulations (like technical control for cars).

There are already laboratory test beds in the world but ‘accredited’ for industry must still come

Contributor Name	Section	Future Horizon
Cristina Rusu, Acreo	12. Testing and compliance	2018-2023

Contribution Text
 R&D will allow for having and/or easily integration of more parameters than just the ones for ID and tracking. ‘more intelligence’ in the tags

Contributor Name	Section	Future Horizon
Cristina Rusu, Acreo	13. R&D	2018-2023