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Section 1

Summary

- 1.1 Ofcom will soon make spectrum available in the range 865-868 MHz for use by radio frequency identification ("RFID") equipment in line with the European Conference of Communications and Postal Administrations ("CEPT") recommendation on Short Range Devices (CEPT/ERC/Rec 70-03 entitled Relating to the use of Short Range Devices SRD)("the Recommendation"). RFID is a generic term for technologies that use radio waves to automatically identify objects.
- 1.2 Globalisation of the market and increased interest from businesses in the potential of RFID technology has led to a growing need for more international RFID solutions which utilise spectrum in a harmonised manner. Such solutions now have advanced technical characteristics necessary, for example, to allow for the co-location of multiple sensors which is a requirement of the retail and logistics industries. Implementation of the Recommendation will go some way towards addressing these requirements and enable the benefits of this new technology to be realised.
- 1.3 In the United Kingdom, Ofcom is responsible for the authorisation of civil use of the radio spectrum and achieves this by granting Wireless Telegraphy ("WT") licences under the Wireless Telegraphy Act 1949 (the "1949 Act") and by making regulations exempting users of particular equipment from the requirement to hold such a licence. Under section 1 of the 1949 Act, it is an offence to install or use equipment to transmit without holding a licence granted by Ofcom, unless the use of such equipment is exempted.
- 1.4 In a consultation launched on 9 August 2005, Ofcom proposed making the frequency band 865 to 868 MHz available for RFID by making regulations (a type of statutory instrument) which permits the use of RFID equipment without the need to hold a licence under the 1949 Act. That exemption is, however, subject to the terms, provisions and limitations set out in the regulations. One of these is that the RFID equipment must not cause or contribute to any undue interference to any wireless telegraphy. Other terms, provisions and limitations are further explained in Section 3 of this document. A draft of these regulations: the Wireless Telegraphy (Radio Frequency Identification Equipment) (Exemption) Regulations 2005 was included in the consultation which closed on 12 September 2005. The Regulations are currently undergoing the final stages of the statutory process necessary to bring them into force. We expect this process to be completed in the next month and Ofcom will inform stakeholders when this is done. Ofcom thought it prudent to make a statement at this time to address any uncertainty amongst stakeholders as to the outcome of the consultation. Once in force the final regulations can be viewed at http://www.opsi.gov.uk/stat.htm
- 1.5 Ofcom received 6 non-confidential responses to the proposals and these are listed in Annex 1. In addition Ofcom received 2 confidential responses to the proposals. The non-confidential responses are published on Ofcom's website and can be viewed at: <u>http://www.ofcom.org.uk/consult/condocs/wireless865_868/responses/</u>.
- 1.6 Section 2 of this document discusses the background to Ofcom's proposals, the responses to the consultation and Ofcom's comments. Following consideration of responses, this Statement confirms that the regulations will be as described in the August-September consultation.

- 1.7 Section 3 of this document sets out the extent of application, scope and intended effect of the Regulations
- 1.8 An Impact Assessment (IA) for the regulations is available at Annex 2 to this document. The IA sets out the risks, costs and benefits of Ofcom's decision and the effects that these will have on the costs to business.

Section 2

The Statement

Background to the Statement

- 2.1 Radio frequency identification ("RFID") is a generic term for technologies that use radio waves to automatically identify objects. There are several methods of identification, for example currently one of the more popular methods is to store a serial number that identifies the object and perhaps other information, on a microchip that is attached to an antenna (the chip and the antenna together are commonly called an RFID tag). The antenna enables the RFID tag to transmit the identification information to a reader. The reader converts the radio waves reflected back from the RFID tag into digital information that can then be passed on to computers that can make use of it. This process can be thought of as analogous to traditional optical bar-coding familiar in a retail setting, however, rather than using light to collect or read a number from a bar code, radio waves read the number from the RFID tag.
- 2.2 Using radio means that the tag, and hence the object to be identified does not have to be in direct line of sight of the reader. This property means that the technology is ideal for a range of applications in the retail environment, in theft prevention, in access control and in support of manufacturing automation, logistics and distribution. The benefits of this technology, and in particular the new frequency bands Ofcom propose to make available, are discussed further in the Impact Assessment in Annex 2. At present, the majority of tags are "passive" which means that they rely on a minute electrical current induced in their antenna by the incoming radio frequency scan of the reader to provide enough power for the tag to send a response and provide data. Tags may also be "active" which means they do not rely upon power from the reader but have their own means of sending a signal.

Current use of RFID

- 2.3 In the United Kingdom the use of RFID equipment is already authorised in a number of frequency bands. Many applications of this technology are a familiar feature of everyday life such as shop security systems, where a tag is used to deter shoplifting by alerting staff to an individual trying to leave retail premises with un-paid goods, or in the access control systems used in many buildings. RFID tags are also commonly used commercially in pallet and container tracking, and truck and trailer tracking in shipping yards.
- 2.4 RFID operating in the Ultra High Frequency (UHF) range is particularly useful for certain applications because of the propagation characteristics of this frequency band and its support for high rates of data transfer. Currently a limited amount of spectrum is available in this range (869.4 to 869.65 MHz) and the resultant limit on capacity in conjunction with other technical considerations restricts its utility.

European developments for RFID

2.5 Globalisation of the market and increased interest in the potential of RFID technology has inevitably led to a growing need for more international RFID solutions with more spectrum and higher power limits necessary, for example, for the co-location of multiple sensors which is a requirement of the retail and logistics industries.

- 2.6 Responding to this growing need for new RFID applications, the European Conference of Communications and Postal Administrations ("CEPT") through its' sub committee the Electronic Communications Committee ("ECC"), identified additional spectrum in the 865-868 MHz range for RFID applications. As a result, the existing CEPT recommendation on Short Range Devices (CEPT/ERC/Rec 70-03 entitled Relating to the use of Short Range Devices SRD (the "Recommendation") has been amended to include this allocation and the European Telecommunications Standards Institute (ETSI) have developed a technical standard for equipment (EN 302 208)¹. This amendment was accepted by all CEPT members.
- 2.7 Ofcom highlighted its intention to implement the Recommendation as it relates to RFID and the band 865-868 MHz in its Statement on Spectrum Trading (6 August 2004). This confirmed previous statements issued by the Radiocommunications Agency (the responsible regulatory body prior to the establishment of Ofcom in December 2003) in relation to implementing the Recommendation.

Ofcom's consultation

- 2.8 The "Notice of Ofcom's proposal to exempt the use of radio frequency identification equipment in the 865-868MHz frequency band from wireless telegraphy licensing" was published on 9 August 2005 and the consultation period closed on 12 September 2005.
- 2.9 In order to authorise the use of RFID equipment operating in accordance with the CEPT recommendation, Ofcom proposed the making of regulations which would exempt the establishment, installation and use of RFID equipment in the 865-868 MHz band, from the requirement under section 1(1) of the 1949 Act to hold a licence. These "Proposed Regulations" were included at Annex 4 of the consultation document and but for minor drafting amendments form the Regulations that will come into force following publication of this statement. The Regulations are currently undergoing the final stages of the statutory process necessary to bring them into force. We expect this process to be completed in the next month and Ofcom will inform stakeholders when this is done. Ofcom thought it prudent to make a statement at this time to address any uncertainty amongst stakeholders as to the outcome of the consultation. Once in force the final regulations can be viewed at <u>http://www.opsi.gov.uk/stat.htm</u>
- 2.10 Licence exemption was proposed as the appropriate method of authorisation on the basis that RFID equipment used in the 865-868 MHz band is unlikely to cause interference to other users of the radio spectrum when operating in accordance with the requirements of the CEPT recommendation as implemented in the Regulations.
- 2.11 The CEPT recommendation identifies a number of technical parameters necessary to ensure the efficient use of the available spectrum and avoid interference. These were arrived at after a detailed sharing analysis² of the ability of different services and users to co-exist in this band. Ofcom proposed to implement these parameters in the following way:
 - For RFID the CEPT recommendation identifies appropriate power levels, frequency bands, channelisation arrangements and antenna characteristics to ensure efficient use of the spectrum. The Regulations reflect these recommended parameters.

¹ ETSI 300 328 Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2W.

² ECC Report 37 "Compatibility of Planned SRD applications with currently existing Radiocommunications applications in the frequency band 863-870 MHz.

- The CEPT recommendation also proposed the adoption of "listen before talk" techniques, which is a spectrally "polite" protocol that avoids transmission in spectrum already in use by other users. The sharing analysis identified four parameters that are essential to ensure that RFID readers using "listen before talk" behave in a spectrally efficient manner:
 - o The maximum period of continuous transmission should be restricted;
 - o A minimum "listen" period before transmission should be stipulated;
 - A minimum period before re-transmission on the same sub-band should be defined;
 - o A minimum sensitivity and bandwidth in the "listen" mode should be defined.
- 2.12 ETSI have developed a harmonised standard for RFID in this band (EN 302 208) which contains an implementation of "listen before talk" including the above parameters and which was formulated in accordance with the sharing analysis. This standard is also referenced by the CEPT Recommendation. Therefore, in the initial implementation of the CEPT recommendation, Ofcom's Regulations in relation to "listen before talk" reflect the ETSI Standard.
- 2.13 Ofcom stated that it does not intend to mandate all of the requirements described in EN 302 208 only those reflected in the Regulations. The technical limits outlined in the Regulations would constitute the minimum equipment requirements for the operation of RFID in the frequency range 865-868 MHz within the UK.
- 2.14 Ofcom also stated in its consultation that it believed that the Regulations represent the best way to ensure that an appropriate authorisation regime is put in place for RFID use in accordance with the CEPT recommendation within a timescale that as far as possible, meets the needs of the majority of stakeholders. Ofcom did, however, seek views on the appropriate spectrum management framework necessary to support future developments in RFID technology and use.
- 2.15 Ofcom additionally recognised that there are concerns about the infringement of personal privacy through the use of RFID technology, however it was explained in the consultation exercise that the handling of these concerns falls outside Ofcom's spectrum management remit. Ofcom stated in the Notice that the Department of Trade and Industry (DTI) would manage the development of the technology within a statutory and regulatory framework which would allow the benefits to be enjoyed whilst addressing public concerns. The Information Commissioner's Office also issued a statement to coincide with publication of the Notice which stated that where RFID tags were involved in "the collection, generation or disclosure of personal information then the Data Protection Act 1998 (the Act) will apply."

Responses to the consultation

2.16 Ofcom received two confidential and five non-confidential responses to the consultation. The non-confidential responses are published on Ofcom's website and can be viewed at: <u>http://www.ofcom.org.uk/consult/condocs/wireless865_868/responses/</u>. The responses are summarised as follows:

- There was broad support for Ofcom's proposal to exempt, by regulations, the use of RFID in the 865-868MHz band, with five respondents explicitly expressing their support and none objecting.
- Three respondents welcomed Ofcom's statement on privacy issues explaining the roles of both the DTI and the Information Commissioner and the clear delineation of spectrum management issues from those of system implementation and content.
- Four respondents commented upon the spectrum efficiency of the "listen before talk" protocol mandated in the Recommendation, the capacity of the band and its ability to support the full range of RFID applications envisaged for the band.
- One respondent highlighted a long-term concern about whether the current spectrum allocation would be adequate for future spectrum needs given the expected expansion of RFID use.
- One respondent highlighted the need to monitor the implementation of RFID in other countries outside the domain of ETSI, where experience may show that more relaxed technical parameters were successful, would be a valuable exercise which could assist in the evolution European technical parameters and ensure that European businesses were not at a disadvantage compared to businesses operating in countries with less restrictive regulations.
- One response suggested minor changes to clause 4 *Terms, Provisions and Limitations*, of the Proposed Regulations to be more consistent with the ETSI Standard EN 302 208.
- With reference to the Impact Assessment (IA) one respondent wished to point out that although Ofcom had used the retail sector as a reference point it should acknowledge that use of RFID extends to a range of other sectors.
- The Island Authorities requested that the regulations should not come into force in relation to Jersey before 1 November at which time it is expected that the Data Protection (Jersey) Law would come into force.
- One respondent raised an issue concerning the Risk Assessment section of Annex 5, of the consultation. Specifically it was thought that paragraph A5.39 which stated; "Some of the characteristics of this technology could be thought to mitigate the risk of precluding (at least some) other future uses, namely the limited distance between tags and reading equipment may allow other possible future sues of this band to co-exist with RFID equipment without harmful interference deterring entry by users of the incoming technology" implied that additional more restrictive regulations might apply and that this would lead to economic uncertainty for businesses adopting the technology in the UK.

Ofcom's comments

- 2.17 Following consideration of these responses, Ofcom makes the following comments;
 - Ofcom is pleased to have received support for the proposal to exempt RFID equipment operating in the band 865-868 MHz, from the requirement for Wireless Telegraphy Licensing. This approach is the least burdensome for both RFID stakeholders and Ofcom and is in line with Ofcom's statutory duties.
 - Ofcom appreciates the input of the DTI and the Information Commissioner on the clear delineation of responsibilities over privacy concerns and notes that this is understood and supported by stakeholders.
 - Ofcom has chosen to implement the requirement for "listen before talk" as it is a technical requirement of the ECC recommendation. The limits and mitigation

techniques contained in these documents have been set as the result of considerable study within both CEPT and ETSI. Without further studies being conducted, we feel that it would be inappropriate to relax the regulations at this time. Ofcom is keen however, to work with stakeholders to investigate how this band would best support developments in RFID technology, and can amend the regulations accordingly in the future if studies demonstrate that more flexibility can be supported in this band. We believe that we should make regulations now based upon existing technical parameters in order to give the RFID community access to the spectrum quickly.

- We would welcome the opportunity to work with stakeholders to understand their requirements for radio spectrum and how these can best be met both nationally and internationally.
- Ofcom will continue to monitor the development of the RFID industry and to represent the best interests of stakeholders where this is possible within the regulatory framework, as part of its' statutory duties.
- For reasons of clarity and consistency, Ofcom has made a slight amendment to clause 4 of the Regulations in accordance with the comment received.
- Ofcom recognises that the application of RFID extends beyond the retail sector but chose this area to demonstrate most readily the economic costs and benefits.
- With the agreement of the Island Authorities, when the Regulations come into force in the UK they will apply to Jersey as they will to Guernsey and the Isle of Man.
- It is not the intention of Annex 5 paragraph 5.39 (of the Notice) to imply that future RFID use of the 865-868MHz band will be the subject of further restrictions to allow co-existence with potential new entrants. Rather this paragraph seeks to illustrate that the operating parameters of RFID make it possible for other users to share the band and thus reduces the opportunity cost of making this spectrum available to RFID users.

Conclusion

- 2.18 Respondents are generally supportive of Ofcom's intention to make the Wireless Telegraphy (Radio Frequency Identification Equipment)(Exemption) Regulations 2005 in line with the proposals set out in the August-September consultation document.
- 2.19 Ofcom plans to make regulations which enable the use of RFID technology with the technical characteristics as defined in the ERC Recommendation, however, Ofcom is keen to engage with Stakeholders going forward, to address concerns over the future spectrum requirements of the RFID industry.
- 2.20 Some minor drafting changes have been made to the Regulations since the consultation, but these are not material.
- 2.21 The Regulations will be made following completion of the necessary legal procedures and Ofcom will inform stakeholders of the date upon which the Regulations will come into force once this is confirmed.

Section 3

General effect of the Wireless Telegraphy (Radio Frequency Identification Equipment)(Exemption) Regulations 2005

The legislative framework

- 3.1 Of com can exempt the establishment, installation and use of wireless telegraphy equipment by making regulations under section 1(1) of the 1949 Act.
- 3.2 The Regulations, once published, can be found at <u>http://www.opsi.gov.uk/stat.htm</u>.

Extent of Application

3.3 The Regulations will apply in the United Kingdom, the Channel Islands and Isle of Man.

The Regulations

- 3.4 Regulation 3 of the Regulations exempts the establishment or installation of equipment and the use of equipment so established or installed from the provisions of section 1(1) of the Wireless Telegraphy Act 1949.
- 3.5 The term "equipment" has been defined as broadly as possible to cover a station or apparatus for wireless telegraphy. Under the 1949 Act users need to hold a licence to use either stations or apparatus for wireless telegraphy. The Regulations therefore exempts both.
- 3.6 The exemption is subject to two different sets of requirements.
- 3.7 The first set is set out in regulation 4(1) which applies to all equipment. Regulation 4(1) sets out the frequency bands and channels of operations. The channels of operation must be no greater than 200 kHz in bandwidth and must have a centre frequency which is one of those listed in the Schedule.
- 3.8 Regulation 4(1)(c) makes the exemption conditional on the equipment not causing undue (harmful) interference.
- 3.9 Regulation 4(1)(d) requires that transmissions are within certain effective radiated power limits.
- 3.10 The second set of requirements is contained in regulation 4(2). These are for equipment which is capable of initiating communications with other equipment (known as an "interrogator").
- 3.11 In addition to complying with all of the requirements in regulation 4(1) applicable to other equipment, interrogators must:
 - only transmit with a certain beamwidth;

- only begin transmitting at the effective radiated power levels stated where the signal level at the receiver of the interrogator is at the levels stipulated;
- operate so that the duration of each transmission from an interrogator is no longer than four seconds; and
- operate with an interval between each transmission from the interrogator using the same channel of not less than 100 milliseconds.

Annex 1

List of respondents to the consultation

A1.1 The following submitted non-confidential responses :

- Dr. Hendrik van Eeden (iPico Identification)
- John Falck (Chairman ETSI_ERM_TG34)
- Richard Rees (Scanology)
- Sharon Hardiman (The British Retail Consortium)
- David Lyon (GS1 UK)
- Mike Entwistle (Jersey Administration)

Annex 2

Impact Assessment

Introduction

- A2.1 Impact Assessments (IAs) form part of best practice policy-making and are commonly used by other regulators. Ofcom carries out IAs where its proposals would be likely to have a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities.
- A2.2 These Regulations provide for the inspection of Radio Frequency Identification Devices (RFID) equipment and for persons authorised by Ofcom to require on demand restrictions on use or cessation of use of non-compliant RFID equipment.
- A2.3 Use of RFID equipment without the need to hold a wireless telegraphy licence (under section 1 of the Wireless Telegraphy Act 1949) is permitted under the Wireless Telegraphy (Radio Frequency Identification Equipment) (Exemption) Regulations 2005 (the "RFID Exemption Regulations") which are being made to enter into force at the same time as these Regulations.
- A2.4 An Impact Assessment is an essential part of considering different options for regulation, including alternatives to formal regulation, and then, using objective criteria, selecting the best option.
- A2.5 Ofcom's principal duty is to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition. In addition Ofcom has specific duties relating to its management of the radio spectrum. By encouraging policy makers to identify and analyse a wide range of policy options, Impact Assessments form an important part of the decision-making process.
- A2.6 Impact Assessments should enable Ofcom and our stakeholders to see more clearly the costs and benefits associated with different policy and policy implementation options. They will therefore be able to comment on our proposals more easily and as a result, consultations should be more effective.
- A2.7 Ofcom is proposing to make regulations (a type of statutory instrument) in order to:
 - exempt the use of RFID equipment in the 865 to 868 MHz frequency band from the need to hold a wireless telegraphy licence in accordance with the conditions of use set out in CEPT/ERC recommendation 70-03³; and
 - enable the development and further roll-out of RFID equipment in the UK in line with a harmonised European standard. The technology has the potential to significantly lower supply chain costs, benefiting both suppliers and customers.
- A2.8 As required by the Communications Act 2003 Ofcom gave notice of its proposal to make these regulations and initiated a one month consultation period on its proposals for the exemption of RFID equipment in the 865-868MHz band. Eight responses were received which were all supportive of these proposals. Some respondents made minor

³ European Conference of Postal and Telecommunication Administrations (CEPT)/European Radio Committee (ERC) Recommendation 70-03 (Tromso 1997 and subsequent amendments) "Relating to the use of short range devices."

drafting suggestions intended to clarify Ofcom's intentions, which have been incorporated where appropriate; some made reference to possible changes to the technical restrictions that apply to this frequency band. Ofcom's technical assessment in line with that carried out by the European Communications Committee, suggests that such restrictions are necessary so as to avoid interference to other users of the band. Ofcom therefore intends to introduce regulations that require the technical restrictions set out in its consultation. Ofcom does however, believe that all such restrictions may benefit from review from time-to -time and will in conjunction with other European administrations investigate whether further technical flexibility could be supported in this frequency band. If these investigations provide evidence that changes to the technical restrictions applied to this band are appropriate Ofcom would consult further on proposals in this area. Responses to the consultation are discussed in detail in Ofcom's RFID statement.

Economic costs and benefits

- A2.9 RFID is a technology that uses radio signals to communicate between reading devices and small electronic transponders (i.e. tag). When the tag is within a certain range of a reader, (typically 10 cm to a few metres) communication is established through a signal emitted by the reader. The information transmitted from the tag to the reader enables it to be identified. Importantly, a line of sight does not need to be established between the reader and tag, thus raising the level of performance that can be achieved in capturing and collecting unique numbers and data on product items (compared to, say, traditional bar codes).
- A2.10 RFID is expected to be used in a number of commercial applications in the future. Some possible areas of application include:
 - tagging and tracking goods along the supply chain in supermarkets;
 - tagging of pharmaceutical products to prevent counterfeiting;
 - tracking baggage in the airline industry;
 - intelligent transport systems;
 - ticket less travel in public transport; and
 - building security.
- A2.11 Although there are a wide range of possible applications, it is expected that the retail sector will experience the biggest growth in RFID, initially in the supply chain between the producer and the retail store. For instance, one UK retailer has announced a rollout of RFID within its supplier base while another has conducted trials both at pallet and item level within a number of stores.⁴
- A2.12 For illustrative purposes, this section identifies the costs and benefits of the technology as applied in the retail sector between producers and retail stores. In doing so, it will identify the possible magnitude of costs and benefits that could arise by facilitating the introduction of the technology to the retail sector.
- A2.13 Ofcom is assessing the costs and benefits arising from the proposed regulations and comparing them to the different regulatory options available. However, in order to do

4 RFID Futures in Western Europe, Juniper Research, January 2005. These tests were, however, conducted under a different frequency band to that discussed in this IA.

that it is first worth assessing the costs and benefits arising to business from RFID equipment.

Economic benefits of RFID

- A2.14 The key economic benefits of RFID arise from the information generated through tracking and tracing products and improved security along the supply chain. The resulting benefits include the provision of real time inventory information leading to greater supply chain efficiency and a reduction of theft and write-offs.
- A2.15 The provision of real time inventory information will enable suppliers to better manage their inventories, keeping inventory levels to a minimum, while also minimising situations where a customer requests a good that is not in stock. Retailers that are overstocked and under stocked with inventories typically incur additional supply costs. The costs of being overstocked include higher working capital costs and storage costs, whereas the costs of being under stocked relate to lost sales and profits arising from an inability to meet consumer demand. Studies indicate that when a good is out of stock fewer than 50 per cent of consumers purchase a replacement item, with a third agoing to other retailers. The cost to retailers of being 'out of stock' is estimated to be approximately 4-8 per cent of sales.^{5,6} Estimates of cost savings arising from the prevention of overstocking in the retail sector include lower inventory costs⁷ in distribution centres could be as high as 7.5 percent on an on-going basis.⁸
- A2.16 Another key benefit relates to improved security in the supply chain, through prevention of theft, shrinkage and inventory write-offs. When counts are taken of stock, sometimes these counts are inaccurate because of customer or employee theft. misplaced orders and stock re-ordered because items are displayed elsewhere. Inventory write-offs occur when goods are damaged or no longer fit for consumption. RFID can assist retailers track use-by dates to reduce write-offs through better inventory management.
- A2.17 A survey conducted in the US in 2000 suggested that overall shrinkage represents approximately 1.7 per cent of sales for retailers.⁹
- A2.18 In relation to the additional turnover that could result from better inventory management and improved security, the turnover for the UK supermarket sector was estimated at £60 billion at 2003.¹⁰ If, going forward, stock outs were reduced by half¹¹

May 24-25, 2004Shanghai, China: "Supply Chain Innovations in the U.S. Retail Sector"

Jean Kinsey, Professor, Department of Applied Economics Co-Director, The Food Industry Center, University of Minnesota

⁹ "2000 Retail Survey Report", University of Florida, 2000.

⁵ Chappell, Gavin, Durdan, David, Gilbert Greg, Ginsburg, Lyle, Smith, Jeff and Tobolski, Joseph, 2003. "Auto-ID in the Box: The Value of Auto-ID Technology in Retail Stores," Accenture and Auto-ID Centre MIT, February 1, 2003 and Corsten, Daniel and Gruen, Thomas, 2004. "Stock-Outs mean Walkouts," Harvard Business Review. May 2004, volume 82, issue 5.

⁶ Corsten, Daniel and Gruen, Thomas, 2004. "Stock-Outs mean Walkouts," Harvard Business Review. May 2004, volume 82, issue 5.

This includes a reduction in labour costs associated with reduced counting of stock.

⁸ Supermarkets and Agricultural Development in China: Opportunities and Challenges

¹⁰Euromonitor International at euromonitor.com. Includes sales turnover for Tesco, Sainsbury, ASDA,

Sommerfield/Morrisons. ¹¹ A US study estimates reductions in shrinkage of over 50 per cent. See Chappell, Gavin, Durdan, David, Gilbert Greg, Ginsburg, Lyle, Smith, Jeff and Tobolski, Joseph, 2003. "Auto-ID in the Box: The Value of Auto-ID Technology in Retail Stores," Accenture and Auto-ID Centre MIT, February 1, 2003.

through roll out of RFID across the sector, then we might expect an eventual 2 - 4 per cent¹² increase in sales revenues worth £2-£4 billion (in NPV terms).¹³

- A2.19 Similarly, if we assume that shrinkage could be reduced by 50 per cent from 1.7 per cent of sales to 0.85 per cent then accordingly, additional sales revenues reclaimed could amount to £1 billion (in NPV terms). Assuming a steady rollout of RFID, across the sector until completed by 2014/15¹⁴, and on a NPV basis, an indicative estimate of additional sales revenues is between £3- £5 billion.¹⁵
- A2.20 In addition to these estimates based on US studies, data provided to Ofcom by industry stakeholders suggests additional sales revenue is of the same order of magnitude to that estimated in US studies. Importantly, further benefits for UK companies could result from the harmonisation of spectrum frequency used for RFID with other jurisdictions (e.g. leading to European supply chains to be managed more efficiently).
- A2.21 Importantly, only part of the increased revenue (estimated between £3 billion and £5 billion) represents a welfare gain to suppliers or consumers. The additional welfare gain arises in two complementary ways. First, suppliers are able to supply additional goods at a price that enables them to earn a profit margin on each unit sold. The difference between a supplier's costs to supply and the retail price (i.e. profit margin) represents a welfare gain to suppliers (i.e. a 'producer surplus'). Second, consumers benefit through lower prices if efficiency savings are passed on. The difference between customer's valuations of the goods and the product price represents the welfare gains to consumers (i.e. consumer surplus).
- A2.22 An indicative measure of the producer surplus is the profit margin expressed as a proportion of the increase in turnover from the additional sales. Ofcom uses an estimated operating profit margin of 6 per cent¹⁶ and assuming this margin is maintained in the future, this suggests a producer surplus of around £150 £300 million (in NPV terms).¹⁷ In addition, if we assume that the responsiveness of demand and supply are similar, we could infer that consumer's benefit to a similar degree as suppliers. The total indicative benefits are therefore between £300 million (in NPV terms).
- A2.23 Consumers benefit through lower prices, since RFID allows more efficiency and lower costs in their operations such that they can lower prices to customers. Suppliers also benefit through higher profits (to the extent that cost savings are not passed on to customers).

¹² Based on reducing stock outs from 4-8 per cent of sales to 2-4 per cent. Ofcom has applied a discount rate of 12.6 per cent to future benefits. This estimate is based on an average pre-tax nominal cost of capital estimated by the Competition Commission for supermarket industry for the years 1996-1999 (see Competition Commission, Supermarkets: A report on the supply of groceries from multiple stores in the United Kingdom, 1999, paragraph 8.87, p164).

¹³ Assuming initial stock outs levels similar to the US.

¹⁴ Assume rolled out by supermarkets collectively representing 50 per cent of sales in the retail supermarket sector. ¹⁵ There are two key assumptions to deriving the NDV of the future stream. (I was fit for the stream of the sector)

¹⁵ There are two key assumptions to deriving the NPV of the future stream of benefits from introducing RFID. First, Ofcom has applied a discount rate of 12.6 per cent to future benefits. This estimate is based on an average pre-tax nominal cost of capital estimated by the Competition Commission for supermarket industry for the years 1996-1999 (see Competition Commission, Supermarkets: A report on the supply of groceries from multiple stores in the United Kingdom, 1999, paragraph 8.87, p164). Second it is assumed that RFID is rolled out across the industry by 2014/2015. Accordingly between 2005/06 and 20014/2015 benefits increase linearly and remain constant thereafter. A terminal value is also estimated using a stable future growth assumption (i.e. annual benefit in that year divided by the cost of capital).

¹⁶ Based on figures from the Tesco Annual Report 2005

¹⁷ This is based on the range of additional sales revenue of the midpoint between US based estimates of additional sales (£3.4 billion) and analysis undertaken by Ofcom using UK industry data (approximately £6 billion).

Economic costs of RFID

- A2.24 The costs of introducing RFID to the supermarket supply chain are expected to be sizeable, such that at least for the short term, existing technologies such as barcodes could remain more cost effective. However, changes in RFID chip fabrication could accelerate RFID rollout as costs of introducing the technology fall.¹⁸
- A2.25 The main cost of implementing RFID includes the hardware costs, return on investment (ROI) and costs of integrating any new system with existing systems. In addition, there are ongoing costs related to maintenance of reading devices and procurement of tag devices.
- A2.26 Ofcom has considered US study data¹⁹ and has cross checked that data with information for the UK market provided to Ofcom by stakeholders. This leads Ofcom to estimate that costs might represent a magnitude of approximately two thirds of the value of improved efficiency generated through introducing RFID. On this basis, costs would be of the order of £200 £400 million.

Non-economic costs and benefits of RFID

- A2.27 In addition to economic costs and benefits, Ofcom recognises that, although RFID is not new, the increasing proliferation and potential of the technology has raised the issues of opportunities presented to consumers in the form of customer empowerment but also risks of possible infringements of personal privacy.
- A2.28 At present, many of the concerns raised regarding privacy relate to the misuse of information which would place the use in breach of privacy and/or data protection legislation. Accordingly, Ofcom does not intend to incorporate non-economic costs that are based on the assumption that users of the devices will do so illegally.
- A2.29 The UK Government, through the DTI, has publicly stated that it is fully committed to ensuring that the use of RFID technology is sensibly managed within a statutory and regulatory framework that allows the benefits to be enjoyed while also addressing public concerns through necessary safeguards for citizens and consumers.

Summary of costs and benefits of RFID

- A2.30 In summary, consumers and suppliers benefit in net terms from RFID.
- A2.31 This IA provides indicative NPV estimates of the net benefits in the region of £100 £200 million over 10 years. However, this analysis is necessarily partial and incomplete due to the lack of data and uncertainty regarding future costs.
- A2.32 Non-economic costs and benefits have also been considered, and suggest both opportunities and risks. However, it is not clear that the risks relate to the technology per se but rather that they relate to possible breaches of existing privacy or data protection legislation through misuse of information.

Regulatory options

A2.33 In the light of the net benefits of RFID outlined above, Ofcom has considered the costs and benefits of the proposed regulations and the alternative regulatory options.

¹⁸ RFID Adoption in the Retail Industry, USA Strategies Inc, May 2005.

¹⁹ RFID Adoption in the Retail Industry, USA Strategies Inc, May 2005.

Option 1: not licence RFID equipment and not make RFID equipment licence exempt

A2.34 Under the 'do nothing' option, there would be no costs of implementation, compliance with or enforcement of regulations. However, by neither licensing nor making RFID exempt, there would be costs borne both by consumers and businesses in terms of the loss of net benefits from future rollout of RFID, as outlined in the previous section. This loss of net benefits may fall between £100 - £200 million.

Option 2: require wireless telegraphy licensing of RFID equipment

- A2.35 The 'technological and information' related benefits arising from the use of RFID to better manage inventories and to improve security along the supply chain is common to both regulatory options, that is to say this Option 1 and Option 2 discussed below. These benefits have been discussed above. There are no separate material benefits that arise solely from undertaking this regulatory option.
- A2.36 The cost of adopting a licensing approach includes applying for a licence (including any fees payable by businesses for the licence), and compliance with and enforcement of the regulations. The licensing approach would therefore place costs on consumers, businesses and the regulator
- A2.37 The Licensing option would require the use of each RFID device installed by supermarket retailers and other users in other sectors to be individually licensed under the Wireless Telegraphy Act 1949. Individuals and companies seeking to introduce this technology would bear administrative costs related to applying for the licence and payment of fees, if applicable.
- A2.38 In addition to the direct compliance costs faced by supermarket retailers, there could also be indirect costs where users are discouraged from adopting RFID if they are required to apply for, and potentially pay licence fees for, each licensable device.
- A2.39 Ofcom would also bear costs of administrating the licence scheme. This would extend to assessing applications and issuing licences, as well as undertaking enforcement action where necessary (e.g. where unlicensed devices are in use).

Option 3: exempt the use of RFID equipment in the 865 to 868 MHz band from the requirement to hold a WT Act licence

- A2.40 The 'technological and information' related benefits arising from the use of RFID to better manage inventories and to improve security along the supply chain is common to both regulatory options. These benefits have been discussed above.
- A2.41 The cost of compliance for users of RFID under licence exempt status is not material, since users of legitimate RFID devices would not be required to apply for a WT Act licence. Consequently the direct cost to business of these regulations is zero.
- A2.42 The cost to the regulator of making RFID devices which meet the requirements of the regulations, exempt from requiring a licence will include the one-off cost to Ofcom of making these regulations. The regulator will be required to undertake enforcement to ensure that devices not meeting the necessary technical specifications, and therefore risking the possibly of harmful interference, can be located, and their use restricted or prevented. These costs, however, will be absorbed within the existing budget for enforcement activities. Ofcom considers that these are the only costs to affect the costs of delivery of public services in respect of RFID.

Risk assessment

A2.43 There is a risk that designating this spectrum band for licence exempt use by RFID equipment could affect future use of this band. The uncertainty surrounding other potential future technologies makes the magnitude of this risk difficult to quantify. However, some of the characteristics of this technology could be thought to mitigate the risk of precluding (at least some) other future uses: namely the limited distance between tags and reading equipment may allow other possible future uses of this band to co-exist with RFID equipment without harmful interference deterring entry by users of the incoming technology.

Conclusion

- A2.44 This IA has identified the costs and benefits of the use of spectrum designated in the 865 to 868 MHz band for RFID applications. The benefits arise from sizeable reductions in supply chain costs due to better management of inventory and stocks and improved security.
- A2.45 This IA provides indicative estimates of the net benefit in the region of £100 million and £200 million. However, this analysis is necessarily partial and incomplete due to the lack of data and uncertainty regarding future costs and benefits.
- A2.46 Option 1 proposes taking no regulatory action to facilitate the rollout of RFID in the UK. This would present significant costs for consumers and businesses in terms of lost net benefits from the rollout of RFID.
- A2.47 Option 2 proposes taking action to licence RFID device users, which would facilitate rollout of RFID. However, there are material compliance and enforcement costs associated with this regulatory approach.
- A2.48 In conclusion, Ofcom recommends that Option 3, licence exemption of RFID equipment be adopted, since this option is the least costly way of facilitating the introduction of RFID devices, and will maximise the benefits from adoption of the technology that will flow from this decision.