RFID Update - April 2005 Odette - Sweden

Craig K. Harmon





1 JANUARY 2005...

 \succ

- Some industry pundits have claimed that compliance to Wal-Mart's mandate can be achieved by a process of "slap and ship". *Wal-Mart will accept a read rate of 70 to 85%. I don't think so!* RF tag orientation and placement must be based upon the packaging material onto which the RF tag is applied and the material contained within the packaging material onto which the RF tag is applied.
- We are going to move pallets of 40 cartons filled with (???) through the reader portal at 15 mph and read all of the tags on each of the boxes on each of the pallets; right? *I don't think so!* A rationale approach to data management needs to be considered immediately. If you truly want the EPCs of each of the boxes on the pallet you need a higher functionality tag than a simple 96-bit EPC on the pallet.

This 4 MB file posted at http://www.autoid.org/presentations/presentations.htm

... 1 JANUARY 2005

Oh . . . the data already will be in our database because of advance receipt of this data through either XML or ASC X12 transmissions. *Why do we believe* that Ship Notice/Manifest *EDI* (ANS X12.856) or XML *will* somehow *be more widely implemented* with RFID *than with bar codes?*

Where are the recommendations for *what happens if we are unable to read an RF tag*; do we *key in 96 1s and 0s?*



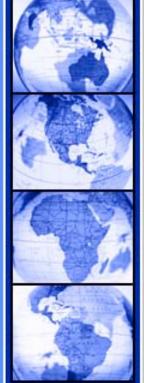
RFID WILL REPLACE BAR CODES ON 1 JANUARY 200X!!!



Q.E.D. SYSTEMS • CRAIG K. HARMON • PRESIDENT Visit our web sites: http://www.autoid.org and http://www.qed.org

- Chair, ISO TC 122/104 JWG Supply Chain Applications of RFID
- Chair, RFID Experts Group (REG)
- Chair, U.S. TAG to ISO/IEC JTC 1/SC 31/WG 4 "RFID"
- Senior Project Editor ISO/IEC JTC 1/SC 31/WG 4/SG 3 (RFID Air Interface 18000)
- Chair, ASC MH 10/SC 8/WG 4, RFID for Returnable Containers
- Chair, ISO TC 122/WG 4 (Shipping Labels) & ISO TC 122/WG 7 (Product Packaging)
- Vice-chair, ASC MH 10 and U.S. TAG to ISO TC 122 (Packaging)
- Member, EPCglobal HAG (UHFGen2), FMCG BAG, HLS BAG, SAG
- Past Chair, ASC INCITS T6 (RFID) ANS INCITS 256:1999, 2001
- JTC 1/SC 31 Liaison Officer to the International Telecommunications Union (ITU-R)
- JTC 1/SC 31 Liaison Officer to the International Air Transport Association (IATA)
- JTC 1/SC 31 Liaison to the European Telecommunications Standards Institute (ETSI)
- ASC MH 10/SC 8 Liaison Universal Postal Union (UPU) Physical Encoding Group (PEG)
- Advisor and Member of USPS Strategic Technology Council
- ISO TC 104 & 122 (Freight Containers / Packaging) Liaison Officer to JTC 1/SC 31
- Project Editor, ISO 18185-7 (Electronic Container Seal Physical Layer)
- Chairman & Project Editor, ANS MH10.8.2 (Data Application Identifiers)
- Vocabulary Rapporteur to ISO/IEC JTC 1/SC 31
- Co-chair, HIBCC Automatic Identification Technical Committee (AITC)
- AIAG Bar Code, Applications, 2D, Tire, Returnables, and RFID Committees
- Project Editor, EIA Shipping Label, Product, Product Package, & Component Marking
- Advisor, U.S. Department of Defense in Migration to Commercial Standards
- Project Editor, NATO STANAG 2233 (RFID for NATO Asset Tracking)
- Standards Advisor, R1 RFID Forum China (Cooperation of China, Korea, Japan)
- Recipient of the 2004 Richard Dilling Award

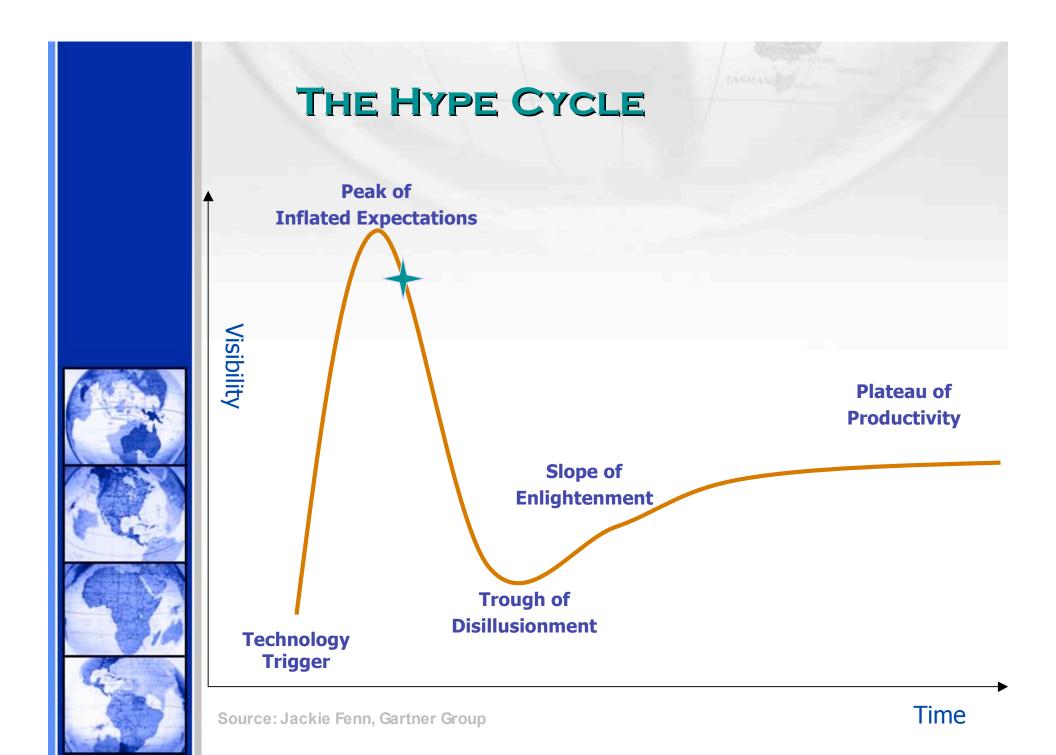
This 4 MB file"OdetteSweden_qed.ppt" posted at http://www.autoid.org/presentations/presentations.htm



THE HYPE HAS EVERYONE EXCITED BUT FEW ARE YET ATTEMPTING TO MANAGE EXPECTATIONS

... THE WORLD DID NOT IMPLEMENT ON 1 JANUARY 2005!!!

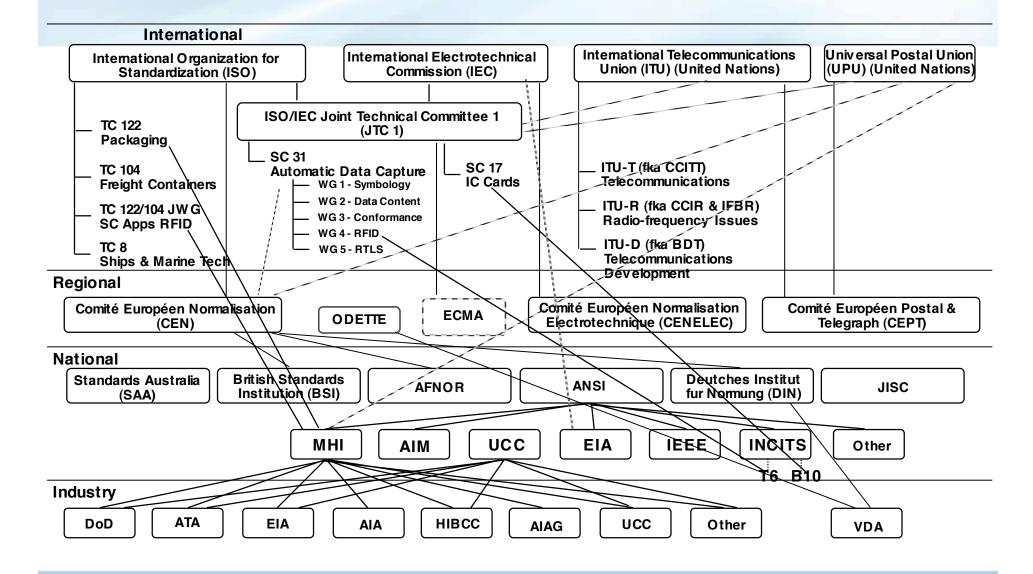




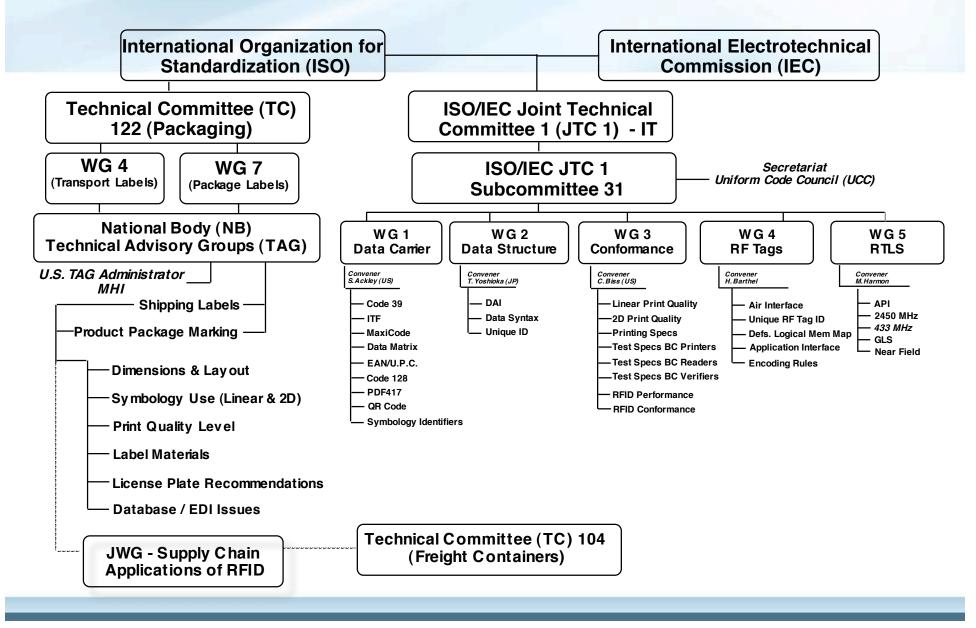




STANDARDS ORGANIZATIONS



AIDC FOCUSED ISO STANDARDS



Types of Standards

Technology

- Symbology, RFID, I.C. Card
- Data Content
 - Semantics (DIs or AIs), Syntax

Conformance

Print Quality, Test Specifications, Conformance to Air Interface

Application Standards

Freight container, RTI, Ship Label, Product Package, Product Mark/Tag, eSeal





ISO TC 122 (Packaging)

ISO TC 122 project status

- ISO 15394, Packaging Bar code and twodimensional symbols for shipping, transport and receiving labels
 - IS Approved 2000-04-01
 - Periodic review to commence in 2005
- ISO 22742, Packaging Linear bar code and two-dimensional symbols for product packaging
 - IS Approved 2004-12-05
- ISO 21067, Packaging Vocabulary
 - DIS closed 2005-05-02

ISO TC 104 (Freight containers)



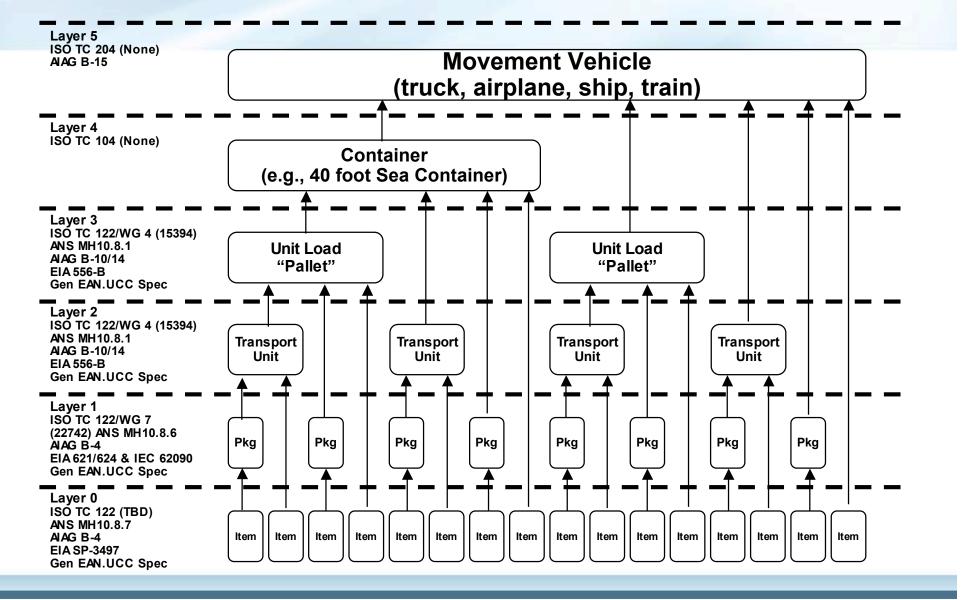
ISO TC 104 project status

- ISO 830, Freight containers Vocabulary
 - CD Ballot 2005-07-31
 - Revision of ISO 830:1999, ISO 830:1999/Cor 1:2001
- ISO 17712, Freight containers Mechanical seals
 - FDIS Ballot 2005-05-11
 - Previously approved as PAS
- ISO 18185, Freight containers Electronic seals
 - Part 1, Communication protocol
 - Part 2, Application requirements
 - Part 3, Environmental characteristics
 - Part 7, Physical layer
 - Parts 1, 2, 3, and 7 CD ballot closed 2005-03-10
 - Part 4, Data protection
 - Part 6, Messages sets for transfer between seal reader and host computer
 - Parts 4 and 6 CD ballot closes 2005-07-30
 - Part 5, Sensor interface
 - Withdrawn 18185 is a read-only tag

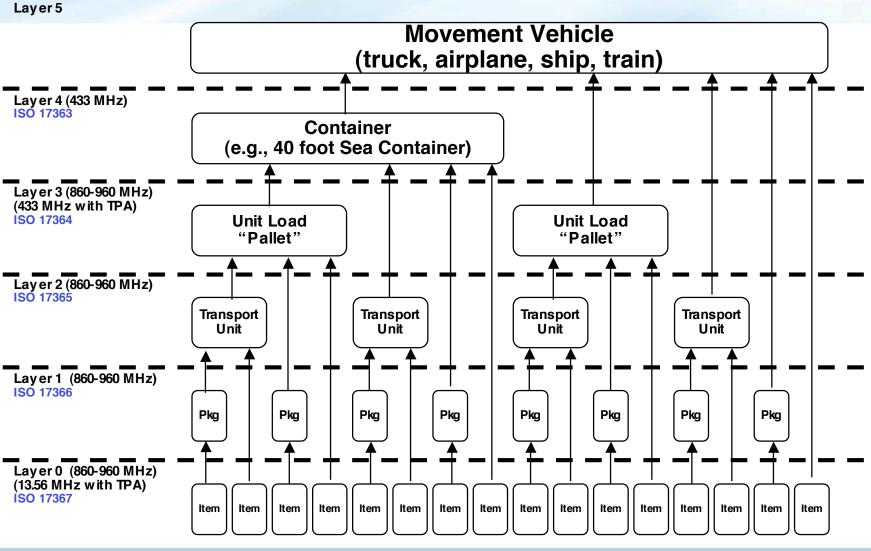
ISO TC 122/104 Joint Working Group (JWG) (Supply chain applications of RFID)



THE LAYERS OF LOGISTIC UNITS (OPTICALLY READABLE MEDIA)



THE LAYERS OF LOGISTIC UNITS (RADIO FREQUENCY IDENTIFICATION - RFID)



"TPA" - Trading Partner Agreement

ISO TC 122/104 JWG project status

- ISO 10374.2, Freight containers RF automatic identification
 - IS Issued 1991, Amd 1 1995
 - CD expected 2007-04-30
- ISO 17363 Supply chain applications of RFID -Freight containers
 - CD sent for ballot 2005-02-25
- ISO 17364 Supply chain applications of RFID -Returnable transport items
 - CD sent for ballot 2005-04-30
- ISO 17365 Supply chain applications of RFID -Transport units
 - CD sent for ballot 2005-04-30
- ISO 17366 Supply chain applications of RFID -Product packaging
 - CD sent for ballot 2005-04-30
- ISO 17367 Supply chain applications of RFID -Product tagging
 - CD sent for ballot 2005-02-25

ISO/IEC JTC 1/SC 31 Automatic Identification and Data Capture Techniques

Working Group (WG) 4 RFID for Item Management



ISO/IEC JTC 1/SC 31

Charted to work on technical specifications

"JTC 1 was established in 1987 for 'standardization in the field of information technology systems ... and equipment ...(with the exclusion of) information technology for specific applications...." [jtc16778]

✓ JTC 1 is comprised of both ISO and IEC

SC 31 is chartered to work on automatic data capture technical specifications



TECHNOLOGY STANDARDS

ISO/IEC 18000 - RFID for Item Management

- Part 2 125 150 kHz
- Part 3 13.56 MHz
- ✓ Part 4 2450 MHz
- ✓ Part 6 860 960 MHz
- ✓ Part 7 433.92 MHz (active)

DATA STANDARDS

- ISO/IEC 15418 Application Identifiers & Data Identifiers
- ISO/IEC 15434 Syntax
- ISO/IEC 15459 Unique Item Identification
- ISO/IEC 15961 Data Protocol: Application Interface
- ISO/IEC 15962 Data Protocol: Data Encoding Rules and Logical Memory Functions
- ISO/IEC 15963 Unique Identification for RF Tags

CONFORMANCE STANDARDS

- ISO/IEC 18047 RFID device conformance test methods (at)
 - ✓ Part 2 125 150 kHz
 - ✓ Part 3 13.56 MHz
 - ✓ Part 4 2450 MHz
 - ✓ Part 6 860 960 MHz
 - ✓ Part 7 433.92 MHz (active)

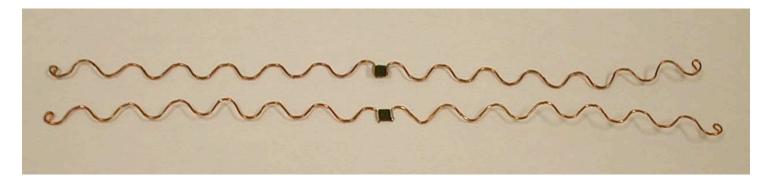
APPLICATION STANDARDS Radio Frequency Identification - Open Standards

- ISO 10374 Freight containers Automatic identification
- ISO 18185 Freight Containers Radiofrequency communication protocol for electronic seal
- ISO 11785 Radio-frequency identification of animals — Technical concept
- ANSI MH10.8.4 RFID for Returnable Containers
- **AIAG B-11 Tire & Wheel Identification Standard**
- ISO 122/104 JWG Supply Chain Applications of RFID
 - ✓ ISO 17363 Freight containers
 - ✓ ISO 17364 Returnable transport items
 - ✓ ISO 17365 Transport units
 - ✓ ISO 17363 Product packaging
 - ✓ ISO 17364 Product tagging

AIAG B-11 TIRE TAG

ANSI INCITS 256 (T6) and ISO/IEC 18000, Part 4 & Part 6 compliant

- ✓ 902 928 MHz for U.S. / 869 MHz for Europe
- ✓ 2450 MHz for Japan
- Molded into tire, applied with adhesive, or label
- ✓ 1024 bits
- ISO 15418/MH10.8.2 Data Identifiers
- ✓ Successfully demonstrated in the U.S. & the E.U.

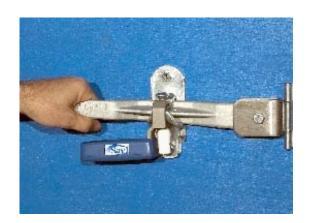


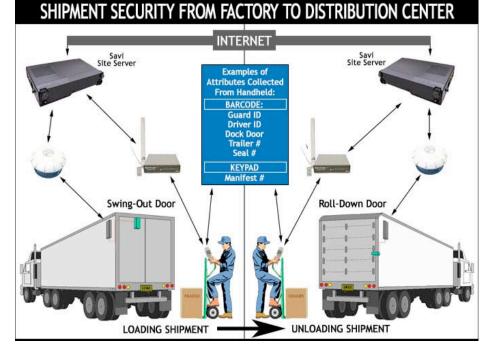
SEALING AND ANTI-TAMPER CAPABILITY

Bolt Seal Security Tag

- Electronically secures ocean containers, air cargo ULD containers, trailers,
- Monitors presence and integrity of bolt seal, generates alarm upon bolt removal or breakage
- Re-usable tag
- Reduces manual inspections
- Minimizes theft, loss and tampering









ITEM IDENTIFICATION VERSUS ANTI-COUNTERFEITING





a. The adoption and common use of reliable track and trace technology is feasible by 2007, and would help secure the integrity of the drug supply chain by providing an accurate drug "pedigree," which is a secure record documenting the drug was manufactured and distributed under safe and secure conditions.

Modern electronic technology is rapidly approaching the state at which it can reliably and afronably provide much greater assurances that a drug product was manufactured safely and distributed under conditions that did not compromise its potency. FDA has concluded that this approach is a much more reliable direction for assuring the legitimacy of a drug than paper recordiseeping requirements, which are more likely to be incomplete or fashind, and that its feasible for use by 2007. Raid/infequency (dentification (RFID) tagging of products by manufacturers, wholesalers, and retailers appears to be the most promising approach to reliable product tracking and tracing. Significant feasibility studies and technology improvements are underway to confirm that RFID be informed confirmed tracking and the movement of every package of drugs from production to dispensing. Most importantly, reliable RFID technology will make the copying of medications either extremely difficult or unportable. FDA is working with RFID product developers, sponsors, and participants of RFID feasibility studies to ensure that FDA's regulations facilitate the development and safe and secure use of this technology. FDA is also working with other government al agencies to coordinate activities in this area.

b. Authentication technologies for pharmaceuticals have been sufficiently perfected that they can now serve as a critical component of any strategy to protect products against counterfeiting.

Authentication technologies include measures such as color shifting inks, holograms, fingernhis, taggartist, or chemical markers embedded in a drug or its label. The use of one or more of these measures on drugs, starting with those considered most likely to be counterfielded, is an important part of an effective anti-counterfeiting strategy. Because counterfieters will adapt rapidly to any paticular measure and because the most effective measures differ by product, the most effective use of authentication technology will vary by drug product over time. FDb intends to clarify its policies and procedures to help manufacturers employ and update these technologies safely and effectively. In particular, FDA plans to publish a draft guidance on notification procedures for making changes to products (e.g., addition of taggants), their packaging, or their labeling, for the purpose of encouraging timey adoption and adaptation of effective technologies for detecting counterfeit drugs. FDA also intends to continue to evaluate and provide information to stakeholders

ii

DATA CONTENT STANDARDS ISO/IEC JTC 1/SC 31/WG 2 & WG 4/SG 1

- ISO/IEC 15424 Data Carrier/Symbology Identifiers
- ISO/IEC 15418 EAN.UCC Application Identifiers and ASC MH 10 Data Identifiers
- ISO/IEC 15434 Syntax for High Capacity ADC Media
- ISO/IEC 15459 Unique identification Part 1: Transport units; Part 2: Registration procedures; Part 3: Common rules; Part 4: Unique Item identification for supply chain management
- ISO/IEC 15961 Data protocol: Application interface
- ISO/IEC 15962 Protocol: Data encoding rules and logical memory functions
- ISO/IEC 15963 Unique ID of RF Tag



TECHNICAL STANDARDS RADIO FREQUENCY IDENTIFICATION (RFID)

ISO/IEC JTC 1/SC 31/WG 4/SG 3 RFID for Item Management Air Interface (ISO 18000)

- ISO/IEC 18000-1 Generic parameters Air interface
- ISO/IEC 18000-2 Parameters for air interface below 135 kHz
- ISO/IEC 18000-3 Parameters for air interface at 13.56 MHz
- ISO/IEC 18000-4 Parameters for air interface at 2.45 GHz
- ISO/IEC 18000-6 Parameters for air interface at 860-960 MHz
- ISO/IEC 18000-7 Parameters for active air interface at 433.92 MHz

CONFORMANCE STANDARDS RADIO FREQUENCY IDENTIFICATION (RFID) ISO/IEC JTC 1/SC 31/WG 3/SG 1

- ISO/IEC 18046 RFID Device Performance Test Methods
- ISO/IEC 18047 RFID Device Conformance Test Methods
 - Part 2 <135 kHz</p>
 - Part 3 13.56 MHz
 - Part 4 2.45 GHz
 - Part 6 860-960 MHz
 - Part 7 433 MHz

SC 31/WG 4 (RFID) Technology Projects

ISO Designation	Title	Status
ISO/IEC 18000, Part 1	Information technology - AIDC techniques - RFID for item management - Part 1 - Definition of parameters to be standardized	Published 2004-08-06 AMD 1 in process
ISO/IEC 18000, Part 2 Mode A - ISO 11785 based Mode B - Yoshikawa RF	Information technology AIDC techniques - RFID for item management - Part 2 - Parameters for air interface communications below 135 kHz	Published 2004-07-30 AMD 1 in process
ISO/IEC 18000, Part 3 Mode A - ISO/IEC 15693 based Mode B - Magellan based	Information technology AIDC techniques - RFID for item management - Part 3 - Parameters for air interface communications at 13.56 MHz	Published 2004-08-06 AMD 1 in process
ISO/IEC 18000, Part 4 Mode A - Intermec based Mode B - Siemens/NEDAP based	Information technology AIDC techniques - RFID for item management - Part 4 - Parameters for air interface communications at 2.45 GHz	Published 2004-05-31 AMD 1 in process
ISO/IEC 18000, Part 6 Type A - BTG based Type B - Intermec/Philips based Type C - UHFGen2 (v1.0.9) based	Information technology AIDC techniques - RFID for item management - Part 6 - Parameters for air interface communications at 860-960 MHz	Published 2004-08-15 AMD 1 in process
ISO/IEC 18000, Part 7 Savi based	Information technology AIDC techniques - RFID for item management - Part 7 - Parameters for active air interface communications at 433 MHz	Published 2004-05-31 AMD 1 in process
ISO/IEC 15961	RFID for Item Management – Data protocol: Application interface	Published 2004-10-15
ISO/IEC 15962	RFID for Item Management – Protocol: Data encoding rules and logical memory functions	Published 2004-10-15
ISO/IEC 15963	RFID for Item Management – Unique Identification of RF Tag	Published 2004-09-01



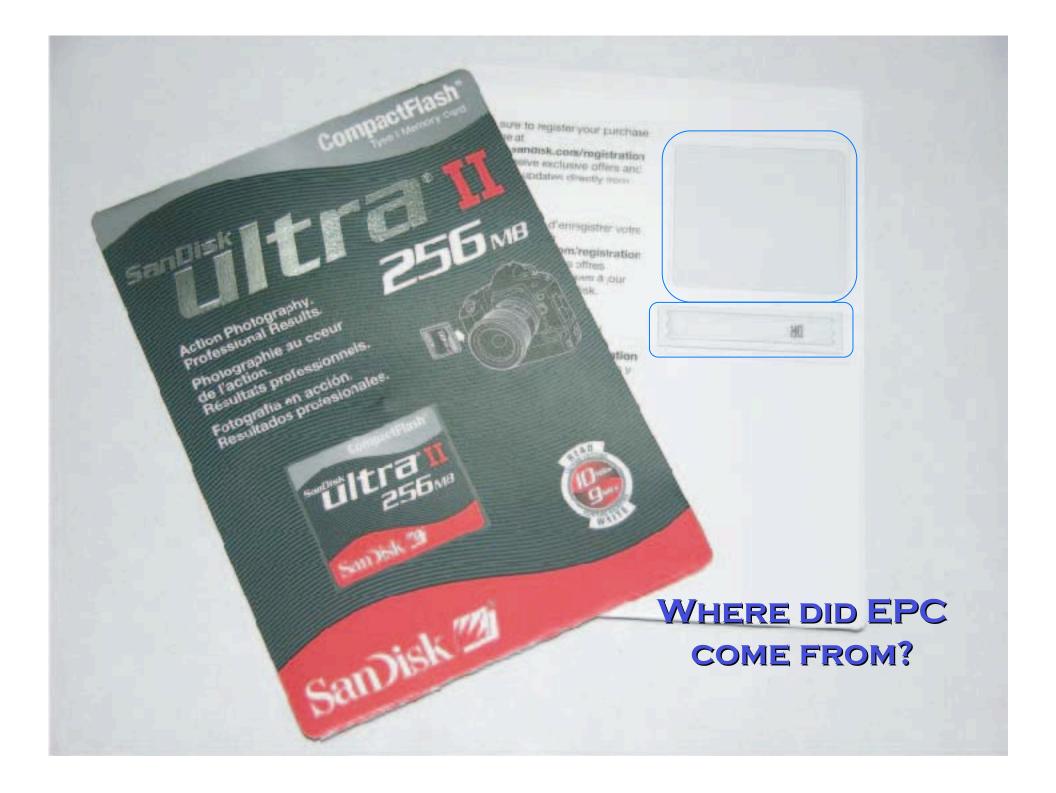
ISO Standards

- ISO has published air interface, data structure, and conformance standards
- ISO (JTC 1/SC 31) has 28 countries that actively participate in standards development including China, Korea, and Japan
- ISO (JTC 1/SC 31) has 28 other regional and international organizations with which it cooperates in liaison
- ISO follows established rules and engages all member countries in voting and comments to developing standards
- ISO is open



AN AGENCY OF UCC AND EAN





WHERE DID EPC COME FROM?

- VICS 1998 Due to anti-trust implications relative to the dual technology environment, VICS must move beyond the dual technology universe, and work with the EAS providers to collaborate towards making the source tagging application more compatible for product manufacturers and retailers.
- Consumer Product Manufacturer's Association (CPMA) 1999 The first (of packaging security) would allow for product security only. The second would allow the addition of product authentication. The third would allow for the addition of interactive communication capability. Within each level, additional functionality may be added on an as-needed basis. (The Consumer Products Manufacturers Association (CPMA) was founded in 1999 by Eastman Kodak, Johnson and Johnson, The Gillette Company, and Procter & Gamble)
- AIM 2000 AIM International Technical Specification (ITS) for Electronic Article Surveillance (EAS) systems, modeled after the Verein Deutscher Ingenieure (VDI) Guidelines 4471 Anti-Theft Systems for Goods Compatibility of Electronic Article Security Systems. VDI 4471 dated July 2000. The original source document was developed by the VDI Packaging Committee.
- No agreement on common technique between electro-magnetic, radio-frequency, acousto-magnetic technologies.
- Common-reader would have cost between 2 to 3 times the cost of a single technology reader.
- The "kill" command is as much for the benefit of retailers (anti-theft) as for consumers (privacy)



EPC TAG CLASSIFICATION

EPC Tag Class	Tag Class Capabilities	
Class 0	Read only, (i.e., the EPC number is encoded onto the tag during manufacture and can be read by a reader, not written to)	
Class 1	EPC, TID, "kill function", optional password-protected access control, and optional user memory	
Class 2	Class 1 with extended TID, extended user memory, authenticated access control, ++	
Class 3	Class 2 capabilities plus a power source to provide increased range and/or advanced functionality, e.g., sensors	
Class 4	Class 3 capabilities plus active communication and the ability to communicate with other tags	



EPCGLOBAL...

 \succ

- A joint venture between EAN International and Uniform Code Council (UCC)
- The only authorized domain registrar is the U.S. based VeriSign, as opposed to country specific registration
- Without sale of numbers, questionable value proposition for EPCglobal
- Mishandled Class 1 Gen 2
- Currently a U.S. standard, not generally accepted by other countries
- Data structure is proprietary

EPCGLOBAL...

 \succ

- Class 0 (based on the product offering of ONE company) does not conform to the regulations of ETSI or of FCC
- Class 1 (based on the product offering of ONE company) has significant failure rates (>20%^{NOTE})

NOTE - BASED ON STATEMENTS OF TWO VERY LARGE RETAILERS AND ONE VERY LARGE CG MANUFACTURER

EPCGLOBAL...

>

- EPC adoption will require fundamental changes in existing IT infrastructure to support "serialized" tracking and inventory
- Existing data structures will need to be replaced; there is a significant infrastructure based on bar code technology and other numbering structures
- There is benefit for "serialized" tracking at container, returnable, and transport unit level
- The only perceived benefit of EPC at the item level is for EAS (anti-theft)

EPCGLOBAL GEN2 UPDATE ...

- EPCglobal Board of Governors approved UHF Gen2 v1.0.9
- Advances in state-of-the-art RFID
 - High-speed world-wide anti-collision algorithm
 - Dense reader operating modes
 - Multiple operating sessions
 - Improved security for identification, read, write, lock
 - Reduced tag chip size
- Submitted to ISO/IEC JTC 1/SC 31/WG 4/SG 3 on 10 January 2005
- ISO expected to make the air interface more generic permitting data structures other than EPC
- ISO expected to provide an umbrella standard that will support read/write, identity-only and larger memory, and extensibility



INTELLECTUAL PROPERTY



INTELLECTUAL PROPERTY

- Public domain, royalty-free, or RAND
- All ISO standards are RAND
- All EPCglobal are royalty-free (I don't think so!!)
- If royalty-free for the standard (said "document"), not necessarily for the implementation
 - Notices of infringement and suit
 - Royalties for I.P. is not a "bad" thing; I.P. is what fuels Research & Development

I.P. ISSUES WITH EPC

- 1. There are many holders of fundamental IP that are not EPCglobal participants. EPCglobal cannot indemnify manufacturers or users against infringement suits from these IP holders.
- 2. EPCglobal itself holds a number of IPs, most of which have neither been filed nor declared royalty free.
- 3. Some IP holders are still very unhappy with the EPCglobal IP policy and are holding back.
- 4. The EPCglobal IP policy is not binding under the ISO standards process. IP holders that have agreed to royalty-free use of their IP under the EPCglobal umbrella are not required to honor those agreements outside of EPCglobal.

EPCGLOBAL AND ISO

ISO REQUIREMENT	EPC UHF GEN2 v1.0.9
Standard to cover the widest possible set of applications for a common protocol	Restricted to "EPC-only" data structures
Top-down architecture	Bottom-up architecture
Standard to embrace global applications	Restricted to EPC applications
Active tags to comply with ISO/IEC 18000-7	No accommodation for active tags
Extensible commands, e.g., sensors, write	No extensibilities beyond Class 1
RAND	EPC's I.P. not disclosed, "royalty- free"
AFIs for multi-application use	No AFIs
Consistent and common use of Tag ID, Item ID Object ID, Chip ID, etc.	Usages are not mainstream and are confusing

EPC IN THE FUTURE...

- EPC business model has changed several times over its life
- Unable to license chips due to "royalty-free" perspective
- The technology was not developed by EPCglobal; it was developed by the technology providers, mostly who participate in ISO
- ISO/IEC 18000, Part 6c enables multiple industries with the same protocol without the requirement of participating in EPCglobal
- Attempting to "sell" GDSN (Global Data Synchronization Network) as a solution that "requires" EPC
- Retailer product manufacturers already have EPC constructs based on their UPC/EAN numbers
- Of their +1 MILLION members, UCC/EAN have been able to get fewer than 500 to sign up as EPC members; and of those, over half are solution providers
- EPCglobal's current business model requires penetration of markets where they can charge fees
 - ✓ Health care
 - ✓ Defense and aerospace
 - Cargo and freight
 - 🗸 ...
- ✦ Adopters will have to forego existing number structures for EPC



ISO TC 20 (Airplanes)

ISO TC 20/WG 13 project status . .

- ISO 21849, Aircraft and space Industrial data — Product identification and traceability
 - CD closes 2005-05-04
 - SAE AS9132 used as the definition of print quality and is normative. The specification is only quantitative and cannot be used for Six Σ quality assurance programs. In addition, the measurement criteria will often fail perfectly readable symbols and pass symbols that are entirely unreadable in the open system. The print quality specification should be optically based.

.. TC 20/WG 13 project status ...

- 21849 relegates Data Identifiers and Application Identifiers as subordinate to TEIs
- U.S. DoD (Rob Leibrandt) publicly stated (Brussels
 14 March 2005) that industries faced with airplane requirements for TEIs and auto/electronic requirements for DIs or retail requirements for AIs should use TEIs
- drCD21849 is a "very poorly" written document with requirements in the notes to tables, subjective print quality, and attempts to codify AS9132 which codifies ATA Spec 2000

... TC 20/WG 13 project status ...

- It is the intent of TC 20/WG 13 to transfer the work to TC 184/SC 4, Industrial automation systems and integration Industrial data
- 21849 2004 Working Draft "ISO 21849 was prepared by Technical Committee ISO/TC 20, Aircraft & Space Vehicles, Working Group 13. This document was prepared in cooperation with TC184/SC4. Upon publication TC184/SC4 will assume responsibility for maintaining ISO 21849."
- TC 184 Scope: "Standardization in the field of industrial automation and integration concerning discrete part manufacturing and encompassing the application of multiple technologies, i.e. information systems, machines and equipment, and telecommunications."

... TC 20/WG 13 project status

- drCD21849 is a threat to those who have spent the past 20 years attempting to establish global standards for data semantics.
- When there are two ways of doing exactly the same thing (Als and Dls), we should be endeavouring to rationalize this to a single system; not adding yet a third.
- Encourage your national body to vote NO on 21849.

ISO/IEC 15434 Status

- FCD15434 to FDIS should be supported as it simply removes the ASN.1 format header and updates the document
- NP15434 to CD should be rejected as it includes TEIs as a valid format header
- U.S. DoD commandeered the illegal format header "DD" to represent TEIs. Now they want a valid header. There was no operational imperative, simply DoD bowing to Boeing.
- UID, a permanent mark. "DD", a temporary solution to a permanent mark.
- When there are two ways of doing exactly the same thing (Als and Dls), we should be endeavouring to rationalize this to a single system; not adding yet a third.
- Encourage your national body to vote NO on CD15434.
- Encourage your national body to vote YES on FDIS15434.

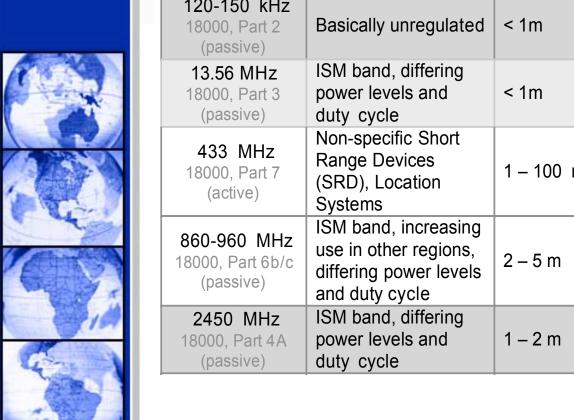




WHICH TECHNOLOGY

- How far?
- How fast?
- How many?
- How much?
- Geometry of tagging space
- Interferers (physical and radio)

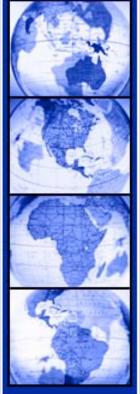
How FAR, HOW FAST, HOW MUCH, HOW MANY, ATTACHED TO WHAT?



Frequency	Regulation	Range	Data Speed	Comments
120-150 kHz 18000, Part 2 (passive)	Basically unregulated	< 1m	Low	Animal identification and factory data collection systems
13.56 MHz 18000, Part 3 (passive)	ISM band, differing power levels and duty cycle	< 1m	Low to moderate	Popular frequency for I.C. Cards (Smart Cards), Libraries
433 MHz 18000, Part 7 (active)	Non-specific Short Range Devices (SRD), Location Systems	1 – 100 m	Moderate	Container Security and Tracking. Asset tracking for U.S. DoD (Pallets) - Active
860-960 MHz 18000, Part 6b/c (passive)	ISM band, increasing use in other regions, differing power levels and duty cycle	2 – 5 m	Moderate to high	MH10.8.4 (RTI), AIAG B-11 (Tires), EPC, 18000-6c, DoD Passive
2450 MHz 18000, Part 4A (passive)	ISM band, differing power levels and duty cycle	1 – 2 m	High	IEEE 802.11b, Bluetooth, Cordless Tel

RADIO REGULATION RECOMMENDATIONS

Issue	Value / Response	Value / Response	
Subject band	860-960 MHz	433.92 MHz	
Transmission	Passive	Active	
Recommended band	Close to 900 MHz. This band should be in the 860-960 MHz band, as defined in ISO/IEC 18000, Part 6	433 - 435 MHz	
Minimum power level (Note: this is the "minimum" requested value for the "maximum" allowable radiated power)	4W EIRP or 2W ERP, though different specification methods they result in similar communication distance	0.1 Watt (50% duty cycle) / 0.01 Watt (100% duty cycle)	
Spectrum mask	Similar to either CEPT/ETSI or FCC		
Channelization	Spread Spectrum preferred	Narrowband	
DSSS or FHSS	FHSS		
Min # of Channels	10 (recommend 25 to 50 if band permits as this allows an effective "uncoordinated" FHSS technique as specified under FCC Part 15)		
Min. Channel Width	200 kHz		
Min. Channel Separation	200 kHz		
Recommended Modulation	AM	FSK	
Recommended Bit Rate	40 kbps	27.7 kbps	
Recommended Minimum Duty Cycle	30% (measurement period of one hour)	50% at 0.1 Watt / 100% at 0.01 Watt	
Maximum Frequency Deviation		± 50kHz	
Operating Frequency Accuracy		<50 ppm	
Other issues	"Contained" emissions (I.e. shielded read zones) should allow for 100% duty cycles)		



Regulations - ITU



Regulatory Differences

- Usage of channel
 - Primary service
 - Secondary service
 - Cannot interfere with primary service
 - Cannot claim protection of interference from primary service
 - Can claim protection of interference from other secondary users
 - Industrial, Scientific, & Medical (ISM) Bands
- Narrowband or Spread Spectrum
- Power level
- Duty cycle



RECENT DEVELOPMENTS

➢ 860 - 960 MHz

- Includes Industrial, Scientific, & Medical (ISM) band
- Technology enhancement (frequency agile and listen before talk) permits
 - 902 928 MHz used in Region 2 (U.S.)
 - 865.6 867.6 MHz nearing finalization in Region 1 (Europe)
 - 908.5 914 MHz regulations finalized in Region 3 (Korea)
 - 950 956 MHz regulations in process in Region 3 (Japan)
 - Engaging China to develop "in band" regulations (917 924 MHz??)
- ISO/IEC 18000-6 (860-960 MHz) re-opened to address new developments, such as Gen2



RECENT DEVELOPMENTS

433.92 MHz

- ISM band permitted by ITU (implemented in Region 1 but for different parameters in Regions 2 and 3)
- ✓ ITU receptive to Regions 2 and 3 supporting Region 1 for a 433 MHz allocation for freight containers
- Chairman of ISO TC 104 (Freight containers) has made request to ITU and WCO to embrace both passive (860 - 960) and active (433.92 MHz) calling out 18000-6 and 18000-7
- Under serious consideration in both Japan and Korea
- Both Japan and Korea have requested U.S. governmental letters of support, i.e., FCC, NTIA, DoD, NATO
- Received support through new (April 2004) FCC rules, specific to RFID, that increases both power and duty cycle.
- ✓ Engaging China to develop 434 MHz in RFID regulations





RFID Experts Group

- Formed in February 2004 to assist DoD with RFID implementation
- Under the AIM Global umbrella in July 2004
- Reaching out for international cooperation
 - Europe
 - Japan
 - Korea
 - China



REG Terms of Reference (ToRs)

- ToR: Reader System Implementation & Operations
- ToR: Enabled Labels & Packaging
- ToR: Recyclability
- ToR: Tag Quality
- ToR: Education & Certification
- ToR: Global Operation
- ToR: Privacy
- ToR: Safety
- ToR: Security
- ToR: Sensors and Transducers
- ToR: Technology Selection

ISO/IEC Implementation TRs

- ISO/IEC 24729-1, Information technology Radio frequency identification for item management — Implementation guidelines – Part 1: RFID-enabled labels
- ISO/IEC 24729-2, Information technology Radio frequency identification for item management — Implementation guidelines – Part 2: Recyclability of RF tags
- ISO/IEC 24729-3, Information technology Radio frequency identification for item management — Implementation guidelines – Part 3: RFID interrogator/antenna installation







INTERMEC ROYALTY FREE PATENTS OFFERED TO EPCGLOBAL

- 4786907: Transponder useful in a system for identifying objects
- 5673037: System and method for radio frequency tag group select
- 6172596: System method and apparatus for identifying and communicating with a plurality of types of radio frequency communication devices
- 6400274: High-performance mobile power antennas (claims 1-10 only)
- 6404325: Method and system for storage and recovery of vital information on radio frequency transponders

m



RAND PATENTS/APPLICATIONS OFFERED TO EPCGLOBAL BY INTERMEC

- 4739328: System for identifying particular objects
- 5030807: System for reading and writing data from and into remote tags
- 5777561: Method of grouping RF transponders
- 5828318: System and method for selecting a subset of autonomous and independent slave entities
- 5828693: Spread spectrum frequency hopping reader system
- 5850181: Method of transporting radio frequency power to energize radio frequency identification transponders
- 5912632: Single chip RF tag oscillator circuit synchronized by base station modulation frequency.
- 5995019: Method of communicating with RF Transponders
- 6429775: Apparatus for transporting radio frequency power to energize radio frequency identification transponders
- 6288629: Method of using write--ok flag for radio frequency (RF) transponders



SYMBOL VS. INTERMEC

- 1. We believe that Symbol's aggressive litigation tactics give further weight to our argument that Symbol is disproportionately reliant on its laser scanner franchise and that the company is fighting an uphill battle in the area of RFID technology.
- 2. Intermec, on the other hand, appears well-positioned with regard to both areas of technology dispute and we expect the company to use its advantage to steadily gain market share from Symbol.
- 3. Symbol's decision to terminate its supply agreement with Intermec, at first glance, looks like it could be a body blow to Intermec. Upon further analysis, however, the move may actually prove beneficial to Intermec (i.e., long-term purchase agreement with Symbol invalidated, freedom to sue Symbol on smart battery technology) and a detriment to Symbol (i.e., loss of \$5-10 million of high margin scanner sales).

Consequently, we continue to recommend that investors stay clear of Symbol (investment rating of Underperform), while recommending the purchase of UNOVA shares (rated Outperform).

Raymond James, March 14, 2005