

UHF RFID

Ultra High Frequency Radio Frequency IDentification Technology

<p>& RFID/USN</p> <p>.....</p> <p>. 900MHz RFID</p> <p>. 433MHz RFID</p> <p>.</p>	<p>(H.W. Son) RFID</p> <p>(H.S. Mo) RFID</p> <p>(N.S. Seong) RFID</p>
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RFID , , 가 , ID , , , ,

. RFID , , , , RFID

(anyone) (anything)

900MHz RFID 433MHz

RFID .

I.

(identification) ,
(sensing) RFID

. RFID

, , 가 ,

, ,

RFID , , ,

.

, ,

,

. RFID ID

가

가

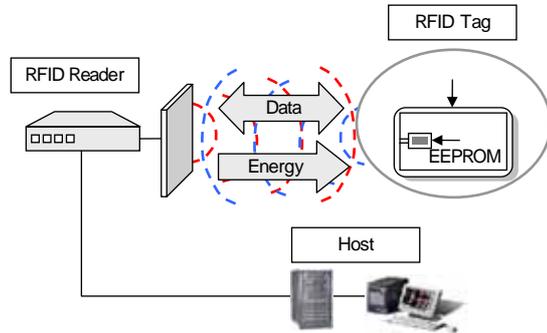
(battery) 가

가 USN [1].

900MHz

RFID 433MHz

RFID



(1) RFID

(interrogation) ,

가 (continuous elec-
tromagnetic wave)

(interrogating signal) ,

(back-scattering modulation)

. 900MHz RFID

RFID (1)
(tag or transponder) (reader or interro-
gator)

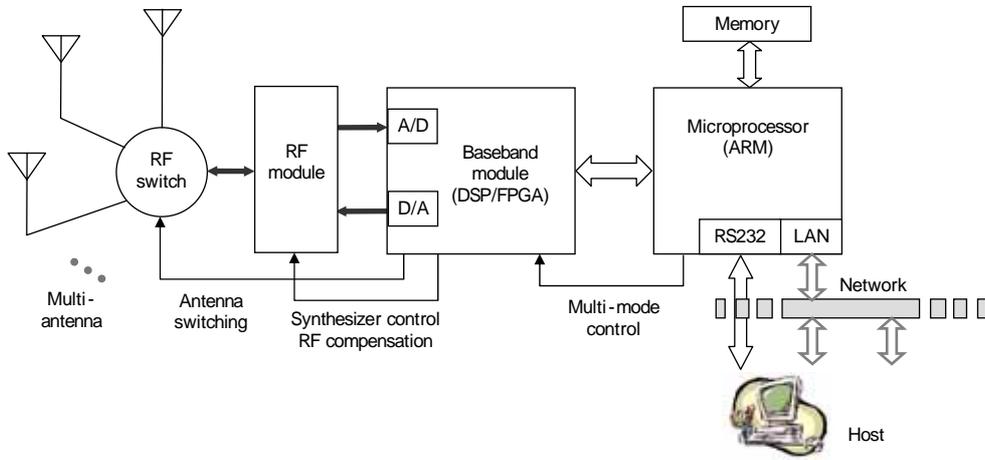
가 (read zone)

1.

가.

900MHz RFID

RFID (2)



(2) RFID

, RF , , RFID
 (binary search)
 (slotted aloha) (anti-collision)
 RFID [2].

2~4 가 , 가
 가 , ISO 18000-6A
 EPCglobal Class 1 Generation 2(C1 Gen2)
 13.56MHz 2.45GHz ISO 18000-6B EPCglobal
 가 Class 0(C0), Class 1(C1)

RF 가 SoC 가 . EPCglobal Class 1 Generation 2 Protocol

가 가 900MHz de-facto
 가 EPCglobal 860~960MHz
 UHF Gen 2 Philips, TI, Inter-mec
 ISO 2004

RFID . ISO 2005
 900MHz
 18000-6 Type C
 Gen 2 [3] C0 C1 Ver1.0



ID 가

, EPC PC ,

, IC ,

, ISO AFI 가 . AFI

ISO/IEC 14443 ,

ISO/IEC 15963 SC31 RFID

WG4 SC17/WG8 SC31/

, AFI

. 900MHz 가

UHF RFID

, 가 .

/ 가

, ,

. < 1> 가

, PDA

, PCMCIA ,

Wal-Mart

902~928MHz, FHSS

/

, RFID

ETRI 2004

900MHz

. < 2> ETRI

EPC C0

C1

,

< 1> RFID

	(MHz)		
Alien	902~928	EPC C0/C1	
Symbol	902~928	EPC C0/C1	PDA
Intermec	902~928	EPC C0/C1	PDA
Samsys	865~868 902~928		
AWID	902~928	EPC C0/C1	
Telenxeus	902~928	EPC C0/C1	
Sirit	902~928	EPC C0/C1	
Skyetek	902~928 13.56	EPC C0/C0+/C1 ISO 14443, 15693	
WJ	902~928	EPC C0/C0+/C1	PCMCIA
MaxID	902~928	EPC C1 ISO 18000-6 U-CODE 1.19	
PSC	902~928	EPC C0/C1	PDA
Tnex	902~928	EPC C0/C0+/C1	

< 2> ETRI

908.5~914MHz
EPC C0, C1
EPC C0, EPC C1, EPC C0/C1
50~100 /
3~4m(), 1m ()
FHSS/LBT, 200kHz
(4)
RS-232, USB,
OS

4
 . 2005 UHF
 EPC C1 Gen2
 RFID RFID
 SoC

900MHz RFID
 가 (EPC-
 global C0, C1, ISO/IEC 18000)
 , EPC-
 global C1 Gen2가

2.

가 , 가
 EPC-

RFID (3)
 [4].

global C1 Gen2
 Alien, Symbol, Philips, TI, Impinj
 2005

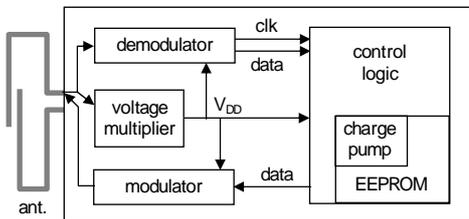
ETRI C1 Gen2
 , 2005

가

가

(inlay)

(flip chip)



(3) RFID

가 . < 3>
 가 .
 가 50 10
 가 1/10
 가 10 4

. Alien

가. /

strap FSA
 Philips FSA vibratory assembly
 . Symbol

5 가 , ,
 가 가 40%

< 3> 가 가

가

가					
	50 (100)	20 (40)	5 (10)	5 (10)	20 (40)
가(c)	10	2	3	4	1
(%)	(100)	(20)	(30)	(40)	(10)
	4 (100)	1 (25)	1 (25)	1 (25)	1 (25)

. Hitach 0.3 x 0.3mm²
 , Alien 0.35 x 0.35mm²
 Symbol Philips

900MHz



20 3 2005 6

PICA

가

AoC

Hi-

tach

가 3mm

RFID
5.8GHz

125kHz

(5)

가

RFID

가 가
가 UHF

PCB

가

RFID

가 , 가

RFID

가

가가

RFID

RFID



가



가

(4)

PET

가

(

4)



<CAENRFID>

RFID

가



<Matrics>

가

가



<AWID>

(5)

PET 가 가 Precisia, Palalec, Dupont Symbol 가 Dupont RFID (smart label) 가 1/50 0.5~1 () < 4> 10~30% (volume) reel-to-reel 가 가

433MHz RFID

< 4> RFID

Alien	900MHz	EPC C1
Symbol	900MHz	EPC C0, C0+
TI	900MHz/ 13.56MHz/135kHz	EPC C1G2/ISO 14443, 15693
Philips	900MHz/ 13.56MHz	EPC C1/ISO 180006-B, 14443, 15693
ATMel	13.56MHz/135kHz	-
Intermec	900MHz	ISO 180006-B
AWID	900MHz	ISO 180006-B/ U-CODE 1.19
AVERY	900MHz	EPC C0+, C1
RafSac	900MHz	EPC C1/ U-CODE 1.19
Impinj	900MHz	EPC C0
ASK	900MHz/13.56MHz	EPC C0, C1/ ISO 180006-A, B
Vanguard	13.56MHz	ISO 14443, 15693
PILtek	900MHz/13.56MHz	EPC C0, C0+, C1/ISO 15693
ESCORT	13.56MHz/135kHz	ISO 15693

RFID RFID RF RFID HDX 가 RFID ISO/IEC JTC 1/SC31 eSeal ISO TC104 FHWA Freight FOT, CCDoTT CHCP eSeal RFID



20 3 2005 6

, WLAN AP

RFID

, 2001 9.11

(security eSeal

check)

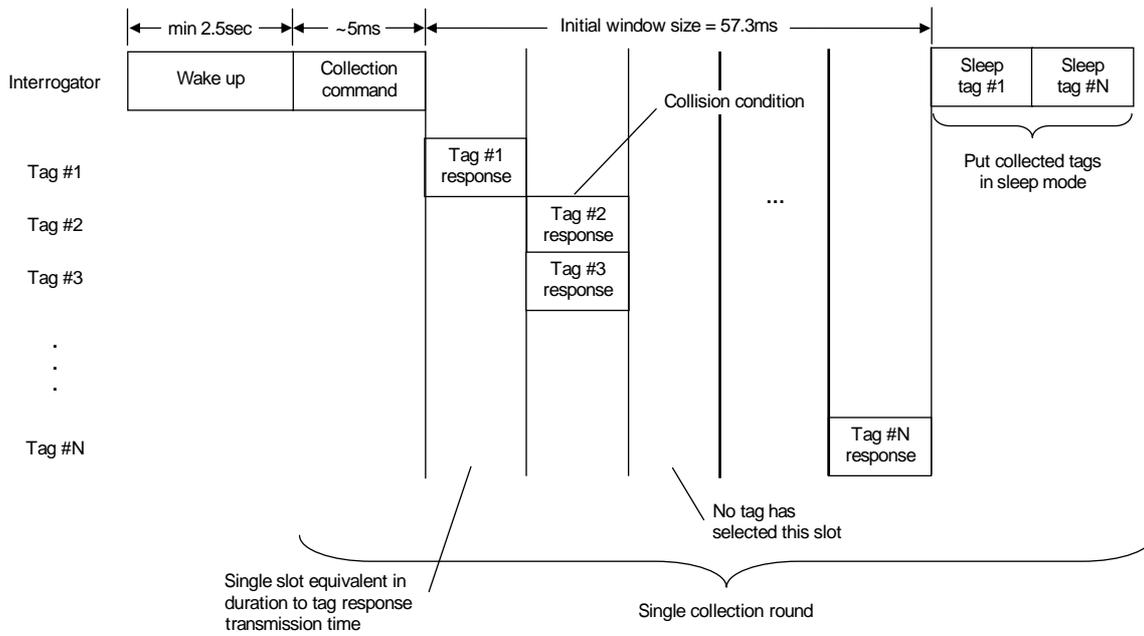
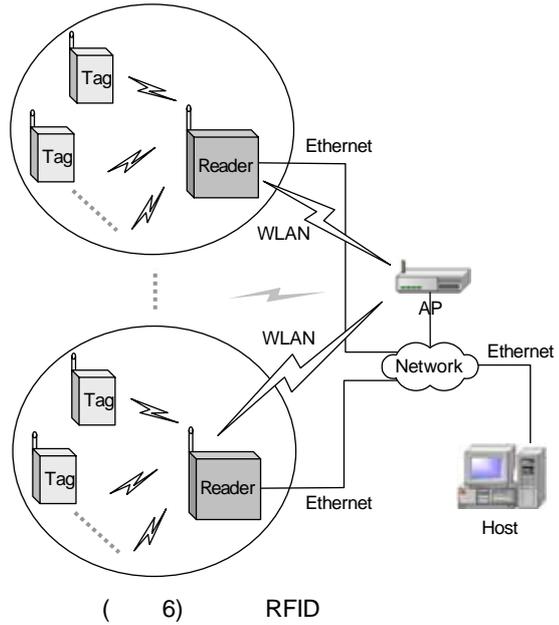
RFID 2005

, ETRI 2004

433MHz

1. RFID

RFID (6)



- RFID / FSK . eSeal
(half duplexing)
- 2.5 wake-up seal(eSeal) seal RFID seal
sleep ID
slotted aloha inventory 가
inventory ID
((7)). eSeal 433MHz, 916.5MHz, Savi,
e-Logicity, AllSet, Hi-G-Tek (< 5>)
sleep Savi eSeal
inventory 가 inventory , 123kHz Signpost
wake-up Signpost
point-to-point Signpost 433MHz
가 Savi
echopoint . (9)
eSeal
Savi eSeal ST-645 seal
, new ST-645

2. RFID

RFID
eSeal . eSeal ,
가.
(8)

< 5> eSeal

Seal			
eSeal	e-Logicity	Active RF	433.92MHz
DataSeal	Hi-G-Tek	Active RF	916.5MHz
SmartSeal	Savi	Active RF	123kHz & 433.92MHz
AllSeal	AllSet Tracking	Active RF	2.44GHz
MacSema + Navalink	CGM	Contact Memory	-



(8)



(Savi)



ST-645



New ST-645



ST-646 (Security Tags)

Crypta Data Tag (Encrypta)



(9)



Data Tag (TydenTek)

eSeal

가 가 seal

2GHz

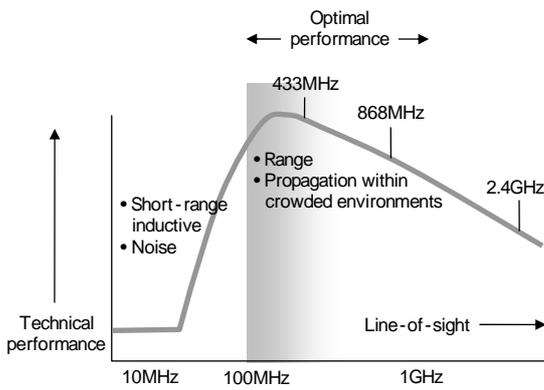
ISO 18185

(10)
RFID

100MHz~1GHz

eSeal

eSeal



2003 1

- (data security)
- (data integrity)
- (data validity)

, 2004 12

eSeal “vulnerability and threats for eSeal” 가 task force

(11)

가 ‘(threats)’

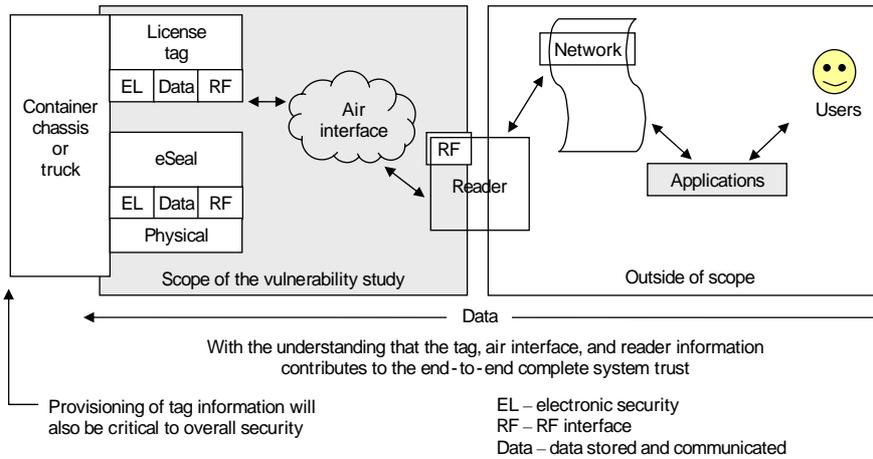
5가

(10)

- eSeal/ (cloning)
- eSeal/ (spoofing)
- eSeal/

Seal

- (jamming)
- (shielding)



(11)

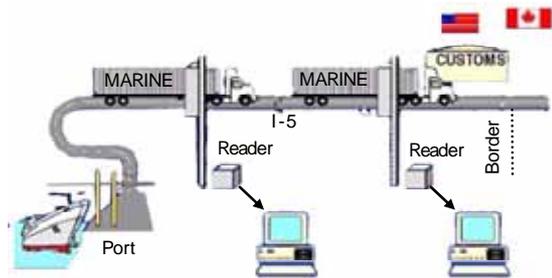
(vulnerability)

11가

- Imposter/Substitution Seal(Cloned Seal)
- Imposter/Substitution Reader(Cloned Reader)
- Spoof Message between the Seal and Reader (Rogue Seal)
- Spoof Message between the Seal and Reader (Rogue Reader)
- Communication Disruption: Jamming(Denial of Service – DOD Attack)
- Communication Disruption: Shielding(Denial of Service – DOD Attack)
- Seal Disruption – Increased Power Utilization
- Passive Information Gathering
- Seal Probing(Physical Information Extraction)
- Seal Destruction
- Man-in-the-middle Air Interface Attack (Intercept and Alter)



(12) FOT eSeal (e-Logicity/EJ Brooks)



(13) FOT

5. RFID

((12), (13)

) [6].

RFID

eSeal 가

. CHCP

가 FHWA Freight ITS Operational Test Evaluation(FOT) USDOT

CHCP

RFID

CHCP

RFID

315MHz/433.92MHz/2.45GHz

eSeal

FOT

9.11

가

CHCP

eSeal

가

CHCP

eSeal

2.45GHz

가. FOT

[7].

eSeal

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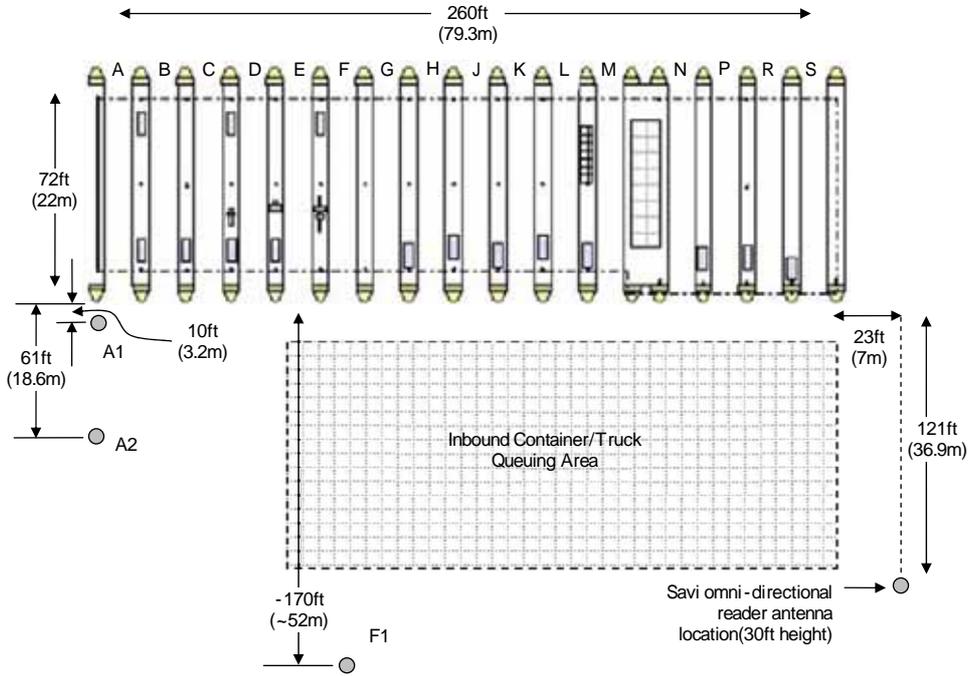
seal

가

•

eSeal

•



(14) Terminal In - Gate



(15) On - Rail

Hook
On-rail
rail
((15)).

• Seal

•

• Terminal In-Gate ((14))

• On-Rail ((15))

• On-Road

CHCP

Howland Hook Marine

900MHz
RFID 433MHz
RFID
가 , ,
RFID
2005
EPC C1 Gen2

가
 , 가
 가 가 , ,
 , ,
 , 433MHz RFID
 RFID
 ISO18000-7
 eSeal 가
 , ,
 eSeal
 ,
 4~5
 eSeal
 가
 ,
 ,
 /
 RFID eSeal / /

FHWA	Federal Highway Administration
FOT	Freight ITS Operational Test Evaluation
FSA	Fluidic Self Assembly
FSK	Frequency Shift Keying
HDX	Half Duplexing
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
JTC	Joint Technical Committee
PC	Protocol Control
PCB	Printed Circuit Board
PCMCIA	PC Memory Card International Association
PDA	Personal Digital Assistants
PET	Polyethylene Terephthalate
PICA	Parallel Integrated Chip Assembly
RFID	Radio Frequency Identification
SC	Sub Committee
SoC	System on Chip
USDOT	US Department of Transportation
USN	Ubiquitous Sensor Network
WSC	World Shipping Council

AFI	Application Family Identifier
AoC	Antenna on Chip
AP	Access Point
CHCP	Cargo Handling Cooperation Program
EPC	Electronic Product Code
eSeal	electronic Seal
FHSS	Frequency Hopping Spread Spectrum

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 ," DT -UHFR - TM -003, ETRI, 2004.

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 1.0.9., 2004.

[4] U. Karthaus and M. Fischer, "Fully Integrated Passive
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[6] WSDOT, "Intermodal Data Linkages Freight ITS
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 13770.htm](http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13770.htm)

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 Sep. 2003, www.ccdott.org/accomplishments