GS1 EPCglobal Conveyance Asset Tag (CAT) Environmental Testing

Technical Implementation Guide

Issue 2, 15 April 2010

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1	12 November 2009	Shirley Arsenault	Document creation
2	15 April 2010	Shirley Arsenault	Remove erroneous comments

Disclaimer

Table of Contents

1. Introduction

1.1. Purpose of this Document

This EPCglobal guidance document provides guidance for use of Passive RFID devices to label and or identify on 'Conveyance Asset Tags (CAT). The intent of this document is to bring clarity to the level of testing required for RFID devices throughout the transportation industry.

Installations of passive RFID devices should meet or exceed any criteria that any regulatory agency may impose on their use i.e. FAA, EASA, ISO, Interstate Commerce Commission, FCC etc.

The use of passive RFID devices on a commercial aircraft is identified by the FAA Advisory Circular AC20-162 and testing to meet said requirements identified in the Society of Automotive Engineers Aerospace specification *AS5678 Passive RFID Tags Intended for Aircraft Use.*

This document provides guidance to RFID Tag Manufacturers so that they can identify the tags that will be used on ULDs, Trucks, Trailers, Rail Cars, and Ocean Containers.

Verification of testing should be completed by a qualified Product Testing Laboratory. Documentation of testing shall be retained for regulatory examination.

When requirements in this document do not agree with regulatory documents, use requirements in the regulatory documents.

1.2. Who Will Use this Document?

This implementation guideline was created to provide guidance on the use of CAT tags to TLS industry players including shippers, consignees, terminal and warehouse operators, standards organizations, solution providers and other research institutes

1.3. Scope

The scope of this document is to:

- Provide a requirements document for RFID Tag Manufacturers to produce passive-only UHF RFID tags for the Conveyances.
- Specify the test requirements specific to Passive UHF RFID tags to be used for Conveyances.
- Identify existing standards applicable to Passive UHF RFID tags.
- The identification of the conveyance asset is a key element in many applications. The GS1 recommendation for the unique identification of conveyances is the Global Individual Asset Identifier (GIAI 202). Work is being done with relevant bodies to devise a global solution for the conveyance asset ID

2. Tag Specifications and Attributes

2.1. CAT Tag Specifications (Class 1 Gen 2)

2.1.1. Requirements:

Permanently associated with conveyance type

- Trailer
- Truck
- Railcar
- Ocean container

- Air cage
- Air pallet
- ULD
-

Inexpensive Tag

Low-maintenance

No battery

Consistent with UHF Gen2

Rugged and durable external casing

15 year life span

Tag memory

- License plate data is PERMA locked
- User memory is locked at the discretion of the owner
- User memory size determined by conveyance type
- Mandatory data can be locked

Data retention: 15 years

Tag Weight - < 8 oz (230 grams) – air requirement

Must agree with existing standards FAA requirements

Data –

- Data should be non-confidential
- Data is not expected to be secure or encrypted on the tag

Environmentally friendly "Green Tag"

Must be ROHS compliant

License plate (required data by conveyance type)

- Company identifier
- Conveyance type
- Conveyance ID
- Mfg date (or purchase date)

2.1.2. License identification for ocean, rail, and air

The following license identification for ocean, rail, and air are meant as sources for the identification of conveyance types using existing standards. Neither trailers nor trucks have identification standards at the present and it has been decided that they will either follow the same format as the ocean container or will use the license plate associated with either the trailer or the truck.

2.1.2.1. Truck / Trailer:

Proprietary ID similar to ocean container (alpha numeric)

License plate

- Double byte in Asia
- Cyrillic

*The unique conveyance number type (e.g. ISO code for ocean container numbers) will be determined based on the conveyance type ID

- Standards already exist for tractors, locomotives, railcars, ocean containers

2.1.2.2. Ocean container identification

For Overseas containers the following is required:

Equipment identification number, which consists of:

- Owner code, in accordance with ISO 6346;
- Equipment category identifier, in accordance with ISO 6346;
- Serial number, in accordance with ISO 6346; and
- Check digit, in accordance with ISO 6346.
- Size and type code, in accordance with ISO 6346;

For Overseas containers, the following is optional (from ISO standard 10374; and Technical Specification 10891):

- Operational marks for maximum gross and tare masses, in accordance with ISO 6346;
- Date manufactured, in form yyyymmdd;
- Manufacturer's identification;
- Approved Continuous Examination Programmed (ACEP) number, in accordance with xxxx;
- Timber Treatment endorsement number, in accordance with xxxx;
- International Convention for Safe Containers, 1972 (CSC) number, in accordance with xxxx;
- Date manufactured, in form yyyymmdd; and
- TIR Customs Convention number, in accordance with xxxx.

2.1.2.3. From ISO TS 10891

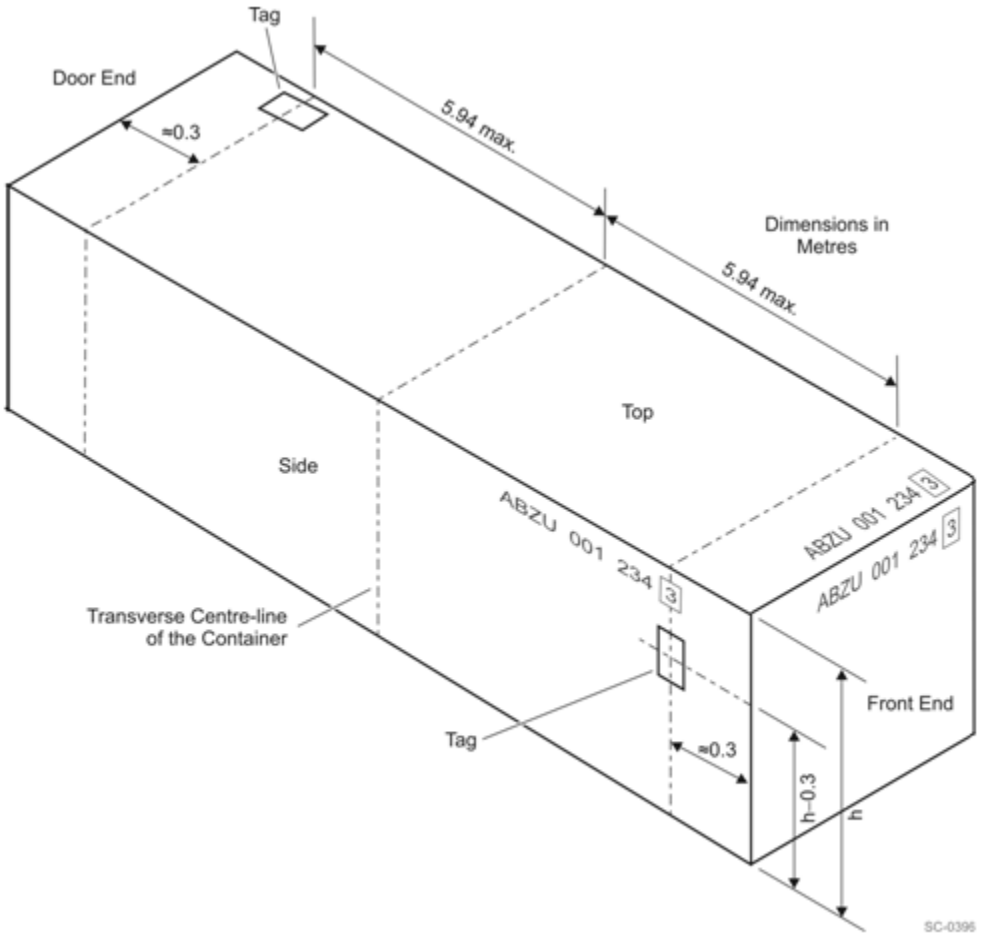


Figure 4 – Tag locations for containers of length 12.2 m (40 ft) or less

2.1.2.4. North American Rail (Automatic Equipment Identification – AEI) – Example currently in use

S-918 (Mandatory standards North American railroads) – and also used for several other railroad industries around the world. It was agreed to use this standard as the basis for railroad car identification.

- Tag data
- Formatting tag
- Messaging from reader to subscriber (can be any signatory railroad)

Installer programs a tag with the following information:

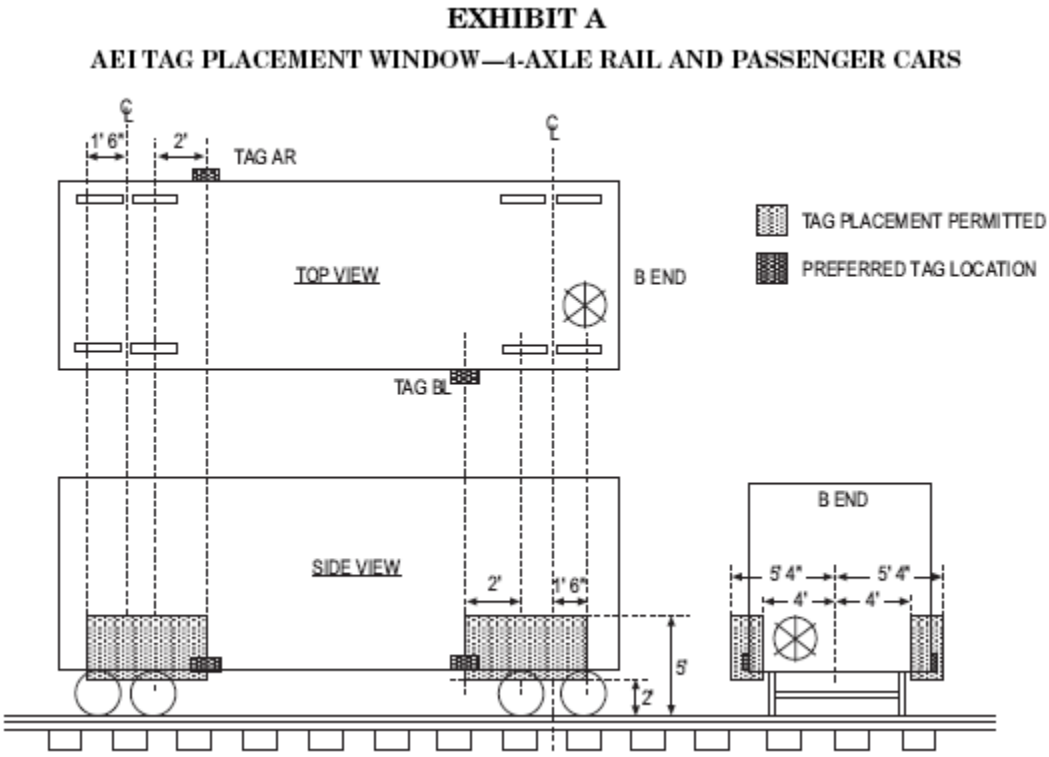
Equipment Group code	D (Locomotive)
Tag Type	128-bit tag (AAR Type)
Owner's code	KMCX
Locomotive number	1587234
Length	120
No. of axles	4
Bearing Type code	2
Side indicator	1 (right side)
Security	##

The corresponding base 2 values stored in the tag would be as follows:

Equipment Group code	00101
Tag Type	01
Owner's code	0110010011001001100
Locomotive number	00011000001110000010010
Length	001111000
No. of axles	00100
First Check Sum	11
Reserved Frame Marker	11
Bearing Type code	010
Side indicator	1
Spare/Reserved	00000000000000000000000000000000
Security	000011000011
Data Format code	110011

Second Check Sum 112

2.1.2.5. One Example (there are more within the S918 document:



2.1.2.6. Air (ULD):

IATA Code - SAX

ULD Type - Full Contour Hazardous

Average Tare - 713

Base Dimensions (in inches) - 88 x 125 x 79

Volume (in cubic feet) - 418

Certified Weight - 13,300

Comments - Aluminum 88" full contour hazardous materials container

All ULDs are identified by their ULD number. A three-letter prefix identifies its type, followed by a 4 or 5 digit serial number to uniquely identify it from others of the same type, and ending with a two character (alpha-numerical) suffix identifying the ULD's owner (if an airline, same as IATA designator codes).

Example - SAX 12345 FX (means the ULD is an aluminum 88" full contour hazardous materials container with unique numbers 12345 and its owner is Federal Express). (The spaces are accepted practice in marking all ULDs).

Following is an excerpt from IATA: Recommended Practice 1640 – Attachment 'A' – Use of radio frequency technology for the automatic identification of unit load devices CSC(18)1640

OPERATIONAL REQUIREMENTS

The tag must be capable of:

- having a read-only data area and optionally a read/ write data
- encoding/decoding its information into a form suitable for the read/write equipment;
- being electronically secure and tamper-proof;
- installation on ULD's with fasteners or adhesives approved for such uses by the national aeronautical authorities;
- international application without modification or adjustment;
- working without a battery. However, if batteries are required, the vendor must certify that the batteries used comply with all relevant international regulations;
- a minimum life of five years or 200,000 reads of the mandatory data in normal operation without periodic maintenance;
- complying with all appropriate health and environmental specifications.

The reading equipment must be capable of:

- acquiring information contained in the tag when in range,
- be of a technology adaptable for fixed, mobile or portable application,
- complying with all appropriate health and environment specifications;
- may optionally:
  - consist of single or multiple readers,
  - have the capability to read tags that have a read/ write data area,
  - have the capability to write to tags that have a read/write data area.

Safety, Regulatory, Health and Environment

- When installed or operated in a particular country, the system must comply with all national and local governmental safety, aeronautical and radio regulations, and any other governmental rules and regulations which may apply, including those regarding human exposure levels.
- The system must not affect aircraft air worthiness.

Environmental Conditions

- All equipment will be subject to air, road, rail and marine transportation environments. Snow, ice, mud, salt spray, engine and hydraulic liquids, grease, including grime, can be expected to "coat" the tag and sensing equipment. Physical shock and vibration are commonly encountered as a result of handling and transport operation.
- Substantial and frequent temperature variations are common in worldwide air cargo operations as is prolonged exposure to sunlight, including ultraviolet rays. The tag must therefore operate satisfactorily under any conditions set forth in the RTCA DO-160.

Range

- Range shall be considered as the distance from a reader to the tag. A fixed reader must be capable of reading a tag at distances up to at least 5 m (16 feet, 5 in).

Passing Speed

- Passing speed shall be considered as the speed at which a tag passes a reader.
- A fixed reader must be capable of reading the first one kilobyte of information held in a tag at a passing speed of up to 10 m per second (32.8 feet per second).

Discrimination

- The system shall be capable of discriminating individual tags with a separation distance of 30 mm (1.18 in) between tags.

System Reliability and Accuracy

- System Reliability — the ability of the system to capture information from every tag, properly mounted, programmed and presented, which enters its coverage area.
- Requirement — tags which are properly mounted, programmed and presented to the sensing equipment shall have a minimum reliability of 99.99% or one no-read in 10,000 readings and an accuracy of 99.9999% or one undetected incorrect reading in 1,000,000 readings.

Tag Positioning

- A single tag shall be required to identify each ULD/GSE.
- The tag shall not be an impediment to loading. This means that the tag shall not protrude beyond the envelope of the ULD nor interfere with securing of the ULD in the restraint system on an aircraft. The tag shall have provision for permanent mounting that will not significantly impact the structural or environmental integrity of the ULD.
- The tag shall be located in the edge rail of the base of the container adjacent to a corner.
- Pallets — the tag shall be located in the edge rail of the pallet adjacent to pallet identifier.

3. Tag Characteristics and Specifications

The system must meet all applicable regulatory requirements for radio frequency technology on a universal basis, in all countries in which it may be deployed. The tag shall not itself originate or generate radio frequencies when not communicating with a reader.

- The tag shall be capable of being mounted on a container or on a pallet as specified in 6.5 of the requirements.
- The attachment method shall be determined jointly by the user and the equipment manufacturer.

- The tag shall meet or exceed the following environmental standards:

	Government Testing Value	Standard
Portal radiation devices (x-ray, gamma-ray)	American National Standard for Evaluation and Performance of Radiation Detection Portal Monitors for Use in Homeland Security ANSI N42.35-2006	Although RTCA DO 160-E address emission of radiation it doesn't address portal devices ..RTCA 160-E Emission of Radio Frequency Energy Section 21 I recommend considering ANSI N42.35-2006
Electromagnetic environment	These tests determine whether equipment will operate within performance specifications when the equipment and its interconnecting wiring are exposed to a level of RF modulated power, either by a radiated RF field or by injection probe induction onto the power lines and interface circuit wiring.	DO-160-E Section 20 Radio Freq. Susceptibility (Radiated and Conducted)
Cleaning	Test procedures include: Condensing Water Drip Proof Test; Drip Proof Test; Spray Proof Test ; and Continuous Stream Proof Test	DO-160-E Section 10 Waterproofness
Pressure resistance	See paragraph 4.6.3	DO-160E Section 4 Temperature & Altitude
Ice	See paragraph 4.5 Temperature Tests - low temp	DO-160E Section 4 Temperature & Altitude
Salt spray	Tests materials to determine if tag can withstand the deleterious effects of fluid contaminants.	DO-160E Section 11 Fluids Susceptibility
Engine and hydraulic liquids	Tests materials to determine if tag can withstand the deleterious effects of fluid contaminants.	DO-160E Section 11 Fluids Susceptibility

	Government Testing Value	Standard
Grease		Grease in and of itself probably won't have any effect on the RFID however grease can be harden by the presents of fungal growth….see DO-160E Section 13 paragraph 13.2
Cyclic Temperature	with a rate of change of 1 +/- 0.2ºC/min for four cycles	I EC 60068-2-14 Method Nb
Temperature Shock		IEC 60068-2-14, Method Na
Random Vibration	equivalent to an acceleration spectral density (ASD) of 3.0 m^2/s^3 RMS over an excitation frequency range of 10–200 Hz, and an ASD of 1.0 m^2/s^3 over the excitation frequency range of 250–2000 Hz for two hours for each X, Y, and Z axis	IEC 60068-2-64
Humidity	(-10ºC to +55ºC) at 95% relative humidity	IEC 60068-2-38, Method Z/AD
Rain	simulated rain environment at a rate of 40 mm/hr, with a drop falling height of 2m, tilt angles of 0º and 30º, and duration of 60 minutes at each angle	IEC 60068-2-18, Method Ra1
Drop shock	simulate a container (empty) drop from a height of 10 feet	IEC 60068-2-27, Method Ea
Sand and dust		IEC 68 Series (Mil. Std. 810E, Method 510.3)
Salt Mist	95°F salt mist environment for 96 hours. Salt mist is to be a solution of 5 parts per weight of high-quality NaCl to 95 parts per weight of distilled or demineralized water, having a pH between 6.5 and 7.2 at 32°C	DO-160E SECTION 14.0 Salt Spray
Frost/Ice	damp heat of 30°C (86°F) with a 95% relative humidity followed by a freezing temperature of -30°C (-22°C) for a total of 4 cycles	IEC 60068-2-39, Z/AMD

	Government Testing Value	Standard
Radiated Emissions	Verify that a device's levels of radiated emissions do not exceed the limits mandated in 47 CFR Part 15 or the limits for equipment installed in the bridge or deck zone of a ship. The following limits apply to equipment installed in the general power distribution area of a ship 80 dBµV/m to 50 dBµV/m over the range of 150 kHz to 30 MHz 60 dBµV/m to 54 dBµV/m over the range of 30 MHz to 100 MHz 54 dBµV/m over the range of 100 MHz to 2 GHz Except 24 dBµV/m over the range of 156 MHz to 165 MHz	
Radiated Susceptibility	1 V/m over the range of 2.0–2.7 GHz, 3 V/m over the range of 1.4–2.0 GHz, and 10 V/m over the range of 80–1000 MHz	IEC 61000-4-3
Magnetic Susceptibility	to assess the functional degradation caused by an external radiated emission of a power-frequency magnetic field of 30 A/m over the range of 30 Hz–100 kHz	IEC 61000-4-8
Static Electricity		IEC 61000-4-2, Method 1a
Nearby Lightning	simulate a lightning strike from close range (100m) with a peak current amplitude of 30kA having a transient magnetic field with a peak of 50 A/m	IEC 61000-4-9

4. Tag Data Content and Format

The tag shall have a minimum data capacity sufficient to contain the mandatory information in 2.2. This will normally be read-only, but may be amended subject to encryption protection by the owner. The encryption method may be decided and published separately. The tag may also have a variable data read/write capacity. All data elements must conform to Cargo-IMP standards. Only data elements not in Cargo-IMP, are defined here.

4.1. Mandatory Read Only Information

A one digit tag type. To distinguish between ULD's and other GSE, and read only — versus read/write, the ULD tag type will be as follows: 0 = ULD, read only,

1 = ULD, read/write,

2 = GSE, read only,

3 = GSE, read/write;

- a field containing the ULD ID code as specified in Resolution 686;
- a single character field delimiter, always coded as "/";
- a tare weight field with a unit of weight identifier;
- a single character field delimiter, always coded as "/";
- month and year of tag manufacture or battery change.

4.2. Optional Read/Write Information

The optional information will generally correspond to that contained in the ULD tag and be preceded by a field delimiter (/) to separate mandatory and optional information.

Each field is individually optional and may be repeated.

The field identifier shall be a single alphabetic character as defined below:

D — destination

O — loading airport

C — transfer airport

F — first flight

Y — flight date

G — second flight

P — loading position on first flight

Q — loading position on second flight

A — air waybill number/number of pieces loaded

N — baggage tag details — tags numbers

W — weight and unit of weight identifier Each field shall be separated by a field delimiter

Examples

- ULD ID Code (mandatory data only): 1AVE12345LH/200K/AUG89 1 tag type = ULD AVE12345LH = ULD ID Code 200K = tare weight of ULD in kg AUG89 = month and year of tag manufacture or battery change
- ULD ID Code (mandatory and optional data): 1AVE12345LH/200K/AUG89/OFRA/DJNB/FLH012/ Y03APR/A08112345675-9 OFRA = origin FRA DJNB = destination JNB FLH012 = loaded on flight LH012 Y03APR = flight date 03 April A08112345675-9 = Total of nine pieces of air waybill 081-12345675

4.3. Reference Values:

Reference values: Must stay consistent for all conveyance types.

Industry has indicated that if RFID is going to be adopted, then there may be a need to have more data stored as part of the asset/conveyance identifier than just the license plate ID. It does not mean that we want all data that could be referenced backend to become part of the ID, but to expect that some will be.

4.3.1. Rail:

Defined in S-918 (e.g.) - AAR

Axel

Car length

Weight

Car type

4.3.2. Ocean:

Defined in ISO 6834 (e.g.)

Container type

Tag placement (more than one)

Chassis

Genset

4.3.3. Truck: ATA (NA), Japan Truck Assoc., etc.

Type

Classification

Axels

Number of tires

License type

4.3.4. Trailers

Size

Genset

Reefer

Flatbed

Softside

4.3.5. ULD

Material type

Size

Cookie sheet

Air pallets

Cage

5. Tag Characteristics

All referenced read and speed will be in meter, km/h.

5.1. Sea: Container / Trailer

	Gate	Discharge / Load	Container Handling Equipment – Transtainer, Top pick/ Side Pick / Quay Cranes/hostler	Yard	CFS – Container Freight Station
Read Range	7	10	7	10	7
Moving Speed	20	20	15	40	5
Read Speed					
Tag Antenna angle of incidence varies (Y/N)	N	Y	Y	Y	N
Write speed	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Write Range	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Number of Tags	9	9	9	9	9

- Note read speed/write speed can be calculated using read range and vehicle speed.
- Note the write requirements are only for data in user memory (e.g. routing information, container weight)
- Tag commissioning will occur in the field and then applied to the conveyance.
- Note, the tag location will be consistent by conveyance type, but not across all conveyance types. Reader infrastructure will be deployed to optimize the read/write of the tag; including line of site to the tag.

5.2. Air: ULD, Air Cage, Air Pallet

	Load/Unload	Cross Dock	Handling Dolly	K-Loader	Yard Wide on the Ramp
Read Range	2	3	1	2	10
Moving Speed	5	25	0	5	25
Read Speed					
Tag Antenna angle of incidence varies (Y/N)	Y	N	N	Y	y
Write speed	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Write Range	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Number of Tags in field	20	20	20	20	100

- Note read speed/write speed can be calculated using read range and vehicle speed.
- Note the write requirements are only for data in user memory (e.g. routing information, container weight)
- 100 in field potentially for air “cookie sheets”
- Commissioning of conveyance tag will occur at a certified FAA (or equivalent) facility
- Note, the tag location will be consistent by conveyance type, but not across all conveyance types. Reader infrastructure will be deployed to optimize the read/write of the tag; including line of site to the tag.

5.3. Rail

	Along side load facility	On rail	Ingate/outgate Border crossing	Handling equipment and quay cranes	yard
Read Range	5	5	7	7	10
Moving Speed	0	130	50	15	40
Read Speed					
Tag Antenna angle of incidence varies (Y/N)	N	N	N	Y	Y
Write speed	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Write Range	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Number of Tags in field	5	1	20	20	4

- Note read speed/write speed can be calculated using read range and vehicle speed.
- Note the write requirements are only for data in user memory (e.g. routing information, container weight)
- Tag commissioning will occur in the field and then applied to the conveyance.
- Note, the tag location will be consistent by conveyance type, but not across all conveyance types. Reader infrastructure will be deployed to optimize the read/write of the tag; including line of site to the tag.

5.4. OTR

	On the road	Cross Dock/WHS/DC Receiving dock	Yard	Gate in gate out	Weigh stations, toll gate, border crossing
Read Range	10	7	10	7	7
Moving Speed	100	5	40	20	30
Read Speed					
Tag Antenna angle of incidence varies (Y/N)	Y	N	Y	N	Y
Write speed	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Write Range	Derived from above	Derived from above	Derived from above	Derived from above	Derived from above
Number of Tags in field	1	9	9	9	9

- Note read speed/write speed can be calculated using read range and vehicle speed.
- Note the write requirements are only for data in user memory (e.g. routing information, container weight)
- Tag commissioning will occur in the field and then applied to the conveyance.
- Note, the tag location will be consistent by conveyance type, but not across all conveyance types. Reader infrastructure will be deployed to optimize the read/write of the tag; including line of site to the tag.

6. Form Factors

It was decided that the air conveyance types would be separated from the others due to the high degree of regulation surrounding radio frequency and the air cargo industry. It does not mean that CAT tags used for rail, ocean, trucking, and trailers cannot be used by the air industry, but only the form factor for the later described tags will be similar and may not work for the air industry.

- The form factor for Truck, Rail, Ocean and Trailer will basically be the same
  - Tag width not to exceed: 60 mm (to fit within the ocean container corrugation)
- Mechanical dimensions of the CAT tag shall be based on the conveyance type and tag placement location on the conveyance. Dimensions of the tag shall not interfere with the loading or storing of the conveyance. If tags are placed externally on the conveyance, the dimensions of the tag will not extend beyond the edges of the conveyance. For Ocean, Tag must fit within the corrugation
- Mounting the CAT tag shall be based on conveyance type and environment conditions/requirements (screws, glue, spot weld, adhesive tape, etc.). If glue or adhesives are used to mount the tag to the conveyance, environment conditions (such as temperature, moisture, dust, dirt, vibration, etc.) that can affect the adhesion of the tag to the conveyance must be considered. Materials used in the composition of the conveyance type (metal, plastics, fiberglass, etc.) must also be considered when determining the mounting hardware or method. The CAT tag should not be mounted on removable conveyance doors.
- Once mounted to the conveyance type, dismounting the tag will break the tag. This will provide a level of physical tamper resistance. The tag cannot be removed from the conveyance without destroying the tag itself.
- The CAT tag must be capable of performing as described per the requirements when mounted upon a metal conveyance. Most conveyance types with the exception of air conveyance types may be made of metal. Air conveyance types may be metal as well, but some are made of other materials. Content of the conveyance types made of metal will not affect the tag capabilities. Content may have an affect on non-metal conveyance types.

7. Tag Location by Conveyance

Tag location shall be based on the conveyance type and usage requirements for the conveyance. The table below indicates the suggested location of the CAT tag based on general conveyance type. Under certain circumstances, two identical CAT tags can be placed on the conveyance to ensure a positive read of the CAT tag associated with the conveyance. Tag location may be placed on the inside or the outside of the conveyance, based on the materials used to build the conveyance. Optimally, tags should be placed in areas that are protected from shear or contact with other containers or surfaces that might scrape against the container. This can be in grooves, behind door bars, or rounded surfaces that may not have direct contact with other surfaces.

Air: The tag shall not protrude beyond the envelope of the ULD nor interfere with securing of the ULD in the restraint system on the aircraft. Permanent mounting will not negatively impact the structural or environmental integrity of the ULD.

7.1. Container tag positioning

The container tags shall not protrude beyond the envelope/exterior frame of the freight container and shall have no provisions for permanent mounting that will render the structural or environmental integrity of the freight container below its service requirements.

Two tags shall be affixed to each container but it is only necessary to read one of these tags for successful operations.

A tag, shall be located on the exterior surface of the right side panel (S) as seen from the door end of the container, approximately 0,3 m from the front end, in the case of containers of length 12,2 m or less (recessed between the first and second side panel corrugations, if available). For containers of length greater than 12,2 m, the tag shall be located approximately 0,3 m to the rear of the right front “40 ft. lifting position”, but in any case not more than 5,94 m from the transverse centre-line of the container. Figures 4 and 5 give these relationships.

7.2. Key

1 tag

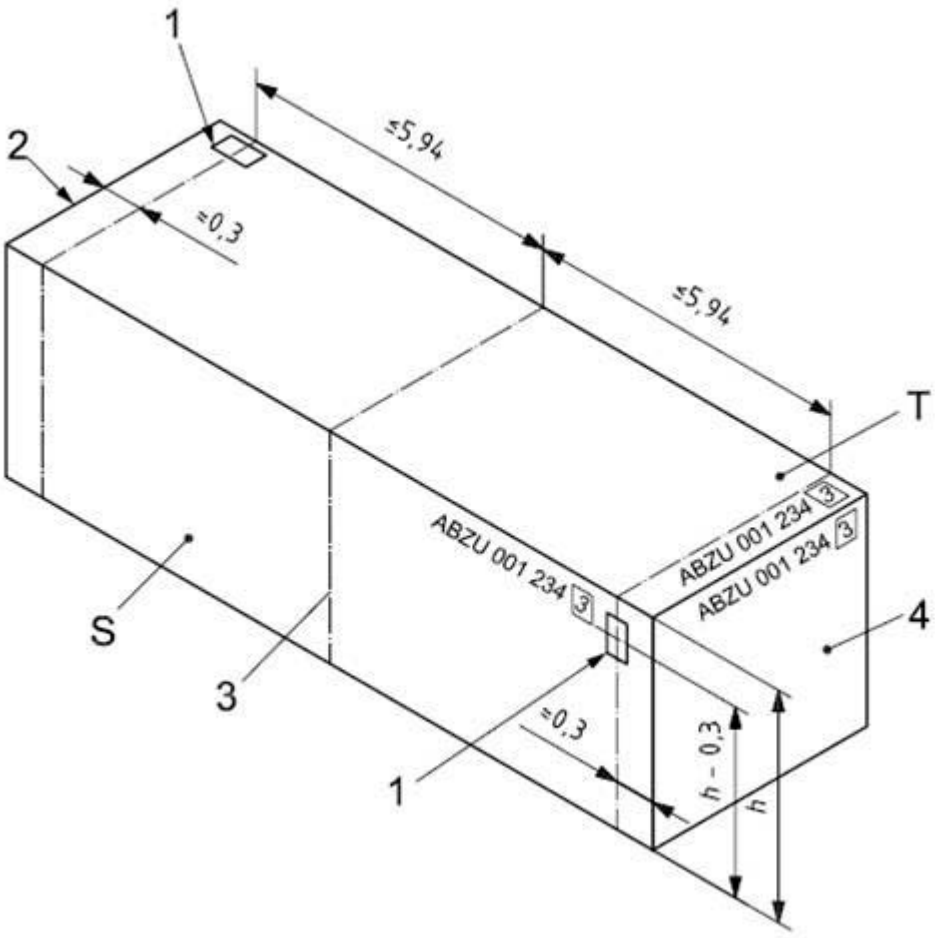
2 door end

3 transverse centre-line of container

4 front end

S side panel

T top



Container Type	Location
Ocean container (Tag 1)	**Per standard 10774/TS 10891**
Ocean container (Tag 2)	**Per standard 10774/TS 10891**
Trailers (Tag 1)	**top right hand quadrant of the nose, (viewing from the nose)** ****Left side for right side steering**
Trailers (Tag 2)	**Similar to side tag of ocean container**
Rail Car	**S918 version 2005**
Truck	**Driver side: Top rear side corner (1 side)**

Container Type	Location

ULD	**TBD:** **Front left top and/or back top right** **Note that some ULD doors are removable and tags should not be put on removable doors if the doors are not going to stay with the conveyance** **Further testing needs to be done to verify the mounting location.**
Air Cage	**TBD:** **Front left top. Further testing needs to be done to verify the mounting location.**
Air Pallet	**TBD:** **1. Top inside corner next to tie-down rail. Further testing needs to be done to verify the mounting location.**

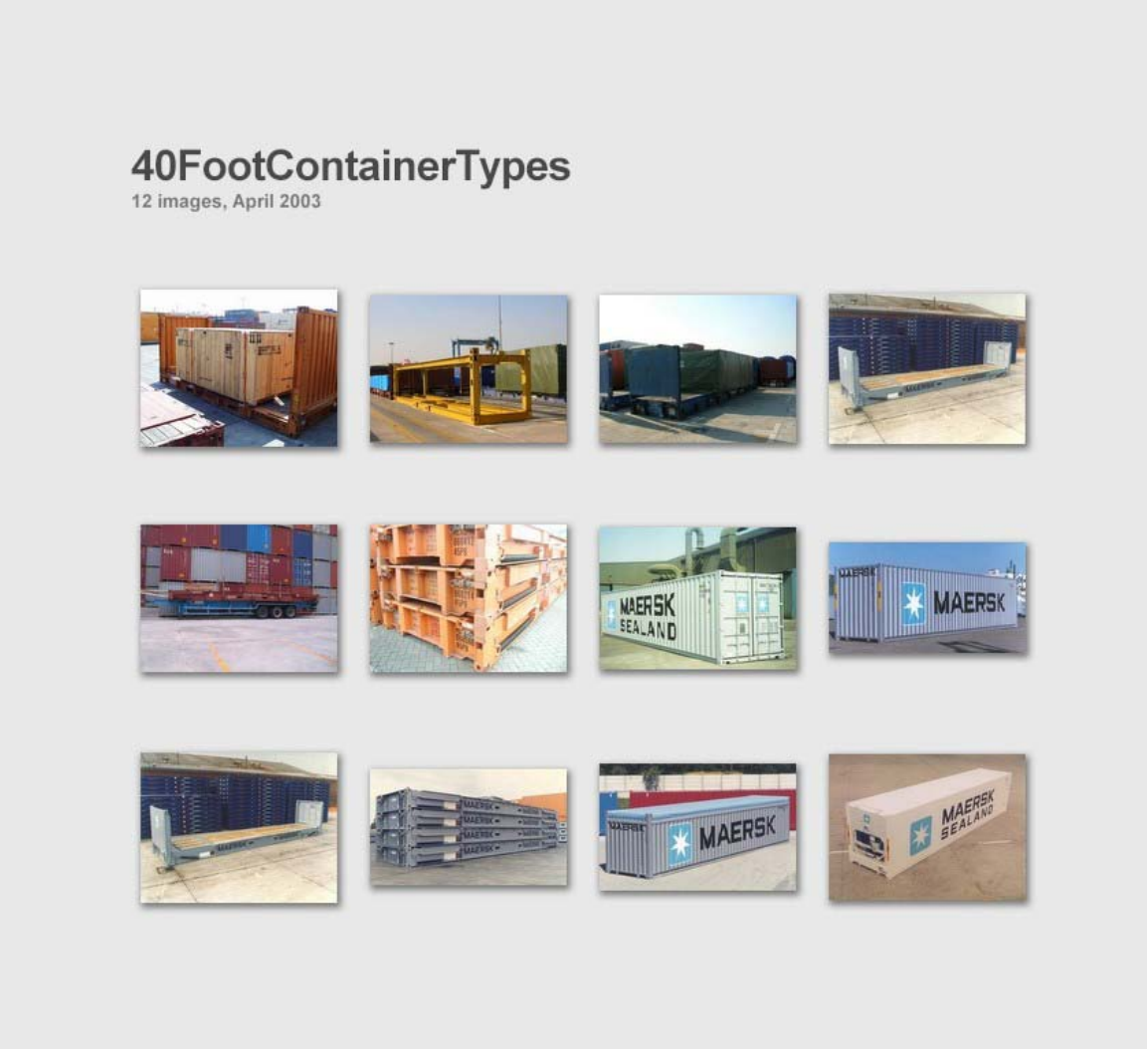
Note: Regarding tag density – There can be multiple tags per container and containers can be next to each other or on top of each other

8. Appendix

8.1. Sea Conveyance Types, Descriptions and Pictures

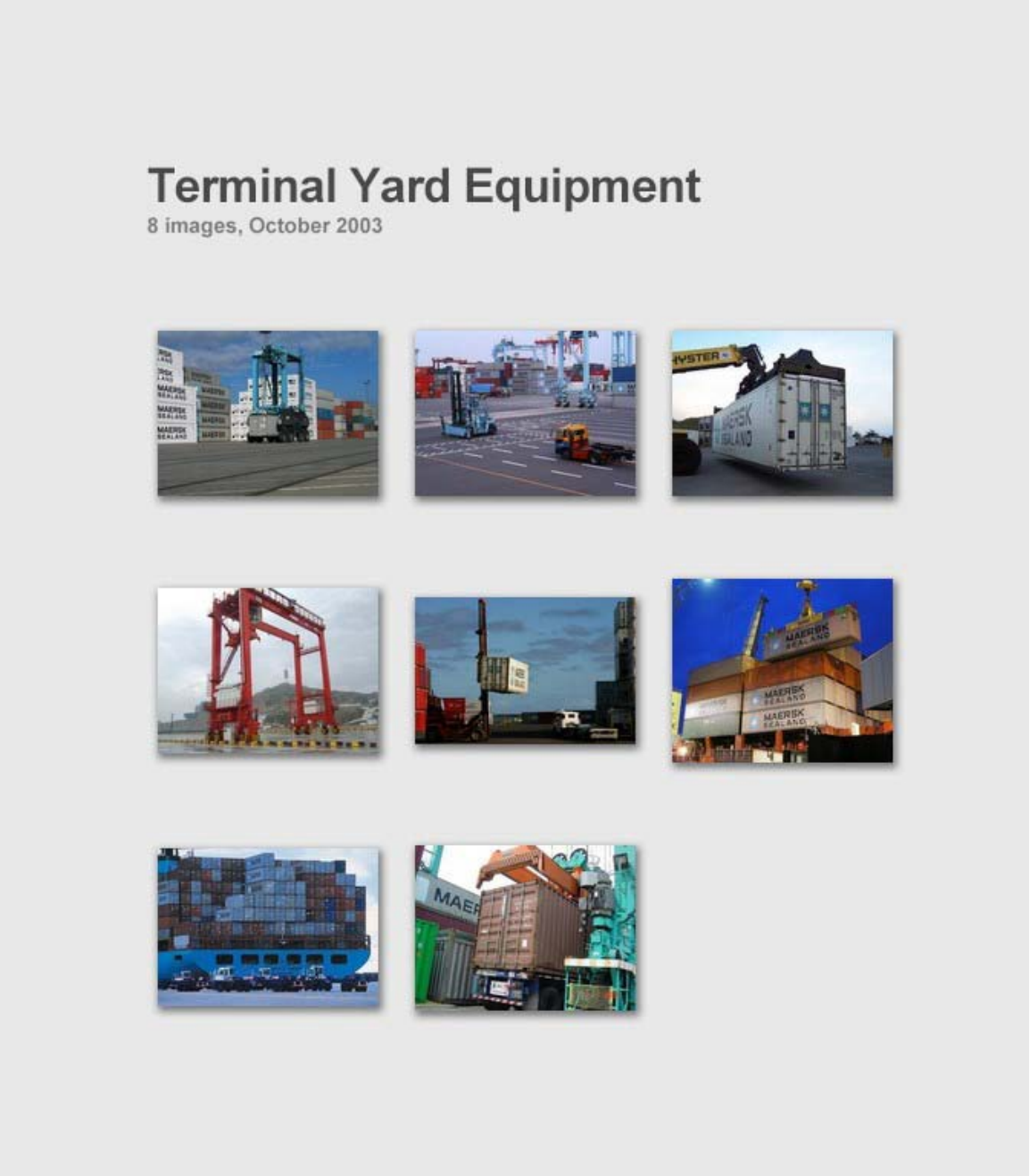
Container Size	Container Type	Description
20	DRY	20 x 8'6" DRY
40	DRY	40 x 8'6"DRY
20	FLAT	20 x 8'6"FLAT RACK
40	FLAT	40 x 8'6"FLAT RACK
20	HANG	20 x 8'6" HANGERTAINER
40	HANG	40 x 8'6" HANGERTAINER
40	HCHG	40 x 9'6" HI-CUBE HANGERTAINER
45	HCHG	45 x 9'6" HI-CUBE HANGERTAINER
40	HCPW	40 x 9'6" HI-CUBE PALLETWIDE
45	HCPW	45 x 9'6" HI-CUBE PALLETWIDE
40	HCRF	40 x 9'6" HI-CUBE DRY REEFER
40	HIGH	40 x 9'6" HI-CUBE DRY
45	HIGH	45 x 9'6" HI-CUBE DRY
48	HIGH	L- 47' 4", W - 8' 2", H - 9' 2"
53	HIGH	L- 52' 6", W - 8' 3", H - 9' 1"
20	OPEN	20 x 8'6"OPEN TOP
40	OPEN	40 x 8'6" OPEN TOP

Container Size	Container Type	Description
40	PLWD	40 x 8'6" PALLETWIDE
20	REEF	20 x 8'6"DRY REEFER
40	REEF	40 x 8'6" DRY REEFER
20	TANK	20 x 8'6" TANK
40	TANK	40 x 8'6" TANK
40	HRFA	40 x 9'6" HI-CUBE REEFER
20	ATD	20 x 2' ARTICIFIAL TWEENDECK
20	RFA	20 x 8'6" REEFER
40	RFA	40 x 8'6" REEFER
40	ATD	40 x 2' ARTICIFIAL TWEENDECK
20	BULK	20 x 8'6" BULK
20	HIVE	20 x 8'6" DRY VENTILATED
20	PLWD	20 x 8'6" PALLETWIDE
20	PORT	20 x 8'6" PORT REEFER
40	RFHV	40 x 9'6" REEFER VENTILATED
40	HDRY	



Reefer Equipment

3 images, December 2006



45Foot Container

2 images, December 2006

8.2. Air Conveyances Types

ULD Specifications						
IATA Code	**ULD Type**	**Average Tare**	**Base Dimensions (in inches)**	**Volume (in cubic feet)**	**Certified Weight**	**Comments**
AAE	Hazardous	550	88 x 125 x 79	383	13,300	Aluminum haz container (obsolete;a few still used)
AAK	LD-9	483	88 x 125 x 64	344	13,300	Aluminum 88" container (obsolete)
AAM	M-3	672	88 x 125 x 96	563.5	13,300	Aluminum 88" container (being phazed out)
AAM	M-3	735	88 x 125 x 96	565	15,000	Partial Lexan 88" container (being phazed out)
AAM	M-3	755	88 x 125 x 96	565	15,000	Full Lexan 88" container (being phazed out)
AMJ	M-1C	767	96 x 125 x 96	590.3	15,000	Full Lexan 96" container
AKE	LD-3	215	60.4 x 61.5 x 64	153	3,500	Full Lexan 60" LD-3 container
AVE	LD-3	182	60.4 x 61.5 x 64	153	3,500	Aluminum 60" LD-3 container
AWX	QC-11 Hazardous	518	60.4 x 125 x 79	265	7,000	Aluminum 60" haz container, ICU aircraft
AYX	Demi Hazardous	294	88 x 62 x 79	201.5	6,650	Aluminum 88" demi haz container
AYY	Demi	276	88 x 62 x 79	201.5	6,650	Aluminum 88" demi container
AYY	Demi	298	88 x 62 x 79	201.5	6,650	Partial Lexan 88" demi container
AYY	Demi	301	88 x 62 x 79	201.5	6,650	Full Lexan 88" demi container

ULD Specifications

IATA Code	ULD Type	Average Tare	Base Dimensions (in inches)	Volume (in cubic feet)	Certified Weight	Comments
AZA	Special	878	156 x 96 x 96	775	15,000	Single base, specialized freight container
SAA	Full Contour	575	88 x 125 x 79	427	13,300	Double base aluminum 88" full contour container
SAK	Ballast LD-9	5000	88 x 125 x 64	344	13,300	88" LD-9 ballast container (obsolete)
SAX	Full Contour Hazardous	713	88 x 125 x 79	418	13,300	Aluminum 88" full contour haz container
PAG	Pallet	240 w/net	88 x 125	variable	13,300	88" pallet
P1P	Pallet	240 w/net	88 x 125	variable	13,300	88" pallet
PKC	Pallet	179 w/net	62 x 60.4	variable	3,500	60" lower deck pallet
PLA	Pallet	216 w/net	60.4 x 125	variable	7,000	60" pallet
P9P	Pallet	216 w/net	60.4 x 125	variable	7,000	60" pallet
PMC	Pallet	260 w/net	96 x 125	variable	15,000	96" pallet
PMP	Pallet	260 w/net	96 x 125	variable	15,000	96" pallet
P6P	Pallet	260 w/net	96 x 125	variable	15,000	96" pallet
P6Q	Pallet	260 w/net	96 x 125	variable	15,000	96" pallet
PYY	Demi Pallet	143 w/net	62 x 88	variable	6,500	88" demi pallet
PAH	Ballast Pallet	5000	88 x 125	n/a	5,000	Not for Cargo

ULD Specifications						
IATA Code	**ULD Type**	**Average Tare**	**Base Dimensions (in inches)**	**Volume (in cubic feet)**	**Certified Weight**	**Comments**
PGA	Pallet	1035	96 x 238.5	variable	25,000	20-foot pallet
P7E	Pallet	1035	96 x 238.5	variable	25,000	20-foot pallet

The air conveyance types are:

- ULD (Unit Load Device)
- Composition: plastic (lexon), fiberglass, metal, canvas
- Dimensions: specific to aircraft to be used in

Examples:

"A" container in aircraft

"C" containers in aircraft

LD's

Air Pallet: Below is a cookie sheet (sitting on a scale/platform). In this example, the sheet is loaded with a regular wood pallet with cartons shrink-wrapped. A cargo net is usually placed over the freight and tied down. Usually there are clamps that will hold the cookie sheet in place.

Photos of ULDs and A/C Pallets

AYY (Demi)

AKE (LD3)

SAX (Full Contour Haz Can)

AMJ (Narrow Door)

AMJ (Wide Door)

AMJ (Bent Hoop)

AWX (QC-11 Haz Can)

SAA (Metal Door Style)

AKE (LD3)

PLA Pallet

PMC Pallet

SAA (Pull Down Center Door)

PAG Pallet

AZA (X-Box)

PGA (20 Foot Pallet)

AMJ with Net

Some photos show improper storage methods.

No ULD should be stored directly on the ground.

8.3. Notes on Frequency for OTR

Avoid using the following frequencies with the RFID tags, and this relatively common in the industry where cellular or satellite is already being used for tracking :

- Cellular 800 Mhz Band
- PCS 1900 Mhz Band
- L Band GPS 1575.42 Mhz
- L Band GPS 1227.60 Mhz
- Ultrasonic 40 Khz

RFID tags can range from 30 Hz to 5.8 Ghz. Some other specific tags known of transmit at the following frequencies:

- Low Freq (LF) = 125 KHz and 134 KHz
- High Freq (HF) = 13.56 Mhz
- Ultra High Freq (UHF) = 303.8 Mhz, 433 Mhz & 868 Mhz
- Microwave Freq = 915 Mhz

Notes on OTR Placement

Distance between rear edge of cab extension and front of trailer 24 to 30 inches based upon trailer fifth wheel position Size requirement preference not to exceed 12 x 12 x 1 inches is confirmed Photos of trailer front surface with Trailer Tracks installed 12 volt dc power limitations The center pin of the 7 way is fused at 20 amps. The current trailer fleet with ABS and Trailer Tracks pulls about 10amps. Wire degradation over the life of the trailer can negatively effect this power circuit -- Not all power equipment is powered through this pin either. This was driven by the ABS mandate in 1999. Power units prior to this date may not be equipped with this circuit.

8.4. OTR Conveyance Pictures

8.5. Rail


ba810.jpg


F_dosierbar_2Rad.jpg


F_dosierbar_4Rad.jpg


F_elektrohydraulisch_4Rad.jpg


F_pneumatisch_4Rad.jpg


F_schlagartig_hydraulisch_4Rad.jpg


F_schlagartig_hydraulisch_6Rad.jpg


F_schlagartig_mechanisch_4Rad.jpg


F_schlagartig_mechanisch_6Rad.jpg


F_schlagartig_pneumatisch_4Rad.jpg


gattung_E.jpg


gattung_F.jpg


gattung_G.jpg


gattung_H.jpg


gattung_K.jpg


gattung_R.jpg


gattung_S_6Rad.jpg


gattung_S_Blech_Ladegerust.jpg


gattung_S_Coil.jpg


gattung_S_Niederbinde.jpg


gattung_T_DachOeffn.jpg


gattung_T_gedeckt.jpg


gattung_U.jpg


H_4Glied_Geschlossen_2Stock_Auto_8Rad.jpg


K_KlappenSeiteStirn_RungenSeiteStirn_2Rad.jpg


K_KlappeSeiteStirn_0Rungen_2Rad.jpg


K_PlanendachOeffnungsfaehig_2Rad.jpg


kfz_Transport.jpg


kombinierter_Verkehr.jpg


T_DachOeffn_Rolldach.jpg


T_DachOeffn_Schiebetuer_Hubschwenk.jpg


T_DachOeffn_SchiebeWandDach.jpg


T_DachOeffn_Schwenkdach.jpg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