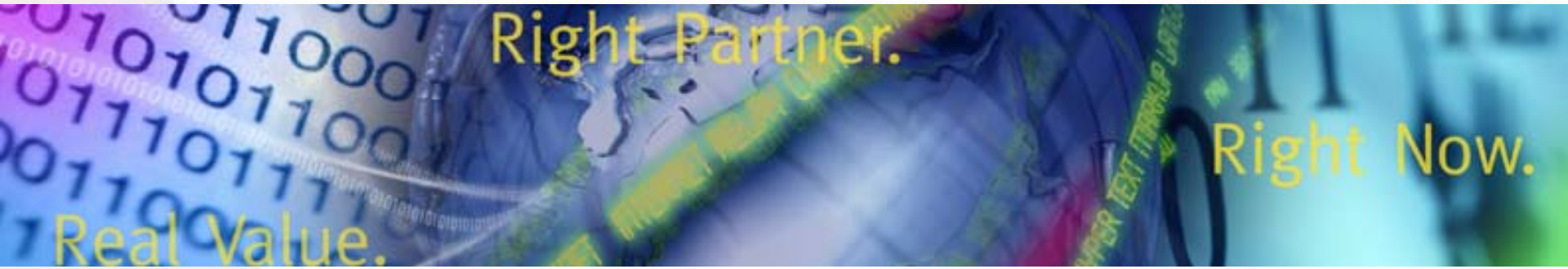

RFID & EPC Essentials

Version 01

EPCglobal

Overview

- What is EPC?
- Bit formats of GTIN, GLN & SSCC
- Bit formats of other keys
- Introduction to tags and readers
- Introduction to EPCglobal network

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What Is EPC?

- The tag, including a chip, an antenna and the packaging substrate
- A numbering scheme that uniquely identifies all objects
- Incorporates existing EAN.UCC keys, and very recently US DoD constructs
- Connects physical objects to computer networks

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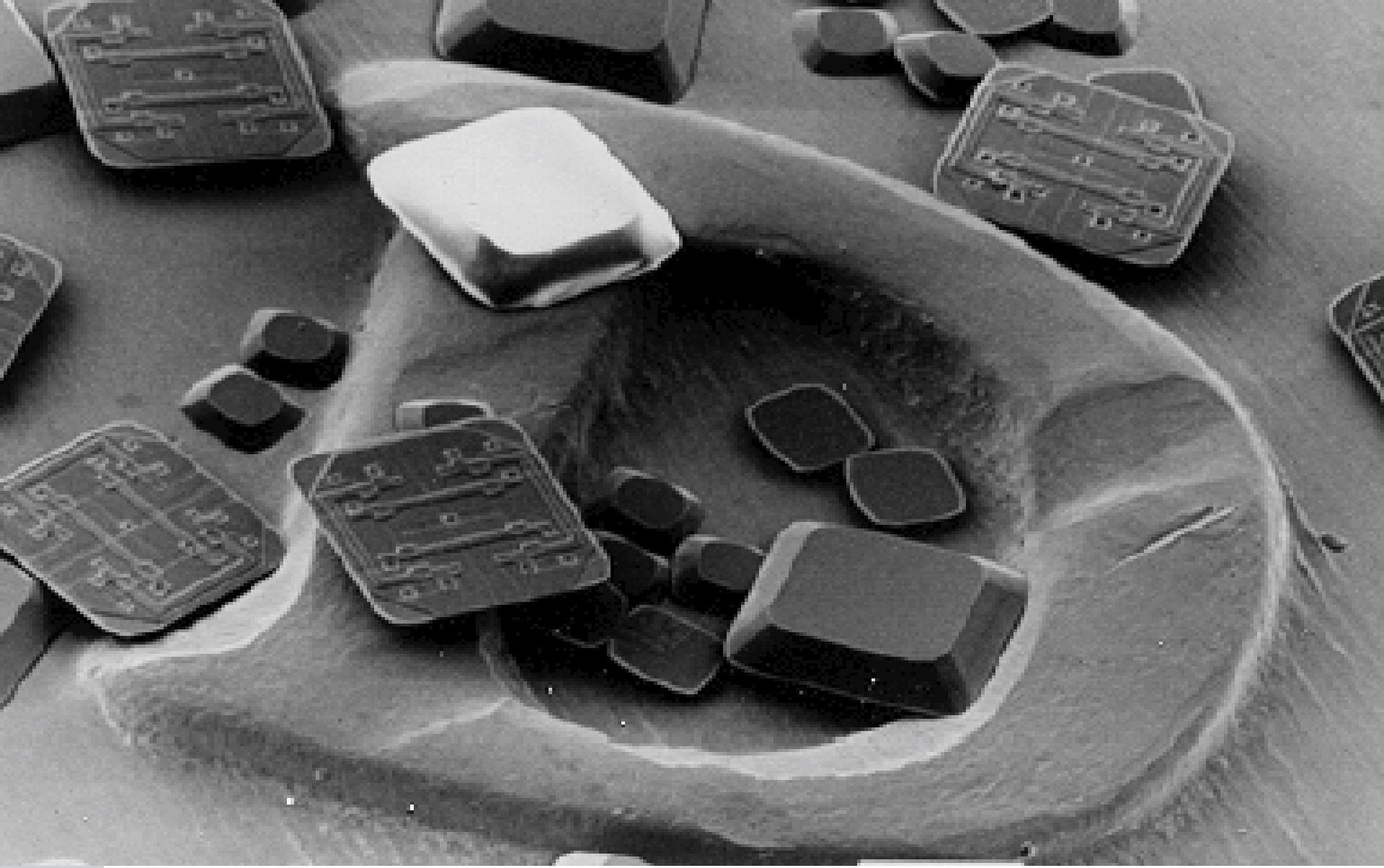

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Tags and Readers

Radio Frequency Identification - RFID

- Chip + antenna + packaging substrate = Tag
- Readers use radio waves –
  - non line-of- sight technology

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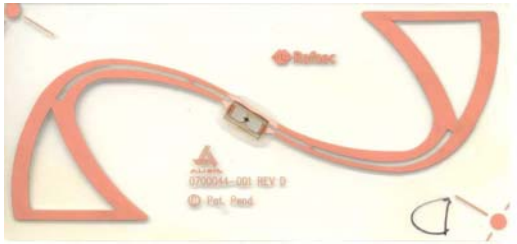
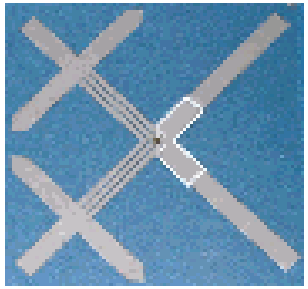
What do Tags Look Like?





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Tags and Readers

The reader ‘zaps’ the chip with a radio wave, the chip replies with its EPC

- EPC is the only thing stored on the chip
- The chip is passive (no power)

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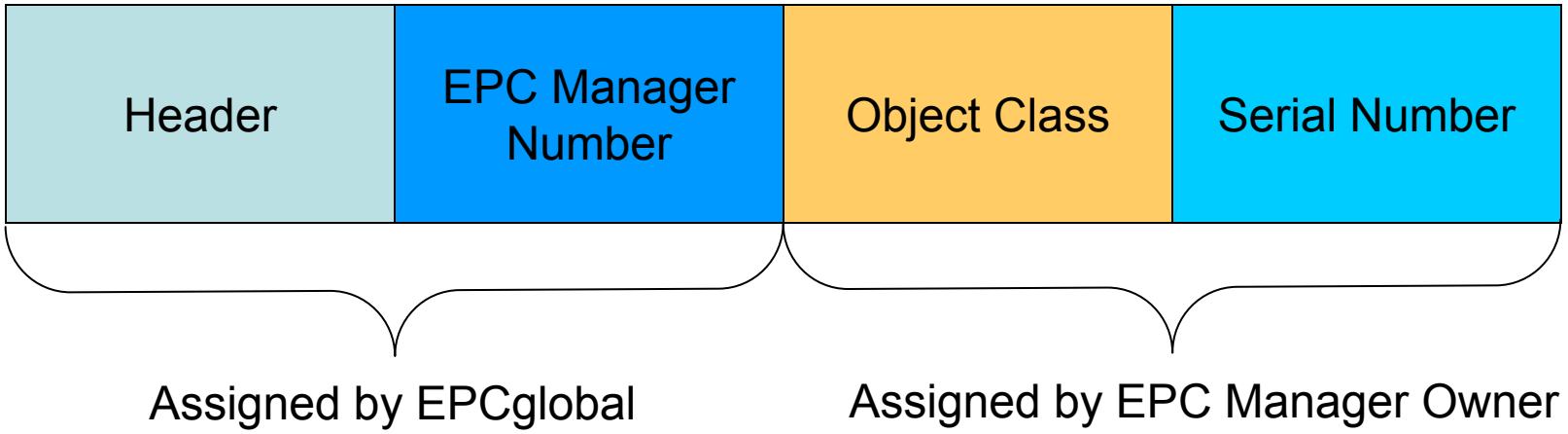
Basic Format



- Header
  - identifies the length, type, structure, version, and generation of the EPC
- EPC Manager Number
  - entity responsible for maintaining the subsequent partitions
- Object Class
  - identifies a class of objects
- Serial Number
  - identifies the instance

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EPC Structure

- Encoded on radio frequency tags in bits
  - 0's and 1's
- Provides multiple formats for
  - various bit length tags (64 and 96)
  - accommodates existing identifiers
- All formats support unique EPCs

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11 Schemes Defined in v1.1

- 64-bit and 96-bit formats for
  - GTIN
  - SSCC
  - GLN
  - GRAI
  - GIAI
- 96-bit format for
  - General Identifier (GID)
  - GID is not an EAN.UCC format

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64-bit Tags

- Widely available today
- Being used in pilots
- A temporary measure for immediate and cost-effective implementation
- Forward compatible with 96 bit chips
- Has some constraints

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Mapping GTIN into EPC

- **In 96-bit, variable length company prefix supported by a flexible partition**
- **In 64-bit, translation table required for company prefix**
- **In addition to GTIN**
  - **Serial number**
  - **Filter value**

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64-Bit SGTIN Format

	Header	Filter Value	Company Prefix *Index*	Item Reference	Serial Number
64-bit GTIN	2 bits	3 bits	14 bits	20 bits	25 bits
		8 (decimal capacity)	16,383 (decimal capacity)	9-1,048,575 (decimal capacity)	33,554,431 (decimal capacity)

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96-bit SGTIN Scheme

	Header	Filter Value	Partition	Company Prefix	Item Reference	Serial
96-bit GTIN	8 bits	3 bits	3 bits	20-40 bits	24-4 bits	38 bits
		8 (decimal capacity)	8 (decimal capacity)	999,999 - 999,999,999,999 (decimal capacity)	9,999,999-9 (decimal capacity)	274,877,906,943 (decimal capacity)

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SGTIN Partition

Partition Value	Company Prefix		Item Reference and Indicator Digit	
	bits	digits	bits	digits
0	40	12	4	1
1	37	11	7	2
2	34	10	10	3
3	30	9	14	4
4	27	8	17	5
5	24	7	20	6
6	20	6	24	7

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Mapping SGTIN

EPC	EPC Manager Number	Indicator Digit	Object Class	Serial Number
	0614141	0	00734	203886

GTIN	Indicator Digit	Company Prefix	Item Reference	Check Digit
	0	0614141	00734	9

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Example

Start with a UPC

- 614141 is the UPC Company Prefix
- 00734 is the Item Reference
- 9 is the Check Digit

614141 00734 9

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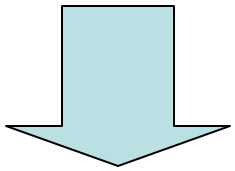
Example

Turn it into a Global Trade Item Number (GTIN)

- Add “0” indicator and “0” number system carrier to build out full 14 digit format

614141 00734 9



0 0614141 00734 9

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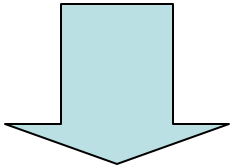
Example

Prepare for EPC™ encoding

- Move indicator to first digit of Item Reference
- Drop Check Digit

0 06 14141 00734 9



0614141 000734

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Encode into 96-bit EPC Tag

- Select header for SGTIN-96 (48)
- Filter Value (3 – shipping unit)
- Partition is determined by the length of the EAN.UCC Company Prefix (0614141 is seven digits, so the Partition Value is 5)
- Item Reference Number (000734)
- Add the Serial Number (203886)
- Decimal representation:

48 3 5 0614141 000734 203886

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Example

Partition	Value	Binary Number
Header	48	0011 0000
Filter Value	3	011
Partition	5	101
Company Prefix	0614141	000010010101111011111101
Item Reference	000734	00000000001011011110
Serial Number	203886	00000000000000000000110001110001101110

Tag data in bits – encode/decode won't be by hand!

0011 0000 000 101 000010010101111011111101 00000000001011011110
00000000000000000000110001110001101110

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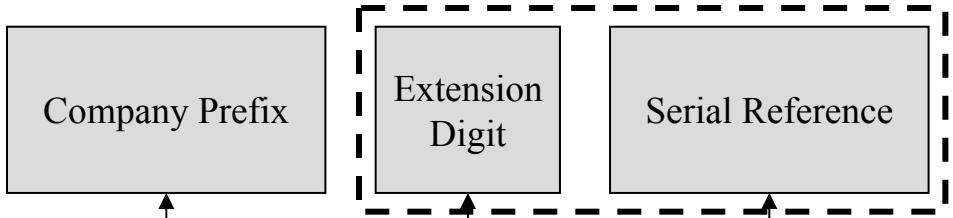
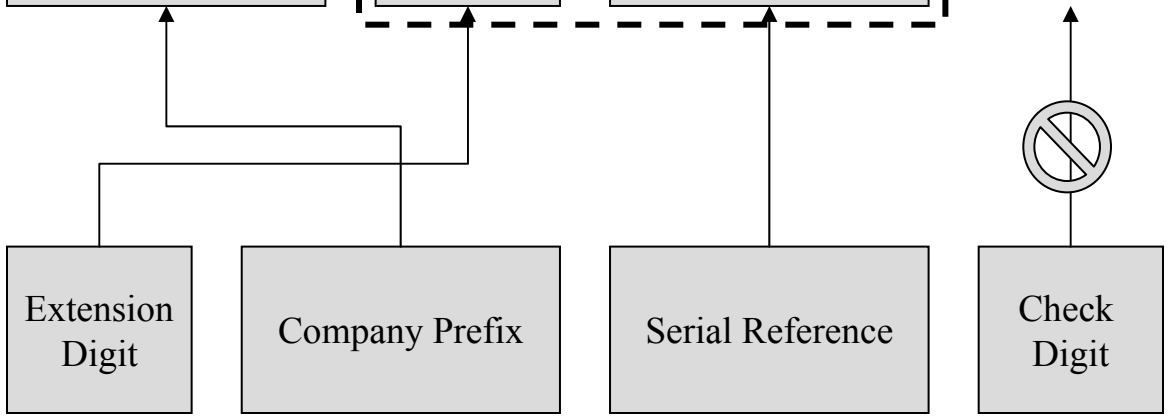
Mapping SSCC

0614141 0 000099777

SSCC EPC Encoding



SSCC Bar Code Structure



0 0614141 000099777 1

SSCC-96 Scheme

		Header	Filter Value	Partition	Company Prefix	Serial Reference	Unallocated
EPC	SSCC-96	8 bits	3 bits	3 bits	20-40 bits	37-17 bits	25
		0011 0001 (actual value)	8 (decimal capacity)	8 (decimal capacity)	999,999 – 999,999,999,999 (decimal capacity)	99,999,999,999 – 99,999 (decimal capacity)	[Not Used]
	Eg.	**049**	**3**	**5**	**0614141**	**0000999777**	
SSCC	Eg.			**0**	**0614141**	**000999777**	**1**
				Extension Digit	Company Prefix	Serial Reference	Check Digit

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SGLN-96 Scheme

	Header	Filter Value	Partition	Company Prefix	Location Reference	Serial Number
SGLN- 96	8 bits	3 bits	3 bits	20-40 bits	21-1 bits	41
		8 (decimal capacity)	8 (decimal capacity)	999,999 – 999,999,999,999 (decimal capacity)	999,999 – 0 (decimal capacity)	[Not Used]

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SGLN Partition

Partition Value	Company Prefix		Location Reference	
	bits	digits	bits	digits
0	40	12	1	0
1	37	11	4	1
2	34	10	7	2
3	30	9	11	3
4	27	8	14	4
5	24	7	17	5
6	20	6	21	6

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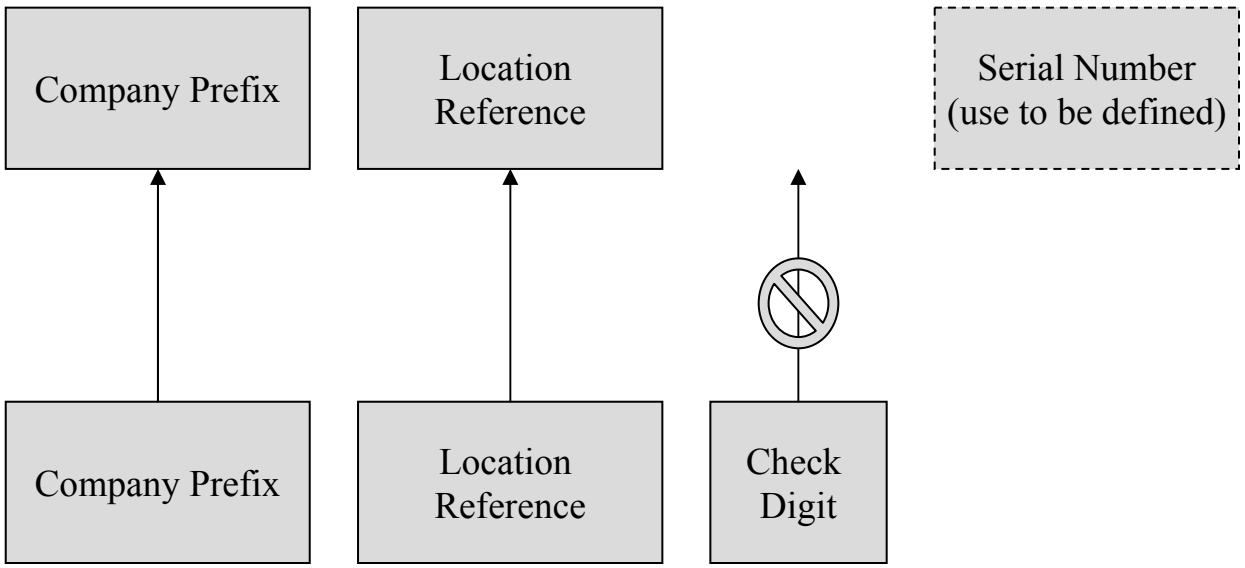
Mapping SGLN

0614141 00734

SGLN Bit-level Encoding

GLN Identity Structure



0614141 00734 9

Filter Value

- Not part of the EPC identifier
- Used during RF reads to select or mask out types of EPC
  - Screen out items not needed in distribution applications to improve RF reads
- Different for GTIN, SSCC, GLN formats
- Validated by GSMP early in 2005

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Other Keys in EPC

- Other keys will be accommodated by EPC in additional formats
  - US Department of Defense constructs
  - Any other industry with unique numbering systems
  - The formats must always result in unique EPCs

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