

# IBM LTO Ultrium Cartridge Label Specification (Revision 6)

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## ABOUT THIS DOCUMENT

This document is intended to provide a functional specification for the cartridge barcode label on LTO tapes, both with and without an embedded RFID tag, for use in tape automation solutions.

### Summary of Changes

#### Revision 0

First draft version.

#### Revision 1 - (July 2002)

- Added provision for using and labeling the Universal Cleaning Cartridge (UCC).
- Added general comment on Surface Reflectivity (page 2 )

#### Revision 2 - (released March 2005 )

- Modified to allow specific customer text. Sept 2004
- Definitions for Worm cartridge added. Oct 2004
- Added 'minimum' to the quiet zone length. Oct 2004

#### Revision 3 - (released November 2006 )

- Added definitions for Gen 4 Worm media

#### Revision 4 - (Released August 2007)

Added the definitions of an RFID tag that may be embedded within the Barcode Label and added environmental requirements.

#### Revision 5 - (Released April 2008)

Added further definitions of RFID tag contents and testing requirements for RFID tag read range.

#### Revision 6 - (Released February 2009)

Added further definitions of RFID tag contents.

## Introduction

This document defines format and contents of the external label on a LTO cartridge. The requirements stated herein are defined to standardize the label and allow users to purchase or print labels. Specific automation solutions may have additional requirements beyond the scope of this document. The objective of this document is to establish uniformity of the label content.

The LTO cartridge label uses the bar code symbology of USS-39. A description and definition is available from the Automatic Identification Manufacturers (AIM) specification Uniform Symbol Specification (USS-39) and the ANSI MH10.8M-1993 ANSI Barcode specification. Further, the definitions of an RFID tag that may be embedded within the Barcode Label are set forth.

## Surface Reflectivity

The front surface of the label shall have a matte or non-reflective finish.

## Optical Specification

The optical requirements and measurement techniques are further defined in the AIM Uniform Symbol USS-39 specification.

1. The print contrast of the Mcbeth PCMII shall be calibrated using the white calibration standard. All calibration and measurement shall be done with the filter select switch on position A.
2. The reflectivity of the white background, RW, shall be defined for use in note 3 as the reflectivity measured in the center of narrow spaces using the Mcbeth PCMII print contrast meter. RW shall be between 70% and 85%. This measurement should avoid isolated print defects and edge roughness.
3. A spot is defined as an area anywhere within the white background in which the reflectivity is less than 65%. No spot may be greater than 0,102 mm enclosed diameter. There may be no more than five (5) spots, in the bar code area, per label. No two spots may be within 0,254 mm of each other.
4. The reflectivity of the black areas, RB, may be measured anywhere within any black area on the barcode. The print contrast signal, PCS, shall be defined as  $(RW-RB)/RW$  and is to be measured using the Mcbeth PCMII print contrast meter. PCS shall be 0.85 minimum. The PCS measurement shall avoid isolated print defects and edge roughness.
5. A void is defined as an area within a black area in which the PCS is less than 0.85. No voids may be greater than 0,102 mm enclosed diameter. There may be no more than five (5) voids, in the bar code area, per label. No two voids may be within 0,254 mm of each other.

## Physical Parameters

The LTO label dimensions are derived using the AIM USS-39 specification. By cooperative agreement the recommended range of dimensions for LTO cartridges will be limited herein this specification.

1. Symbol height - 11,1mm minimum. As measured to the inside of the edge roughness.
2. Wide to narrow ratio - 2,75
3. Narrow element width - 0,432mm + 0,03/- 0,076 mm
4. Nominal width of the Wide spaces and bars is 1,188 mm.
5. Inter character gap - 0,432mm + 0,03/- 0,076 mm
6. Bar code element width maximum shall be measured to the outside of the edge roughness as defined in Note 10. Space width is then the distance between bar maxima.
7. Minimum quiet zones at beginning and end of printed barcode string - 10X narrow width = 4,32 mm. Total barcode string length (including quiet zones) nominal - 74,088 mm
8. The barcode string may be printed in either direction on the label. But, must begin/end with a valid start/stop character (★).
9. The edge of the bar code shall be defined as the edge of all printed area attached to the bar. The edge roughness shall be defined as the transition encountered as a horizontal line is moved vertically from all black to all white. The edge roughness shall be 0,038 mm maximum
10. Unless otherwise specified, tolerances are X,XXX ± 0,127 mm, X,XX ± 0,762 mm.
11. Variation between all wide bars, white and black, shall be less than ± 0,0381 mm.  
Variation between all narrow bars, white and black, shall be less than ± 0,0381 mm.
12. The barcode string is printed on the label so it is on the side of the label towards the hub.
13. Label stock dimensions: Must fit within the label recess on the face of the cartridge without curling up on the sides or ends. ( 79 mm X 17 mm +0/- 0,8). Minimum length sufficient for the quiet zones, start-stop and data characters (nominal 74.088 mm). Minimum width no less than 1,5 mm narrower than the cartridge label recess width. Corners are cut with a 1,5 mm radius.
14. The maximum label thickness when applied to a cartridge, including RFID tag if present, together with any associated layers and adhesives shall not exceed 0,40 mm.
15. The barcode label and associated adhesive shall have an environmental performance to match or exceed the environmental specifications of the cartridge to which it is applied.

## Encodation

The description/format of start, series of characters and the stop character is described in the AIM Uniform Symbol USS-39 specification.

## Quiet Zone

The quiet zones are the areas preceding the start and after the stop characters and is clear of any printing or reflective properties that would cause spurious reflections. Per AIM Uniform Symbol USS-39 specification.

## Barcode Label Data

The barcode data string shall consist of a start character, eight alphanumeric characters and the stop character. Quiet zones precede and follow the start/stop characters. The first six (6) characters may be any combination of upper case A-Z or 0-9 (e.g. ABC123) to identify the cartridge Volume Serial Number. The last two (2) characters are determined by the LTO cartridge Media Type (i.e. “L” for LTO and “1” for tape cartridge generation or drive manufacturer unique identifier).

No characters other than upper case alpha A-Z or numeric 0-9 are allowed.

Human readable characters are allowed provided there is no conflict or interference with the automation code. The format, colors and location of the human readable characters are at users specification.

If an RFID tag is embedded, identical “Volume Serial Number” and “Media Type” data, excluding start and stop characters, are to be recorded in the tag using ASCII stored in a hexadecimal format. After recording, the tag shall be locked so that it may not be altered.

## Human Readable Text

While the contents of the human readable text must include the data encoded in the barcode, this area of the label may be formatted to include customer defined text as agreed between the customer and the label vendor. Examples are shown in the figures on pages 7 and 8.

The human readable text must not interfere or intrude into the area defined for the barcode in any way. The specific customer text shall not be encoded in the barcode. The color of the characters and the background behind these human readable characters is by customer definition.

## RFID Tag Definition

1. The RFID tag shall conform to the specification - EPCGlobal Inc., Class 1 Generation 2 UHF Air Interface Protocol Standard, version 1.0.9. or later.
2. The range for a successful read of the tag after being placed on a cartridge must be at least 2.0 meters when measured with an Alien 8890 Fixed Reader (ETSI) and with the label face directed toward the reader. The cartridge shall be read individually and shall not be in a carrying case or other packaging.
3. The chip portion of the tag must be positioned under the human readable section of the Barcode Label so that any abrasion of the label surface caused by the increased thickness of the chip will not degrade the barcode.
4. The Tag shall have two data fields,
  - Field one shall be a minimum size of 216 bits.
  - Field two shall be a minimum size of 256 bits.

Field one shall be encoded as follows and then this entire field shall be locked by the label vendor

- ‘Header Field’ as defined by the EPC standard, (8 bits long). This field contains the hexadecimal number 0x35. (As an example the hexadecimal number 0x35 has a binary value of 0011 0101 ).
- ‘Manager Number’ as assigned to the label vendor by EPC Global Inc, (28 bits long) with the maximum possible decimal value of 268,435,455. This is encoded as a hexadecimal number. (As an example Manager Number 1234567 is 0x012D687 hexadecimal, which is encoded as 0000 0001 0010 1101 0110 1000 0111 binary ).
- ‘Object Class Field’, (24 bits long). This field shall be filled with 0x00 and then the hexadecimal representation of the ASCII values of the two character Media Type letters. The relevant Object Class data is listed in the table under the section ‘Volume Identifier Formats’ below. (As an example Media Type L4 becomes 4C 34 ASCII in hexadecimal format which is encoded as 0000 0000 0100 1100 0011 0100 ).
- ‘Sub Vendor Number’ as a hexadecimal number assigned by the owner of the Manager Number referenced above, (8 bits long). (This allows vendors to license out their process, including their Manager Number, to 256 others and yet still produce unique labels numbers). If there is no sub vendor this field shall be 0x00. (As an example Sub Vendor 0xA7 is encoded as 1010 0111 ).
- Sequence Number, (28 bits long). This shall be a non repeating hexadecimal number starting at zero. (Note: All Sub Vendors may start at zero without risk of duplication). (As an example Sequence Number 14,146 becomes 0x0003742 in hexadecimal which is then encoded as 0000 0000 0000 0011 0111 0100 0010 ).

- Date in YYDDD format, (40 bits long), encoded as the hexadecimal representation of the ASCII string. (As an example the date 18 Oct 2008 converts to 08291 in the YYDDD format. When represented in hexadecimal format this becomes 30 38 31 39 31 and is encoded as 0011 0000 0011 1000 0011 0001 0011 1001 0011 0001 ).
- VOLSER, (64 bits long) as defined in the section 'Barcode Label Data' above. Encoded as the hexadecimal representation of the ASCII string. (As an example Barcode Label 123ABCL5 when converted to ASCII in hexadecimal format becomes 31 32 33 41 42 43 4C 35 which then encodes as 0011 0001 0011 0010 0011 0011 0100 0001 0100 0010 0100 0011 0100 1100 0011 0101 binary ).
- Any remaining bits in the this Field shall be set to 0x00

Field two shall be set to 0x00 and shall not be locked by the label vendor.

### Volume Identifier Formats

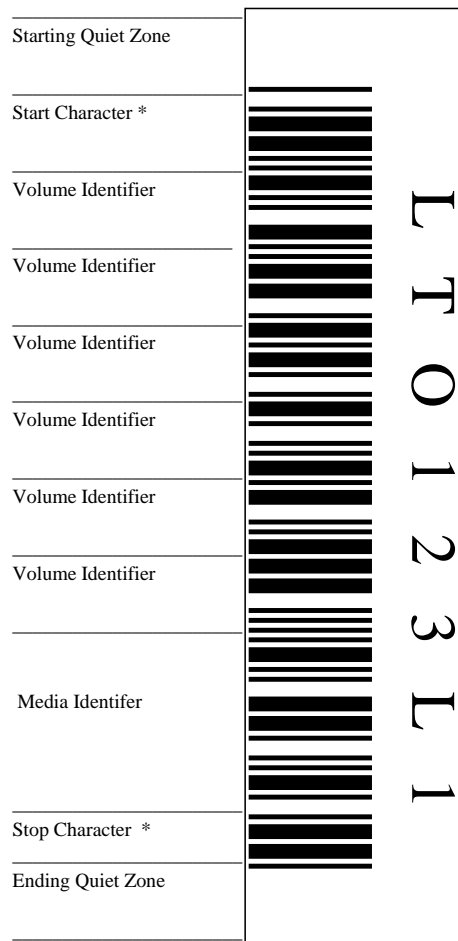
1. The volume identifier will be limited to the use of ASCII characters A-Z (41h-5Ah), 0-9 (30h-39h) and the combinations of "CLN" and "DG(space)" as described herein.
2. The prefix "CLNvnnL1" will be reserved for cleaning cartridges. The "v" field will be an alphanumeric field to identify cleaning cartridge applications, "U" for Universal Cleaning Cartridges or a drive unique identifier. The "nn" alphanumeric field will be used to track individual cleaning cartridge activity. (i.e. usage and life) When the drive requires cleaning it will request loading of the unique type cleaner cartridge. See note 1 below.
3. Diagnostic/Service cartridges will use the prefix "DG{space}vnnL1". The "v" field will be an alphanumeric field to identify a drive unique diagnostic cartridge if required. The "nn" alphanumeric field will identify a specific diagnostic cartridge volume.
4. The volume identifier field does consist of six (6) left justified alphanumeric characters. SCSI-3 Medium Changer Commands (SMC) ANSI NCITS 314-199X
5. The media identifier characters "Lg" are controlled characters. The "L" designates the LTO type of cartridge. The next character "g" (alphanumeric) will designate a generation and capacity of the LTO cartridge. Ultrium Generation 1 8-Channel Format Specification.

Note 1. In IBM tape drives and libraries the value of the "Media Type" characters on Cleaner Cartridges are ignored although a valid value must be present. Other vendors of drives, libraries and /or software applications may require specific values relating the generation of the drive being cleaned.

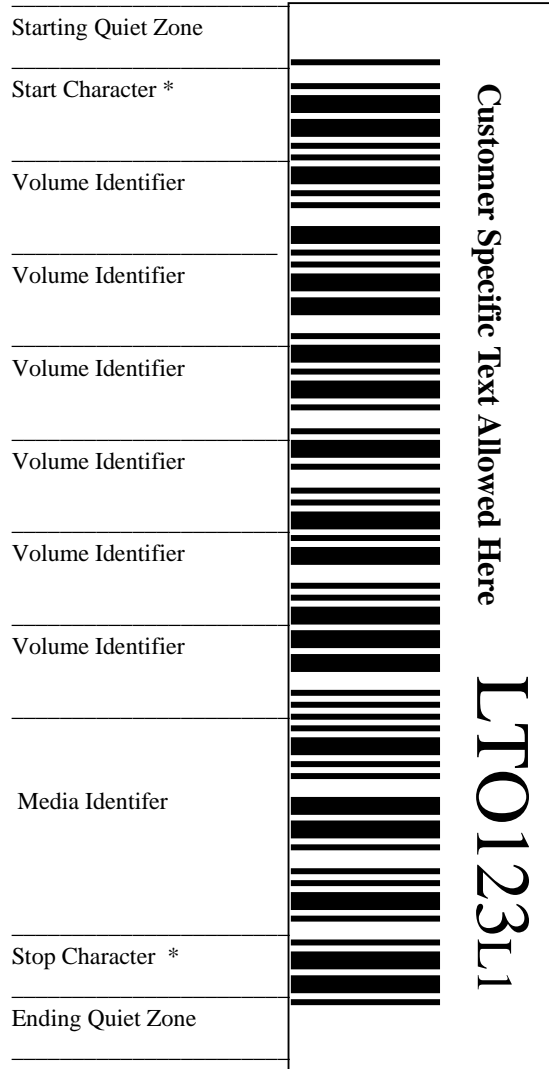
<b>MEDIA CHARACTER S</b>	<b>DEFINITION</b>	<b>NATIVE CAPACITY</b>	<b>Object Class for RFID tag</b>
L1	Generation 1 Type A	100 GB	0L1
LA	Generation 1 Type B	50 GB	0LA
LB	Generation 1 Type C	30 GB	0LB
LC	Generation 1 Type D	10 GB	0LC
L2	Generation 2 Type A	200GB	0L2
L3	Generation 3 Type A	400 GB	0L3
L4	Generation 4 Type A	800 GB	0L4
L5	Generation 5 Type A	1500 GB	0L5
L6	Generation 6 Type A	Future definition	0L6
L7	Generation 7 Type A	Future definition	0L7
L8	Generation 8 Type A	Future definition	0L8
L9	Generation 9 Type A	Future definition	0L9
LD		Future definition	0LD
LE		Future definition	0LE
LF		Future definition	0LF
LG		Future definition	0LG
LH		Future definition	0LH
LI	Not Used		
LJ		Future definition	0LJ
LK		Future definition	0LK
LL		Future definition	0LL
LM		Future definition	0LM
LN		Future definition	0LN
LO	Not Used		
LP		Future definition	0LP
LQ	Not Used		
LR	Generation 1	100 GB WORM Format	0LR
LS	Generation 2	200 GB WORM Format	0LS
LT	Generation 3	400 GB WORM Format	0LT
LU	Generation 4	800 GB WORM Format	0LU
LV	Generation 5	1500 GB WORM Format	0LV
LW	Generation 6	Future definition WORM Format	0LW
LX	Generation 7	Future definition WORM Format	0LX
LY	Generation 8	Future definition WORM Format	0LY
LZ	Generation 9	Future definition WORM Format	0LZ



**Barcode label (not to scale): Reference only - Normal text**



**Barcode label (not to scale): Reference only - Customer Defined text**



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