

SMPTE STANDARD

Unique Material Identifier (UMID)



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## Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Administrative Practices.

SMPTE ST 330 was prepared by Technology Committee 30MR.

## Intellectual Property

SMPTE draws attention to the fact that it is claimed that compliance with this Standard may involve the use of one or more patents or other intellectual property rights (collectively, "IPR"). The Society takes no position concerning the evidence, validity, or scope of this IPR.

Each holder of claimed IPR has assured the Society that it is willing to License all IPR it owns, and any third party IPR it has the right to sublicense, that is essential to the implementation of this Standard to those (Members and non-Members alike) desiring to implement this Standard under reasonable terms and conditions, demonstrably free of discrimination. Each holder of claimed IPR has filed a statement to such effect with SMPTE. Information may be obtained from the Director, Standards & Engineering at SMPTE Headquarters.

Attention is also drawn to the possibility that elements of this Standard may be subject to IPR other than those identified above. The Society shall not be responsible for identifying any or all such IPR.

## Introduction

The UMID is a unique identifier for audiovisual material that is locally created and globally unique. It differs from many unique identifiers in that the number does not depend wholly upon a pre-registration process, but can be generated automatically at the point of material origination without reference to a central resource.

## 1 Scope

This standard defines the format of the unique material identifier (UMID).

The UMID provides a method of identification for instances of audiovisual material and thus enables the material to be linked with its associated metadata. The UMID itself is neither intended for the identification of copyright nor the ownership of rights. Nor, for example, does it identify program content or works.

The UMID consists of an ordered group of components each providing a key aspect to the identification of the audiovisual material, be it picture, sound or data. A key property of a UMID generated in accordance with this standard is that it is possible to use the resulting UMID simply as a globally unique dumb number.

The UMID can exist in one of two forms:

- A basic UMID, which contains the minimum components necessary for unique identification; and
- An extended UMID, which attaches a packed metadata set (source pack) to the basic UMID.

This standard specifies the formats of each component in both the basic UMID and the extended UMID.

This standard also identifies and specifies methods by which the components of the identifier can be created.

A glossary is provided to define the terms used in this standard and this scope.

## 2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

### 3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 298:2009) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 298-2009). Documents with the same root number (e.g. 298) and publication year (e.g. 2009) are functionally identical.

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

SMPTE ST 298:2009, Universal Labels for Unique Identification of Digital Data

SMPTE ST 12-1:2008, Time and Control Code

SMPTE ST 309:1999, Television — Transmission of Date and Time Zone Information in Binary Groups of Time and Control Code

SMPTE ST 2029:2009, Uniform Resource Names for SMPTE Resources

SMPTE ST 336:2007, Data Encoding Protocol Using Key-Length-Value

SMPTE RP 210, Metadata Dictionary Registry of Metadata Element Descriptions

AES3-2009, AES Standard for Digital Audio Engineering — Serial Transmission Format for Two-Channel Linearly Represented Digital Audio Data

IEEE 1394-1995, High Performance Serial Bus

ISO 3166-1:2006, Codes for the Representation of Names of Countries and Their Subdivisions — Part 1: Country Codes

ISO/IEC 8859-1:1998, Information Technology — 8-Bit Single-Byte Coded Graphic Character Sets — Part 1: Latin Alphabet No. 1

IETF RFC 4122:2005, A Universally Unique Identifier (UUID) URN Namespace

DMA TR 8350.2, Department of Defense, World Geodetic System 1984. U.S. Defense Mapping Agency DMA TR 8350.2, Second Edition, 1 September 1991

### 4 Glossary of Terms

**audio-visual material:** Any one or any combination of picture (or video) essences, sound (or audio) essences and data (or auxiliary) essences. This term is also frequently referred to simply as “material”.

**dumb number:** A number, the value of which has no intrinsic meaning.

**essence:** An abstract term that describes any data or signal necessary to represent any single type of visual, aural or other sensory experience independent of the method of coding. Essence excludes any form of metadata.

**material unit:** The entity that represents the quantum of the audiovisual material defined by its cyclic sampling structure. The material unit duration depends on the type of material; examples being an AES3 block and a video frame. Note that the duration of a material unit is defined by the requirements of the audiovisual material type and its application. The value of the material unit duration is not specified in the basic UMID. It can, however, be specified in the source pack.

**metadata:** Data which conveys information about the audio-visual material. For example, information about identification, essence coding, timelines, intellectual property, business operations, etc.

## 5 General Specification

A unique material identifier (UMID) provides for the globally unique identification of any audiovisual material.

This standard defines a dual approach through the specification of a basic UMID and an extended UMID.

The basic UMID provides a globally unique identification for audiovisual material that comprises an integer number of one or more contiguous material units. The basic UMID has no embedded mechanism to distinguish between individual material units within a single instance of audiovisual material. The data in the basic UMID can be created through automatic generation.

The extended UMID comprises the basic UMID followed immediately by a source pack that provides a signature for material units. The source pack comprises a fixed length metadata pack of 32 bytes that provides sufficient metadata by which source “when, where and who (or what)” information can be identified regardless of current ownership or status. The extended UMID also provides a mechanism to distinguish between individual material units within a single instance of audiovisual material.

The basic UMID is 32 bytes long and the extended UMID is 64 bytes long.

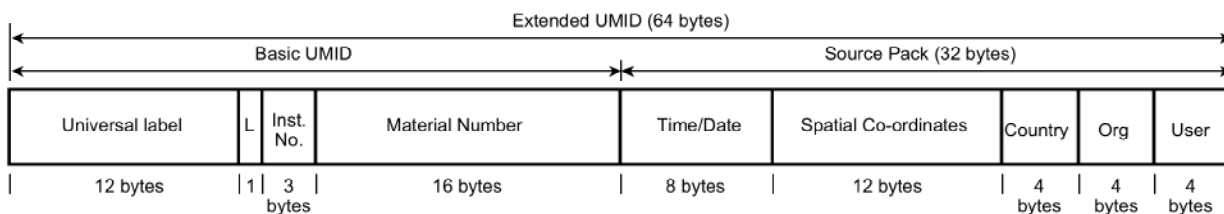
Both UMID types use the key-length-value construct defined by SMPTE ST 336. The key is a 16-byte universal label truncated to 12 bytes.

In the case of the basic UMID, the length field has a value of 13h and the value is formed by the combination of a material number and an instance number.

In the case of the extended UMID, the length field has a value of 33h and the value is formed by the combination of the material and the instance numbers followed by the source pack.

All components of the UMID have a defined byte order for consistent application in storage and streaming environments.

Figure 1 illustrates the layout of the both basic UMID and the extended UMID.



**Figure 1 – Basic and extended UMID structures**

The components of the basic UMID are:

1. A 12-byte universal label,
2. A 1-byte length value,
3. A 3-byte instance number, and
4. A 16-byte material number.

The combination of the instance and material numbers can be treated as a dumb number.

Note: The material number does not indicate the status of the material (such as copy number) or its representation (such as the compression kind). The material number can be identical in copies and in different representations of the material. The purpose of the instance number is to separately identify different representations or instances of audiovisual material. Thus, for example, a high-resolution picture and a thumbnail can both have the same

material number because they both represent the same picture but, because they are different instances, they will have different instance numbers for the different representations. Guidance for the consistent application of new material numbers and instance numbers is given in SMPTE RP 205.

The extended UMID comprises a basic UMID, followed by a source pack. The components of the source pack are:

1. An 8-byte date stamp and unit count component,
2. A 12-byte geospatial coordinate,
3. A 4-byte country code,
4. A 4-byte organization code, and
5. A 4-byte originator code.

Notes:

1. The source pack metadata only represents that information available at the time when the extended UMID is first applied. The source pack values therefore refer to the “when, where and who (or what)” at the point of application of the source pack and this can differ from the originating device.
2. All metadata fields in the source pack can be automatically generated for each material unit using a timer, a global position calculator and pre-registered identification data. Where automatic generation of any value is not possible, it can be manually entered.
3. The source pack needs to be registered in a Metadata Groups Register.
4. The terms origination and originator above refer to physical origination and have no meaning in terms of intellectual property.

## **6 UMID Format Specification**

Section 6.1 defines the basic UMID, Section 6.2 defines the extended UMID, and Section 6.3 defines the source pack.

Number formats including the material and instance numbers together with the date/time and geospatial coordinate fields shall be presented with the least significant byte first (also known as little-endian byte order) unless otherwise defined.

### **6.1 Basic UMID**

#### **6.1.1 Structure of the Basic UMID**

The basic UMID shall be 32 bytes long, and shall contain a 12-byte universal label, a length, an instance number, and a material number in this order with each item as defined below.

#### **6.1.2 12-Byte Universal Label**

The 12-byte universal label defines the type of material, which the UMID identifies and the methods by which the material number and instance number are created.

The first 12 bytes of the UMID shall identify the UMID with a SMPTE universal label as defined by SMPTE ST 298 having the registered string value defined in Table 1.

Table 1 – UMID universal label

Byte No.	Description	Value (hex)	Meaning
1	Object identifier	06h	Universal label start
2	Label size	0Ah	12-byte Universal label
3	Designation: ISO	2Bh	ISO registered
4	Designation: SMPTE	34h	SMPTE registered
5	Registry category	01h	Dictionaries
6	Specific category	01h	Metadata dictionaries
7	Structure	01h	Dictionary standard (SMPTE ST 335)
8	Version number	05h	Version of the metadata dictionary (defined in SMPTE RP 210)
9	Class	01h	Identifiers and locators
10	Subclass	01h	Globally unique identifiers
11	Material type	XXh	See Section 6.1.2.1
12	Number creation method	YYh	See Section 6.1.2.2

Note: SMPTE ST 298 defines SMPTE labels as having a length of 16 bytes. The 12-byte UMID universal label is still a valid and unique ISO object identifier as defined in SMPTE ST 298. When the UMID universal label is used in isolation, the 12-byte UMID universal label can be converted to a SMPTE label by padding with 4 bytes of null fill and changing the value of the label size in byte 2 from '0Ah' to '0Eh'.

#### 6.1.2.1 Material type identification

Byte 11 of the UL shall define the material type being identified using one of the values defined in Table 2.

The use of material types '01h', '02h', '03h' and '04h' shall be deprecated for use in implementations using this revised standard. These values are preserved only for compatibility with systems implemented using SMPTE ST 330:2000.

**Table 2 – Material type identification**

Byte value	Meaning	Examples and notes
01h	picture material	Deprecated
02h	audio material	Deprecated
03h	data material	Deprecated
04h	other material	Deprecated (originally not only picture, audio, or data material, but also a combination of material types)
05h	single picture component	e.g. Y component
06h	Two or more picture components in a single container	e.g. interleaved Y, Cb and Cr components
08h	single audio component	e.g. mono audio
09h	two or more audio components in a single container	e.g. AES3 audio pair
0Bh	single auxiliary (or data) component	e.g. sub-titles only
0Ch	two or more auxiliary (or data) components in a single container	e.g. multiple sub-titles streams in different languages
0Dh	mixed group of components in a single container	e.g. video & stereo audio pair
0Fh	material type is not identified	

### 6.1.2.2 Number creation method identification

Byte 12 of the UL shall define the method by which the material and instance numbers are created. This byte is divided into top and bottom nibbles for the purpose of this definition.

The top nibble shall occupy the 4 most significant bits (MSBs) of the byte and the value shall be used to define the method of material number creation. The values used by this nibble shall be limited to the range 0 to 7h so that byte 12 conforms to the ASN.1 BER short form coding rules used by SMPTE ST 298.

The methods of material number generation shall be as defined in table 3 and the specification of the each method shall be as defined in Annex A.

Note: New material number generation methods can be added by amendment or revision of this document. Each addition will provide the proposed value (within the range of values currently identified as “Reserved but not defined”) for inclusion in Table 3 together with the supporting definition to be added to Annex A.

**Table 3 – Identification of material number generation method**

Value (hex)	Method
0	No defined method
1	SMPTE method
2	UUID/UL method
3	Masked method
4	IEEE 1394 network method
5-7	Reserved but not defined

The bottom nibble shall occupy the 4 least significant bits (LSBs) of the byte and the value shall be used to define the method of instance number creation. The values used by this nibble shall be unlimited and thus occupy the range 0h to Fh.

The methods of instance number generation shall be as defined in table 4 and the specifications of each method shall be as defined in Annex B.

Note: New instance number generation methods can be added by amendment or revision of this document. Each addition will provide the proposed value (within the range of values identified as "Reserved but not defined") for inclusion in Table 4 together with the supporting definition to be added to Annex B.

**Table 4 – Identification of instance number generation method**

Value (hex)	Method
0	No defined method
1	Local registration
2	24-bit PRS generator
3	Copy number and 16-bit PRS generator
4 ~ E	Reserved but not defined
F	Live stream

### 6.1.3 Length

The length field defines the length of the remaining parts of the UMID.

The length shall be a 1-byte number with the value 13h for a basic UMID and 33h for an extended UMID.

### 6.1.4 Instance Number

The 3-byte instance number shall identify different instances of material where each instance shares a common material number. An instance number allows each instance to be linked to all metadata associated with that particular instance of the material.

The instance number shall be created by one of the methods identified in Table 4 and defined in Annex B.

The origination of new audiovisual material shall require the creation of a new material number together with an instance number that shall be initialized to zero to identify the original material.

### 6.1.5 Material Number

The 16-byte material number shall be globally unique for every item of material and having the same value for related instances of the same audiovisual material only where the instance number is used to uniquely identify these related instances.

A common material number may be used to identify all instances of the same material.

The 16-byte material number shall be created by one of several means identified in Table 3 and defined in Annex A. Annex A defines methods by which the material number can be generated and which are known to provide a high likelihood of being unique.

Note: A common material number allows a given instance of the material to be linked to other instances of the same material.

## 6.2 Extended UMID

The extended UMID shall be 64 bytes long and shall comprise a basic UMID (with a length value of 33h), followed by a source pack.

## 6.3 Source Pack

The source pack is a metadata pack that identifies the source of a material unit by defining the “when, where and who (or what)” of the material unit with which it is associated.

The source pack shall only be present in the extended UMID.

Once a non-zero source pack field value has been included in an extended UMID, it shall not be changed and shall always relate to its associated material unit.

The source pack shall be 32 bytes long, and shall contain a date and time stamp, geospatial coordinates, a country code, an organization code, and a user code in this order with each item as defined below.

Any component of the source pack may be zero-filled where no meaningful value can be entered. Any zero-filled component shall be wholly zero-filled to clearly indicate to a downstream decoder that the component does not contain a meaningful value.

### 6.3.1 Date Stamp and Unit Count Component

The date stamp and unit count component of the source pack provides the temporal information (the “when”).

The date stamp and unit count component shall identify the time and date of origination of the material unit with which the source pack is associated.

Sections 6.3.1.1 and 6.3.1.2 are deprecated for future use but are documented for legacy. Section 6.3.1.3 now defines the temporal information.

#### 6.3.1.1 Date stamp and time-code unit count format for picture related material (deprecated)

The use of this date stamp and time-code unit count method for picture related material shall be deprecated for use in systems using this revised standard. These values are preserved only for compatibility with SMPTE ST 330:2000.

In the case where the material unit is picture related and the material type identifier (byte 11 of the UL) has the value ‘01h’, ‘03h’ or ‘04h’, the 8-byte date stamp and unit count shall be as defined in Figure 2.

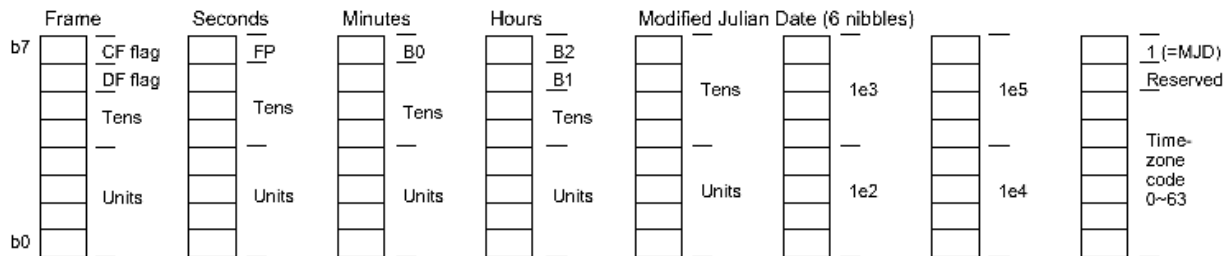


Figure 2 – Picture related date stamp and unit count data format

The first four bytes shall be as defined by SMPTE ST 12-1 and the last four bytes shall be as defined by SMPTE ST 309.

A list of the abbreviated terms in Figure 2 and their full names follows:

CF flag: Color frame flag;

DF flag: Drop frame flag;

FP: Field phase (525/60), Binary group flag 0 (625/50);

B0: Binary group flag 0 (525/60), Binary Group Flag 2 (625/50);

B1: Binary group flag 1 (525/60 and 625/50).

B2: Binary group flag 2 (525/60), Field phase (625/50);

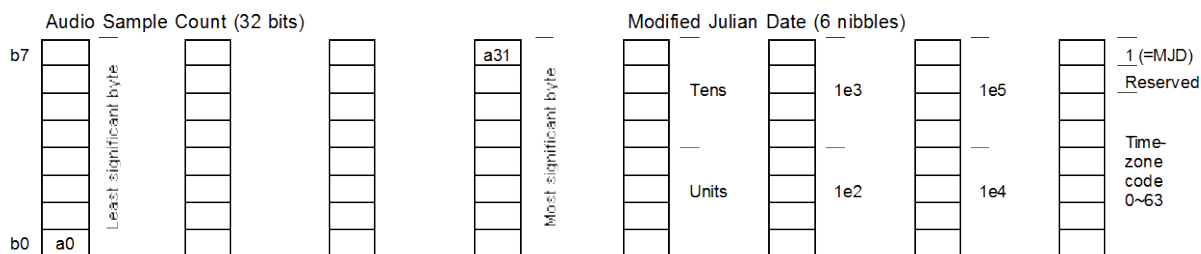
The date format shall use the modified Julian date (MJD). The allocation of the MJD data fields and the values of the binary group flags shall be as defined in SMPTE ST 309.

This format is deprecated for use with new implementations, but the information is provided for backwards compatibility.

**6.3.1.2 Date stamp and unit count format for audio related material (deprecated)**

The use of this date stamp and unit count format for audio related material method shall be deprecated for use in systems using this revised standard. These values are preserved only for compatibility with SMPTE ST 330:2000.

In the case where the material unit is audio related and the material type identifier (byte 11 of the UL) has the value '02h', the data format for the 8-byte date stamp and unit count shall be as described in Figure 3.



**Figure 3 – Audio related date stamp and unit count data format**

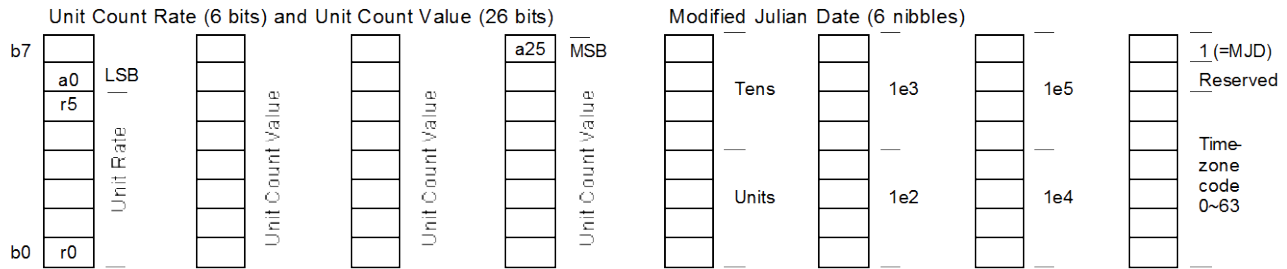
The first 4 bytes represent time by a unit count rate of 48 kHz with the count starting from midnight (as defined by AES3). The 32 bits for the time component allow a maximum count range of 4,294,967,296. The sample count is based on 48-kHz audio sampling, which has 4,147,200,000 counts in a 24-hour period.

The date format shall use the modified Julian date (MJD). The allocation of the MJD data fields is defined in SMPTE ST 309.

This format is deprecated for use with new implementations, but the information is provided for backwards compatibility.

**6.3.1.3 Date stamp and unit count for all material types (single and in combination)**

In the case where the material unit has a material type identifier (byte 11 of the UL) with any value of '05h' or higher, the data format for the 8-byte date stamp and unit count shall be as described in Figure 4.



**Figure 4 – Date stamp and unit count data format**

Bits 0 to 5 of the first byte (bits r0 to r5 in Figure 4) shall be used to identify the unit count rate. The remaining 26 bits in the first four bytes (bits a0 to a25 in Figure 4) shall be used as the unit count value within a 24-hour period starting at midnight.

The unit count rate values shall be as defined in Table 5.

Note: New unit count rate values can be added to Table 5 by amendment or revision of this document. Each addition will define the proposed decimal value, the unit count rate value (within the range of values currently identified as “Reserved but not defined”) and a definition of the intended application for inclusion within the table.

**Table 5 – Identification of unit count rate**

Decimal Value of bits r5~r0	Unit Count Rate (Hz)	Intended Application
0 (default)	750	Default operation. This is equivalent to an audio frame rate of 48 kHz which, using the 192 sample AES3 block interval, results in a constant value for the 6 LSBs. In this case the 6 LSBs (r5~r0) are effectively set to zero.  This rate is intended to support AES3 block rates for an audio frame rate of 48 kHz. In this case, the count will increment in steps of 3 for each new AES3 block duration.  This rate is also intended to provide a default count method for all other material types and can be used as a method of calculating time within a 24 hour period.
1	500	This rate is intended to support AES3 block rates for an audio frame rate of 32 kHz and will increment in steps of 3 for each new AES3 block duration.
2	24	This material unit rate is intended to support film rates at 24 fps (frames per second).
3	24/1.001	This material unit rate is intended to support film-for-television rates at 24/1.001 fps.
4	25	This material unit rate is intended to support film and television rates at 25 fps.
6	30	This material unit rate is intended to support film and television rates at 30 fps.
7	30/1.001	This material unit rate is intended to support film-for-television and television rates at 30/1.001 fps.
8	48	This material unit rate is intended to support film rates.
9	48/1.001	This material unit rate is intended to support film-for-television rates.
10	50	This material unit rate is intended to support film and television rates.
12	60	This material unit rate is intended to support film and television rates.
13	60/1.001	This material unit rate is intended to support film-for-television and television rates.

14	72	This material unit rate is intended to support film and television rates.
16	75	This material unit rate is intended to support film and television rates.
18	90	This material unit rate is intended to support film and television rates.
20	96	This material unit rate is intended to support film and television rates.
22	100	This material unit rate is intended to support film and television rates.
24	120	This material unit rate is intended to support film and television rates.
60	44100/64 (~699)	This rate is intended to support AES3 block rates for an audio frame rate of 44.1 kHz (CD rate) and will increment in steps of 3 for each new AES3 block.
61	44100/64.064 (~688)	This rate is intended to support AES3 block rates for an audio frame rate of 44.1/1.001 kHz and will increment in steps of 3 for each new AES3 block.
63	Unspecified	The unit rate is not specified and the increments may be irregular. Its value may be determined by other means. The time of day may be incalculable using this value.
All other values	Reserved but not defined	All values not defined in the rows above are reserved but not defined.

Note: The 26 bits for the unit count value allow a maximum count range of 67,108,864 over a 24-hour period. This allows for a minimum unit duration of approximately 1.29 msec, which is equivalent to a maximum unit rate of 775 units per second.

The rightmost four bytes define the date format, which shall use the modified Julian date (MJD). The allocation of the MJD data fields shall be as defined in SMPTE ST 309.

### 6.3.2 Geospatial Coordinate Component

The geospatial coordinate component of the source pack provides the location information (the “where”).

The geospatial coordinate component shall define the geospatial coordinates at the time of origination of the material unit with which the source pack is associated.

The geospatial coordinate component shall define the location in latitude, longitude and altitude for the recording device, sensor device or the target object. The geospatial coordinate value shall consist of three parts, each of 4 bytes, defined as follows:

1. Altitude: 8 decimal numbers specifying the altitude in meters;
2. Longitude: 8 decimal numbers specifying east/west 180.00000 degrees (5 decimal places active);
3. Latitude: 8 decimal numbers specifying north/south 90.00000 degrees (5 decimal places active).

The reference World Geodetic System for the geospatial coordinate component shall be OWGS84 (as defined by DMA TR 8350.2) which is the datum used by the NAVSTAR Global Positioning System.

Notes:

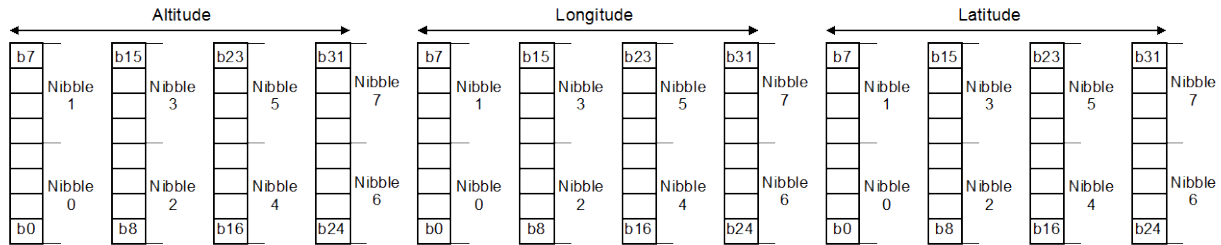
1. The geospatial coordinates could be located in three places depending on the operational use. The UMID makes no distinction between these locations that are indicated for information only.

- target object location: where the geospatial coordinates are the location of the target object, typically that of the image or sound source. This location would be used in the case where, for example, a sensor device was capturing images at long range, but where the location of the image object was known by some means.
- sensor device location: where the geospatial coordinates are the location of the sensor device, typically that of the camera or microphone. This location would be used in the case of an integrated camcorder device where the geospatial coordinate sensor is located in the camcorder.

- recording device location: where the geospatial coordinates are the location of the recording device, typically that of a video or audio recorder which is remotely located from the camera or microphone. This location can be also used where geospatial coordinates of the target object or the sensor are not available at the time of recording.

2. Although geospatial coordinates can be static for many kinds of material, this is not true for all cases. Material captured from a moving source such as a camera mounted on a vehicle can show changing geospatial coordinate values.

Figure 5 illustrates the format of the geospatial coordinate component.



**Figure 5 – 12-byte geospatial coordinate format**

Except where otherwise specified, each nibble shall have a decimal number value in the range 0~9. Values in the range  $A_h \sim F_h$  shall be reserved for special purposes as defined in the following sub-sections.

The format of each 4-byte part shall be little-endian which means that the least significant decimal number occupies the least significant 4 bits of the first byte (nibble 0) and the most significant decimal number occupies the most significant 4 bits of the fourth byte (nibble 7).

### 6.3.2.1 Altitude part

The altitude value shall be expressed either as a value from the center of the earth or as a signed value relative to the sea level of the local geoid.

If nibbles 0 to 7 all lie in the range 0 to 9, the altitude value shall be measured from earth center using the full range of nibbles 0 to 7.

Note: This allows an altitude of 99,999,999 meters from earth center.

If nibble 7 lies in the range  $A_h$  to  $F_h$ , the altitude shall be measured relative to the local geoid and these values of nibble 7 shall be interpreted as defined in Table 6.

**Table 6 – Values and definitions for nibble 7**

Nibble 7 Value	Definition
Ah	Defines a positive altitude relative to the sea level of the local geoid <u>and</u> that the geospatial coordinates are those of the sensor device location
Bh	Defines a positive altitude relative to the sea level of the local geoid <u>and</u> that the geospatial coordinates are those of the recording device location
Ch	Defines a positive altitude relative to the sea level of the local geoid <u>and</u> that the geospatial coordinates are those of the target object location
Dh	Defines a negative altitude relative to the sea level of the local geoid <u>and</u> that the geospatial coordinates are those of the sensor device location
Eh	Defines a negative altitude relative to the sea level of the local geoid <u>and</u> that the geospatial coordinates are those of the recording device location
Fh	Defines a negative altitude relative to the sea level of the local geoid <u>and</u> that the geospatial coordinates are those of the target object location

In nibble 6, semantics shall be defined for each bit as:

- b27 and b26 shall indicate “the number of satellites – 1” used for the measurement.
- b25 shall indicate if the geospatial measurements have been aided with any supportive apparatus such as a gyroscope.
- b24 shall indicate whether the value in nibble 5 is used for altitude measurement or for PDOP (position dilution of precision) value (including the horizontal DOP or the vertical DOP). If this bit is ‘0’, then nibble 5 provides for an altitude range of +/-999,999 meters. If this bit is set to ‘1’, then nibble 5 shall be interpreted as the PDOP value and the altitude is limited to the range +/- 99,999 meters. Note that this bit is useful only if the measurement has been calculated using more than two satellites.

Note: PDOP is the value obtained from more than three satellites. If only three satellites are available, it would be called either Horizontal DOP or Vertical DOP. The relationship between these values is:  $PDOP^2 = HDOP^2 + VDOP^2$ .

The values of nibble 6 shall be interpreted as defined in Table 7.

**Table 7 – Definition for nibble 6 of the altitude part**

<b>Nibble 6 Value</b>	<b>Definition</b>
0h	All geospatial coordinates have been manually input (+/-999,999m)
1h	The measurement has been obtained by the GPS system, but that the result is not valid and could at best be that held over from the last successful capture (+/- 999,999m)
2h	The measurement has been obtained by only the supportive apparatus because no or only one satellite has been captured (+/-999,999m)
3h	Reserved for future use
4h	The measurement has been captured from two satellites only, without any supportive apparatus (+/- 999,999m)
5h	Reserved for future use
6h	The measurement has been captured from two satellites with supportive apparatus (+/-999,999m)
7h	Reserved for future use
8h	The measurement has been captured from three satellites, without any supportive apparatus (+/- 999,999m)
9h	The measurement has been captured from three satellites, without any supportive apparatus (+/- 99,999m)
Ah	The measurement has been captured from three satellites with supportive apparatus. (+/-999,999m)
Bh	The measurement has been captured from more than or equal to three satellites with supportive apparatus (+/-99,999m)
Ch	The measurement has been captured from more than or equal to four satellites, without any supportive apparatus (+/-999,999m)
Dh	The measurement has been captured from more than or equal to four satellites, without any supportive apparatus (+/-99,999m)
Eh	The measurement has been captured from more than or equal to four satellites with supportive apparatus. (+/-999,999m)
Fh	The measurement has been captured from more than or equal to four satellites with supportive apparatus (+/-99,999m)

The interpretation of nibble 5 shall depend on the value of bit b24 in nibble 6 (see above).

If the value of nibble 6 is 9h, Bh, Dh or Fh, then the altitude value shall be limited to +/-99,999m and the value of nibble 5 shall be the PDOP (position dilution of position) value. The PDOP value shall define a rounded integer number from '0' upward where a higher value indicates lower positional accuracy.

Otherwise, the altitude value shall have the range +/-999,999m and the value of nibble 5 shall be the most significant decimal value of the altitude.

Note: A useful reference can be found at <http://www.montana.edu/gps/index.html>. There are many other sources of such information that can be found from searches on the World-Wide Web.

### 6.3.2.2 Longitude part

Nibble 7 of the longitude part shall be used to represent the combination of the east/west parameter and the most significant longitude number, which may be a 0 or a 1. The LSB of nibble 7 shall be used to represent the longitude number and the remaining bits shall represent the east/west parameter. This results in the following values defined in Table 8.

**Table 8 – Definitions for nibble 7 of the longitude part**

Value	Definition
0h	Longitude West 0
1h	Longitude West 1
Eh	Longitude East 0
Fh	Longitude East 1

**6.3.2.3 Latitude part**

Nibble 7 of the latitude part shall specify the north/south parameter as follows in Table 9.

**Table 9 – Definitions for nibble 7 of the latitude part**

Value	Definition
0h	Latitude North
Fh	Latitude South

Where the geospatial coordinate metadata field is not used, the 12 bytes shall be set to zero. In this case, the first 4 bytes indicate that the altitude is at the center of the earth (which is clearly not a valid value).

**6.3.3 Country, Organization and User Components**

The country, organization and user components of the source pack provide the originator information (the “who” or “what”).

**6.3.3.1 Country code component**

The country code component shall identify the registered country name of the originator of the material unit with which the source pack is associated;

The country code component shall be either the country code of the legal organization or person owning or operating the device, or zero (per 6.2).

The 4-byte country code shall be an abbreviated alphanumeric string according to the values defined in ISO 3166-1. Where the country code is less than 4 bytes, the active part of the code shall occupy the first part of the 4 bytes and the remainder shall be the space character (20h).

ISO 3166-1 3-byte alpha codes should be used, but 2-byte alpha codes or numeric codes may be used where other policies prescribe.

For non-zero values, each byte shall be an alphanumeric character from the Latin set 1 as defined by ISO/IEC 8859-1. Alphanumeric character values shall be in the range 20h to 7Eh inclusive.

Note: The value 7F is a non-printable character.

**6.3.3.2 Organization code component**

The organization code component shall identify the organization name of the originator of the material unit with which the source pack is associated.

The organization name is local to the country name, so organizations may use the same name provided the country name is different.

The organization code shall be set to either a SMPTE registered 4-byte alphanumeric string or to zero (per 6.2).

Organizations are encouraged to obtain a registered alphanumeric string from the SMPTE Registration Authority at <<http://www.smp-te-ra.org/umidreg/umidappl.php>>.

Organization codes shall not use the “~” symbol (ISO/IEC 8859-1 character number: 7Eh) as the first character. This character shall be reserved for freelance operator registration.

Where a SMPTE registered organization code is less than 4 bytes, the active part of the code shall occupy the first part of the 4 bytes and the remainder shall be the space character (20h).

For all SMPTE registered values, each byte shall be an alphanumeric character from the Latin set 1 as defined by ISO/IEC 8859-1. Alphanumeric character values shall be in the range 20h to 7Eh.

### **6.3.3.3 User code component**

The user code component shall identify the local name of the originator of the material unit with which the source pack is associated. This name is local to the organization for a given country name, so the same name may be used provided the country and organization names are different. It may be a device name or person name as determined by the organization.

User codes shall be assigned locally by each organization and are not SMPTE registered. User codes shall be used in conjunction with the organization code.

If the organization code is set to zero per 6.2, then the user code shall be set to zero.

If the organization code is set to a SMPTE registered value, then the user code shall be set to either a 4-byte alphanumeric code, which is determined by the organization (and may, for example, relate to a department, person or to the device itself) or to zero (per 6.2).

For all non-zero user code values, each byte of the user code shall be an alphanumeric character from the Latin set 1 as defined by ISO/IEC 8859-1. Alphanumeric character values shall be in the range 20h to 7Eh.

Where the user code is less than 4 bytes, the active part of the code shall occupy the first part of the 4 bytes and the remainder shall be the space character (20h).

### **6.3.3.4 Freelance operator component**

A freelance operator is an individual who is not, or does not wish to be, associated with an organization, but still wishes to be identified as an operator with a registered code.

The Organization code and User code components may be combined to form a Freelance Operator component, as follows. When the first byte of the combined components is set to 7Eh, the combined components shall specify the freelance operator.

The operator code shall be either a SMPTE registered 8-byte alphanumeric string or to zero (per 6.2).

When the country code is non-zero, freelance operators shall use their country of domicile for the country code together with the SMPTE registered operator code. Freelance operators are encouraged to obtain a registered alphanumeric string from the SMPTE Registration Authority.

All SMPTE registered freelance operator codes shall start with the “~” symbol (ISO/IEC 8859-1 character number, 7Eh). The remaining 7 alphanumeric characters shall all be filled with characters from the Latin set 1 as defined by ISO/IEC 8859-1. Alphanumeric character values shall be in the range 20h to 7Eh.

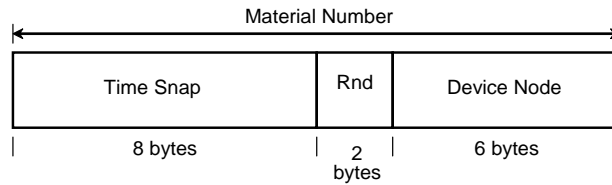
Where a SMPTE registered operator code is less than 8 bytes (including the ~ character), the active part of the code shall occupy the first part of the 8 bytes and the remainder shall be the space character (20h).

Note: If the operator code is set to zero, it will be interpreted as setting the organization and user codes to zero.

## Annex A Generation of UMID Material Numbers (Normative)

### A.1 SMPTE Method ('01h')

The material number generation shall be divided into 3 parts as shown in Figure A.1.



**Figure A.1 – Format of the SMPTE material number**

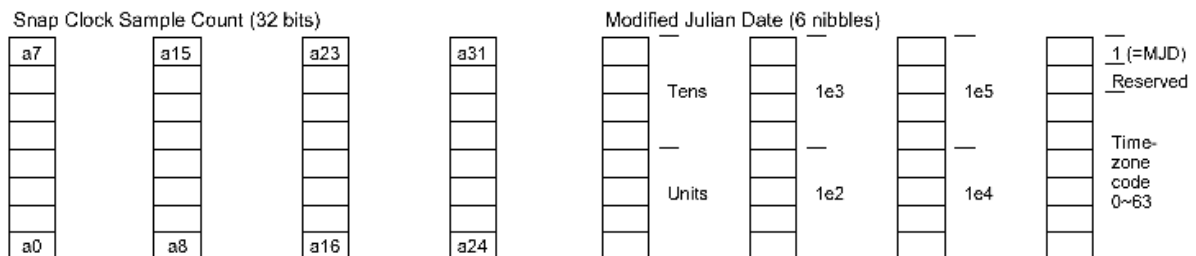
The three sub-components shall be:

- An 8-byte time snap value. This time snap value shall be referenced to the first associated unit of the material. Note that the time snap is neither a time-code nor a time-stamp. It is simply a method of creating a globally unique material number in combination with the subsequent two parts. The time snap value shall be treated as a dumb number.
- A 2-byte random number. This is included to prevent possible conflicts which might occur if the time snap value is set to a duplicate time, creating the possibility of duplicate material numbers from the same device.
- A 6-byte node identifier that is a uniquely registered number for each device used for material creation.

Each of these three parts is now defined in detail.

#### A.1.1 Time Snap

The 8-byte time snap format shall be divided up into a first 4-byte section used to enter a count, which marks a point of time in one day and a second 4-byte section used to enter the modified Julian date. The allocation of the time snap into individual bytes is shown in Figure A.2.



**Figure A.2 – Format of the 8-byte time snap**

The first 4 bytes, which define the time in a day period, shall represent the value of the snap clock sample count starting from midnight. The 32 bits for the time-of-day allow a maximum count range of 4,294,967,296.

The snap clock may be any suitable clock that preferably has an integer number of clock cycles in a day. The minimum clock value shall be the material unit rate and the maximum value shall be 49.7 kHz. The minimum value is determined by the need to ensure that each material unit has a unique number and the maximum value is determined by the need to avoid overflow of the 32-bit counter in any day.

The 4-byte date format shall use the modified Julian date (MJD). The allocation of the MJD data fields shall be as defined in SMPTE ST 309.

### **A.1.2 Random Number**

This 16-bit number is provided to help avoid duplicate numbers that can occur through incorrect setting of the clock or through a change in node identification.

The number shall be created by a 16-bit random number generator, whose creation method shall be linked neither to the time snap value nor to the network node value.

### **A.1.3 Node Identifier**

The node identification shall be an IEEE 6-byte address, normally defined by the IEEE 802 network host address. For systems with multiple network node addresses, only one address shall be used as the node identifier. Where a particular port is being used to output the defined material, the network node address of that port shall be used.

Note: The node identifier bytes are placed left to right in Figure A.1 according to network byte order.

## **A.2. UUID/UL Method ('02h')**

This method permits either a universally unique identifier (UUID) according to IETF RFC 4122 or a SMPTE universal label (UL) according to SMPTE ST 298 to be accommodated in the same space with a guarantee that the values are always different.

According to IETF RFC 4122, the UUID "variant" bits (see below) ensure that the MSB of the 9<sup>th</sup> byte of every UUID is always set to a '1'. A UUID shall be mapped into the material number in its defined byte order.

Per SMPTE ST 298, the MSB of 1<sup>st</sup> byte of every UL is always set to '0'. A UL shall be mapped into the Material Number with the last 8 bytes swapped with the first 8 bytes. Thus the 1<sup>st</sup> byte of the UL will be placed in 9<sup>th</sup> byte of the material number and vice-versa.

These two mappings ensure that the MSB of 9<sup>th</sup> byte in the material number is always a '0' for a UL and a '1' for a UUID. Thus, the value of a UL and a UUID in the Material Number will always be different.

The defining standard for creating a UUID shall be IET RFC 4122.

Note: The node identification of a UUID is an IEEE 6-byte address, normally defined by the IEEE 802 network host address. For systems with multiple network node addresses, only one address can be used.

## **A.3 Masked Method ('03h')**

In certain applications, the uniqueness of the material number is the only desired function. The material originator may not wish to reveal any information about the time, location, or equipment on which the material originated, for privacy or other security reasons (e.g, investigative journalism). The masked method shall create a material number that is statistically unique to very high probability.

Masked material numbers are effectively random and do not support sorting or any other meaning-based processing.

### **A.3.1 Reference Masking Method (Informative)**

The reference masking method post-processes a material number, which has been created by either of the methods defined in Annex A.1 or Annex A.2 using additional pseudorandom data and the MD5 hash function (IETF-RFC1321).

The 128-bit “clear” material number needs to be computed in accordance with Annex A.1 or Annex A.2. An additional 128 bits of local data is appended to the clear material number. The 256-bit string is then processed using the MD5 algorithm resulting in a 128-bit result. This result is the masked material number.

The local data can be a fixed string of 128 “0” bits. Additional security implications are discussed below.

### A.3.2 Alternative Masking Methods

The masked material number is an unpredictable number uniformly distributed over the range 0 thru 2<sup>128</sup>-1. Its effectiveness as a unique identifier relies on this uniform random distribution, and the exact method of its generation is not important. Therefore, the use of the reference masking method is not normative, and any method providing an equivalent level of unpredictability and uniformity of distribution may be used with the “masked method” value in the “number generation method” field of the UMID universal label (see Table 1 in Section 6.1.1).

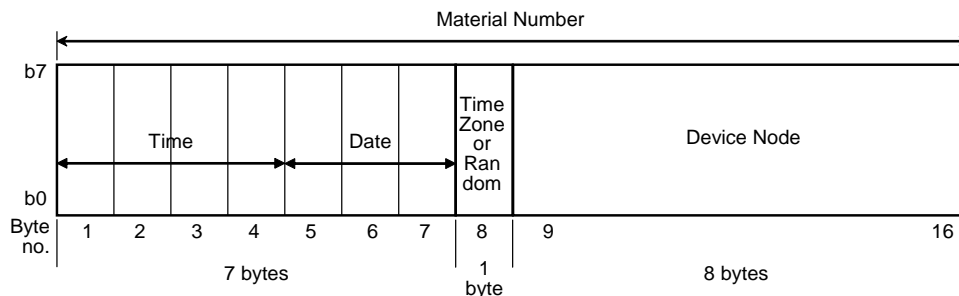
### A.3.3 Security Implications (Informative)

The MD5 function is designed as a “secure hash function”, for which it is computationally infeasible to derive the input value from the output value. Therefore, a single blinded material number does not reveal the IEEE 802 Node ID of the originator, nor does it reveal the time snap. However, as in many hash applications, a brute-force attack is possible in which an opponent tries all possible values of clear material number, computes the corresponding MD5 hash, and compares this result to the blinded material number he wishes to identify. If the opponent can independently guess likely values for the time snap and node ID, it could then be practical to use a brute-force attack to expose the blinded material number. This attack is especially powerful if another application, producing clear material numbers, also runs (concurrently or sequentially) on the same hardware as the sensitive application.

For this reason, particularly sensitive editorial content originators might want to employ additional unpredictable data (sometimes called salt) to resist brute-force attacks. In the reference masking method, 128 bits of salt are suggested, but alternative masking methods can use more. Methods of deriving unpredictable data are discussed in IETF RFC-2518 and in standard cryptography texts.

## A.4 IEEE 1394 Network Method (‘04h’)

The material number generation is composed of 3 parts as shown in Figure A.3.



**Figure A.3 – Format of the SMPTE material number**

The byte values of the 3 parts shall be defined as follows:

1. A 7-byte time and date format as follows:
  - a. Bytes 1 to 4 define the time in a day period represented by the snap clock sample count. The 32 bits for the time-of-day allow a maximum count range of 4,294,967,296. The snap clock may be any suitable clock that preferably has an integer number of clock

cycles in a day. The minimum clock value shall be the material unit rate and the maximum value shall be 49.7 kHz. The time value shall be treated as a dumb number.

Note: The minimum value is determined by the need to ensure that each material unit has a unique number and the maximum value is determined by the need to avoid overflow of the 32-bit counter in any day.

- b. Bytes 5 to 7 provide the Modified Julian Date (MJD) information as a 3-byte date value per Annex A.1.1.
2. Byte 8 may take one of two forms based on the value of bit 6. Bit 7 of byte 8 shall be set to '1' to identify that the date is the MJD (and not the DDMMYY) format. When bit 6 of byte 8 is '0' the remaining bits, b5 to b0, are assigned as per SMPTE ST 309 to give the time-zone information. When bit 6 of byte 8 is '1' bits b5 to b0 form a 6-bit random number serving to reduce the likelihood of the same number being created more than once when a device's clock is incorrectly set. In accordance with SMPTE ST 309, the time shall be set to UTC.
3. The 6-byte device node ID shall use the EUI-64 network node ID value defined by IEEE 1394 to fill the available 8-byte space. If the network node number is EUI-48 rather than EUI-64, then the convention is to set the 4th and 5th bytes of the address (bytes 12 & 13) to the fixed values of 'FFh' and 'FEh" respectively for easy detection. The first 3 bytes of the EUI-48 address are then mapped to bytes 9 to 11 and the last 3 bytes of the EUI-48 address are mapped to bytes 14 to 16.

## **Annex B Generation of UMID Instance Numbers (Normative)**

### **B.1 Local Registration ('1h')**

The instance number for every instance of a given material number shall be obtained from a local register, which records all registered instance numbers for the material number in question.

This method needs a carefully managed local environment - for instance, material may be taken off-site and copies made with duplicate instance numbers. Thus, this method should only be used where full managerial control of the local environment can be guaranteed.

### **B.2 24-Bit PRS Generator ('2h')**

Any suitable pseudo-random sequence (PRS) generator polynomial may be used provided it has a maximal length of 16,777,215 clock cycles. At the point of creating a new instance of the material, the 24-bits from the PRS generator shall be sampled to gain a new instance value.

PRS generators shall not permit a zero value.

The following conditions shall apply:

1. Any suitable seed may be used to start the pseudo-random sequence (PRS) 24-bit generator.
2. The PRS generator should use a free-running clock having no time relationship with the clock used to generate the sampling strobe.
3. The PRS generator clock frequency should be greater than 10 kHz.
4. The number of feedback taps resulting from the PRS generator polynomial should be between 8 and 16 to ensure the random nature of the sequence.

### **B.3 Copy Number and 16-Bit PRS Generator ('3h')**

The first (leftmost) byte of the instance number shall be incremented for each new copy.

The remaining two bytes shall be created from a 16-bit pseudo-random sequence (PRS). The constraints on the 16-bit PRS generation shall be the same as that defined in clause B.2 with the exception that the PRS generator shall have a maximal length of 65,535 clock cycles and that the recommended number of feedback taps shall lie between 4 and 12 to ensure the random nature of the sequence.

### **B.4 Live Stream ('Fh')**

This instance number method shall be used to identify that the material is a direct live signal source from a material creation device.

Notes

- 1 This instance number method differentiates original material direct from a camera, microphone or source device from reproduced material that has a UMID with a new material number and a zero instance number.
- 2 It is possible that there could be several sources of the same live stream via parallel feeds and care needs to be exercised in its application; see SMPTE RP 205.

## **Annex C Text Representation of the UMID (Normative)**

Some applications do not support the use of byte-coded data such as used by the UMID. In these applications, failure can occur due to false interpretation of the byte values, either individually or in particular sequences.

This annex provides for the representation of the UMID as a ISO 7-bit character text string both to aid human readability and to ensure that byte values are not falsely decoded in a textual format. This annex provides for two textual formats, a URN representation and a simple text string.

The URN representation of a UMID shall be as defined in SMPTE ST 2029.

### **C.1 Legacy Text Format Definition**

The simple text string representation defined in SMPTE ST 330:2004 shall be deprecated for further use, but is defined here for legacy. This format provided for the UMID, whether as a basic UMID or as an extended UMID, to be represented as a simple string of the hexadecimal representation of each byte of a UMID.

The hexadecimal representation was preceded by the identifier '0x'. This default method of identification resulted in 66 hexadecimal characters to represent a basic UMID as follows:

0x060A2B340101010501010D13 ... etc.

The hexadecimal letters could be encoded as upper case (A...F) with the proviso that decoders accept hexadecimal letter representations in both upper and lower case (A...F and a...f).

## Annex D Documentation of Legacy UMID Generation (Informative)

This method of material number generation documents a commercial method (known as OMF, Open Media Framework) for generating a basic UMID in existing use in the field. This method is deprecated for new designs.

### D.1 First 16 Bytes

The 12-byte key for this identifier differs from that defined in this standard and thus provides ready differentiation from the specification in this standard. The value of the first 16 bytes, in period separated hexadecimal notation, is:

06.0C.2B.34.02.05.11.01.01.UT.10.00.13.00.00.00

Notes:

1. Byte 2 has a value of '0Ch', This value is incorrect for a Label size of 12 bytes.
2. Byte 5 has a value of '02h'. This value is reserved for any forthcoming essence dictionary and is thus invalid.
3. Byte 10 ("UT") means "UMIDType" and has an unspecified value.
4. Byte 13 has the correct value of '13h'
5. Bytes 14~16 define an instance number of zero.
6. This 16-byte value must be precluded from any forthcoming essence dictionary in order to avoid potential duplication of meaning.

### D.2 Second 16 Bytes

The second part of the UMID is created as follows:

Byte number	Value
16 to 21	06.0E.2B.34.7F.7F (defined values)
22 and 23	Prefix (2 bytes, company specific)
24 to 27	Major (4 bytes, derived from time of day)
28 to 31	Minor (4 bytes, derived from processor tick count)

## Annex E Bibliography (Informative)

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 335:2001) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 335M-2001). Documents with the same root number (e.g. 335) and publication year (e.g. 2001) are functionally identical.

SMPTE ST 335:2001, Television — Metadata Dictionary Structure

SMPTE RP 205:2009, Application of Unique Identifiers in Production and Broadcast Environments

IETF-RFC1321, The MD5 Message-Digest Algorithm, Internet Engineering Task Force, 1992

IEEE 802-1990, IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture

EBU/SMPTE Task Force for Harmonized Standards for the Exchange of Programme Material as Bit Streams, Final Report: Analyses and Results, July 1998, SMPTE J. 107(9):603-815; 1998 September

RFC 2518, HTTP Extensions for Distributed Authoring – WEBDAV, Internet Engineering Task Force, 1999

SMPTE Registration Authority can be found at: <[www.smpte-ra.org](http://www.smpte-ra.org)>

XML Schema definitions can be found at: [www.w3.org/TR/xmlschema-2/](http://www.w3.org/TR/xmlschema-2/)