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**System Information for Satellite Distribution of
Digital Television for Cable and MMDS**

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System Information for Satellite Distribution of Digital Television for Cable and MMDS

1 Scope

NOTE: This document is identical to SCTE 57 2011 except for informative components such as the title page, NOTICE text, headers and footers. No changes have been made to any text in the document beyond this point, other than headers and footers.

1.1 Purpose

This document defines a Standard for System Information (SI) compatible with MPEG-2 compliant digital multiplex bitstreams constructed in accordance with ISO/IEC 13818-1 (MPEG-2) and transmitted over satellite for distribution on cable and MMDS. The document defines the standard protocol that carries relevant System Information (SI) tables contained within packets carried in the transport multiplex. The term **SI** will be used to refer to system-wide information in the Network Packet Identifier (PID).

The reader should note that not all applications use this standard for SI delivery. SI for cable applications have been superseded by SCTE 65 (Reference 9) and ATSC Standard A/65 (Reference 10). Other common standards for this application are written by the Digital Video Broadcasting Project (DVB) and standardized by ETSI (See references 11 through 14).

1.2 Application

This document describes tables that are applicable to satellite broadcast signals carried over cable and MMDS. As noted below, some tables are carried in the Network PID in the MPEG-2 Transport Stream. Others tables are carried in transport streams packets carrying the MPEG-2 TS_program_map_section. This PID is referred to as the Program Map Table (PMT) PID. (The reader should note that portions of SI tables defined in this specification are delivered in messages. A message is a data structure that conforms to the ISO/IEC 13818-1 (MPEG-2) table section format.)

This document also defines certain descriptors that may appear in the satellite, cable and MMDS environments.

1.2.1 System Information for Satellite Transmission Medium

MPEG-2 Transport Streams compliant with this specification shall include, for the satellite application, System Information in the Network PID indicated in the Program Association Table carried in PID 0 per MPEG-2. Messages carrying data applicable to satellite transmission include the Network Information message, the Network Text message, and the Virtual Channel message. Each of these message types includes a field called **transmission_medium**, set to “satellite” for tables applicable to satellite use.

The System Time message shall be included in the Transport Stream to synchronize system events. Rate of transmission is typically once per minute. MPEG-2 Transport Streams carried on satellite shall include SI data appropriate to the satellite medium, including Satellite Information Table, Satellite Name Table, Transponder Data Tables, Transponder Name Tables, Carrier Definition Table, Modulation Mode Table, Source Name Table, Virtual Channel Tables, and Defined Channel Maps. Transmission of Map Name Tables, Inverse Channel Maps, Rating System Tables, and Ratings Text Tables is optional.

SI data shall at minimum describe the satellite and transponder carrying the Transport Stream, but may optionally describe other satellites and other transponders, both on the same and on other satellites.

SI data for transmission media other than satellite may be present in a Transport Stream delivered over satellite. These tables are present to support equipment downstream from the satellite downlink, including Decoders receiving Transport Streams on other media. The Decoder is expected to discard tables for media other than the one within which it is designed to operate.

1.2.2 Cable and MMDS Distribution of Satellite Transport Streams

For satellite distribution over cable and MMDS, MPEG-2 compliant Transport Streams shall include System Information in the Network PID indicated in the Program Association Table carried in PID 0. Messages carrying data applicable to cable and MMDS transmission include the Network Information message, the Network Text message, and the Virtual Channel message. Each of these message types includes a field called **transmission_medium**, set to “cable” for tables applicable to cable use.

The System Time message shall be included in the Transport Stream to synchronize system events. Rate of transmission is typically once per minute.

SI data for transmission media other than cable may be present in a Transport Stream delivered over cable and MMDS. The Decoder is expected to discard tables for media other than the one within which it is designed to operate.

1.3 Organization

The sections of this document are organized as follows:

- **Section 1** — Provides general introduction.
- **Section 2** — Lists applicable documents.
- **Section 3** — Provides a list of acronyms and abbreviations used in this document.
- **Section 4** — Describes the basic structure of sections.
- **Section 5** — Describes formats of sections carried in the Network PID.
- **Section 6** — Describes formats of sections carried in the PMT PID.

- **Section 7** — Describes descriptors and stream types used.
- **Section 8** — Describes multilingual character strings.
- **Annex A** — Provides an overview of tables defined in this System Information Standard.
- **Annex B** — Provides usage guidelines.

2 References

The following documents are applicable to this System Information Standard:

2.1 Normative References

The following documents contain provisions that in whole or in part, 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 amendment, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

1. ATSC A/52B: Digital Audio Compression (AC-3) (E-AC-3) Standard, Rev. B
2. ATSC [A/53, ATSC Digital Television Standard: Part 4 \(2009\)](#), “MPEG-2 Video System Characteristics”.
3. EBU Tech. 3264-E, Specification of the EBU Subtitling Data Exchange Format, European Broadcasting Union, February 1991.
4. ISO 639-2 — Code for the Representation of Names of Languages – Part 2: Alpha-3 code, as maintained by the ISO 639/Joint Advisory Committee (ISO 639/JAC), <http://www.loc.gov/standards/iso639-2/iso639jac.html>; ISO 639-2 standard online: <http://www.loc.gov/standards/iso639-2/langhome.html>.
5. The Unicode Standard, Version 5.1.0, The Unicode Consortium, Addison-Wesley Pub., ISBN 0201616335
6. Unicode Technical Report #6, A Standard Compression Scheme for Unicode, Revision 3.6, 2005, The Unicode Consortium
7. ISO/IEC 13818-1:2007, Information Technology — Generic coding of moving pictures and associated audio — Part 1: Systems.
8. ITU-T Rec. J.83:1997, Digital multi-programme systems for television, sound and data services for cable distribution.
9. ITU-R Rec. BO.1211:1995, Digital multi-programme emission systems for television, sound and data services for satellites operating in the 11/12 GHz frequency range.
10. ANSI/SCTE 27 2011 Subtitling Methods for Broadcast Cable
11. ANSI/SCTE 19 2006 Methods for Isochronous Data Services Transport
12. ANSI/SCTE 53 2008 Methods for Asynchronous Data Services Transport
13. ANSI/SCTE 35 2007 Digital Program Insertion Cueing Message for Cable

2.2 ***Informative References***

14. ANSI/CEA-766-C: U.S. and Canadian Region Rating Table (RRT) and Content Advisory Descriptor for Transport of Content Advisory Information Using ATSC Program and System Information Protocol (PSIP)
15. ANSI/SCTE 65 2008 Service Information Delivered Out-Of-Band For Digital Cable Television
16. ATSC A/65:2009 ATSC standard: "Program and System Information Protocol for Terrestrial Broadcast and Cable"
17. ETSI EN 300 468 V1.9.1 (2009-03): "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
18. ETSI TR 101 211 V1.9.1 (2009-06): "Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)".
19. ETSI TR 101 154 V1.9.1 (2009-09): "Digital Video Broadcasting (DVB); Implementation guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications".
20. ETSI ETR 162: "Digital Video Broadcasting (DVB); Allocation of Service Information (SI) codes for DVB systems".

3 Definitions

3.1 Compliance Notation

As used in this document, "*shall*" denotes a mandatory provision of the standard. "*Should*" denotes a provision that is recommended but not mandatory. "*May*" denotes a feature whose presence does not preclude compliance that may or may not be present at the option of the implementer.

3.2 Definition of Terms

The following terms are used throughout this document:

section: A data structure comprising a portion of an *ISO/IEC 13818-1*-defined table, such as the Program Association Table (PAT), Conditional Access Table (CAT), or Program Map Table (PMT). The term conforms to MPEG terminology. All sections begin with the `table_ID` and end with the `CRC_32` field. Sections are carried in non-PES¹ streams; their starting points within a packet payload are indicated by the `pointer_field` mechanism defined in the *ISO/IEC 13818-1 Systems* document.

message: The more general term *message* is used interchangeably with *section*, especially to refer to non-table-oriented data structures such as, for example, the System Time message. Likewise, the term *message* is used to refer to a data structure that may deliver portions of various types of tables. The Network Information message, for example, defines portions of several types of network tables.

program element: A generic term for one of the elementary streams or other data streams that may be included in a program.

program: A collection of program elements. Program elements may be elementary streams. Program elements need not have any defined time base; those that do have a common time base and are intended for synchronized presentation. The term *program* is also used in the context of a "television program" such as a scheduled daily news broadcast. The distinction between the two usages should be understood by context.

service: *ISO/IEC 13818-1* uses the term *program* to refer to a collection of program elements without regard to time. In this System Information Standard, the term *service* is used in this same context to denote a collection of elementary components. Usage of the term *service* clarifies certain discussions that also involve the notion of the term *program* in its traditional meaning — in, for example, the statement, "A video service carries a series of programs."

stream: An ordered series of bytes. The usual context for the term *stream* involves specification of a particular PID (such as the "Program Map Table PID stream"), in which

¹ Packetized Elementary Stream

case the term indicates a series of bytes extracted from the packet multiplex from packets with the indicated PID value.

epoch: A period of time. A “program epoch” is the period of time during which a particular program is aired. Access control is defined in terms of program epochs, so that access requirements may change at program epoch boundaries, but not between.

3.3 Acronyms and Abbreviations

The following acronyms and abbreviations are used within this specification:

bslbf	bit serial, leftmost bit first
CAT	Conditional Access Table
CDT	Carrier Definition Table
CRC	cyclic redundancy check
ECM	Entitlement Control Message
EMM	Entitlement Management Message
GMT	Greenwich Mean Time
GPS	Global Positioning System
IPG	Interactive Program Guide
IPPV	Impulse Pay-Per-View
IRD	Integrated Receiver-Decoder
ISO	International Organization for Standardization
MCPT	Multiple Carriers per Transponder
MMDS	Multi-point Multi-channel Distribution System
MMT	Modulation Mode Table
MPEG	Moving Picture Experts Group
NVOD	Near Video On Demand
PAT	Program Association Table
PCR	Program Clock Reference
PES	Packetized Elementary Stream
PID	Packet Identifier
PMT	Program Map Table
PSI	Program Specific Information
PTS	Presentation Time Stamp
rpchof	remainder polynomial coefficients, highest order first
RTT	Rating Text Table
SECAM	Sequential Couleur Avec Memoire
SIT	Satellite Information Table
SMATV	Satellite Master Antenna Television
TAI	International Atomic Time ²
TDT	Transponder Data Table
TNT	Transponder Name Table

² Reversal of acronym letters is due to the translation from the French.

TS	Transport Stream
UTC	Coordinated Universal Time ³
uimsbf	unsigned integer, most significant bit first
VCN	Virtual Channel Number
VCT	Virtual Channel Table ⁴

3.4 Section and Data Structure Syntax Notation

This document contains symbolic references to syntactic elements. These references are typographically distinguished by the use of a different font (e.g., *restricted*), may contain the underscore character (e.g., *sequence_end_code*) and may consist of character strings that are not English words (e.g., *dynrng*).

The formats of sections and data structures in this document are described using a C-like notational method employed in *ISO/IEC 13818-1*. Extensions to this method are described in the following sections.

3.4.1 Field Sizes

Each data structure is described in a table format wherein the size in bits of each variable within that section is listed in a column labeled "Bits." The column adjacent to the bits column is labeled "Bytes" and indicates the size of the item in bytes. For convenience, several bits within a particular byte or multi-byte variable may be aggregated for the count. An example follows:

	Bits	Bytes	Description
example_section() {			
section_syntax_indicator	1	1	
...			
if (section_syntax_indicator) {			
table_extension	16	(2)	uimsbf
ISO_reserved	2	(1)	bslbf
version_number	5		uimsbf
current_next_indicator	1		bslbf {next, current}
...			
}			
...			
}			

In the byte count column, items that are conditional (because they are within a loop or conditional statement) are parenthesized. Nested parentheses are used if the loops or conditions are nested.

³ Since unanimous agreement could not be achieved by the ITU on using the English word order, CUT, or the French word order, TUC, a compromise to use neither was reached.

⁴ Note that the structure and semantics of this table as defined herein is restricted to this specification only.

4 Message Structure

This section defines the structure of tables and messages specified in this System Information Standard. This System Information standard defines tables and message sections that are carried in transport packets identified by the Network PID and the Program Map Table (PMT) PID.

4.1 Common Message Structure

4.1.1 Framing and Synchronization

Tables and messages defined in this System Information Standard are structured in the same manner used for carrying *ISO/IEC 13818-1* -defined PSI tables. The MPEG-defined 32-bit CRC shall be present in all cases.

4.1.2 Table ID Ranges and Values

Table 4.1 defines table_ID ranges and values.

Table 4.1. Table ID Ranges and Values

Table ID Value (hex)	System Information Sections	Stream	Reference
0xC0	PROGRAM INFORMATION	Program Map Table	Sec. 6.1
0xC1	PROGRAM NAME	Program Map Table	Sec. 6.2
0xC2	NETWORK INFORMATION	Network	Sec. 5.1
0xC3	NETWORK TEXT	Network	Sec. 5.2
0xC4	VIRTUAL CHANNEL	Network	Sec. 5.3
0xC5	SYSTEM TIME	Network	Sec. 5.4

The messages defined in this document, and any created as user extensions to it are considered “private” with respect to *ISO/IEC 13818-1*. For other table identifiers, refer to the ATSC registry.

4.1.3 Maximum Section Length

In accordance with *ISO/IEC 13818-1*, the maximum total length of any message section specified herein shall be 1024 bytes. This total includes table_ID, CRC, and everything in between.

4.1.4 Extensibility

This System Information Standard describes a number of tables and messages delivered in transport packets identified by either the Network PID or Program Map Table (PMT) PID. The System Information Standard is designed to be extensible via the following mechanisms:

1. **Reserved Fields:** Fields in this System Information Standard marked reserved are reserved for use either when revising this System Information Standard, or when another standard is issued that builds upon this one. See Section 4.1.5 below.
2. **User Private Descriptors:** Privately defined descriptors may be placed at designated locations throughout the messages described in this System Information Standard.

4.1.5 Reserved Fields

reserved — Fields in this System Information Standard marked "reserved" shall not be assigned by the user, but shall be available for future use. Decoders are expected to disregard reserved fields for which no definition exists that is known to that unit. Fields marked "reserved" shall be set to a value of zero until such time as they are defined and supported.

ISO_reserved — Fields in this System Information Standard marked "ISO_reserved" are reserved under *ISO/IEC 13818-1* and hence shall not be assigned by the user. All ISO_reserved bits shall be set to '1.'

zero – Indicates the bit or bit field shall be the value zero.

4.1.6 Protocol Version Field

protocol_version — A 5-bit unsigned integer field whose function is to allow, in the future, any defined table type to carry parameters that may be structured fundamentally differently than those defined in the current protocol. At present, all defined message types in this protocol are defined for protocol_version zero only. Nonzero values of protocol_version may only be processed by Decoders designed to accommodate the later versions as they become standardized.

4.2 Message Structure – Program Map Table PID Only

This section describes details of message structure and transport of program description messages carried within transport packets identified with PIDs containing the Program Map Table in the MPEG-2 multiplex.

4.2.1 Stuffing Table

Table ID 0xFD is reserved for use as a “stuffing table.” The Decoder is expected to ignore the contents of a stuffing table. In some applications it will be helpful for generation equipment to include one or more stuffing tables in transport packets formatted in compliance with MPEG-2 PSI structures, so that downstream equipment may easily edit the Transport Stream to replace them with other data.

5 Message Formats — Network PID

The following sections define the formats of messages as they appear within the Network PID of the Transport Stream.

5.1 Network Information Message

The NETWORK INFORMATION message is carried in MPEG-2 transports stream packets identified by the Network PID (see Section 1.2.1 and 1.2.2) Stream, and delivers sections of non-textual tables applicable system-wide. The tables include:

- Carrier Definition Tables (CDTs) for each transmission medium (cable and satellite)
- Modulation Mode Tables (MMTs) for each transmission medium
- Satellite Information Table (SIT)
- Transponder Data Table (TDT)

The message format consists of

- The table index pointing to the first record in the table to be defined in this message
- The number of records being defined in this message
- The table type (CDT, MMT, and so on)
- If the table is a TDT type, the satellite ID

Figure 5.1 shows the format of the NETWORK INFORMATION message.

	Bits	Bytes	Description
network_info_message() {			
table_ID	8	1	uimbsf value 0xC2
zero	1	2	bslbf
reserved⁵	3		bslbf
section_length	12		uimbsf
zero	3	1	
protocol_version	5		uimbsf see section 4.1.6
first_index	8	1	uimbsf range 1-255
number_of_records	8	1	uimbsf
transmission_medium	4	1	uimbsf see Table 5.1
table_type	4		uimbsf see Table 5.2
if (table_type==TDT) {			
satellite_ID	8	(1)	uimbsf range 0-255
}			
for (i=0; i<number_of_records; i++) {			
if (table_type==CDT) {			
CDT_record()		((5))	
}			
if (table_type==MMT) {			
MMT_record()		((6))	
}			
if (table_type==SIT) {			
SIT_record()		((4))	
}			
if (table_type==TDT) {			
TDT_record()		((6))	
}			
descriptors_count	8	(1)	uimbsf range 0-255
for (i=0; i<descriptors_count; i++) {			
descriptor()	*	((*))	optional
}			
}			
for (i=0; i<N; i++) {			
descriptor()	*	(*)	optional
}			
CRC_32	32	4	rpchof
}			

Figure 5.1. Network information message format

5.1.1 Table ID

The table_ID of the NETWORK INFORMATION message shall be 0xC2.

5.1.2 Common Data

Certain data is common to all types of data delivered in the NETWORK INFORMATION message.

⁵ Reserved field may indicate addressing mode in some deployed systems.

first_index — An 8-bit unsigned integer number in the range one to 255 that indicates the index of the first record to be defined in this message. If more than one record is provided, the additional records define successive table entries following **first_index**. The value zero is illegal and shall not be specified.

number_of_records — An 8-bit unsigned integer number that defines the number of records being defined in this message. The minimum allowed value is one. The maximum is limited by the maximum allowed length of the message.

transmission_medium — A 4-bit field that defines the transmission medium for which the data in this NETWORK INFORMATION message applies. Table 5.1 defines the coding.

Table 5.1. Transmission Medium

transmission_medium	meaning
0	cable
1	satellite
2	MMDS
3	SMATV
4-15	reserved

A NETWORK INFORMATION message received with **transmission_medium** indicating an unknown or unsupported medium is expected to be discarded.

table_type — A 4-bit value that defines the type of table delivered in the message. One instance of a NETWORK INFORMATION message can define entries within at most one type of table. The **table_type** parameter is defined in Table 5.2.

Table 5.2. Table Type

table_type	meaning
0	invalid
1	CDT — Carrier Definition Table
2	MMT — Modulation Mode Table
3	SIT — Satellite Information Table
4	TDT — Transponder Data Table
5-15	Reserved

A value of zero for **table_type** is undefined, and may be used to indicate *unknown* or *invalid*.

A NETWORK INFORMATION message received with **table_type** indicating an unknown or unsupported table type is expected to be discarded.

5.1.2.1 Satellite ID

The `satellite_ID` is included in the message if the `table_type` is TDT.

satellite_ID — An 8-bit unsigned integer value in the range zero to 255 that identifies the satellite to which data in this message applies.

5.1.2.2 Descriptors Count

descriptors_count — An 8-bit unsigned integer value in the range zero to 255 representing the number of descriptor blocks to follow.

5.1.3 Carrier Definition Table (CDT)

Figure 5.2 defines the structure of the `CDT_record()`. The CDT defines sets of carrier frequencies to support cable and satellite media. Separate tables for each of the transmission media may be present in network data. If that is the case, the Decoder is expected to discard the inapplicable table or tables. A full frequency plan table for one medium is constructed from one or more `CDT_record()` structures, each defining a starting frequency, a number of carriers, and a frequency spacing for carriers in this group.

The specified carrier represents the nominal center of the spectral band for all modulation methods, including analog. Carrier frequencies in the table thus represent the data carrier frequency for digital transmissions modulated using QAM or PSK.

Each `CDT_record` represents a definition of N carriers. The `first_index` parameter reflects the index of the first carrier in the group. If the message includes more than one `CDT_record()`, the carrier index of the second group would be `first_index` plus the number of carriers defined in the first group. References to the Carrier Definition Table, such as the `CDT_reference` in the `TDT_record()`, are to the carrier's index (a carrier defined within a `CDT_record()`), *not* to the index of a `CDT_record()` itself.

Note that the carriers, as defined by one or more `CDT_record()`s, may or may not end up sorted in order of increasing carrier frequency. Certain frequency plans may be specified by overlapping two or more `CDT_record()`s, each of which defines equally-spaced carriers.

Note also that carriers may be defined that are currently not in use. To facilitate the compressed delivery format, carriers may be defined that do not reflect reality. An example: carriers at 1, 2, 4, 5, 7, 8 MHz could be defined as eight carriers at 1MHz spacing (3 MHz and 6 MHz do not really exist, or are not currently in use).

	Bits	Bytes	Description
CDT_record() {			
number_of_carriers	8	1	uimsbf
spacing_unit	1	2	bslbf see Table 5.3
reserved	1		bslbf reserved
frequency_spacing	14		uimsbf range 1-16,383 units of 10 or 125kHz
frequency_unit	1	2	bslbf see Table 5.4
first_carrier_frequency	15		uimsbf range 0-32,767 units of 10 or 125kHz
}			

Figure 5.2. CDT record format

number_of_carriers — An unsigned integer in the range one to 255 that represents the number of carriers whose frequency is being defined by this CDT_record().

spacing_unit — A 1-bit field identifying the units for the frequency_spacing field. Table 5.3 defines the coding for spacing_unit.

Table 5.3. Spacing Unit

spacing_unit	meaning
0	10 kHz spacing
1	125 kHz spacing

frequency_spacing — A 14-bit unsigned integer number in the range one to 16,383 that defines the frequency spacing in units of either 10 kHz or 125 kHz, depending upon the value of the spacing_unit parameter. If spacing_unit is zero, indicating 10 kHz, then a value of one indicates 10 kHz spacing, two indicates 20 kHz, and so on. If the number_of_carriers field is one, the frequency_spacing field is ignored. The maximum frequency that can be represented is $((2^{14}) - 1) * 125 \text{ kHz} = 2047.875 \text{ MHz}$. The minimum frequency spacing is 10 kHz.

frequency_unit — A 1-bit field identifying the units for the first_carrier_frequency field. Table 5.4 defines the coding for frequency_unit.

Table 5.4. Frequency Unit

frequency_unit	meaning
0	10 kHz units
1	125 kHz units

first_carrier_frequency — A 15-bit unsigned integer number in the range zero to 32,767 that defines the starting carrier frequency for the carriers defined in this group, in units of either 10 kHz or 125 kHz, depending on the value of *frequency_unit*. If only one carrier is defined for the group, the *first_carrier_frequency* represents its frequency. When the *frequency_unit* indicates 125 kHz, the *first_carrier_frequency* can be interpreted as a fractional frequency (1/8 MHz) in the least-significant 3 bits, and an integer number of megahertz in the upper 12 bits. The range of frequencies that can be represented is zero to $((2^{15}) - 1) * 125 \text{ kHz} = 4095.875 \text{ MHz}$.

For satellite use, carrier frequencies specified in the CDT are defined relative to the point in the receiver following block conversion of the downlink signal — i.e., at the L-band input to the receiver. The Local Oscillator (L.O.) frequency offset is defined by the *frequency_band* parameter defined in the Satellite Information Table for each satellite. In addition, a convention for synthesis of the tuned frequency is assumed (either high side or low side), again based on frequency band. Table 5.5 defines the L.O. frequency and conversion method for each band.

To convert a frequency specified in the CDT to the corresponding downlink frequency, for the high-side conversion method, the CDT frequency is subtracted from the L.O. frequency appropriate to the satellite. For low-side conversion, the CDT frequency is added to the L.O. frequency.

Table 5.5. Local Oscillator Frequencies vs. Frequency Band

Frequency Band	L. O. Frequency	Conversion
C Band	5.150 GHz	High side
Ku (FSS)	10.750 GHz	Low side
Ku (BSS)	11.250 GHz	Low side

5.1.4 Modulation Mode Table (MMT)

Figure 5.3 defines the structure of the *MMT_record()*.

	Bits	Bytes	Description
MMT_record() {			
transmission_system	4	1	uimbsf see Table 5.6
inner_coding_mode	4		uimbsf see Table 5.7
split_bitstream_mode	1	1	bslbf {no, yes}
reserved	2		bslbf reserved
modulation_format	5		uimbsf see Table 5.8
reserved	4	4	bslbf reserved
symbol_rate	28		uimbsf units: one symbol per sec.
}			

Figure 5.3. MMT record format

5.1.4.1 Transmission System

transmission_system — A 4-bit field that identifies the transmission standard employed for the waveform defined by this MMT record. Table 5.6 defines the coding for **transmission_system**.

Table 5.6. Transmission System

transmission_system	meaning
0	unknown — The transmission system is not known.
1	The transmission system conforms to Annex A of Reference [8].
2	The transmission system conforms to Annex B of Reference [8].
3	The transmission system conforms to Reference [9].
4	ATSC — The transmission system conforms to the ATSC Digital Television Standard (Reference [2]).
5	DigiCipher — The transmission system conforms to the General Instrument DigiCipher® II System for satellite distribution of compressed audio and video.
6-15	Reserved

5.1.4.2 Inner Coding Mode

inner_coding_mode — A 4-bit field that indicates the coding mode for the inner code associated with the waveform described in this MMT record. The following values are currently defined: 5/11, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, and 7/8. Coding of the **inner_coding_mode** field is shown in Table 5.7.

Table 5.7. Inner Coding Mode

inner_coding_mode	meaning
0	rate 5/11 coding
1	rate 1/2 coding
2	reserved
3	rate 3/5 coding
4	reserved
5	rate 2/3 coding
6	reserved
7	rate 3/4 coding
8	rate 4/5 coding
9	rate 5/6 coding
10	reserved
11	rate 7/8 coding
12-14	reserved
15	none — indicates that the waveform does not use concatenated coding

5.1.4.3 Modulation Format

modulation_format — A 5-bit field that defines the basic modulation format for the carrier. Table 5.8 defines the parameter.

Table 5.8. Modulation Format

modulation_format	meaning
0	unknown — The modulation format is unknown.
1	QPSK — The modulation format is QPSK (Quadrature Phase Shift Keying).
2	BPSK — The modulation format is BPSK (Binary Phase Shift Keying).
3	OQPSK — The modulation format is offset QPSK.
4	Reserved
5	Reserved
6	QAM 16 — The modulation format is 16-level Quadrature Amplitude Modulation (QAM).
7	QAM 32 — 32-level QAM
8	QAM 64 — 64-level QAM
9	QAM 100 — 100-level QAM
10	QAM 128 — 128-level QAM
11	QAM 144 — 144-level QAM
12	QAM 196 — 196-level QAM
13	QAM 256 — 256-level QAM
14	QAM 400 — 400-level QAM
15	QAM 512 — 512-level QAM
16	QAM 576 — 576-level QAM
17	QAM 784 — 784-level QAM
18	QAM 1024 — 1024-level QAM
19	8-PSK
20-31	Reserved

5.1.4.4 Symbol Rate

symbol_rate — A 28-bit unsigned integer field that indicates the symbol rate in units of one symbol per second associated with the waveform described in this MMT record.

5.1.5 Satellite Information Table (SIT)

Figure 5.4 defines the structure of the SIT_record().

	Bits	Bytes	Description
SIT_record() {			
satellite_ID	8	1	uimbsf
you_are_here	1	2	bslbf {no, yes}
frequency_band	2		uimbsf see Table 5.9
out_of_service	1		bslbf {no, yes}
hemisphere	1		bslbf see Table 5.10
orbital_position	11		uimbsf units: 0.1 deg.
polarization_type	1	1	bslbf see Table 5.11
reserved	1		bslbf reserved
number_of_transponders	6		uimbsf range 0-63 (1-count)
}			

Figure 5.4. SIT record format

satellite_ID — An 8-bit unsigned integer number in the range zero to 255 that identifies the satellite associated with the data defined in this record.

you_are_here — A Boolean flag that indicates, when set, that the **satellite_ID** field reflects the satellite carrying the Transport Stream that delivered this NETWORK INFORMATION message. The **you_are_here** flag may be used to verify dish alignment during installation of a C-band or Ku-band IRD having a movable dish. All NETWORK INFORMATION messages having **you_are_here** bits set true must be locally originated at an Encoder, rather than being originated at a central site and carried in the Network stream.

frequency_band — A 2-bit field that indicates the frequency band associated with the CDT record. Table 5.9 defines the coding.

Table 5.9. Frequency Band

frequency_band	meaning
0	C Band
1	Ku Band (FSS)
2	Ku Band (BSS)
3	reserved

Refer to Table 5.5 for a description of how **frequency_band** is used to specify downlink frequencies for the satellite CDT.

out_of_service — A Boolean flag that, when set, indicates that the satellite given by **satellite_ID** is permanently out of service; i.e., it has failed or has been retired without replacement. When the flag is false, the satellite is currently in (at least partial) operation. The **out_of_service** flag may be used as a signal to delete satellite and transponder records from Decoder memory.

hemisphere—A 1-bit field indicating whether the satellite given by `satellite_ID` resides in the western (value zero) or eastern (value one) hemisphere. The coding for hemisphere is given in Table 5.10.

Table 5.10. Hemisphere

hemisphere	meaning
0	Western hemisphere
1	Eastern hemisphere

orbital_position — An 11-bit unsigned integer number in the range zero to 1800 representing the orbital position of the satellite given by `satellite_ID`, in units of 0.1° longitude. The longitudinal coordinates provided in the table are West longitude for products fielded in the western hemisphere, and East longitude for products fielded in the eastern hemisphere.

polarization_type — A one-bit field that indicates whether the satellite uses a linear polarization method (horizontal/vertical planes), or a circular method (left/right circular polarization). Table 5.11 defines `polarization_type`.

Table 5.11. Polarization Type

polarization_type	meaning
0	Linear polarization
1	Circular polarization

number_of_transponders — A 6-bit unsigned integer number in the range zero to 63 representing one less than the number of transponders (carriers) associated with the satellite being defined. A value of 23 in the field indicates that the satellite is associated with 24 transponders (carriers), for example.

5.1.6 Transponder Data Table (TDT)

Figure 5.5 defines the structure of the `TDT_record()`.

	Bits	Bytes	Description
TDT_record() {			
transport_type	1	1	bslbf see Table 5.12
polarization	1		bslbf see Table 5.13
transponder_number	6		uimbsf range 0-63
CDT_reference	8	1	uimbsf range 1-255
if (transport_type==MPEG_2) {			
MMT_reference	8	(1)	uimbsf range 1-255
VCT_ID	16	(2)	uimbsf range 0-0xFFFF
reserved	8		bslbf reserved
} else { /* non-MPEG_2 */			
wide_bandwidth_video	1	(1)	bslbf {no, yes}
reserved	2		bslbf reserved
waveform_standard	5		uimbsf see Table 5.14
audio_mode()	24	(3)	
}			
}			

Figure 5.5. TDT record format

transport_type — A 1-bit field identifying the type of transport carried on this transponder as either being an MPEG-2 transport (value zero), or not (value one). Table 5.12 defines the coding.

Table 5.12. Transport Type

transport_type	meaning
0	MPEG-2 transport
1	Non-MPEG-2 transport

polarization — A 1-bit field identifying the polarization of the carrier associated with a satellite transponder. A value of zero indicates horizontal (or left) polarization; a value of one indicates vertical (or right) polarization. The polarization method used (linear or circular) is given in the SIT record for the satellite as polarization_type. Table 5.13 defines polarization.

Table 5.13. Polarization

polarization	meaning
0	Horizontal (for linearly polarized satellites) or Left (for circularly polarized satellites)
1	Vertical (for linearly polarized satellites) or Right (for circularly polarized satellites)

transponder_number — An unsigned 6-bit integer value in the range zero to 63 that indicates which transponder is being defined by this TDT_record(). A value of zero indicates the first transponder, and so on.

NOTE: Numbering in the TDT may or may not correspond to conventional transponder numbering, that for typical C-band satellites (for example) are numbered one to 24.

CDT_reference — An unsigned 8-bit integer value in the range one to 255 that associates the transponder being defined with a particular carrier frequency via this reference into the Carrier Definition Table. The value zero is illegal and shall not be specified. CDT_reference is used as an index value into the CDT.

If a frequency_spec_descriptor() (see Section 7.2.1) is present with the TDT record, the CDT_reference shall be discarded.

5.1.6.1 Standard MPEG-2 Transports

MMT_reference — An 8-bit unsigned integer value in the range one to 255 that references an entry into the Modulation Mode Table (MMT) for satellite transmission medium. For digital waveforms, the MMT_reference associates the transponder/carrier with a digital modulation mode. The value zero is illegal and shall not be specified. MMT_reference is used as an index value into the MMT.

VCT_ID — A 16-bit unsigned integer number in the range zero to 0xFFFF that indicates the Virtual Channel Table ID associated with this transponder.

5.1.6.2 Other Transport Types

wide_bandwidth_video — A Boolean flag that indicates, when set, that the video is modulated at 10.75 MHz peak deviation. When the flag is clear, the video is modulated in "narrow" format, or 8.2 MHz peak deviation.

waveform_standard — A 5-bit field that identifies the waveform standard associated with the transponder (carrier). Table 5.14 defines waveform_standard. If the waveform used has not been explicitly defined in the table, then it shall be coded as "unknown".

Table 5.14. Waveform Standard

waveform_standard	meaning
0	unknown — The waveform type is unknown or undefined..
1	NTSC — The waveform is standard NTSC
2	PAL 625 — The waveform is standard 625-line PAL
3	PAL 525 — The waveform is standard 525-line PAL
4	SECAM — The waveform is standard SECAM
5	D2-MAC — The waveform is D2-MAC
6	B-MAC — The waveform is B-MAC
7	C-MAC — The waveform is C-MAC
8	DCI — The waveform conforms to the General Instrument DigiCipher® I scrambling standard
9	VideoCipher — The waveform conforms to the General Instrument VideoCipher® scrambling standard
10	RCA DSS — The waveform conforms to the RCA DSS system
11	Orion — The waveform is scrambled using the TvCom (formerly Oak) Orion system
12	Leitch — The waveform is scrambled using the Leitch system
13-31	Reserved

5.1.6.3 Audio Mode

Figure 5.6 describes the format of the audio_mode() structure.

	Bits	Bytes	Description
audio_mode() {			
wide_bandwidth_audio	1	3	bslbf see Table 5.15
companded_audio	1		bslbf {no, yes}
matrix_mode	2		uimsbf see Table 5.16
subcarrier_2_offset	10		uimsbf range 0-1023, units of 0.01MHz above 5.0 MHz
subcarrier_1_offset	10		uimsbf range 0-1023, units of 0.01MHz above 5.0 MHz
}			

Figure 5.6. Audio mode structure format

wide_bandwidth_audio — A 1-bit field indicating whether the audio subcarrier(s) defined for this transponder/carrier are modulated in narrow bandwidth (value zero) or wide bandwidth (value one) format. Table 5.15 defines the coding.

Table 5.15. Wide Bandwidth Audio

wide_bandwidth_audio	meaning
0	narrow bandwidth
1	wide bandwidth

companded_audio — A Boolean flag indicating whether audio is transmitted in companded format on this transponder/carrier. A value of zero indicates not companded; a value of one indicates companded audio.

matrix_mode — A 2-bit field that indicates the matrix mode associated with analog audio subcarriers on this transponder/carrier. The field is coded as shown in Table 5.16.

Table 5.16. Matrix Mode

matrix_mode	meaning
0	mono — Indicates that subcarrier 1 carries the L+R (mono) audio channel. Subcarrier 2, if present (specified as a different frequency than subcarrier 1), then subcarrier 2 carries cue tones or other audio.
1	discrete_stereo — Indicates that subcarrier 1 carries the left audio channel, and subcarrier 2 carries the right audio channel.
2	matrix_stereo — Indicates that subcarrier 1 carries the L+R (sum) vector and subcarrier 2 carries the L-R (difference) vector.
3	Reserved

subcarrier_2_offset — A 10-bit unsigned integer field in the range zero to 1023 that defines the audio subcarrier offset for the second audio subcarrier (if any). The value is given in units of 0.01 MHz above 5.0 MHz. A value of one, for example, indicates a subcarrier offset of 5.01 MHz. If no second subcarrier exists, the value of subcarrier_2_offset is set to equal subcarrier_1_offset.

subcarrier_1_offset — A 10-bit unsigned integer field in the range zero to 1023 that defines the audio subcarrier offset for the primary audio subcarrier. The value is given in units of 0.01 MHz above 5.0 MHz.

5.1.7 Message-End Descriptors

The message may include at its end one or more structures of the form tag, length, data. The number of descriptors present is determined indirectly by processing the section_length field.⁶

⁶ The total capacity of the CDT is 255 frequencies. As more Ku band satellites are launched that do not re-use existing frequency plans, this CDT may potentially overflow. One solution to a CDT overflow condition is a mechanism whereby the frequency can be specified directly in the TDT. This is done using the frequency_spec_descriptor.

5.2 Network Text Message

The NETWORK TEXT message is carried in the network data stream, and delivers sections of textual tables applicable system-wide. The NETWORK TEXT message is defined multilingually. The defined table types include:

- Transponder Name Table (TNT)
- Satellite Text Table (STT)
- Rating Text Table (RTT)
- Rating System Table (RST)
- Currency System Table (CST)
- Source Name Table (SNT)
- Map Name Table (MNT)

Figure 5.7 defines the format of the NETWORK TEXT message. Note that table type acronyms defined above parenthetically are used in Figure 5.7, as opposed to the actual integer table type values defined in Table 5.18. This is done to improve readability.

	Bits	Bytes	Description
network_text_message() {			
table_ID	8	1	uimbsf value 0xC3
Zero	2	2	bslbf
ISO_reserved	2		bslbf
section_length	12		uimbsf
Zero	3	1	
protocol_version	5		see section 4.1.6
ISO_639_language_code	24	3	per ISO 639 Part 2
transmission_medium	4	1	uimbsf see Table 5.17
table_type	4		uimbsf see Table 5.18
if (table_type==TNT) {			
satellite_ID	8	(1)	uimbsf range 0-255
first_index	8	(1)	uimbsf range 0-255
number_of_TNT_records	8	(1)	uimbsf
for (i=0; i<number_of_TNT_records; i++) {			
TNT_record()	*	((*))	
TNT_descriptors_count	8	((1))	range 0-255
for (i=0; i<TNT_descriptors_count; i++) {			
descriptor()	*	((*))	
}			
}			
}			
if (table_type==STT) {			
first_index	8	(1)	uimbsf range 0-255
number_of_STT_records	8	(1)	uimbsf
for (i=0; i<number_of_STT_records; i++) {			
STT_record()	*	((*))	
STT_descriptors_count	8	((1))	uimbsf range 0-255
for (i=0; i<STT_descriptors_count; i++) {			
descriptor()	*	(((*)))	
}			
}			
}			
if (table_type==RTT) {			
rating_region	8	(1)	uimbsf
rating_text_table()	*	(*)	
}			
if (table_type==RST)			
rating_system_table()	*	(*)	
if (table_type==CST)			
currency_system_table()	*	(*)	
if (table_type==SNT)			
source_name_table()	*	(*)	
if (table_type==MNT)			
map_name_table()	*	(*)	
for (i=0; i<N; i++) {			
descriptor()	*	(*)	optional
}			
CRC_32	32	4	rpchof
}			

Figure 5.7. Network text message format