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SERIES J: CABLE NETWORKS AND TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

Digital transmission of television signals – Part 1

Time-division multiplexing of multiple MPEG-2 transport streams and generic formats of transport streams over cable television systems

Recommendation ITU-T J.183

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Summary

Recommendation ITU-T J.183 describes a time-division multiplexing (TDM) format for transmitting multiple Motion Picture Experts Group version 2 (MPEG-2) transport streams (TSs) or generic formats of TSs by using a simple implementation of an MPEG-2 systems physical interface on cable television systems. The TDM frame encapsulates the MPEG-2 TSs or generic formats of TSs, which are packetized into 188-byte length prior to transmission. It also describes the framing structure for high-speed transmission by channel-bonding technology.

The format features interoperability with the existing satellite transmodulation format, which is based on the specification in Annex C of ITU-T J.83 and Annex C of ITU-T J.84 (satellite master antenna television (SMATV) system C (III)).

It may also be applicable to other transmission systems. When this format is introduced into existing digital cable television systems, it is recommended that information about the frame format be transmitted by the network information table simultaneously. It is necessary for the set-top box to identify the digital channel containing multiple MPEG-2 TSs or generic formats of TSs.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T J.183	2001-03-09	9	11.1002/1000/5395
2.0	ITU-T J.183	2016-03-15	9	11.1002/1000/12766

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Time-division multiplexing of multiple MPEG-2 transport streams and generic formats of transport streams over cable television systems

1 Scope

This Recommendation specifies a time-division multiplexing (TDM) frame format for adapting multiple Motion Picture Experts Group version 2 (MPEG-2) transport streams (TSs) or generic formats of TSs, some of which exceed the transmission rate per channel, into the existing physical layer interface specified in Annex C of [ITU-T J.83]. This format may be applicable to other transmission systems.

The frame format aims to multiplex TSs without change, except that some of the service information (SI) related to the network is replaced. By using this frame structure as an optional addition to conventional digital transmission equipment, multiple TSs can be multiplexed as they are. The functionality of multiplexing TSs into a single TS is not needed. In addition, the expansion of the frame format, being compliant with the first edition (2001-03-09) of this Recommendation, can provide the functionality for a high-speed transmission scheme by channel-bonding technology.

The frame format enables a cable television operator to pack multiple TSs into a single channel or multiple channels. Operation of a cable distribution network would become flexible if services could be integrated on the basis of the TS.

This Recommendation provides the information needed by designers and manufacturers of equipment (including receivers) for distributing digital multi-programme signals by cable networks.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.222.0] Recommendation ITU-T H.222.0 (2014) | ISO/IEC 13818-1:2015, *Information technology – Generic coding of moving pictures and associated audio information: Systems.*

[ITU-T H.262] Recommendation ITU-T H.262 (2012) | ISO/IEC 13818-2:2013, *Information technology – Generic coding of moving pictures and associated audio information: Video*.

[ITU-T J.83] Recommendation ITU-T J.83 (2007), *Digital multi-programme systems for television, sound and data services for cable distribution.*

[ITU-T J.94] Recommendation ITU-T J.94 (1998), *Service information for digital broadcasting in cable television systems*.

[ITU-T J.288] Recommendation ITU-T J.288 (2016), *Encapsulation of type-length-value (TLV) packet for cable transmission systems*.

[ITU-R BT.1869] Recommendation ITU-R BT.1869 (2010), *Multiplexing scheme for variable-length packets in digital multimedia broadcasting systems*.

[ISO/IEC 13818-3] ISO/IEC 13818-3 (1998), *Information technology – Generic coding of moving pictures and associated audio information – Part 3: Audio.*

[ISO/IEC 13818-7] /IEC 13818-7 (2006), *Information technology – Generic coding of moving pictures and associated audio information – Part 7: Advanced Audio Coding (AAC).*

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 fragmented TLV packet: A fixed-length packet that has fragmented type-length-value (TLV).

3.2.2 generic format of transport stream: A data stream other than Motion Picture Experts Group version 2 (MPEG-2) transport stream (TS), e.g., type-length-value (TLV). For transmitting a TLV stream in an existing ITU-T J.83 system, packetization is carried out in accordance with [ITU-T J.288].

3.2.3 network: A collection of Motion Picture Experts Group version 2 (MPEG-2) transport stream (TS) multiplexes transmitted on a single delivery system, e.g., all digital channels on a specific cable system.

3.2.4 original_network_id: A label identifying the network_id of the originating delivery system.

3.2.5 physical interface: The interface on a physical layer equipment for transmission.

3.2.6 programme: A concatenation of one or more events under the control of a broadcaster, e.g., news show, entertainment show.

3.2.7 set-top box: A hardware box that contains a digital signal demodulator, de-multiplexer, Motion Picture Experts Group version 2 (MPEG-2) decoder, other functionalities and interfaces related to digital signal reception and presentation of the distributed programme at the subscriber's site.

3.2.8 stream_id: A unique identifier of a transport stream (TS) or other generic stream within an original network.

4 Abbreviations and acronyms:

This Recommendation uses the following abbreviations and acronyms:

bslbf bit string, left bit first

CRC Cyclic Redundancy Check

HD High Definition

HDTV High-Definition Television

MPEG-2 Motion Picture Experts Group version 2

NIT Network Information Table

PID Packet Identifier

QAM Quadrature Amplitude Modulation

rpchof	remainder polynomial coefficients, highest order first
SI	Service Information
SMATV	Satellite Master Antenna Television
TDM	Time-Division Multiplexing
TLV	Type-Length-Value
TS	Transport Stream
TSMF	Transport Stream Multiplexing Frame
TV	Television
UHDTV	Ultra High-Definition Television
uimsbf	unsigned integer, most significant bit first

5 Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

In the body of this document and its annexes, the words *shall*, *shall not*, *should* and *may* sometimes appear, in which case they are to be interpreted, respectively, as *is required to*, *is prohibited from*, *is recommended* and *can optionally*. The appearance of such phrases or keywords in an appendix or in material explicitly marked as *informative* are to be interpreted as having no normative intent.

6 Transmission system for multiple MPEG-2 transport streams or generic formats of transport streams

The framing structure for a transmission system for multiple MPEG-2 TSs or generic formats of TSs meets the following requirements:

a) multiple MPEG-2-TSs and generic formats of TSs are required to be transmitted over a digital carrier in compliance with the specification of existing cable TV systems;

b) all packets of all MPEG-2-TSs or generic formats of TSs are required to be transmitted without any packet loss;

c) all MPEG-2-TSs received are required to be in compliance with the specification of MPEG-2 systems;

d) the transmission system is required to make effective use of cable TV channel capacity;

e) delay time resulting from optional use of signal processing is required not to affect digital broadcasting services;

f) the added cost of introduction of the optional facilities in a cable TV headend and the receiver is required to be low;

g) the system is required to support interoperability with conventional single TS transmission systems for cable distribution;

h) the system is recommended to support channel-bonding functionality for high-speed TSs such as ultra high-definition television (UHDTV), while maintaining backward compatibility with conventional single carrier transmission systems.

Concerning MPEG-2, systems coding is specified in [ITU-T H.222.0]; video coding is specified in [ITU-T H.262] and audio coding is specified in [ISO/IEC 13818-3] and [ISO/IEC 13818-7].

Concerning transport streams (TSs), a data structure is specified in [ITU-T H.222.0].

6.1 Framing structure for transmission of multiple MPEG-2 TSs or generic formats of transport streams

The transmission system for multiple MPEG-2 TSs or generic formats of TSs uses the frame structure shown in Table 1 to multiplex multiple MPEG-2 TSs or generic formats of TSs. The frame structure is called the transport stream multiplexing frame (TSMF). The packets of the MPEG-2 TSs or generic formats of TSs shall be assigned to slots in the TSMF. A slot is constituted from 188 bytes, namely, the same size as a TS packet, and the TSMF consists of N slots.

The TSMF has a TSMF_header, which contains information about multiplexing and de-multiplexing in the first slot. By outputting this frame repeatedly, multiple MPEG-2 TSs or generic formats of TSs are transmitted.

Table 1 – TSMF structure

Syntax	No. of bytes	Description
TSMF () {		
TSMF_header()	188	
for (I = 1; i< N; i++){		
TS_packet[i]	188	
}		
}		
NOTE – 'TS_packet' may be interpreted as '188-byte length fragmented data packet', including sync_byte and specific packet identifier (PID).		

6.2 Physical interface and channel coding of the transmission system for multiple MPEG-2 TSs or generic formats of transport streams

Except for the framing block, channel coding is identical to that of the single TS transmission system (Figure 1) because the signal multiplexed by using the TSMF is a stream of TS packets or '188-byte length fragmented data packets', including sync_byte and specific PID packets. Accordingly, the technology and standards specified for the physical interface of a single TS transmission system, for example, [ITU-T J.83], can be applied.

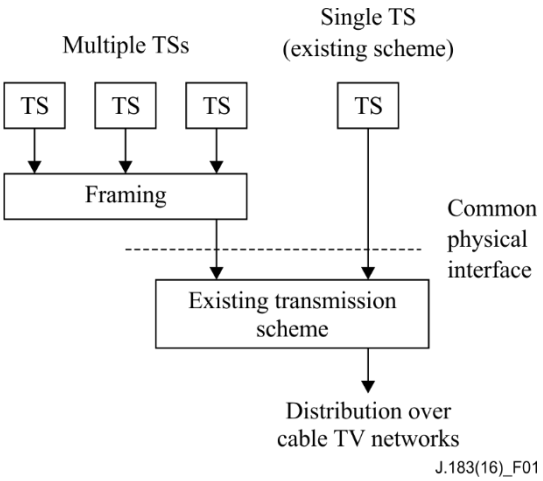

Figure 1 – System configuration for transmission of single TS and multiple TSs

NOTE – In Figure 1, 'TS' includes MPEG-2 TSs or generic formats of TSs packetized in compliance with the specification of existing common physical interface for cable TV distribution.

6.3 Structure of TSMF_header

The TSMF_header is required to be comprised of 188-byte data. The first byte, namely, 0x47, is for packet synchronization. It is followed by 187 bytes of the following information:

– frame synchronization;

– identification of MPEG-2 TS or generic formats of TSs for each slot;

– others (e.g., version number, and flag bit for broadcasting emergency alerts).

Each of the MPEG-2 TSs or generic formats of TSs, multiplexed in the TSMF, is uniquely distinguished by the stream identification (stream_id) and original network identification (original_network_id). Instead of directly using the corresponding information between a slot number and stream_id/original_network_id, the relative stream number (relative_stream_number) is employed. The stream_id/original_network_id of a stream, to which a TS_packet or a 188-byte-length fragmented generic stream in a slot belongs, is resolved into two stages: the first is the translation of slot number to relative_stream_number and the second is the translation of relative_stream_number to stream_id/original_network_id. This procedure reduces the number of bits for the stream identification in the TSMF_header. The content of the TSMF_header is specified in Table 2 and below.

Table 2 – TSMF_header

Syntax	No. of bits	Description
TSMF_header() {		
packet_header()	32	
TSMF_sync	16	bslbf
version_number	V	
slot_information()	S	
identifiers_information()	32 * M	M = 2^m – 1
control_information()	C	bslbf
relative_stream_information()	m * (N – 1)	
extension_data	1424 – V – S – 32 * M – C – m * (N – 1)	

Table 2 – TSMF_header

Syntax	No. of bits	Description
CRC	32	rpchof
}		

NOTE 1 – The semantic definition of the fields in the TSMF header is as follows:

TSMF_sync: A 16-bit field, whose value shall be determined by the transmission system; bslbf.

version_number: AV-bit field indicating renewal of the area from slot_information to control_information in the TSMF_header. It shall be incremented by 1 when a change occurs. When it reaches maximum value, it wraps around to 0.

extension_data: A field whose syntax and semantics shall be defined by the system.

cyclic redundancy check (CRC): Added to detect any errors. As defined in [ITU-T H.222.0], the value of CRC has zero register output when 184 bytes of a TSMF_header, excluding the first 4 bytes, are input into the register of a decoder; remainder polynomial coefficients, highest order first (rpchof): remainder polynomial coefficients, highest order first.

NOTE 2 – $V + S = 8 * I_1$, where V is the number of bits for version_number, S is the number of bits for slot_information, and I_1 is an integer.

NOTE 3 – $C = 8 * I_2$, where C is the number of bits for control_information, and I_2 is an integer.

NOTE 4 – N is the number of slots in the TSMF, or the total length of the frame.

NOTE 5 – M is the maximum number of TSs multiplexed in the TSMF.

6.3.1 Packet_header

The first four bytes of the TSMF_header have a structure similar to that of the MPEG-2 TS packet header, as shown in Table 3.

Table 3 – Packet_header

Syntax	No. of bits	Description
packet_header() {		
sync_byte	8	bslbf
'000'	3	bslbf
TSMF_header_PID	13	uimsbf
'0001'	4	bslbf
continuity_counter	4	uimsbf
}		

NOTE – The semantic definition of the fields in packet header is as follows:

sync_byte: A fixed 8-bit field whose value is '0100 0111' (0x47).

TSMF_header_PID: A 13-bit field whose value is set to a unique value other than the PIDs of TS packets. Since the value of TSMF_header_PID is unique, the TSMF_header can be identified from other TS or other packets; uimsbf: unsigned integer, most significant bit first.

continuity_counter: A 4-bit field incrementing with each TSMF_header. When the value reaches '1111' (0x0f), it wraps around to 0.

uimsbf: unsigned integer, most significant bit first.

6.3.2 TSMF_sync

The TSMF_sync is used for frame synchronization. Using the TSMF_sync and the TSMF_header_PID together, frame synchronization is ensured. The value shall be defined by the system.

6.3.3 Version_number

The version_number indicates renewal of the TSMF_header information. It shall be incremented each time the TSMF_header is renewed. The receiver may decode the TSMF header information only when a change of information occurs. The use of version number and the area where information renewal is examined are optionally defined by the system.

6.3.4 Slot_information

The slot_information (see Table 4) shall include the TSMF_format, and the indicator of the availability of each relative_stream_number, and so on. The TSMF_format may indicate the maximum number of TSs or other streams, such as type-length-value (TLV), transmitted simultaneously and the number of slots in the TSMF. Concerning TLV, a data structure is specified in [ITU-R BT.1869]. Each of the availability_for_relative_stream_number shall be transmitted sequentially in order of the relative_stream_number from 1 to M.

Table 4 – Slot_information

Syntax	No. of bits	Description
slot_information() {		
TSMF_format	F	bslbf
for (I = 1; i<= M; i++) {		M = 2^m – 1
availability_for_relative_stream_number[i]	1	bslbf
}		
reserved_for_future_use	S-F-M	
}		

NOTE 1 – F is the number of bits of the TSMF_format.

NOTE 2 – M is the maximum number of streams multiplexed in the TSMF.

NOTE 3 – S is the number of bits of slot_information.

NOTE 4 – Semantic definition of the fields in the slot_information is as follows:

TSMF_format: An F-bit field which indicates N and M, whose values is required to be the same as defined in Annex C of [ITU-T J.94].

availability_for_relative_stream_number[i]: A 1-bit field that represents availability of the TS or other stream labelled by relative_stream_number i.

NOTE 5 – The term "reserved_for_future_use" indicates that the value may be used in the future defined extensions. All "reserved_for_future_use" bits shall be set to "1".

6.3.5 Identifiers_information

The algorithm relating relative_stream_number and stream_id/original_network_id is shown in Table 5. The stream_id/original_network_id shall be composed of 32-bit numbers and arranged in order of the relative_stream_number from 1 to M.

Table 5 – Identifiers_information

Syntax	No. of bits	Description
identifiers_information(){		
for (I = 1; i<= M; i++) {		M = 2^m – 1
stream_id[i]	16	uimsbf
original_network_id[i]	16	uimsbf
}		
}		
NOTE 1 – The maximum number of TSs or 188-byte length fragmented data of generic streams transmitted simultaneously, M, shall be indicated by the 'TSMF_format' as shown in Table 4. NOTE 2 – The semantic definition of the fields in the identifiers information is as follows: **stream_id[i]**: A 16-bit field that represents stream_id of the TS or other generic stream labelled as relative_stream_number i. When a fragmented TLV stream is transmitted, 'stream_id' represents 'TLV_stream_id'. **original_network_id[i]**: A 16-bit field that represents the original_network_id of the stream_id labelled as relative_stream_number i.		

6.3.6 Control_information

The control_information may be used to control set-top boxes, e.g., a flag for broadcasting emergency alerts. The encoding format shall be defined by the system. The number of bits for the control_information, "C", is defined in Table 2.

6.3.7 Relative_stream_number_information

The relative_stream_number for each TS_packet or 188-byte length fragmented packet of generic formats of TSs shall be transmitted sequentially in order of slot from 1 to (N –1) as shown in Table 6. The number of slots in TSMF, N, shall be defined by the system.

Table 6 – Relative_stream_number_information

Syntax	No. of bits	Description
relative_stream_information(){		
for (I = 1; i< N; i++) {		
relative_stream_number[i]	m	uimsbf
}		
}		
NOTE 1 – M is 2^ m – 1. NOTE 2 – The semantic definition of the fields in the relative stream number is as follows: **relative_stream_number[i]**: An m-bit field that represents the relative_stream_number of the ith TS_packet or 188-byte-length fragmented packet of generic formats of TSs.		

Annex A

TSMF format for Annex C of ITU-T J.83

(This annex forms an integral part of this Recommendation.)

A.1 Introduction

This annex describes the format of the TSMF structure for adapting MPEG-2 TS or TLV with large capacity, to be divided into the multiple channel physical layer interfaces specified in Annex C of [ITU-T J.83]. The TSMF is designed for channel bonding by using additional information in the 'extension_data' field of the TSMF header. This technology will support cable TV transmission systems to distribute large-sized contents by multiple carriers when conventional systems having high-definition television (HDTV) channels maintain the same physical layer specification.

A.2 Concept

Channel-bonding technology is overviewed in Figure A.1. The large capacity of an MPEG-2 TS or TLV is divided at the cable TV headend and multiplexed into TDM frames, which are described as 'superframes' in clause A.3. Each of the frames is transmitted by a 64 quadrature amplitude modulation (QAM) or 256 QAM signal. Each of the QAM channels, having symbol clock synchronized, can be allocated to any frequency. The signal of each channel is separately demodulated and all of the demodulated signals are restored to the original stream of UHDTV at a receiver.

The channels carrying UHDTV services and those for existing broadcasting services are confirmed not to disturb each other. As 256 QAM provides transmission capacity larger than 64 QAM, the former is preferable for transmitting UHDTV signals. However, 256 QAM is less robust against any kind of noise or distortion than 64 QAM.

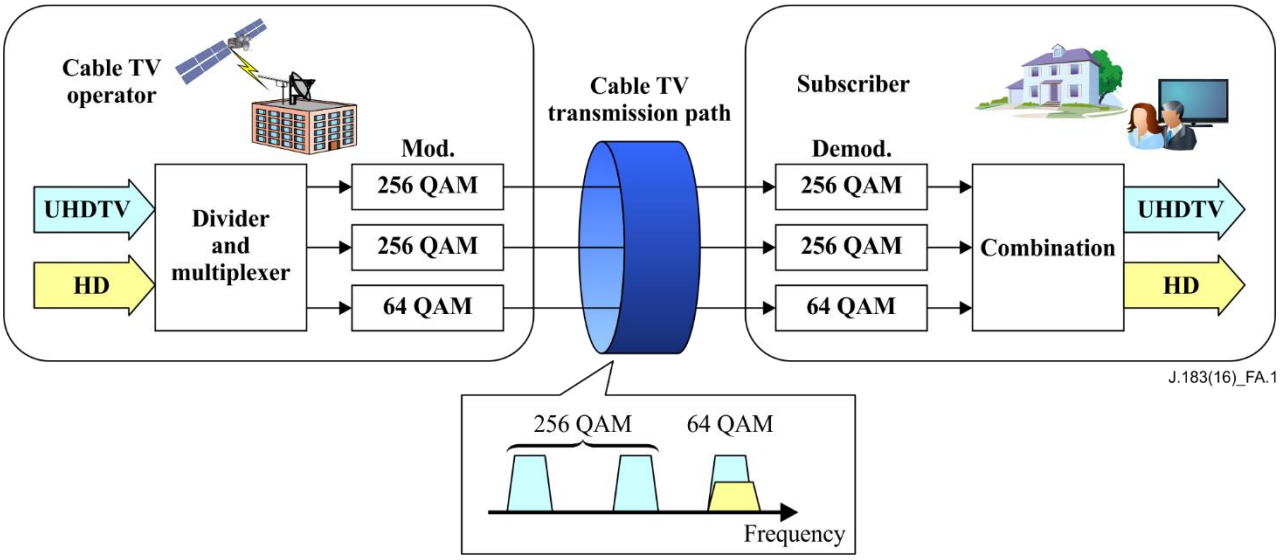

Figure A.1 – Overview of channel bonding

An example of the combination of one 64 QAM and two 256QAM channels used for a single UHDTV transmission is shown in Figure A.2, in which a UHDTV signal occupies two 256QAM channels and a part of 64QAM channel. Note that other programmes, such as those in HDTV, may be transmitted using the remaining capacity of the 64 QAM channel. Any combination of QAM scheme used by the relevant multi-carriers as a group is allowed. Since the bitrates transmitted by 64 and 256 QAMs are different, TSMF is required for bonding channels with different bitrates.

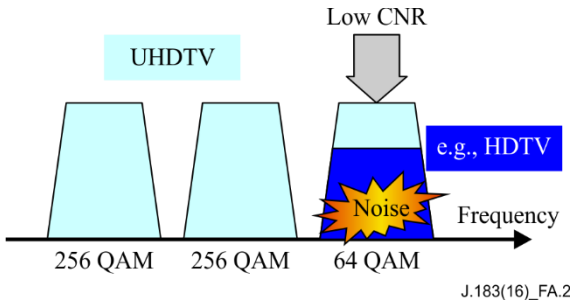

Figure A.2 – Multiple channels used for transmission of UHDTV signals

An example of a TS transmitted by one 64 QAM and two 256 QAM signals using TSMF format is shown in Figure A.3. Channel coding is identical to that of a single TS transmission system, because the stream divided among channels by using the TSMF is a stream of TS or data packets.

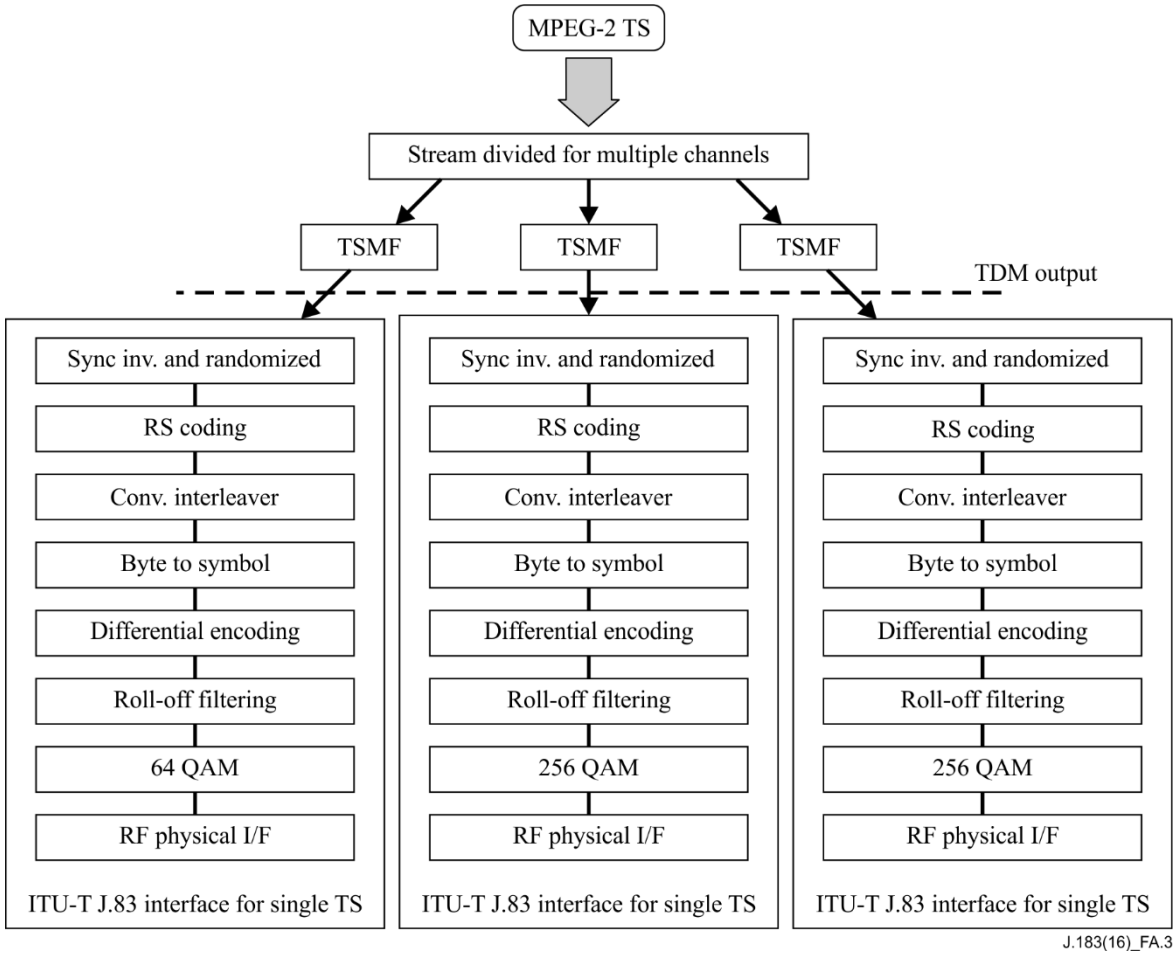

Figure A.3 – Example of a TS carried by one 64 QAM and two 256 QAM signals using TSMF format

A.3 Superframe

The structure of the superframe is outlined in Figure A.4. The number of TSMFs in a superframe is determined to make the periods of superframes identical regardless of the modulation format.

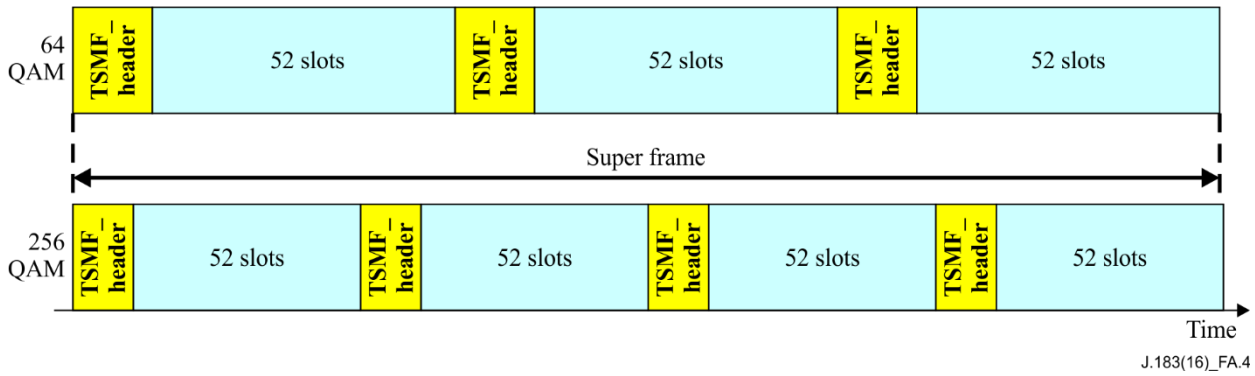

Figure A.4 – Structure of superframe for 64 QAM and 256 QAM

A superframe for a 64 QAM has three TSMFs and that for a 256 QAM has four TSMFs according to the bitrate ratio. The modulation scheme of either channel, 64 QAM or 256 QAM, is determined by the transmission characteristics of the channel.

At the receiver, the arrival time of transmitted signals may differ according to the propagation delay in each channel. A receiver has to temporally align all relevant signals demodulated from received carriers. The TSMF_header of the first TSMF in every superframe is utilized as a marker to synchronize received signals.

In order to apply the TSMF structure for channel-bonding technology, some of the additional parameters in the extension_data of the TSMF_header are defined in this Recommendation.

A.4 TSMF

In order to define the TSMF for channel-bonding functionality, additional parameters are specified within the extension_data of the TSMF_header as shown in Table A.1.

Table A.1 – TSMF_header

TSMF_header	For channel bonding	No. of bits	Description
TSMF_header() {	TSMF_header() {		
packet_header()	as in Table 3		
TSMF_sync	as in Table 2		
version_number	as in Table 2		
slot_information()	as in Table 4		
identifiers_information()	as in Table 5		
control_information()	as in Table 2		
relative_stream_number_information()	as in Table 6		
extension_data	Auxiliary_code_information	AC	bslbf
	stream_type	M	bslbf
	group_id	8	uimsbf
	number_of_carriers	8	uimsbf
	carrier_sequence	8	uimsbf
	number_of_frames	4	uimsbf
	frame_position	4	uimsbf
	reserved_for_future_use	(Note 2)	
CRC	as in Table 2		
}	}		

Table A.1 – TSMF_header

NOTE 1 − The definition of specific fields in the TSMF header is as follows:

auxiliary_code_information: This code information is used to provide auxiliary information, such as earthquake early-warning message for cable TV subscribers in a specific region. The number of bits for auxiliary code information, "AC", and its coding format shall be defined by the system.

stream_type: An M-bit field indicating the kind of streams corresponding to relative_stream_number (ex. "0" for TLV, "1" for MPEG-2 TS or none).

group_id: An 8-bit field representing a unique identifier of a group corresponding to bonding channels.

number_of_carriers: An 8-bit field describing the number of carriers for channel bonding in the same group_id.

carrier_sequence: An 8-bit field indicating the sequence number for channel bonding by carriers with the same group id.

number_of_frames: A 4-bit field representing the number of TSMFs included in the superframe. (ex. 0x03 for 64 QAM, 0x04 for 256 QAM in Annex C of [ITU-T J.83]).

frame_position: A 4-bit field representing the sequence number of multiple TSMFs in the superframe.

NOTE 2 − The value is {(No. of bits in extension_data in Table 2 of [ITU-T J.183])−AC−32}.

Appendix I

System parameters of TSMF for Annex C of ITU-T J.83

(This appendix does not form an integral part of this Recommendation.)

Table I.1 shows parameters for the TSMF employed with the physical layer interface specified in Annex C of [ITU-T J.83].

Table I.1 – System parameters

Parameter	Notation	Value	Remarks
The number of slots in the TSMF, or the total length of the frame	N	53	including TSMF_header
The maximum number of TSs multiplexed in the TSMF	M	15	
TSMF_sync			reserved 3 bits 0x1a86 13 bits
version_number			3 bits (V=3)
slot_information			21 bits (S=21)
TSMF_type			slot_allocation_type 1 bit frame_type[a)] 4 bits (Note) (F=5)
control_information			receive_status 2*M=30 bits emergency_indicator 1 bit
extension_data			85 bytes
NOTE − The "frame_type" in the TSMF_type should be included in the cable delivery system descriptor of the network information table (NIT) for the reception. The set-top box can identify whether each channel on the cable network is with the TSMF. The values of N and M are identical to the definition in Annex C of [ITU-T J.94].			

Bibliography

[b-ITU-T J.84] Recommendation ITU-T J.84 (2001), *Distribution of digital multi-programme signals for television, sound and data services through SMATV networks*.

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