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

Switched digital video over cable networks

Transmission specification for IP-based switched digital video using data over cable service interface specifications

Recommendation ITU-T J.1103

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Transmission specification for IP-based switched digital video using data over cable service interface specifications

Summary

Recommendation ITU-T J.1103 describes the transmission specifications of IP-based switched digital video (SDV) using data over cable service interface specifications (DOCSIS) in a digital cable network. The cable broadcasting system has been changed to use resources efficiently and to transmit said resources in such a way that the varying needs of subscribers are easily accommodated. The transmission specifications described in this Recommendation are defined according to Recommendation ITU-T J.1101, *Functional requirements for IP-based switched digital video using data over cable service interface specifications*. These specifications are designed to maintain quality of service (QoS) while using bandwidth effectively in a hybrid fibre/coaxial (HFC) network environment.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T J.1103	2015-08-13	9	11.1002/1000/12572

* 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.

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Recommendation ITU-T J.1103

Transmission specification for IP-based switched digital video using data over cable service interface specifications

1 Scope

This Recommendation defines the transmission specifications of the IP-based switched digital video (SDV) using data over cable service interface specification (DOCSIS). The transmission specifications described in this Recommendation are defined according to [ITU-T J.1101]. The transmission specifications described in this Recommendation are defined as follows:

– multicast service flow processing transmission specifications

– multicast packet scheduling transmission specifications

– media access control (MAC) header processing transmission specifications

– MPEG-2 TS convergence transmission specifications.

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 J.210] Recommendation ITU-T J.210 (2006), *Downstream RF interface for cable modem termination systems*.

[ITU-T J.222.1] Recommendation ITU-T J.222.1 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems: Physical layer specification*.

[ITU-T J.222.2] Recommendation ITU-T J.222.2 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems: MAC and Upper Layer protocols*.

[ITU-T J.1101] Recommendation ITU-T J.1101 (2012), *Functional requirements for IP-based switched digital video using data over cable service interface specifications*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 IP-based SDV [ITU-T J.1101]: A service mechanism which provides interfaces and functionalities to enable cable television system operators to offer QoS-guaranteed broadcasting and multicasting.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CCP	Channel Charge Protocol
CM	Cable Modem
CMTS	Cable Modem Termination System
CRC	Cyclic Redundancy Check
DA	Destination Address
DC	Downstream Channel
DCID	Downstream Channel Identifier
DEPI	Downstream External PHY Interface
DMPI	DOCSIS MAC-PHY Interface
DOCSIS	Data Over Cable Service Interface Specifications
DRFI	Downstream Radio Frequency Interface
DS	Downstream
DSID	Downstream Service Identifier
EH	Extended Header
EHDR	Extended MAC Header
FC	Frame Control
FEC	Forward Error Correction
FTP	File Transfer Protocol
GBE	Giga Bit Ethernet
HCS	Header Check Sequence
HFC	Hybrid Fibre/Coaxial
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPC	Inter Process Communications
MAC	Media Access Control
M-CMTS	Modular Cable Modem Termination System
MDD	MAC Domain Descriptor
MIB	Management Information Base
MPEG	Moving Picture Experts Group
MSB	Most Significant Bit
NSI	Network Service Interface
PDU	Protocol Data Unit
PHY	Physical Layer
PID	Packet Identifier
PUSI	Payload Unit Start Indicator

QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
RPC	Remote Procedure Call
SA	Source Address
SDV	Switched Digital Video
SF	Service Flow
SFID	Service Flow Identifier
SID	Service Identifier
SIP	Session Initiation Protocol
STB	Set-Top Box
VSI	Video Service Interface

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 Recommendation 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 IP-based SDV reference model

As shown in Figure 1, functionally IP-based SDV using the DOCSIS system can be categorized into three parts:

– the transmission function
– the subscriber function
– the control function.

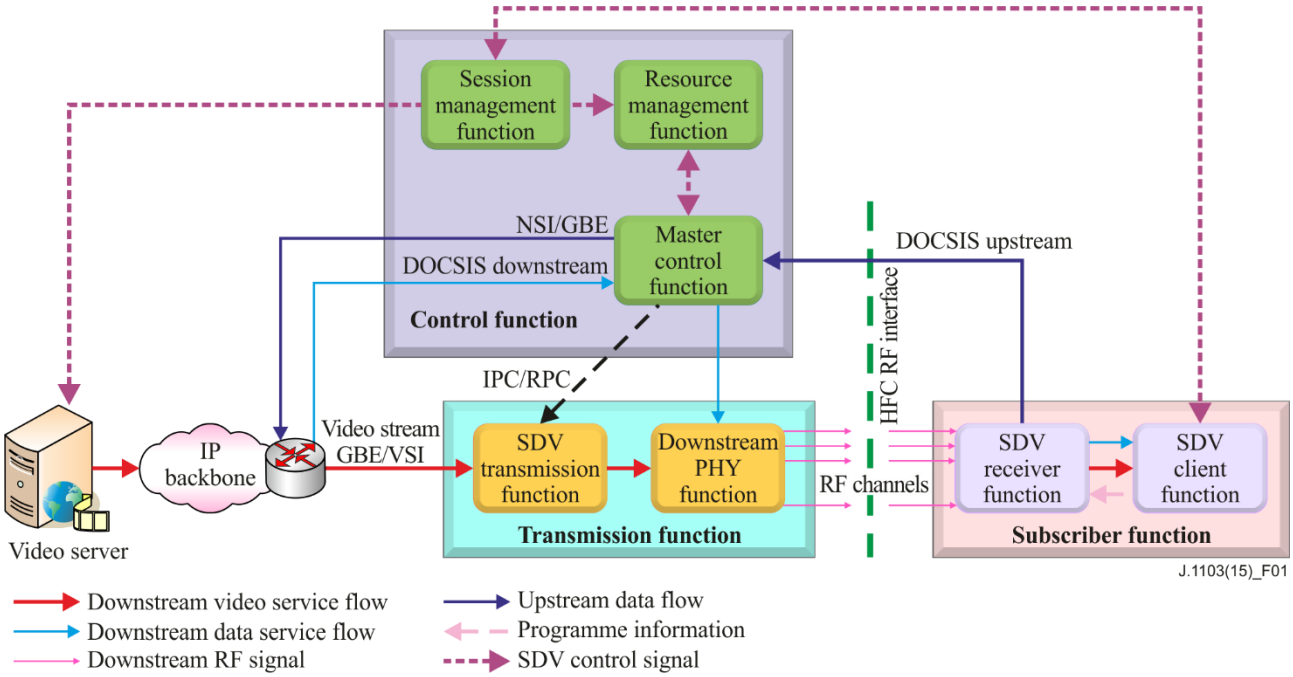

Figure 1 – Diagram of an IP-based switched digital video system

6.1 Transmission function

The transmission function processes the DOCSIS frame header and transmits it to the multicast service group. The transmission function consists of an SDV transmission function and a downstream PHY function. The SDV transmission function processes service flow and packet header processing on the DOCSIS MAC layer [ITU-T J.222.2]. The downstream PHY function transmits the DOCSIS header processed video stream to the subscriber.

6.1.1 SDV transmission function

The SDV transmission function processes service flow and does packet header processing on the DOCSIS MAC layer.

6.1.2 Downstream PHY function

The downstream PHY [ITU-T J.222.1] function transmits the DOCSIS header processed video stream to the subscriber.

6.2 Subscriber function

The subscriber function processes the video data stream from the transmission function. The subscriber function consists of the SDV client service function and SDV receiver function. The subscriber function also sends request information of an SDV video service programme to the control function.

6.2.1 SDV client function

The SDV client function recovers an IP-based received video data stream from an MPEG-2 based video stream and outputs it to the set-top box (STB).

6.2.2 SDV receiver function

The SDV receiver function processes physical signal processing; it is a function of the DOCSIS cable modem.

7 Transmission specification

Figure 2 shows the structure of an IP-based SDV transmission module. The IP-based SDV transmission module is required to consist of service flow processing, packet scheduling, MAC header processing and MPEG-2 TS convergence. Service flow processing is required to obtain the following information on input packets: the packet type, the service flow ID, the downstream service ID, the transmission priority and the available downstream transmission channel list. Packet scheduling is required to schedule the service flow by deciding on the available downstream channel, multiplexing the DOCSIS management message and multicasting the video data packet. MAC header processing is required to process the packet according to the transmission priority and to create the DOCSIS MAC header according to the service flow information of the input packet. MPEG-2 TS convergence is required to place the DOCSIS MAC frame in the queue and to map the DOCSIS MAC frame to MPEG-2 TS.

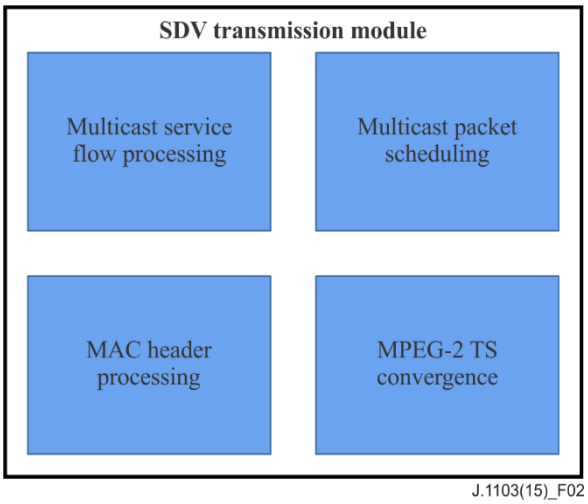

Figure 2 – The architecture of IP-based SDV transmission

7.1 Service flow processing

The service flow processing block is required to obtain the following information from the input packet:

– packet type, downstream service identifier (DSID), service flow identifier (SFID)

– priority

– downstream channel (DC) list bitmask

The packet scheduling block is required to determine the available channel using this information.

The packet format of a transmission specification is shown in Figure 3. Detailed definitions of the header elements are provided in Table 1. The TYPE part consists of five elements as follows: TYPE_CAST, TYPE_BOND, TYPE_PRIORITY, TYPE_MESSAGE and TYPE_RSVD.

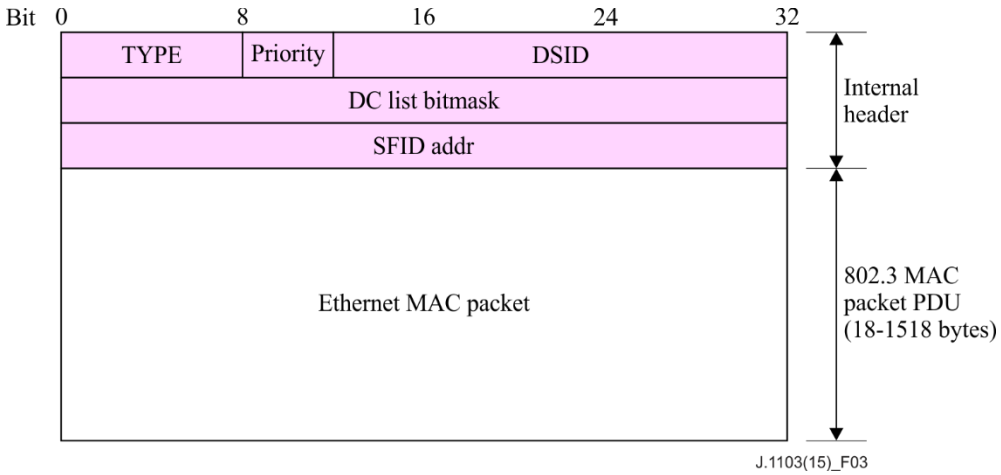

Figure 3 – The data packet format

Table 1 – Data packet frame header

Field	Length (bits)	Function
TYPE_CAST	2	TYPE: 00 – Unicast 01 – Multicast 10 – Broadcast 11 – Reserved
TYPE_BOND	1	TYPE BONDING CONDITION 0 – Channel non-bonded 1 – Channel bonded
TYPE_PRIORITY	1	TYPE ZERO PRIORITY 0 – Zero priority 1 – Non-zero priority
TYPE_MESSAGE	1	TYPE MESSAGE 0 – User packet 1 – MAC management message
TYPE_RSVD	3	TYPE Reserved
PRIORITY	4	PRIORITY 0x 0 ~ 7: High value is high priority
DSID	20	Downstream ID
DC LIST MASK	32	Service available channel list
SFID_ADDR	32	Service flow ID

The service flow classification process is shown in Figure A.1.

7.2 Packet scheduling

Packet scheduling is required to determine the available downstream channel. It is possible to transmit a management message for a determined channel. The management packet format of a transmission specification is shown in Figure 4. Detailed definitions of the header elements are provided in Table 2.

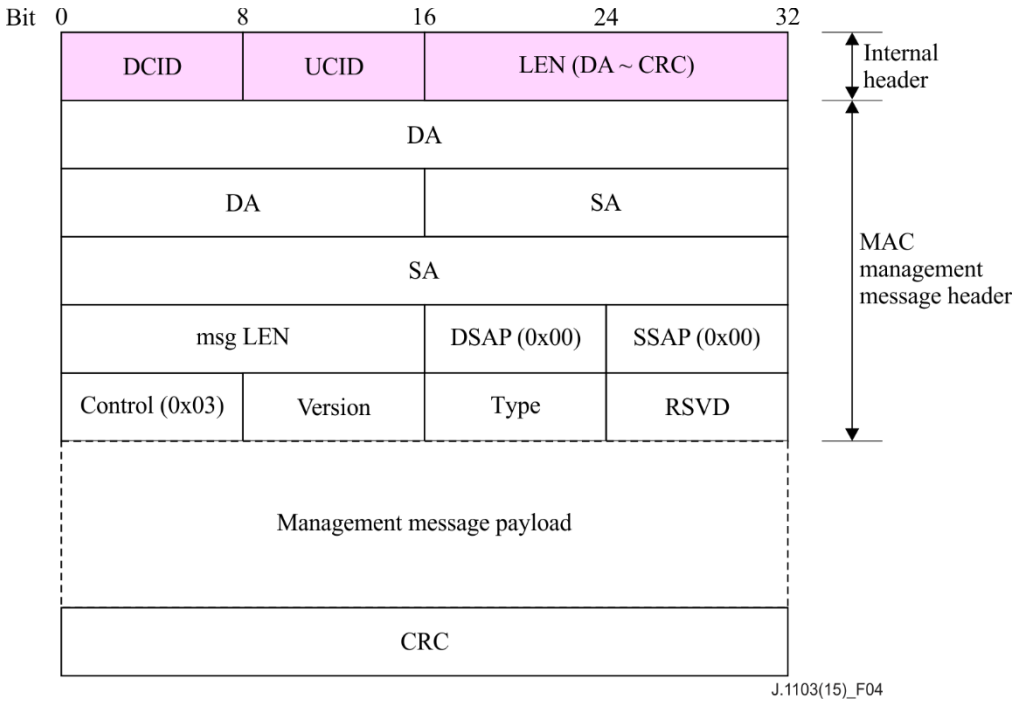

Figure 4 – The management packet format

Table 2 – Management packet frame header

Field	Length (Bit)	Function
DCID	8	Down channel ID
UCID	8	Up channel ID
LEN	16	Length

7.3 MAC header processing

The MAC header processing unit is required to classify the packet and store it in the queue according to the transmission priority. The MAC header processing unit is required to process the stored packets according to the queue priority shown in Table 3.

Table 3 – Queue priority

Input packet priority	Queue priority
15	2
7, 6, 5, 4	1
3, 2, 1, 0	0

Different MAC header types are created according to the packet type as shown in Table 4.

Table 4 – MAC packet header type

MAC header type	Value	Packet type
Five-Byte DS EHDR	00110xxx	Channel bonding unicast packet
		Zero length packet
	01110xxx	Channel bonding multicast packet
Three-Byte DS EHDR	01010xxx	Non-bonding multicast packet
One-Byte DS EHDR	00010xxx	Non-bonding and the priority of service flow is not zero
No DS EHDR	00000xxx	Non-bonding and the priority of service flow is not defined
	10000xxx	Non-bonding, broadcast and unknown MAC address message
	00001xxx	Unicast MAC management message
	01001xxx	Multicast MAC management message

The format of MAC header processing for a user data packet is shown in Figure 5 and the format of MAC header processing for a management packet is shown in Figure 6.

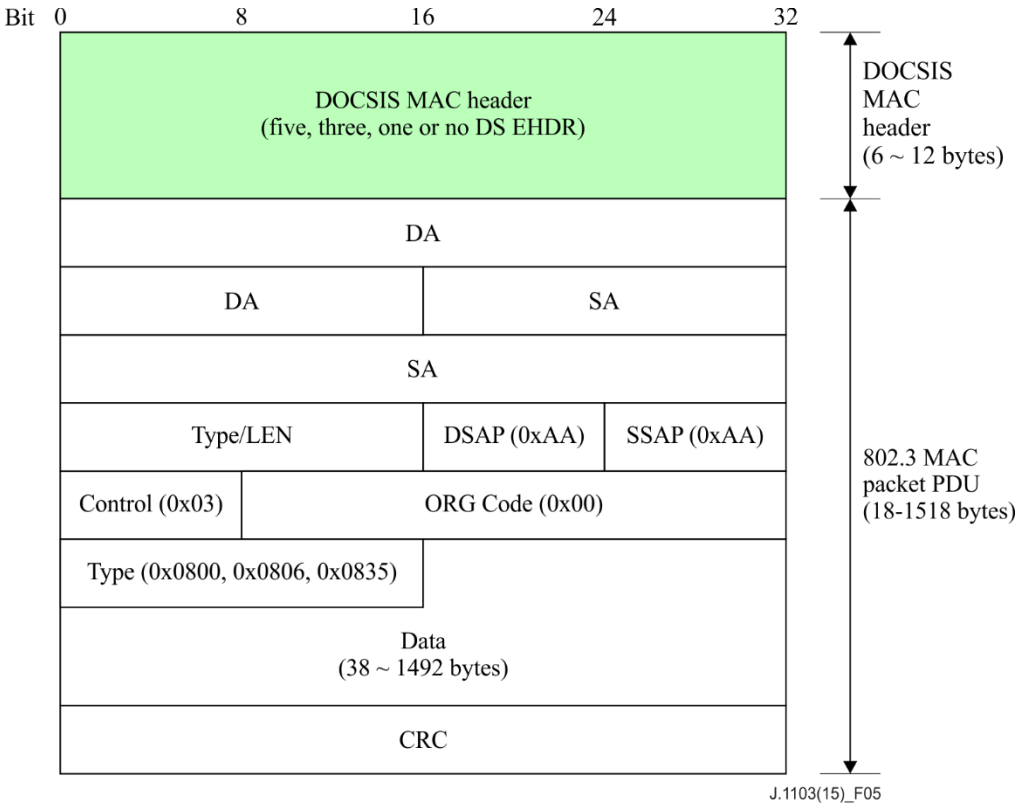

Figure 5 –MAC header processing for a user data packet

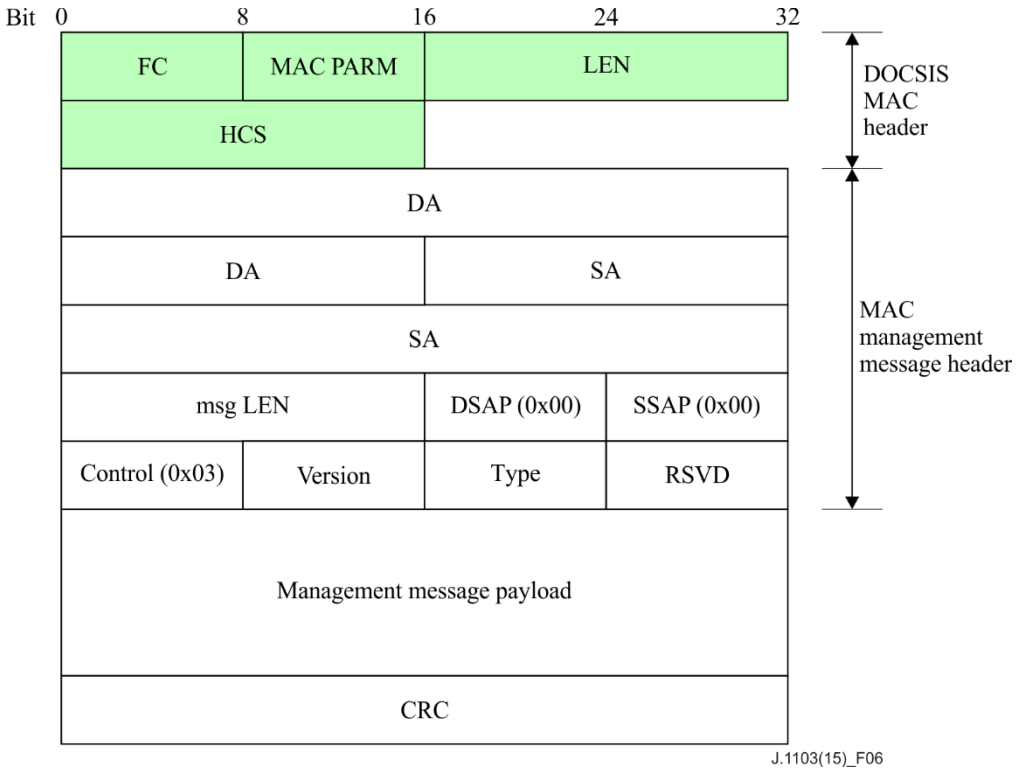

Figure 6 –MAC header processing for a management packet

The message format of a five-byte DS EHDR DOCSIS MAC header is shown in Figure 7. MAC header processing is required to operate the sequence count and count initialization at each DSID if the input packet is a bonded packet (Type=1).

The setting of a five-byte DS EHDR DOCSIS MAC header is shown in Table 5.

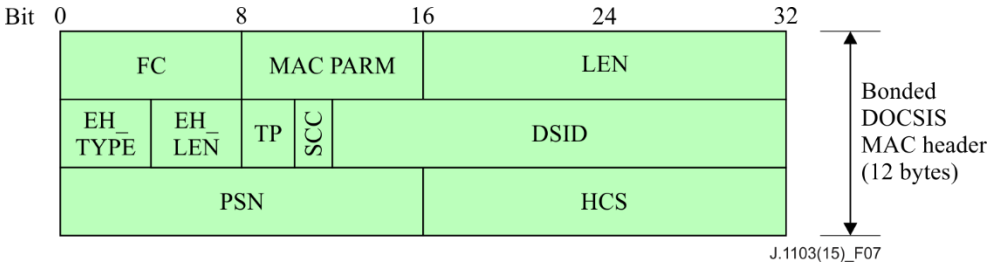

Figure 7 – Message format of five-byte DS EHDR DOCSIS MAC header

Table 5 – Setting of a five-byte DS EHDR DOCSIS MAC header

Field	Size (bits)	Value	
FC	8	0x01	EHDR_ON = 1
MAC_PARAM	8	0x06	Extended header length
LEN	16		packet PDU length + 6 (extended header length)
EH_TYPE	4	0x8	
EH_LEN	4	0x5	
TP	3		Priority of additional area
SCC	1		DSID of initialization flag bit

Table 5 – Setting of a five-byte DS EHDR DOCSIS MAC header

Field	Size (bits)	Value	
DSID	20		DSID of additional area
PSN	16		DSID of current sequence count value
HCS	16		Calculation of FC to PSN

- LEN: the sum of the length of the input packet and the value of the DOCSIS extended header length (6)
- TP: the priority value of the internal additional header in the input packet
- SCC: the initialization flag bit of the relevant DSID
- DSID: the DSID value of the internal additional header of the input packet
- PSN: the current sequence count value which the input packet belongs to
- HCS: the value created by the polynomial $X^{16} + X^{12} + X^5 + 1$ from FC to PSN

The message format of a null packet DOCSIS MAC header is shown in Figure 8. MAC header processing is required to create null packets and increase the counter value by 1, if the DSID has no input packet (TYPE=0). The setting of a null packet DOCSIS MAC header is shown in Table 6.

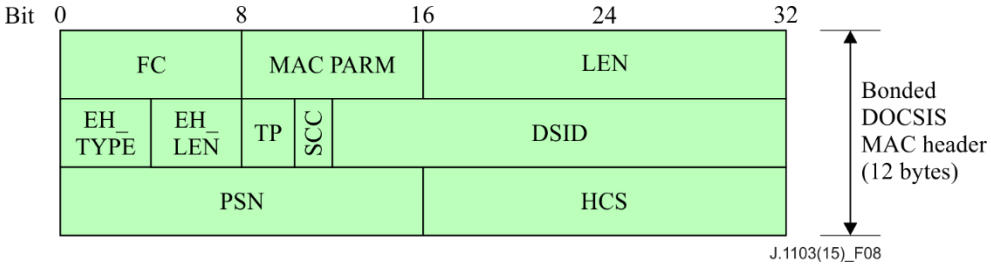

Figure 8 – Message format of a null packet DOCSIS MAC header

Table 6 – Setting of a null packet DOCSIS MAC header

Field	Size (bits)	Value	
FC	8	0x01	EHDR_ON = 1
MAC_PARAM	8	0x06	Extended header length
LEN	16		6 (extended header length)
EH_TYPE	4	0x8	
EH_LEN	4	0x5	
TP	3	0x0	
SCC	1		DSID of initialization flag bit
DSID	20		DSID of additional area
PSN	16		DSID of current sequence count value
HCS	16		Calculation of FC to PSN

- LEN: the value of the DOCSIS extended header length (6)
- SCC: the initialization flat bit of the relevant DSID
- DSID: the DSID value of the internal additional header of the input packet
- PSN: the current sequence count value which the input packet belongs to

- HCS: the value created by the polynomial $X^{16} + X^{12} + X^5 + 1$ from FC to PSN

The message format of a three-byte DS EHDR DOCSIS MAC header is shown in Figure 9. MAC header processing is required to create the three-byte DS EHDR DOCSIS MAC header if the input packet is a non-bonded multicast packet (Type=2).

The setting of a three-byte DS EHDR DOCSIS MAC header is shown in Table 7.

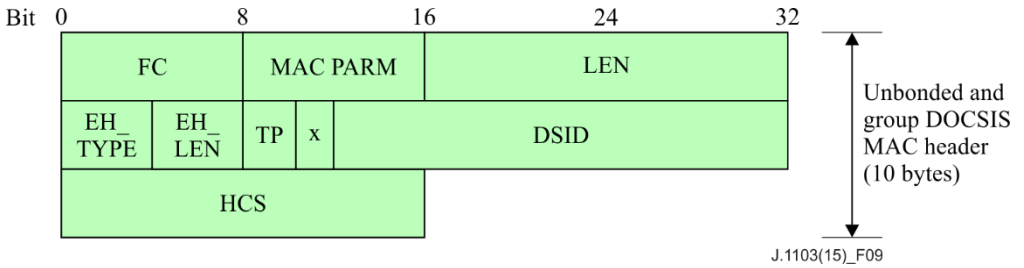

Figure 9 – Message format of a three-byte DS EHDR DOCSIS MAC header

Table 7 – Setting of a three-byte DS EHDR DOCSIS MAC header

Field	Size (bits)	Value	
FC	8	0x01	EHDR_ON = 1
MAC_PARAM	8	0x04	Extended header length
LEN	16		packet PDU length + 4 (extended header length)
EH_TYPE	4	0x8	
EH_LEN	4	0x3	
TP	3		Priority of additional area
Reserved	1		DSID of initialization flag bit
DSID	20		DSID of additional area
HCS	16		Calculation of FC to DSID

- LEN: the length of the input packet protocol data unit (PDU) and the value of the DOCSIS extended header length (4)
- TP: the priority value of the internal additional header in the input packet
- SCC: the initialization flag bit of the relevant DSID
- DSID: the DSID value of the internal additional header of the input packet.
- HCS: the value created by the polynomial $X^{16} + X^{12} + X^5 + 1$ from FC to DSID.

The message format of a one-byte DS EHDR DODSIS MAC header is shown in Figure 10. MAC header processing is required to create the one-byte DS EHDR DOCSIS MAC header if the input packet is non-bonded and the priority of service flow is set up as a not zero value (Type=3).

The setting of a one-byte DS EHDR DODSIS MAC header is shown in Table 8.

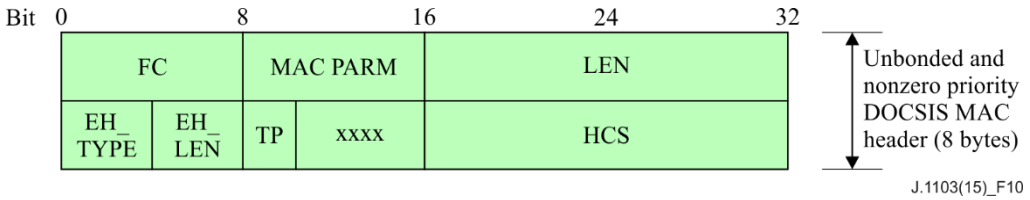

Figure 10 – Message format of one-byte DS EHDR DOCSIS MAC header

Table 8 – Setting of a one-byte DS EHDR DOCSIS MAC header

Field	size (bits)	value	
FC	8	0x01	EHDR_ON = 1
MAC_PARAM	8	0x02	Extended header length
LEN	16		packet PDU length + 2 (extended header length)
EH_TYPE	4	0x8	
EH_LEN	4	0x1	
TP	3		DSID of additional area
Reserved	5	0x0	
HCS	16		Calculation of FC to PSN

- LEN: the length of the input packet PDU and the value of the DOCSIS extended header length (4).
- TP: the priority value of the internal additional header in the input packet
- HCS: the value created by the polynomial $X^{16} + X^{12} + X^5 + 1$ from FC to PSN

The message format of a NO DS EHDR DOCSIS MAC header is shown in Figure 11. MAC header processing is required to create the no DS EHDR DOCSIS MAC header if the input packet is a non-bonded and the priority of service flow is not defined (Type=4).

The setting of a NO DS EHDR DOCSIS MAC header is shown in Table 9.

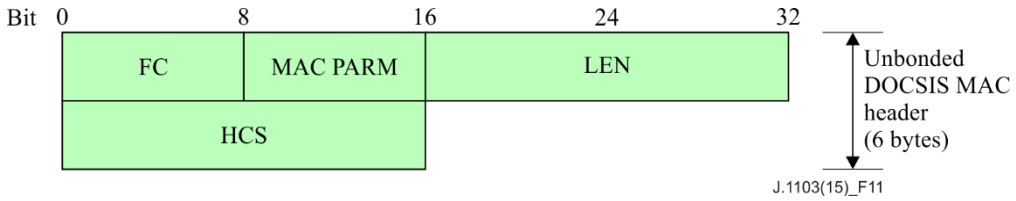

Figure 11 – Message format of a NO DS EHDR DOCSIS MAC header

Table 9 – Setting of a NO DS EHDR DOCSIS MAC header

Field	Size (bits)	Value	
FC	8	0x00	EHDR_ON = 0
MAC_PARAM	8	0x00	0
LEN	16		packet PDU length
HCS	16		Calculation of FC to PSN

- LEN: the value of the length of the input packet PDU
- HCS: the value of polynomial $X^{16} + X^{12} + X^5 + 1$ from FC to LEN

7.4 MPEG-2 TS convergence

MPEG-2 TS convergence is required to store the DOCSIS MAC frame in the queue and for mapping to MPEG-2 TS. The mapped MPEG-2 TS is required to multiplex the MPEG-2 TS from an A/V encoder or re-multiplexer. The structure of MPEG-2 TS convergence is shown in Figure 12 and the structure of MPEG-2 TS encapsulation is shown in Figure 13. The setting values of MPEG-2 TS header are shown in Table 10. An example of MPEG-2 TS encapsulation is shown in Figure B.1.

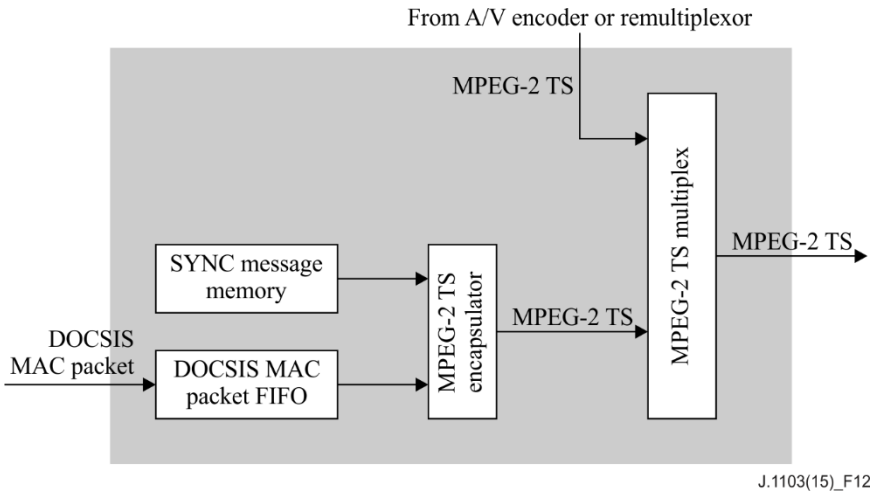

Figure 12 – Structure of MPEG-2 TS convergence

The MPEG-2 TS convergence is required to set the MPEG-2 TS header format in accordance with Table 10. MPEG-2 TS convergence is required to use the 'pointer field' as the payload unit start indicator (PUSI) is set to 1.

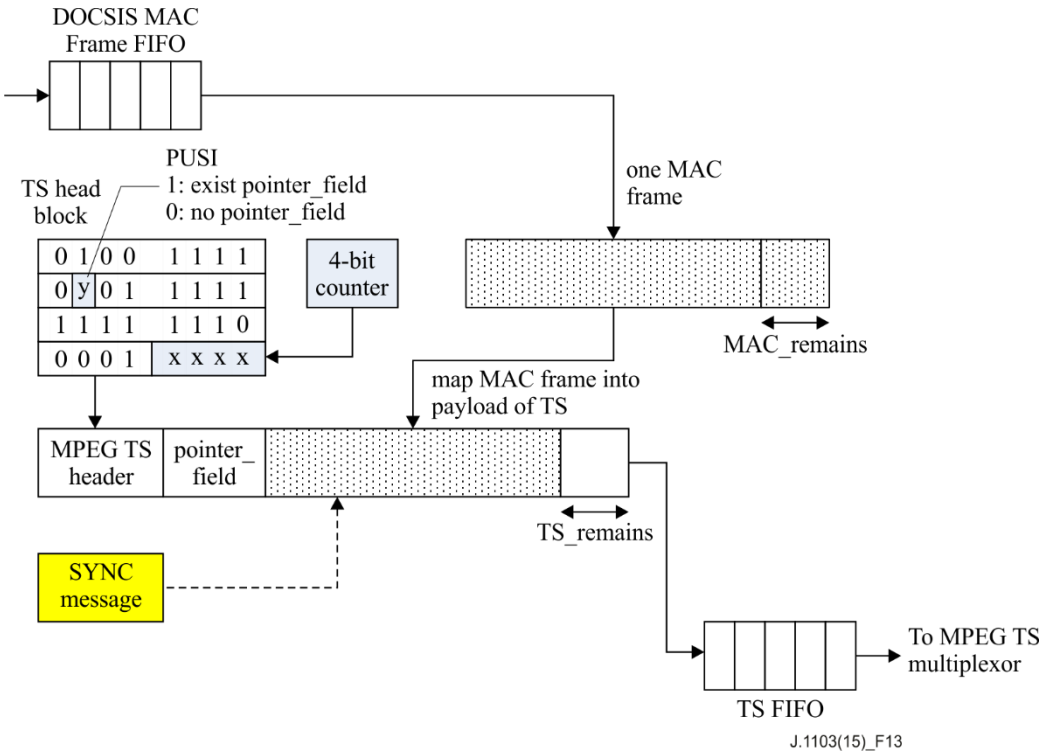

Figure 13 – Structure of MPEG-2 TS encapsulation

Table 10 – MPEG-2 TS header

Field	Size (bits)	Value	
Sync_byte	8	0x47	
Transport_error_indicator	1	'0'	
Payload_unit_start_indicator (PUSI)	1		
Transport_priority	1	'0'	Reserved
PID	13	0x1FFE	
Transport_scrambling_control	2	'0'	Reserved
Adaptation_field_control	2	'01'	
Continuity_counter	4		

Annex A

The service flow classification process

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

The input packet is classified into only one service flow by field searching. The service flow classification process consists of a two-stage approach as follows:

First stage: classification via the destination address of the input MAC packet

Second stage: classification via a defined packet classifier

Figure A.1 illustrates the service flow classification process.

In the first stage, it is possible to determine a specific set-top box (STB) according to the destination MAC address of the input packet. It is necessary to find the specific address from the input MAC Dest. Addr. To CM Classifier Entity Table.

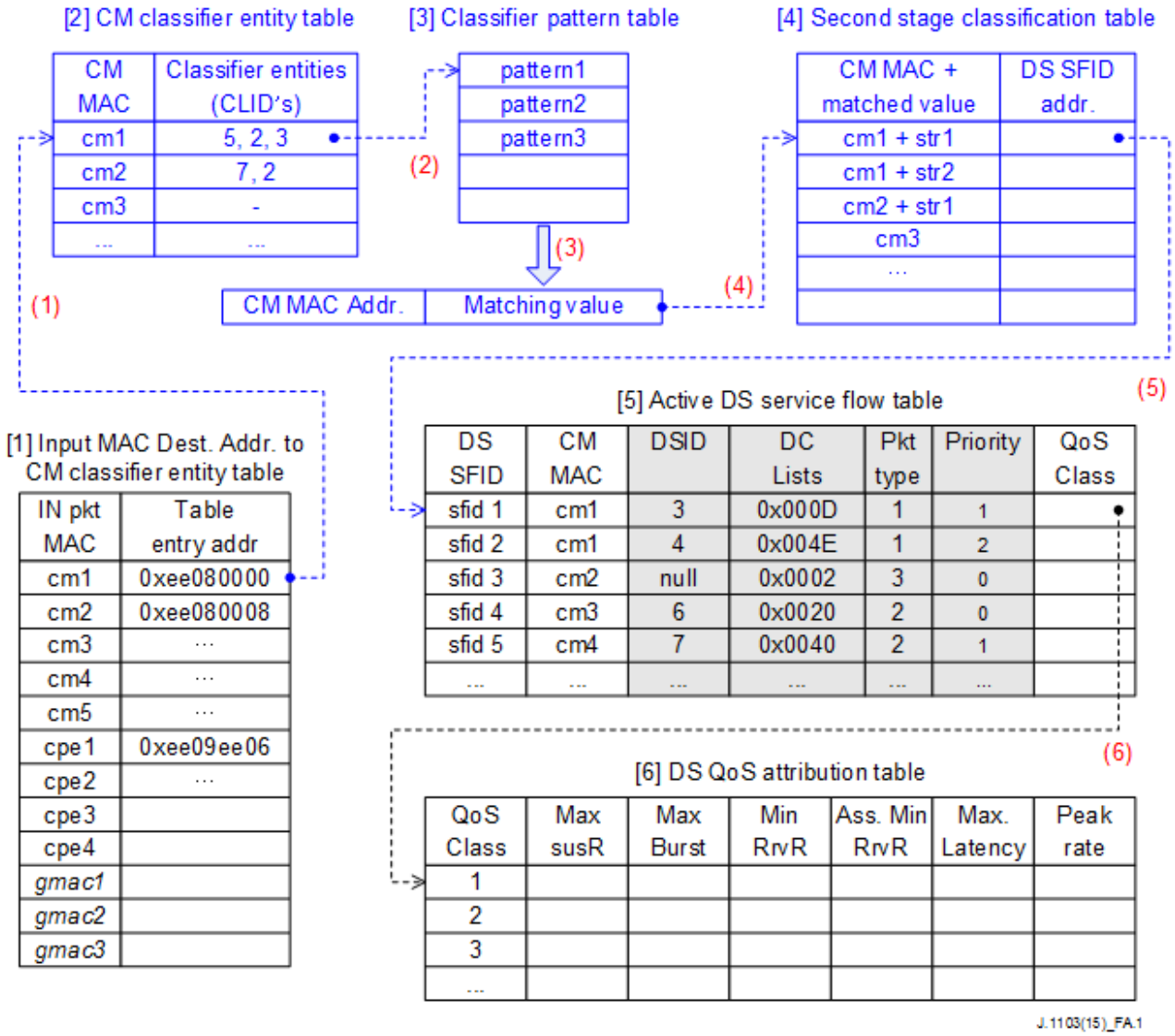

Figure A.1 – Example of a service flow classification process

For the second stage, it is necessary to find a specific service flow using the following three tables: the CM Classifier Entity Table, the Classifier Pattern Table and the Second Stage Classification Table.

The CM Classifier Entity Table is required to store the classifier ID. The maximum number of classifiers depends upon the specification of the headend MAC module.

The input packet is classified into a specific service flow through a field search of the input packet. As stated previously the service flow is generally classified as follows.

Step 1: Classification via the destination address of the input MAC packet

Step 2: Classification via a defined packet classifier

This classification is via the MAC packet destination address of stage 1. A specific MAC address of the terminal platform with which the MAC packet is associated can be found through the first stage of the classification process. In the second stage of the classification process, the final service flow is determined in the relevant terminal MAC in the case where the classification with other fields besides the input MAC address is defined during the registration of the relevant terminal platform or the dynamic service creation procedure. If there is no stage 2 of the classification process, the service flow is mapped as the default service flow (or primary service flow) which is allocated to the relevant terminal platform. Figure A.1 shows the mapping process through which the input packet is classified and mapped into one service flow.

In the first stage of the classification process the terminal to which the packet is to be transmitted is determined according to the MAC address and the result of the Input MAC Dest. Addr to CM Classifier Entity Table.

[1] Input MAC Dest. Addr to CM Classifier Entity Table

The terminal platform associated with the input MAC destination address is set so that it is able to find the relevant saved address of the [2] CM Classifier Entity Table for the second classification.

The saved address from the [2] CM Classifier Entity Table of the relevant cable modem (CM) is obtained from the destination MAC address of the input MAC packet through the [1] Input MAC Dest. Addr to CM Classifier Entity Table for the second classification of the relevant terminal platform.

The aim of the second stage of the classification process is to find to which service flow in the relevant terminal platform the input packet relates and the following three tables are needed for this search:

[2] CM Classifier Entity Table

The MAC address of the CM and the classifier IDs which are to apply to each CM are saved according to priority.

The classifier IDs are the IDs from the [3] Classifier Pattern Table and have values in the range 0 ~ 63556.

In accordance with the supported specification of the headend MAC module, the maximum value of the classifier to which a terminal platform can apply is set at maximum.

[3] Classifier Pattern Table

This table contains the classifier patterns which are commonly used in the headend MAC.

A single classifier can be composed from a combination of fields.

[4] Second Stage Classification Table

The table is set to find the service flow the result value from the MAC address of the CM to which the input packet is transmitted and the defined classifier in the relevant CM.

The result value is input when the terminal platform MAC address and the classifier are applied. As for the result value, the address to which the specific service flow attribution of the [5] Active DS Service Flow Table is saved as output.

The second stage of the classification process is as follows:

From the address of the [2] CM Classifier Entity Table which is obtained from the first stage of the classification process, the terminal platform MAC address and the classifier ID which is applied in the CM are obtained.

According to the MAC address of the relevant terminal platform and the order of the classifier ID which is to be applied to the relevant terminal platform, one character string is composed by adding the result value which is obtained by applying the classifier to the CM Classifier Entity Table.

The value which is relevant to the resulting character string is obtained from the Second Stage Classification Table. Then the address of the service flow which belongs to the relevant character string is found on the [5] Active DS Service Flow Table.

If the second classification procedure is completed, the address of the service flow where the packet belongs can be found on the [5] Active DS Service Flow Table. The basic attribution of the service flow which is necessary for downstream transmission can be obtained from the [5] Active DS Service Flow Table.

[5] Active DS Service Flow Table

The basic information of downstream service flow is saved as below:

- Terminal platform MAC address
- DSID
- DSID channel list
- Packet type
- Priority
- DS QoS attribution

[6] DS QoS Attribution Table

The supported QoS is classified as the determined number and applied to the relevant service flow.

The following attributions are saved in the DS QoS attribution table:

- QoS class
- Maximum sustained traffic rate
- Minimum reserved traffic rate
- Assumed minimum reserved traffic rate
- Maximum latency
- Peak Rate

The DS QoS attribution is not applied in the first implementation.

The Create/Alter/Delete functions of each table are performed in the headend MAC control server module and completed through the following process.

Presetting by the operator in the headend MAC module (provisioning)

Signalling between the headend MAC module and the terminal platform MAC module (registration, DSA)

Obtaining the CPE MAC address (address aging)

The destination MAC address process for multicasting is dealt with separately as it is not relevant to certain terminal platforms (excluded from the first year implementation range).

The [3] Classifier Pattern Table is required to store the classifier pattern and it consists of the following configuration fields: IPV4 packet classification, TCP/UDP packet classification, Ethernet LLC packet classification, IEEE 802.1P/Q packet classification and IPV6 packet classification. The classifier configuration fields are shown in Table A.1.

Table A.1 – Classifier configuration fields

Function	Detailed field
IPv4 Packet Classification	IPv4 Type of Service Range and Mask IP Protocol IPv4 Source Address IPv4 Source Mask IPv4 Destination Address IPv4 Destination Mask
TCP/UDP Packet Classification	TCP/UDP Source Port Start TCP/UDP Source Port End TCP/UDP Destination Port Start TCP/UDP Destination Port End
Ethernet LLC Packet Classification	Destination MAC Address Source MAC Address Ethertype/DSAP/MacType
IEEE 802.1P/Q Packet Classification	IEEE 802.1P Priority Range IEEE 802.1Q VLAN ID
IPv6 Packet Classification	IPv6 Traffic Class Range and Mask IPv6 Flow Label IPv6 Next Header Type IPv6 Source Address IPv6 Source Prefix Length (bits) IPv6 Destination Address IPv6 Destination Prefix Length (bits)

The [4] Second Stage Classification Table is required to find the service flow and it is possible to find the DS SFID address of the [5] Active DS Service Flow Table.

The [5] Active DS Service Flow Table is required to contain the following information: STB MAC address, DSID, DSID channel list, packet type, priority and DS QoS attribution.

The [6] DS QoS Attribution Table is required to contain the following information: QoS Class, maximum sustained traffic rate, minimum reserved traffic rate, assumed minimum reserved traffic rate, maximum latency and peak rate.

Annex B

Examples of MPEG-2 TS encapsulation

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

Examples of MPEG-2 TS encapsulation are shown in Figure B.1.

Case (a) is an example of one MPEG-2 TS transmission including a MAC frame. In this case PUSI is set to '1' and the 'pointer field' is set to '0'.

Case (b) is an example of one MPEG-2 TS transmission including part of a MAC frame and another MAC frame. The value of PUSI is set to '1' and in the 'pointer field' the first 'stuff byte' is indicated.

Case (c) is an example of one MPEG-2 TS transmission including multiple MAC frames. The value of PUSI is set to '1' and the 'pointer field' is set to '0'.

Case (d) is an example of three MPEG-2 TS transmissions for one MAC frame. The value of PUSI is set to '1' and the 'pointer field' is set to '0' in the first MPEG-2 TS transmission.

The value of PUSI is set to '0' in the second MPEG-2 TS transmission.

The value of PUSI is set to '1' and the 'pointer field' indicates the first 'stuff byte' in the third MPEG-2 TS transmission. The third MPEG-2 TS transmission includes a part of one MAC frame and another MAC frame as in Case (b).

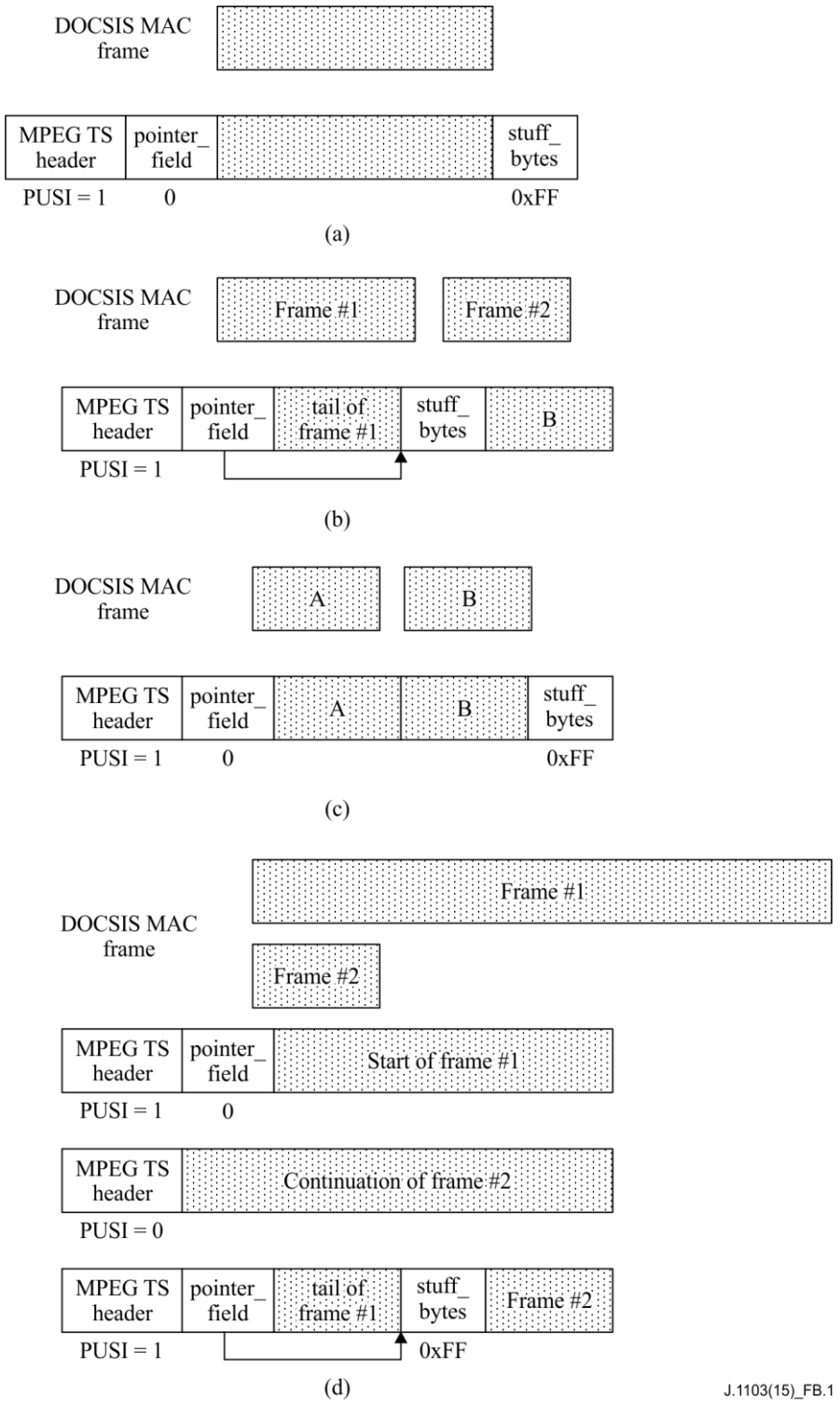

Figure B.1 – Examples of MPEG-2 TS encapsulation format

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