# INTERNATIONAL STANDARD

# IEC 61883-7

First edition
2003-01

## Consumer audio/video equipment – Digital interface –

## Part 7: Transmission of ITU-R BO.1294 System B

*Matériel audio/vidéo grand public – Interface numérique –*

*Partie 7: Transmission du Système B de l'UIT-R BO.1294*



Reference number
IEC 61883-1:2003(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

## Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**

- **Catalogue of IEC publications**

  The on-line catalogue on the IEC web site (http://www.iec.ch/searchpub/cur_fut.htm) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

  This summary of recently issued publications (http://www.iec.ch/online_news/justpub/jp_entry.htm) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

  If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

  Email: custserv@iec.ch
  Tel: +41 22 919 02 11
  Fax: +41 22 919 03 00

# INTERNATIONAL STANDARD

# IEC 61883-7

First edition
2003-01

## Consumer audio/video equipment – Digital interface –

## Part 7: Transmission of ITU-R BO.1294 System B

*Matériel audio/vidéo grand public –*
*Interface numérique –*

*Partie 7:*
*Transmission du Système B de l'UIT-R BO.1294*






International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE N

*For price, see current catalogue*

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

## Part 7: Transmission of ITU-R BO.1294 System B

## FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61883-7 has been prepared by technical area 4, Digital system interfaces, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 100/558/FDIS | 100/610/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

International Standard IEC 61883 consists of the following parts under the general title *Consumer audio/video equipment – Digital interface:*

Part 1: General

Part 2: SD-DVCR data transmission

Part 3: HD-DVCR data transmission

Part 4: MPEG2-TS data transmission

Part 5: SDL-DVCR data transmission

Part 6: Audio and music data transmission protocol

Part 7: Transmission of ITU-R BO.1294 System B

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

# CONSUMER AUDIO/VIDEO EQUIPMENT – DIGITAL INTERFACE –

## Part 7: Transmission of ITU-R BO.1294 System B

## 1 Scope

This specification defines packetization and transmission for transport streams of ITU-R BO.1294 system B (DirecTV system/DSS) over the IEEE 1394 Serial Bus.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61883-1, *Consumer audio/video equipment – Digital interface – Part 1: General*

ITU-R BO.1294:1997, *Common functional requirements for the reception of digital multi-programme television emissions by satellites operating in the 11/12 GHz frequency range*[1]

IEEE 1394:1995, *Standard for a High Performance Serial Bus*

IEEE 1394a:2000, *Standard for a High Performance Serial Bus – Amendment 1*

## 3 Terms, definitions and abbreviations

For the purposes of this part of IEC 61883, the following terms and definitions apply.

### 3.1 Terms and definitions

For the purposes of this part of IEC 61883, the following terms and definitions apply.

**3.1.1**
**byte**
eight bits of data, used as a synonym for octet

NOTE The symbol for byte is B.

**3.1.2**
**CSR architecture**
convenient abbreviation of the following reference: ISO/IEC 13213:1994, *Information technology – Microprocessor systems – Control and status register (CSR) architecture for microcomputer buses*

**3.1.3**
**quadlet**
four bytes of data

[1] In this document, the name “DSS” is used instead of ITU-R BO.1294 system B.

### 3.2 Abbreviations

For the purpose of this part of IEC 61883, the following abbreviations used in IEEE 1394 apply:

| | |
|---|---|
| AV/C | Audio Video Control |
| CIP | Common Isochronous Packet |
| CTR | Cycle Time Register |
| HD | High Definition |
| IEEE | The Institute of Electrical and Electronics Engineers, Inc. |
| MPEG | Motion Picture Expert Group |
| TSP | Transport Stream Package |

## 4 DSS transport stream

A DSS transport stream consists of transport stream packets with a length of 130 B.

NOTE Refer to Annex 1 of ITU-R BO.1294: 1997 for more information.

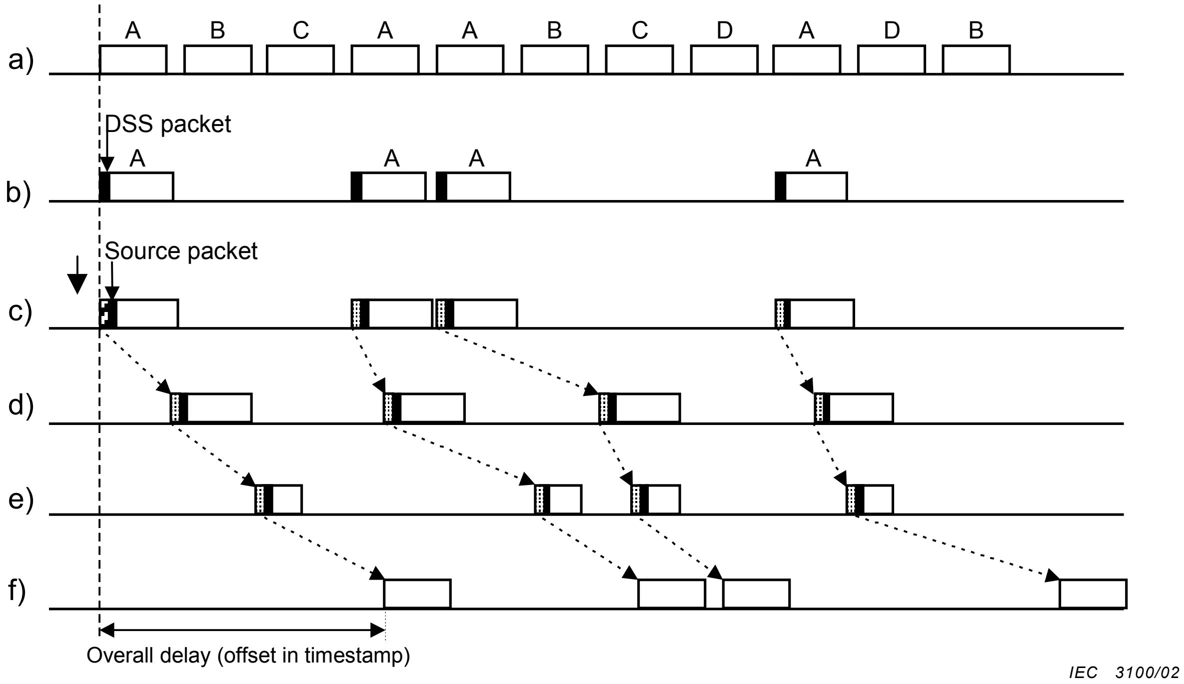
A stream may contain several programs. In Figure 1, an example is given of a transport stream, which consists of several programs. Often, only one or a few programs need to be transmitted. If a program selection is carried out, then only those transport stream packets from that particular transport stream are transmitted. In this situation, the occupied bandwidth on the IEEE 1394 interface can be reduced. Reduction of the bit rate is carried in a smoothing buffer. As a result of the smoothing operation, the transport stream packets will be shifted in time.

The transport stream packets at the output of the smoothing buffer are transmitted over the IEEE 1394 interface. During transmission, this interface will introduce some jitter on the arrival time of the transport stream packets in the receiver.

In the DSS transport stream, there are strong requirements on the timing of the transport stream packets. The jitter introduced by the both the smoothing buffer and the transmitter of the interface has to be compensated. This is done by adding a time stamp to the transport stream packets:

– at the moment it arrives at the input of the smoothing buffer; or
– at the input of the digital interface, if smoothing is not applied.

The receiver of the interface contains a receiver buffer, which compensates for the introduced jitter.




a) Complete transport stream with multiplex of programs (A,B,C,D)
b) Transport stream of the selected program A with DSS packet header (=DSS source packets)
c) Source packets with source packet header
d) Source packets at the output of the smoothing buffer
e) Source packets at the input of the 1394 receiver
f) Reconstructed timing for the transport stream

NOTE The clock frequency for transferring the bytes of a transport stream packet may be different in every situation

**Figure 1 – Steps in the transmission of transport stream**

Figure 2 shows how the DSS stream is processed between the original multiplex signal, the IEEE 1394 interface and the decoder.

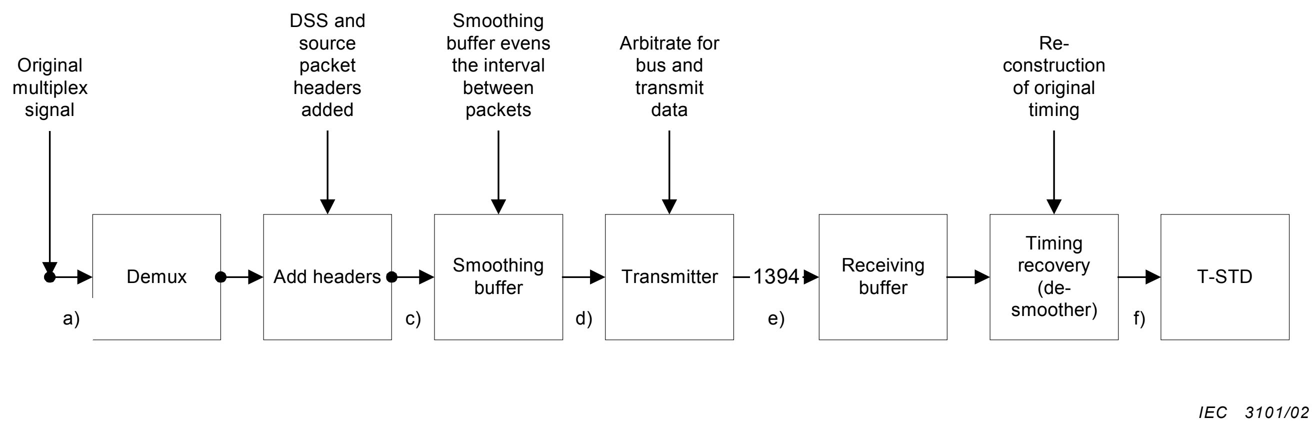



**Figure 2 – DSS stream processing block diagram**

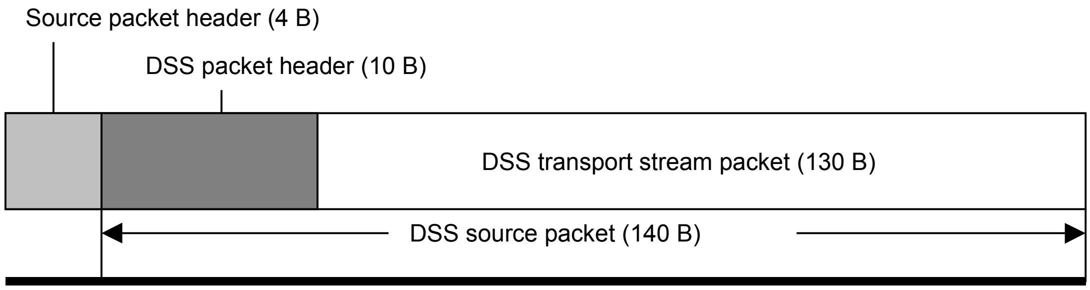
# 5 Construction of an IEEE 1394 packet

## 5.1 Source packets

### 5.1.1 Structure of a source packet

The length of the source packet is 140 B as shown in Figure 3. The source packet consists of one DSS transport stream packet with a length of 130 B and a DSS packet header of 10 B.

The source packet header is additionally added before transmission to the smoothing buffer. The source packet header contains a time stamp.




IEC 3102/02

**Figure 3 – Structure of a source packet**

### 5.1.2 DSS packet header

Figure 4 shows the structure of a DSS packet header.

| | msb | | | | | | | lsb |
|---|---|---|---|---|---|---|---|---|
| MSB | SIF | System Clock Count (23 bit) | | | | | | |
| | EF | Reserved ($0000000_2$) | | | | | | |
| | Reserved byte 0 ($00_{16}$) | | | | | | | |
| | Reserved byte 1 ($00_{16}$) | | | | | | | |
| | Reserved byte 2 ($00_{16}$) | | | | | | | |
| | Reserved byte 3 ($00_{16}$)<br>Reserved byte 4 ($00_{16}$) | | | | | | | |
| LSB | Reserved byte 5 ($00_{16}$) | | | | | | | |

IEC 3103/02

**Figure 4 – DSS packet header structure**

Table 1 shows the DSS packet header components.

**Table 1 – Fields in the DSS packet header**

| Field | Definition |
|---|---|
| SIF | System clock count Invalid Flag (1: invalid, 0: valid) |
| System clock count<br>(23 bit) | A 23 bit field that is set to the lowest 23 bit of the 27 MHz clock counter, which is synchronized with MPEG system clock. The value of this counter may be different from the byte time stamp counter used to generate the byte time stamp in the auxiliary data packet (defined in 4.1 of Appendix 1 to Annex 1 of ITU-R BO.1294: 1997. |
| EF | Error Flag (1: Error, 0: no Error)<br>Set to value 1 when the associated transport stream packet is erroneous |

The system clock count is used by bit stream recorders, like D-VHS, to lock its system clock phase to the source stream without needing to look into the DSS transport stream packet for clock information. If a stream contains video and/or audio application packets, then the stream shall contain packets with a valid system clock count. The maximum interval between valid system clock counts (or "ticks") shall be 200 ms. Therefore many audio and video packets in between may not contain a valid system clock count.

If a stream does not contain video or audio application packets, then the system clock count is not required.

### 5.1.3 Source packet header

Figure 5 shows the structure of the source packet header.

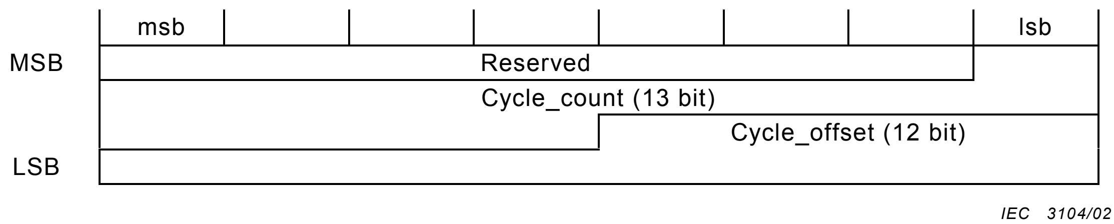



**Figure 5 – Structure of the source packet header**

The reserved bits are zero. The cycle_count and cycle_offset fields represent a time stamp.

The time stamp is used by isochronous data receivers for reconstructing a correct timing of the transport stream packets at their output. The time stamp indicates the intended delivery time of the first bit/byte of the transport stream packets from the receiver output to the T-STD (Transport Stream Target Decoder). The time stamp represents the 25 bit of the IEEE 1394 CYCLE_TIME register (CTR) at the moment the first bit/byte of the transport stream packet arrives from the application, plus an offset which is equal to the constant overall delay of the transport stream packet between the moment of arriving (of the first bit) and the moment the transport stream packet (first bit) is delivered by the receiver to the application.

### 5.1.4 Fractions

A source packet is split into 4 data blocks with a length of 9 quadlets. Zero or more data blocks are packed in an IEEE 1394 isochronous packet. A receiver of the isochronous packets collects the data blocks of one source packet and combines them in order to reconstruct the source packet before sending this source packet to the application. There are restrictions on the transmission of fractions (see 5.2.2).

## 5.2 Isochronous packets

### 5.2.1 CIP header for the DSS transport stream

The structure of the CIP header for DSS transport stream conforms to the two quadlet CIP header format explained in IEC 61883-1, 6.2.1. Table 2 shows the values of the CIP header components.

**Table 2 – Fields in the CIP header**

| Field | Value | Description |
|---|---|---|
| SID | … | Depends on configuration |
| DBS | $00001001_2$ | 9 quadlets |
| FN | $10_2$ | 4 data blocks in one source packet |
| QPC | $000_2$ | No padding |
| SPH | 1 | Source packet header is present |
| DBC | 0 … 255 | See 5.2.2 |
| FMT | $100001_2$ | Format type of DSS (ITU-R BO.1294 System B) |
| FDF | … | See 5.2.3 |

### 5.2.2 DBC values

The first data block of a source packet (data block containing the source packet header) corresponds to a DBC value from which the two LSBs are $00_2$.

An isochronous packet contains 0, 1, or 2 data blocks, or an integer number of source packets.

– If the isochronous packet contains:
  One data block, then the BDC value increments by 1;
  Two data blocks, then the DBC value is a multiple of 2, the LSB is $0_2$.
– If the isochronous packet contains *n* source packets (*n* is an integer) then the DBC value is a multiple of 4. The two LSBs are $00_2$.

### 5.2.3 FDF data

The structure of the CIP header is shown in Figure 6.

TSF (Timeshift_flag): indicates a time-shifted stream

– 0 = the stream is not time-shifted;
– 1 = the stream is time-shifted.

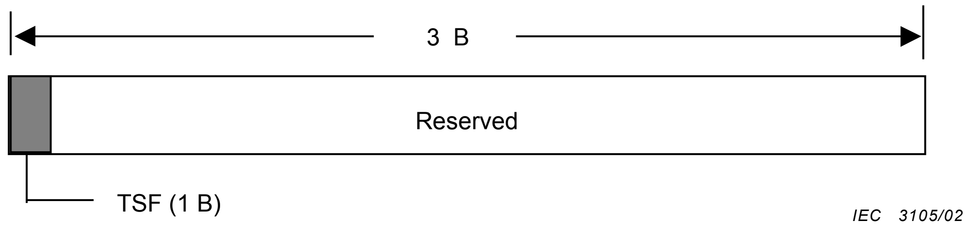



**Figure 6 – FDF structure**

## 6 Transmission of isochronous packets

Active transmitters send an isochronous packet in every cycle. If there is insufficient data to transmit in the isochronous packet, an empty packet is transmitted.

### 6.1 Late packets

The time stamp in the transmitted source packet header points to a value in the future. If the delay in the transmitter is too long and results in a time stamp which points in the past (late packet), then this source packet is not transmitted.

A late packet occurs if the actual value of the CTR becomes equal to the value represented in the time stamp from the source packet header and before transmission of the isochronous packet(s) that contain the source packet (including CRC).

– If one source packet/cycle is transmitted, the interval needed to transmit the complete isochronous packet can be calculated (the clock frequency and the number of bits is known). If a late packet occurs, then an empty packet or the next valid packet should be sent and the late packet is discarded.
– If more than one source packet/cycle is transmitted, then the same procedure is followed. It is allowed to discard all source packets from the isochronous packet if one source packet turns out to be a late packet.
– If fractions are transmitted, it is recommended to first collect a complete source packet in the transmitter.
– If a late packet occurs, then the complete source packet should be discarded.

If a late packet occurs when some data blocks of the source packet have already been transmitted (for example at a bus reset), then data blocks remaining in the transmitting buffer are removed.

# Annex A
(normative)

# Buffer size for DSS transmission

## A.1 General

To calculate receiving buffer size, two kinds of buffers are defined:

a) buffer for IEEE 1394 jitter; and
b) buffer for MPEG smoothing.

There are two kinds of transmissions. Calculation is made with both cases:

1) for full transponder transport stream transmission, only a buffer for IEEE 1394 jitter is necessary since no smoothing exists;
2) for partial transport stream transmission, both a buffer for 1394 jitter and a buffer for MPEG smoothing are required.

## A.2 Buffer for IEEE 1394 jitter

The TSP packet can be sent to the application by the receiver as soon as the CRC of the isochronous packet is carried out. The buffer size needed to compensate jitter introduced by the transmitter is given by the following relation:

Buffer_size_I = (R_bus) × (max_jitter) + (B_granularity)

where

| | |
|---|---|
| R_bus | is the allocated data rate on the IEEE 1394 interface; |
| max_jitter | is the maximum 1394_jitter (~ 311 μs) minus the minimum time needed to transmit one bus packet. 311 μs (fixed) = 125 μs (1 cycle late) + 78 μs (delay by async) + 108 μs (delay by iso); |
| one_bus_packet_time | bus packet size / 393,216 Mbit/s; |
| B_granularity | is the size of one bus packet (TSP/cycle). |

The necessary buffer size will be largest with high transmission rates (several TSPs per cycle) and high clock frequencies of the bus (400 Mbit/s).

In Table A.1, the buffer size for jitter is given for some transmission rates.

**Table A.1 – Buffer for jitter example**

| **Transmission rate** TSP/cycle | **Transmission rate** Mbit/s | **Minimum buffer size** B |
|---|---|---|
| 1/8 | 1,152 | 63 |
| 1/4 | 2,304 | 125 |
| 1/2 | 4,608 | 250 |
| 1 | 9,216 | 499 |
| 2 | 18,432 | 991 |
| 3 | 27,648 | 1 476 |
| 4 | 36,864 | 1 955 |
| 5 | 46,080 | 2 427 |
| NOTE 1 The buffer size above does not include the size, which depends on the reading out data rate.<br>NOTE 2 The data rate on the bus is 393,216 MHz. | | |

## A.3 Buffer for MPEG smoothing

The buffer for MPEG smoothing is defined by the equation as follows:

$$\text{Buffer\_size\_S} = (\text{B\_smoothing}) + (\text{R\_bus} \times \text{jitter\_RTI}) + (\text{B\_aux})$$

where

B_smoothing = 1 536 B;

R_bus = data rate on IEEE1394;

jitter_RTI = 50 μs (ISO/IEC 13818-9);

B_aux = 144 B as source packet.

In Table A.2, the MPEG smoothing buffer size is given for some transmission rates:

**Table A.2 – Buffer for MPEG smoothing example**

| **Transmission rate** TSP/cycle | **Transmission rate** Mbit/s | **Minimum buffer size** B |
|---|---|---|
| 1/8 | 1,152 | 1 687 |
| 1/4 | 2,304 | 1 694 |
| 1/2 | 4,608 | 1 709 |
| 1 | 9,216 | 1 738 |
| 2 | 18,432 | 1 795 |
| 3 | 27,648 | 1 853 |
| 4 | 36,864 | 1 910 |
| 5 | 46,080 | 1 968 |
| NOTE Minimum buffer size needed to compensate jitter originating from the smoothing buffer (including RTI and AUX packet). | | |

## A.4 Buffer for full transponder transport stream

The DSS full transponder data rate = 30,3 Mbit/s < 4 TSP/cycle. Thus, using Table A.1, the smallest buffer that meets the size requirements for the data rate is 1 955 B.

## A.5 Buffer for DSS HD partial transport stream

The DSS HD partial stream data rate < 20 Mbit/s < 3 TSP/cycle. The smallest buffer size for DSS HD requires both the buffer for jitter and the buffer for MPEG smoothing:

= Buffer_size_I + Buffer_size_S
= 1 476 B (from Table A.1) + 1 853 B (from Table A.2).
= 3 329 B

## A.6 Conclusion

The required buffer size is determined by comparing the buffer for the full transponder transport stream and the buffer for the DSS HD partial transport stream and choosing the largest, which is 3 329 B. Rounding up to the nearest multiple of 144, the required buffer size for a DSS Link is 3 456 B.

**Standards Survey**

**The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!**

Customer Service Centre (CSC)
**International Electrotechnical Commission**
3, rue de Varembé
1211 Genève 20
Switzerland

or

Fax to: **IEC**/CSC at +41 22 919 03 00

Thank you for your contribution to the standards-making process.

Nicht frankieren
Ne pas affranchir

Non affrancare
No stamp required

**A Prioritaire**

**RÉPONSE PAYÉE**

**SUISSE**

Customer Service Centre (CSC)
**International Electrotechnical Commission**
3, rue de Varembé
1211 GENEVA 20
Switzerland

**Q1** Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

.............................................................

**Q2** Please tell us in what capacity(ies) you bought the standard *(tick all that apply).* I am the/a:

- purchasing agent ❑
- librarian ❑
- researcher ❑
- design engineer ❑
- safety engineer ❑
- testing engineer ❑
- marketing specialist ❑
- other.....................................................

**Q3** I work for/in/as a: *(tick all that apply)*

- manufacturing ❑
- consultant ❑
- government ❑
- test/certification facility ❑
- public utility ❑
- education ❑
- military ❑
- other.....................................................

**Q4** This standard will be used for: *(tick all that apply)*

- general reference ❑
- product research ❑
- product design/development ❑
- specifications ❑
- tenders ❑
- quality assessment ❑
- certification ❑
- technical documentation ❑
- thesis ❑
- manufacturing ❑
- other.....................................................

**Q5** This standard meets my needs: *(tick one)*

- not at all ❑
- nearly ❑
- fairly well ❑
- exactly ❑

**Q6** If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

- standard is out of date ❑
- standard is incomplete ❑
- standard is too academic ❑
- standard is too superficial ❑
- title is misleading ❑
- I made the wrong choice ❑
- other ...................................................

**Q7** Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

- timeliness .............................................
- quality of writing....................................
- technical contents...................................
- logic of arrangement of contents ..........
- tables, charts, graphs, figures...............
- other ...................................................

**Q8** I read/use the: *(tick one)*

- French text only ❑
- English text only ❑
- both English and French texts ❑

**Q9** Please share any comment on any aspect of the IEC that you would like us to know:

............................................................
............................................................
............................................................
............................................................
............................................................
............................................................
............................................................
............................................................
............................................................
............................................................
............................................................
............................................................

ISBN 2-8318-6772-X

9 782831 867724

**ICS 33.160.01; 35.200**

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND