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SOURCE : Stuart Dunstan, Siemens Ltd. (Australian UVC consortium)
TITLE : Australian National Body comments on ISO/IEC 13818-1: Systems
PURPOSE : Information

Organisation of CD

1. The Program Stream Map is to the Program Stream what the Program Specific Information is to the Transport Stream. Yet there appear at different levels within the clause numbering system.

To match the level at which the PSI is located, clauses 2.4.6.9, and 2.4.6.10, should be combined to form clause 2.4.x "Program Map syntax and semantics", and clauses 2.4.6.11, and 2.4.6.12 should be combined to form clause 2.4.x "Program Stream directory syntax and semantics". Both clauses should follow the Program Stream syntax and semantics.

2. Clause 2.4.7 PSI should be moved so that it immediately follows syntax and semantics of the Transport Stream since this is what it relates to. An introductory sentence in clause 2.4.7 saying that PSI relates to the Transport Stream would be useful.

3. The titles in clause 2.4.3 "Specification of the system Transport Stream syntax" and clause 2.4.7 "Specification of the Program Stream syntax" are incorrect, since these clauses also cover semantic definitions.

The title of these two clauses should be changed.

4. Clause 2.4.10.2 Transport Stream is in the wrong position. Clause 2.4.10 is titled "Constrained system parameter stream". In clause 2.4.10.1 a subset of Program Streams is defined as CSPS. However clause 2.4.10.2 does not form a subset of Transport Streams: it is a restriction on all Transport Streams.

Clause 2.4.10.2 should be moved back one level of indexing to the same level as clause 2.4.10.

Introduction

5. The term "Recommendation | International Standard" is used. While the ITU has adopted ISO/IEC 13818-2 as Recommendation H.262, it is still open as to whether the ITU will adopt ISO/IEC 13818-1.

6. In the introduction the term "ISO/IEC 11172 Systems Multiplex is used". The term "Systems Multiplex" is neither defined nor used in ISO/IEC 11172.

The word "Multiplex" should be dropped or changed to "multiplex".

7. In the introduction the term "Program Stream packet" is used. This term is misleading. This term should be replaced with "PES packets in a Program Stream".

8. There are a number of places in which the terms "data link", "medium", and "DSM" are used. In all cases these terms should be replaced by the term "channel". This term is generic and suitably defined in clause 2.1.4.

In Figure 0-2, 0-3, 0-4, the term "Data Link" should be replaced by "Channel", and the term "Data Link specific decoder" should be replaced by "channel specific decoder".

In Figure 0-5 the term "DSM" should be replaced by "Channel", and the term "Medium Specific decoder" should be replaced "channel specific decoder".

In paragraph 11 of clause 0.1 the term "Data Link Specific Decoder" should be replaced with "channel specific decoder" and the term "data link specific decoder" should be replaced with "channel specific decoder".

In the first paragraph of clause 0.2 the term "Medium Specific Decoder" should be changed to "channel specific decoder".

In paragraph 1 in clause 0.7 the references to "DSM" and "data link" should be replaced by channel. This paragraph becomes:

Multiplex-wide operations include the coordination of data retrieval from the channel, the adjustment of clocks, and the management of buffers. The tasks are intimately related. If the rate of data delivery from the channel is controllable, then data delivery may be adjusted so that decoder buffers neither overflow nor underflow. If the data rate is not controllable, then elementary stream decoders must slave their timing to the channel to avoid overflow or underflow.

In paragraph 2 clause 0.7 the term "data source" should be replaced by "channel". This paragraph becomes:

Program Streams are composed of packs whose headers facilitate the above tasks. Pack headers specify intended times at which each byte is to enter the Program Stream Decoder from the channel, and this target arrival schedule serves as a reference for clock synchronisation and buffer management. The schedule need not be followed exactly by decoders, but they must compensate for deviations about it.

In paragraph 3 clause 0.7 the term "data source" should be replaced by "channel".

In the last sentence in the definition of transport_priority clause 2.4.3.3 the reference to "data link" should be replaced. This sentence becomes:

This field may be changed by channel specific encoders or decoders.

9. The second reference to figure 0-3 in the first paragraph following figure 0-2 in clause 0-1 is not required. The paragraph should be changed to:

Figure 0-3 illustrates the second case, where a Transport Stream containing multiple programs is converted into a Transport Stream containing a single program. In this case the remultiplexing operation will include the correction of Program Clock Reference (PCR) timestamps to account for the change in arrival of timestamps.

10. There is confusion in clause 0-2 as to whether a Program Stream decoder is just ISO/IEC 13818-1, or whether it is ISO/IEC 13818-1, ISO/IEC-2, and 13818-3. It is proposed that the term "Program Stream decoder" refer just to ISO/IEC 13818-1. This should be consistent with clause 0-1, and may affect that section also.

11. The first sentence in paragraph 1 in clause 0-2 is ambiguous. In the second sentence "System Decoder" is not a defined term and should not be capitalised. The paragraph should be changed to:

A prototypical audio/video Program Stream decoder system is depicted in figure 0-5. The architecture is not unique (system decoder functions including decoder timing control might equally well be distributed among elementary stream decoders and the Channel Specific Decoder) but this figure is useful for discussion. The prototypical decoder design does not imply any normative requirement for the design of an ISO/IEC 13818 Program Stream decoder. Indeed non-audio/video data is also allowed, but not shown.

12. The first sentence in paragraph 2 in clause 0-2 suggests there is such a term as "System decoder". No such term is defined. Also paragraph 2 should be edited to remove reference to DSM. It should be changed to:

The prototypical ISO/IEC 13818 system decoder based on the Program Stream shown in figure 0-5 is composed of Program Stream, Video, and Audio decoders conforming to Parts 1, 2, and 3, respectively, of this Recommendation 1 International Standard. The channel and the channel specific format is not governed by this Recommendation 1 International Standard, nor is the channel specific decoding part of the prototypical ISO/IEC 13818 system decoder based on the Program Stream.

In line with above, ISO 11172, and the references in paragraph 3 of clause 0-2, Figure 0-5 should be relabelled "Prototypical ISO 13818 system decoder based on Program Stream". The term "Program Stream demultiplexor" in Figure 0-5 should be changed to "Program Stream Decoder".

13. In paragraph 3 of clause 0.2 the references to DSM and medium should be removed. The paragraph should be changed to:

The prototypical decoder accepts as input an ISO/IEC 13818 Program Stream and relies on a Program Stream Decoder to extract timing information from the stream. The Program Stream Decoder de-multiplexes the stream, and the elementary streams so produced serve as inputs to Video and Audio decoders. Included in the design, but not shown in the figure, is the flow of timing information among the Program Stream Decoder, the Video and Audio Decoders, and the Channel Specific Decoder. The Video and Audio Decoders are synchronized with each other and with the channel using this timing information.

14. In the last paragraph in clause 0-2 the term "Program system " should be changed to "Program Stream system layer".

15. Paragraph 3 in clause 0.3 does not read well. It conveys no new information as the idea has already been adequately expressed in paragraph 1 in clause 0.3.

Remove paragraph 3 in clause 0.3.

16. The final paragraph in clause 0.7 does not read well. Two commas are required as follows:

The Transport Stream and Program Stream each contain information which identifies the pertinent characteristics of, and relationships between, the elementary streams which constitute each program. Such information may include the language spoken in audio channels, as well as the relationship between video streams when multi-layer video coding is implemented.

17. In paragraph 1 clause 0.8 the sentence "These topics are discussed below." should be removed. Such sentences add nothing to the understanding of the text.

18. In paragraph 1 clause 0.8.2 replace "Program and Transport bit streams" by "Program Stream and Transport Streams" remove reference to "DSM", and clean up last sentence. Paragraph 1 becomes:

Synchronization among multiple elementary streams is effected with presentation time stamps (PTS) in the Program Stream and Transport Stream. Time stamps have a resolution of 90kHz, but the System Clock Reference (SCR), the Program Clock Reference (PCR) and the optional Elementary Stream Clock Reference (ESCR) have a resolution of 27MHz. Decoding of N elementary streams is synchronized by adjusting the decoding of streams to a common master time base rather than by adjusting the decoding of one stream to match that of another. The master time base may be one of the N decoders' clocks, the channel clock, or some external clock.

19. Paragraph 2 clause 0.8.2 does not read well. It should be replaced by:

Each program in a Transport Stream, has its own time base. The time bases of different programs within a Transport Stream may be different.

20. In paragraph 4 clause 0.8.2 replace "data source" with "channel". The word "equivalently" should be repositioned, since its current use is ambiguous. Commas can help with the understanding of sentence two. Sentence 4 should be cleaned up. Remove the final sentence, since it repeats what has been said in sentence three. This paragraph becomes:

Synchronization of a decoding system with a channel is achieved through the use of the SCR in the Program Stream and equivalently, by the PCR in the Transport Stream. The SCR and PCR are time stamps encoding the timing of the bit stream itself, and are derived from the same time base used for the audio and video PTS values of the same program. Since each program may have its own time base, there are separate PCR fields for each program in a Transport Stream containing multiple programs. Programs in a multi-program Transport Stream may share the same PCR. Clause 2.4.7 Program Specific Information, defines the method of identifying which PCR is associated with a program. A program shall have one and only one PCR time base associated with it.

21. In paragraph 1 clause 0.8.3 the term "video packet" should be replaced by "video PES packet". The meaning of the third sentence may be better conveyed by the following:

For example, video start codes may occur anywhere within the payload of a PES packet.

Alternatively, the third sentence could be removed. The preceding sentence is quite clear.

22. In clause 2.1 PTS and DTS are defined. SCR, PCR, and ESCR should also be defined here.

23. In clause 2.1.43 the reference to table 2-1 on page 9 is incorrect. The reference should be removed such that the final sentence in this clause reads as follows:

Start code consists of a 24 bit prefix (0x0000001) and an 8 bit stream_id.

24. In clause 2.2.6 many of the mnemonics appear to be relevant only to video or audio, and are not used within systems. Additional mnemonics here confuse the reader.

Clause 2.2.6 should be edited so that only the mnemonics used in ISO/IEC 13818-1 are listed.

25. In clause 2.3 the C like syntax and comments are mixed up. Also commas in the for() loop should be replaced by semi colons.

Consideration should be given to replacing the whole of clause 2.3 with clause 5.1 in ISO/IEC 13818-2.

26. In paragraph clause 2.4.1 the first sentence does not read well. Replace whole paragraph with:

The Transport Stream coding layer allows multiple programs to be combined into a single stream. A program is defined as a group of elementary streams, sharing a common system_clock_frequency time base. Data from each elementary stream are encoded and multiplexed together with information that allows elementary streams within a program to be played in synchronism.

27. In paragraph 4 clause 2.4.1 the term "opening up a range" does not express well what is required. Also "packet data" should be replaced with "PES packet data".

The whole paragraph should be replaced by:

The PES packet header begins with a 32-bit start-code that also identifies the stream to which the packet data belongs. The PES packet header may contain decoding and/or presentation time-stamps (DTS and PTS) that refer to the first access unit that commences in the packet. The PES packet header contains other optional fields. The PES packet data field contains a variable number of contiguous bytes from one elementary stream.

STDs and related issues

28. In clause 2.4.2 in the T-STD for the definitions of PCR(i) the text says:

PCR(i) is the time encoded in the PCR field measured in units of the 27 MHz system clock where i is the byte index of the final byte of the PCR field.

Is this in fact correct? Is not i the byte index of the final byte of the PCR_base field?

This also applies to SCR(i) in P-STD in clause 2.4.5.

29. The nomenclature defined for the T-STD and P-STD should be reviewed. There are a number of problems including:

- one is led to believe that a subscripted letter refers to an index. For example buffer B_n (n is a subscript) and time t_{bn}(i) (n is a subscript), where n is the elementary stream index. However t_m(i) (m is a subscript) fails. t_m(i) is trying to express the time of arrival of the ith byte at the decoder.

- one is led to believe that anything in a bracket is an index e.g. t_m(i). i is an index. However this fails in the term B_{Sn}(dec) (n is a subscript), dec is not an index.

- The use of the term M(i), the time of arrival of the ith byte is used inconsistently. It is interpreted as referring to the Mth Transport Stream in the definition of t_{bn}(p) and t_{bsys}(p) (n and sys are subscripts). In clause 2.4.9.1 M(i) is used to refer to an ISO/IEC 13818 Transport Stream. However that is mathematically incorrect since M(i) refers to a single byte. It should be qualified with the condition i = 0, 1, ..., N.

The following rules should adopted

- only indices are subscripts
- only indices are placed in brackets

Hence the m in t_m(i) should not be a subscript. It should be noted that in ISO 11172 m is not a subscript.

A new expression for B_{Sn}(dec) (n is a subscript) should be found.

The use of the term M(i) is confusing and is not required. A number of times in the text M(i) is preceded by the phrase "the ith byte" making M(i) redundant. It adds nothing to the understanding of the STDs and is not used in any formal mathematical definition. M(i) should be removed.

An exception to the first rule might be terms using "sys" in the T-STD. "sys" might be viewed as one value of n.

30. In clause 2.4.2 the definitions for t_{bn}(p) (n is a subscript) and t_{bsys}(p) (sys is a subscript) are wrong. The definitions should read:

t_{bn}(p) indicates the time, measured in seconds, at which the pth transport packet enters buffer B_n.

t_{bsys}(p) indicates the time, measured in seconds, at which the pth transport packet enters buffer B_{sys}.

31. In the section on notation in clause 2.4.5 SCR(i) is defined. The definition is incorrect.

There is a problem with the STD notation in that it is not clear as to whether terms are syntax elements or mathematical abstractions. For example system_clock_reference_base is a syntax element. What then is SCR_base? If SCR_base(i) is the value that system_clock_reference_base takes then this should be stated.

In the P-STD section in clause 2.4.5 SCR(i) should be modified and the other paragraphs appended as follows:

SCR_base(i) is the time encoded in the system_clock_reference_base field in units of the 27 MHz system clock divided by 300, where i is the byte index of the final byte of the system_clock_reference_base field.

SCR_ext(i) is the time encoded in the system_clock_reference_extension field in units of the 27 MHz system clock, where i is the byte index of the final byte of the associated system_clock_reference_base field.

SCR(i) is the time encoded in the system clock reference fields in units of the 27 MHz system clock, where i is the byte index of the final byte of the system_clock_reference_base field.

The above paragraphs could alternatively be inserted following equations 2-14, 2-15, and 2-16. The definitions should occur once and once only.

Similar statements should be inserted in the notation section of clause 2.4.2 for the T-STD, or following the equations for PCR in clause 2.4.3.7. Formally similar definitions should also be written for the ESCR equations in clause 2.4.3.7.

32. In clauses 2.4.2, 2.4.3.7, and 2.4.5 the equations for PCR, ESCR, and SCR respectively are incorrect. The equations as written give negative results for the extension fields, with the largest negative number being $-2^{33} \times 300$, occurring near the final count of the base fields. This is clearly incorrect.

To correct this base and extension equations must use the INT function, and not NINT (floor) and not round() in C language). In addition the equations may be written in a simpler form.

In general the equations for the output of a modulo K counter whose carry output enables incrementing of a modulo L counter is:

$$\begin{aligned} y_{base}(t) &= \text{INT}(\text{system_clock_frequency} \times t/K) \% L \\ y_{ext}(t) &= \text{INT}(\text{system_clock_frequency} \times t) \% K \\ y(t) &= y_{base}(t) \times K + y_{ext}(t) \end{aligned}$$

where t is a continuous positive variable, and ybase(t), yext(t), and y(t) are positive integers.

Equations for PCR, ESCR, and SCR should be written to match this form. For example equations for PCR(i) become:

$$\begin{aligned} \text{PCR_base}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)/300) \% 2^{33} \\ \text{PCR_ext}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)) \% 300 \\ \text{PCR}(i) &= \text{PCR_base}(i) \times 300 + \text{PCR_ext}(i) \end{aligned}$$

33. The paragraph following equation 2-3 in clause 2.4.2 does not read well. In addition the reference to location other than the equation number, should be removed. Also the definition is incorrect. The reference should be to the final byte of the PCR_base field. The paragraph should be replaced by the following:

The input arrival time, tm(i) for all other bytes, shall be constructed from PCR(i) and the transport rate at which data arrive, where the transport rate is defined as the number of bytes in the Transport Stream between the bytes containing the last bit of two consecutive program_clock_reference_base fields of the same program, divided by the difference between the time values encoded in these same two PCR fields. This is expressed mathematically in equation 2-4.

34. Equation 2-4 and 2-5 should be cleaned up. When one first sees the terms i, i', and i'', one interprets i as being a general time index, i' as being a specific value of i, and i'' as being a second and _later_ value. However equations 2-5 and 2-4 uses $i'' < i < i'$. This is very confusing and makes the equations overcomplicated. In addition the definitions in equations 2-4 and 2-5 are poorly written. The complete section should be replaced by the following. In this the transport rate used in the current PCR interval is calculated from PCR values received in the preceding PCR interval.

$$\text{tm}(i) = \frac{\text{PCR}(i'')}{\text{system_clock_frequency}} + \frac{i - i''}{\text{transport_rate}(i'')}$$

where

$$\text{transport_rate}(i'') = \frac{(i'' - i') \times \text{system_clock_frequency}}{\text{PCR}(i'') - \text{PCR}(i')}$$

and

i is the index of any byte in the Transport Stream
i'' is the index of the byte containing the last bit of the latest program_clock_reference_base field
i' is the index of the byte containing the last bit of the program_clock_reference_base field preceding the program_clock_reference_base field at byte index i'',
 $i' < i'' < i$

PCR(i) is the time encoded in the program_clock_reference_base and program_clock_reference_extension fields at time index i.

35. There is a problem with the term Res(max) (es is a subscript) in the paragraph preceding equation 2-6. es is not an index, and max is not an index. The term should be modified to fit the above rules regarding nomenclature. In addition Res is written differently to its definition, since "es" is not subscripted and the subscript n has been dropped.

Res(max) (es is a subscript) should be changed to Resmaxn (es is not a subscript, max is not a subscript, n is a subscript). Res (es is a subscript) should be written as it is defined in clause 2.4.2 i.e. Resn (es is not a subscript, n is a subscript).

Equation 2-6 and the preceding paragraph should be modified.

36. The term "PMT_PID" used in the paragraph following equation 2-6 is not defined and incorrect. The correct term should be "program_map_PID".

37. In the third paragraph following equation 2-6 the word "operations" should be singular. The nomenclature regarding Res(max), Refl, Res, BSmax, BSn(dec), should be corrected as described above. In the phrase "theoretical effective rate" one of the first two words is redundant. (Is there a practical effective rate?). The paragraph becomes:

The main buffer sizes BS_1 through to BS_n are defined as follows. In the case of constant bitrate operation $Res_{max} = Res$. An effective rate $Reff$ is calculated as the elementary stream rate, Res_{max} , multiplied by 188/184. A portion BS_{mux} of the buffer size BS_n allocated for multiplex buffering is defined as $BS_{mux} = Reff \times 4$ milliseconds. Another portion, BS_{dec_n} , of the buffer size BS_n is allocated for decoding and is defined as the size of the Video Buffering Verifier, as specified in Part 2 of this Recommendation 1 International Standard, in the case of video elementary stream data, or the size of one audio access unit, as specified in Part 3 of this Recommendation 1 International Standard, in the case of audio elementary stream data. The size BS_n of buffer B_n is equal to the sum $BS_{mux} + BS_{dec_n}$.

Should not these terms be defined in clause 2.4.2?

38. The language used in the CD with regard to skipped pictures suggests a reluctance in accepting them as a valid mode of operation. Such language is unacceptable.

The sixth paragraph following equation 2-6 should be corrected as follows:

When the low_delay flag in the video sequence extension is set to '1' (subclause 6.2.2.3 of ISO/IEC 13818-2) skipped pictures are permitted in the data. In this case when the STD elementary stream buffer is examined at the time specified by $td_n(j)$, the complete data for the access unit may not be present in the STD elementary stream buffer. When this case arises, the buffer shall be re-examined at intervals of two field-periods until the data for the complete access unit is present in the buffer. At this time the entire access unit and associated system data if any shall be removed from buffer instantaneously. Overflow of the buffer shall not occur.

The seventh paragraph following equation 2-6 should be corrected as follows:

Picture skipping is allowed to occur continuously without limit. The STD decoder shall remove access unit data from the buffer at the earliest time consistent with the paragraph above and any DTS or PTS values encoded in the bitstream. Note that the decoder may be unable to re-establish correct decoding and display times as indicated by DTS and PTS until the skipped picture situation ceases and a PTS or DTS is found in the bitstream. In all cases the STD buffer shall not overflow.

These two paragraphs should also replace the equivalent paragraphs regarding the P-STD in clause 2.4.5.

39. A definition of PCR and equations are given in clause 2.4.2 on T-STD. The definition is repeated in clause 2.4.3.5 on semantics. A definition of SCR and equations are given in clause 2.4.5 on P-STD. Both the definition and equations are repeated in clause 2.4.6.4 on semantics.

Formal semantics and equations should be given once and once only. It is proposed that semantics and equations be given in the semantics section, and that other clauses refer to there if required.

In clause 2.4.2 the definition of PCR in the last 2 sentences of the paragraph beginning "Data from the ISO/IEC 13818 Transport Stream enters the system target decoder ...", and equations 2-1, 2-2, and 2-3 should be deleted. Equations and definitions should appear in clause 2.4.3.5 on semantics.

In clause 2.4.5 the definition of SCR in the last 2 sentences of the paragraph beginning "Data from the ISO/IEC 13818 Program Stream enters the system target decoder ...", and equations 2-14, 2-15, and 2-16 should be deleted. Equations and definitions appear in clause 2.4.6.4 on semantics.

40. The clause 2.4.3.6 the naming of ESCR is incorrect: the field is actually ESCR_base. However to make the naming consistent with the other clock reference fields it is proposed to use the names "elementary_stream_clock_reference_base" and "elementary_stream_clock_reference_extension".

Another problem is that while syntax and semantics use "program_clock_reference_base" for example, equations use PCR_base; PCR_base is not formally defined. As described above PCR(i), PCR_base(i), PCR_ext(i) are values that respective PCR fields may take, and should be defined in the section on notation in each of the STDs.

41. PCR, OPCR, ESCR, and SCR should be defined in clause 2.1, as are DTS and PTS. There should also be a definition for the system clock.

42. The definitions of PCR in clause 2.4.3.5, OPCR in clause 2.4.3.5, ESCR in clause 2.4.3.7, and SCR in clause 2.4.6.4 are structured differently, are garbled, and possibly contain errors. Specifically reference is made to the specification of the tolerance on a 90 kHz system clock. There is no such specification: the tolerance specification is given for a 27 MHz clock. The text is ambiguous and suggests that the system clock frequency is 90 kHz.

It is proposed that the form of the text for semantics be identical for the PCR, OPCR, ESCR, and SCR fields. The following paragraphs are proposed.

For program_clock_reference:

program_clock_reference (PCR) -- The program_clock_reference is a 42 bit field coded in two parts. The first part program_clock_reference_base is a 33 bit field whose value is the output of a counter, clocked at the rate of system_clock_frequency/300. program_clock_reference_base represents a system clock resolution of 90 kHz. The second part program_clock_reference_extension is a 9 bit field whose value is the output of a modulo 300 counter, clocked at the rate of system_clock_frequency. program_clock_reference_base is related to program_clock_reference_extension in that its value is incremented by 1 on the transition of program_clock_reference_extension from 299 to 0.

PCR indicates the time of arrival of the byte containing the last bit of the program_clock_reference_base field at the input of the system target decoder. The presence of PCR is indicated by PCR_flag.

PCR may be expressed in mathematical form as:

$$\begin{aligned}\text{PCR_base}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)/300) \% 2^{33} \\ \text{PCR_ext}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)) \% 300 \\ \text{PCR}(i) &= \text{PCR_base}(i) \times 300 + \text{PCR_ext}(i)\end{aligned}$$

For transport packets containing video or audio elementary streams, if a PCR field is present in the adaptation field, that PCR field must be valid for the elementary stream contained in its transport packet.

The last paragraph is unnecessarily long. It is proposed to replace it with:

If a PCR field is present in transport packets containing video and audio elementary streams, it shall be valid.

For OPCR in clause 2.4.3.5:

original_program_clock_reference (OPCR) -- The original_program_clock_reference is a 42 bit field coded in two parts. The first part original_program_clock_reference_base is a 33 bit field whose value is the output of a counter, clocked at the rate of system_clock_frequency/300. original_program_clock_reference_base represents a system clock resolution of 90 kHz. The second part original_program_clock_reference_extension is a 9 bit field whose value is the output of a modulo 300 counter, clocked at the rate of system_clock_frequency. original_program_clock_reference_base is related to original_program_clock_reference_extension in that its value is incremented by 1 on the transition of original_program_clock_reference_extension from 299 to 0.

OPCR indicates the time of arrival of the byte containing the last bit of the original_program_clock_reference_base field at the input of the system target decoder. The presence of OPCR is indicated by OPCR_flag.

OPCR may be expressed in mathematical form as:

$$\begin{aligned}\text{OPCR_base}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)/300) \% 2^{33} \\ \text{OPCR_ext}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)) \% 300 \\ \text{OPCR}(i) &= \text{OPCR_base}(i) \times 300 + \text{OPCR_ext}(i)\end{aligned}$$

OPCR is only valid for single program Transport Streams. If it is present in a multi-program Transport Stream, it may be ignored by the decoder. Further, it may not be modified by any multiplexer or decoder. The purpose of OPCR is for recovery of the original single-program Transport Stream with its identical time stamps. OPCR will only be valid if the original single program Transport Stream is reconstructed exactly.

For ESCR in clause 2.4.3.7:

elementary_stream_clock_reference (ESCR) -- The elementary_stream_clock_reference is a 42 bit field coded in two parts. The first part elementary_stream_clock_reference_base is a 33 bit field whose value is the output of a counter, clocked at the rate of system_clock_frequency/300. elementary_stream_clock_reference_base represents a system clock resolution of 90 kHz. The second part elementary_stream_clock_reference_extension is a 9 bit field whose value is the output of a modulo 300 counter, clocked at the rate of system_clock_frequency. elementary_stream_clock_reference_base is related to elementary_stream_clock_reference_extension in that its value is incremented by 1 on the transition of elementary_stream_clock_reference_extension from 299 to 0.

ESCR indicates the time of arrival of the byte containing the last bit of the elementary_stream_clock_reference_base field at the input of the system target decoder. The presence of ESCR is indicated by ESCR_flag.

ESCR may be expressed in mathematical form as:

$$\begin{aligned}\text{ESCR_base}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)/300) \% 2^{33} \\ \text{ESCR_ext}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)) \% 300 \\ \text{ESCR}(i) &= \text{ESCR_base}(i) \times 300 + \text{ESCR_ext}(i)\end{aligned}$$

For SCR in clause 2.4.6.4:

system_clock_reference (SCR) -- The system_clock_reference is a 42 bit field coded in two parts. The first part system_clock_reference_base is a 33 bit field whose value is the output of a counter, clocked at the rate of system_clock_frequency/300. system_clock_reference_base represents a system clock resolution of 90 kHz. The second part system_clock_reference_extension is a 9 bit field whose value is the output of a modulo 300 counter, clocked at the rate of system_clock_frequency. system_clock_reference_base is related to system_clock_reference_extension in that its value is incremented by 1 on the transition of system_clock_reference_extension from 299 to 0.

SCR indicates the time of arrival of the byte containing the last bit of the system_clock_reference_base field at the input of the system target decoder.

SCR may be expressed in mathematical form as:

$$\begin{aligned} \text{SCR_base}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)/300) \% 2^{33} \\ \text{SCR_ext}(i) &= \text{INT}(\text{system_clock_frequency} \times \text{tm}(i)) \% 300 \\ \text{SCR}(i) &= \text{SCR_base}(i) \times 300 + \text{SCR_ext}(i) \end{aligned}$$

Transport packet

43. In clause 2.4.3.3 the definition of PID could be improved from "The PID is a 13 bit field, indicating the type of the data stored in the packet payload." The PID value does not indicate the _type_ of data. That is indicated by PSI tables.

The sentence should be changed to:

The PID is a 13 bit packet multiplex identifier field.

It may be preferable to express the given PID values in table form.

44. In clause 2.4.3.3 in the definition of transport_scrambling_control the word "mode" should be inserted in the first sentence such that it reads:

This 2 bit field indicates the scrambling mode of the transport packet payload

45. In clause 2.4.3.3 in the definition of continuity_counter the first sentence may be better expressed as:

The continuity_counter is a 4 bit field whose value is incremented for each consecutive transport packet with the same PID field value.

46. In the definition of elementary_stream_priority_indicator in clause 2.4.3.5 it should be explicitly stated as to whether this bit may or may not be changed by coders/decoders.

47. In the definition of transport_private_data_flag in clause 2.4.3.5 a quote is missing from the term "I" in the last sentence.

48. The last sentence of splice_countdown semantics in clause 2.4.3.5 says:

Transport packets with the same PID, which follows, may contain data from a different elementary stream of the same type.

If "same type" means the same value of stream_id then it should be made explicit.

The sentence should be rewritten to read:

Transport packets with the same PID, which follow, may contain data from a different elementary stream. The new elementary stream must have the same PES packet header stream_id value.

PES packet

49. In clause 2.4.3.7 the semantics for PTS_DTS_flags should be replaced by a table. The following is proposed:

PTS_DTS_flags -- A 2 bit flag indicating the presence of PTS and DTS fields in the PES packet header as shown in table xx.

table xx PTS_DTS_flags values

value	description
00	none present
01	forbidden
10	PTS present, DTS not present
11	PTS and DTS present

50. In clause 2.4.3.7 the semantics for `DSM_trick_mode_flag` are garbled. The trick mode field is 8 bits wide, but `trick_mode_control` is a 3 bit field. The text should read:

`DSM_trick_mode_flag` -- a 1 bit field which when set to '1' indicates the presence of an 8 bit trick mode field.

51. In the syntax and semantics of the PES packet, clauses 2.4.3.6 and 2.4.3.7 respectively, the field names "`PES_extension_flag`" and "`PES_extension_field_flag`" do not give much hint as to what the difference in the fields actually is.

Are there better names for these fields?

52. The semantics for `PES_header_data_length` in clause 2.4.3.7 are garbled. Its meaning is not clear and it attempts to explain the semantics of `PES_extension_flag` at the same time. The following semantics are proposed:

`PES_header_data_length` -- An 8 bit field specifying the number of bytes in the PES packet header following this field.

53. There are many examples where page referencing fails. An example is the semantics for PTS in clause 2.4.3.7, where the following sentence says:

The value of PTS is measured in the number of periods of a 90kHz system clock with a tolerance specified in clause 2.4.2 on page 11.

Clause 2.4.2 begins on page 11 and spans several pages. The system clock tolerance specification is on page 13 of clause 2.4.2. The above sentence is ambiguous as to what is on page 11.

It is proposed that all page references be removed. Reference should be made only to clauses, equation, figures, etc. It is noted that ISO/IEC 13818-2 and ISO/IEC 13818-3 have no page references.

54. The semantic definitions of PTS and DTS and the given equations in clause 2.4.3.7 are incorrect. There is no 90 kHz system clock defined, only a 27 MHz system clock.

The 2nd sentence in the semantics for PTS in clause 2.4.3.7 should be replaced with:

The value of PTS is the output of a counter, clocked at the rate of `system_clock_frequency/300`. This represents a resolution of 90 kHz.

Equation 2-7 should be replaced with:

$$PTS = NINT(system_clock_frequency \times t_{pn}(k)/300) \cdot 2^{33} \quad (2-7)$$

The same changes apply to the semantics of DTS and equation 2-8.

55. In the semantics for `ES_rate` in clause 2.4.3.7 the underscores on "`elementary_stream_rate`" and "`PES_packet`" are incorrect. The underscores should be removed.

56. In the semantics for trick mode control the semantics for each syntactical element are not stated explicitly. Would it not be better to state them explicitly?

57. In the semantics for `frequency_truncation` in clause 2.4.3.7 reference to Table 2-10 is indirect. It should be made explicit.

58. The semantic definition of `previous_PES_packet_CRC` in clause 2.4.3.7 makes reference to the Transport Stream. But this mechanism may also be used in a PES stream, or a Program Stream.

The first sentence in the semantics for `previous_PES_packet_CRC` should be changed to:

This is a 16 bit field whose value is a CRC calculated over the PES packet data bytes in the previous PES packet in the case of a Program Stream, and in the previous PES packet with the same PID value, in the case of the Transport Stream.

59. In clause 2.4.3.7 the semantics of all elements with the suffix of `_flag` or `_indicator` have a common grammatical error. The semantic typically reads " -- is a 1 bit field, when set to '1' indicates ...". This sentence is not correct.

The form of semantics for all fields with the suffix of `_flag` or `_indicator` in clause 2.4.3.7 should be as follows:

`name_flag` -- `name_flag` is a 1 bit flag, which when set to '1' ...

60. In the semantics for `P-STD_buffer_scale` in clause 2.4.3.7, the phrase "... preceding `stream_id` ..." is misleading. The format specifying that `P-STD_buffer_scale` is relevant only to the Program Stream is unconventional. A table would be useful here.

The semantics for `P-STD_buffer_scale` in clause 2.4.3.7 should be replaced by:

P-STD_buffer_scale -- The P-STD_buffer_scale is a 1 bit field that indicates the scaling factor used to interpret the subsequent P-STD_buffer_size field. The value that P-STD_buffer_scale takes depends upon the stream type as shown in table xx. P-STD_buffer_scale is used only in the Program Stream.

table xx P-STD_buffer_scale values

stream type	P-STD_buffer_scale
ISO/IEC 13818-3 audio stream	0
ISO/IEC 13818-2 video stream	1
other	unspecified

61. In the semantics for P-STD_buffer_size and P-STD_buffer_flag in clause 2.4.3.7, it is necessary to state that P-STD_buffer_scale applies only to the Program Stream, then it should also be stated for P-STD_buffer_size and P-STD_buffer_flag.

The semantics for P-STD_buffer_flag should be changed to:

P-STD_buffer_flag -- P-STD_buffer_flag is a 1 bit flag, which when set to '1' indicates that the P-STD_buffer_scale and P-STD_buffer_size are available in the PES packet header. P-STD_buffer_flag may only be set to '1' in the Program Stream.

The following sentence should be appended to the semantics for P-STD_buffer_size:

P-STD_buffer_size is used only in the Program Stream.

62. In the semantics for PES_extension_field_length in clause 2.4.3.7, the term "PES_extension_field" suggests that it is a syntactical element. It is not. The underscores should be removed.

63. In the semantics for PES_packet_data_byte in clause 2.4.3.7, the term "is specified by" is contradictory to the following sentence there. This contradiction can be avoided. The term "shall be" in the last sentence may be misleading. The phrase "... the last byte ..." in the last sentence is not required.

The semantics for PES_packet_data_byte in clause 2.4.3.7 should be replaced by:

PES_packet_data_byte -- PES_packet_data_byte is an 8 bit field. Multiple PES_packet_data_bytes shall be contiguous bytes of data from the elementary stream indicated by the packet's stream_id. The byte-order of the elementary stream shall be preserved. The number of PES_packet_data_bytes, N, is equal to the value indicated in the PES_packet_length field minus the number of bytes between the PES_packet_length field and the first PES_packet_data_byte.

PES packet stuffing_byte and padding_byte

64. In clause 2.4.3.7 in the semantics for stuffing_byte the references to DSM should be removed. The last sentence in this paragraph raises two issues:

- the syntax and semantics do not define where the PES packet header ends and where the PES packet payload begins. Stuffing bytes may equally be thought of as residing in the PES packet payload.
- the constraint that there may be only 32 stuffing bytes in the PES packet header may be too restrictive. What if an application wanted to always stuff to an integral number of Transport Stream packet payloads? While stuffing could be done in the Transport Stream it may be simpler to do it at the PES layer. Other lower layer protocols supporting the PES packet may not be able to easily stuff.

In clause 2.4.3.7 the semantics for stuffing_byte should be replaced by:

stuffing_byte -- This is an 8 bit field with a fixed value of '1111 1111'. It is discarded by the decoder.

65. In clause 2.4.3.7 in the semantics for padding_byte the references to DSM should be removed.

The semantics for padding_byte should be replaced by:

padding_byte -- This is an 8 bit field with a fixed value of '1111 1111'. It is discarded by the decoder.

66. In the semantics for stuffing_byte in clause 2.4.6.4 the reference to DSM should be removed. The reference to the system header is incorrect. The paragraph should be replaced with:

stuffing_byte -- This is a fixed 8-bit value equal to '1111 1111'. It is discarded by the decoder. No more than 16 stuffing bytes shall be present in 1 pack header.

Program Stream

67. In the second paragraph of 2.4.4 the term "access unit" is written with first letters capitalised inconsistently. What should it be?

68. In the paragraph preceding clause 2.4.6 the word "exactly" is superfluous. Acronyms do not need to be repeatedly defined. This paragraph should be replaced by:

Decoding and presentation in the Program Stream system target decoder are the same as defined for the Transport Stream system target decoder in clause 2.4.2.

69. In the semantics for `pack_stuffing_length` in clause 2.4.6.4 the word "non-negative" should be replaced by "positive" for consistency with other definitions.

70. In the semantics for `rate_bound` in clause 2.4.6.6 the term "`mux_rate`" should be "`program_mux_rate`".

71. In the semantics for `fixed_flag` in clause 2.4.6.6 it is not at all clear what the meaning of the equation is. If the intention is that SCR shall be coded at constant and fixed intervals then this should be stated in words. The equation is copied from ISO 11172 and does not reflect ISO/IEC 13818 changes.

An explanation of equation 2-21 should be given in words, and it should be corrected for ISO/IEC 13818, if it is at all required.

72. In the semantics for `system_audio_lock_flag` in clause 2.4.6.6 there should be underscores on "system clock frequency" i.e. `system_clock_frequency`.

73. In the semantics for `stream_id` in clause 2.4.6.6 the reference in the fourth paragraph to table 2-17 is incorrect. The reference is supposed to be to `stream_id` in the PES header. However there is no need to refer backwards to that field in this paragraph. The paragraph should be replaced with the following:

If the `stream_id` takes on any other value it shall be a byte value greater than or equal to '1011 1100' and shall be interpreted as referring to the stream type and elementary stream number according to table 2-17.

74. In the semantics for `pack_header_field_flag` in clause 2.4.3.7 the final sentence does not read well. The whole paragraph should be replaced with:

`pack_header_field_flag` -- `pack_header_field_flag` is a 1-bit flag, which when set to '1' indicates that an ISO/IEC 11172 pack header or an ISO/IEC 13818 Program Stream pack header is stored in this PES packet header. In a Program Stream this field shall be set to '0'.

75. In clause 2.4.6.8 the first paragraph is inconsistent in underscoring and capital letters in referring to the `pack_header` field. It is not clear why there is a reference to clause 2.4.3.6, the PES packet syntax. There is a word missing in the second last sentence. The paragraph should be replaced with the following:

Conversion between Transport Streams and Program Streams is possible by means of PES packets. To assist in conversion the ISO/IEC 13818 Program Stream `pack_header` field, possibly including the `system_header` field, may be carried in the Transport Stream in the PES packet header. In the conversion from a Transport Stream to a Program Stream the ISO/IEC 13818 `pack_header` field is removed from PES packets belonging to one program, and placed ahead of the associated PES packet header in the Program Stream. The `pack_header_field_flag` value shall then be set to '0' indicating that the ISO/IEC 13818 `pack_header` field is no longer present in the PES packet header.

Program Stream Map

76. In the semantics for `packet_start_code_prefix` in clause 2.4.6.10 the reference to "`stream_id`" is incorrect. It should be "`map_stream_id`".

77. In the table 2-18 in clause 2.4.6.9 the syntactical element "`elementary_stream_info_length`" should be indented one level, and be placed one line above its current position.

78. In clause 2.4.6.9 the term "Program Stream Map" is capitalised inconsistently. What should it be? It is proposed that it be always capitalised.

79. There appears to be a semantic problem with the `stream_id` field in table 2-17 in the case where the Program Stream is carrying ISO 11172 coded audio and video. In this case in the Program Stream Map the `stream_type` field correctly indicates ISO 11172 coded audio and video. However the `stream_id` field in the PES packet header indicates ISO/IEC 13818 coded audio and video.

Should not the semantics for `stream_id` in table 2-17 have one value that indicates ISO/IEC 13818 _or_ ISO 11172 coded audio and video?

Program Stream directory

80. In clause 2.4.6.11 the term "`directory_stream_id`" is given underscores as though it is a syntactical element. It is in fact a specific value of `stream_id`. The underscores should be removed to distinguish it from a syntactical element.

81. The second and third sentences in the second paragraph of clause 2.4.6.11 say the same thing, and repeat what has already been said in paragraph 1. An introductory sentence should be included to explain the purpose of the

Program Stream directory. "Program Stream Directory" should have first letters capitalised to agree with other like terms, and references made in the introduction.

The first two paragraphs in clause 2.4.6.11 should be replaced by the following:

The Program Stream Directory provides a means of identifying access points in a Program Stream. The Program Stream Directory is optional in the Program Stream. The Program Stream Directory is carried by PES packets with a stream_id value of '1111 1111' as indicated in table 2-17. In these PES packets, the PES packet header fields shall have the values as shown in table 2-20.

82. In clause 2.4.6.11 the sentence beginning "where 'X'..." should be placed after table 2-20.

83. The paragraph following table 2-20 does not read correctly. Surely table 2-20 describes a complete PES packet header. This paragraph should be removed.

84. In table 2-21 the correct term is "packet_stream_id".

Program Specific Information

85. In the second paragraph of 2.4.7 there is no need to define the acronym "PSI" a second time.

86. The last sentence in the third paragraph following table 2-24 does not read correctly. The page reference and word "below" should be removed. Such pointers add nothing to understanding of the text.

The last sentence in this paragraph should be replaced with:

The beginning of a section is indicated by a pointer field in the transport packet payload. The syntax of this field as specified in table 2-25.

87. Clause 2.4.7.3 uses the terminology of "stream type" to refer to the stream_id values in table 2-17. However the syntactical element "stream_type" is used in table 2-19 in the Program Stream Map. This shows a problem in naming, but highlights the point that table 2-17 and 2-19 have overlapping functionality. In addition the text in clause 2.4.7.3 should identify to which element table 2-17 applies. In addition there is no such thing as a "Program Stream Program Specific Information".

Because of confusion as to what clause 2.4.7.3 is trying to say, it should be removed completely.

88. In the second paragraph in clause 2.4.7.4 the term "program number" is a syntactical element and should be joined by an underscore.

89. Table 2-27 in clause 2.4.7.6 is badly positioned. It follows a statement that says "... This is an 8 bit field, which shall be set to 0x00.

Table 2-27 should be moved to a PSI introductory clause to explain the general functioning of table_id, and the common syntax used here.

90. In the semantic definition for section_length in clauses 2.4.7.6, 2.4.7.8, and 2.4.7.10 there are too many words in the last sentence. In all cases the last sentence should be replaced by:

section_length -- This is a twelve bit field, the first two bits of which shall be '00'. It specifies the number of bytes of the section, following the section_length field, and including the CRC.

91. In the first paragraph in clause 2.4.7.9 there should be an explicit statement that a Program Map Table is composed of one or more TS_program_map_sections. The paragraph should be replaced with the following:

The Program Map Table provides the mapping between programs and the elementary streams that comprise them. A single instance of such a mapping is referred to as a "program definition". The Program Map Table is the collection of all program definitions for a Transport Stream. The Program Map Table may be segmented into one or more Transport Stream program map sections. The syntax for the Transport Stream program map section is shown in table 2-29. Transport Stream program map sections are transmitted in TS packets, the PID values of which are privately assigned. Multiple PID values may be used.

92. In the semantic definition of "stream_type" in clause 2.4.7.10, is the reference to table 2-31 correct? Why does a stream_type field take descriptor_tag values?

93. In the first paragraph in clause 2.4.7.11 replace "-- If" by "-- if"

94. In the second paragraph in 2.4.7.11 the term "put together" is unnecessary. The paragraph should be replaced by:

A private table is made of several private_sections, all with the same table_id.

95. In the semantics for section_syntax_indicator in clause 2.4.7.12 the expression can be improved. The paragraph should be replaced by:

section_syntax_indicator -- This is a 1 bit indicator. When set to '1', it indicates that the generic section header syntax continues after the private_section_length field. When set to '0', it indicates that the private_data_bytes immediately follow the private_section_length field.

96. In the semantics for private_indicator and private_data_byte fields in clause 2.4.7.12 why is the statement "and shall not be specified by ISO in the future," necessary? For example PES_packet_data_byte requires no such qualification.

It is proposed that the qualification is unnecessary and should be removed.

97. In paragraph 2 in clause 2.4.8 the page reference and pointer phrase "on page 53 below" is not required. It adds nothing to the understanding of the text. It should be removed.

98. Semantic definitions are given in clause 2.4.8.1 for syntactical elements that have not been defined. This is unconventional. An introductory clause on the descriptor structure and descriptor use, followed by a formal syntax section is required.

99. In the semantic definition for descriptor_tag in clause 2.4.8.1 the reference to table 21 is incorrect. The word "discretion" is unnecessary in the last sentence. The paragraph should be replaced with the following:

descriptor_tag -- The descriptor_tag is an 8 bit field which identifies the descriptor type. The field values and meaning are given in table 2-31. Some values have normative meaning and some are reserved for future ISO/IEC use. The remaining values may be user defined.

100. In tables 2-33 and 2-35 the term "TBD" is undefined.

101. In the semantic definition for audio_coding_version in clause 2.4.8.5 the final sentence uses a pointer phrase, which is unnecessary. The paragraph should be replaced by:

audio_coding_version -- audio_coding_version is an 8 bit field which specifies the type of audio coding used for the associated elementary stream. Its values are shown in table 2-35.

102. The clause 2.4.8.6 the first sentence does not read well. It should be replaced by:

The hierarchy descriptor provides information to identify the components of hierarchical coded video.

103. The semantic definition for hierarchy_type in clause 2.4.8.7 does not read well and contains an unnecessary page reference and pointer phrase. It should be replaced by the following.

hierarchy_type -- hierarchical_type is an 8 bit field which identifies the relationship between the elementary stream associated with this descriptor and the elementary stream indicated by hierarchy_embedded_layer. The hierarchical_type field values are given in table 2-37.

104. The title for table 2-37 is incorrect. It should be "Table 2-37 -- hierarchy_type field values"

105. The title of the syntactical element hierarchy_embedded_layer is not intuitive as to its meaning. In any case the semantics for this element in clause 2.4.8.7 may be improved by changing the word "for" to "before" as follows:

hierarchy_embedded_layer -- hierarchy_embedded_layer is a 6 bit field that identifies the hierarchy position of the video elementary stream that needs to be accessed before decoding of the elementary stream associated with this hierarchy descriptor.

106. In clause 2.4.8.8 the term "registration_id" is written inconsistently. To match convention the letters should not be capitalised.

107. The second paragraph following table 2-39 has an error. It should probably read:

RAC 1 is reserved for ISO/IEC 13818, if ISO/IEC designates a Registration authority to administer a registration_id.

108. The format of RAC 0, RAC 1, etc used in clause 2.4.8.9, is undefined and unconventional. These expressions should be replaced by a phrase of the following nature:

An RAC field value of 0 ...

109. The expression "under the following" in relation to registration authorities for "RAC 4", "RAC 5", and "RAC 6" in clause 2.4.8.9 is unusual language. In all cases it should be replaced by the phrase "at the following address".

110. In the first paragraph in clause 2.4.8.16 the final sentence should be qualified with the addition of the phrase "conditional access", such that it reads:

If any system-wide conditional access management information exists within a Transport Stream, a CA descriptor must be present in the appropriate map section.

Semantic restrictions

111. In clause 2.4.9.1, as previously described, $tm(i)$ (m is a subscript) should be corrected to $tm(i)$ (m is not a subscript), the quotes should be removed from "skipped pictures", and the page references should be removed.

112. In clause 2.4.9.2 the reference to the `system_clock_reference` fields is probably incorrect. The mathematical formulation does not require reference to $M(i)$, and is probably incorrect. It may be preferable to use a decimal point in the equation. Clause 2.4.9.2 should be rewritten as:

The ISO/IEC 13818 Program Stream shall be constructed so that the time interval between the bytes containing the last bit of `system_clock_reference_base` fields in successive packs shall be less than or equal to 0.7 seconds. Thus:

$$|tm(i) - tm(i')| \leq 0.7 \text{ seconds}$$

for all i and i' where $tm(i)$ and $tm(i')$ are the time of arrival at the system target decoder of bytes containing the last bit of consecutive `system_clock_reference_base` fields.

113. In clause 2.4.9.3 the same modifications as described above for clause 2.4.9.2 should be made.

114. In clause 2.4.9.4 the same modifications as described above for clause 2.4.9.2 should be made. In addition the word "NOTE" should be removed in the final paragraph in clause 2.4.9.4.

115. In equation 2-27 in clause 2.4.10.1 the term "bits/sec" should not be in brackets.

116. In the paragraphs preceding 2.4.10.2 the word "peek" should be changed to "peak", the sentence in which this word appears should be prefixed with the word "where" and the whole sentence moved up two lines beneath the expression for `BSadd`.

Annexe A

117. It should be stated more clearly that the functions provided by the DSM CC protocol, as defined in this IS, are not restricted to ISO/IEC 13818 application systems, but can be used as well for ISO/IEC 11172 application systems.

118. It should be clarified how the protocol can ensure that the command initiator, receiving an acknowledgement from the command receiver, can always be sure about what is the issued command to which the received acknowledgement refers. This can become particularly critical in the case that some acknowledgement can be lost due to channel errors.

119. Pag. 66 - Par. A.0.2. The definition of "Video networks" as one of the groups of possible future applications does not seem to identify clearly what is intended. Probably something like "Video data exchange on computer networks" would be more appropriate.

120. Pag. 67 - Par. A.0.3. "...end-users can perform ISO/IEC 13818 DECODING without having to understand fully the detailed operation of the specific DSM used," does not correctly describe the scope of DSM CC. "...end-users can perform storage and retrieval of ISO/IEC 13818 bitstreams without..." would be more appropriate.

121. Pag. 71 - Par. A.2.2 - last item. It should be clarified better who is responsible for manipulating the trick mode bits. "DSM" is not meaningful in this sense.

122. Pag. 75 - Par. A.2.7 - first line. Reference is made to possible not supported functions (e.g. reverse play in standard speed). A table explicitly listing supported and not supported functions could be useful.

123. In clause A.2.9 reference is made to a 90 kHz system clock. This is not strictly correct. PTSs have a resolution of 90 kHz but are derived from the 27 Mhz system clock.

Annex A editorial comments.

124. Pag. 66 - Par. A.0 - last line. Numbering and indentation are missing.

125. Pag. 69 - Par. A.1.3 - last line before Figure A-3. The referred figure is "A-3", not "3".

126. Pag. 69 - Par. A.1.3 - five lines from the bottom. "stream_id table 0-17" is actually "stream_id table 2-17".

127. Pag. 74 - first line. It should be "Constraints on setting flags in DSM CC Acknowledgement".

128. Pag. 76. It is completely blank. Is there any text missing?

129. "System" and "Systems" are both used in the document and the figures. It would be preferable to be uniform to use one term.

Other annexes

130. In the second line of the third paragraph of clause B.0.3 the phrase "... occupies more that one byte ..." should be changed to "... occupies more than one byte ...".

131. In the third paragraph of clause B.0.3 reference is made to the "last byte of the SCR". The reference should be to "the last byte of the system_clock_reference_base field".
132. In the third paragraph of clause B.0.3 the term "data source" should be changed to "channel".
133. In the second last line of the last paragraph in clause B.0.3 the phrase "...VCO slew rate can designed..." should be changed to "... VCO slew rate can be designed ...".
134. In the first line of the fourth paragraph in clause B.0.9 the phrase "...and the with variable rate streams..." should be changed to "...and with variable rate streams...".
135. The purpose of annex D is not clear. The whole annex could be replaced by the sentence "program and elementary stream descriptors may be embedded".

- end -