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TECHNICAL CORRIGENDUM NO.1

TO ATSC STANDARD:

PROGRAM AND SYSTEM INFORMATION PROTOCOL FOR TERRESTRIAL BROADCAST AND CABLE

DOC. A/65 (23 DEC 97)

(CORRIGENDUM)

ADVANCED TELEVISION SYSTEMS COMMITTEE

Introduction

This Technical Corrigendum contains changes to A/65 that correct editorial errors and clarify the original document. It also contains additional provisions to handle circumstances that were not covered in the original document.

1) Table of Contents

Add to Table of Contents with an auto page reference at Page #:

ANNEX G AN OVERVIEW OF PSIP FOR CABLE .....PAGE #

2) Section 1.3

Add to Section 1.3:

- **Annex G** — An overview of PSIP for Cable

3) Section 2

Add the word "(*normative*)" following references 13 and 14.

Add new reference:

15. Record of Test Results for Digital HDTV Grand Alliance System, September 8, 1995, Advanced Television Test Center (*Informative*).

4) Section 3.2

Delete from section 3.2 (since it is not used in the document):

GA Grand Alliance

Add to section 3.2:

BMP Basic Multilingual Plane

EMM Entitlement Management Message

OOB Out of Band

5) Section 3.3

Add to Section 3.3 @ p. 7 a new definition for 'region'

region: As used in this document, a region is a geographical area consisting of one or more countries.

6) Section 4.1

Correct the caption for Table 4.1 to include initial capitalization.

In Table 4.1 add column heading "**Syntax**" at upper left.

Insert a rule under column headings.

Remove the bold from the first line of text "typical_PSI_table()"{

In Table 4.1 change the fifth line from "**zero 2 '00'**" to "**reserved 2 '11'**". This change is to conform to the MPEG-2 table structure. The revised Table 4.1 is shown below.

Table 4.1 Table Format Used in PSIP

Syntax	Bits	Format
typical_PSI_table( ) {		
table_id	8	uimsbf
section_syntax_indicator	1	'1'
private_indicator	1	'bslbf'
reserved	2	'11'
section_length	12	uimsbf
table_id_extension	16	uimsbf
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
protocol_version	8	uimsbf
actual_table_data	*	
CRC_32	32	rpchof
}		

7) Section 4.3

Change paragraph 2 from:

2. **Standard Table Types:** As indicated in Table 4.1, table_id values in the range 0xCE-0xDF and 0xE6-0xFE shall be reserved for use either when revising this PSIP Standard, or when another standard is issued that builds upon this one.

To:

2. **Standard Table Types:** As indicated in Table 4.2, table_id values in the range 0xCE-0xDF and 0xE6-0xFE shall be reserved for use either when revising this PSIP Standard, or when another standard is issued that builds upon this one.

Change paragraph 3 from:

3. **User Private Table Types:** As indicated in Table 4.1, table_id values in the range 0x40 through 0xBF shall be reserved for "user private" use.

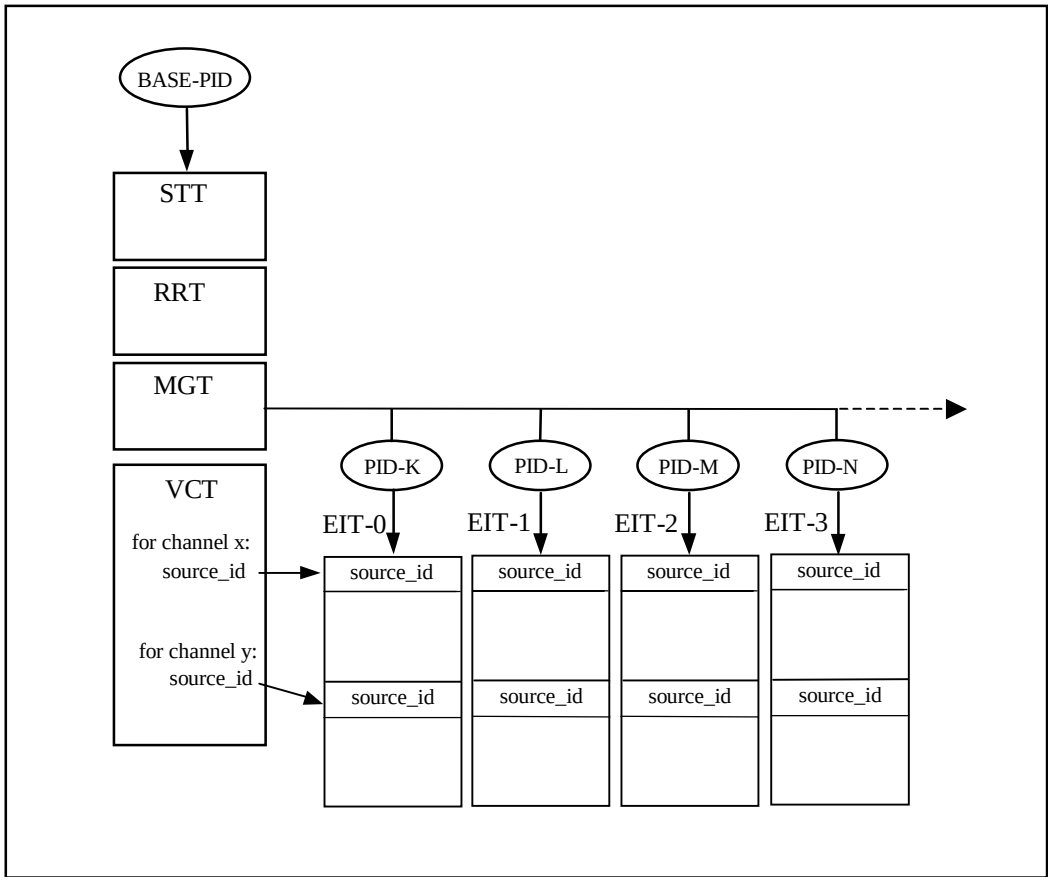
To:

3. **User Private Table Types:** As indicated in Table 4.2, table_id values in the range 0x40 through 0xBF shall be reserved for "user private" use.

8) Section 5

Correct the caption for Figure 5.1 to use an initial capital for "**Hierarchy**".

In Figure 5.1 delete line segment inside MGT box and align dotted portion of that line, center and change from B-PID to BASE-PID in oval. Add EIT-3 and then re-label PID-L, M and N to be PID-K, L, M and N. The revised Figure 5.1 is shown below.



In Section 5, in the last paragraph before section 5.1,change from:

"These tables carry relatively long text messages for describing events and virtual channels."

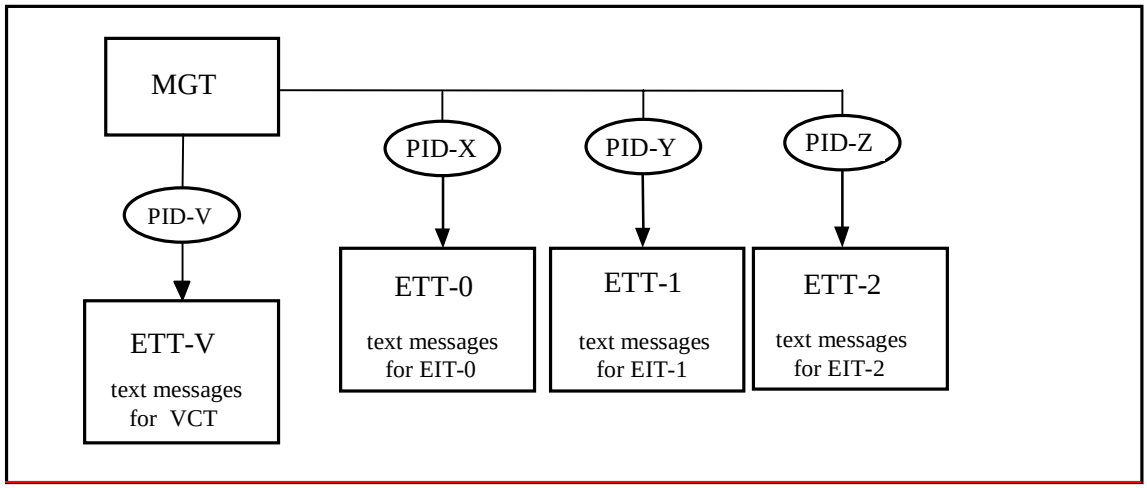
To:

"The ETTs carry relatively long text messages for describing events and virtual channels."

Correct the caption for Figure 5.2 to include initial capitals as follows:

"**Figure 5.2 Extended Text Tables (ETTs) Defined to Carry Text Messages for Describing Virtual Channels and Events**"

In Figure 5.2, as shown below, delete line segments inside MGT box. Also adjust alignment of lines from MGT box and add "Y" to PID above ETT-1 as shown below.



9) Section 6.1

In Table 6.1 change the fifth line from "**zero 2 '00'**" to "**reserved 2 '11'**". In the 18th line of the table, change "**descriptors()**" to "**descriptor ()".** Delete the 'var' in the bits field for **descriptors()**. The revised Table 6.1 is shown below.

Table 6.1 Bit Stream Syntax for the System Time Table

Syntax	Bits	Format
system_time_table_section () {		
table_id	8	0xCD
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
table_id_extension	16	0x0000
reserved	2	'11'
version_number	5	'00000'
current_next_indicator	1	'1'
section_number	8	0x00
last_section_number	8	0x00
protocol_version	8	uimsbf
system_time	32	uimsbf
GPS_UTC_offset	8	uimsbf
daylight_savings	16	uimsbf
for (I = 0;I< N;I++) {		
descriptor()		
}		
CRC_32	32	rpchof
}		

10) Section 6.2

Modify the last line of the second paragraph in Section 6.2 @ p.15 to cover the situation where it takes more than one packet to carry the MGT:

Change from:

"The following constraints apply to the Transport Stream packet carrying the MGT:"

To:

"The following constraints apply to the Transport Stream packet (or packets) carrying the MGT:"

In Table 6.2 change the fifth line from "**zero 2 '00'**" to **"reserved 2 '11'"**. Delete the 'var' in the bits field for **descriptor()**. Add opening and closing brackets for both descriptor loops. The revised Table 6.2 is shown below.

Table 6.2 Bit Stream Syntax for the Master Guide Table

Syntax	Bits	Format
master_guide_table_section () {		
table_id	8	0xC7
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
table_id_extension	16	0x0000
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	0x00
last_section_number	8	0x00
protocol_version	8	uimsbf
tables_defined	16	uimsbf
for (i=0;i<tables_defined;i++) {		
table_type	16	uimsbf
reserved	3	'111'
table_type_pid	13	uimsbf
reserved	3	'111'
table_type_version_number	5	uimsbf
number_bytes	32	uimsbf
reserved	4	'1111'
table_type_descriptors_length	12	uimsbf
for (k=0;k<n;k++) {		
descriptor()		
}		
}		
reserved	4	'1111'
descriptors_length	12	uimsbf
for (i = 0;i< n;i++) {		
descriptor()		
}		
CRC_32	32	rpchof
}		

Clarify the definition of **tables_defined** by changing from:

tables_defined — This 16-bit unsigned integer in the range 0 to 65535 represents the number of tables in the following loop.

To:

tables_defined — This 16-bit unsigned integer has a range of 6 - 370 (for terrestrial) and 2 - 370 for cable.

Move sentence in the definition of **table_type_version_number** @ p 18, Section 6.2 for more appropriate association.

Change from :

table_type_version_number— This 5-bit field reflects the version number of the table_type described in the loop. The value of this field shall be the same as the version_number entered in the corresponding fields of tables and table instances. The version number for the next VCT (current_next_indicator = 0) shall be one unit more (modulo 32) than the version number for the current VCT (current_next_indicator = 1). For example, the value of this field for EIT-3 will be the same as that of the version_number that appears in the actual EIT-3.

To:

table_type_version_number— This 5-bit field reflects the version number of the table_type described in the loop. The value of this field shall be the same as the version_number entered in the corresponding fields of tables and table instances. For example, the value of this field for EIT-3 will be the same as that of the version_number that appears in the actual EIT-3. The version number for the next VCT (current_next_indicator = 0) shall be one unit more (modulo 32) than the version number for the current VCT (current_next_indicator = 1).

11) Section 6.3.1

In Table 6.4 change the fifth line from "**zero 2 '00'**" to "**reserved 2 '11'**". Change the "Format" column's text formatting for **short_name** so that it appears on one line. In the 33rd line of the table, change "**descriptors()**" to "**descriptor()**". In the 39th line of the table, change "**additional_descriptors()**" to "**additional_descriptor()**". The revised Table 6.4 is shown below.

Table 6.4 Bit Stream Syntax for the Terrestrial Virtual Channel Table

Syntax	Bits	Format
terrestrial_virtual_channel_table_section () {		
table_id	8	0xC8
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
transport_stream_id	16	uimsbf
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
protocol_version	8	uimsbf
num_channels_in_section	8	uimsbf
for(i=0; i<num_channels_in_section;i++) {		
short_name	7*16	unicode™BMP
reserved	4	'1111'
major_channel_number	10	uimsbf
minor_channel_number	10	uimsbf
modulation_mode	8	uimsbf
carrier_frequency	32	uimsbf
channel_TSID	16	uimsbf
program_number	16	uimsbf
ETM_location	2	uimsbf
access_controlled	1	bslbf
hidden	1	bslbf
reserved	6	'111111'
service_type	6	uimsbf
source_id	16	uimsbf
reserved	6	'111111'
descriptors_length	10	uimsbf
for (i=0;i<N;i++) {		
descriptor()		
}		
}		
reserved	6	'111111'
additional_descriptors_length	10	uimsbf
for(j=0; j<N;j++) {		
additional_descriptor()		
}		
CRC_32	32	rpchof
}		

Also in Section 6.3.1, change the second sentence of the definition of major channel number from:

major_channel_number— A 10-bit number that represents the "major" channel number associated with the virtual channel being defined in this iteration of the "for" loop. Each virtual channel must be associated with a major and a minor channel number.

To:

major_channel_number— A 10-bit number that represents the “major” channel number associated with the virtual channel being defined in this iteration of the “for” loop. Each virtual channel shall be associated with a major and a minor channel number.

Also in Section 6.3.1, there was an omission of one ATSC transmission format and extra columns were both unneeded and in error in Table 6.5. Also, changes are required to the wording in the "meaning" column entries to be more consistent and unambiguous.

Delete the “terrestrial broadcast” and “cable” columns from Table 6.5.

Change the fifth entry in Table 6.5 from:

ATSC (8 VSB) — The virtual channel uses the 8-VSB modulation method conforming to the ATSC Digital Television Standard.

To:

ATSC (8 VSB) — The virtual channel uses the 8-VSB modulation method conforming to the *ATSC Digital Television Standard A/53*. Ref. [2].

Add a new entry after the current fifth entry that states:

0x05 **ATSC (16 VSB)** — The virtual channel uses the 16-VSB modulation method conforming to the *ATSC Digital Television Standard A/53*, Ref. [2].

Change “0x05-0x7F” to “0x06-0x7F”.

The revised table is shown below.

Table 6.5 Modulation Modes

modulation_mode	meaning
0x00	[Reserved]
0x01	**Analog** — The virtual channel is modulated using standard analog methods for analog television.
0x02	**SCTE_mode_1** — The virtual channel has a symbol rate of 5.057 Msps, transmitted in accordance with *Digital Transmission Standard for Cable Television*, Ref. [12] (Mode 1). Typically, mode 1 will be used for 64-QAM.
0x03	**SCTE_mode_2** — The virtual channel has a symbol rate of 5.361 Msps, transmitted in accordance with *Digital Transmission Standard for Cable Television*, Ref. [12] (Mode 2). Typically, mode 2 will be used for 256-QAM.
0x04	**ATSC (8 VSB)** — The virtual channel uses the 8-VSB modulation method conforming to the *ATSC Digital Television Standard A/53*. Ref. [2].
0x05	**ATSC (16 VSB)** — The virtual channel uses the 16-VSB modulation method conforming to the *ATSC Digital Television Standard A/53*, Ref. [2].
0x06-0x7F	[Reserved for future use by ATSC]
0x80	Modulation parameters are defined by a private descriptor
0x81-0xFF	[User Private]

In Section 6.3.1, in the definition of **carrier_frequency,** add a new footnote to the 310 kHz offset value in the second paragraph.

Reason: The actual frequency can be +19.4 kHz, or + 28.6 kHz from the value shown. There is also a +/- 10 kHz offset to NTSC channels, which needs to be supported.

The location of the footnote is shown with a "2" in the following paragraph:

For the ATSC Digital Television Standard, where the PTC bandwidth is 6 MHz, the pilot tone is located 310 kHz[2] above the lower edge of the physical transmission channel, or 2.690 MHz below the specified center of the band. Similarly, for analog NTSC transmitted in the US, the picture carrier is 1.25 MHz above the lower edge of the 6 MHz physical transmission channel.

Insert the following footnote:

[2]"This is the nominal value. To minimize interference for various combinations of nearby TV stations precision offsets of 19.403 kHz or 28.615 kHz may be used (See Ref. [15] page I-3-15). The actual frequency may also shift due to the +/- 10 kHz offsets used in the NTSC assignments."

Renumber original footnotes 2 through 7 to become 3 through 8.

Correct the caption for Table 6.6 to use an initial capital for "**Location**".

In Table 6.8 change the fifth line from "**zero 2 '00'**" to "**reserved 2 '11'**". Change the "Format" column's text formatting for short_name so that it appears on one line. In the 35th line of the table, change "**descriptors()**" to "**descriptor()**". In the 41st line of the table, change "**additional_descriptors()**" to "**additional_descriptor()**". The revised Table 6.8 is shown below:

Table 6.8 Bit Stream Syntax for the Cable Virtual Channel Table

Syntax	Bits	Format
cable_virtual_channel_table_section () {		
table_id	8	0xC9
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
transport_stream_id	16	uimsbf
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
protocol_version	8	uimsbf
num_channels_in_section	8	uimsbf
for(i=0; i<num_channels_in_section;i++) {		
short_name	7*16	unicode™BMP
reserved	4	'1111'
major_channel_number	10	uimsbf
minor_channel_number	10	uimsbf
modulation mode	8	uimsbf
carrier_frequency	32	uimsbf
channel_TSID	16	uimsbf
program_number	16	uimsbf
ETM_location	2	uimsbf
access_controlled	1	bslbf
hidden	1	bslbf
path_select	1	bslbf
out_of_band	1	bslbf
reserved	4	'1111'
service_type	6	uimsbf
source_id	16	uimsbf
reserved	6	'111111'
descriptors_length	10	uimsbf
for (i=0;i<N;i++) {		
d**escriptor()**		
}		
}		
r**eserved**	6	'111111'
additional_descriptors_length	10	uimsbf
for(j=0; j<N;j++) {		
additional_descriptor()		
}		
CRC_32	32	rpchof
}		

12) Section 6.4

In Table 6.10 change the fifth line from "**zero 2 '00'**" to "**reserved 2 '11'**". In the 36th line in the table, change "**descriptors()**" to "**descriptor()**". Add a space after "table_id_extension" before the open bracket. Delete the 'var' in the bits field for **descriptor()**. The revised

Table 6.10 is shown below.

Table 6.10 Bit Stream Syntax for the Rating Region Table

Syntax	Bits	Format
rating_region_table_section () {		
table_id	8	0xCA
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
table_id_extension {		
reserved	8	0xFF
rating_region	8	uimsbf
}		
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	uimsbf
last_section_number	8	uimsbf
protocol_version	8	uimsbf
rating_region_name_length	8	uimsbf
rating_region_name_text()	var	
dimensions_defined	8	uimsbf
for(i=0; i<dimensions_defined;i++) {		
dimension_name_length	8	uimsbf
dimension_name_text()	var	
reserved	3	'111'
graduated_scale	1	bslbf
values_defined	4	uimsbf
for (j=0;j<values_defined;j ++) {		
abbrev_rating_value_length	8	uimsbf
abbrev_rating_value_text()	var	
rating_value_length	8	uimsbf
rating_value_text()	var	
}		
}		
reserved	6	'111111'
descriptors_length	10	uimsbf
for (i=0;i<N;i++) {		
descriptor()		
}		
CRC_32	32	rpchof
}		

13) Section 6.5

Modify the first sentence in the third paragraph of Section 6.5 as shown below:

Change from:

"The PSIP shall have at least four EITs and no more than 128 EITs, each of which provides the

event information for a certain time span."

To:

"PSIP supports up to 128 EITs, each of which provides the event information for a certain time span. For terrestrial broadcast, at least the first four EITs shall be included in the Transport Stream."

Delete the second period at the end of the fifth paragraph of section 6.5.

After the fifth paragraph of Section 6.5 add the following paragraph:

"For NVOD services, event entries in the EIT correspond to events scheduled in the virtual channel that carries the time_shifted_descriptor (the reference virtual channel). However, an NVOD event shall be listed in applicable EITs even when the NVOD event has finished in the reference virtual channel as long as the NVOD event remains on the air as a time shifted service in complementary virtual channels. Hence, an EIT may contain, in some cases, an expired event describing NVOD services."

Also in Section 6.5, change definition of **length_in_seconds** from:

length_in_seconds — Duration (in seconds) of this event.

To:

length_in_seconds — Duration of this event in seconds.

Change the title of Table 6.13 from:

Table 6.13 ETM_Location

To:

Table 6.13 ETM Location

14) Section 6.6

Modify Table 6.14 as follows to show all 16 bits being zero in the **table_id_extension** and to change the format of **version_number** from 0x00 to uimsbf.

Change the seventh line of Table 6.14 from:

table_id_extension	16	0x00

To:

table_id_extension	16	0x0000

Change the ninth line of Table 6.14 from:

version_number 5 0x00

To:

version_number 5 uimsbf

The revised Table 6.14 is shown below.

Table 6.14 Bit Stream Syntax for the Extended Text Table

Syntax	Bits	Format
extended_text_table_section () {		
table_id	8	0xCC
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
table_id_extension	16	0x0000
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	0x00
last_section_number	8	0x00
protocol_version	8	uimsbf
ETM_id	32	uimsbf
extended_text_message()	var	
CRC_32	32	rpchof
}		

Change the semantics of table_id extension from:

table_id_extension — This field shall be set to 0x00.

To:

table_id_extension — This field shall be set to 0x0000.

15) Section 6.7

Modify Section 6.7 and revise Table 6.16 as follows:

Change Section 6. 7 from:

6.7 Core Descriptors

Table 6.16 lists all of the core descriptors and their descriptor tags. Asterisks mark the tables where the descriptors may appear. The range of MPEG-2 defined or reserved descriptor tags is between 0x02 and 0x3F.

To:

6.7 Core Descriptors

Table 6.16 lists all of the core descriptors and their descriptor tags. The Service location descriptor shall always be present in the terrestrial VCT (shown with an "S"). When present some descriptors shall be in each indicated location (shown with an "M"). Some descriptors also may be present in a second location within either the terrestrial or the cable case (shown with an "O"). Asterisks mark the tables where the descriptors may appear without restrictions. The range of MPEG-2-defined or reserved descriptor tags is between 0x02 and 0x3F plus FF.

Change Table 6.16 from:

Table 6.16 List of Descriptors for PSIP Tables.

Descriptor Name	Descriptor tag	Terrestrial				Cable		
		PMT	MGT	VCT	EIT	PMT	MGT	VCT
stuffing descriptor	0x80	*	*	*	*	*	*	*
AC-3 audio descriptor	0x81	*			*	*		
program identifier descriptor	0x85	*				*		
caption service descriptor	0x86	*			*	*		
content advisory descriptor	0x87	*			*	*		
extended channel name descriptor	0xA0			*				*
service location descriptor	0xA1			*				
time-shifted service descriptor	0xA2			*				*
component name descriptor	0xA3					*		
user private	0xC0-0xFF		*	*	*		*	*

To:

Table 6.16 List of Descriptors for PSIP Tables.

Descriptor Name	Descriptor tag	Terrestrial				Cable			
		PMT	MGT	VCT	EIT	PMT	MGT	VCT	EIT
stuffing descriptor	0x80	*	*	*	*	*	*	*	*
AC-3 audio descriptor	0x81	M			M	M			O
caption service descriptor	0x86	O			M	M			O
content advisory descriptor	0x87	O			M	M			O
extended channel name descriptor	0xA0			M				M	
service location descriptor	0xA1			S				M	
time-shifted service descriptor	0xA2			M				M	
component name descriptor	0xA3	M				M			
user private	0xC0-0xFE	*	*	*	*	*	*	*	*

16) Section 6.7.2

Change Section 6.7.2 from:

"The program_identifier_descriptor, as defined in Ref. [5], may be used in the PMT."

To:

"The program_identifier_descriptor, as defined in Ref. [5], shall not be used in any PSIP descriptor loops."

17) Section 6.7.6

Change Section 6.7.6 to avoid confusion about scope of this standard from:

"6.7.6 Service Location Descriptor

This descriptor specifies the stream types, PID and language code for each elementary stream. This descriptor shall appear in the TVCT, and must be valid for the current event in the corresponding virtual channel.

The bit stream syntax for the service location descriptor is shown in Table 6.20."

To:

"6.7.6 Service Location Descriptor

This descriptor specifies the stream types, PID and language code for each elementary stream covered by this standard. This descriptor shall appear in the TVCT, and shall be valid for the current event in the corresponding virtual channel.

Note that for cable, the information in the service_location_descriptor is carried in the PMT with the syntax defined by Ref. [10].

The bit stream syntax for the service_location_descriptor is shown in Table 6.20."

18) Section 6.7.8

Fix the number of bits and the format value split in Table 6.23.

Change Table 6.23 from:

Table 6.23 Bit Stream Syntax for the Component Name Descriptor

Syntax	Bits	Format
component_name_descriptor() {		
descriptor_tag		80xA3
descriptor_length		8uimsbf
component_name_string()		v
	ar	
}		

To:

Table 6.23 Bit Stream Syntax for the Component Name Descriptor

Syntax	Bits	Format
component_name_descriptor() {		
descriptor_tag	8	0xA3
descriptor_length	8	uimsbf
component_name_string()	var	
}		

19) Section 6.8

In Section 6.8 change the definition of ISO_639_language_code from:

ISO_639_language_code — This 3-byte (24 bits) field, based on ISO 639.2/B, specifies the language used for the i^{th} string.

To:

ISO_639_language_code — This 3-byte (24 bits) field, in conformance with ISO 639.2/B, specifies the language used for the i^{th} string.

In Table 6.26 change the meaning for Mode 0x0F from "Reserved" to "Select ISO/IEC 10646-1 Page 0x0F". Change the languages for Mode 0x0F and 0x10 to show Tibeten is 0x0F and only Georgian is 0x10. The corrected lines of the table are shown below:

0x0F	Select ISO/IEC 10646-1 Page 0x0F	Tibetan
0x10	Select ISO/IEC 10646-1 Page 0x10	Georgian

20) Section 7.1

Correct the caption for Table 7.1 to use initial capitals as follows: "**Maximum Cycle Time for the STT, MGT, VCT and RRT**"

Correct the caption for Table 7.2 to use initial capitals as follows: "**Maximum Rate for Each PSIP Packet Stream**"

Make the column headings in Table 7.2 bold face.

21) Annex B

Change the introductory line to correct the spelling of "assignmentn" to "assignment".

22) Section C1.2.2

Change the name of the variable from:

left_child_word_offset_or_character_leaf—

To:

left_child_word_offset_or_char_leaf—

Change the name of the variable from:

right_child_word_offset_or_character_leaf

To:

right_child_word_offset_or_char_leaf

Change the next to last paragraph in section C1.2.2 from:

It can be seen from Table F.3 that each node (corresponding to one iteration of the for-loop) has a byte for the left child or character, and a byte for the right child or character.

To:

It can be seen from Figure F.3 that each node (corresponding to one iteration of the for-loop) has a byte for the left child or character, and a byte for the right child or character.

23) Annex D, Section D2

Insert the following three paragraphs after the third paragraph of Section D2:

"It should be noted that, except for the MGT, PSIP tables may start in any byte position within an MPEG-2 transport stream packet. The Master Guide Table is special in that the first byte always is aligned with the first byte of the packet payload. The A/65 standard states this restriction as the "pointer_field of the Transport Stream packet carrying the table_ID field of the MGT section shall have the value 0x00 (section starts immediately after the pointer_field)."

"In general, table sections may span packet boundaries. Also, if the tables are small enough, more than one PSIP table may be present within a single transport stream packet. The MPEG-2 pointer_field mechanism is used to indicate the first byte of a table within a packet payload. The starting byte of subsequent tables that might be in the same payload is determined by processing successive section_length fields. The location of the section_length field is guaranteed to be consistent for any type of PSIP table, as the format conforms to MPEG-2 defined Program Specific Information (PSI) tables."

"If a packet payload does not include the start of a table, the payload_unit_start_indicator bit in the packet header is set to '0' and the pointer_field is not present."

Delete the extra period at the end of the fourth paragraph in Section D2.

Use the corrected Figure 5.1 (from Item **7)** of this Corrigendum) in place of Figure D.1. Correct the caption of Figure D.1 to use an initial capital for "Tables".

Use the corrected Figure 5.2 1 (from Item **7)** of this Corrigendum) in place of Figure D.2. Correct the caption of Figure D.2 to use an initial capital for "**Hierarchy**". Change the last sentence of the first paragraph after figure D.1 from:

It defines table sizes necessary for memory allocation during decoding; it defines version numbers to identify those tables that need to be updated; and it gives the packet identifiers (PIDs) that label the tables.

To:

It defines table sizes necessary for memory allocation during decoding; it defines version numbers to identify those tables that need to be updated; it has a constrained header location to facilitate receiver acquisition; and it gives the packet identifiers (PIDs) that label the tables.

24) Annex D, Section D3

Modify Tables D.2 and D.3 and the explanatory text to track the specific major-minor channel numbers rather than the Virtual Channel generic label, e.g., VC#1, VC#2, etc. Correct the captions of Tables D.2 and D.3 to use initial capitals, and revise all table entries to use initial capitals.

The corrected Tables are shown below:

Table D.2 The First 3-Hour Segment to be Described in VCT and EIT-0

		14:00-14:30	14:30 -15:00	15:00 - 15:30	15:30 - 16:00	16:00 - 16:30	16:30-17:00
PTC 12 (12-0)	NBZ	City Life	City Life	Travel Show	Travel Show	News	News
PTC 39 (12-1)	NBZ	City Life	City Life	Travel Show	Travel Show	News	News
PTC 39 (12-2)	NBZ	Soccer	Golf Report	Golf Report	Car Racing	Car Racing	Car Racing
PTC 39 (12-3)	NBZ	Secret Agent	Secret Agent	Lost Worlds	Lost Worlds	Lost Worlds	Lost Worlds
PTC 39 (12-4)	NBZ	Headlines	Headlines	Headlines	Headlines	Headlines	Headlines

Table D.3 The Second 3-Hour Segment to be Described in VCT and EIT-1

		17:00-17:30	17:30-18:00	18:00 - 18:30	18:30 - 19:00	19:00-19:30	19:30 - 20:00
PTC 12 (12-0)	NBZ	Music Today	NY Comedy	World View	World View	News	News
PTC 39 (12-1)	NBZ	Music Today	NY Comedy	World View	World View	News	News
PTC 39 (12-2)	NBZ	Car Racing	Car Racing	Sports News	Tennis Playoffs	Tennis Playoffs	Tennis Playoffs
PTC 39 (12-3)	NBZ	Preview	The Bandit	The Bandit	The Bandit	The Bandit	Preview
PTC 39 (12-4)	NBZ	Headlines	Headlines	Headlines	Headlines	Headlines	Headlines

Change the last paragraph of section D3 from:

"Similar tables can be built for the next 6 hours (for EIT-2 and EIT-3). According to this scenario, NBZ broadcasts four regular digital channels (also called virtual channels and denoted as VC), one matching the analog transmission (simulcast), another for sports, and a third one for movies. The fourth one supports a service displaying headlines with text and images."

To:

"Similar tables can be built for the next 6 hours (for EIT-2 and EIT-3). According to this scenario, NBZ broadcasts four regular digital channels (also called virtual channels and denoted by their major and minor channel numbers), one with the same program as the analog transmission, another for sports, and a third one for movies. The fourth one supports a service displaying headlines with text and images."

25) Annex D, Section D3.2

Add to section D3.2 as the last paragraph of that section:

"It is recommended that the broadcaster insert into the VCT any major-minor channel that would be used to carry any program announced in the EIT. This means if no current program was using 7-7, and if a program 16 days from now was going to use 7-7, that 7-7 would be in the VCT. This would enable receivers to include the channel number in a program guide presented to the consumer. If a program is announced in the EIT and the source ID for that program is not found in the VCT, the receiver cannot determine which "channel" to display for that program."

26) Annex D, Section D3.3

Change the sixth sentence in the third paragraph of section D3.3 from:

Notice that events can have start times before the activation time (14:00 EST in this example) of the table.

To:

Notice that events can have start times before the activation time (14:00 EDT in this example) of the table.

Change the last paragraph of this section from:

Several descriptors can be associated with each event. The most important is the content advisory descriptor which assigns a rating value according to one or more systems. Recall that the actual rating system definitions are tabulated within the RRT. When a closed caption descriptor is included, it signals the existence of closed captioning and lists the necessary parameters for decoding.

To:

Several descriptors can be associated with each event. One is the content advisory descriptor which assigns a rating value according to one or more systems. Recall that the actual rating system definitions are tabulated within the RRT. Another is a closed caption descriptor which signals the existence of closed captioning and lists the necessary parameters for decoding.

27) Annex D, Section D3.4

Change the first sentence of the second paragraph from:

Figure D.6 shows an example of one instance of an RRT, defined as the first rating region and carrying the MPAA standard rating system.

To

Figure D.6 shows an example of one instance of an RRT, defined as the first rating region and carrying the MPAA standard rating system [Note that this is not the correct data for rating region 1, see EIA-766 for that data definition.]

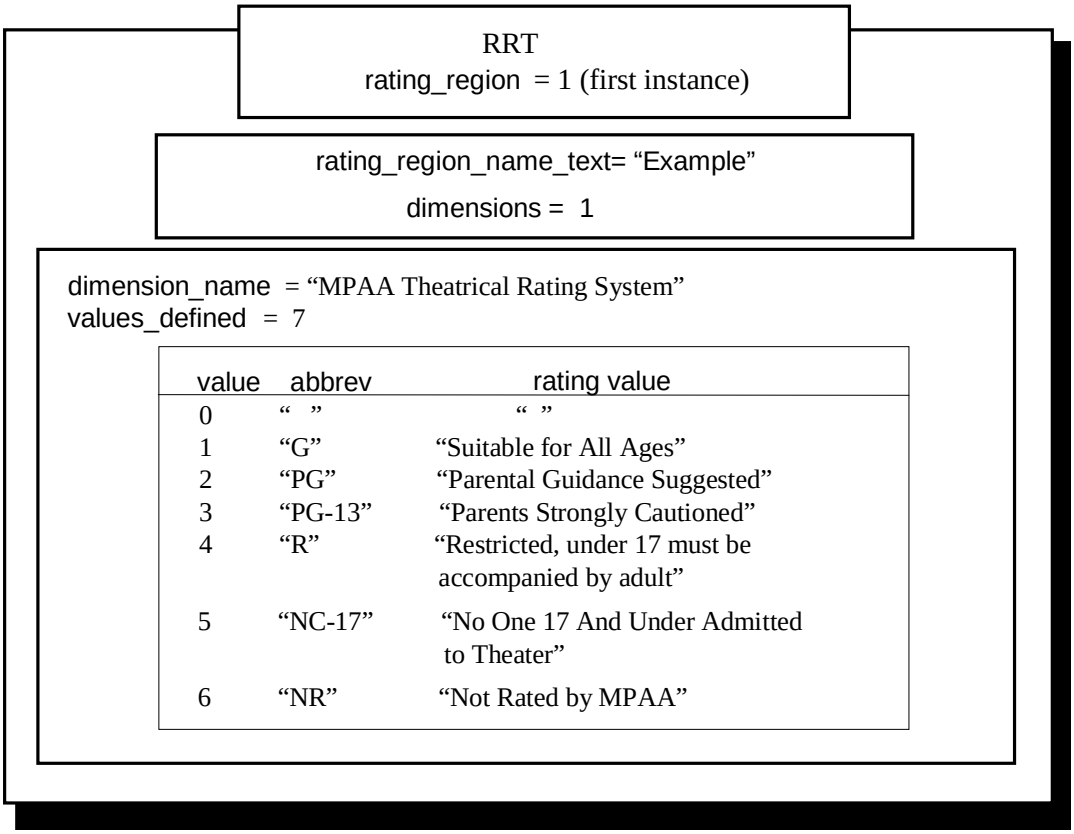
Change the rating_region_name_text in Figure D.6 from:

rating_region_name_text= “US (50 states+possesions)”

To

rating_region_name_text= “Example”.

The corrected table is shown below:



value	abbrev	rating value
0	“ ”	“ ”
1	“G”	“Suitable for All Ages”
2	“PG”	“Parental Guidance Suggested”
3	“PG-13”	“Parents Strongly Cautioned”
4	“R”	“Restricted, under 17 must be accompanied by adult”
5	“NC-17”	“No One 17 And Under Admitted to Theater”
6	“NR”	“Not Rated by MPAA”

Correct the caption for Figure D.6 to use an initial capital for “**Instance”**.

Change the entry in Figure D.6 for the abbrev for value 3 from:

“PG-14”

To:

“PG-13”

28) Annex D, Section D4

Correct the caption for Figure D.7 to use initial capitals as follows: “**Packetization and Transport of the PSIP Tables**”.

29) Annex D, Section D5

Change the Section number for D5 from "D.5" to "D5."

Change the second paragraph in section currently labeled D.5 to clarify how services are accessed. The new second paragraph shall be as follows:

"Once the VCT has been collected, a user can tune to any virtual channel present in the Transport Stream by referring to the major and minor channel numbers. Assuming that in this case, the user selects channel 5 - 11, then the process for decoding the audio and video components is shown in Fig. D.9. For terrestrial broadcast, the existence of a service location descriptor in the VCT is mandatory and therefore there is no need to access the PAT or PMT for tuning to the principal television program services. This feature has been included in PSIP to minimize the time required for changing and tuning to channels. However, PAT and PMT information is required to be present in the Transport Stream to provide MPEG-2 compliance. Access to data or other supplemental services may require access to or monitoring of the PAT or PMT. Cable systems may choose not to carry the service location descriptor, and therefore the information contained therein (minus the language code) will be found in the PMT in some cable systems."

Correct the caption of Figure D.9 to use initial capitals as follows: "**Acquisition of Audiovisual Components**".

30) Annex E

Correct the captions of Tables E.2, E.3, E.4, E.5 and E.6 to use an initial capital for the word "**Size**".

Correct the captions of Tables E.7 and E.8 to use initial capitals for the words "**Sizes**" and "**Example**".

31) Annex F

Correct the caption of Figure F.3 to use initial capitals as follows: "**Huffman Tree for Prior Symbol "x"**".

32) New Annex G

Add a new Annex as follows:

Annex G

(Informative)

AN OVERVIEW OF PSIP FOR CABLE

As described in this standard, certain data specified in the Program and System Information Protocol (PSIP) forms a mandatory part of every ATSC-compliant digital multiplex signal delivered via terrestrial broadcast. Annex D provides an overview of the use of PSIP for the terrestrial broadcast application. This Annex supplements that discussion, focusing on the use of PSIP for digital cable.

G1. INTRODUCTION

PSIP was designed, as much as possible, to be independent of the physical system used to deliver the MPEG-2 multiplex. Therefore, the System Time Table, Master Guide Table, Virtual Channel Table (VCT), and Event Information Tables and Extended Text Tables are generally applicable equally as well to cable as to terrestrial broadcast delivery methods. The differences can be summarized as follows:

- For cable, the Cable Virtual Channel Table (CVCT) provides the VCT function, while the Terrestrial Virtual Channel Table (TVCT) applies for terrestrial broadcast. The cable VCT includes two parameters not applicable to the terrestrial broadcast case, and the syntax of several parameters in the table is slightly different for cable as compared to the terrestrial broadcast case. The specifics are discussed in Section G2.
- Use of the program guide portion of PSIP (EIT and ETT) for cable is considered optional, while it is mandatory when PSIP is used for terrestrial broadcasting. Cable operators are free to *not* provide any program guide data at all if they so choose, or provide the data in a format other than PSIP if they do support an EPG.

G2. COMPARING CVCT AND TVCT

While the syntax of the Cable and Terrestrial VCTs are nearly identical, the Cable VCT has two parameters not present in the Terrestrial VCT: a "path select" bit, and a bit that can indicate that a given virtual channel is transported out-of-band (OOB). Also, the semantics of the major and minor channel number fields and the source_ID differ for the Cable VCT as compared with its terrestrial broadcast counterpart.

G2.1. Path Select

Use of the path select is required when PSIP is used in a cable network in which two separate physical cables are present. In such a case, the value of the path_select bit indicates whether the receiver should select the cable connected to its primary port ("path 1") or the secondary cable ("path 2").

G2.2. Out of Band

When a cable virtual channel is flagged as being "out of band," it is carried on an out-of-band channel at the given carrier_frequency. In general, out of band channels are delivered using different transmission formats (symbol rates, etc.) than the regular multiplexes. More than one standard format exists. A typical cable-ready digital TV or VCR will not process OOB data, unless perhaps it is in the context of an access control function such as monitoring an EMM stream.

If a receiver is implemented with a dedicated OOB tuner, it can select and process the OOB multiplex if a user chooses a virtual channel flagged as out_of_band. Receivers not capable of receiving or processing data on out-of-band carriers may use the out_of_band flag as a way to skip or ignore them.

G2.3. Major and Minor Channel Numbers

When PSIP is used for terrestrial broadcast, care must be taken in the assignment of major and minor channel numbers to avoid conflicts. For example, the PSIP standard indicates that for the US and its possessions, a terrestrial broadcaster with an existing NTSC license shall use a major channel number for digital services that corresponds to the NTSC RF channel number in present use for the analog signal. For cable, such restrictions are technically unnecessary. The use or potential re-assignment of a broadcaster's major channel number is beyond the scope of this standard. For terrestrial broadcast, the major channel number is limited to the range 1 to 99 for ATSC digital television or audio services. For cable, major channel numbers may range from 1 to 999.

For minor channel numbers, broadcasters specify that zero shall be used for NTSC analog television services, 1 to 99 for ATSC digital television or audio only services, or 1 to 999 for data services. Minor channel numbers for cable, on the other hand, have no restrictions on use: they can range from 0 to 999 for any type of service.

G2.4. Source Ids

The source_ID parameter is defined identically between cable and terrestrial broadcast VCTs, except that for the cable case, value 0x0000 indicates that the programming source is not identified. Value zero is therefore valid for cable but is reserved (not presently defined) for terrestrial broadcast.

A source ID with value zero is useful for cases where a cable operator wishes to define a channel for which no EPG data is currently available. It would also be useful to an operator who wishes not to supply EPG data at all.

G3. IN-BAND VERSUS OUT-OF-BAND SYSTEM INFORMATION

Cable operators often make use of one or more out-of-band (OOB) control channels. OOB control gives the operator nearly guaranteed access to each set-top box deployed in a cable network, because a dedicated tuner in each set-top remains tuned to the OOB channel independent of where the user might choose to tune the frequency-agile tuner while accessing

various services.

Without an OOB channel, the cable operator either wouldn't be able to supply a uninterrupted stream of control messages to each set-top, or would be forced to carry (redundantly) the same control stream on each analog and digital signal. Duplicating the control stream this way is costly and wasteful of bandwidth. Analog channels in the network pose a problem because there isn't a convenient way to add a channel for control data to each NTSC signal.

PSIP data on cable is provided in-band so that cable-ready consumer electronic equipment can receive navigation data without having to process an OOB channel. Some custom, cable system-specific receiving devices may supplement the PSIP data by making use of other data, provided that the delivery of such data does not conflict with any requirements of the PSIP specification.

G4. USING PSIP ON CABLE

PSIP data carried on cable in-band is analogous to PSIP included in the terrestrial digital broadcast multiplex: a receiver can discover the structure of digital services carried on that multiplex by collecting the current VCT from it. A cable-ready digital TV can visit each digital signal on the cable, in sequence, and record from each a portion of the full cable VCT. This is exactly the same process a terrestrial digital broadcast receiver performs to build the terrestrial channel map.

G4.1. Terrestrial Virtual Channel Maps on Cable

If a cable operator chooses to deploy digital cable boxes in a cable network, to properly support the cable terminals, that network will need to conform to the transmission and transport standards defined through the Society of Cable Telecommunications Engineers (SCTE). In some instances, however, a small cable operator may offer a cable service in which no cable boxes are required. That operator may wish to implement a low-cost headend where off-air terrestrial broadcasts are simply received and placed onto the cable, as is done with a community antenna scheme such as SMATV. In some cases, signals may be shifted in frequency before being placed on the cable (such as to move a UHF frequency down to the VHF range).

In cases such as these, a receiver may encounter a Terrestrial Virtual Channel Table when acquiring a Transport Stream from the 75Ω cable port on the receiver. Although that TS does not comply with SCTE standards for digital cable, cable-ready receivers should nonetheless be designed to handle the case where a Terrestrial VCT is found where a Cable VCT is expected.

G4.2 Frequency Specification in the Cable VCT

The Cable VCT specifies the frequency that the digital Transport Stream or analog NTSC picture carrier associated with a particular virtual channel is to be found. The frequency specified in the CVCT may be incorrect, however, and receivers should be designed to accommodate this inconsistency.

As mentioned, one way in which this can occur when a small cable system or SMATV

operator shifts the frequency of an analog or digital signal without correcting the PSIP data. Another way in which it can occur is if a cable operator takes an off-air broadcast signal and does not edit the PSIP data when it is modulated for cable.

Receiving equipment should be designed to minimize reliance on the accuracy of the frequencies quoted in the VCT. The recommended approach involves use of a digital signal's Transport Stream ID (TSID) and an analog NTSC signal's Transmission Signal ID (we call this the analog TSID). The FCC is expected to assign each broadcast station operator in the US two unique TSID values, one for analog and one for digital transmission. The digital TSID is defined by the MPEG-2 *Systems* specification, ISO/IEC 13818-1. The analog TSID is defined in EIA-752, and is simply a 16-bit signal identifier that is carried in an Extended Data Service packet according to the EIA-608 *Recommended Practice for Line-21 Data Service* standard.

Upon initial setup by an installer or consumer, a receiver should perform an automatic scan of all frequencies where analog or digital signals may be found.[1] The frequencies used for the scan correspond to standard frequency plans for off-air broadcast or cable, as appropriate. When a signal is found at a given frequency, the receiver should take note of the analog or digital TSID. Although not all analog signals are required to include TSIDs, all digital transport streams are required to carry the unique TSID.

Now, when asked to acquire a specific service, instead of using the frequency quoted by the VCT for that service, the receiver can instead use the frequency upon which it was last found. The only case in which this approach fails is if an analog TSID is not available—in such a case, the receiver must rely on the frequency quoted in the VCT.

The data in the modulation field may also be in error unless the cable system modifies it. The SCTE has standardized two modulation modes for cable television transmission of digital television. The terrestrial broadcast PSIP shall indicate ATSC 8-VSB modulation for over-the-air transmission of digital television. Any receiver that does not have access to an out-of-band data stream indicating the modulation modes of the various carriers on the network will need to be designed to acquire any of the modes that may be present. In the US, 64-QAM, 256-QAM, 8-VSB or 16-VSB modulation may be encountered.

G4.3 Service Location on Cable

The service_location_descriptor() indicates the stream types, PID and language code for each elementary stream that comprises a virtual channel. As mentioned, one of the differences between the terrestrial and cable is that the service_location_descriptor() is not required in the Cable VCT, even though its use is mandatory for the Terrestrial VCT. The difference arises from the fact that cable operators may re-multiplex digital Transport Steams that are available to them, adding or deleting services as necessary to create cable Transport Streams. A motivation for re-multiplexing is that the data rate for information on cable is typically higher than that available from terrestrial broadcast transmissions, and a cable operator may wish to construct multiplexes that make full use of the channel capacity.

For cable, the receiver or set-top box needs to learn the structure of each service via the PMT which contains the same information as the service_location_descriptor() [except for the language code]. ATSC multiplexes are MPEG-2 compliant, and the presence of the PMT is

mandatory.

A typical cable receiver or set-top box may implement a scheme where the last-used PID values for audio and video streams are stored with each VCT record. Initial acquisition of a virtual channel may be slower by as much as 400 milliseconds (the maximum interval between repetitions of the PMT) since the PMT will need to be processed to learn the PID values, but subsequent acquisitions can avoid this delay. However, one step in the acquisition process should always be to check the current PMT to verify that the PID values have not changed since the last acquisition of the service. If they have changed, the new values replace the old.

G4.4 Analog Channel Sharing

Some cable operators time-share certain 6-MHz slots between two analog television services, switching from one to the other on a daily schedule. If PSIP were to be used (out of band) to describe such a shared analog channel, two approaches are possible:

1. Define the channel as a single entity, using one source ID. The channel name may be a combination of the two service names, such as "WXYZ/USTV" for example. Or it could be a neutral name such as "Combo." Since the channel is defined as a single entity in PSIP, it appears as one horizontal grid line on the EPG display.
2. Define the channel using two source IDs, one for the first source and another for the second. Using PSIP it would be possible to assign each source a separate channel name. Both would be assigned the same channel number and frequency, corresponding to the channel's EIA RF 6-MHz band on the cable. Use of the RF channel number is necessary for consistency between DTV receivers using PSIP and analog receivers that tune and number using the conventional analog method. On the EPG grid, each of the services are expected to show "Off the air" (or equivalent) during the part of the broadcast day when the transmission channel is being used for the other source.

The second case represents an unusual situation for the DTV, in that two services share the exact same channel number. If the user selects such a doubly-defined channel by direct entry of the number, the frequency is unambiguous so the DTV can tune straightforwardly. If the DTV would wish to display the proper channel name or program name, it must rely on the analog TSID to properly identify the received signal.

In both of these cases, it is the responsibility of the cable headend to perform source switching as necessary to create the composite channel.

G5. RE-MULTIPLEXING ISSUES

As mentioned, a cable operator may wish to take incoming digital Transport Streams from various sources (terrestrial broadcast, satellite, or locally generated), add or delete services or elementary streams, and then re-combine them into output Transport Streams. If the incoming Transport Streams carry PSIP data, care must be taken to properly process this data in the re-multiplexer.

Specifically, the re-multiplexer needs to account for any MPEG or PSIP fields or variables that are scoped to be unique within the Transport Stream. Such fields include PID values, MPEG

program_numbers, source_ID tags that are in the range 0x0001 through 0x0FFF and event_ID fields.

Other PSI and PSIP-related tasks that need to be performed include:

- Construct an output Virtual Channel Table represents the virtual channels that will be included in the resulting Transport Stream.
- Combine EIT and ETT data from the various sources and remove data for any deleted services. (Rules for deleting services are beyond the scope of this standard.)
- The output Rating Region Table includes all regions that the cable operator is either required to support or chooses to support.
- Rebuild the Master Guide Table to represent the resulting PSIP tables.
- The service_location_descriptors present in incoming Terrestrial Virtual Channel Tables may be deleted, and if so should be reconstructed to identify all the services in the Cable Virtual Channel Table for a new transport stream.
- Edit the MPEG-2 Program Map Table to accurately reflect the Transport Stream PID values for all elementary streams in each service.

The special case of remultiplexing without adding or dropping content in the transport stream does not require PSIP modification, although some modification could reduce frequency information inconsistencies.

G6. THE TRANSITION TO PSIP ON CABLE

The first digital cable boxes to employ MPEG-2 transport and video coding were deployed in North America beginning in 1996. This PSIP standard was developed and approved by the ATSC in 1997. In 1998, the use of PSIP on cable was balloted and approved by the Digital Video Subcommittee of SCTE.

Cable systems supporting the first digital cable terminals provide an out-of-band control channel for system control and addressing of these boxes. System Information in accordance with ATSC A/56 *System Information for Digital Television*, as extended by the SCTE DVS-011 *Cable and Satellite Extensions to ATSC System Information Standard* provides navigational information such as the cable frequency plan in use, the channel line-up, and channel names and numbers. The A/56 standard used the same virtual channel map approach that PSIP uses.

Cable operators wishing to support cable-ready CE equipment in their network would need to begin sending PSIP data in-band for each digital transport multiplex. PSIP support involves supplying transport stream packets with PID value 0x1FFB. Legacy digital terminals are unaffected by the presence of these new packets, because they have no reason to process data from PID 0x1FFB. Both the PSIP and the A/56 SI data can co-exist in the same system with neither affecting the other.

G7. DATA RATES FOR PSIP ON CABLE

The typical sizes of PSIP data in the cable application are computed here. Since the structure of the PSIP tables is unchanged from the terrestrial application, the analysis of table

sizes found in Annex E of the PSIP standard applies equally well to cable. On cable, the service_location_descriptor() is optional, however, so the CVCT data size may be reduced by (23 * Cd) where Cd represents the number of digital services in the multiplex.

If the CVCT is repeated at a rate of 2.5 repetitions per second, and we say that there are 10 digital channels and one reference to an analog channel, the total data rate for each instance of the CVCT is:

R_{CVCT} = (size of CVCT in bytes) * (8 bits/byte) * (table repetition rate) =

= (16+52*11) * 8 * 2.5 = 11,760 bps

If the MGT is repeated at a rate of one repetition each 150 milliseconds, and it includes references to EIT-0 through –3, the data rate for the MGT is:

R_{MGT} = (size of MGT in bytes) * (8 bits/byte) * (table repetition rate) =

= 138 *8 * 1 / .15 = 7360 bps

An adjustment needs to be made to account for the fact that the MGT must be placed into the transport multiplex such that the first byte of the table (the table_ID) aligns with the first byte of the packet payload. If we assume that, on average, half of the prior packet's payload (for the base_PID) will be padded to create this alignment, the data rate for the padding is:

R_{PAD} = (number of pad bytes) * (8 bits/byte) * (MGT repetition rate) =

= 92 *8 * 1 / .15 = 4907 bps

If the RRT is repeated at a rate of one repetition per minute, assuming one region with nine dimensions and an average of four levels per dimension, the data rate is:

R_{RRT} = (size of RRT in bytes) * (8 bits/byte) * (table repetition rate) =

= (37+9*(14+26*4)) * 8 * 1/60 = 1099 * 8 / 60 = 147 bps

If the STT is repeated at a rate of once per second the data rate is:

R_{STT} = 20 * 8 = 160 bps

So, the total data rate for tables required for the cable application is:

$R_{TOTAL} = R_{CVCT} + R_{MGT} + R_{PAD} + R_{RRT} + R_{STT}$

= 11,760 + 7360 + 4907 + 147 + 160 = 19.427 kbps $\cong$ 25 kbps

The analysis can be extended to include the case that EIT/ETT is present in the multiplex as well.

[1]It is strongly recommended that such a scan is done also when the receiver is in the "off" state to refresh VCT and program guide data