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AV/C Tuner Broadcast System Specification - ATSC Digital Television System (DTV)

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Abstract:

This specification defines the detailed specifications for Digital Television System (DTV) data structures which are used by an AV/C tuner subunit which supports DTV. The AV/C tuner defines a model and command set for analog and digital tuners operating over IEEE 1394-1995. The command set makes use of the Function Control Protocol (FCP) defined by IEC 61883, Digital Interface for Consumer Electric Audio/Video Equipment standard, for the transport of audio/video command requests and responses. The audio/video devices are implemented as a common unit architecture within 1394-1995.

Keywords:

1394, AV/C, Tuner, ATSC, DTV.

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Table of Contents

1. Overview	6
1.1 Purpose	6
1.2 Scope	6
2. References	7
3. Definitions	8
3.1 Conformance Levels	8
3.2 Glossary of Terms	8
3.3 Acronyms and Abbreviations	8
4. ATSC DTV Broadcast System Specific Fields	9
4.1 DTV Text Field Encoding	9
4.2 DTV <i>system_id</i>	9
4.3 DTV <i>implementation_profile_id</i> Assignments	9
4.4 DTV <i>SID:selection_attribute_range_specification</i>	9
4.5 DTV <i>SID:system_specific_information</i>	9
4.6 DTV Tuner Status Descriptor - <i>antenna_general_system_info</i>	10
4.7 DTV Tuner Status Descriptor - <i>demux_general_system_info</i>	10
4.8 DTV Multiplex Selection and Information Fields	10
4.9 DTV Service Selection and Information Fields	11
4.10 DTV Component Selection and Information Fields	12
4.11 DTV Object ID Size and Assignment Rules	13
4.12 DTV DSIT command <i>system_specific_search_flag</i>	14
4.13 DTV DIRECT SELECT DATA <i>dsd_selection_specification</i>	15
4.14 DTV TUNER STATUS notify command <i>system_specific_event</i>	15
5. ATSC DTV <i>implementation_profile_id</i>	16
5.1 <i>implementation_profile_id</i> 10 ₁₆	16
5.1.1 Supported Descriptors	16
5.1.2 Supported AV/C Commands	16
5.2 <i>implementation_profile_id</i> 30 ₁₆	17
5.2.1 Supported Descriptors	17
5.2.2 Supported AV/C Commands	18

List of Figures

Figure 4.1 – DTV *system_specific_information* field.....9
Figure 4.2 – DTV *system_specific_multiplex_selection* Field.....10
Figure 4.3 – DTV *system_specific_multiplex_information* Field10
Figure 4.4 – DTV *system_specific_service_selection* Field11
Figure 4.5 – DTV *system_specific_service_information* Field.....11
Figure 4.6 – DTV *system_specific_component_selection* Field12
Figure 4.7 – DTV *system_specific_component_information* Field.....12
Figure 4.8 – DSIT Search Flags.....14
Figure 4.9 – *dsd_selection_specification*.....15

List of Tables

Table 4.1 – <i>specification_version</i> values.....	9
Table 4.2 – DTV Object ID Assignment Rules.....	13
Table 4.3 – Preferred DTV Object ID Assignments.....	14
Table 5.1 – DTV <i>implementation_profile_id</i>	16
Table 5.2 – General AV/C Command Support Level - Simplest	17
Table 5.3 – AV/C Tuner Command Support Level - Simplest	17
Table 5.4 – General AV/C Command Support Level – Service Level.....	18
Table 5.5 – AV/C Tuner Command Support Level – Service Level.....	18

1. Overview

1.1 Purpose

Advanced Television System Committee (ATSC) Digital Television System (DTV) is one of the broadcast systems supported by AV/C Tuner Subunit.

This document defines the AV/C Tuner broadcast system specific information of the ATSC DTV, that implements the AV/C Descriptor Mechanism as described in references [R3] and [R4], and the AV/C Tuner Descriptor Mechanism described in reference [R5] and [R6].

1.2 Scope

This document defines the AV/C Tuner broadcast system specific information of the ATSC DTV. The definitions of general fields of the AV/C Tuner Subunit can be found in references [R3], [R4], [R5], and [R6].

2. References

The following standards contain provisions, which through reference in this document, constitute provisions of this standard. All the standards listed are normative references. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

- [R1] IEEE Std 1394-1995, Standard for a High Performance Serial Bus.
- [R2] IEC 61883-1, Consumer audio/video equipment – Digital interface – Part 1: General.
- [R3] AV/C Digital Interface Command Set General Specification, Version 3.0. TA document number 1998003.
- [R4] Enhancement to the AV/C General Specification 3.0, Version 1.0. TA document number 1998010.
- [R5] AV/C Tuner Model and command Set, Version 1.0. TA document number 1998004.
- [R6] AV/C Tuner Model and command Set, Version 2.0. TA document number 1999035.
- [R7] ATSC A/65: Program and System Information Protocol for Terrestrial Broadcast and Cable.
- [R8] ISO/IEC 13818-1:1996(E), Information Technology - Generic Coding of Moving Pictures and Associated Audio Information: Systems
- [R9] ISO 639:1988, Code for the representation of names of languages
- [R10] ISO 639-2:1998, Codes for the representation of names of languages – Part2: Alpha-3 code

3. Definitions

3.1 Conformance Levels

3.1.1 expected: A key word used to describe the behavior of the hardware or software in the design models *assumed* by this Specification. Other hardware and software design models may also be implemented.

3.1.2 may: A key word that indicates flexibility of choice with *no implied preference*.

3.1.3 shall: A key word indicating a mandatory requirement. Designers are *required* to implement all such mandatory requirements.

3.1.4 should: A key word indicating flexibility of choice with a strongly preferred alternative. Equivalent to the phrase *is recommended*.

3.1.5 reserved fields: A set of bits within a data structure that are defined in this specification as reserved, and are not otherwise used. Implementations of this specification shall zero these fields. Future revisions of this specification, however, may define their usage.

3.1.6 reserved values: A set of values for a field that are defined in this specification as reserved, and are not otherwise used. Implementations of this specification shall not generate these values for the field. Future revisions of this specification, however, may define their usage.

The IEEE is investigating whether the “may, shall, should” and possibly “expected” terms will be formally defined by IEEE. If and when this occurs, draft editors should obtain their conformance definitions from the latest IEEE style document.

3.2 Glossary of Terms

3.2.1 byte: Eight bits of data, used as a synonym for octet.

3.2.2 CSR Architecture: A convenient abbreviation of the following reference (see clause 2): ISO/IEC 13213 : 1994 [ANSI/IEEE Std 1212, 1994 Edition], Information Technology—Microprocessor systems—Control and Status Register (CSR) Architecture for Microcomputer Buses.

3.2.3 quadlet: Four bytes of data.

3.3 Acronyms and Abbreviations

AV/C Audio Video Control

ATSC Advanced Television System Committee

DTV Digital Television

SID Subunit Identifier Descriptor

4. ATSC DTV Broadcast System Specific Fields

4.1 DTV Text Field Encoding

ATSC DTV uses ISO/IEC 10646-1 character code in its text fields, with English as the default. Regional variations allow the manufacturer to set the default to other languages, such as French, German, or Spanish, etc.

4.2 DTV *system_id*

The *system_id* field for a DTV tuner subunit shall be set to 22₁₆.

4.3 DTV *implementation_profile_id* Assignments

The *implementation_profile_id* assignments are described in details in Section 5.

4.4 DTV SID:*selection_attribute_range_specification*

Currently, there is no *selection_attribute_range_specification* defined for the DTV tuner subunit identifier descriptor.

4.5 DTV SID:*system_specific_information*

The *system_specific_information* field of the DTV Tuner Subunit Identifier Descriptor is specified in the following figure:

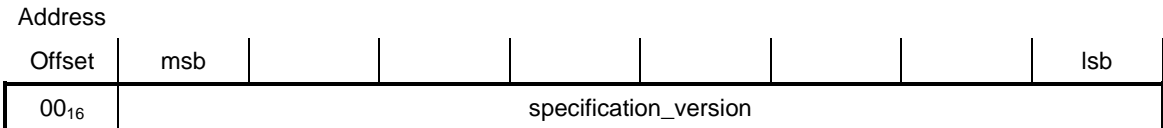


Figure 4.1 – DTV *system_specific_information* field

The *specification_version* currently has the following values defined:

Table 4.1 – *specification_version* values

value	meaning
10 ₁₆	Implementation conforms to the AV/C Tuner Broadcast System – ATSC DTV, version 1.0 specification
all others	reserved for future specifications

If the *specification_version* field does not exist (indicated by *system_specific_information_length* = 0), the controller shall assume the implementation conforms to version 1.0.

4.6 DTV Tuner Status Descriptor - *antenna_general_system_info*

Currently, there is no *antenna_general_system_info* defined for the DTV tuner subunit identifier descriptor.

4.7 DTV Tuner Status Descriptor - *demux_general_system_info*

Currently, there is no *demux_general_system_info* specified for the DTV tuner subunit.

4.8 DTV Multiplex Selection and Information Fields

The DTV *system_specific_multiplex_selection* field is specified in the following figure, with the mandatory attributes in **BOLD**:

Address								
Offset	msb							lsb
system_specific_multiplex_attributes_valid_flags								
02 ₁₆	reserved_fields	transport_stream_id	0	0	0	0	0	0
03 ₁₆	0	0	0	0	0	0	0	0
system_specific_multiplex_selection_attributes								
04 ₁₆	currently_available	selected	reserved					
05 ₁₆	transport_stream_id							
06 ₁₆	transport_stream_id							

Figure 4.2 – DTV *system_specific_multiplex_selection* Field

The *transport_stream_id* field contains the 16-bit identifier of the MPEG2 transport stream that is currently broadcasting the Multiplex. It is unique within the DTV broadcast system and is used to identify the television station and its associated information, such as frequency, etc. For details of the *transport_stream_id*, please refer to reference [R7].

All other fields are defined in reference [R6].

Currently, no information attributes of the DTV *system_specific_multiplex_information* field are defined, as shown in the following figure:

Address								
Offset	msb							lsb
system_specific_multiplex_information_attributes								
<< no information attributes are defined >>								

Figure 4.3 – DTV *system_specific_multiplex_information* Field

4.9 DTV Service Selection and Information Fields

The DTV *system_specific_service_selection* field is specified in the following figure, with the mandatory attributes in **BOLD**:

Address							
Offset	msb						lsb
system_specific_service_attributes_valid_flags							
01 ₁₆	reserved_fields	CA_output	channel_number	service_name	reserved		
system_specific_service_selection_attributes							
02 ₁₆	currently_available	reserved					
03 ₁₆	CA_output	reserved					
04 ₁₆	major_channel_number						
05 ₁₆							
06 ₁₆	minor_channel_number						
07 ₁₆							

Figure 4.4 – DTV *system_specific_service_selection* Field

The *CA_output* field indicates whether this Service is currently being output to the source plug as a scrambled (= 1) or not scrambled signal (= 0). **THIS FIELD IS VALID ONLY FOR SELECTION PURPOSES.** This field is only a placeholder in the descriptor structure, and shall be ignored when reading the descriptor.

The *major_channel_number* and *minor_channel_number* fields uniquely identify a Service within the network. For details of the channel numbers, please refer to reference [R7].

All other fields are defined in reference [R6].

The DTV *system_specific_service_information* field is specified in the following figure:

Address							
Offset	msb						Lsb
system_specific_service_information_attributes							
08 ₁₆	service_name_length						
09 ₁₆	service_name						
:							

Figure 4.5 – DTV *system_specific_service_information* Field

The *service_name_length* field indicates the number of bytes used for the following *service_name* field.

The *service_name* field contains the text of the Service name as it is derived from the air. If the name cannot be derived from the air, then the tuner shall set the *service_name_length* field to zero and there shall be no *service_name* field.

4.10 DTV Component Selection and Information Fields

The DTV *system_specific_component_selection* field is specified in the following figure, with the mandatory attributes in **BOLD**:

Address							
Offset	msb						lsb
system_specific_component_attributes_valid_flags							
01 ₁₆	reserved_fields	PID	stream_type	iso_639_language_code	component_name	reserved	
system_specific_component_selection_attributes							
02 ₁₆	currently_available	reserved					
03 ₁₆	PID						
04 ₁₆							

Figure 4.6 – DTV *system_specific_component_selection* Field

The *PID* (Packet ID) field indicates the PID value for this Component and is unique within the Multiplex.

All other fields are defined in reference [R6].

The DTV *system_specific_component_information* field is specified in the following figure:

Address							
Offset	msb						lsb
system_specific_component_information_attributes							
05 ₁₆	stream_type						
06 ₁₆	iso_639_language_code						
07 ₁₆							
08 ₁₆							
09 ₁₆	component_name_length						
0A ₁₆	component_name						
:							
:							

Figure 4.7 – DTV *system_specific_component_information* Field

The *stream_type* field specifies the type of stream (video, audio, EBU_data, etc.) as defined in reference [R7]. In addition, many of the stream types are also defined in reference [R8].

The *iso_639_language_code* field identifies the language associated with this Component. Some Components are language dependent, such as Audio or Text. Some Components, such as Video, have nothing to do with the language. In cases that the language of the Component is not available or the Component is not language dependent, the *iso_639_lang_code* flag in the *system_specific_component_attributes_valid_flags* field shall be set to 0, indicating the

iso_639_language_code field is not valid. The 3-byte values of language codes are defined in references [R9] and [R10].

The *component_name_length* field specifies the number of bytes used for the following *component_name* field.

The *component_name* field contains text of the Component name, if it is available from the air. If it is not available, then the length field shall be zero and there shall be no *component_name* field.

4.11 DTV Object ID Size and Assignment Rules

The size of object IDs for the Tuner Subunit is declared in the *size_of_object_ID* field of the Tuner Subunit Identifier Descriptor.

When the tuner subunit creates DTV objects (Multiplex, Service, and Component), it shall follow these rules for assigning object ID's:

Table 4.2 – DTV Object ID Assignment Rules

	msb						lsb
object entry type	object ID assignment rule						
multiplex							
	<< implementation dependent >>						
	(must be 6 bytes in length)						
service	transport_stream_id (MSB)						
	transport_stream_id (LSB)						
	major_channel_number (MSB)						
	major_channel_number (LSB)						
	minor_channel_number (MSB)						
	minor_channel_number (LSB)						
component							
	<< implementation dependent >>						
	(must be 6 bytes in length)						

The format of the *Multiplex* and *Component* object ID values for DTV will depend on the tuner subunit implementation.

The format of the *Service* object ID values for all DTV tuners shall be specified as above.

The following table lists one of the preferred assignments of DTV object IDs:

Table 4.3 – Preferred DTV Object ID Assignments

	msb							lsb
object entry type	object ID assignment rule							
multiplex	transport_stream_id (MSB)							
	transport_stream_id (LSB)							
	0							
	0							
	0							
	0							
service	transport_stream_id (MSB)							
	transport_stream_id (LSB)							
	major_channel_number (MSB)							
	major_channel_number (LSB)							
	minor_channel_number (MSB)							
	minor_channel_number (LSB)							
component	transport_stream_id (MSB)							
	transport_stream_id (LSB)							
	0							
	0							
	PID							
	PID							

4.12 DTV DSIT command *system_specific_search_flag*

The *system_specific_search_flag* used in the DSIT control command for a DTV selection are defined as follows:

address								
offset	msb							lsb
00 ₁₆	0	channel_ number_ up	channel_ number_ down	0	0	0	0	0

Figure 4.8 – DSIT Search Flags

The *channel_number_up* and *channel_number_down* search flags allow a controller to initiate a search of the next channel, based on the current channel number selection in the DSIT command, in either the up or down direction.

4.13 DTV DIRECT SELECT DATA *dsd_selection_specification*

The DTV *dsd_selection_specification* field is defined as follows:

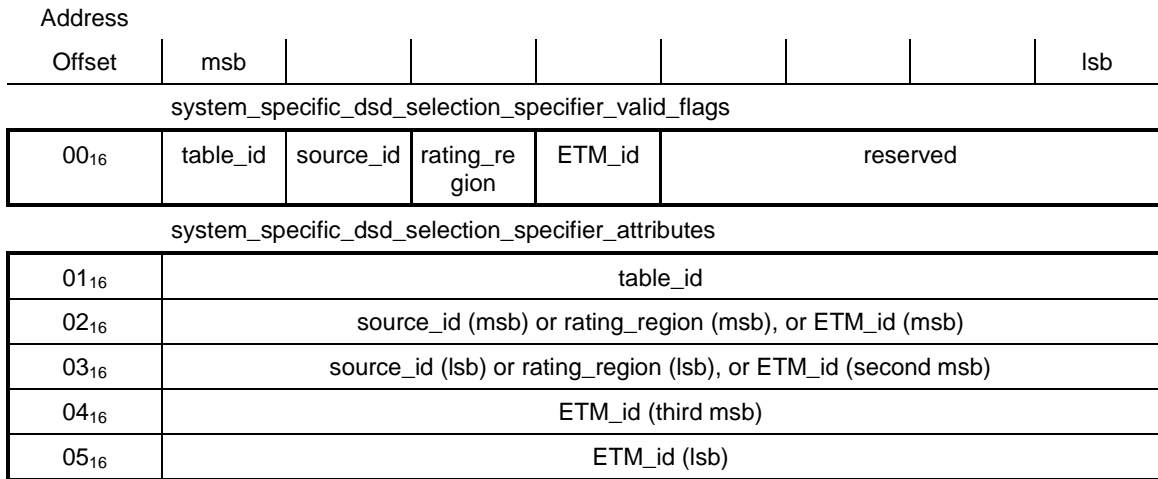


Figure 4.9 – *dsd_selection_specification*

The *table_id*, *source_id*, *rating_region*, and *ETM_id* fields are defined in reference [R7].

To select the Master Guide Table (MGT), the Terrestrial Virtual Channel Table (TVCT), the Cable Virtual Channel Table (CVCT), or the System Time Table (STT), specify the *table_id*.

To select the Rating Region Table (RRT), specify the *table_id* and *rating_region*.

To select the Event Information Table (EIT), specify the *table_id* and *source_id*.

To select the Extended Text Table (ETT), specify the *table_id* and *ETM_id*.

4.14 DTV TUNER STATUS notify command *system_specific_event*

Currently, there is no *system_specific_event* defined for the DTV tuner subunit.

5. ATSC DTV implementation_profile_id

The following table lists the currently defined DTV *implementation_profile_id* values:

Table 5.1 – DTV implementation_profile_id

value	Functional Support Level	comments
10 ₁₆	Minimum	Simplest implementation, least support
30 ₁₆	Medium	Medium support

5.1 implementation_profile_id 10₁₆

This profile defines the simplest AV/C tuner that supports no list descriptors or entry descriptors.

The *implementation_profile_id* in the *subunit_dependent_information* field of the Tuner Subunit Identifier Descriptor shall be 10₁₆ when using this profile.

The controller is required to have system-specific knowledge of the physical parameters of the tuner. It must have this knowledge from elsewhere, as the tuner does not provide this information.

Selection is performed using the DIRECT SELECT INFORMATION TYPE command. Selection of the Service is required. Selection of the Multiplex or the Component is optional.

5.1.1 Supported Descriptors

The tuner must maintain the tuner Subunit Identifier Descriptor and the tuner Status Descriptor.

5.1.2 Supported AV/C Commands

AV/C commands are categorized into AV/C General Commands and AV/C Tuner Commands.

AV/C General Commands are described in reference [R3] and [R4]

AV/C Tuner Commands are described in reference [R5] and [R6].

5.1.2.1 AV/C General Commands

The following table shows which of the optional general AV/C commands are required for this profile.

A “M” means that the command is required for this profile, an “O” means that the command is not required for this profile, a “-” means that the command is not applicable according to the AV/C specification.

Table 5.2 – General AV/C Command Support Level - Simplest

Command	Support Level			Comments
	Control	Status	Notify	
OPEN DESCRIPTOR	M	M	O	1, 2
READ DESCRIPTOR	M	-	-	
SEARCH DESCRIPTOR	O	-	-	
WRITE DESCRIPTOR	O	O	-	
OBJECT NUMBER SELECT	O	O	O	

¹ Only subfunctions *open_read* and *close* are required.

² Only support the accesses to Subunit Identifier Descriptor and Status Descriptor.

5.1.2.2 AV/C Tuner Commands

The following table shows the AV/C Tuner Commands required for this profile.

Table 5.3 – AV/C Tuner Command Support Level - Simplest

Command	Support Level			Comments
	Control	Status	Notify	
DIRECT SELECT INFORMATION TYPE	M	-	-	
DIRECT SELECT DATA	O	-	-	
CA ENABLE	O	O	O	
TUNER STATUS	-	-	O	

5.2 implementation_profile_id 30₁₆

This profile defines the medium AV/C tuner that supports some list descriptors or entry descriptors.

The *implementation_profile_id* in the *subunit_dependent_information* field of the Tuner Subunit Identifier Descriptor shall be 30₁₆ when using this profile.

The controller is thus not required to have system-specific knowledge of the physical parameters of the tuner.

Selection is performed using the DIRECT SELECT INFORMATION TYPE command and the OBJECT NUMBER SELECT command.

5.2.1 Supported Descriptors

The tuner must maintain the tuner Subunit Identifier Descriptor and tuner Status Descriptor.

In addition, the tuner subunit must maintain a Multiplex List for this system, as defined in the tuner Subunit Identifier Descriptor. The Multiplex Entry Descriptor has as its children a Service List Descriptor for each Multiplex Entry Descriptor. The Component List is optional.

5.2.2 Supported AV/C Commands

AV/C commands are categorized into AV/C General Commands and AV/C Tuner Commands.

5.2.2.1 AV/C General Commands

The following table shows which of the optional AV/C General commands are required for this profile.

A “M” means that the command is required for this profile, an “O” means that the command is not required for this profile, a “-” means that the command is not applicable according to the AV/C specification.

Table 5.4 – General AV/C Command Support Level – Service Level

Command	Support Level			Comments
	Control	Status	Notify	
OPEN DESCRIPTOR	M	M	O	1, 2
READ DESCRIPTOR	M	-	-	
SEARCH DESCRIPTOR	O	-	-	
WRITE DESCRIPTOR	O	O	-	
OBJECT NUMBER SELECT	M	M	O	3, 4

¹ Only the subfunctions *open_read* and *close* are required.

² Access is supported only to complete descriptors or object lists, i.e. only descriptor_type 00₁₆, 10₁₆, 11₁₆ and 80₁₆ are supported in the descriptor_identifier.

³ The ONS command must use the “Don’t Care” ons_selection_specification (target_depth = FF₁₆).

⁴ The list_type field in the path_specifier of the ONS command always refers to a Service list.

5.2.2.2 AV/C Tuner Commands

The following table shows the AV/C Tuner commands required for this profile.

Table 5.5 – AV/C Tuner Command Support Level – Service Level

Command	Support Level			Comments
	Control	Status	Notify	
DIRECT SELECT INFORMATION TYPE	M	-	-	
DIRECT SELECT DATA	O	-	-	
CA ENABLE	O	O	O	
TUNER STATUS	-	-	O	