



AV/C Tuner Broadcast System Specification - Analog Audio

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Abstract: This specification defines the detailed specifications for Analog Audio Broadcast data structures which are used by an AV/C tuner subunit which supports analog audio broadcast systems. 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: Audio, Video, 1394, Digital, Interface, Tuner, analog audio

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1. Normative References

The following documents may be useful to the reader interested in learning about the full AV/C protocol and related technologies. All standards are subject to revision; the reader is encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

This document is designed to be used in conjunction with the General AV/C and AV/C Tuner Subunit documents referenced below.

1.1 Contact Information

The documents referenced herein may be obtained from the following organizations:

1.1.1 1394 Trade Association (1394 TA)

The 1394 Trade Association can be contacted via the references provided on the cover page of this and all AV/C specification documents.

1.1.2 Association of Radio Industries and Business (ARIB)

Nittochi Bld. 14F 1-4-1 Kasumigaseki Chiyoda-ku Tokyo
100-0013 Japan

Phone: +81-3-5510-8590

Fax: +81-3-3592-1103

1.1.3 Advanced Television Systems Committee (ATSC)

Documents from the ATSC can be located on the following WWW site:

<http://www.atsc.org>

1.1.4 European Telecommunications Standards Institute (ETSI)

ETSI Secretariat

Postal Address: F-06921 Sophia Antipolis Cedex - FRANCE

Office Address: 650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE

Phone: +33-4-92-94-42-00

Fax: +33-4-93-65-47-16

Internet: secretariat@etsi.fr

<http://www.etsi.fr>

1.1.5 International Electrotechnical Commission (IEC) (contact in the United States)

U.S. National Committee of the IEC ANSI

11, West 42nd Street, 13th floor

New York, NY 10036

Phone: +1-212-642-4900
+1-212-642-4980 (sales)
Fax: +1-212-398-0023
Internet: <http://www.ansi.org>

Documents can be ordered from:

<http://www.iec.ch/cs1ord-e.htm>
<http://www.iec.ch/cs1oi-e.htm>

1.1.6 The Institute of Electrical and Electronics Engineers, Inc. (IEEE)

The IEEE can be contacted via their WWW home page: <http://www.ieee.org>

1.1.7 International Telecommunication Union (ITU)

The ITU can be contacted via their WWW home page:<http://www.itu.int>

1.2 1394 Trade Association Specifications

AV/C Master Index: Guide to AV/C Specification Documents - this document is available on the 1394 Trade Association web site noted above, and is kept up to date with the latest released versions of AV/C specifications. The reader is encouraged to always consult this document for information on the latest versions of specifications mentioned here, as well as specifications which may be developed in the future.

AV/C Digital Interface Command Set General Specification Version 3.0

AV/C Digital Interface Command Set General Specification Version 2.0.1

AV/C Tuner Model Specification Version 1.0

AV/C Tuner Model Working Specification Version 1.0W

1.3 Related Technical Specifications

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

ISO/IEC 13213:1994, *Control and Status Register (CSR) Architecture for Microcomputer Buses*

EN300 468 V1.3.1 (1997-09), *Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB Systems*

2. Introduction

This document defines the Analog Audio system specification for AV/C Tuner subunits. This document is used in conjunction with the AV/C Tuner Model and Command Set specification noted in the references.

2.1 Rules for Reserved Fields

This section clarifies the rules which have always been in effect regarding how reserved fields shall be treated in command parameters and data structures for AV/C.

Unless otherwise specified (see note below), command parameters and data structure fields marked as “reserved” or “reserved for future specification” shall be set to zero by controllers on input to a target, and by targets on output to controllers.

For input operands of commands, targets shall NOT ignore fields that were reserved when the target was implemented. Rather, the target shall examine the reserved fields; if any of them are specified, then the target shall reject the command with a NOT IMPLEMENTED response.

On output data structures or parameters of commands, controllers shall ignore fields that were reserved when the controller was implemented. These rules exist to allow future extension of the specification while retaining compatibility with existing products.

NOTE: In some instances, reserved command operands or data structure fields may be specified as non-zero values. These cases will be clearly indicated in the specification. Controllers and targets shall deal with them in the same manner as defined above.

3. General Broadcast System Specifications

This section contains a review of the general structures used by all tuner subunits to represent broadcast objects - multiplex, service, component.

3.1 Text Field Encoding

The format of all text fields in the various read-only broadcast system descriptors which are maintained by the tuner subunit shall be defined according to the particular broadcast system being represented. The exception is for regional variations which are based on a given broadcast system. For example, the Japanese digital broadcast system is based on the European DVB system, but the Japanese system specifies two-byte character codes which are not in the European DVB specification. The appropriate references are provided.

3.2 Multiplex Descriptors

For convenience when reading all of the system-specific structures below, the basic format of the tuner subunit multiplex descriptor is presented here. The multiplex descriptors for each broadcast system will share this same format:

address offset	msb	lsb
00 ₁₆	system_id	
01 ₁₆	input	antenna_number
system_specific_multiplex_attributes_valid_flags		
02 ₁₆	system_specific_multiplex_attributes_valid_flags	
:		
system_specific_multiplex_selection_attributes		
:	currently_available	selected reserved
:	broadcast_system_specific_multiplex_selection_attributes	
:		
:	reserved_field_length (if specified by <i>reserved_field</i> bit of multiplex attributes valid flags)	
:	reserved_field (if specified by <i>reserved_field</i> bit of multiplex attributes valid flags)	
system_specific_multiplex_information_attributes		
:	system_specific_multiplex_information_attributes	
:		
:	reserved_field_length (if specified by <i>reserved_field</i> bit of multiplex attributes valid flags)	
:	reserved_field (if specified by <i>reserved_field</i> bit of multiplex attributes valid flags)	

The *system_id* field identifies the type of system (e.g. DVB, analog video) described by this tuner object. The values are defined in the table of *system_id* values presented in the AV/C Tuner Model and Command Set specification.

The *system_id* for an analog audio tuner shall be 11₁₆.

All *reserved* fields shall be treated as specified in Rules for Reserved Fields on page 6.

The *input* field indicates which input, either the antenna or demux destination plug, the subunit should use to get the requested service(s). The following table illustrates the values defined for this field:

Value for input	Meaning
0	Take input from the antenna destination plug.
1	Take input from the demux destination plug.

The *antenna_number* field is the index of an antenna specifier for the subunit, as described in the subunit identifier descriptor data structure. This is a zero-based value. If the demux destination plug is selected, then the *antenna_number* field has no meaning in the object descriptor and the selection specifier (when used for making a selection).

The *system_specific_multiplex_attributes_valid_flags* are defined per system, and indicate the validity of the entries in both of the following fields (selection and information attributes). They are detailed in the sections that follow.

While the *system_specific_multiplex_attributes_valid_flags* are defined per *system_id*, all system definitions share one common flag as shown here:

flags	meaning
1xxx xxxx (MSB)	The most significant bit of the multiplex attributes valid flags indicates whether the reserved fields are present or not. When this flag is 1, then the fields exist in both the selection and information attributes fields. If the flag is 0, then they do not exist.
xxxx xxxx (LSB)	All other flags are defined per <i>system_id</i> .

The *selected* flag indicates whether this multiplex is currently selected or not. The value 1 means it is selected. When a selection is being performed, the *selected* flag will be ignored.

The *currently_available* flag indicates whether this multiplex is actually available at this time. In some situations it is possible that the multiplex (or a certain part of it, such as a service) may not be available even though it is selected. If this bit is set to 1, then it is available. When a selection is being performed, the *currently_available* flag will be ignored.

The *broadcast_system_specific_multiplex_selection_attributes* field will contain the various attributes that specify a multiplex in the given *system_id*. These attributes are used for selection purposes. If the input is via the demux destination plug of the tuner subunit, then this field shall be empty.

The *system_specific_multiplex_information_attributes* field will contain the various attributes that provide useful information about a multiplex in the given *system_id*. These attributes are NOT used for selection purposes.

The *reserved_field_length* and *reserved_field* fields only exist in the structure if defined by the valid flag described above.

3.3 Service Descriptors

The service descriptors for each broadcast system will also share a common format, but this format is slightly different from that of the multiplex descriptor:

address offset	msb						lsb
00 ₁₆	system_id						
system_specific_service_attributes_valid_flags							
01 ₁₆	system_specific_service_attributes_valid_flags						
:							
system_specific_service_selection_attributes							
:	currently_available	reserved					
:							
:	broadcast_system_specific_service_selection_attributes						
:							
:	reserved_field_length (if specified by <i>reserved_field</i> bit of service attributes valid flags)						
:	reserved_field (if specified by <i>reserved_field</i> bit of service attributes valid flags)						
:							
system_specific_service_information_attributes							
:	system_specific_service_information_attributes						
:							
:	reserved_field_length (if specified by <i>reserved_field</i> bit of service attributes valid flags)						
:	reserved_field (if specified by <i>reserved_field</i> bit of service attributes valid flags)						
:							

The fields for this common structure are all the same as defined for the multiplex descriptor above, but service descriptors do not have (or need) the input and antenna field. The reason for this is that the selection process for a given type of object (multiplex, service or component) requires the specification of the appropriate objects higher in the hierarchy.

All *reserved* fields shall be treated as specified in Rules for Reserved Fields on page 6.

The *system_specific_service_attributes_valid_flags* are defined per *system_id*, but all systems share one common definition:

flags	meaning
1xxx xxxx	The most significant bit of the multiplex attributes valid flags indicates whether the reserved fields are present or not. When this flag is 1, then the fields exist in both the selection and information attributes fields. If the flag is 0, then they do not exist.

The *reserved_field_length* and *reserved_field* fields only exist in the structure if defined by the valid flag described above.

3.4 Component Descriptors

The component descriptors for each broadcast system will also share a common format, which is similar to that of the service descriptor:

address offset	msb						lsb
00 ₁₆	system_id						
system_specific_component_attributes_valid_flags							
01 ₁₆	system_specific_component_attributes_valid_flags						
:							
system_specific_component_selection_attributes							
:	currently _availabl e	reserved					
:							
:	broadcast_system_specific_component_selection_attributes						
reserved_field_length (if specified by reserved_field_bit of component attributes valid flags)							
reserved_field (if specified by reserved_field bit of component attributes valid flags)							
:							
system_specific_component_information_attributes							
:	system_specific_component_information_attributes						
:							
:	reserved_field_length (if specified by reserved_field bit of component attributes valid flags)						
:	reserved_field (if specified by reserved_field bit of component attributes valid flags)						
:							

The fields for this common structure are all the same as defined for the service descriptor above.

All reserved fields shall be treated as specified in Rules for Reserved Fields on page 6.

The *system_specific_component_attributes_valid_flags* are defined per *system_id*, but all systems share one common definition:

flags	meaning
1xxx xxxx	The most significant bit of the multiplex attributes valid flags indicates whether the reserved fields are present or not. When this flag is 1, then the fields exist in both the selection and information attributes fields. If the flag is 0, then they do not exist.

The *reserved_field_length* and *reserved_field* fields only exist in the structure if defined by the valid flag described above.

4. Analog Audio Broadcast System Specification

This section contains information about the Analog Audio broadcast system. This includes the details of system-dependent information fields for all of the descriptors used in the tuner model, object descriptors and lists, etc.

Some of the data structures defined in this section are used by the tuner subunit to indicate the information types which are currently available in the air, or the status of the tuner subunit and its plugs. Some of these structures may also be used by controllers when performing selection operations, such as DIRECT SELECT INFORMATION TYPE or DIRECT SELECT DATA.

The descriptions of the data structures will indicate how the controller should treat the information when it is provided by the tuner subunit for status reporting, or when it is provided by the controller as operands in commands being sent to the tuner subunit.

4.1 Analog Audio system_id

The *system_id* field for an analog audio tuner subunit shall be set to 11₁₆.

4.2 Analog Audio Profile ID Assignments

Currently, there are no profiles defined for the analog audio tuner subunit.

4.3 Analog Audio Multiplex Descriptor and Mandatory Attributes

The multiplex descriptor for analog audio has the following system specific fields in a multiplex object structure. The mandatory attributes are in **BOLD**:

address offset	msb						lsb
system specific multiplex attributes valid flags							
02 ₁₆	reserved fields	pol	orb_pos	RF_freq_ raster	audio_ system	reserved	
03 ₁₆	reserved						
system specific multiplex selection attributes							
04 ₁₆	currently _availabl e	selected	reserved				
05 ₁₆	polarization*		west_ east*	reserved			
06 ₁₆	orbital_position_upper* orbital_position_lower*						
07 ₁₆							
08 ₁₆	raster_frequency		RF_frequency (22 bits)				
09 ₁₆							
0A ₁₆							
0B ₁₆							
audio_system							
system specific multiplex information attributes							
<< no information attributes are defined >>							

NOTE: The mandatory attributes marked with () have the following rules:

- a) For satellite antennas, the *polarization* attribute is mandatory
- b) For movable antennas, the *west_east* and *orbital_position* attributes are mandatory

The *system_specific_multiplex_attributes_valid_flags* have the same meaning as described for the general multiplex layout described above.

For a detailed explanation of the *polarization* field, refer to the DVB Service Information specification ETS 300 468, section 6.2.6. The definition for analog audio broadcast is the same as for DVB.

A detailed explanation of the *west_east* field can be also be found in DVB SI 6.2.6. This data is not valid when the *orb_pos* valid flag is set to value 0.

For details of the *orbital_position*, refer to DVB SI 6.2.6.

The *main_frequency* field is a 24 bit value composed of the *raster_frequency* and *RF_frequency* fields. This field is encoded as defined in the DVB reference noted at the beginning of this document.

The *audio_system* field has the following structure:

FM mode:

bit 7 (msb) 1 = FM
bit 6 1 = stereo, 0 = mono
bit 5 1 = low speed data channel present
bit 4 1 = high speed data channel present

bits 3-2 low speed data system
 00 = ARI system
 01 = reserved
 10 = RDS
 11 = reserved

bits 1-0 high speed data system
 00 = HSDS
 01 = DARC
 10 = reserved
 11 = reserved

AM mode:

bit 7 (msb) 0 = AM
bit 6 1 = stereo, 0 = mono
bit 5 1 = data channel present
bit 4 1 = DSB (double side band modulation), 0 = SSB (single side band modulation)

bits 3-2 low speed data system
 00 = to be defined
 01 = reserved
 10 = reserved
 11 = reserved

bits 1-0 reserved

4.4 Analog Audio Service Descriptor and Mandatory Attributes

The analog audio service descriptor is defined as follows. The mandatory attributes are in **BOLD**:

address offset	msb						lsb
system_specific_service_attributes_valid_flags							
02 ₁₆	reserved fields	reserved					
system_specific_service_selection_attributes							
03 ₁₆	currently available	reserved					
<< no broadcast system specific service selection attributes are defined >>							
system_specific_service_information_attributes							
04 ₁₆	service_name_length						
05 ₁₆	service_name						
:							
:							

The *system_specific_service_attributes_valid_flags* fields have the same meaning as described above for the general service descriptor layout described above.

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

The *service_name* field holds 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.

For analog audio broadcasting, services are not multiplexed together on a transponder; each transponder carries exactly one service. As defined for analog video, we describe an analog audio “multiplex” as consisting of a single service. So, a service and a multiplex are essentially the same in this case. A controller wishing to select an analog audio service should just select the multiplex.

However, this does not mean that there are no service lists and objects in the analog case. They do exist, because analog services do have components, and therefore component lists, associated with them.

4.5 Analog Audio Component Descriptor and Mandatory Attributes

The analog audio component descriptor has the following format. The mandatory attributes are in **BOLD**:

address offset	msb				lsb
system_specific_component_attributes_valid_flags					
02 ₁₆	reserved_fields	data_type_indicator	data_type_dependent	reserved	
system_specific_component_selection_attributes					
03 ₁₆	currently_available	reserved			
04 ₁₆	data_type_indicator		reserved		
05 ₁₆	data_type_dependent				
system_specific_component_information_attributes					
06 ₁₆	component_name_length				
07 ₁₆	component_name				
:					
:					

The *system_specific_component_attributes_valid_flags* for the component have the same meaning as defined for the general component descriptor described above.

The *data_type_indicator* field specifies what kind of component this is:

data_type_indicator	type of component
00 ₁₆	reserved
01 ₁₆	audio
02 ₁₆	data
03 ₁₆	reserved

The *data_type_dependent* field will have a format that depends on the *data_type_indicator*. The three formats are defined as follows:

address offset	data_type_dependent field for an analog audio, audio component
04 ₁₆	reserved

In the case of an analog audio “audio component”, there is no information in the *data_type_dependent* field; it shall be set to zero.

For an analog audio data component, the fields have these meanings:

address offset	data_type_dependent field for an analog audio data component
04 ₁₆	reserved

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

The *component_name* fields hold the length and 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.

4.6 Analog Audio DIRECT SELECT INFORMATION TYPE Search Flags

The search flags used in the DSIT control command for an analog audio selection are defined as follows:

address offset	msb						lsb	
00 ₁₆	orb_pos	main_freq_up	main_freq_down	0	0	0	0	0

The *main_freq_up* and *main_freq_down* search flags allow a controller to initiate a search based on the frequency, in either the up or down direction. The *orb_pos* flag allows a search based on this criteria. Only one search flag may be set for any operation.

All other flags shall be treated as reserved, as specified in Rules for Reserved Fields on page 6.

4.7 Analog Audio DIRECT SELECT DATA dsd_selection_specification

Currently there is no *dsd_selection_specification* structure defined for the analog audio system.

4.8 Analog Audio Object ID Assignment Rules

When the tuner subunit creates analog audio objects (multiplex, service and component), it shall follow these rules for assigning object ID's. The format of the service object ID depends on whether PI information is available in the signal:

object entry type	msb	ID assignment rule						lsb
multiplex	<< implementation dependent >>							
	(must be 4 bytes in length)							
service (by PI code)	id_format	reserved						
	00 ₁₆							
	PI (MSB)							
	PI (LSB)							
service (by frequency)	id_format	reserved						
	Frequency (MSB)							
	Frequency							
	Frequency (LSB)							
component	<< implementation dependent >>							
	(must be 4 bytes in length)							

The format of the *multiplex* and *component* object ID values for analog audio will depend on the tuner subunit implementation.

The format of the *service* object ID values for all analog audio tuners shall be as specified above.

The *id_format* flag bit indicates whether the service object ID is specified as PI code (= 0) or as a frequency (= 1).

4.9 Analog Audio Subunit Identifier Descriptor - System Specific Information

Currently there is no system specific information defined for the analog audio subunit identifier descriptor.

4.10 Analog Audio Subunit Identifier Descriptor selection_attribute_range_specification definitions

The analog audio tuner model specifies that the following selection attributes have range specifications. This list is presented in the order in which the *selection_attribute_range_specification* structures are packed into the *system_specific_antenna_range_specification* structure:

		msb					lsb
	attribute	analog audio selection attributes with range specifications					
A	polarization	polarization	reserved				
B	position	west_east	reserved				
			orbital_position (MSB) orbital_position (LSB)				
C	main frequency	raster_frequency	frequency (MS bits)				
			frequency				
			frequency (LSB)				
D	audio system	audio_system					

The *size_of_attribute* for each of the selection attributes indicated above can be derived from the number of rows used to specify the attribute. For example, the *position* attribute is 3 bytes, composed of the *west_east* bit flag, a *reserved* field, and 2 bytes for the *orbital_position* field.

4.11 Analog Audio Tuner Status Descriptor - antenna_general_system_info Field Specification

The format of the *antenna_general_system_info* field of a tuner subunit which supports the analog audio system appears as follows:

address offset	msb	lsb
02 ₁₆	raster_frequency	RF_frequency (MS bits)
03 ₁₆	RF_frequency (LSB)	
04 ₁₆		
05 ₁₆	manufacturer_dependent_info_length	
06 ₁₆	manufacturer_dependent_info	

4.12 Analog Audio Tuner Status Descriptor - demux_general_system_info Field Specification

There is no *demux_general_system_info* specified for the analog audio tuner subunit.

4.13 Analog Audio Tuner Status Notification - Event Specifications

Currently there are no system specific events defined for the analog audio tuner subunit.