TA Document 1999034

AV/C Tuner Broadcast System Specification - Analog Audio 1.1

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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.

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1. Overview

1.1 Purpose

This document defines the Analog Audio system specification for AV/C Tuner subunits. This specification applies to 1394 devices that receive analog audio broadcast signals such as AM and FM.

1.2 Scope

This document defines the broadcast system specific information that applies to analog audio. All general fields are defined and described in AV/C Tuner Model and Command Set specification Version 1.0, TA document number 1998004, referenced below. A good understanding of the reference is mandatory before reading this document.

2. 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.

[R1] AV/C Digital Interface Command Set General Specification, Version 3.0

[R2] AV/C Tuner Model and Command Set, Version 1.0

[R3] AV/C Tuner Broadcast System Specification –Digital Video Broadcast (DVB), Version 1.0

[R4] Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB Systems, ETSI, EN 300 468 V1.3.1 (1998-02)

2.1 Resources

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

2.1.1 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.

2.1.2 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

2.1.3 Advanced Television Systems Committee (ATSC)

Documents from the ATSC can be located on the following WWW site: http://www.atsc.org

2.1.4 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

2.1.5 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

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

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

2.1.7 International Telecommunication Union (ITU)

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

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 codes: A set of codes for a reserved field that are defined in this specification, but not otherwise used. Future specifications may implement the use of these codes. A product implementing this specification shall not generate these codes.

3.1.6 reserved fields: A set of bits for a reserved field that are defined in this specification, but are not otherwise used. Products that implement this specification shall zero these fields. Products that implement future revisions of this specification may set these codes as defined by the specification.

NOTE —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 Controller

4. 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.

4.1 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.

4.2 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 *reserved_field* bit of multiplex attributes valid flags)							
:	reserved_field (if specified by *reserved_field* bit of multiplex attributes valid flags)							
:								
	system_specific_multiplex_information_attributes							
:	system_specific_multiplex_information_attributes							
:								
:								
:	reserved_field_length (if specified by *reserved_field* bit of multiplex attributes valid flags)							
:	reserved_field (if specified by *reserved_field* bit of multiplex attributes valid flags)							
:								

Figure 4.1 – Multiplex Descriptors

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, Version 1.0 [R2].

The *system_id* for an analog audio tuner shall be 11_{16}.

All *reserved* fields shall be treated as specified on page 8 of reference [R2].

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:

Table 4.1 – Input Field Bit Allocation

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:

Table 4.2 – system_specific_multiplex_attributes_valid_flags Field Bit Allocation

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 system_id.

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.

4.3 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 *reserved_field* bit of service attributes valid flags)							
:	reserved_field (if specified by *reserved_field* bit of service attributes valid flags)							
:								
:								
	system_specific_service_information_attributes							
:	system_specific_service_information_attributes							
:								
:	reserved_field_length (if specified by *reserved_field* bit of service attributes valid flags)							
:	reserved_field (if specified by *reserved_field* bit of service attributes valid flags)							
:								
:								

Figure 4.2 – Service Descriptors

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 on page 8 of reference [R2].

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

Table 4.3 – system_specific_service_attributes_valid_flags Field Bit Allocation

flags	meaning
1xxx xxxx	The most significant bit of the service 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.

4.4 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_ available	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)							
:								

Figure 4.3 – Component Descriptors

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 on page 8 of reference [R2].

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

Table 4.4 – system_specific_component_attributes_valid_flags Field Bit Allocation

flags	meaning
1xxx xxxx	The most significant bit of the component 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.

5. 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.

5.1 Analog Audio system_id

The *system_id* field for an analog audio tuner subunit shall be set to 11_{16}.

5.2 Analog Audio Profile ID Assignments

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

5.3 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_available	selected	reserved					
05_{16}	**polarization****		**west_east****	reserved				
06_{16}	**orbital_position_upper***							
07_{16}	**orbital_position_lower***							
08_{16}	**raster_frequency**							
09_{16}	**RF_frequency (22 bits)**							
$0A_{16}$								
$0B_{16}$	audio_system							
	system_specific_multiplex_information_attributes							
	<< no information attributes are defined >>							

NOTE*: The valid flag of the orbital_position also specify the varifity of west_east field.
NOTE**: The mandatory attributes marked with (**) have the following rules:

1. For satellite antennas, the *polarization* attribute is mandatory
2. For movable antennas, the *west_east* and *orbital_position* attributes are mandatory

Figure 5.1 – Analog Audio Multiplex Descriptor

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 [R4], 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 [R4], section 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 [R4], section 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 AV/C Tuner Broadcast System Specification –Digital Video Broadcast (DVB), Version 1.0 [R3].

The *audio_system* field has the following structure:

Table 5.1 – audio_system Field Bit Allocation for FM

Bit	Meaning
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
bit 3-2	low speed data system 00 = ARI system, 01 = reserved, 10 = RDS, 11 = reserved
bit 1-0	high speed data system 00 = HSDS, 01 = DARC, 10 = reserved, 11 = reserved

Table 5.2 – audio_system Field Bit Allocation for AM

Bit	Meaning
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)
bit 3-2	low speed data system 00 = to be defined, 01 = reserved, 10 = reserved, 11 = reserved
bit 1-0	reserved

5.4 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							
01_{16}	reserved_fields	reserved						
	system_specific_service_selection_attributes							
02_{16}	currently_available	reserved						
	<< no broadcast system specific service selection attributes are defined >>							
	system_specific_service_information_attributes							
03_{16}	service_name_length							
04_{16}	service_name							
:								
:								

Figure 5.2 – Analog Audio Service Descriptor

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.

5.5 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								
01_{16}	reserved_fields	data_type_indicator	data_type_dependent	reserved				
system_specific_component_selection_attributes								
02_{16}	currently_available	reserved						
03_{16}	**data_type_indicator**	reserved						
04_{16}	**data_type_dependent**							
system_specific_component_information_attributes								
05_{16}	component_name_length							
06_{16}	component_name							
:								
:								

Figure 5.3 – Analog Audio Component Descriptor

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:

Table 5.3 – data_type_indicator Field Bit Allocation

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 two formats are defined as follows:

address offset	msb							lsb
data_type_dependent field for an analog audio, audio component								
04_{16}	reserved							

Figure 5.4 – data_type_dependent field for an analog audio, audio component

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.

address offset	msb							lsb
	data_type_dependent field for an analog audio, data component							
04_{16}	reserved							

Figure 5.5 – data_type_dependent field for an analog audio, data component

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

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.

5.6 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

Figure 5.6 – Analog Audio DIRECT SELECT INFORMATION TYPE Search Flags

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 on page 8 of reference [R2].

5.7 Analog Audio DIRECT SELECT DATA dsd_selection_specification

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

5.8 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:

	msb							lsb
object entry type	ID assignment rule							
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)							

Figure 5.7 – Analog Audio Object ID assignment rule

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).

5.9 Analog Audio Subunit Identifier Descriptor - System Specific Information

address offset	msb							lsb
00_{16}	Analog_Audio_specification_version							

Figure 5.8 – Analog Audio Subunit Identifier Descriptor - System Specific Information

The *Analog_Audio_specification_version* field indicates the version number of Analog Audio specification that this tuner subunit conforms to.

This field can have one of the following values:

Table 5.4 – Analog_Audio_specification_version

AA_specification_version values	AA_specification_version meaning
11_{16}	Data structures and command sets as specified in the AA Specification, Version 1.1
all others	reserved for future specification

If the system_specific_information field does not exist (system_sepcific_information_length=0), the implementation conforms to Version 1.0.

5.10 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							

Figure 5.9 – analog audio selection attributes with range specifications

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.

5.11 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}								
04_{16}	RF_frequency (LSB)							
05_{16}	manufacturer_dependent_info_length							
06_{16}								
	manufacturer_dependent_info							

Figure 5.10 – Analog Audio Tuner Status Descriptor - antenna_general_system_info Field

5.12 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.

5.13 Analog Audio Tuner Status Notification - Event Specifications

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