ATSC Standard: A/71:2012
Parameterized Services Standard

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Advanced Television Systems Committee
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The Advanced Television Systems Committee, Inc., is an international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

Specifically, ATSC is working to coordinate television standards among different communications media focusing on digital television, interactive systems, and broadband multimedia communications. ATSC is also developing digital television implementation strategies and presenting educational seminars on the ATSC standards.

ATSC was formed in 1982 by the member organizations of the Joint Committee on InterSociety Coordination (JCIC): the Electronic Industries Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable and Telecommunications Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Currently, there are approximately 150 members representing the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

ATSC Digital TV Standards include digital high definition television (HDTV), standard definition television (SDTV), data broadcasting, multichannel surround-sound audio, and satellite direct-to-home broadcasting.

Note: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. One or more patent holders have, however, filed a statement regarding the terms on which such patent holder(s) may be willing to grant a license under these rights to individuals or entities desiring to obtain such a license. Details may be obtained from the ATSC Secretary and the patent holder.

Revision History

Version	Date
A/71 approved	26 March 2007
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1. SCOPE

This supplementary standard defines a general purpose method to enable announcement of the technical attributes of program elements that must be supported in a receiving device to render the programming on a particular virtual channel.

It is not a replacement for fully-defined and optimized combinations of program elements defined for a particular Service Type (A/53 Part 1 [3], Section 4.2), such as those established by A/53 and A/97 [6].

1.1 Introduction and Background

This standard defines tools intended to help manage technological change and reduce the impact of evolutionary changes to the ATSC Digital Television Standard. As time goes on, broadcast service providers may desire to introduce new structures and formats of program elements. Some may be alternative methods for compressing audio or video, others that are less central to the broadcast service may include such things as providing for secure use of broadcast content within a home, or the signaling of IPTV-related services.

In contrast, the base set of standards provides an enumerated set of standardized techniques with detailed constraints agreed-upon and established prior to the deployment of receiving devices.

The particular technological element of control that is relevant to the signaling of the structure of service offerings is the service_type [3], which is a construct to explicitly define the exact match of transmit and receive capabilities required for successful rendering of digital content found on the virtual channel associated with the given service_type value. For collections of program elements that are to be presented in a specific predetermined and predictable manner, especially for mass-market optimized products, well known sets of enumerated characteristics are valuable.

Traditionally, a change is made to the base set (defined by specific values of service_type) when the need arises to make a major improvement in delivery formats. Special-purpose combinations that need to be unknown to the consumer also have justified the establishment of new service_type values.

This standard introduces a different approach designed to establish, for products supporting it, a uniform and controlled way to enable new components to be transmitted without impacting legacy devices and products that are unable to support the identified codecs or program elements. This approach is similar to the device discovery and control profiles in the Digital Living Network Alliance (DLNA) guidelines [8].

The fundamental element of the new approach is a descriptor that specifies characteristics of the critical parameters for each service element of a particular virtual channel. The descriptor is placed in the A/65 [2] VCT and lists the stream_type and other details describing capabilities that need to be supported in the receiver to render all content in the associated virtual channel.

1.2 Organization

This document is organized as follows:

- Section 1 – Outlines the scope of this document and provides a general introduction

- Section 2 – Lists references and applicable documents
- Section 3 – Provides a definition of terms, acronyms, and abbreviations for this document
- Section 4 – Definition of Parameterized Service
- Section 5 – Definition of Extended Parameterized Service
- Section 6 – Definition of Component List Descriptor
- Section 7 – Definition of Parameterized Service Descriptor
- Annex A – Example of stream info details
- Annex B – Expected receiver behavior

2. REFERENCES

At the time of publication, the editions indicated below were valid. Users of this Standard are cautioned that newer editions might or might not be compatible.

2.1 Normative References

The following documents, in whole or in part, as referenced in this document, contain specific provisions that are to be followed strictly in order to implement a provision of this Standard.

[1] IEEE: "Use of the International Systems of Units (SI): The Modern Metric System", Doc. IEEE/ASTM SI 10-2002, Institute of Electrical and Electronics Engineers, New York, N.Y.

[2] ATSC: "Program and System Information Protocol for Terrestrial Broadcast and Cable," Doc. A/65:2009, Advanced Television Systems Committee, Washington, D.C, 14 April, 2009.

2.2 Informative References

The following documents contain information that may be helpful in applying this Standard.

[3] ATSC: "ATSC Digital Television Standard, Part 1," Doc. A/53 Part 1:2009, Advanced Television Systems Committee, Washington, D.C., 7 August 2009.

[4] ATSC: "ATSC Digital Television Standard, Part 4," Doc. A/53 Part 4:2009, Advanced Television Systems Committee, Washington, D.C., 7 August 2009.

[5] ATSC: "ATSC Digital Television Standard, Part 5," Doc. A/53 Part 5:2010, Advanced Television Systems Committee, Washington, D.C., 6 July 2010.

[6] ATSC: "Software Download Data Service," Doc. A/97, Advanced Television Systems Committee, Washington, D.C., 16 November 2004.

[7] ISO/IEC: IS 13818-1 (E), International Standard, Information technology – Generic coding of moving pictures and associated audio information: systems.

[8] Digital Living Network Alliance: DLNA Networked Device Interoperability Guidelines expanded.

3. DEFINITION OF TERMS

With respect to definition of terms, abbreviations, and units, the practice of the Institute of Electrical and Electronics Engineers (IEEE) as outlined in the Institute's published standards [1] shall be used. Where an abbreviation is not covered by IEEE practice or industry practice differs from IEEE practice, the abbreviation in question will be described in Section 3.3 of this document.

3.1 Compliance Notation

This section defines compliance terms for use by this document:

shall – This word indicates specific provisions that are to be followed strictly (no deviation is permitted).

shall not – This phrase indicates specific provisions that are absolutely prohibited.

should – This word indicates that a certain course of action is preferred but not necessarily required.

should not – This phrase means a certain possibility or course of action is undesirable but not prohibited.

3.2 Treatment of Syntactic Elements

This document contains symbolic references to syntactic elements used in the audio, video, and transport coding subsystems. These references are typographically distinguished by the use of a different font (e.g., restricted), may contain the underscore character (e.g., sequence_end_code) and may consist of character strings that are not English words (e.g., dynrng).

3.3 Acronyms and Abbreviations

The following acronyms and abbreviations are used within this specification.

ATSC – Advanced Television Systems Committee

CVCT – Cable Virtual Channel Table

DLNA – Digital Living Network Alliance

IEC – International Electrotechnical Commission

IEEE – Institute of Electrical and Electronics Engineers

IPTV – Internet Protocol television

ISO – International Standards Organization

MPEG – Moving Picture Experts Group

TVCT – Terrestrial Virtual Channel Table

VCT – Virtual Channel Table

4. SERVICE TYPE 0x07 – PARAMETERIZED SERVICE

A virtual channel with a value 0x07 in the service_type field shall indicate a service of type "Parameterized Service." The VCT signaling in a Parameterized Service conveys information a receiver can use to determine whether or not it has the hardware and software resources needed to create a meaningful presentation of the service. For virtual channels of service_type 0x07, this information is conveyed in the component_list_descriptor() defined in Section 6.

For any terrestrial_virtual_channel_table_section() or cable_virtual_channel_table_section() in which the value of the service_type field is 0x07, either one or two instances of the component_list_descriptor() shall be present in the descriptor loop following the descriptors_length field.

Component_list_descriptor()s shall contain stream_info_details() for each essential elementary stream component.[1]

[1] Because the basis of A/53 is MPEG-2 video and AC-3 audio, when their use is as constrained by A/53 Parts 4 [4] and 5 [5] respectively, signaling their presence at the virtual channel level is not needed.

Receivers are expected to process the component_list_descriptor()(s) in a virtual channel of service_type value 0x07 in accordance with the guidance given in Annex B, Section B.1.

5. SERVICE TYPE 0x09 – EXTENDED PARAMETERIZED SERVICE

A virtual channel with a value 0x09 in the service_type field shall indicate a service of type "Extended Parameterized Service." The VCT signaling in an Extended Parameterized Service conveys information a receiver can use to determine whether or not it has the hardware and software resources needed to create a meaningful presentation of the service. For virtual channels of service_type 0x09, this information is conveyed in one or more Parameterized Service Descriptors (PSD), and optionally one or two instances of the component_list_descriptor() defined in Section 6. The syntax and semantics of the PSD is specified in Section 7.

One, or at most two instances of the component_list_descriptor() defined in Section 6 may be present in the descriptor loop following the descriptors_length field of a terrestrial_virtual_channel_table_section() or cable_virtual_channel_table_section() in which the value of the service_type field is 0x09.

If present, component_list_descriptor()(s) shall contain stream_info_details() for each essential elementary stream component.

For virtual channels of service_type 0x09, the stream types that are listed in the component_list_descriptor()s should include those that may be transported and identified in other protocol layers, for example in a Service Map Table carried in an IP subnet tunneled via an elementary stream component of the program, as well as those appearing in the PMT sections.

One or more Parameterized Service Descriptors as defined in Section 7 shall be present in the descriptor loop following the descriptors_length field for virtual channels of service_type value 0x09. Each PSD shall signal further information about the service, to be used by the receiver when deciding whether or not it can offer a meaningful presentation of the service to the user. The PSD is designed so that future versions of the ATSC protocols can extend the length of PSD and stream_info_details() data structures by adding new fields at the ends.

Receivers are expected to process the component_list_descriptor()(s) and PSD(s) in a virtual channel of service_type value 0x09 in accordance with the guidance given in Annex B, Section B.2. If a receiver is not designed to process all the fields found in the descriptor, then it is expected to conclude that it does not have the necessary capability to present the channel.

6. COMPONENT LIST DESCRIPTOR (NORMATIVE)

The component_list_descriptor() is used in the A/65 [2] TVCT and/or the CVCT to signal the combination of components (stream types, etc.) associated with a particular virtual channel. Each instance of the component_list_descriptor() shall identify the set of components (which set can include more than one instance of a particular stream_type) that, if supported in a receiving device, allow that device to render and properly present all programming on the channel. The stream_type values announced in the component_list_descriptor()s need not at all times exactly match the stream_type values transmitted. In particular, some or all of the identified stream types may be absent at any given time.

No more than two instances of the Component List Descriptor shall appear in the TVCT/CVCT descriptor loop; if two are present, one is a "primary" and one is a an "alternate." A second instance is appropriate when content carried within a particular program element is simulcast on a second program element, where the simulcast stream is encoded using a different codec. This situation reflects the case that support in the receiver for either of two different sets

of stream types is sufficient to guarantee support for encoding formats for the content on the channel.

This standard establishes no constraints or relaxations on the contents of the TVCT or CVCT other than those explicitly stated herein.

The bit-stream syntax for the component_list_descriptor() shall be as shown in Table 6.1.

Table 6.1 Bit Stream Syntax for the Component List Descriptor

Syntax	No. of Bits	Format
component_list_descriptor() {		
descriptor_tag	8	0xBB
descriptor_length	8	uimsbf
alternate	1	bslbf
component_count	7	uimsbf
for (i=0; i<component_count; i++) {		
stream_type	8	uimsbf
format_identifier	32	uimsbf
length_of_details	8	uimsbf
stream_info_details()	var	
}		
}		

descriptor_tag – This 8-bit unsigned integer shall have the value 0xBB, identifying this descriptor as component_list_descriptor().

descriptor_length – This 8-bit unsigned integer specifies the length (in bytes) immediately following this field up to the end of this descriptor. The maximum value shall be 253.

alternate – A flag that indicates, when set to '1', that this instance of the component_list_descriptor() is a second, "alternate" description of streams associated with the virtual channel. When the flag is set to '0', the set of stream types in the instance of the descriptor is the "primary" or "preferred" set. If only one component_list_descriptor() appears in the descriptor loop, the value of the alternate flag shall be set to '0'.

component_count – This 7-bit unsigned integer shall specify the number of components specified in the "for" loop to follow. The value shall be in the range of 1 to 36.

stream_type – This 8-bit unsigned integer field shall indicate the stream_type associated with the component described in this iteration of the "for" loop. Stream types in the range 0xC4 to 0xFF identify stream types defined privately (not described by ATSC Standards).

> *Note*: The values for each defined stream_type with values less than 0xC4 are found in the ATSC Code Point Registry, which coordinates such values among cooperating standards development organizations.

format_identifier — This 32-bit unsigned integer shall correspond to the format_identifier in the MPEG-2 Registration Descriptor defined in ISO/IEC 13818-1 [7] Section 2.6.9 and shall identify the entity providing the stream_type value. The value of format_identifier shall be 0x4741 3934 ("GA94" in ASCII) unless the applicable ATSC standard specifies a different value, in which case that value shall be used. The stream_type values defined in ISO/IEC 13818-1 [7] and whose use is not standardized by ATSC Standards shall use value 0x00000000 for format_identifier.

length_of_details – This 8-bit unsigned integer shall specify the length, in bytes, of the defined length of the stream_info_details() field to follow. The value of length_of_details shall be set to the length of the stream_info_details() field that has been defined for the associated stream_type value. The value shall be in the range of 0 to 246 inclusive.

stream_info_details() – This field shall provide further information pertaining to the component identified by the value in the preceding stream_type field. The meaning and structure of the bits contained in stream_info_details() shall be as specified in the standard defining the meaning of the value in the stream_type field when used in an ATSC transport stream. If ATSC standards define a stream_info_details() structure for a given value of stream_type, the ATSC definition shall take precedence over any definition originating from any other standards developing organization.

6.1 Additional Constraints

A given value of stream_type may appear at most one time in any given component_list_descriptor(). At most two instances of the component_list_descriptor() are permitted to appear in the descriptor loop following the descriptors_length field of any terrestrial_virtual_channel_table_section() or cable_virtual_channel_table_section() [2]. If two instances of the component_list_descriptor() appear in a given descriptor loop, one shall have the alternate flag set to '0' and the other shall have the alternate flag set to '1'.

7. PARAMETERIZED SERVICE DESCRIPTOR

The parameterized_service_descriptor() is used in the A/65 [2] TVCT and/or CVCT, in a virtual channel of service_type value 0x09. Each instance of the parameterized_service_descriptor() shall provide parameters of the service, that, if supported in a receiving device, allow that device to render and properly present all programming on the channel.

The PSD, as defined, contains the field application_data() whose syntax and semantics are application-specific. A field called application_tag identifies the application to which the payload applies.

The bit-stream syntax for the parameterized_service_descriptor() shall be as shown in Table 6.2.

Table 6.2 Bit Stream Syntax for the Parameterized Service Descriptor

Syntax	No. of Bits	Format
parameterized_service_descriptor() {		
descriptor_tag	8	0x8D
descriptor_length	8	uimsbf
application_tag	8	bslbf
application_data()	var	
}		

descriptor_tag – This 8-bit unsigned integer shall have the value 0x8D, identifying this descriptor as a parameterized_service_descriptor().

descriptor_length – This 8-bit unsigned integer specifies the length (in bytes) immediately following this field up to the end of this descriptor. The maximum value shall be 255.

application_tag – This 8-bit unsigned integer shall uniquely identify the application associated with the syntax and semantics of the application_data() to follow. Values of application_tag are specified in other standards and are managed by the ATSC Code Points Registrar.

application_data() – The syntax and semantics of this field shall be as specified in the standard that establishes the associated application_tag value.

Annex A: Example of Stream Information Details (Informative)

A.1 NEW CODEC PROFILE

The example below describes how a standards body might use this tool to set the parameters for announcement of an arbitrary codec called the "NIH" codec.

While the word "shall" is used in several places in this example in the context of this Parameterized Services Standard to which this annex is attached, they are not actual conformance key words.

Start of Example Section from "NIH" Codec Standard

12.7 STRUCTURE OF THE NIH STREAM INFO DETAILS FIELD

ATSC A/71, "Parameterized Services Standard," establishes the requirements for announcement of a new (previously undocumented) stream_type as a component of a virtual channel. Those requirements include use of the component_list_descriptor(). The component_list_descriptor() contains the stream_info_details() field, the semantics of which are codec-specific. A/71 requires the definition of the semantics and contents of the stream_info_details() field in order to use component_list_descriptor() to announce the characteristics of the content using the identified stream type. This section defines the syntax and semantics of the stream_info_details() field for stream_type 0xTBD.

The contents of the stream_info_details() for stream_type 0xTBD shall be structured as shown in Table 12.5.

Table 12.5 Stream Information Details Syntax for stream_type Value 0xTBD

Syntax	No. of Bits	Format
stream_info_details() {		
profile	2	uimsbf
level	3	uimsbf
one_bits	3	'111'
}		

profile – This is a two-bit unsigned integer field. Values shall be as defined in Table 12.3 in Section 12.2: '01' = low; '10' = medium and '11' = high. As specified in Section 12.2, all receiving devices that support a higher binary-numbered profile must support all lower numbered profiles. The highest profile that will be used for the virtual channel associated with the component_list_descriptor() carrying this stream_info_details() shall be sent.

level – This is a three-bit unsigned integer field. Values shall be as defined in Table 12.4 in Section 12.2: '001' = tiny; '010' = small; '011' = intermediate; '100' = big; '101' = large; '110' = huge. As specified in Section 12.2, all receiving devices that support a higher binary-numbered level must also support a lower numbered level. The highest level that will be used for the virtual channel associated with the component_list_descriptor() carrying this stream_info_details() shall be sent.

End of Example

Annex B: Expected Receiver Behavior

B.1 RECEIVER BEHAVIOR FOR SERVICE TYPE 0x07

This Section describes the expected behavior of receivers when processing a Virtual Channel Table entry indicating a service_type value of 0x07 (Parameterized Services). The process involves checking the Component List Descriptor to see if the stream types are supported, and for each supported stream type, if the stream_info_details() indicates a supported mode of operation. Two instances of the Component List Descriptor may be present in the Virtual Channel Table entry; if the receiver can handle the stream type values described in either one, it will be able to reliably present the channel.

This section contains an example implementation which results in this expected behavior. The algorithm is described in two routines. The first routine is "Parse Component List Descriptor," which returns a Boolean variable called ok_to_proceed. The Parse Component List Descriptor routine is diagrammed in flow chart format in Figure B.1. As shown, for each stream type value listed in the descriptor, the following checks are made:

- Is the stream type value recognized?
- Is the stream type supported in the receiver hardware and/or software?
- For this stream type, are the capabilities described in stream_info_details() supported?
- Is the value of length_of_details a supported value?

If the answer to any of these questions is "no," the routine returns a value of "false" in the variable called "ok_to_proceed," otherwise a value of "true" is returned.

In accordance with the general rule, receivers are expected to disregard descriptors with unrecognized values of descriptor_tag if any are encountered.

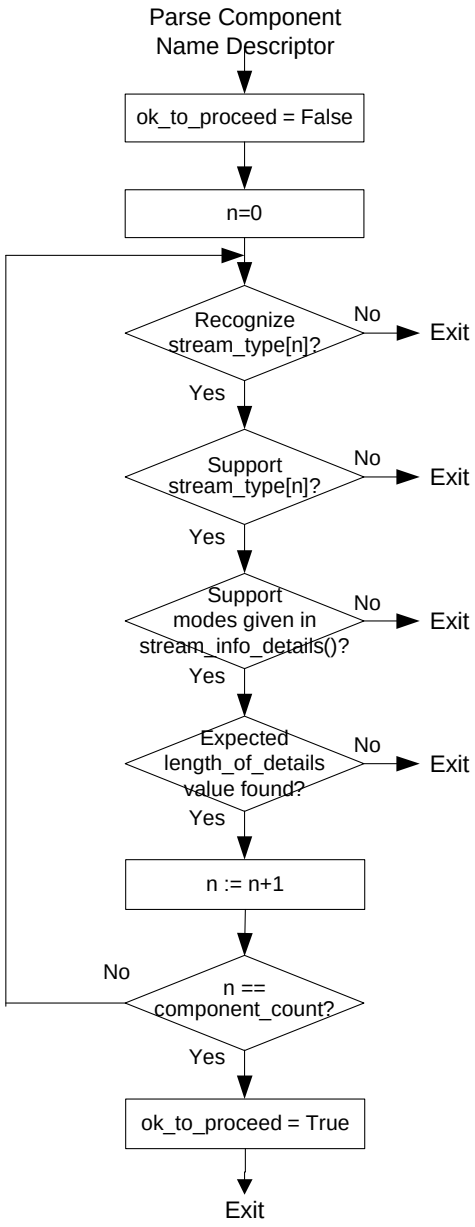

Figure B.1 Parse Component List Descriptor Routine.

Figure B.2 diagrams the overall decision process for a Virtual Channel of service_type value of 0x07, using the output of the "Parse Component List Descriptor" routine above.

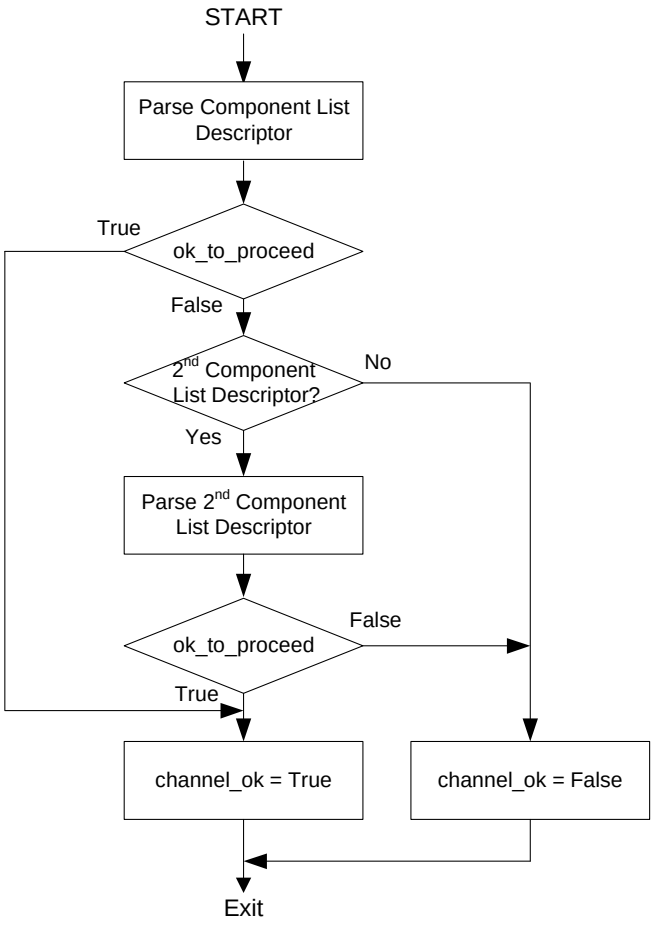

Figure B.2 Expected Receiver Behavior for Service Type 0x07.

B.2 RECEIVER BEHAVIOR FOR SERVICE TYPE 0x09

This Section describes the expected behavior of receivers when processing a Virtual Channel Table entry indicating a service_type value of 0x09 (Extended Parameterized Services). The algorithm is described in Figure B.3 below. The algorithm uses the "Parse Component List Descriptor" described in Figure B.1 above.

The process involves first checking the Component List Descriptor to see if the stream types are supported, and for each supported stream type, if the stream_info_details() indicates a supported mode of operation. If no unsupported modes are found in the Component List Descriptor, the Parameterized Service Descriptors are checked. The case that no PSD is found represents an error in the received signal; the expected receiver response in this case is to decide the channel is unavailable.

Next, each PSD is checked in turn to see if the application_tag value is recognized, and if it is, whether or not the modes of operation of the channel described in the descriptor are supported. If the descriptor_length field indicates a value larger or smaller than expected, the receiver concludes that the channel cannot be reliably decoded (the assumption being that the unrecognized parameters provided may indicate an unsupported mode of operation).

In accordance with the general rule, receivers are expected to disregard descriptors with unrecognized values of descriptor_tag if any are encountered.

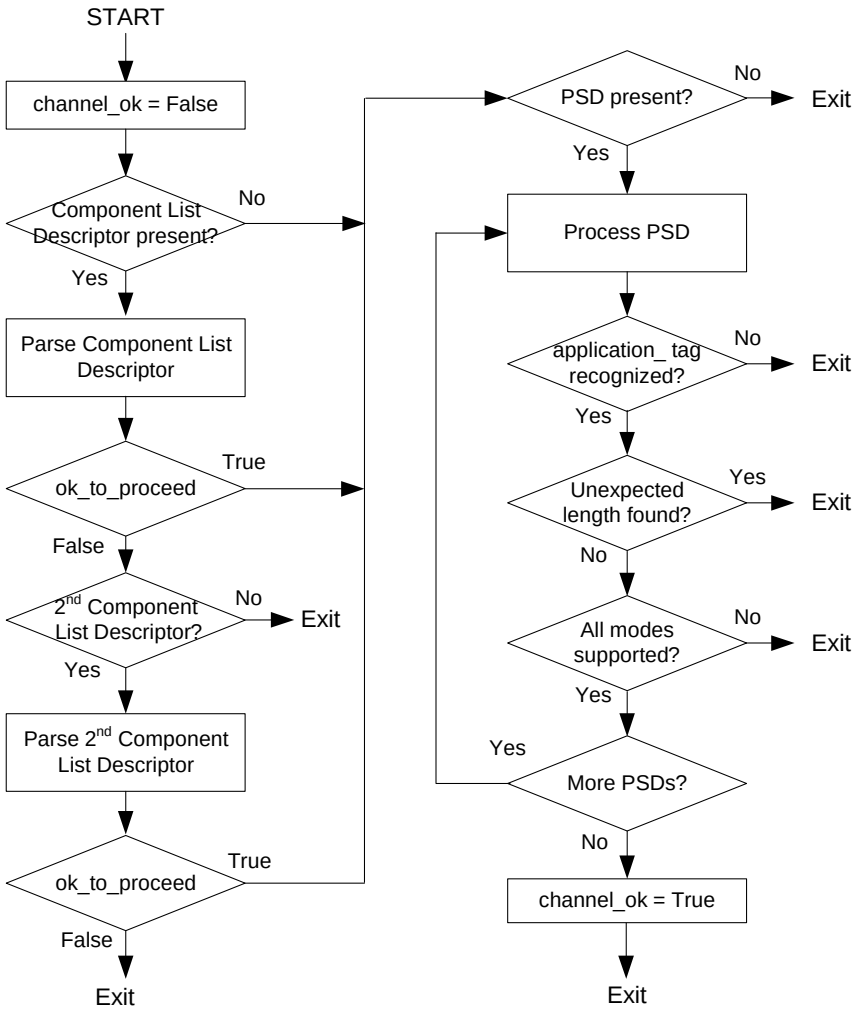

Figure B.3 Expected Receiver Behavior for Service Type 0x09.

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