# Informational Document:

# Technology Group Report on Code Point Issues

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The Advanced Television Systems Committee (ATSC) is an international, non-profit membership organization developing voluntary standards for the entire spectrum of advanced television systems.

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 Television Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Members represent 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.

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## 1. EXECUTIVE SUMMARY

The Technology Group on Distribution has reviewed code points used or defined by ATSC Standards and has determined that no conflicts currently exist within ATSC Standards. Moving forward, we recommend that the ATSC, and other interested standards development organizations (SDOs), cooperatively:

- Set up a database, called the *Code Point Registry*, to document the assigned values of all existing ATSC code points. A template for this database is given in Annex A.

- Publish the Registry on the ATSC Web site, and other Web sites as appropriate.

- Administer assignment of future ATSC code points. The basic assignment procedure is outlined in Annex A. More detailed procedures will be developed in cooperation with all interested parties.

- Establish a procedure for retiring outdated code points, once the procedure for assigning them has stabilized.

- Review all code points at the video and audio layers.

- Require that all ATSC Specialist Groups become familiar with the assignment process.

- Create a liaison with SCTE and other SDOs to inform them of the mechanics of the Registry and to identify and resolve (if possible) existing code point conflicts.

### 1.1  Purpose

This document is intended for authors and users of MPEG-2-based standards (e.g., SCTE, CEA, and SMPTE). It is intended to ensure harmonization of code points among all of these standards. If the information in this report were turned into an engineering guideline (or other similar document) then it would allow, for example, ATSC and SCTE system information to co-exist in Transport Streams and would allow ATSC-based receivers to respond properly.

While consideration was given to other users of MPEG-2 Systems (e.g., DVB and ARIB), additional harmonization work may be required to allow the co-existence of ATSC-based system information with that of other systems.

## 2. BACKGROUND AND SCOPE

At the March 22, 2001, meeting of the ATSC T3/S8 Transport Specialist Group, Michael Isnardi (Sarnoff) was asked to chair an Ad Hoc Group to update the "code point" document and to recommend a method for assigning and maintaining future code points. This group was asked to coordinate with the Ad Hoc Group on Private Ranges, chaired by Richard Chernock (IBM). Many teleconferences were held to discuss the scope of work, the scoping of each ATSC code point, and the procedure for documenting and assigning code points.

The scope of effort of this Ad Hoc Group was to:

a) Identify all existing ATSC and relevant MPEG code points.

b) Identify whether collisions already exist, and if so, to document them.

c) Define the scoping rules for each code point.

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    d) Communicate the findings to all relevant SDOs, with an initial focus on SCTE, CEA, and SMPTE.

The AHG Final Report was approved as an Informational Document by the Technology Group on Distribution (T3) on February 7, 2002.

## 3. DEFINITIONS

During the course of the AHG work, some terms were used frequently but defined nowhere. It was recommended that the final report contain proposed definitions of these terms.

**ATSC code point** A syntax element defined in an ATSC standard containing at least one ATSC-defined value. The syntax element table_type, defined in ATSC A/65A Section 6.2, is an example of an ATSC code point.

**ATSC user private** A value or range of values of a code point listed as "user private" in an ATSC standard. If the code point is an MPEG code point, the ATSC assigned, reserved and user private ranges must be a strict subset of the MPEG user private range. This relationship is shown in the diagram below.
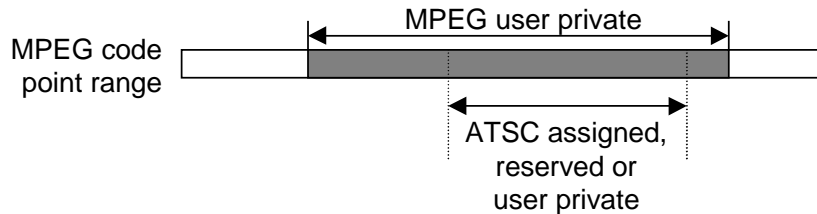


**code point** A syntax element in a defined standard containing at least one value defined in that standard. If a code point value is not explicitly defined, it is either "forbidden", "reserved", or "user private".

**collision** A code point value used by two or more private systems with different meaning without the context or identification necessary for receiving devices to reliably distinguish between them.

**conflict** Synonymous with "collision".

**MPEG code point** A syntax element defined in an ISO/IEC MPEG standard containing at least one MPEG-defined value. The syntax element table_id, defined in ISO/IEC 13818-1:2000 Section 2.4.4.4, is an example of an MPEG code point.

**MPEG user private** A value or range of values of a code point listed as "user private" in an ISO/IEC MPEG standard.

**scope** *noun* Those instances of occurrence where a code point must be uniquely defined in order to be interpreted unambiguously by receiving devices. *verb* To bound the set of values of code points such that they are uniquely identified in order to be interpreted unambiguously by receiving devices.

**user private** A value or range of values of a code point that may be privately defined by users of a particular standard. It must be possible to determine the identity of the standards body or private party specifying a user private value. In some instances, the MPEG-2 registration descriptor is used.

## 4. SUMMARY OF WORK EFFORT

### 4.1 Code Point Lists

A list of MPEG code points having ATSC assigned or reserved ranges is given in Table 1. A partial list of ATSC code point ranges requiring management is given in Table 2. More work needs to be done within T3 to complete this list and confirm its accuracy. In particular, code points at the video and audio layers need to be reviewed. In addition, the code point document T3/S8-305 has been revised to include, where known, DVB and ARIB code points, but the list may not be complete. This code point document differs from Tables 1 and 2 in this report in that it lists all known code point assignments, not just ranges.

### 4.2 Conflict Evaluation

Within ATSC Standards, no conflicts have been found. The document "MPEG Private Data Code Points" (ATSC T3/S8-305 rev 4, also submitted as SCTE DVS-242) has been updated and will be used by ATSC staff to form an initial version of the database called the "Code Point Registry". In Annex A, a general framework is described that will ensure no conflicts in ATSC-based systems moving forward.

### 4.3 Scoping of Code Points

The scope of a code point will determine whether collision matters. The scopes of MPEG code points and selected ATSC code points are listed in Tables 1 and 2.

**Table 1** MPEG Code Points having ATSC Assigned or Reserved Ranges

| MPEG Code Point | MPEG User Private Range | ATSC Assigned or Reserved Range | Defining MPEG Standard | Scope | Recommended Registrar |
|---|---|---|---|---|---|
| PID | 0x0010 - 0x1FFE | 0x1FFB - 0x1FFE | ISO/IEC 13818-1 | MPEG-2 Transport (Note 1) | N/A |
| table_id | 0x40 - 0xFE | 0x80 - 0x8F 0xC7 - 0xD8 | ISO/IEC 13818-1 | PID (Note 2) | ATSC |
| stream_type | 0x80 - 0xFF | 0x80 - 0xC3 | ISO/IEC 13818-1 | PMT, service_location_descriptor. | ATSC |
| transport_stream_id | 0x0000 - 0xFFFF | TBD | ISO/IEC 13818-1 | Geographic region (Note 3) | ATSC, FCC and other bodies |
| descriptor_tag | 0x40 - 0xFF | 0x40 - 0xAF | ISO/IEC 13818-1 | table_id (Note 4) | ATSC |
| descriptorType | 0x40 - 0xFF | 0x40 - 0xFF | ISO/IEC 13818-6 | compatibility_descriptor | ATSC |
| specifierType | 0x80 - 0xFF | 0x80 - 0xFF | ISO/IEC 13818-6 | compatibility_descriptor | ATSC |

Notes:

1) The use of reserved PID values should be avoided. When they are used, they shall be globally scoped (i.e., unique within the scope of this document). In the case of ATSC Standards, no more reserved PID's shall be assigned.

2) The scope of a table_id is the framework of the PSI and PSIP in which it is used, which will then constrain it to one or more PID's at any given point in time. While it is

possible to carefully re-use table_id values, as a general rule, they should not be. In the case of ATSC Standards, table_id values shall be globally scoped.

3) The scope of the Transport Stream ID (TSID) according to 13818-1 is the "network". This value, when used for ATSC terrestrial broadcast, represents the geographic region over which broadcast signals may be received (which includes remultiplexing onto cable and satellite systems). ATSC will assign blocks of TSID values to geographic regions. For the U.S. and its possessions, the current MSTV list is used, but the FCC is expected to administer this in the future. For U.S. cable, the scope of TSID is all Transport Streams that can be received by any given receiving device in the cable network.

4) The scope of the descriptor tag code point is the list of the types of tables (identified by their table_id) carrying the descriptor. For clarity and ease of use, PSI and PSIP standards often avoid re-use of descriptor tag code point values even in cases where such re-use is possible. In the case where the table is an MPEG-2 table, such as the PMT, then the descriptor_tag value shall be globally scoped.

**Table 2** ATSC Code Points Requiring Management (Incomplete)

| ATSC Code Point | ATSC Assigned or Reserved Range | Defining ATSC Standard | Scope | Recommended Registrar |
|---|---|---|---|---|
| source_id | 0x1000 - 0xFFFF | A/65A | Unique at the regional level. | SMPTE |
| table_type | 0x0000 - 0x03FF, 0x1000 - 0xFFFF | A/65A | MGT | ATSC |

Note: Code points entirely managed by the defining ATSC Standard are not included in this table and do not require ATSC management. Other code points do require ATSC management.

## 5. RECOMMENDATIONS

This AHG recommends that:

1) A registration process for ATSC code points be established; all assignments of code points to standards developing organizations (SDO) should be made on a reasonable and nondiscriminatory basis.

2) A database, called the *Code Point Registry*, be created and maintained by ATSC staff in cooperation with other SDOs, as appropriate.

3) The general procedures in Annex A of this report be followed for setting up and maintaining the ATSC Registry.

4) Other standards groups, including all T3 Specialist Groups, be requested to search their documents for code points having an ATSC Reserved Range requiring ATSC management, and to forward this list to the attention of the T3 chair. Each ATSC T3 Specialist Group has the right to choose which code points are locally managed (and therefore not part of the ATSC Registry) and which code points are best managed by the ATSC through the Registry. As a guideline, if a code point in a defining ATSC standard is likely to be used by another ATSC standard, then that code point is best managed through the Code Point Registry.

5) Once the Registry is established, existing standards that list code point values or ranges as reserved should be modified to indicate that future assignment of values from those ranges shall be administered through the Registry.

6) In future ATSC Standards, no more PID's shall be directly assigned. In other words, PID assignments shall be made indirectly through assignments in ATSC-defined or user-private tables.

7) In future ATSC standards, table_id values shall be globally scoped. In other words, within ATSC standards, all table_id values shall be unique.

8) In future ATSC Standards, descriptor_tag values shall be globally scoped even though they may be re-used within MPEG-2 tables. (Note that this chooses a smaller namespace then is strictly necessary.)

9) A joint meeting with representatives of ATSC, SCTE, CEA, and SMPTE be planned to discuss how best to avoid code point conflicts moving forward. This should include development of a standard method of description of code points.

10) A joint meeting with representatives of DVB and ARIB be planned to discuss how to avoid global code point conflicts.

11) A procedure be established for retiring unused code points, once the process for assigning and maintaining them has stabilized

## 6.  AD HOC GROUP PARTICIPANTS

Michael Isnardi (Sarnoff and Chair, Ad Hoc Group on Code Point Issues)

Art Allison (NAB)

Rich Chernock (IBM and Chair, Ad Hoc Group on Private Fields and Ranges)

Mike Dolan (Consultant)

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Bernie Lechner (Consultant)

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Jerry Whitaker (ATSC Technical Director)

# Annex A:
# Procedure for Setting up and Maintaining the Code Point Registry

It is recommended that the ATSC, in cooperation with other SDOs, create a database of code points, hereinafter called the "Code Point Registry" and identify a keeper (the Registrar) for:

1) All ATSC syntax elements for which there are "ATSC Reserved" values or ranges that require ATSC management.

2) All MPEG syntax elements containing "MPEG User Private" ranges used in ATSC standards.

It is recommended that the Code Point Registry database have the format shown below and be formatted in a way that allows printing and electronic searching. Each record is a separate code point value.

**ATSC Code Point Registry**
Last Updated 15-August-2001

| Standard | Type | Name | Field | Value | Description | Scope | Also Used In |
|---|---|---|---|---|---|---|---|
| A/65 | Packet | transport_packet | PID | 0x1FFFB | Base PID for ATSC PSIP | MPEG-2 Transport | ISO 13818-1 transport_packet |
| A/65 | Descriptor | service_location_descriptor | descriptor_tag | 0xA1 | Identifies this as the SLD | table_id | |
| A/52 | Descriptor | AC3_audio_descriptor | descriptor_tag | 0x81 | Identifies this as the AC3 descriptor | table_id | |
| A/53 | Descriptor | registration_descriptor | format_identifier | * | (see SMPTE) | table_id | |
| A/65 | Table | master_guide_table | table_id | 0xC7 | Identifies this as the MGT table | PID | |
| A/53 | Table | program_map_table | stream_type | 0x81 | Identifies this as A/53 audio | PID | A/65 SLD |
| A/65 | Table | master_guide_table | table_type | 0x0000 | TVCT, current_next=1 | PID | |
| A/90 | Table | data_service_table | protocol_encapsulation | 0x04 | Async IP | DST | |
| A/65 | Table | terrestrial_virtual_channel_table | source_id | * | (see SMPTE) | Transport Stream | A/65 EIT, A/90 DET |
| A/65 | Table | terrestrial_virtual_channel_table | tsid | * | (see FCC) | Geo. Region | |

Additionally, the following general procedures are recommended:

1) The Registry is reviewed by all T3 specialist groups and placed on the ATSC web site along with the standards. The Registry is informative only and refers to the standard that defines the values. Thus, it never requires balloting.

2) ATSC Standards would be revised to include only the field values for which they normatively define. For example, A/65 would be silent on any A/65 table/descriptor field values defined by A/90 (or any other document), and instead refer the reader to the Registry. All such field values would refer the reader to the Registry for a complete listing, but may include informative references that will facilitate reading of the standards.

3) When a Specialist Group wishes to define a new code point field(s), the Specialist Group chair goes to the Registrar and requests registration, providing all required information except the value(s). The Registrar registers the field(s), updates the Registry and informs the chair. The Specialist Group chair then uses the field(s) in the draft standard. If the draft standard is ultimately not adopted by the ATSC, then the field(s) is removed from the Registry. The Registry is updated upon publication of any new or amended Standard.

4) When a Specialist Group wishes to define a code point value(s), the Specialist Group chair goes to the Registrar and requests assignment, providing all required information except the value(s). The Registrar assigns the value(s), updates the Registry and informs the chair. The Specialist Group chair then uses the value(s) in

the draft standard. If the draft standard is ultimately not adopted by the ATSC, then the value(s) is returned. The Registry is updated upon publication of any new or amended Standard.

1) Requests for undefined code points will not be honored. Each value must be defined in the request and the relevant daft standard. While multiple requests for code points can be made, requests for ranges of code points will not be honored. If a range is technically justified, exception cases are possible.

2) Organizations creating a new code point range may establish one or more values as "User Private," which are not addressed or managed by the registry. Use of "User Private" values requires an MPEG Registration Descriptor (ATSC Doc. T3-548); it is recommended that the guidelines given in the Collision Avoidance document (ATSC Doc. T3-549) be followed.