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AMERICAN NATIONAL STANDARD

ANSI/SCTE 142 2009

**Recommended Practice for
Transport Stream Verification**

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1.0 SCOPE

This Recommended Practice provides a common methodology for describing Transport Stream conformance criteria. This document explicitly describes the elements and parameters of SCTE 54 [2], along with ATSC A/53-3 [5] and A/65 [6] that should be verified in an SCTE Transport Stream for it to be considered a proper emission. It does not cover RF, captioning or elementary streams.

This Standard is based upon an ATSC Recommended Practice, A/78A [16], which provided a complete foundation for this work. SCTE would like to express its gratitude to the ATSC for this pioneering work.

While the SCTE standards define strict limits for each parameter, in practice the severity of the error may depend upon the magnitude of the deviation. This document recommends severity levels associated with the ranges of deviation from the standard in these parameters.

2.0 DEFINITIONS AND ACRONYMS

AEIT - Acronym for Aggregate Event Information Table.

AETT - Acronym for Aggregate Extended Text Table, defined in A/65C [6].

ANSI - Acronym for American National Standards Institute.

ARIB - Acronym for Association of Radio Industries and Businesses.

CM - Acronym for Component Missing.

CRC - Acronym for Cyclic Redundancy Check, defined in 13818-1 [14].

CVCT - Acronym for Cable Virtual Channel Table, defined in A/65C [6].

DPI - Acronym for Digital Program Insertion.

DTS - Acronym for Decoding Timestamp, defined in 13818-1 [14].

DTV - Acronym for Digital Television.

DVB - Acronym for Digital Video Broadcasting.

EAS - Acronym for Emergency Alert System.

EIT - Acronym for Event Information Table, defined in A/65C [6].

EPG - Acronym for Electronic Program Guide.

ES - Acronym for Elementary Stream, defined in 13818-1 [14].

ETT - Acronym for Extended Text Table.

FCC - Acronym for Federal Communications Commission.

GPS - Acronym for Global Positioning System.

L-VCT - Acronym for Long-form Virtual Channel Table, defined in A/65C [6].

MPEG - Acronym for Moving Picture Experts Group.

MGT - Acronym for Master Guide Table, defined in A/65C [6].

NIT - Acronym for Network Information Table, defined in 13818-1 [14].

NTT - Acronym for Network Time Table, defined in A/65C [6].

OOB-SI - Acronym for Out of Band - SI.

PAT - Acronym for Program Association Table, defined in 13818-1 [14].

PCR - Acronym for Program Clock Reference, defined in 13818-1 [14].

PES - Acronym for Packetized Elementary Streams, defined in 13818-1 [14].

PID - Acronym for Packet ID, defined in 13818-1 [14].

PMT - Acronym for Program Map Table, defined in 13818-1 [14].

POA - Acronym for Program Off Air.

PSI - Acronym for Program Specific Information, defined in 13818-1 [14].

PSIP - Acronym for Program and System Information Protocol, defined in A/65C [6].

PTS - Acronym for Presentation Time-Stamp, defined in 13818-1 [14].

PVR - Acronym for Personal Video Recorder.

QAM - Acronym for Quadrature Amplitude Modulation.

QoS - Acronym for Quality of Service.

RAM - Acronym for Random Access Memory.

RF - Acronym for Radio Frequency.

RP - Acronym for Recommended Practice.

RRT - Acronym for Rating Region Table, defined in A/65C [6].

SCTE - Acronym for Society of Cable Telecommunications Engineers.

SI - Acronym for Service Information, defined in ANSI/SCTE 54 [2].

SLD - Acronym for Service Location Descriptor, defined in A/65C [6].

STT - Acronym for System Time Table, defined in A/65C [6].

S-VCT - Acronym for Short-form Virtual Channel Table, defined in A/65C [6].

TNC - Acronym for Technically Non-Conformant.

TOA - Acronym for Transport Stream Off Air.

TVCT - Acronym for Terrestrial Virtual Channel Table, defined in A/65C [6].

TS - Acronym for Transport Stream, defined in ANSI/SCTE 54 [2].

T-STD - Acronym for Transport Stream System Target Decoder, defined in 13818-1 [14].

VCT - Acronym for Virtual Channel Table.

3.0 NORMATIVE REFERENCES

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

3.1 SCTE References

- [1] ANSI/SCTE 43-2005, Digital Video Systems Characteristics Standard for Cable Television
- [2] ANSI/SCTE 54-2009, Digital Video Service Multiplex and Transport System Standard for Cable Television
- [3] ANSI/SCTE 65-2008, Service Information Delivered Out-Of-Band for Digital Cable Television

3.2 Standards from other Organizations

- [4] ATSC A/52B: "Digital Audio Compression (AC-3, E-AC-3) Standard," Advanced Television Systems Committee, Washington, D.C., 14 June 2005.
- [5] ATSC A/53-3:2007: "ATSC Digital Television Standard, Part 3 – Service Multiplex and Transport Subsystem Characteristics," Advanced Television Systems Committee, Washington, D.C., 3 January 2007.

- [6] ATSC A/65C: “Program and System Information Protocol for Terrestrial Broadcast and Cable,” Advanced Television Systems Committee, Washington, D.C., 2 January 2006.

4.0 INFORMATIVE REFERENCES

The following documents may provide valuable information to the reader but are not required when complying with this standard.

4.1 SCTE References

- [7] ANSI/SCTE 35-2007, Digital Program Insertion Cueing Message for Cable
- [8] ANSI/SCTE 18-2007 (also known as ANSI J-STD-042-2002), Emergency Alert Message for Cable
- [9] SCTE 128-2007, AVC Video Systems and Transport Constraints for Cable Television

4.2 Standards from other Organizations

- [10] ATSC A/69: “Recommended Practice: Program and System Information Protocol Implementation Guidelines for Broadcasters,” Advanced Television Systems Committee, Washington, D.C., 25 June 2002.
- [11] ATSC A/110A: “Synchronization Standard for Distributed Transmission, Revision A,” Advanced Television Systems Committee, Washington, D.C., 19 July 2005.
- [12] CableLabs OC-SP-HOST2.1-CFR-I01-070720, OpenCable™ Host Device 2.1 Core Functional Requirements, July 2007.
- [13] ETSI TR 101 290 V1.2.1, Digital Video Broadcasting (DVB): Measurement guidelines for DVB systems, May 2001.
- [14] ISO/IEC IS 13818-1:2000 (E), International Standard, Information technology – Generic coding of moving pictures and associated audio information: systems.
- [15] ISO/IEC 13818-4:2004 (E), International Standard, Information technology – Genetic Coding of Moving Pictures and associated audio information: Conformance Testing.
- [16] ATSC A/78A, Recommended Practice: Transport Stream Verification, 9 May 2007.
- [17] ATSC A/54A, Recommended Practice: Guide to the Use of the ATSC Digital Television Standard, 4 December 2003.

5.0 INTRODUCTION

The SCTE and ATSC standards define the contents and characteristics of the emission Transport Stream. There may be a large number of interactions and interrelationships amongst various components. Successful tuning and display of programs can be enabled if this Transport Stream adheres to the SCTE standards. The connection between the

emission remultiplexer and the QAM modulator is the reference analysis point assumed in this document, as shown in Figure 1.

Please note that this diagram shows only a conceptual, functional block view of a DTV system. In practice, actual implementations will only share MPEG data with other devices using the MPEG-2 Transport Stream (TS), as Elementary Streams (ES) or Packetized Elementary Streams (PES) cannot tolerate the introduction of any transmission errors and once synchronization is lost the system crashes. Furthermore, real systems may group the functions in different ways and will likely appear different on an electrical or physical block diagram.

This Standard uses terms and acronyms defined in ISO 13818-1 [14], A/53-3 [5] and A/65 [6], and assumes a fair degree of familiarity with MPEG-2 systems as implemented per the SCTE standards. Readers that do not recognize the terms should read A/54A [17], A/69 [10], SCTE 54 [2], and SCTE 65 [3].

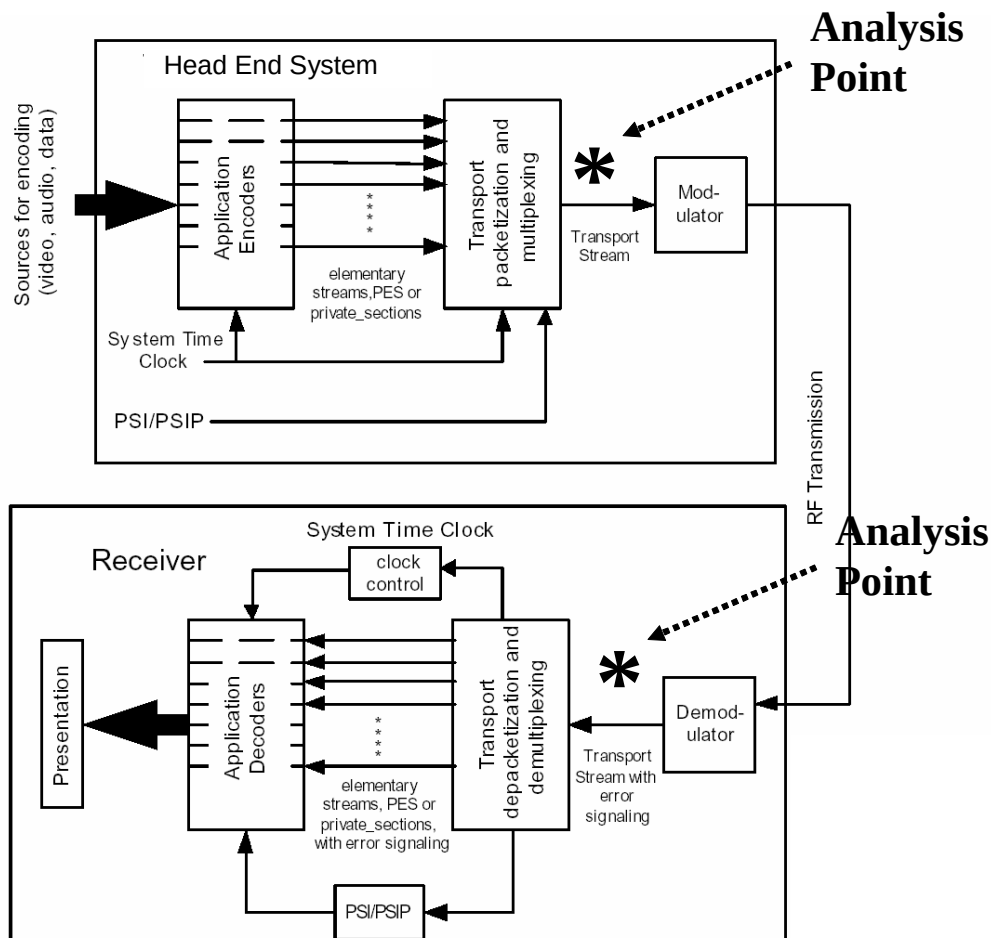


Figure 1 – Reference analysis point in the DTV system.

This Standard identifies transport stream issues by type, dividing errors into the following categories:

- ☐ Section 7.0: PSI tables (PAT and PMT)
- ☐ Section 8.0 Out-Of-Band Tables
- ☐ Section 9.0 In-Band Tables
- ☐ Section 10.0: PSIP tables (MGT, VCT, etc.)
- ☐ Section 11.0: Timing Model and Buffering
- ☐ Section 12.0: Consistency
- ☐ Section 13.0: General Errors

Each error type is also provided with an error severity, as listed below:

- ☐ Transport Stream Off Air (TOA)
- ☐ Program Off Air (POA)
- ☐ Component Missing (CM)
- ☐ Quality Of Service (QOS)
- ☐ Technically Non-Conformant (TNC)

6.0 ERROR CHARACTERIZATION

As noted earlier, in this document, errors are categorized as:

- ☐ Transport Stream Off Air (TOA)
- ☐ Program Off Air (POA)
- ☐ Component Missing (CM)
- ☐ Quality Of Service (QOS)
- ☐ Technically Non-Conformant (TNC)

The distinctions between these are important and should be taken into account both by equipment manufacturers of SCTE TS monitoring equipment and the users of that equipment.

6.1 Regarding “Technically Non-Conformant” error handling

Considering these classes of errors, particular attention needs to be paid to the “TNC” or “Technically Non-Conformant” class. In Standards as complex as MPEG-2 and those from the SCTE, situations arise where two “shall” statements collide. At such junctures, the Transport Stream (TS) may be momentarily non-conformant. An example of this might be “PAT repetition error” (see Section 7.1). If the multiplexer is faced with a choice of outputting a packet carrying a PTS on a video PID on the schedule required by Section 11.2 or a repetition of the PAT within the requirements of Section 7.1, an implementer may choose to output the PTS sample rather than the PAT. Either way, the TS is for a moment non-conformant. Neither choice of non-conformance will affect any real-world receivers. Neither will result in disruption of service. Either will be non-conformant. There is no avoiding these conflicts, and they arise periodically in real-world equipment.