

CEA Bulletin

DTV Recommended Practice for Locating and Navigating among ATSC Television Channels (Including PSIP Recommendations)

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DTV Recommended Practice for Locating and Navigating among ATSC Television Channels (Including PSIP Recommendations)

1 Scope

This bulletin, CEA-CEB12-B, provides guidance for the development and implementation of Advanced Television Systems Committee (ATSC) Program and System Information Protocol (PSIP)-compliant receivers, cable-ready DTV receivers, personal recorders and other consumer electronics devices. It includes recommendations and suggestions for device functionality. CEA-CEB12-B should in no way prohibit consumer device manufacturers from including additional features, and CEA-CEB12-B should not be interpreted as recommending an upper limit to device performance.

Numerous possible PSIP implementation scenarios could be considered. However, CEA-CEB12-B does not include an exhaustive classification of the possibilities; rather, some simpler scenarios are addressed.

CEA-CEB12-B assumes that the user sets up the receiver without professional assistance, and that setup is menu-driven, simple, and mostly automatic. It is possible, however, that receivers may be professionally installed and set up by trained technicians.

CEA-CEB12-B does not currently address receivers that have built-in satellite receiving capability, nor receivers that access EPG databases using phone lines. Nor does it address cable set-top boxes, satellite boxes, VCRs, DVD players, or other auxiliary devices or connections.

CEA-CEB12-B uses the terminology defined in ATSC A/65, and should be read in conjunction with ATSC A/65.

NOTE—Designers should be aware that there are FCC regulations that may apply to functions described in this CEA-CEB12-B; and while every reasonable attempt was made to have this CEA-CEB12-B conform to those regulations in place as of the date of publication, implementers are cautioned to read and understand all applicable regulations.

2 References

Designers are encouraged to use the most recent editions of the reference standards listed here.

2.1 Informative References

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

2.1.1 Informative Reference List

ATSC A/53:2007, ATSC Digital Television Standard, Parts 1-6

ATSC A/65D, Program and System Information for Terrestrial Broadcast and Cable, 2009

CEA-608-E, Line 21 Data Services, April, 2008

CEA-708-D, Digital Television (DTV) Closed Captioning, August, 2008

ANSI/CEA-766-C, U.S. and Canadian Rating Region Tables (RRT) and Content Advisory Descriptors for Transport of Content Advisory Information Using ATSC Program and System Information Protocol (PSIP), April, 2008

ATSC A/69, Recommended Practice: Program and System Information Protocol Implementation Guidelines for Broadcasters, 25 June 2002

2.1.2 Informative Reference Acquisition

CEA Standards and Bulletins:

- Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO USA 80112-5776; Phone 800-854-7179; Fax 303-397-2740; Internet <http://global.ihs.com>; Email global@ihs.com

ATSC Standards:

- Advanced Television Systems Committee (ATSC), 1750 K Street N.W., Suite 1200, Washington, DC 20006; Phone 202-828-3130; Fax 202-828-3131; Internet <http://www.atsc.org/stan&rps.html>

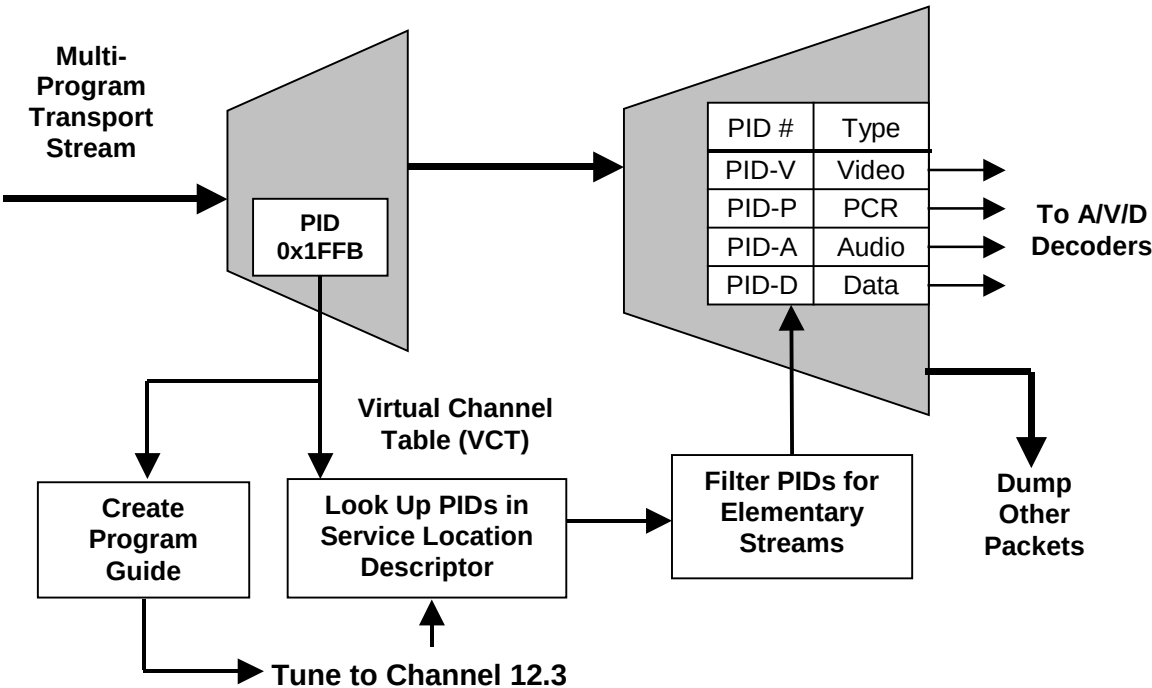
3 Acronyms

AAD	AC-3 Audio Descriptor
ATSC	Advanced Television Systems Committee
CAD	Content Advisory Descriptor
CND	Component Name Descriptor
CSD	Caption Service Descriptor
CVCT	Cable Virtual Channel Table
DCC	Directed Channel Change
DCCT	Directed Channel Change Table
DCCSCT	Directed Channel Change Selection Code Table
DVI	Digital Visual Interface
DTV	Digital Television
ECND	Extended Channel Name Descriptor
EIT	Event Information Table
EPG	Electronic Program Guide
ETT	Extended Text Table
GPS	Global Positioning System
HRC	Harmonically Related Carriers
IRC	Integrally Related Carriers
LTST	Long Term Service Table
MGT	Master Guide Table
NTSC	National Television Systems Committee
PID	Packet Identifier
PMT	Program Map Table
PSIP	Program and System Information Protocol
PTC	Physical Transmission Channel
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RRT	Rating Region Table
SCTE	Society of Cable Telecommunications Engineers
SLD	Service Location Descriptor
STT	System Time Table
STB	Set-top Box
TS	Transport Stream
TSID	Transport Stream Identifier (for ATSC signals), Transmission Signal Identifier (for NTSC signals)
TSSD	Time-Shifted Service Descriptor
TVCT	Terrestrial Virtual Channel Table
UHF	Ultra High Frequency
UTC	Coordinated Universal Time
VC	Virtual Channel
VCT	Virtual Channel Table
VHF	Very High Frequency

VSB Vestigial Side Band
XDS Extended Data Service

4 Overview

The basic ATSC decoder processes PSIP data along with video, audio, and timing information. See Figure 1. Each DTV Physical Transmission Channel's (PTC's) PSIP data stream provides information that receivers should use to select virtual channels (VCs). To initially collect and update this information, receivers scan the channels as described in detail in sections 5 and 7. The data are compiled in a Master Channel Map (see Section 5) and may be used to create a Program Guide Database.



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Figure 1 PIDs & Tuning¹

A user may input a channel number that the receiver uses to select a virtual channel. Virtual channels are acquired using information from the master channel map (see section 5.1).

Receivers should also use the major/minor channel numbers along with other PSIP data to construct an electronic program guide (EPG) on-screen display, a typical example of which is shown in Figure 2. See also section 8.3.4.1.

¹ Tuning, as used in CEA-CEB12-B, refers to either the RF selection process or the virtual channel selection process, or both.

April 8, 2000		6:11 pm					
Chan	Name	6:00 pm	6:30 pm	7:00 pm	7:30 pm	8:00 pm	8:30 pm
12-0	NBZ	Local News		"Dino World"			
12-1	NBZ News & Movies	Local News		"Dino World" (1997) Harrison Pontiac, Peg O'Ryan Dinosaurs eat Newark, NJ in this award-winning film. PG-13 (CC)			
12-2	NBZ-S	Soccer - World Cup Subscription Only			Golf	Table Tennis	

VCT (points to 12-2)
 ETT-V (points to 12-1)
 EIT-0 (points to 12-2)
 Conditional Access (points to Soccer - World Cup)
 ETT-0 (points to Golf)
 Content Advisory (points to Table Tennis)
 Caption Service (points to Table Tennis)

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Figure 2 Electronic Program Guide Example

5 Data Organization

A fundamental aspect of receiver design involves collecting, storing, and maintaining various data items relevant to the navigation function. CEA-CEB12-B refers at various times to three different "channel maps," the Master Channel Map, the User Channel Map, and the Favorites Channel Map. It should be recognized that there are many ways to organize and manage data, and no single way is designated as "right". CEA-CEB12-B examples of data organization should represent one possible approach.

For CEA-CEB12-B purposes three types of channel maps are defined:

- Master Channel Map**—A data structure containing all navigation-related data collected from all NTSC and ATSC signals found on any RF channel. Navigation-related data includes the type of signal received on a given RF channel, the analog TSID value (if available) for an analog NTSC signal and, for a digital signal, all data collected from the Virtual Channel Table in that TS. Master Channel Map data should include information collected from previous scans of the RF channels (this will be necessary if movable antennas are supported).
- User Channel Map**—A data structure that represents the analog and digital programming services offered to the user. The User Channel Map should be derived from the Master Channel Map by processing it to resolve the duplicated service references that might happen if identical analog or digital transmissions are received from multiple sources, for example, broadcast translators. At the discretion of the product designer, the User Channel Map may exclude references to inaccessible services. It may make special provisions for services that require adjustment of an antenna for their access.
- Favorites Channel Map**—The user may indicate that some of the programming services offered in the User Channel Map should be included in a "favorites list." The resulting list of favorite channels is the Favorites Channel Map.

5.1 Master Channel Map

Table 1 is an example of a Master Channel Map. Shaded rows highlight RF channel bands in which analog signals were found. The organizational approach in Table 1 arranges the data according to the RF channel the receiver tuned to receive it. Table 1 shows two portions of the tuned spectrum, corresponding to RF channels 10 through 12 and 20 to 23.

For analog signals (in addition to taking note of the fact that the type of signal found was an analog NTSC waveform), the analog TSID value found in the XDS packets of the NTSC VBI should be recorded, if it is available. In the example, the NTSC signal found on RF channel 12 is identified with an analog TSID

value of 32. The NTSC signal found on RF channel 10 had no TSID and therefore was not associated with the DTV VCT using that major channel number, as it could have been another NTSC channel.

STRONG RECOMMENDATION: For digital signals, the TSID value found in the Program Association Table as well as all data delivered in the Virtual Channel Table should be recorded. ☒

The VCT may include data describing NTSC services as well as digital services on other Transport Streams. In Table 1, the VCT recovered from DTV PTC 21 includes data relevant to an analog NTSC signal whose analog TSID value is 32. An NTSC signal with TSID value 32 was found on RF channel 12. Also in Table 1, the TS with TSID value 25 found at DTV PTC 20 includes a VCT that lists two services carried in the same TS as well as two carried on a different TS (one with a TSID value of 77). Table 1 shows a case where, due to the presence of a translator in the area, the same Transport Stream is received at two different RF frequencies. The Transport Streams received at DTV PTCs 11 and 23 are known to be identical because the TSID value for both is 77.

The Master Channel Map may include other types of data for analog or digital signals, for example the last and/or maximum received signal strength or antenna position (if an electronically operated antenna positioning system is supported).

RF Channel	TSID	VCT	Channel TSID	Source ID	Svc. Type	SLD (PIDs)	Sig. Str.
10	(analog)						
11	77	11.1 KABZ-DT 11.2 KABZ-D2	77 77	1 2	ATSC ATSC	##,##, ##,##,	8.3
12	32 (analog)						
20	25	11.1 KABZ-DT 11.2 KABZ-D2 11.3 KABZ-D3 11.4 KABZ-D4	77 77 25 25	1 2 3 4	ATSC ATSC ATSC ATSC	##,##, ##,##, ##,##, ##,##,	8.6
21	33	12.0 KEBC 12.1 KEBC-D1 12.2 KEBC-D2 12.3 KEBC-D3	32 33 33 33	5 11 12 13	NTSC ATSC ATSC ATSC	- ##,##, ##,##, ##,##,	7.8
22	113	12.1 KU-D1 12.2 KU-D2	113 113	3 4	ATSC ATSC	##,##, ##,##,	0.0
		10.0 KEY 10.1 KEY-D1 10.2 KEY-D2 10.3 KEY-D3	200 201 201 201	17 1 2 3	NTSC ATSC ATSC ATSC	-##,##, ##,##, ##,##, ##,##,	7.9
	201						
23	77	11.1 KABZ-DT 11.2 KABZ-D2	77 77	1 2	ATSC ATSC	##,##, ##,##,	5.5

Table 1 Example Master Channel Map

In the VCT column in Table 1, the channel number reflects the major and minor channel number fields from the VCT (the delimiter, shown here as a decimal point, is not transmitted). The channel name reflects the **short_name** field from the VCT (in this example, some broadcasters chose to include hyphens). The contents of the **short_name** field are at the discretion of the broadcaster.

Designers should be aware that the value of the short_name field in the VCT may not be unique among the various broadcasters in a given area. Two or more broadcasters could name a minor channel "Sports" or "News" for example. The navigation functions in the receiver should accommodate different VCs labeled with the same short_name text.

The column labeled "SLD (PIDs)" in Table 1 demonstrates that the Master Channel Map should include PID data from the Service Location Descriptor (or Program Map Table).

Two different Transport Streams were found (at different times) on DTV PTC 22.

5.2 User Channel Map

Table 2 is an example of one construction of a User Channel Map. Channels listed in the User Channel Map represent programming services offered to the user. In Table 2, the channel number is the primary service identifier, so the User Channel Map is organized by channel number (the virtual number for digital services and the literal RF channel number for analog services).

The fact that translated signals are available for certain services is hidden from the user in the User Channel Map. If the user navigates to channel 11.2, the TS transmitted in either DTV PTC 11 or 23 may be tuned. Both are known to be equivalent because both are identified with TSID value 77.

Chan No. & Name	TSID	Source ID	Favorite?
10			N
10.1 KEY-D1	201	1	Y
10.2 KEY-D2	201	2	Y
10.3 KEY-D3	201	3	Y
11.1 KABZ-DT	77	1	Y
11.2 KABZ-D2	77	2	N
11.3 KABZ-D3	25	3	N
11.4 KABZ-D4	25	4	N
12.0 KEBC	32	5	Y
12.1 KEBC-D1	33	11	Y
12.2 KEBC-D2	33	12	Y
12.3 KEBC-D3	33	13	Y

Table 2 Example User Channel Map

If the user selects a certain channel from the User Channel Map, that particular programming service is accessed by finding the TSID value associated with it in the Master Channel Map. In the Master Channel Map, the RF channel or channels associated with that TSID value are found and tuned.

A channel might be offered in the User Channel Map that is not always accessible (due to signal conditions or antenna placement). When looking for a desired virtual channel, a signal might be found at the RF channel indicated in the Master Channel Map, but it might not be the right one. If the TSID does not match the desired value, the receiver may display a message to the user indicating "Requested channel not available" or something similar. Table 2 illustrates the recommendation that an analog signal that does not include an analog TSID should be represented to the user only by its RF channel number. Accordingly, the receiver should not assume that the signal found on RF channel 10 is the analog service named KEY described in the VCT found in RF channel 22, TSID 201.