

PSIP 101:

What You Need to Know

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The *Program and System Information Protocol (PSIP)* is a collection of tables designed to operate within every transport stream for terrestrial broadcast of digital television. The purpose of the protocol, described in ATSC document A/65, is to facilitate the tuning of programs by specifying the information at the system and event levels for all virtual channels carried in a particular transport stream. Additionally, information for analog channels — as well as digital channels from other transport streams — may be incorporated.

Although the intent of PSIP is well known in the broadcast industry, the implementation details required to make PSIP work are not. This article, therefore, will focus on specific implementation issues.

PSIP information is generated through a process illustrated in Figure 1 for the general case. Figure 2 places the PSIP generator in perspective relative to the ATSC transmission system, and Figure 3 describes the reception and decoding process. Having illustrated the overall program and data flow, the specifics of key elements can be described.

PSIP tables

PSIP, in its most basic form, is a collection of tables, specifically:

- *System time table*, STT, which provides the time reference;
- *Master guide table*, MGT, which contains the pointers to the identification number of the packets that contain

Table	Required for Broadcast?	Required for Cable?
STT	Yes	Yes
MGT	Yes	Yes
VCT	Yes (TVCT)	Yes (CVCT)
RRT	Yes	Yes
EIT	Yes (EIT-0, -1, -2, -3) All others optional	Optional
ETT	Optional	Optional

Table 1. PSIP Tables Required for Transmission in the Broadcast and Cable Modes.

all other tables (except the STT);

- *Virtual channel table*, VCT, which provides attributes for all virtual channels in the *transport stream* (TS);
- *Rating region table*, RRT, which provides rating information for each geographic region;
- *Event information table*, EIT, which provides program titles and technical data about the planned events on the virtual channels;
- *Extended text table*, ETT, which provides detailed descriptions of virtual channels and events;
- *Directed Channel Change Table*, DCCT;
- *Directed Channel Change Selection Code Table*, DCCST.

Not all of these tables are required for terrestrial and cable applications, as detailed in Table 1.

The STT is a short table that is sent in packets with the base PID. It contains the current time, sent once every second,

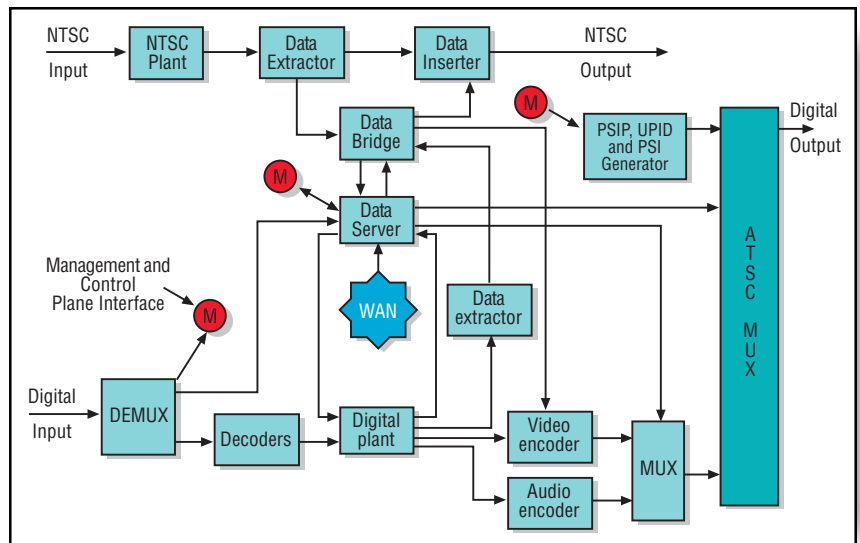


Figure 1. Block diagram of the PSIP generation and insertion process.

and is expected to be very accurate, even though the PSIP standard has a relatively wide implementation tolerance of ± 4 seconds to allow compliant operation before the integrated digital automation systems are standard equipment.

The MGT lists key information about all other PSIP tables (except the STT), including version numbers, table sizes, and PIDs. The MGT allows simpler decoder designs for receivers because any change in PSIP status is flagged in this table. Only the base PID (0x1FFB) needs to be monitored by a receiver to detect changes in PSIP status.

The VCT contains a list of channels

in the TS. It may also include the broadcaster's analog channel and digital channels in other streams. For terrestrial broadcasting, the terrestrial VCT is used (TVCT) and for cable, the TVCT or the cable VCT (CVCT) may be used. Key information contained in the VCT includes the major and minor channel numbers, and *transport stream identification* (TSID), pointers to the component streams that make up a program and descriptive information.

The *major channel number* is used to group all services associated with a broadcaster's NTSC brand, for example Channel 4. The *minor channel number* specifies a particular channel within that group. Zero (0) is reserved for the NTSC channel; all other values (1-999) are allowed for digital services. One common approach is to start

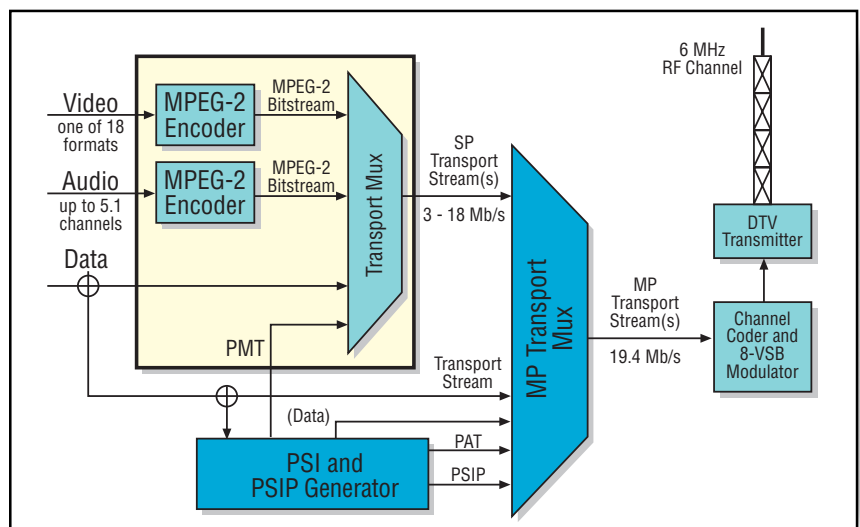


Figure 2. Block diagram of the ATSC transmission system, including PSIP generation and insertion.

with 1 and to continue numerically for different programs. Data services must use 100 or greater. For example, the NTSC channel would be 4-0, the first digital channel signal would be 4-1, the second 4-2, and the first data service 4-100. ATSC document A/65 assigns major channel numbers for existing NTSC broadcasters to be the same as the current NTSC RF channel number (2–69). Rules for other usage are also covered, with the essential requirement that there be no duplication in a market.

The next major table structure is the EIT. Each EIT covers a period of three hours. The starting time for each EIT is constrained to be one of the following UTC (*Coordinated Universal Time*, the current local time at Greenwich, England) times: 00:00 (midnight), 3:00, 6:00, 9:00, 12:00 (noon), 15:00, 18:00, 21:00.

EIT-0 represents the “current” three hours of programming. For terrestrial PSIP, the first four EITs (EIT-0, EIT-1, EIT-2, and EIT-3) representing nine to 12 hours of programming, are required.

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The maximum number of EITs is 128, permitting up to 16 days worth of program information to be delivered to receivers. Figure 4 shows what a typical electronic program guide (EPG) might look like.

The ETT is an optional component. It is used to provide detailed descriptions of virtual channels or events. These descriptions are called *extended text messages* (ETMs). The format of the 32-bit ETM identification element tells the receiver whether the ETM describes a channel or an event within the EIT. This format allows the receiver

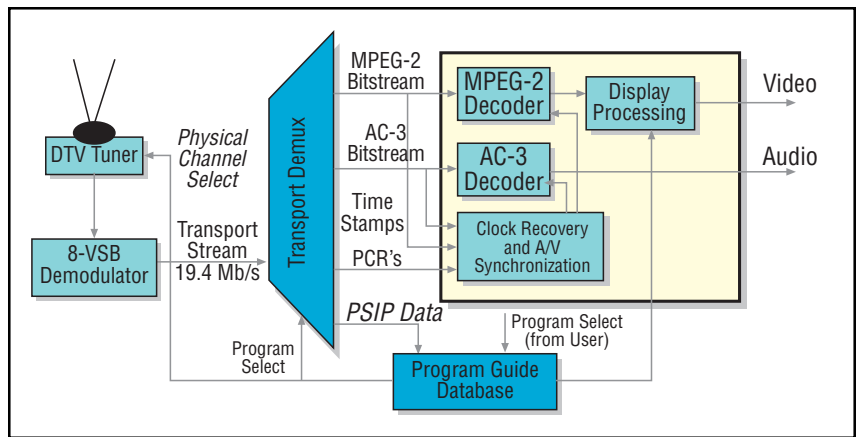


Figure 3. Block diagram of an ATSC decoder, including PSIP extraction and program guide generation.

to search for a single description quickly without having to parse the payload of a large table.

The RRT defines the rating standard for a particular geographic region and/or country. The content advisory descriptor, which may appear in the EIT and PMT, indicates — for a given event — the ratings for any or all of the rating dimensions defined in the RRT.

A channel change may also be based upon the subject matter of the content of the program. Nearly 140 categories of subject matter have been tabulated that can be assigned to describe the content of a program. A broadcaster can use this category of DCC request switching to direct a viewer to a program based upon the viewer’s desire to receive content of that subject matter.

For further information

In this space available, we have just scratched the surface of PSIP implementation. Interested readers are encouraged to consult the following relevant PSIP documents:

- ATSC PSIP Standard A/65, available from the ATSC web site, www.atsc.org
- PSIP Amendment 1 to A/65A (Directed Channel Change), which is now in the final stages of the ATSC approval process
- Conditional Access System for Terrestrial Broadcast (ATSC document A/70), which defines the ATSC conditional access descriptor for the VCT and EIT
- U.S. Region Rating Table and Content Advisory Descriptor for Transport of Content Advisory Information Using ATSC A/65 Program and System Information Protocol, September 1998 (EIA-766)
- In addition, the book *Understanding PSIP: Channel Branding and Navigation for DTV* is recommended. This publication is available for purchase from the National Association of Broadcasters at www.nab.org. There is also a PSIP web page at www.nab.org/scitech/PSIP/default.asp. ■

Channel	Name	6:00 pm	6:30 pm	7:00 pm	7:30 pm	8:00 pm	8:30 pm
6-0	XYZ	City Scene		Travel Log		Movie: <i>Speed II</i>	
6-1	XYZ	City Scene		Travel Log		Movie: <i>Speed II (HD)</i>	
6-2	XYZ	Movie: Start Trek—The Voyage Home				Tune 6-1 for Movie: <i>Speed II (HD)</i>	
6-3L	NC	Local News		Airport Info		HD Program on 6-1	

Figure 4. Example of what an electronic program guide might look like. Future extensions can enable thematic browsing and sorting.

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