



Subtitle Transmission in High Definition

Introduction

With the roll out of High Definition (HD) services has come the requirement to support subtitling in HD. There are many ways of representing subtitles in an HD signal or an HD file format. The results can be used in a conventional broadcast environment, for VOD and IPTV streaming or web based file downloads. This calls for the support of multiple subtitle standards in many transmission and file formats

Scope

This White Paper will describe the subtitling options currently available in HD but will not cover any details on the HD signal formats other than those directly related to the subtitling process.

Only the transmission, monitoring and file based processing parts of the workflow chain will be covered, separate White Papers are available to cover preparation and transcoding.

Subtitle Transmission in HD

Subtitle transmission is the process of taking subtitle data from a file or live input and inserting a suitable signal into the broadcast chain.

In the case of playout from a subtitle file a suitable time code source is required for each channel. See the 'time code in HD' section below.

When it comes to transmitting subtitles for HD services there are five different formats to consider.

- Open (burnt-in or in-vision) subtitles
 - Burnt-in to uncompressed video (HD-SDI)
 - Burnt-in to compressed video (MPEG)
- Teletext subtitles
- DVB bitmapped subtitles (ETS 300 743)
- Imtext subtitles
- Closed captions (EIA 708)



Time code in HD

One part of the video signal that has not changed in HD is the frame rate with rates of 24, 25 and 30 frames per second all supported. The way that time code is represented in the HD-SDI signal (SMPTE 292M-1998) has changed and there are two different recommended practices (SMPTE RP188-1999 and SMPTE RP196-1997).

In both a post production and transmission environment HD time code can be read directly from the HD signal. Some Video servers and VCRs also provide a down-converted SD signal containing VITC timecode which is synchronous with the HD signal and so can be used as a timecode source.

Open Subtitles in HD

There are two methods of adding open subtitles to a video signal as well as the option of pre-processing the video file on a server to add the subtitles. The conventional method is to modify the uncompressed source video with a character generator. New technology now allows a similar process to be performed on compressed MPEG video in a transport stream. This has the advantage that it can be used after the video is encoded and is particularly suitable for downstream modification. See the MPEG insertion, Pass Through and Transcoding White Papers for more details.

Open Subtitles in Uncompressed Video Signals

To insert open subtitles into an HD-SDI (SMPTE 292M-1998) signal requires an HD capable character generator such as the **Polistream G5000** and a subtitle file that has been prepared with a suitably sized font and for the correct aspect ratio. In all other respects the process is the same as for SD.

Open Subtitles in Compressed (MPEG) Video Signals

To insert subtitles into a compressed video stream carried over an ASI signal requires an MPEG graphics inserter such as the **Polistream M4000**. This unit modifies one or more MPEG video streams in a DVB transport stream and can add subtitles, logos or other graphics in real time. MPEG graphics insertion is available in SD as well as HD.

Open Subtitles in Compressed Video Files

Open subtitles can be inserted as graphics into video files in an 'off line' process and often considerably faster than real time. This has many advantages but is only applicable in situations where the media is pre-recorded, the video and subtitle files are available in good time and will never change before transmission. This style of subtitle insertion is ideal for VOD and web delivered content. **MediaMate** supports a wide range of third party transcoding systems including Telestream, Anystream and Rhozet.



Teletext Subtitles in HD

Teletext Subtitles in Uncompressed Video Signals

The HD video signal (HD-SDI to SMPTE 292M-1998) has space allocated for subsidiary data similar to the VBI in an SD signal. This is known as the VANC (Vertical ANCillary data) and HANC (Horizontal ANCillary data). Currently there is no global standard for carrying Teletext data. There are a number of emerging and regional standards including SMPTE-2031 and OP-47 used in Australia. **Polistream** supports the insertion and extraction of VANC data in these and a range of other formats.

Where the HD-SDI signal path is all in the control of the broadcaster then Teletext data can be inserted as a private data stream and extracted downstream as required.

Teletext Subtitles in Compressed Video Signals

Once in the digital broadcast signal Teletext can be carried in a standardised form such as DVB Teletext to ETS 300-472. At this point there is no difference between SD and HD.

Polistream supports the insertion of DVB Teletext for both SD and HD formats.

At the Decoder DVB Teletext is rendered and displayed on screen by the HD STB.

Teletext Subtitles in Compressed Video Files

Some HD file formats and some Video Servers support the storage of VANC data either in the video file or in an associated data file. In these cases the Teletext subtitle data can be added in an 'off line' process, often faster than real time. **MediaMate** supports a wide range of file formats, third party transcoding systems and video servers including Omneon and GVG.



DVB Bitmapped Subtitles in HD

DVB Subtitles in Uncompressed Video Signals

DVB Subtitles can not be transported in an HD-SDI signal as the format is specific to a DVB transport stream. However it is possible to add data into the VANC space of an HD-SDI signal that can be extracted downstream and converted to DVB subtitles by a **Polistream** sub-system.

DVB Subtitles in Compressed Video Signals

DVB bitmapped subtitling to ETS 300-743 is now the EBU recommended subtitling format for all new digital services. DVB Subtitles have the advantage that although the subtitle data is synchronized with the video they are carried in a separate data stream and the video format has no direct impact on the carriage of the subtitle data. This means that the video can be SD, or HD, encoded in MPEG-2, MPEG-4 or any other format without having to change the subtitle format.

The only consideration that affects the subtitle content is the image size. There are two possible approaches to this. Either the receiver can try and scale the subtitles to suit the displayed image size or a suitably sized subtitle bitmap can be prepared in advance. To be able to perform any scaling the size of the original subtitle bitmaps needs to be known. There are extensions to the ETS 300-743 in the latest version V1.3.1 that add source resolution information while remaining backwards compatible.

Polistream supports the encoding and insertion of DVB bitmap subtitles for both SD and HD including the extensions in V1.3.1.

DVB Subtitles in Compressed Video Files

Where the media is stored as compressed and multiplex stream files in Program or Transport stream formats it is possible to add one or more DVB subtitle language streams to these files. The Subtitles are encoded and then multiplexed into the existing stream file, resulting in a new stream file with subtitles. This format is ideal for VOD and IPTV delivery of pre-prepared content. **MediaMate** supports DVB subtitle insertion at up to six times faster than real time.

Imitext Subtitles in HD

The Screen Subtitling Imitext subtitle format is unlikely to be required on HD services.



Closed Captions in HD

Closed Captions in Uncompressed Video Signals

The NTSC closed caption standard is supported within the HD-SDI signal (SMPTE 292M-1998) with space assigned in the VANC for both EIA 608B and EIA708B data. By using an HD compliant encoder closed caption data can be inserted into the HD-SDI signal in the same way as for SD.

Polistream supports the insertion of EIA608B in to SD signals and EIA608B and EIA708B into HD signals.

Closed Captions in Compressed Video Files

Some HD file formats and some Video Servers support the storage of EIA-708 caption data in the VANC space either in the video file or in an associated data file. In these cases the Closed Captions can be added in an 'off line' process, often faster than real time. **MediaMate** supports a wide range of file formats, third party transcoding systems and video servers including Omneon and GVG.

Subtitle Monitoring in HD

The requirement to monitor the subtitle content of a service is driven by 'Quality of Service' agreements and the regulatory requirements for subtitle content in many countries.

In the HD environment monitoring can be divided into the following areas:

- Open subtitling – It is only possible to monitor open subtitles visually as they form part of the picture. For monitoring purposes an SD version of the HD signal would be sufficient, thereby saving the cost of an HD display.
- Teletext subtitles – Once in the broadcast signal Teletext subtitle data is identical to that in SD and can be monitored in the same way. Because the Teletext data is separate from the video it is possible to automate some of the monitoring process to check for subtitle presence and timing.
- DVB bitmapped subtitles - Once in the broadcast signal DVB subtitle data is similar to that in SD and can be monitored in the same way. Any monitoring system would need to be aware of any additional size and positioning extensions to the DVB standard. Because the DVB data is separate from the video it is possible to automate some of the monitoring process to check for subtitle presence and timing.



- Closed Captions – Once in the broadcast signal closed caption data is identical to that in SD and can be monitored in the same way. Because the CC data is separate from the video it is possible to automate some of the monitoring process to check for subtitle presence and timing

The **Polistream MSX** monitoring system provides a single solution for monitoring multiple channels of both SD and HD subtitles including multi-language channels and includes support for the latest version of the DVB standard ETS 300-743 V1.3.1.

HD Subtitle Summary Table

Screen Products can support HD subtitles and captions in all formats and all parts of the workflow. The chart below shows the areas covered.

Use Format	Preparation	Post Production	Transmission	Monitoring
Open (Burnt in)	Y	Y	Y	Y**
Teletext	Y	Y*	Y*	Y
DVB Bitmap	Y	N	Y	Y
Imitext	SD only	SD only	SD only	SD only
Line 21 Closed Caption	Y	Y	Y	Y

Key:

* Technically possible but awaiting agreed standards

** Limited options for monitoring