



## **Encoding Closed Captions for Digital Television**

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### **About Optibase**

Optibase, Ltd. (NASDAQ: OBAS) provides high-quality, cost-effective products that enable the preparation and delivery of MPEG-based digital media over broadband networks. Optibase has created a breadth of product offerings used in applications, such as: video-on-demand; real-time video streaming; digital video archiving; distance learning; and business television. With headquarters in Israel, Optibase operates through its fully-owned subsidiary in Mountain View, California and offices in Austria, France, Japan and China. Optibase products are marketed in over 40 countries through a combination of direct sales, independent distributors, system integrators and OEM partners. For further information, please visit [www.optibase.com](http://www.optibase.com).

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## Introduction

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Over the past decade, the FCC (Federal Communications Commission) has passed extensive legislation requiring broadcasters and TV set manufacturers to make closed captions available on most TV programming. The FCC also declared that caption services must continue to be available as new technologies evolve. This demand is having implications on the move to digital television (DTV), which has also been mandated by the FCC. This white paper gives an overview of closed captions and discusses the implications of the FCC's demand that DTV support closed captions.

## What are Closed Captions?

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Closed captions are subtitles that display the dialogue, narration and sound effects of a TV program. Closed caption data is encoded in line 21 of the NTSC TV signal. Viewers can choose whether or not to display them. A decoder built into or attached to a television set is used to "open" the captions and display the words on the TV screen. The picture below shows closed captions on a TV screen.



## Overview of Laws and Regulations on Closed Captions

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### The Americans with Disabilities Act (ADA) - 1990

The Americans with Disabilities Act (ADA) became law in 1990. ADA protects disabled persons from discrimination in employment, public accommodations, and transportation. The ADA states that disabled persons must have reasonable opportunities to send, receive, and process information with the assistance of auxiliary aids, which includes captioning.

### The Television Decoder Circuitry Act - 1990

In 1990 the FCC passed an amendment called the Television Decoder Circuitry Act of 1990. The law, which went into effect in 1993, states that all TV receivers in use in the US, with screens 13 inches or larger, must have built-in decoder chips to display closed captions. The FCC also declared that caption services must continue to be available as new technologies evolve. This latter requirement is especially relevant in wake of the FCC requirement that all TV stations become fully digital by 2006. In effect, DTV programming has to support closed captions.

### The Telecommunications Act - 1996

A major piece of legislation regarding closed captions came in 1996, when the Telecommunications Act of 1996 mandated that nearly all television programming in the United States had to contain captions. In 1997, the FCC approved a new law which mandated captioning on virtually all television programming in the United States. Section 305 of the Telecommunications Act of 1996 is being implemented as a new section (Section 713) of the existing Communications Act. The ruling has been in effect since January 1998, and phases in requirements separately for "old" and "new" programming.

## The Growing Market Need for Closed Captions

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Although closed captions were developed specifically for people who are hard of hearing, and have been strongly mandated by the FCC, consumer research shows that there is an increasing demand for them by many consumer groups.

- **Videos and DVDs:** The FCC regulations apply to TV programming but closed captions are increasingly available on videos and DVDs. This is the result of growing awareness of the need for closed captions.
- **Noisy public places:** The simplest application for closed captions is in noisy environments such as airports or shopping malls where TV monitors provide ongoing public service information which is interspersed with commercials.
- **Hard of hearing assistance:** In May of 2001, the National Institute on Deafness reported that there are more than 28 million Americans who are deaf or hard of hearing and 30 million more are exposed to dangerous levels of noise. With closed captions hard of hearing people are able to enjoy TV programming, DVDs and videos.
- **English as a foreign language.** 32 million people in the United States speak English is a second language. Studies show that captions can dramatically improve English language, vocabulary, and comprehension among the ESL population.

## The Transition to Digital TV

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The closed caption standard in use today is EIA-608, which specifies the use of closed caption in analog TV signals. But as TV and cable stations begin the transition to full digital environments, all

programming they broadcast will have to support digital closed captions, which are specified in EIA-708. In the interim period, they will probably be supporting both sources. In practice, this means that the encoding and broadcasting equipment used by TV and video production facilities and by TV and cable stations will have to support closed captions in both 608 (analog) and 708 (digital) formats. Eventually, all programming and closed captions will be digital and no conversion between 608 and 708 formats will be required.

Closed captions are produced by companies that usually offer end-to-end captioning services. These include creating textual transcripts based on the sound tracks of TV programs and using software programs to generate the closed caption data that is given to production houses and TV studios so that it can be encoded with the TV signal.

The move from EIA-608 (analog) to EIA-708B (digital) brings with it many improvements. For a full description, please refer to the EIA-708B specification. The following paragraphs outline the increased value of digital closed captioning.

Viewers at home will be able to control the size of the caption text. People with poor vision can make the captions bigger while people who don't want captions covering the picture can make them smaller. Other viewers can leave the captions as they are today. The closed captioning pivots around an "anchor point," which determines what part of the caption is locked to the picture.

EIA-708 offers many more letters and symbols, both for multilingual captioning and for American English. There are letters like Þ ß Ø and many accented letters; as well as some useful symbols, including © ® ™ typographer quotes (“” as opposed to "), and even a closed caption symbol. Support for multiple fonts and more colors will give us more of the attractive "movie subtitle" look rather than the white-on-a-black-box look that is present today. All digital set-top boxes must support 708 closed captioning. The additional color support means up to 64 different text and background colors. The traditional black box as a background can be replaced by a colored box, or done away with entirely in favor of edged or drop-shadowed text. The caption box can also be made translucent.

In addition, much more information can be included in DTV captions. Currently, if we caption a show in two languages (CC1 and CC2) at 250 words per minute, we've about hit the limit of what can be transmitted. There's no room for text or Internet data. EIA-708 increases the data rate by 16 times.

## **Optibase Supports Both EIA-608 and EIA-708B**

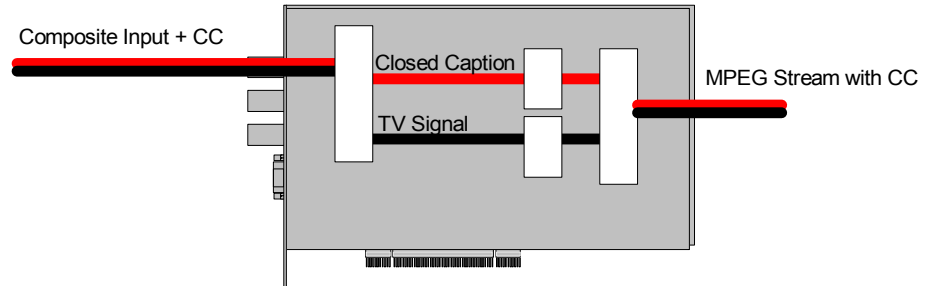
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### ***Encoding Closed Captions based on EIA-608***

Closed caption data is included in the VBI (Vertical Blanking Interval) section of the NTSC analog TV signal. The analog signal has remained virtually unchanged since its development almost four decades ago, except for part of the signal known as the VBI (Vertical Blanking Interval). The VBI is part of the TV signal that is not displayed on TV screens and is used to contain metadata about the TV signal. In addition to information about closed captions, the VBI can also contain information about teletext, time codes, program delivery controls and other reference information relating to the TV signal.

Production house and TV studios take the closed caption data and encode it together with the TV signal. Broadcasters receive an integrated TV signal that includes closed captions.

When production houses and broadcasters encode closed captions they would typically follow the process outlined below:

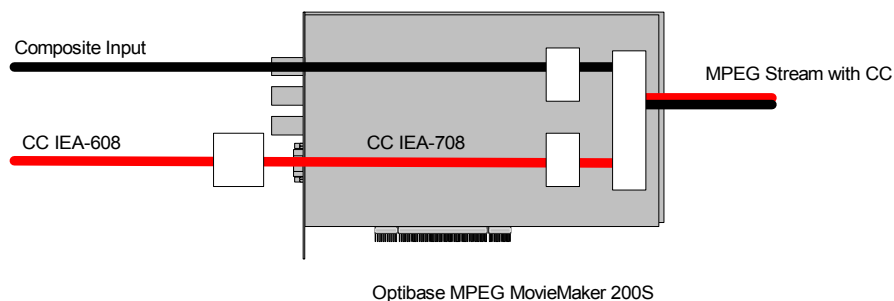


Optibase MPEG MovieMaker 200S

1. A composite analog TV signal is fed into an Optibase MPEG MovieMaker 200S encoding board.
2. MPEG MovieMaker 200S demultiplexes the stream so that the closed caption signal and the TV signal are separated.
3. MPEG MovieMaker 200S demodulates the closed caption stream and compresses the TV signal.
4. MPEG MovieMaker 200S multiplexes the closed caption signal and the encoded MPEG stream and outputs an MPEG-1 or MPEG-2 stream that includes the closed caption signal.

## **Encoding Closed Captions based on EIA-708B**

When encoding closed captions according to the EIA-708 standard, it is necessary to convert the EIA-608 closed caption signal to EIA-708B, as is outlined below.



1. A composite analog TV signal is fed into an Optibase MPEG MovieMaker 200S encoding board.
2. A closed caption EIA-608 signal is fed into a EEG EN520 DTV closed caption encoder or TE500 closed caption upconverter which converts the signal to EIA-708 and then feeds it to the MPEG MovieMaker 200S.
3. MPEG MovieMaker 200S compresses the TV signal.
4. MPEG MovieMaker 200S multiplexes the closed caption EIA-708 signal and the encoded MPEG stream and outputs an MPEG-1 or MPEG-2 stream that includes the closed caption signal.

## **Closed Caption Benefits offered by Optibase's MPEG encoding Boards**

Optibase offers a wide range of MPEG-2 encoding boards that support both EIA-608 and EIA-708B closed caption encoding. Optibase's encoding boards offer production houses and broadcasters numerous benefits:

- The FCC has ruled that effective March 2002, all DTV receivers and set top boxes must contain EIA-708 closed caption decoders. This includes both HD and SD devices and extends to digital cable and satellite receivers.
- Beginning in March 2002, FCC rules require broadcasters to begin phasing in 708-B captioning on DTV programming. By 2006, all DTV programming must be 708-B captioned.
- The FCC requires that by 2006 all broadcasters support digital TV which includes closed captions based on the EIA-708 standard. Both legacy EIA-608 and the new EIA-708B closed caption standards are supported by Optibase MPEG-1 and MPEG-2 encoding boards.
- EIA-708 closed captions support many features that offer benefits not included in EIA-608. These include viewer-sizable fonts, multiple font choices, multiple caption windows, and additional border and drop shadow options.

- Optibase MPEG encoding boards encode closed captions for all types of television and video production, including DVD and CD.

All Optibase MPEG MovieMaker 200S encoding boards support closed captions. Detailed product information is available at [http://www.optibase.com/html/products/MPEG\\_Encoding\\_-\\_Decoding\\_Boards/MPEG-2\\_ENCODING\\_BOARDS/MPEG\\_MovieMaker\\_200S.html](http://www.optibase.com/html/products/MPEG_Encoding_-_Decoding_Boards/MPEG-2_ENCODING_BOARDS/MPEG_MovieMaker_200S.html)