

# Video and Broadcast Components

This chapter presents the PC 98 requirements and recommendations for video playback, video input and capture devices, and technologies for broadcast-enabled computers.

Specific requirements related to video and broadcast components are defined in the following chapters:

- Requirements related to graphics adapters and television output capabilities are defined in the “Graphics Adapters” chapter in Part 4 of this guide.
- Requirements related to displays are defined in the “Monitors” chapter in Part 4 of this guide.
- Requirements related to digital cameras and other digital image input devices are defined in the “Scanners and Digital Cameras” chapter in Part 4 of this guide.

## Contents

---

Introduction to Video and Broadcast Components .....	230
System Requirements for Video and Broadcast Components.....	231
MPEG-2 Playback Requirements .....	236
DVD-Video Playback Requirements.....	239
Video Input and Capture Requirements .....	241
Television Tuner and VBI Capture Requirements .....	242
Digital Broadcast Television Requirements .....	244
PC 98 Design for Video and Broadcast Components.....	248
Plug and Play and Bus Design for Video and Broadcast Components.....	248
Device Drivers and Installation for Video and Broadcast Components.....	249
Video and Broadcast Component References.....	250
Checklist for Video and Broadcast Components.....	252

## Introduction to Video and Broadcast Components

In 1998, video and broadcast television will become integral elements of PC usage, whether for a Consumer, Office, or Entertainment PC. For PC 98, important design issues include:

- Increased quality of video capture and playback, regardless of price point. This includes increased image resolution and increased frame rates.
- Low-latency video delivery, displaying video from both internal and external video devices.
- Easy connectivity and installation for the end user. This requires a reduction in complexity of installation by decreasing the number of components such as power supplies and add-on cards and decreasing the number of user responses required to install a device.
- Implementation of a graphics adapter video port for use by one or more video sources.

**DirectShow for Video Support.** No functionality will be added to Video for Windows (VfW) in any future version of the Windows and Windows NT operating systems. Support for video playback is provided only under Microsoft DirectShow (formerly ActiveMovie).

New technologies that will make PCs more compelling by integrating them with television are also becoming available. These technologies consist of broadcast components that allow PCs to receive television programming, data services, and new forms of entertainment that blend the two, plus user-interface elements appropriate for use on large-screen display devices such as a progressively scanned display or a television monitor. The new technologies will enable new applications, such as the following:

- By combining the PC, the television, and the Internet, content companies can create new types of programming.
- By using broadcast technology to push multimedia-rich Internet content to consumers, broadcast networks can deliver and store data locally on the PC, reducing the Internet bandwidth bottleneck while improving the consumer's overall experience.
- By delivering a new set of secure, billable, and scalable data services—such as subscription services for software, electronic news, and entertainment delivery—broadcast services will encourage the creation of new business models.

These technologies, which will be built into the Windows 98 and Windows NT 5.0 operating systems, are based on industry standards such as MPEG-2, Win32, ActiveX, and DirectX. These technologies are also built on current and emerging standards for broadcast networks and Internet protocols, and they enable multicasting as a point-to-many networking standard for network traffic. Broadcast network capabilities provide a transmission infrastructure that can support automatic software and file updates as well as other services.

**Consumer Electronics and PCs.** The convergence of consumer electronics and personal computing offers new revenue opportunities for participating manufacturers. It also offers the chance for companies from different industries to collaborate on production of new products and services. Companies developing technologies and services that use these components span every industry involved in technology convergence. The related requirements for the elements of broadcast-enabled television are defined in this chapter.

## System Requirements for Video and Broadcast Components

This section summarizes the PC 98 requirements for video and broadcast components.

### 1. System meets PC 98 requirements for DVD-Video and MPEG-2 playback

<i>Consumer PC 98</i>	<i>Office PC 98</i>	<i>Entertainment PC 98</i>
<i>Required</i>	<i>Required with DVD-Video</i>	<i>Required</i>

Under Windows and Windows NT, operating-system playback support for MPEG-1 is provided through DirectShow. This requirement refers to built-in system support for DVD-Video playback or any other MPEG-2 playback capabilities, whether provided as a hardware decoder, a software decoder, or a combination of the two. This requirement does not apply for Office PC 98 systems that provide DVD-ROM drives for storage purposes only.

Related requirements are defined in the “MPEG-2 Playback Requirements” and “DVD-Video Playback Requirements” sections later in this chapter.

### 2. System supports PC 98 analog video input and capture capabilities

<i>Consumer PC 98</i>	<i>Office PC 98</i>	<i>Entertainment PC 98</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Required</i>

Analog video capture capability is recommended for Consumer PC 98 and Office PC 98 and is required for Entertainment PC 98.

Video input and capture functionality can be implemented as an add-on device or as a direct interface on the system board. If video capture capability is implemented in a PC 98 system, it must meet the requirements defined in the “Video Input and Capture Requirements” section later in this chapter.

For PC 98, all video input sources and capture devices must implement driver support as defined for WDM Stream class in the Windows NT 5.0 DDK.

### 3. System includes analog television tuner

<i>Consumer PC 98</i>	<i>Office PC 98</i>	<i>Entertainment PC 98</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Required</i>

An analog television tuner is required for any Entertainment PC 98 system. This can be implemented as a cable tuner or broadcast tuner. For information about the supporting tuner device, see the “Television Tuner and VBI Capture Requirements” section later in this chapter

### 4. System includes digital broadcast or satellite subsystem

<i>Consumer PC 98</i>	<i>Office PC 98</i>	<i>Entertainment PC 98</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>

If this capability is included in a PC 98 system, the implementation must include a digital broadcast or satellite network adapter, a smart card, and drivers that meet PC 98 requirements as defined in the “Digital Broadcast Television Requirements” section later in this chapter.

### 5. System includes DTV support

<i>Consumer PC 98</i>	<i>Office PC 98</i>	<i>Entertainment PC 98</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Required (U.S. only)</i>

This recommendation represents an effort to realize the full potential of digital television (DTV) based on technical standards defined by the Advanced Television Systems Committee (ATSC) across a range of PCs, hybrid PC/TVs, and DTV appliances. ATSC DTV offers the richness of high-resolution video and high-fidelity audio joined with the interactive content of the PC and the Internet.

It is anticipated that within the 1998–99 time frame, Entertainment PC 98 systems will include support for ATSC DTV. This is consistent with current projections for when DTV broadcasts will begin in major U.S. markets. As with all PC 98 components, compliance testing will begin when all related components are generally available.

Specifications and technical information are available at <http://www.atsc.org>. Support for ATSC DTV includes meeting hardware and software requirements for a tuner/demodulator, MPEG-2 decode capabilities, and graphics adapters as defined in the “Digital Broadcast Television Requirements” section later in this chapter.

## 6. Video input, capture, and broadcast device support is based on DirectX foundation class and WDM Stream class

<i>Consumer PC 98</i>	<i>Office PC 98</i>	<i>Entertainment PC 98</i>
-----------------------	---------------------	----------------------------

<i>Required</i>	<i>Required</i>	<i>Required</i>
-----------------	-----------------	-----------------

The driver for any video or tuner device must use the DirectX foundation class to control all video data. The WDM Stream class must be used to support any data streaming. For information, see the DirectX 5.0 DDK and the Windows NT 5.0 DDK. See also the PC 98 requirements defined in the “Device Drivers and Installation for Video and Broadcast Components” section later in this chapter.

## 7. Hardware MPEG-2 decoder uses video port for video data

<i>Consumer PC 98</i>	<i>Office PC 98</i>	<i>Entertainment PC 98</i>
-----------------------	---------------------	----------------------------

<i>Required</i>	<i>Required</i>	<i>Required</i>
-----------------	-----------------	-----------------

For any PC 98 system that includes an MPEG-2 hardware decoder that is not integrated in the graphics accelerator, the decoder must use a video port for piping video data to the graphics adapter’s frame buffer. Systems with MPEG-2 decoders that use the video port of the graphics accelerator must provide a method to disable output. A separate external multiplexor (MUX) meets this requirement.

Systems with multiple video sources that use the video port on the graphics accelerator—including television tuner and capture on the system board or multiple Zoomed Video (ZV) ports—should offer a way to control the flow of video from multiple video sources into a single video port.

For mobile PCs, the ZV standard is available for CardBus peripherals. ZV support must be implemented as defined in *PC Card Standard Guidelines, Volume 10* (PC Card standard). For more information, see the “PC Card” chapter in Part 3 of this guide.

For tri-stated video sources, each source should have a method for arbitrating among multiple devices.

Driver support for any video port implementation must be based on DirectDraw Video Port Extensions (VPE) as defined in the DirectX 5.0 DDK. For more information, see the related “Video port meets PC 98 specifications” requirement in the “Graphics Adapters” chapter in Part 4 of this guide. See also the white paper on DirectDraw VPE and kernel-mode video transport at <http://www.microsoft.com/hwdev/devdes/>.

## 8. PCI-based tuners and decoders support bus mastering with scatter/gather DMA

*Required*

PCI-based hardware must support byte-aligned, multisegment bus master DMA transfers. Devices that are sources (or sinks) for data must be capable of transferring data to or from multiple, non-contiguous host memory buffers that are byte-aligned and odd-sized. The device must support such byte-aligned, odd-sized, non-contiguous buffers using host memory-based buffer transfer descriptors.

This requirement applies for PCI-based MPEG-2 decoders and digital broadcast or satellite television devices. This is required in order to minimize the CPU bandwidth needed to move data from an input source, such as a DVD drive or digital tuner card, to an MPEG decoder.

Because some MPEG-2 packets are 127 bytes long and MPEG-2 streams often contain data bursts and times when data rates are low, bus mastering operations must be able to operate on non-aligned, odd-length data.

Specifically, this means that each stream (with a minimum of eight streams) must have a set of logical buffers (digital broadcast satellite and DVD require a minimum of 16 buffers) composed of physical data segments (with a minimum of 16 + 1 of up to 64K each). Each logical buffer can begin or end on any byte position in physical memory. Thus, the first and last physical data segment can be smaller than a physical memory page (4K), but the intervening segments will be contiguous multiples of the 4K physical-memory page size.

As defined in the “Storage and Related Components” chapter in Part 4 of this guide, DVD drives and other IDE storage controllers and devices must support DMA.

## 9. Background tasks do not interfere with MPEG-2 playback

*Consumer PC 98*

*Office PC 98*

*Entertainment PC 98*

*Required*

*Recommended*

*Required*

This requirement applies to background tasks initiated by applications included with the PC. Video performance should be such that non-foreground tasks—such as downloading a web page or using answering-machine software—should occur without disrupting video playback, including DVD and television. When the user runs an application in the foreground that requires significant system resources, such as a game or video answering machine, the system should degrade gracefully.

For Consumer PC 98, this requirement applies only to applications that are started automatically by the OEM software pre-configuration, such as programs in the Windows/Start Menu/Programs/Startup folder. This guarantees that the video experience “out of the box” is as good or better than consumer television and other A/V components.

For Entertainment PC 98, this requirement applies to all applications included with the system, whether run automatically by the OEM software pre-configuration or run only by the user. This is a critical requirement for Entertainment PC 98 systems, whose users will rely on the PC to perform normal day-to-day operations simultaneously with DVD-Video playback and television.

Specific examples of operations that must not interfere with MPEG-2 playback include the following:

- Answering the telephone to receive voice mail or fax. This applies only to telephony software included with the PC, not third-party software installed by the user. Notice that telephone answering must not be automatically disabled during MPEG-2 playback unless explicitly configured by the user.
- Running scheduled communications tasks such as automatic connection using the modem or ISDN to transfer e-mail and faxes, download cached Internet content, and so on.

**Note:** Programs that make intensive use of system resources or that are designed for interactive foreground operation are excluded from this requirement. This includes games, video and audio playback, speakerphone, and disk utilities such as error checking, defragmentation, and virus protection.

Notice also that for software decoder implementations, compliance testing for the Entertainment PC 98 requirement will begin in a reasonable time frame after enhanced kernel-mode support is provided for MPEG-2 video playback in the Windows operating system.

## **10. All components meet PC 98 general device requirements**

### *Required*

This includes the basic requirements for a Plug and Play device ID, automated software-only settings for device configuration, device drivers and Windows-based installation, and icons for external connectors. For more information, see the “Basic PC 98” chapter in Part 2 of this guide.

**Note:** To ensure proper connection by the user between the video graphics array (VGA) monitor, S-Video, and composite cables and connectors, an icon must be added to any external connector using vendor designs or any of the appropriate designs provided in the “Icons” appendix in the References part of this guide.

## MPEG-2 Playback Requirements

The requirements in this section apply for MPEG-2 decoders. All requirements apply for both software and hardware decoders or any combination of both unless otherwise noted in a specific requirement. The requirements in this section apply for devices that support playback of an MPEG-2 stream from any source, including DVD, digital or broadcast satellite systems, ATSC DTV, hard drives, and so on.

Any PC 98 system that includes the ability to play back MPEG-2 must meet the requirements listed here to ensure quality playback of MPEG-2 data. A PC with an MPEG-2 playback application and MPEG-2 decoder is an example of a system that must meet these requirements.

For example, an Office PC 98 system that includes a DVD-ROM drive for storage purposes but does not include DVD-Video playback software is exempt from these requirements but must warn users that the feature is not supported.

For decoder driver requirements, see the “Device Drivers and Installation for Video and Broadcast Components” section later in this chapter. For related MPEG-2 audio playback requirements, see the “Audio Components” chapter in Part 4 of this guide.

**Important:** An MPEG-2 hardware decoder must meet the PC 98 requirements for bus mastering. If a hardware solution is implemented that is not integrated in the graphics accelerator, a video port must also be included as part of the video subsystem, as defined in the “System Requirements for Video and Broadcast Components” section earlier in this chapter.

### 11. System warns users if it cannot play DVD movies

*Consumer PC 98*

*Office PC 98*

*Entertainment PC 98*

*Required*

*Required if no DVD-Video*

*Required*

An Office PC 98 system that includes a DVD-ROM drive used only for storage purposes must warn end users that DVD-Video playback is not supported whenever such media is inserted in the drive. All system types that support playback of DVD-Video discs must warn users if a DVD-Video disc from another region is inserted in the drive.



## 12. MPEG-2 playback meets PC 98 requirements

*Consumer PC 98*

*Office PC 98*

*Entertainment PC 98*

*Required*

*Required with DVD-Video*

*Required*

All MPEG-2 decoder implementations—whether implemented as hardware, software, or a combination of both—must be capable of the following:

- **MPEG-2 Main Profile at Main Level (MP@ML) playback, with no dropped frames.** Playback requirements include full-frame rate decode of MPEG-2 MP@ML input streams, up to and including the following frame sizes and rates:

720 × 480 at 60 fields per second

720 × 480 at 24 frames per second

720 × 576 at 50 fields per second

720 × 576 at 24 frames per second

Decoded frame rate is measured at the graphics frame buffer. The actual rate at which video is displayed (or rendered) is covered in the following requirement for smooth frame delivery.

- **Smooth frame delivery.** Video frames must be displayed within one-half frame of the intended display time. This requirement is satisfied for implementations in which video frames are completely rendered into a DirectDraw surface and flipped using the DirectDraw Flip API or a hardware autoflip within one-half frame of the intended display time.

It is generally accepted in the video broadcast industry that any level of frame slippage or jitter will be noticeable to viewers and will be considered an annoyance compared to the smooth viewing experience provided by standard broadcast television, VCRs, and so on.

- **Rates for decoding and displaying data.** This requires MPEG-2 data rates of up to 9.8 Mb/s for Consumer PC 98 and Office PC 98, and 15 Mb/s for Entertainment PC 98.
- **Synchronized audio and video.** Audio and video must be synchronized to within one video frame.
- **Proper handling of field-based content.** This requirement includes the dynamic field/frame switching capability.
- **No tearing.** This requires proper video buffering, such as double buffering.
- **Correct display of multiple aspect ratio content.** This requirement includes support for Pan Scan and letterbox-formatted content.
- **Closed captioning support.** Line 21 data must be parsed out of the *extension\_and\_user\_data* and made available for decoding for both DVD and digital broadcast satellite line 21 syntax.

- **Output of all remaining frames at the end of the data sequence.** This requirement ensures output of all remaining frames when the decoder receives one of the following:
  - A `sequence_end_code` message (which differs from an `Ipin::EndOfStream()` function call)
  - A time discontinuity
- **Splicing MPEG.** Decoders must properly interpret the `Closed_Gop` flag by dropping B frames before the first I frame after either a data discontinuity is received or the `Broken_Link` flag is set.

Notice the related video and MPEG-2 support requirements for graphics adapters, such as YUV (4:2:0 and 4:2:2) off-screen overlay surface and up/down bilinear interpolated scaling as defined in the “Hardware Acceleration for Video Playback” section in the “Graphics Adapters” chapter in Part 4 of this guide.

### **13. Retail adapters with hardware MPEG-2 decoders enable a standard video port connection to the graphics adapter**

*Required*

Retail upgrade adapters sold independent of PC systems can use PCI for video transfer to the graphics adapter but must also enable a video port connection to the graphics adapter.

It is expected that an advanced video port specification will be standardized by the VESA Video Port committee within the PC 98 time frame. It is strongly recommended that MPEG-2 implementations on all PC systems and retail adapters comply with this standard as soon as possible after standardization. This will become a requirement in future versions of these design guidelines.

### **14. MPEG-2 decoder supports pull-down algorithm**

*Recommended*

An MPEG-2 software or hardware decoder should be able to detect and behave accordingly when 3:2 pulldown (or any other algorithm) is being used to display 24-fps video. The kernel-mode video transport component in DirectDraw 5.0 requires this information from the decoder in order to know when a particular field-skipping algorithm is being used so it knows which fields to skip.

Notice that even if the subsystem supports 3:2 pulldown out of the decoder, the encoder should still be able to receive the 3:2 content.

For more information, see the DirectX 5.0 DDK; see also the article on <http://www.microsoft.com/hwdev/devdes/>.

## DVD-Video Playback Requirements

In addition to the requirements in the previous section, the following requirements apply for systems that provide DVD-Video playback software and hardware. The goal for DVD and other audio/video (A/V) playback is to ensure that the end-user experience is the same or better than with a stand-alone DVD player.

### **15. DVD decoder driver correctly handles media types, time discontinuity, and decode-rate adjustment**

*Required*

This requirement specifies that the vendor-supplied minidrivers for DVD, MPEG-2, and AC-3 decoders have the following capabilities:

- Use the correct media types, including validation of all format block fields on connection and on every IPin::QueryAccept message.
- Query for IMediaSample2 on every received media sample to test for a time discontinuity bit.
- Adjust the decode rate in response to IPin::NewSegment() calls for video and subpicture.

### **16. DVD decoder supports subpicture compositing and closed captioning**

*Required*

The system must be capable of displaying subpicture data as well as providing closed-captioning support for all such data stored on the disc. This requires YUV offscreen overlay surface support, as defined in the “Adapter supports MPEG-2 and DVD-Video features” requirement in the “Graphics Adapters” chapter in Part 4 of this guide.

Subpicture streams must be supported as defined in *DVD Specification, Version 1.0*, by Toshiba Corporation.

**Note:** Alpha blending is required for static menus. However, until alpha blending of YUV surfaces is implemented in graphics adapters, RGB chroma-keying of subpictures and closed-captioning information appearing over motion video is an acceptable alternative, although visually degraded, for 1998.

**17. Subpicture decoder correctly handles subpicture properties and other functions***Required*

The minidriver for the subpicture decoder must be able to correctly handle the following:

- Must be able to set the subpicture property
- Must be able to turn the subpicture compositing on and off
- Must be able to set the highlight rect parameters

For more information, see the Microsoft DirectX 5.1 SDK and the DirectX 5.0 information in the Windows NT 5.0 DDK.

**18. System supports seamless DVD-Video 1.0 navigation***Required*

This requirement includes menu navigation, video selection, and language and subpicture track selection in support of the user's ability to navigate DVD-Video discs. Test sources include but are not limited to the following:

- Matsushita Electronics Incorporated (MEI) test disc
- Joe Kane Productions Video Essentials disc

**19. System provides a licensed CSS copyright protection scheme***Required*

The system must provide a licensed copy scramble system (CSS) implementation and support for CSS encoded DVD-Video discs to ensure proper protection for content produced in accordance with CSS, including regionalization and analog video protection/analog protection system (APS).

To facilitate the authentication process required by this scheme, software is provided as part of the Windows and Windows NT operating system support for DVD. This allows a DVD-ROM drive to authenticate and transfer keys with a CSS decrypter. Windows and Windows NT operating system software will act as the agent to allow either hardware or software decrypters to be authenticated.

For more information about copyright protection requirements, see the "Storage and Related Peripherals" chapter in Part 4 of this guide. For information about CSS or to obtain a CSS license, contact MEI (see <http://www.mei.co.jp>), or contact the CSS licensing entity when it is established.

## Video Input and Capture Requirements

This section summarizes requirements based on new capabilities that support video capture in the Windows 98 and Windows NT 5.0 operating systems. Analog video capture is required for Entertainment PC 98 but not for other PC 98 system types. If this feature is implemented, the requirements in this section must be met.

For requirements related to digital cameras and other digital image input devices, see the “Scanners and Digital Cameras” chapter in Part 4 of this guide.

### **20. Video input or capture device supports capture of NTSC/PAL picture quality**

*Required*

Video decoders must be capable of decoding 4:3 aspect-ratio, square-pixel  $640 \times 480/768 \times 576$  resolution at 30/25 fps at 16 bpp. Decoding of 4:2:2 data format is also required.

### **21. Analog video capture device outputs video data rate of 3.7 MB per second, minimum**

*Required*

Systems with capture devices must be capable of capturing 3.7 MB per second to disk, providing the user with the ability to capture of 8:1 compression (M-JPEG) of NTSC video.

### **22. Video input or capture device supports time-code reading**

*Recommended*

Time code is a standard representation of time developed for the video and film industries. Time code is an absolute time format expressed in hours, minutes, seconds, and frames as required by frame-accurate video-editing applications. Separate standards are established for NTSC and PAL systems, as follows:

- For NTSC-based systems, the defining standard is ANSI/SMPTE 12M. Both drop and non-drop frame formats should be supported.
- For PAL-based systems, the defining standard is IEC Publication 461. For film, the defining standard is SMPTE Recommended Practice (RP) 136.

### **23. Digital video camera uses external bus support**

*Required*

Digital video cameras must provide connectivity using physical wire and driver support to new external buses with isochronous capabilities, particularly USB and IEEE 1394 for high frame-rate devices.

**Note:** For systems that support video capture and input from multiple sources, it is recommended that the graphics adapter include a video port. For requirements related to implementing a video port, see the “Video port meets PC 98 specifications” requirement in the “Graphics Adapters” chapter in Part 4 of this guide.

## Television Tuner and VBI Capture Requirements

This section defines requirements for television tuner capabilities and VBI data capture capabilities in support of the Windows Broadcast Architecture. This architecture is designed to enable a wide range of data broadcasting services, including the use of decoded data captured from broadcast television signals during the vertical blanking interval (VBI) as well as from video scan lines. An Entertainment PC 98 system must include both television tuner and VBI capture capabilities.

For more information about the operating system Broadcast Architecture and capabilities supported by Windows operating systems, see the Windows NT 5.0 DDK and the white papers available from <http://www.microsoft.com/windows/tv/>.

Cable and broadcast television data networks can inject digital data into any or all video scan lines, including those usually used for images, in the same way that VBI lines can contain data. In general, a VBI decoder refers to the processing of the raw VBI samples into data packets. VBI capture refers to an analog-to-digital converter (ADC) taking VBI samples of VBI data bits. A VBI decoder takes those samples and performs additional processing to determine bit values from the samples. The VBI decoder also handles specific encoding schemes.

VBI decoding can be performed either in hardware or in software. Software VBI decoders need access to oversampled VBI data. In operation, a VBI decoder is similar to a network adapter, except that the data flow is receive-only.

Notice that some requirements in this section specify support related to NABTS data or other locale-specific formats. Devices designed for locales that support other standards do not have to meet these requirements. However, some requirements specify NABTS as an example data format; in these cases, the device must meet the requirements for relevant locale standards.

**Important:** A PCI-based tuner and VBI capture or decoder device must meet the PC 98 requirements for bus mastering. A video port is also highly recommended for all implementations, as defined in the “System Requirements for Video and Broadcast Components” section earlier in this chapter.

**24. Television tuner supports PC 98 audio and video performance***Required*

The audio and video performance capabilities for a television tuner are similar to those defined in the “MPEG-2 Playback Requirements” section earlier in this chapter, including the following:

- Deliver data at full frame rate with smooth delivery and no duplicated frames for both interleaved and progressive video.
- Audio and video playback synchronized to within one video frame.
- Video output quality includes proper handling of field-based content, no tearing, and correct display of multiple aspect ratio content

**25. Television tuner includes stereo tuner and supports SAP***Consumer PC 98**Office PC 98**Entertainment PC 98**Recommended**Recommended**Required*

This requirement includes support for a secondary audio programming (SAP) channel.

For devices designed for use in Europe and South Africa, the device should support Near-Instantaneously Companded Audio Multiplex (NICAM 728) as the standard for digital multichannel sound transmission.

**26. VBI capture oversamples VBI data at least four times***Required*

To ensure accurate data reception, data transmitted on all lines of the VBI must be oversampled at least four times the NABTS data bit rate (or locale-specific data bit rate). For example, if there are 288 bits of NABTS data on a scan line, approximately 1,152 bits plus the necessary margin (that is, the number required for timing tolerances in the NABTS specification and also for timing uncertainties within the capture hardware) must be captured per scan line.

**27. VBI capture detects validity of scan-line data***Required*

Each scan line designated for data reception provides a confidence indication about the quality of the received signal (0–100). This is based on the errors encountered in performing the A-to-D. This confidence information will be used to adjust the ranges of decoded scan lines. This QOS will be used to discover the data available on each possible scan line.

**28. VBI capture makes VBI data available to the CPU for processing***Required*

Raw data samples from VBI lines must go into host memory that can be addressed by the CPU. This data is used to read data encoded into broadcast transmissions, such as closed captioning, NABTS, and Teletext.

To minimize the CPU bandwidth required to process VBI data, the hardware must have the ability to bus master all individual scan lines to different host buffers.

## Digital Broadcast Television Requirements

The requirements in this section apply for any type of system that implements a digital broadcast subsystem, whether receiving satellite, cable, or terrestrial broadcasts. Such capabilities are recommended but not required for all PC 98 system types.

Notice that digital broadcast and satellite support under PC 98 includes all the requirements for hardware decoder capabilities and driver support as defined in this chapter, plus support for the DirectX foundation class, as defined in the Windows NT 5.0 DDK.

**Important:** A digital broadcast receiver must meet the PC 98 requirements for bus mastering. A video port is also highly recommended for all implementations, as defined in the “System Requirements for Video and Broadcast Components” section earlier in this chapter.

**29. Digital broadcast card can receive all video, audio, data, and other streams***Required*

This can be a receiver for cable or broadcast DTV. The receiver card must be installed on a PCI or IEEE 1394 bus and must provide data tuning, conditional access, de-multiplexing, and other network-specific functions.

The receiver card must be able to receive both normal broadcast network-related information, such as MPEG video, audio, and program guide information, as well as data-stream information.



**30. Digital broadcast card can receive full bandwidth from each frequency***Required*

The receiver card must be able to receive from and send to the host all information transmitted on any tuner or transponder frequency. For example, if each satellite system transponder has 30 Mb/s of bandwidth, a single-tuner receiver card should be able to transfer all 30 Mb/s of data to the host.

**31. Digital broadcast card can receive a minimum of eight simultaneous streams***Required*

Recommended: More than eight simultaneous streams.

The receiver card must be able to simultaneously receive and send a minimum of eight streams to the PC on the same carrier frequency. These streams can be of any type, such as eight simultaneous data streams.

These streams, often called service channel IDs (SCIDs) or program IDs (PIDs), are subdivisions of bandwidth on a single tuner frequency.

**32. System includes multiple digital broadcast tuner cards***Recommended*

The device can also simultaneously receive two or more frequencies. The ability to tune to multiple frequencies results in better concurrent data and video operation. With two tuners, the viewer could watch a video on one frequency and download web pages on the other. This also enables picture-in-picture or multiple data streams on different channels or transponders.

**33. Digital broadcast card provides support for legacy conditional access***Required*

Cards must support conditional access mechanisms for any subscriptions, pay-per-view events, and other network-specific access-control mechanisms available on the broadcast services for which they are designed.

In many cases, this is a removable smart card that has been paired with code and run on a secure processor on the card.

**34. Digital broadcast card provides signal quality and other diagnostic information***Required*

The card must be able to self-test and provide diagnostic information such as signal strength, error rate, cable short-circuit events, and the status of any input fuse or circuit breaker. Because these cards are connected to public networks, these capabilities are essential to the carriers who need to diagnose problems in the system.

**35. Digital broadcast card supports general-purpose data cryptography***Recommended*

The digital broadcast receiver card must be able to provide triple data encryption standard (DES) hardware—or single-DES when restricted by export laws—and RSA public-key secure decryption hardware. Hardware anti-tampering countermeasures must be implemented. This capability is separate from and completely independent of other digital broadcast capabilities.

To allow secure broadcasting of bulk-encrypted data, a secure decryption engine must be implemented in the hardware. This engine must have fast key loading, low data latency, and high data throughput in order to support high-speed data networks.

All DES and RSA private keys must be stored in protected RAM and ROM, respectively, within the device so that it cannot be easily read using physical means. The manufacturer also must sign the RSA public keys, and the RSA signature must be stored within the decryption hardware. Furthermore, this triple-DES decryption hardware must be able to decrypt data at the full rate that a stream can be acquired by broadcast receiver hardware.

**36. Digital broadcast card supports substream filtering***Required*

The digital broadcast receiver card must be able to filter out unneeded data substreams (sometimes called subSCIDs or subPIDs) in order to reduce bus activity and CPU usage. Substreams allow data broadcasters to dynamically subdivide their broadcast bandwidth among many data streams of differing size.

Substream filtering lets the host specify which substreams it wants to receive and which should be ignored. This avoids unnecessary bus utilization for data streams that will be discarded by the host software.

**37. ATSC DTV tuner is fully implemented***Required*

If an ATSC DTV tuner is implemented, it must meet the requirements for video and audio compression, packetized data transport structure, and modulation and transmission system as specified in *ATSC Digital Television Standard (A/53)*, available at <http://atsc.org/>.

The tuner should be the same as the analog television tuner for VHF/UHF reception.

**38. Stream splitting is supported using DirectShow filters***Recommended*

If a hardware solution is implemented, it must be possible to read all data input. Stream splitting can be done on the host CPU using DirectShow filters in the same manner as support is implemented for DVD-Video input data streams.

For current information about the software support planned for this capability, see the related DTV white papers at <http://www.microsoft.com/windows/tv/>.

**39. MPEG-2 decoder and video port support ATSC DTV standard***Required*

In a system that supports DTV reception, both the MPEG-2 decoder and the video port must support the final format specifications for layered ATSC DTV in *ATSC Digital Television Standard (A/53)*. The estimated minimum is 2xML resolutions and bit rates, which are proposed as  $704 \times 480$  with a 15 Mb/s input bit rate and a 20 million pixels per second output rate. For current format specifications, see the related white papers on the web site at <http://www.microsoft.com/windows/tv/>.

Formats for this requirement depend on the specific geographical area, and therefore include ATSC 8-Vestigial Side Band (8-VSB), Digital Video Broadcast (DVB), or Orthogonal Frequency Division Multiplexing (OFDM).

This requirement is in addition to the PC 98 requirements for MPEG-2 hardware and playback capabilities defined in the “MPEG-2 Playback Requirements” section earlier in this chapter.

Notice that this requirement is also in addition to the PC 98 requirements for video ports as defined in the “Graphics Adapters” chapter in Part 4 of this guide. As with all PC 98 components, compliance testing will begin when all related components are generally available.

## PC 98 Design for Video and Broadcast Components

This section summarizes requirements related to the PC 98 design initiatives defined in Part 1 of this guide.

## Plug and Play and Bus Design for Video and Broadcast Components

The items in this section summarize requirements for Plug and Play and other resource-related and bus-related capabilities.

### **40. Each device has a Plug and Play device ID**

*Required*

Each device must have a Plug and Play device ID as required for the bus it uses, as defined in Part 3 of this guide. For example, a PCI device must comply with PCI 2.1 requirements and must provide a Subsystem ID and Subsystem Vendor ID as defined in the “PCI” chapter in Part 3 of this guide.

For video and broadcast hardware, a device can be implemented as a single function device or as part of a multifunction device. All memory and register resources for this functionality must be distinct and separate from any other functions in the multifunction case.

### **41. Conflict resolution and dynamic disable capabilities are supported**

*Required*

The operating system must be capable of automatically assigning, disabling, and relocating the resources used by this device when necessary, using the method required for the related bus class. All configuration settings must be capable of being made through software, with no system reboot required.

When the end user changes this device or adds it to the system, setting resource assignments must not require changing jumpers or switches on either the adapter or the system board. In the event of an irreconcilable conflict with other devices on the system, the operating system must be capable of disabling the device to prevent the system from stalling. A disabled device must not claim any resources while disabled.

### **42. Dependent video device is not independently enumerated**

*Required*

If a video device is implemented as a dependent device on a multifunction adapter, it must not be independently enumerated. Instead, its parent must be responsible for installing and loading its driver and for updating the registry on its behalf.

## Device Drivers and Installation for Video and Broadcast Components

This section summarizes the PC 98 requirements for video and broadcast components.

### **43. Device drivers and installation meet PC 98 requirements**

*Required*

The manufacturer does not need to supply a driver for a device if the device passes PC 98 compliance testing using a driver provided with the operating system. If the manufacturer supplies a driver, then the requirements for the device drivers and installation are defined in the “Basic PC 98” chapter in Part 2 of this guide. The basic requirements include driver support for unattended installation and Help file support if special driver parameters are used.

All video components must use a WDM minidriver instead of a VfW driver. For PC 98, a VfW driver is not compliant with these requirements. For information about WDM driver support, see the Windows NT 5.0 DDK. See also the related articles at <http://www.microsoft.com/hwdev/pcfuture/>.

Drivers for hardware decoders and for the audio and video subsystems must be implemented as described in the Windows NT 5.0 DDK in order to support DirectShow, DirectDraw 5.0 VPE, and WDM.

### **44. Software drivers are installed during hardware driver installation**

*Required*

Any additional required device-dependent software such as software codecs or NDIS transports must be installed during the device driver installation routine and must be included in the device INF file.

### **45. Applications provided with device meet Win32 requirements**

*Required*

Recommended: Video and image editing applications bundled with the device should support DirectShow.

Any Windows-based applications provided with the device must meet software compatibility requirements as defined by the Win32 SDK. Applications installed with the device must use a standard Windows-based installation method as defined in the Win32 SDK.

**46. NDIS 5.0 driver provided for digital broadcast receiver***Required*

The driver for the digital broadcast receiver must be implemented as an NDIS 5.0 driver. The miniport portion of the driver has the extra interface required for network-specific functions such as tuning, access control, program-guide retrieval, and MPEG data retrieval. Drivers for each card must be supplied by the card vendor or network provider.

For information about NDIS 5.0 driver support, see the Windows NT 5.0 DDK.

## Video and Broadcast Component References

The following represents some of the references, services, and tools available to help build hardware that is optimized to work with Windows operating systems.

Advanced Television Systems Committee (ATSC) standards

National Association of Broadcasters, (800) 368-5644

Society of Motion Picture and Television Engineers, (914) 761-1100

E-mail: [mktg@smpte.org](mailto:mktg@smpte.org)

<http://www.atsc.org>

ANSI/SMPTE 12M

SMPTE Recommended Practice (RP) 136 and time-code standards

Society of Motion Picture and Television Engineers

595 West Hartsdale Avenue

White Plains, NY 10607-1824

<http://www.smpte.org/stds/stsubj.html>

DirectDraw VPE and kernel-mode video transport white papers

<http://www.microsoft.com/hwdev/devdes/>

DTV and broadcast architecture white papers

<http://www.microsoft.com/hwdev/pcfuture/bcast1.htm>

<http://www.microsoft.com/windows/tv/>

*DVD Specification, Version 1.0*, Toshiba Corporation.

<http://www.toshiba.com>

EIA Standard #ANSI/EIA-516-1988: “Joint EIA/CVCC Recommended Practice for Teletext: North American Basic Teletext Specification (NABTS).”

Electronic Industries Association  
2500 Wilson Boulevard  
Arlington, VA 22201-3834  
<http://www.eia.org/>

IEC Publication 461  
<http://www.iec.ch/>

Matsushita Electronics Incorporated (MEI) test disc  
<http://www.mei.co.jp>

*PC Card Standard Guidelines, Volume 10* (PC Card standards)  
PCMCIA  
2635 North First Street, Suite 209  
San Jose, CA 95134 USA  
Phone: (408) 433-2273  
Fax: (408) 433-9558  
E-mail: [office@pcmcia.org](mailto:office@pcmcia.org)  
<http://www.pc-card.com/>

SFF 8090 (Mt. Fuji specification) and other SFF specifications  
FaxAccess: (408) 741-1600 (fax-back)  
Fax: (408) 867-2115  
<ftp://fission.dt.wdc.com/pub/standards/SFF/specs/>

Video Essentials test disc from Joe Kane Productions, Inc.  
<http://www.videoessentials.com/>

WDM driver support white papers  
<http://www.microsoft.com/hwdev/pcfuture/>

Windows NT DDK, Windows DDK, and DirectX DDK and SDK, including  
NDIS and broadcast services documentation  
MSDN Professional membership

## Checklist for Video and Broadcast Components

If a recommended feature is implemented, it must meet the PC 98 requirements for that feature as defined in this document.

<b>Consumer PC 98</b>	<b>Office PC 98</b>	<b>Entertainment PC 98</b>
1. System meets PC 98 requirements for DVD-Video and MPEG-2 playback <i>Required</i>	<i>Required with DVD-Video</i>	<i>Required</i>
2. System supports PC 98 analog video input and capture capabilities <i>Recommended</i>	<i>Recommended</i>	<i>Required</i>
3. System includes analog television tuner <i>Recommended</i>	<i>Recommended</i>	<i>Required</i>
4. System includes digital broadcast or satellite subsystem <i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>
5. System includes DTV support <i>Recommended</i>	<i>Recommended</i>	<i>Required (U.S. only)</i>
6. Video input, capture, and broadcast device support is based on DirectX foundation class and WDM Stream class <i>Required</i>	<i>Required</i>	<i>Required</i>
7. Hardware MPEG-2 decoder uses video port for video data <i>Required</i>	<i>Required</i>	<i>Required</i>
8. PCI-based tuners and decoders support bus mastering with scatter/gather DMA <i>Required</i>		
9. Background tasks do not interfere with MPEG-2 playback <i>Required</i>	<i>Recommended</i>	<i>Required</i>
10. All components meet PC 98 general device requirements <i>Required</i>		
11. System warns users if it cannot play DVD movies <i>Required</i>	<i>Required if no DVD-Video</i>	<i>Required</i>
12. MPEG-2 playback meets PC 98 requirements <i>Required</i>	<i>Required with DVD-Video</i>	<i>Required</i>
13. Retail adapters with hardware MPEG-2 decoders enable a standard video port connection to the graphics adapter <i>Required</i>		
14. MPEG-2 decoder supports pull-down algorithm <i>Recommended</i>		
15. DVD decoder driver correctly handles media types, time discontinuity, and decode-rate adjustment <i>Required</i>		
16. DVD decoder supports subpicture compositing and closed captioning <i>Required</i>		
17. Subpicture decoder correctly handles subpicture properties and other functions <i>Required</i>		



Consumer PC 98	Office PC 98	Entertainment PC 98
18. System supports seamless DVD-Video 1.0 navigation <i>Required</i>		
19. System provides a licensed CSS copyright protection scheme <i>Required</i>		
20. Video input or capture device supports capture of NTSC/PAL picture quality <i>Required</i>		
21. Analog video capture device outputs video data rate of 3.7 MB per second, minimum <i>Required</i>		
22. Video input or capture device supports time-code reading <i>Recommended</i>		
23. Digital video camera uses external bus support <i>Required</i>		
24. Television tuner supports PC 98 audio and video performance <i>Required</i>		
25. Television tuner includes stereo tuner and supports SAP <i>Recommended</i>	<i>Recommended</i>	<i>Required</i>
26. VBI capture oversamples VBI data at least four times <i>Required</i>		
27. VBI capture detects validity of scan-line data <i>Required</i>		
28. VBI capture makes VBI data available to the CPU for processing <i>Required</i>		
29. Digital broadcast card can receive all video, audio, data, and other streams <i>Required</i>		
30. Digital broadcast card can receive full bandwidth from each frequency <i>Required</i>		
31. Digital broadcast card can receive a minimum of eight simultaneous streams <i>Required</i>		
32. System includes multiple digital broadcast tuner cards <i>Recommended</i>		
33. Digital broadcast card provides support for legacy conditional access <i>Required</i>		
34. Digital broadcast card provides signal quality and other diagnostic information <i>Required</i>		
35. Digital broadcast card supports general-purpose data cryptography <i>Recommended</i>		
36. Digital broadcast card supports substream filtering <i>Required</i>		
37. ATSC DTV tuner is fully implemented <i>Required</i>		

<b>Consumer PC 98</b>	<b>Office PC 98</b>	<b>Entertainment PC 98</b>
38. Stream splitting is supported using DirectShow filters <i>Recommended</i>		
39. MPEG-2 decoder and video port support ATSC DTV standard <i>Required</i>		
40. Each device has a Plug and Play device ID <i>Required</i>		
41. Conflict resolution and dynamic disable capabilities are supported <i>Required</i>		
42. Dependent video device is not independently enumerated <i>Required</i>		
43. Device drivers and installation meet PC 98 requirements <i>Required</i>		
44. Software drivers are installed during hardware driver installation <i>Required</i>		
45. Applications provided with device meet Win32 requirements <i>Required</i>		
46. NDIS 5.0 driver provided for digital broadcast receiver <i>Required</i>		