

Questions from the article "How HDTV Works"

1. Why does the author make a comparison between analog and digital television?

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2. Many people are looking forward to America adopting the digital television standard. What is the biggest disadvantage of this switch for the American consumers?

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3. What kind of digital television would be best for watching movies on DVD.

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4. When, according in the article, will analog broadcasting end?

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**Communication Technology**

# How HDTV Works

*adapted from an article by Tracy V. Wilson*

## HDTV?

When the first high-definition television (HDTV) sets hit the market in 1998, movie buffs, sports fans and tech aficionados got pretty excited, and for good reason. Ads for the sets hinted at a television paradise with superior resolution and digital surround sound. With HDTV, you could also play movies in their original widescreen format without the letterbox "black bars" that some people find annoying.

But for a lot of people, HDTV hasn't delivered a ready-made source for transcendent experiences in front of the tube. Instead, people have gone shopping for a TV and found themselves surrounded by confusing abbreviations and too many choices. Some have even hooked up their new HDTV sets only to discover that the picture doesn't look good.

Fortunately, a few basic facts easily dispel all of this confusion. In this article, we'll explain the acronyms and resolution levels and give you the facts on the United States transition to all-digital television.



**HDTVs don't have to be enormous. This 26-inch set is HDTV ready.**

## Analog, Digital and HD

For years, watching TV has involved analog signals and cathode ray tube (CRT) sets. The signal is made of continually varying radio waves that the TV translates into a picture and sound. An analog signal can reach a person's TV over the air, through a cable or via satellite. Digital signals, like the ones from DVD players, are converted to analog when played on traditional TVs.



**Analog TVs like this one can't use a digital signal without a set-top converter.**

**The Analog System has worked pretty well for a long time, but it has some limitations:**

- Conventional CRT sets display around 480 visible lines of pixels. Broadcasters have been sending signals that work well with this resolution for years, and they can't fit enough resolution to fill a huge television into the analog signal.
- Analog pictures are interlaced - a CRT's electron gun paints only half the lines for each pass down the screen. On some TVs, interlacing makes the picture flicker.
- Converting video to analog format lowers its quality.

United States broadcasting is currently changing to digital television (DTV). A digital signal transmits the information for video and sound as ones and zeros instead of as a wave. For over-the-air broadcasting, DTV will generally use the UHF portion of the radio spectrum with a 6 MHz bandwidth, just like analog TV signals do.

### DTV has several advantages:

- The picture, even when displayed on a small TV, is better quality.
- A digital signal can support a higher resolution, so the picture will still look good when shown on a larger TV screen.
- The video can be progressive rather than interlaced - the screen shows the entire picture for every frame instead of every other line of pixels.
- TV stations can broadcast several signals using the same bandwidth. This is called multicasting.
- If broadcasters choose to, they can include interactive content or additional information with the DTV signal.
- It can support high-definition (HDTV) broadcasts.

DTV also has one really big disadvantage: Analog TVs can't decode and display digital signals. When analog broadcasting ends, you'll only be able to watch TV on your trusty old set if you have cable or satellite service transmitting analog signals or if you have a set-top digital converter.

This brings us to the first big misconception about HDTV. Some people believe that the United States is switching to HDTV, that all they'll need for HDTV is a new TV and that they'll automatically have HDTV when analog service ends. Unfortunately, none of this is true.

### Important DTV Dates

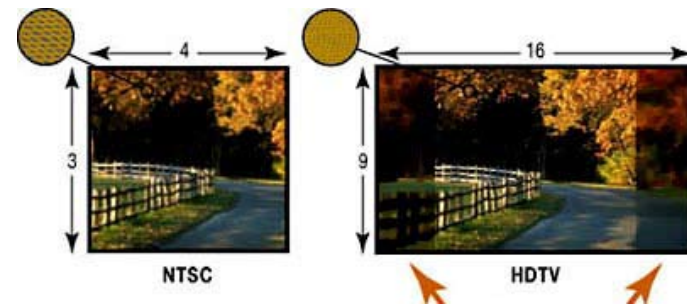
July 1, 2006: All new 25" or larger sets must have DTV tuners or be DTV-ready

March 1, 2007: All new 13" or larger sets must have DTV tuners or be DTV-ready

February 17, 2009: Proposed shutoff date for over-the-air analog broadcasts

### DTV vs. HDTV

The Advanced Television Standards Committee (ATSC) has set voluntary standards for digital television. These standards include how sound and video are encoded and transmitted. They also provide guidelines for different levels of quality. All of the digital standards are better in quality than analog signals. HDTV standards are the top tier of all the digital signals.



Standard vs. high-definition aspect ratio

### Standard vs. high-definition aspect ratio

The ATSC has created 18 commonly used digital broadcast formats for video. The lowest quality digital format is about the same as the highest quality an analog TV can display. The 18 formats cover differences in:

- **Aspect ratio** - Standard television has a 4:3 aspect ratio - it is four units wide by three units high. HDTV has a 16:9 aspect ratio, more like a movie screen.
- **Resolution** - The lowest standard resolution (SDTV) will be about the same as analog TV and will go up to 704 x 480 pixels. The highest HDTV resolution is 1920 x 1080 pixels. HDTV can display about ten times as many pixels as an analog TV set.
- **Frame rate** - A set's frame rate describes how many times it creates a complete picture on the screen every second. DTV frame rates usually end in "i" or "p" to denote whether they are interlaced or progressive. DTV frame rates range from 24p (24 frames per second, progressive) to 60p (60 frames per second, progressive). interlaced.

Many of these standards have exactly the same aspect ratio and resolution - their frame rates differentiate them from one another. When you hear someone mention a "1080i" HDTV set, they're talking about one that has a native resolution of 1920 x 1080 pixels and can display 60 frames per second, interlaced.

### The 18 Primary DTV Standards

	Resolution	Aspect Ratio	Frame Rate (i = Interlaced, p = Progressive)
<b>HDTV</b>	1920 x 1080	16:9	24p, 30p, 60i
	1280 x 720	16:9	24p, 30p, 60p
<b>SDTV</b>	704 x 480	16:9	24p, 30p, 60i, 60p
	704 x 480	4:3	24p, 30p, 60i, 60p
	640 x 480	4:3	24p, 30p, 60i, 60p

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### The 18 Primary DTV Standards

Broadcasters get to decide which of these formats they will use and whether they will broadcast in high definition - many are already using digital and high-definition signals. Electronics manufacturers get to decide which aspect ratios and resolutions their TVs will use. Consumers get to decide which resolutions are most important to them and buy their new equipment based on that.

Until the analog shutoff date, broadcasters will have two available channels to send their signal - a channel for analog, and a "virtual" channel for digital. Right now, people can watch an over-the-air digital signal only if they are tuned in to the broadcaster's virtual digital channel. After analog broadcasting ends, the only signals people will receive over the air will be digital.

However, even though a digital signal is better quality than an analog signal, it isn't necessarily high definition. HDTV is simply the highest of all the DTV standards. But whether you see a high-definition picture and hear the accompanying Dolby Digital® sound depends on two things. First, the station has to be broadcasting a high-definition signal. Second, you have to have the right equipment to receive and view it.

### MPEG-2

DTV usually uses MPEG-2 encoding, the industry standard for most DVDs, to compress the signal to a reasonable size. MPEG-2 compression reduces the size of the data by a factor of about 55:1, and it discards a lot of the visual information the human eye would not notice was missing.