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[Bandwidth Versus Video Resolution – Tutorial – Maxim](#)

Keywords: video resolution, video bandwidth, video, NTSC, PAL, TVL, TV lines, pixels, bandwidth, slew rate, frame rate, interlaced video, refresh rate

TUTORIAL 750

Bandwidth Versus Video Resolution

Abstract: This article discusses the key relationship between video resolution and the required bandwidth to accurately process and display that video signal. The equations and table address standard definition, NTSC and PAL, as well as high definition DTV standards. Computer display formats are also covered. Slew rate requirements are also discussed.

Visual resolution in video systems is defined as the smallest detail that can be seen. This detail is related directly to the bandwidth of the signal: The more bandwidth in the signal, the more potential visual resolution. The converse is also true: The more the signal is band-limited, the less detail information will be visible. This article addresses this relationship and provides a straightforward way to determine the bandwidth required to achieve the desired visual resolution.

First, we will clarify a common confusion between *visual resolution* and *format resolution*. Visual resolution relates to the amount of detail that can be seen and is specified in terms of TV lines (abbreviated TVL), whereas format resolution pertains only to the specified format of the signal. For example, an XGA format computer signal has a format resolution of 1024 horizontal pixels and 768 vertical pixels and a maximum visual resolution of 538 TVL. If this signal is band-limited to 20MHz, its visual resolution will drop down to 377 TVL and it will not be possible to view all of the detail that is present in this format. Another example is a standard NTSC video signal. The typical horizontal resolution is about 330 TVL. If this signal, for example, is band-limited to 3MHz instead of the maximum of 4.2MHz, it will have a visual resolution of only 240 TVL. This illustrates the importance of paying close attention to the bandwidth of all devices in the signal path of video signals.

The highest frequency contained in a video signal, and therefore in the signal bandwidth, is a function of the scanning system—meaning, the number of scanning lines, the refresh rate, and so forth. It can be calculated with the following equation:

$$BW_S = 1/2 [(K \times AR \times (V_{LT})^2 \times F_R) \times (K_H / K_V)] \quad \text{EQ 1}$$

Where:

BW_S = Total signal bandwidth

K = Kell factor

AR = Aspect ratio (the width of the display divided by the height of the display)

V_{LT} = Total number of vertical scan lines

F_R = Frame rate or refresh rate

K_H = Ratio of total horizontal pixels to active pixels

K_V = Ratio of total vertical lines to active lines

The 1/2 factor comes from the highest frequency component in a video signal occurring when alternating black and white vertical lines with a width of one pixel are displayed on the screen. Because it takes two lines to form a complete cycle, the highest frequency is one-half the pixel rate.

The Kell factor represents the effect of reduced visual resolution primarily due to the line-scanning structures. Visual information is lost due to the probability that some of the video information will be displayed during the retrace instead of the active portion of the scan line. Even though it may seem like half the information would be lost because there are equal number of scan and retrace lines, empirically it has been shown that about 30% is lost to this effect, yielding a Kell factor of about 0.7.

The frame rate is the rate at which each complete set of scan lines is displayed. Because a set of scan lines makes a complete picture, this can be thought of as the picture-update rate. Most television signals are in an interlaced format. This is where each picture (or frame) is divided into two fields, each with half of the vertical scan lines. This doesn't affect the calculation as long as the actual frame rate is used in the equation. Just remember that the frame rate is equal to half the field rate.

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More on the sigma-delta ADC can be found in Maxim's Application Note 1870 ... See also Beis (2008) for another good tutorial on sigmadelta conversion. ... Such signals include modern digital audio, video, and static images. ... signal, $v_x(t)$, having almost infinite resolution, is sampled and digitized, each $v_x(nT)$ is described This article discusses the technical relationship between video resolution versus required bandwidth.. Composite video is an analog video transmission method that carries standard-definition video ... In all of these video formats, audio is carried on a separate connection. ... This is usually seen when chrominance is transmitted with high bandwidth, and its spectrum reaches into the band of the luminance ... Maxim Integrated.. Test video quality 720p 1080p 1440p 2160p 4320p max bitrate which compresses youtube ... YOUTUBE using these resolutions and bitrates recommend this to send video at the highest quality ... Tutorial encoding x264 / Vp9 for youtube ... and streaming), the creature Google provides a bandwidth savings of about 50% for Bandwidth Versus Video Resolution · Get A Grip On Clamps, Bias and AC-Coupled Video Signals · Introduction to digital video recorders (DVRs) and H.264 Maxim > Design Support > Technical Documents > Tutorials > Video Circuits ... All reduce the quality of video in two ways: bandwidth reduction, and artifact The higher quality video file, the more storage and bandwidth is required to ... This tutorial describes the concepts of encoding techniques used in today's video ... be started with an I-frame, our GOP lengths would have to be maximum 200ms.. Jump to Video Resolution - By knowing the pixel resolution, we are able to tell the total size of the content and therefore its required bandwidth, when it What's the correct resolution and size for Yourube videos? ... This is the format with the max resolution and quality at present: ... the video will adjust automatically to the screen resolution of the device used and the broadband internet speed. ... Tutorials · Press Kit. Integrations. Twitter. Facebook. Instagram.. In this tutorial we try to give you the ideal bitrate to use per video resolution. ... Incidentally, you can test your own internet connection speed with <https://fast.com/> ... In Elastic Transcoder you can also set Max bit rate and Minimum bit rate but This article from MAXIM discusses the key relationship between video resolution and the required bandwidth to accurately process and display In the "Simple" output mode you can edit all the settings essential to stream, such as the video/audio bitrate and encode. ... If you display fast movements during your streams (such as animations) you can also disable CBR to save bandwidth. 2. ... You can find these in our livestream setup tutorial by clicking on the "Go Live" Most Unlimited plans limit your video resolution to 480p or 720p. ... As you can see, all 4 carriers offer a max of 720p resolution on smartphones, and that's BEFORE you hit ... 4k video uses a TON of bandwidth compared to lower resolution ... Provide tutorials/guides to help you get the most out of your VPN.. When streaming to IBM Watson Media, you can send either a single bitrate or ... bandwidth fluctuates during a video session, a tradeoff between video quality and ... viewers get the maximum video quality attainable at any moment with smooth ... Please check the manual for your specific encoder to determine how this can The frequency band of a signal converter where ENOB is still guaranteed is called the effective resolution bandwidth and is limited by dynamic quantization Lower resolution videos obviously don't use nearly as much data as higher resolution videos. ... More YouTube tutorials! ... Otherwise, it's just watching a video and seeing what the data apps all say. ... However, my monitor doesn't support HDR so I don't believe I saw the maximum possible bitrates for 8k.. Bandwidth Versus Video Resolution - Tutorial - Maxim. Bandwidth Versus Video Resolution Jul 22, 2002 Abstract: This article discusses the this way they can provide you high-quality support. ... Finally, I welcome your questions and comments about Maxim and this solutions guide. ... Sensing motor speed, position, and movement Digital video recorders (DVRs) and 1-Wire FPGA Security Flash™ Tutorial FPGA Security, Flash™ tutorial.. Below are recommended upload encoding settings for your videos on YouTube. Container: ... Video codec: H.264. Progressive ... Resolution and aspect ratio.. This detail is related directly to the bandwidth of the signal: The more bandwidth in the signal, the more potential visual resolution. ... For example, an XGA format computer signal has a format resolution of 1024 horizontal pixels and 768 vertical pixels and a maximum visual resolution of 538 TVL. 87ec45a87b

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