1080p

1080p (1920×1080 pixels; also known as **Full HD** or **FHD**, and BT.709) is a set of HDTV high-definition video modes characterized by 1,920 pixels displayed across the screen horizontally and 1,080 pixels down the screen vertically;[1] the *p* stands for progressive scan, *i.e.* non-interlaced. The term usually assumes a widescreen aspect ratio of 16:9, implying a resolution of 2.1 megapixels. It is often marketed as Full HD or FHD, to contrast 1080p with 720p resolution screens. Although 1080p is sometimes informally referred to as 2K, these terms reflect two distinct technical standards, with differences including resolution and aspect ratio.

TV standards through 1080p. The red-tinted image shows 576i or 576p resolution. The blue-tinted image shows 720p resolution, an HDTV level of resolution. The full-color image shows 1080 resolution.

1080p video signals are supported by ATSC standards in the United States and DVB standards in Europe. Applications of the 1080p standard include television broadcasts, Blu-ray Discs, smartphones, Internet content such as YouTube videos and Netflix TV shows and movies, consumer-grade televisions and projectors, computer monitors and video game consoles. Small camcorders, smartphones and digital cameras can capture still and moving images in 1080p resolution.

Contents

Broadcasting standards

Any screen device that advertises 1080p typically refers to the ability to accept 1080p signals in native resolution format, which means there are a true 1920 pixels in width and 1080 pixels in height, and the display is not over-scanning, under-scanning, or reinterpreting the signal to a lower resolution. The HD ready 1080p logo program, by DIGITALEUROPE, requires that certified TV sets support 1080p 24 fps, 1080p 25 fps, 1080p 50 fps, and 1080p 60 fps formats, among other requirements, with fps meaning frames per second. For live broadcast applications, a high-definition progressive scan format operating at 1080p at 50 or 60 frames per second is currently being evaluated as a future standard for moving picture acquisition. Although 24 frames per second is used for shooting the movies.[2][3] EBU has been endorsing 1080p50 as a future-proof production format because it improves resolution and requires no deinterlacing, allows broadcasting of standard 1080i50 and 720p50 signal alongside 1080p50 even in the current infrastructure and is compatible with DCI distribution formats.[4][5]

1080p50/p60 production format requires a whole new range of studio equipment including cameras, storage and editing systems,[6] and contribution links (such as Dual-link HD-SDI and 3G-SDI) as it has doubled the data rate of current 50 or 60 fields interlaced 1920x1080 from 1.485 Gbit/s to nominally 3 Gbit/s using uncompressed RGB encoding. Most current revisions of SMPTE 372M, SMPTE 424M and EBU Tech 3299 require YCbCr color space and 4:2:2 chroma subsampling for transmitting 1080p50 (nominally 2.08 Gbit/s) and 1080p60 signal. Studies from 2009 show that for digital broadcasts compressed with H.264/AVC, transmission bandwidth savings of interlaced video over fully progressive video are minimal even when using twice the frame rate; i.e., 1080p50 signal (50 progressive frames per second) actually produces the same bit rate as 1080i50 signal (25 interlaced frames or 50 sub-fields per second).[4][5][7]

ATSC

In the United States, the original ATSC standards for HDTV supported 1080p video, but only at the frame rates of 23.976, 24, 25, 29.97 and 30 frames per second (colloquially known as **1080p24**, **1080p25** and **1080p30**). In July 2008, the ATSC standards were amended to include H.264/MPEG-4 AVC compression and 1080p at 50, 59.94 and 60 frames per second (**1080p50** and **1080p60**). Such frame rates require H.264/AVC *High Profile Level 4.2*, while standard HDTV frame rates only require Level 4.0. This update is not expected to result in widespread availability of 1080p60 programming, since most of the existing digital receivers in use would only be able to decode the older, less-efficient MPEG-2 codec, and because there is a limited amount of bandwidth for subchannels.

DVB

In Europe, 1080p25 signals have been supported by the DVB suite of broadcasting standards. The 1080p50 format is considered to be a future-proof production format and, eventually, a future broadcasting format.[2] 1080p50 broadcasting should require the same bandwidth as 1080i50 signal and only 15–20% more than that of 720p50 signal due to increased compression efficiency,[4] though 1080p50 production requires more bandwidth or more efficient codecs such as JPEG 2000, high-bitrate MPEG-2, or H.264/AVC and HEVC.[5][8] In September 2009, ETSI and EBU, the maintainers of the DVB suite, added support for 1080p50 signal coded with MPEG-4 AVC *High Profile Level 4.2* with Scalable Video Coding extensions or VC-1 *Advanced Profile* compression; DVB also supports 1080p encoded at ATSC frame rates of 23.976, 24, 29.97, 30, 59.94 and 60.[9][10]

EBU requires that legacy MPEG-4 AVC decoders should avoid crashing in the presence of SVC or 1080p50 (and higher resolution) packets.[9] SVC enables forward compatibility with 1080p50 and 1080p60 broadcasting for older MPEG-4 AVC receivers, so they will only recognize baseline SVC stream coded at a lower resolution or frame rate (such as 720p60 or 1080i60) and will gracefully ignore additional packets, while newer hardware will be able to decode full-resolution signal (such as 1080p60).

In June 2016, EBU announced the "Advanced 1080p" format[11] which will include UHD Phase A features such as high-dynamic-range video (using PQ and HLG) at 10 and 12 bit color and BT.2020 color gamut, and optional HFR 100, 120/1.001 and 120 Hz; an advanced 1080p video stream can be encoded alongside baseline HDTV or UHDTV signal using Scalable HEVC. The ITU-T BT.2100 standard that includes Advanced 1080p video was subsequently published in July 2016.

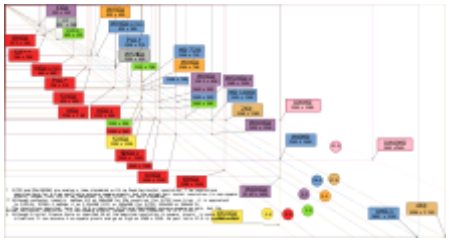
Resolutions

In practice, 1080p typically refers to a 1920×1080 raster with a 16:9 picture aspect ratio and a 1:1 ("square") pixel aspect ratio. The following is a list of other resolutions with a picture height of 1080 lines that are sometimes referred as 1080p.

Standard	Resolution	Picture aspect ratio
1080p HD widescreen	1920×1080	16:9
1080p 4:3 or anamorphic 16:9	1440×1080	4:3 or anamorphic 16:9
Ultrawide HD	2560x1080	21:9
FullHD+	2160×1080	2:1
	1728×1080	16:10 / 8:5

Availability

Broadcasts



This chart shows the most common display resolutions, 16:9 formats shown in blue.

In the United States, 1080p over-the-air are currently being broadcast experimentally using ATSC 3.0 on NBC affiliate WRAL-TV in North Carolina, with select stations in the US announcing that there will be new ATSC 3.0 technology that will be transmitted with 1080p Broadcast television, such as Fox affiliate WJW-TV in Cleveland.[12][13] All other broadcast television stations do not broadcast at 1080p as ATSC 3.0 is currently in experimentation and in test trials while all major broadcast networks use either 720p60 or 1080i60 encoded with MPEG-2. While converting to ATSC 3.0 is voluntary, there is no word when any of the major networks will consider airing at 1080p in the foreseeable future. However, satellite services (e.g., DirecTV, XstreamHD and Dish Network) utilize the 1080p/24-30 format with MPEG-4 AVC/H.264 encoding for pay-per-view movies that are downloaded in advance via satellite or on-demand via broadband. At this time, no pay service channel such as USA, HDNET, etc. nor premium movie channel such as HBO, etc., stream their services live to their distributors (MVPD) in this format because many MVPDs, especially DBS and cable, do not have sufficient bandwidth to provide the format streaming live to their subscribers without negatively impacting their current services.

For material that originates from a progressive scanned 24 frame/s source (such as film), MPEG-2 lets the video be coded as 1080p24, irrespective of the final output format. These progressively-coded frames are tagged with metadata (literally, fields of the PICTURE header) instructing a decoder how to perform a 3:2 pulldown to interlace them. While the formal output of the MPEG-2 decoding process from such stations is 1080i60, the actual content is coded as 1080p24 and can be viewed as such (using a process known as inverse telecine) since no information is lost even when the broadcaster performs the 3:2 pulldown.[14]

In June 2016, Germany commenced terrestrial broadcasts of eight 1080p50 high-definition channels, using DVB-T2 protocol with HEVC encoding; a total of 40 channels will be available by March 2017.[15]

Blu-ray Disc

Blu-ray Discs are able to hold 1080p HD content, and most movies released on Blu-ray Disc produce a full 1080p HD picture when the player is connected to a 1080p HDTV via an HDMI cable. The Blu-ray Disc video specification allows encoding of 1080p23.976, 1080p24, 1080i50, and 1080i59.94. Generally this type of video runs at 30 to 40 megabits per second, compared to the 3.5 megabits per second for conventional standard definition broadcasts.[16]

Smartphones

Smartphones with 1080p FullHD display have been available on the market since 2012. As of late-2014, it is the standard for mid-range to high-end smartphones and many of the flagship devices of 2014 used even higher resolutions, either Quad HD (1440p) or Ultra HD (2160p) resolutions.

Internet content

Several websites, including YouTube, allow videos to be uploaded in the 1080p format. YouTube streams 1080p content at approximately 4 megabits per second[17] compared to Blu-ray's 30 to 40 megabits per second. Digital distribution services like Hulu also deliver 1080p content, such as movies available on Blu-ray Disc or from broadcast sources. This can include distribution services like peer-to-peer websites and public or private tracking networks. Netflix has been offering high quality 1080p content in the US and other countries through select internet providers since 2013.[18]

Consumer televisions and projectors

As of 2012, most consumer televisions being sold provide 1080p inputs, mainly via HDMI, and support full high-definition resolutions. 1080p resolution is available in all types of television, including plasma, LCD, DLP front and rear projection and LCD projection. For displaying film-based 1080i60 signals, a scheme called 3:2 pulldown reversal (reverse telecine) is beginning to appear in some newer 1080p displays, which can produce a true 1080p quality image from film-based 1080i60 programs. Similarly, 25fps content broadcast at 1080i50 may be deinterlaced to 1080p content with no loss of quality or resolution.

AV equipment manufacturers have adopted the term *Full HD* to mean a set can display all available HD resolutions up to 1080p. The term is misleading, however, because it does not guarantee the set is capable of rendering digital video at all frame rates encoded in source files with 1920 X 1080 pixel resolution. Most notably, a "Full HD" set is not guaranteed to support the 1080p24 format, leading to consumer confusion.[19][20][21] DigitalEurope (formerly EICTA) maintains the HD ready 1080p logo program that requires the certified TV sets to support 1080p24, 1080p50, and 1080p60, without overscan/underscan and picture distortion.

Computer monitors

Most widescreen cathode-ray tube (CRT) and liquid-crystal display (LCD) monitors can natively display 1080p content. For example, widescreen WUXGA monitors support 1920x1200 resolution, which can display a pixel for pixel reproduction of the 1080p (1920×1080) format. Additionally, many 23, 24, and 27-inch

(690 mm) widescreen LCD monitors use 1920×1200 as their native resolution; 30 inch displays can display beyond 1080p at up to 2560×1600 (1600p). Many 27" monitors have native resolutions of 2560×1440 and hence operate at 1440p.

Video game consoles

Video game consoles such as Sony's PlayStation 3 and PlayStation 4, Microsoft's Xbox, Xbox 360 and Xbox One and Nintendo's Wii U and Switch in docked mode, as well as microconsoles like OUYA, GameStick and Nvidia Shield can display upscaled games and video content in 1080p, although the vast majority of games are rendered at lower resolutions.[22] For all of the consoles, this is done through HDMI connections (in the case of the Xbox 360, HDMI is only available on consoles manufactured after June 2007). Additionally, the upscaled 1080p video is available on the PS3 and PS4, Xbox 360 and Xbox One, Nintendo Switch, and Wii U via an analog component/D-Terminal (YP_BP_R) connection,[†‡] as well as the VGA connection on the Xbox 360. On the PlayStation 3, developers must provide specific resolution support at the software level as there is no hardware upscaling support, whereas on the Xbox 360 games can be upscaled using a built in hardware scaler chip. However, most games on both consoles do not run at a native 1080p resolution.

The Wii U, PS3, PS4, Xbox One, and Xbox 360 provide 1080p video services. Sony provides both the PlayStation Store VOD service and Blu-ray Disc playback.[23][24] Microsoft provides the Zune Video Marketplace for "instant on" 1080p[†] video content but does not have Blu-ray disc playback capability. It does however support the now-defunct HD DVD disc standard via the Xbox 360 HD DVD Player add-on. Both consoles also offer support for streaming 1080p[†] content in various formats over home network from other computers, and also via USB connection to external storage devices.

^† Due to potential copyright issues, when an analog component connection is used, only system menus and gameplay are available in 1080p; video content is displayed at a lower resolution or in 1080i.

^‡ While 1080p analog component output is supported by the consoles, some display hardware will only accept component connections up to 1080i.

Cameras

Many cameras—professional and consumer still, action and video cameras, including DSLR cameras—and other devices with built-in cameras such as laptops, smartphones and tablet computers, can capture 1080p24, 1080p25, 1080p30 or 1080p60 video, often encoding it in progressive segmented frame format.

See also

- List of common resolutions
- 4320p, 2160p, 1440p, 1080i, 720p, 576p, 576i, 480p, 480i, 360p, 240p
- 21:9 aspect ratio – a common widescreen cinema aspect ratio
- 10K resolution – digital video formats with a horizontal resolution of around 10,000 pixels, aimed at non-television computer monitor usage
- 16K resolution – experimental VR format
- Ultra-high-definition television (UHDTV) – digital video formats with resolutions of 4K (3840×2160) and 8K (7680×4320)
- Rec. 2020 – ITU-R Recommendation for UHDTV
- High Efficiency Video Coding (HEVC) – video standard that supports 4K & 8K UHDTV and resolutions up to 8192×4320

- Digital cinema
- Display resolution

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