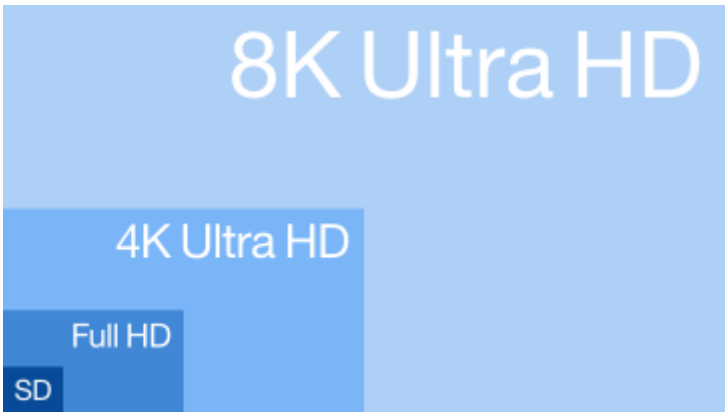
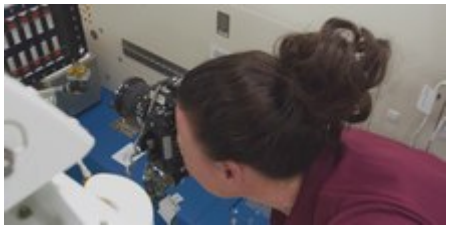
8K resolution

8K resolution refers to an image or display resolution with a width of approximately 8000 pixels. **8K UHD** (7680 × 4320) is the highest resolution defined in the Rec. 2020 (UHDTV) standard.[1]



Comparison chart

8K display resolution is the successor to 4K resolution. TV manufacturers pushed to make 4K a new standard by 2017. At CES 2019, the first 8K TVs were unveiled.[2] The feasibility of a fast transition to this new standard is questionable in view of the absence of broadcasting resources.[3] It is predicted (2018 forecast by Strategy Analytics) that 8K-ready devices will still only account for 3% of UHD TVs by 2023 with global sales of 11 million units a year.[4] However, TV manufacturers remain optimistic as the 4K market grew much faster than expected, with actual sales exceeding projections nearly six-fold in 2016.[5]


Play media
Example 8k footage from the International Space Station (select "WebM source" from the menu to view).

In 2013, a transmission network's capability to carry HDTV resolution was limited by internet speeds and relied on satellite broadcast to transmit the high data rates. The demand is expected to drive the adoption of video compression standards and to place significant pressure on physical communication networks in the near future.[6]

As of 2018, few cameras had the capability to shoot video in 8K, with NHK being one of the only companies to have created a small broadcasting camera with an 8K image sensor.[7] By 2018, Red Digital Cinema camera company had delivered three 8K cameras in both a Full Frame sensor and Super 35 sensor.[8] Until major content sources are available, 8K is speculated to become a mainstream consumer display resolution around 2023 as mentioned in UHD forum Phase-B recommendations. Despite this, filmmakers are pushing demand for 8K cameras due to their ability to capture better 4K footage.

Contents

History

Japan's public broadcaster NHK was the first to start research and development of 4320p resolution in 1995. The format was standardized by SMPTE in October 2007, Interface standardized by SMPTE in August 2010 and Recommended as the international standard for television by lTU-R in 2012. Followed by public displays at electronics shows and screenings of 2014 Winter Olympics in Sochi and public viewings in February 2014 and the FIFA World Cup in Brazil in June 2014 using HEVC with partners AstroDesign and Ikegami Electronics.[9][10][11]

Astro Design 8K camera being displayed at the 2013 NAB Show

On January 6, 2015, the MHL Consortium announced the release of the superMHL specification which will support 8K resolution at 120 fps, 48-bit video, the Rec. 2020 color space, high dynamic range support, a 32-pin reversible superMHL connector, and power charging of up to 40 watts.[12][13][14]


NHK and Hitachi demonstrating their 8K camera at the 2013 NAB Show

On March 1, 2016, The Video Electronics Standards Association (VESA) unveiled DisplayPort 1.4, a new format that lets the use of 8K resolution (7680 × 4320) at 60 Hz with HDRR and 32 audio channels through USB-C.[15]

On January 4, 2017, the HDMI Forum announced HDMI 2.1 featuring support for 8K video with HDR, will be "released early in Q2 2017".[16]

8K Association Formed at CES 2019 to Help Develop 8K Ecosystem[17]

In early February 2020, Samsung Electronics, announced during their Unpacked event that their Samsung Galaxy S20 can video record in 8K, which uses 600 MB of storage per minute.[18]

First cameras

On April 6, 2013, Astrodesign Inc. announced the AH-4800, capable of recording 8K resolution. In April 2015 it was announced by Red that their newly unveiled Red Weapon VV is also capable of recording 8K footage. In October 2016 they announced two additional 8K cameras, Red Weapon 8K S35 and Red Epic-W 8K S35.[19] The Red Weapon Dragon VV has been discontinued as of October 7, 2017, when Red unveiled the Red Weapon Monstro VV, their fourth camera capable of shooting 8K, with additional improvements in dynamic range and noise reduction, among other features.

Mobile phone cameras

In May 2019 mobile phone vendors started releasing the first mobile phones with 8K video recording capabilities were released, such as the ZTE Nubia Red Magic 3 series.

This is enabled by the sufficient resolution of image sensors used in mobile phones, and by the sufficient chipset performance. However, mobile phones with up to 5K (2880p) or 6K (3240p) video cameras have never been released.

Productions

In 2007, the original 65 mm negative of the 1992 film *Baraka* was re-scanned at 8K with a film scanner built specifically for the job at FotoKem Laboratories, and used to remaster the 2008 Blu-ray release. *Chicago Sun-Times* critic Roger Ebert described the Blu-ray release as "the finest video disc I have ever viewed or ever imagined."[20] A similar 8K scan/4K intermediate digital restoration of *Lawrence of Arabia* was made for Blu-ray and theatrical re-release during 2012 by Sony Pictures to celebrate the film's 50th anniversary.[21][22] According to Grover Crisp, executive VP of restoration at Sony Pictures, the new 8K scan has such high resolution that when examined, showed a series of fine concentric lines in a pattern "reminiscent of a fingerprint" near the top of the frame. This was caused by the film emulsion melting and cracking in the desert heat during production. Sony had to hire a third party to minimise or eliminate the rippling artifacts in the new restored version.[21]

On May 17, 2013, the Franklin Institute premiered *To Space and Back*, an 8K×8K, 60 fps, 3D video running approximately 25 minutes. During its first run at the Fels Planetarium it was played at 4K, 60 fps.[23]

In November 2013, NHK screened the experimental-drama short film "The Chorus" at Tokyo Film Festival which was filmed in 8K and 22.2 sound format.[24]

On May 1, 2015, an 8K abstract computer animation was screened at the Filmatic Festival at the University of California, San Diego. The work was created as an assignment in the VIS 40/ICAM 40 Introduction to Computing in the Arts class taught at UCSD by Associate Teaching Professor Brett Stalbaum during the winter quarter of 2015, with each student producing three hundred 8192 × 4800 pixel frames. The work's music soundtrack was composed by Mark Matamoros.[25][26]

On January 6, 2016, director James Gunn stated that the 2017 film *Guardians of the Galaxy Vol. 2* would be the first (feature) film to be shot in 8K, using the Red Weapon 8K VV.[27]

Broadcasting

Japanese public broadcaster NHK began research and development on 8K in 1995, having spent over $1 billion on R&D since then.[28] Codenamed **Super Hi-Vision** (named after its old Hi-Vision analog HDTV system), NHK also was simultaneously working on the development of 22.2 channel surround sound audio. The world's first 8K television was unveiled by Sharp at the Consumer Electronics Show (CES) in 2012.[29]

Experimental transmissions of the resolution were tested with the 2012 Summer Olympics, and at the Cannes Film Festival showcasing *Beauties À La Carte*, a 27-minute short showcased publicly on a 220" screen, with a three-year roadmap that entails the launch of 8K test broadcasting in 2016, with plans to roll out full 8K services by 2018, and in time for the 2020 Summer Olympics,[30] which were delayed to 2021 due to the COVID-19 pandemic. On December 1, 2018, NHK launched BS8K, a broadcast channel transmitting at 8K resolution.[31][32][33]

On February 28, 2020, it was reported that BT Sport would broadcast the UEFA Europa League in 8K HDR10+ as early as August 2020.[34]

Gaming

Sony announced that the PlayStation 5 will support 8K graphics.[35] Microsoft then announced Xbox Series X with 8K graphic support set to release in late 2020.[36] NVIDIA's GeForce RTX 3090 promises to enable 8K 60fps HDR gaming, recording and streaming with ShadowPlay on PCs.[37][38]

Editing

8K video can be edited by all major NLEs such as Avid Media Composer, Adobe Premiere Pro, Lightworks, Vegas Pro, Final Cut Pro X, Edius and DaVinci Resolve.

Resolutions

7680 × 4320

This is the resolution of the **UHDTV2** format defined in SMPTE ST 2036–1,[39][40] as well as the **8K UHDTV** format defined in ITU-R BT.2020.[41] It was also chosen by the DVB project as the resolution for their 8K broadcasting standard, **UHD-2**.[42]

7680 × 4320 has 33.2 million pixels and a 16:9 aspect ratio. It is double the resolution of 4K UHD in each dimension (four times as many total pixels), and four times the resolution of 1080p in each dimension (sixteen times as many total pixels).

Examples of 8K resolutions

Resolution	Display aspect ratio	Total pixels (Mpx)
7680 × 2160	3.$\overline{55}$:1 (32:9)	16.59
7680 × 3200	2.40:1 (24:10)	24.58
7680 × 3240	2.$\overline{370}$:1 (64:27)	24.88
7680 × 4320	1.$\overline{77}$:1 (16:9)	33.18
8192 × 4320	≈1.90:1 (256:135)	35.39
8192 × 4608	1.$\overline{77}$:1 (16:9)	37.75
8192 × 5120	1.60:1 (16:10)	41.94
8192 × 8192	1.00:1 (1:1)	67.11

Devices

TVs and monitors

- Sharp's 85" 8K LCD TV, 7680 × 4320 resolution – International Consumer Electronics Show (CES) 2012
- Panasonic's 145" 8K Plasma Display, 7680 × 4320 resolution – Internationale Funkausstellung Berlin (IFA) 2012
- LG's 98" 8K LCD TV, 7680 × 4320 resolution – Internationale Funkausstellung Berlin (IFA) 2014

- Panasonic's 55" 8K 120 Hz LCD, 7680 × 4320 resolution – International Consumer Electronics Show (CES) 2015
- Samsung's 110" 8K 3D LCD TV, 7680 × 4320 resolution – International Consumer Electronics Show (CES) 2015
- Canon 30" 8K reference display – September 2015
- BOE 98" 8K TV at CEATEC 2015[43]
- LG's 98-inch UH9800 with ColorPrime Plus technology – International Consumer Electronics Show (CES) 2016[44]
- Samsung 98-inch SUHD 8K curved TV – International Consumer Electronics Show (CES) 2016[45]
- Hisense 98-inch ULED 8K TV – International Consumer Electronics Show (CES) 2016[46]
- Changhong 98-inch 98ZHQ2R "8K Super UHD", 7680 × 4320 resolution – International Consumer Electronics Show (CES) 2016[47]
- Sharp's prototype 27-inch 8K 120 Hz IGZO desktop monitor with HDR (CEATEC 2016)
- Philips 328P8K 8K UHD desktop Monitor (ces 2017)
- Dell UltraSharp 32 Ultra HD 8K Monitor (UP3218K) (CES 2017)[48][49]
- Samsung Q9S 85-inch QLED TV – International Consumer Electronics Show (CES) 2018
- LG 88 inch 8K OLED TV – International Consumer Electronics Show (CES) 2018
- Samsung Q900 R – 65, 75, 82, 85 inch 8K QLED TV models at CES 2019[50]
- Sony Z9G/ZG9 – 85 inch and 100 inch 8K Ultra HD Bravia TV International Consumer Electronics Show (CES) 2019
- Sony Z8H/ZH8 – 75 and 85 inch 8K Ultra HD Bravia TV International Consumer Electronics Show (CES) 2020
- BOE 8K 13.3 inch Narrow Bezel Laptop Display at CITE 2018[51]
- Digital Projection INSIGHT Laser 8K at Integrated Systems Europe 2018[52]
- TCL 75 inch 8K QLED TV – FIBA Basketball World Cup 2019 Edition displayed at IFA 2018[53]
- Hisense U9E – 75 inch 8K QLED at IFA global press conference 2019[54]

8K VR Headset

- Pimax Vision 8K X, made up of two 3840 × 2160 screens @ 90 Hz, started Crowdfunding in October 2017, with product release now rescheduled to 2020

Cameras

- Sony CineAlta F65, Unveiled on September 7, 2011.
- Astrodesign AH-4800, 1.7-inch CMOS camera capable of recording in 8K resolution. Unveiled by on April 6, 2013.
- RED Weapon Vista Vision 35MM 8K (8192 × 4320) at 60 fps in full-sensor mode, or up to 75 fps in a scope (2.40:1) frame format. The camera has a 40.96 mm × 21.6 mm sensor based on the previous generation Dragon sensor. Unveiled at NAB 2015, released end of 2015.
- RED DSMC2 Helium with an S35MM 8K 29.9 mm × 15.77 mm 35.4 megapixel CMOS sensor —up to 60 fps at 8K (8192 × 4320) and 75 fps at 8K 2.4:1 (8192 × 3456) with a dynamic range of 16.5+ stops; limited release July 2016, general release October 2016.
- RED Epic-W with an S35MM 8K 29.9 mm × 15.77 mm 35.4 megapixel CMOS Helium sensor— up to 30 fps at 8K (8192 × 4320) with a dynamic range of 16.5+ stops; release date: October 2016.

- RED DSMC2 Monstro 8K VV[55] 40.96 mm × 21.60 mm 35.4 megapixel CMOS "wider than full frame" Monstro sensor—up to 60 fps at 8K (8192 × 4320) & 75 fps at 8K 2.4:1 (8192 × 3456) with a dynamic range of 17+ stops; release date: October 2017.
- Ikegami S35MM SHK-810 8K broadcast camera. Unveiled at NAB 2015.
- Hitachi S35MM SK-UHD8060 broadcast camera Unveiled at NAB 2015.
- Hitachi S35MM SK-UHD8000 broadcast camera. Production version of the SK-UHD8060.
- Canon Cinema EOS System S35MM 8K camera. Unveiled September, 2015.
- Canon EOS R5 camera. Announced July 9, 2020.
- Panavision DXL 35MM 8K 60 fps and HDR Digital Cinematography Camera (Vista Vision Sensor). May 2016
- Sharp S35MM 8C-B60A 8K Professional broadcast Camcorder[56] Nov 2017
- Cinemartin Fran 8K VV Global Shutter, announced on May 8, 2018, starting sales in fall 2018. Company went to bankruptcy on April 1, 2019 and camera is no longer available. It never reached production stage, only prototype.[57]
- Blackmagic URSA Mini Pro 12K, originally 110 fps in 8K,[58] since September 2020 firmware update up to 120 fps for DCI, 16:9 and 6:5 Anamorphic aspect ratio modes and up to 160 fps for 2.4:1 aspect ratio mode.[59]

Smartphones with 8K camera

- ZTE Nubia Red Magic 3, shoots 8K @ 15 fps, is the first 8K video capable phone, went on sale from May 2019
- ZTE Nubia Red Magic 3s, shoots 8K @ 15 fps, went on sale from September 2019
- ZTE Nubia Red Magic 5G, shoots 8K @ 15 fps, went on sale from March 2020
- ZTE Nubia Red Magic 5S, shoots 8K @ 15 fps, went on sale from August 2020
- ZTE Nubia Z20, shoots 8K @ 15 fps, went on sale from August 2019
- Asus ROG Phone 3, shoots 8K @ 30 fps, went on sale from July 2020
- Asus ZenFone 7, shoots 8K @ 30 fps, went on sale from September 2020
- Samsung Galaxy S20 series, shoots 8K @ 24 fps, went on sale from February 2020
- Samsung Galaxy Note 20 series, shoots 8K @ 24 fps, went on sale from August 2020
- LG V60 ThinQ, shoots 8K @ 30 fps, went on sale from March 2020
- Xiaomi Mi 10/Mi 10 Pro, shoots 8K @ 30 fps, went on sale from February 2020
- Xiaomi Mi 10 Ultra, shoots 8K @ 24 fps, went on sale from August 2020
- Xiaomi Mi 10T/Mi 10T Pro, shoots 8K @ 30 fps, went on sale from October 2020
- Redmi K30 Pro/K30 Pro Zoom, Poco F2 Pro, shoots 8K @ 24/30 fps, went on sale from March–May 2020
- Sharp AQUOS R5G, shoots 8K @ 30 fps, went on sale from July 2020

8K VR camera

- QooCam 8K, first affordable 8K 360° VR camera, with built-in video stitching.
- Insta360 Pro 2

Fulldome

- Definiti 8K theaters, 8192 × 8192 resolution (apu)

See also

- 4K resolution – digital video formats with a horizontal resolution of around 4000 pixels
- 5K resolution – digital video formats with a horizontal resolution of around 5000 pixels, aimed at non-television computer monitor usage
- 10K resolution – digital video formats with a horizontal resolution of around 10,000 pixels, aimed at non-television computer monitor usage
- 16K resolution – digital video formats with a horizontal resolution of around 15,000 pixels
- 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
- Digital movie camera
- Digital cinematography – makes extensive use of UHD video
- List of large sensor interchangeable-lens video cameras

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