IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

REALTIME ADAPTIVE STREAMING LLC, Plaintiff, v. SONY ELECTRONICS INC., and SONY CORPORATION Defendants.	Case No. ____________________ JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

This is an action for Patent infringement arising under the Patent Laws of the United States of America, 35 U.S.C. § 1 *et seq.* in which Plaintiff Realtime Adaptive Streaming LLC ("Plaintiff" or "Realtime") makes the following allegations against Defendants Sony Electronics, Inc. and Sony Corporation (collectively "Defendants" or "Sony").

PARTIES

1. Realtime is a Texas limited liability company. Realtime has a place of business at 1828 E.S.E. Loop 323, Tyler, Texas 75701. Realtime has researched and developed specific solutions for data compression, including, for example, those that increase the speeds at which data can be stored and accessed. As recognition of its innovations rooted in this technological field, Realtime holds multiple United States Patents and pending Patent applications.

2. Defendant Sony Electronics, Inc. is a Delaware corporation, with its principal place of business at 16535 Via Esprillo, San Diego, California 92127. Sony Electronics Inc. may be served with process by serving its registered agent, Corporation

Service Company at 251 Little Falls Drive, Wilmington, Delaware 19808.

3. Defendant Sony Corporation is a Japanese corporation, with its corporate headquarters located at 1-7-1 Konan, Minato-ku, Tokyo, 108-0075, Japan. Sony Corporation may be served with process under the Delaware long arm statute.

4. Sony Electronics Inc. resides in this District because Sony Electronics Inc. is incorporated in Delaware. Sony Corporation is a foreign corporation and therefore can be sued in this District. Defendants offer their products and/or services, including those accused herein of infringement, to customers and potential customers located in Delaware and in this District.

JURISDICTION AND VENUE

5. This action arises under the Patent laws of the United States, Title 35 of the United States Code. This Court has original subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

6. This Court has personal jurisdiction over Defendants in this action because Defendants have committed acts within the District of Delaware giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over Defendants would not offend traditional notions of fair play and substantial justice. Defendants have also committed and continue to commit acts of infringement in this District by, among other things, offering to sell and selling products and/or services that infringe the asserted Patents.

7. Venue is proper in this district, *e.g.*, under 28 U.S.C. § 1400(b). Defendants reside in this District because they are incorporated in Delaware. Furthermore, upon information and belief, Defendants have transacted business in the

District of Delaware and have committed acts of direct and indirect infringement in the District of Delaware.

THE PATENTS-IN-SUIT

8. This action arises under 35 U.S.C. § 271 for Sony's infringement of Realtime's United States Patent Nos. 7,386,046 (the "'046 Patent"), 8,634,462 (the "'462 Patent"), 8,929,442 (the "'442 Patent"), 8,934,535 (the "'535 Patent"), 9,578,298 (the "'298 Patent"), 9,762,907 (the "'907 Patent"), and 9,769,477 (the "'477 Patent") (collectively, the "Patents-In-Suit").

9. The '046 Patent, titled "Bandwidth Sensitive Data Compression and Decompression," was duly and properly issued by the United States Patent and Trademark Office ("USPTO") on June 10, 2008. A copy of the '046 Patent is attached hereto as Exhibit A. Realtime is the owner and assignee of the '046 Patent and holds the right to sue for and recover all damages for infringement thereof, including past infringement.

10. The '462 Patent, titled "Quantization for Hybrid Video Coding," was duly and properly issued by the USPTO on January 21, 2014. A copy of the '462 Patent is attached hereto as Exhibit B. Realtime is the owner and assignee of the '462 Patent and holds the right to sue for and recover all damages for infringement thereof, including past infringement.

11. The '442 Patent, titled "System and method for video and audio data distribution," was duly and legally issued by the USPTO on January 6, 2015. A true and correct copy of the '442 Patent is included as Exhibit C. Realtime is the owner and assignee of the '442 Patent and holds the right to sue for and recover all damages for

infringement thereof, including past infringement.

12. The ’535 Patent, titled “Systems and methods for video and audio data storage and distribution,” was duly and properly issued by the USPTO on January 13, 2015. A copy of the ’535 Patent is attached hereto as Exhibit D. Realtime is the owner and assignee of the ’535 Patent and holds the right to sue for and recover all damages for infringement thereof, including past infringement.

13. The ’298 Patent, titled “Method for Decoding 2D-Compatible Stereoscopic Video Flows,” was duly and properly issued by the USPTO on February 21, 2017. A copy of the ’298 Patent is attached hereto as Exhibit E. Realtime is the owner and assignee of the ’298 Patent and holds the right to sue for and recover all damages for infringement thereof, including past infringement.

14. The ’907 Patent, titled “System and Methods for Video and Audio Data Distribution,” was duly and properly issued by the USPTO on September 12, 2017. A copy of the ’907 Patent is attached hereto as Exhibit F. Realtime is the owner and assignee of the ’907 Patent and holds the right to sue for and recover all damages for infringement thereof, including past infringement.

15. The ’477 Patent, titled “Video data compression systems,” was duly and properly issued by the USPTO on September 19, 2017. A copy of the ’477 Patent is attached hereto as Exhibit G. Realtime is the owner and assignee of the ’477 Patent and holds the right to sue for and recover all damages for infringement thereof, including past infringement.

COUNT I
INFRINGEMENT OF U.S. PATENT NO. 7,386,046

16. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs,

as if fully set forth herein.

17. On information and belief, Sony has made, used, offered for sale, sold and/or imported into the United States Sony products that infringe the ’046 Patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Sony’s video security camera series, including Minidomes series cameras SNC-VM772R, SNC-VM641, SNC-EM641, SNC-VM642R, SNC-EM642R, SNC-VM632R, SNC-VM602R, SNC-VM631, SNC-VM601, SNC-VM630, SNC-VM600, SNC-EM632RC, SNC-EM602RC, SNC-EM631, SNC-EM601, SNC-EM630, SNC-EM600, SNC-XM631, SNC-XM632, SNC-XM636, SNC-XM637, SNC-HM662, SNC-DH280, SNC-DH240T, SNC-DH140T, SNC-DH240, SNC-DH140, SNC-DH260, SNC-DH160, SNC-DH220T, SNC-DH120T, SNC-DH220, SNC-DH120, SNC-DH210T, SNC-DH110T, SNC-DH210, SNC-DH110, SNC-ZM551, SNC-ZM550; Fixed series cameras SNC-VB770, SNC-VB640, SNC-EB640, SNC-VB642D, SNC-EB642R, SNC-VB635, SNC-VB630, SNC-VB600, SNC-VB632D, SNC-EB632R, SNC-EB602R, SNC-EB630, SNC-EB600, SNC-EB630B, SNC-EB600B, SNC-CX600W, SNC-CX600, SNC-CH280, SNC-CH180, SNC-CH240, SNC-CH140, SNC-CH260, SNC-CH160, SNC-CH220, SNC-CH120, SNC-CH110, SNC-ZB550; and Pan Tilt Zoom series cameras SNC-WR632C, SNC-WR602C, SNC-WR602, SNC-WR630, SNC-WR600, SNC-ER585, SNC-ER580, SNC-EP580, SNC-ER550, SNC-EP550, SNC-ER520, SNC-EP520, SNC-RS86N, SNC-RS46N; other Pan/Tilt/Zoom cameras (for Broadcast & Production) SRG360SHE, BRCH900/PAC2, and BRCH900; the cameras ILCE-7RM3, ILCE-7RM2; Sony’s interchangeable-lens cameras, compact cameras; Sony camcorders, action cameras, motion cameras, film cameras, digital film cameras, music video recorders,

professional camcorders; Sony Surveillance Video Encoders SNT-EX101, SNT-EX101E, SNT-EX104, SNT-EX154, SNT-EP104 and SNT-EP154; and the Sony SAS-HD1SET H.264 satellite and receiver combo, Sony PlayStation models including PS4 models, PS3 models, PS2 models, PS1 models, Sony Televisions such as the Z9D series, A1E series, XBR-X930E-X940E series, XBR-X900E series, XBR-X850E series, XBR-X800E series, X700E series, X690E series, XBR-X940D-X930D series, XBR-X750D-X700D series, XBR-X800D series, XBR-X850D series, W630B series, W650D series, W600D series; Sony Blu-Ray & DVD Players with playback capability of MPEG-4/AVC (.mov, .3gp, .3g2, .3gpp, .3gpp2, .flv) or MPEG-4 AVC (.mkv, .mp4, .m4v, .m2ts, .mts) such as the UBP-X800 and UBP-X1000ES series; Sony MP3 players; Sony in-car receivers and players, Sony 4K products including the Sony 4K BRAVIA TVs, Sony Video Unlimited 4K, Next generation 4K Media Player, Sony 4K Home Theater Projectors such as the VPL-VW500ES and VPL-VW1100ES, Sony consumer 4K Handycams including the FDR-AX1, FDR-AX100, 4K products using the Sony IMX274 Chipset including the Urban Security Group (USG) Sony Chip Ultra 4K IP PoE Network Bullet Security Camera, the USG Sony Chip Ultra 4K IP PoE Network Dome Security Camera, the USG Sony DSP Ultra 4K IP PoE Network Bullet Security Camera, and all versions and variations thereof since the issuance of the ’046 Patent (“Accused Instrumentalities”).

18. For example, Sony notes that several of the Accused Instrumentalities possess H.264 capabilities on this web page on their United States of America website with the header “Did you know that Sony supports H.264?” The article lists several of the Accused Instrumentalities in the column on the right, which has a header of “Related

Products." In the first sentence underneath the main title, the article goes on to state that "Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology." So from the above, it is clear that all, most or many of Sony's cameras utilize H.264 technology when processing, compressing or recording video. *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

Did you know that Sony supports H.264?

Video compression may seem really dull, but the real-world benefits of using the latest technology can radically increase the flexibility of your IP network. Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.

Put simply, better compression means greater flexibility – the more efficiently data is handled, the more choices you have with your existing resources. An existing network can support more cameras, better audio-video quality or both.

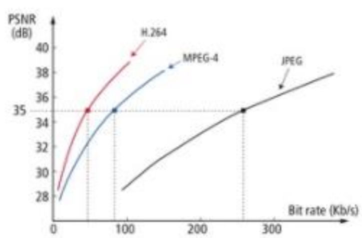
For surveillance applications, the 'industry-standard' image compression format is JPEG – which is perhaps best known for digital still photographs. In fact, using JPEG compression a network camera is acting rather like a digital camera – taking 25 (PAL) or 30 (NTSC) pictures per second. Each image is compressed individually (this is called intra-frame compression) which ensures each image is good quality and also provides a near constant data-size – making predicting network data traffic and data storage demands easy.

Often referred to as Motion JPEG or MJPEG, this form of compression has a relatively low processor demands and made possible the current generation of network cameras. It's also quite well suited to monitoring applications where it's not always essential to provide a TV-quality frame-rate. On the negative side, the MJPEG format dates back to the early 90s and since then the technology of compression has advanced considerably...

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

Related Products

- SNC-DH220T – Vandal-resistant Minidome 1080p/30 fps Camera - E Series
- SNC-CH120 – Box-type 720p/30 fps Camera - E Series
- SNC-CH280 – Outdoor IR Bullet 1080p/30 fps Camera - V Series
- SNC-CH140 – Box-type 720p/30 fps Camera - V Series
- SNC-DH160 – Outdoor IR Ruggedized 720p/30 fps Camera - E Series
- SNC-ZM550 – Minidome 720p/30 fps camera capable of transmitting both analog video and H...
- SNC-ER550 – 720p/30 fps Rapid Dome Camera - E Series
- SNC-EB602R – Outdoor IR Bullet 720p/ 30 fps Camera Powered by IPELA ENGINE EX™ – E Series
- SNC-EB632R – Outdoor IR Bullet 1080p/30 fps Camera Powered by IPELA ENGINE EX™ – E Series

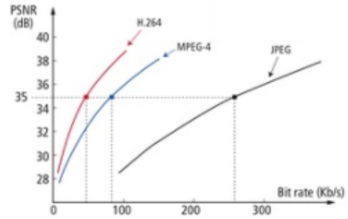
19. On that same website, Sony also mentions some background on the

benefits of H.264, and also adds that “Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn’t make any difference in operational terms.” The website further states that: “Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!” *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit rate than MPEG-4, it uses a variety of different advanced techniques to achieve this aim – most notably block patterns used to predict movement across video frames.



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

The practical benefits of these varying compression formats can be illustrated quite simply. In the above diagram you can see JPEG compression operating at 260Kb/s, while MPEG-4 transmits at 85Kb/s and H.264 transmits at 50K/bs. To put this into perspective, MPEG-4 requires approximately one-third of the bandwidth used by JPEG and H.264 requires just one-fifth.

Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms.

Leadership & Compatibility

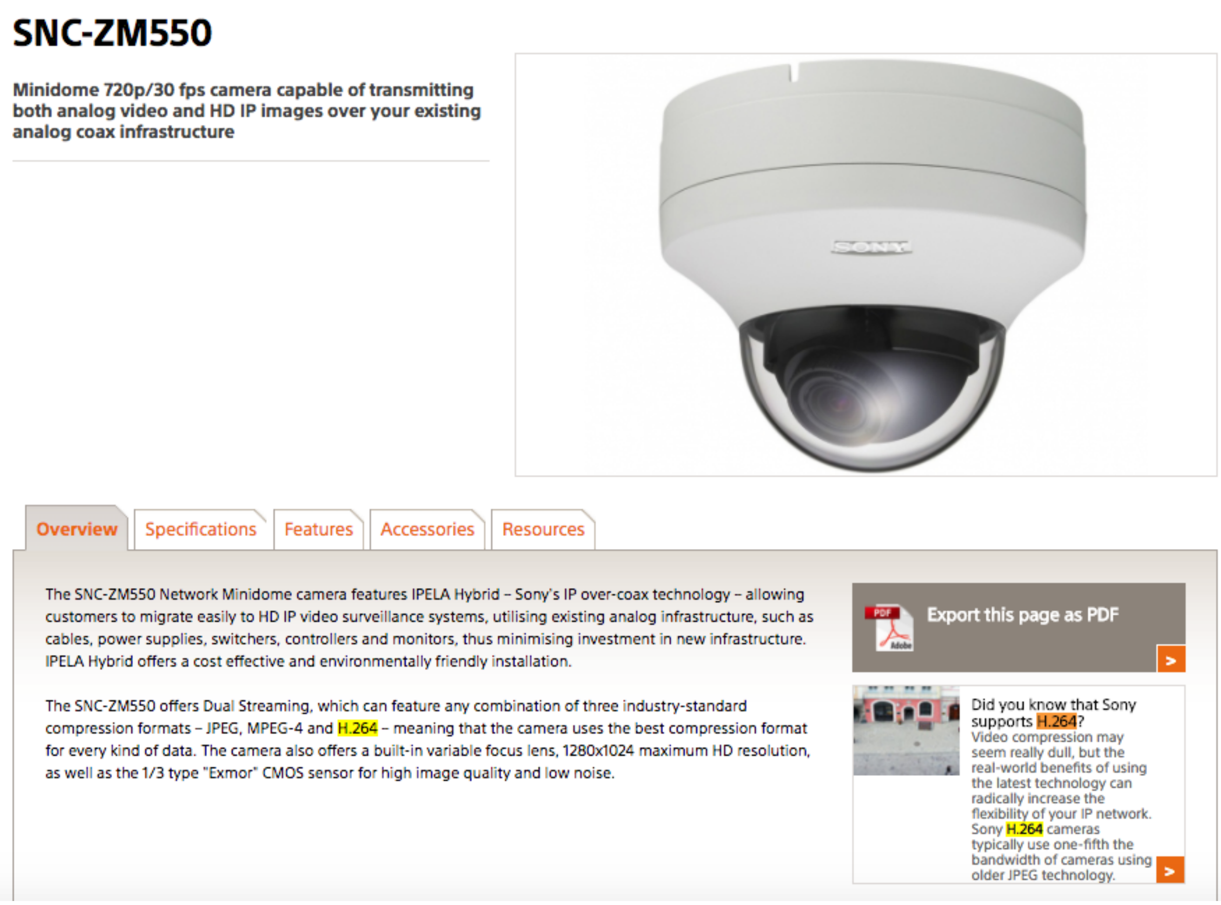
A five-fold increase in the capacity of an IP-based network might seem science fiction, but in a networked digital world it should come as no surprise that there's huge amount of investment in ensuring the highest possible video quality at the lowest possible bitrate. H.264 technology is currently used in Blu-ray discs, HDTV broadcasting (including BBC HD and Euro 1080), AVCHD (a HD recording format for HDD and Solid State camcorders) and a wide variety of mobile devices, including Apple's iPhone and Sony's PSP. The format is also commonly used online for high quality content, for example HD movie trailers, and it's also been adopted by YouTube for its new high quality mode. This also means most media players, such as QuickTime or VLC, support H.264 encoded content.

Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!

More information on Sony Video Security solutions

* The vertical axis shows Peak Signal-to-Noise Ratio (PSNR), a metric for the "quality" of compressed video images, while the horizontal axis shows the transmission bit rate. The graph shows just one example of comparing bit rates at which JPEG, MPEG-4, and H.264 images can be transmitted. Actual bit rates for transmitting data using these three compression formats differ with image quality and image size settings. In this example, the video parameters are; 10 frames per second, 176x144 (QCIF) resolution, 10 seconds of video (100 frames).

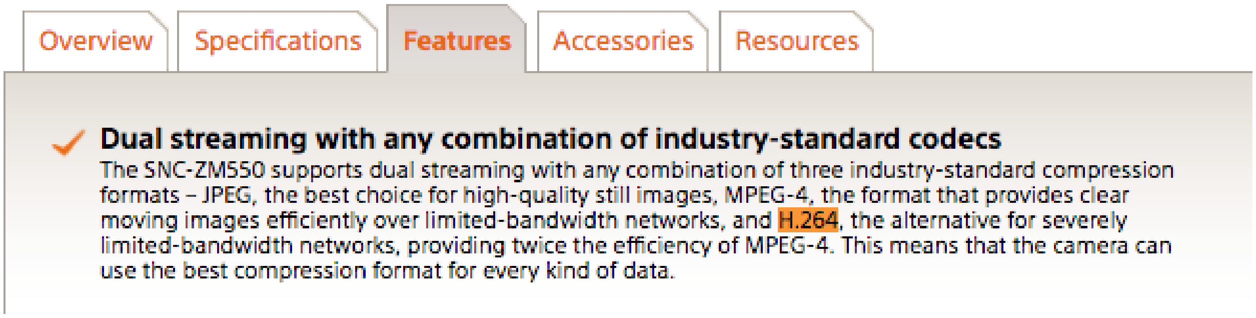
20. As an illustrative example, the website for Sony's SNC-ZM550 camera states in its "Overview" tab that "The SNC-ZM550 offers Dual Streaming, which can feature any combination of three industry-standard compression formats – JPEG, MPEG-4 and H.264 – meaning that the camera uses the best compression format for every kind of data." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-



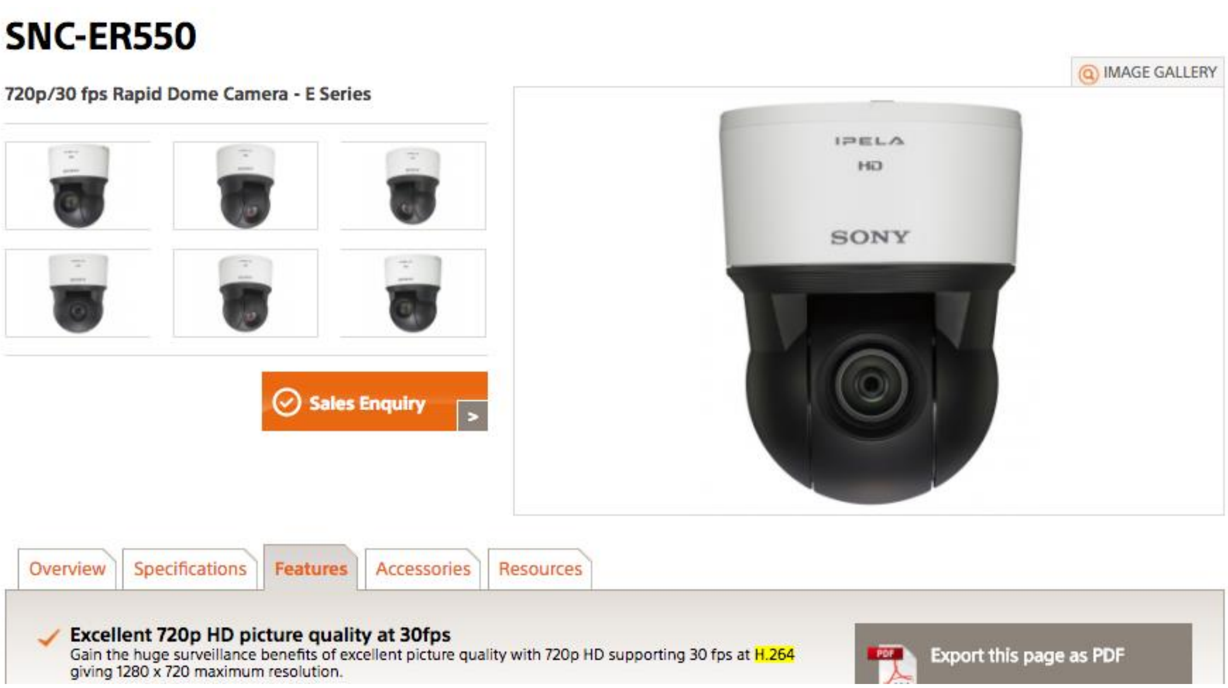
minidomes/snc-zm550/overview/#overview:

21. On the same web site, under the "Features" tab, it states that "The SNC-ZM550 supports dual streaming with…H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4." *See*

http://us.professional.sony.com/pro/product/video-security-ip-cameras-minidomes/snc-zm550/features/#features:



22. As another illustrative example, the website for Sony's SNC-ER550 camera has a "Features" tab which states: "Gain the huge surveillance benefits of excellent picture quality with 720p HD supporting 30 fps at H.264 giving 1280 x 720 maximum resolution." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-pan-tilt-zoom/snc-er550/features/#features:



23. As yet another illustrative example, the website for Sony's SRG360SHE camera (sub-header: "Triple-Stream PoE + Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)") mentions, under its "Overview" tab: "Simultaneous transmission of 3G-SDI, HDMI and IP H.264 full-HD video" and "This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264 compressed video/audio stream via IP" as well as "The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing angle to produce H.264 IP video streaming with selectable bit rates." *See*

https://pro.sony.com/bbsc/ssr/cat-broadcastcameras/cat-broadcastcamerapantiltzoom/product-SRG360SHE/:

24. Furthermore, Sony's Surveillance Video Encoders all use H.264 as a "Video compression format" as can be seen by the below datasheet. *See* https://pro.sony.com/bbsccms/assets/files/cat/camsec/brochures/quickref_sntexep.pdf:

Home > Cameras - Broadcast & Production > Pan/Tilt/Zoom > SRG360SHE

Back Convert to PDF Print Email

Zoom Image

SRG360SHE

Triple-Stream PoE+ Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)

$3,999.00 U.S. List Price

Have Sony Contact Me Compare Model

UPC:027242286139

Overview Specifications Accessories Resources Software & Firmware

The SRG-360SHE is designed to serve the needs of classrooms, courtrooms, boardrooms, houses of worship and any other settings where full HD visual communications are crucial. The latest addition to the popular SRG lineup builds on the success of the SRG-300SE by adding power over Ethernet (PoE+) and triple simultaneous video and audio streaming (embedded audio in IP, HDMI and 3G-SDI). The simultaneously output of 1080/60p baseband video through the three streaming outputs making it ideal for webcasting and viewing while simultaneously recording live events.

Highlights:

- Simultaneous transmission of 3G-SDI, HDMI, and IP H.264 full-HD video The SRG-360SHE supports triple streaming outputs. This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264-compressed video/audio stream via IP. This triple streaming capability makes the camera ideal for webcasting, viewing and simultaneously recording conferences, lectures, seminars, and other live events. It can also simultaneously output 1920 x 1080/60p video over a single BNC cable through 3G-SDI that can run approximately up to 100m, easing installation and adding more flexibility to customer's live
- Powerful optical zoom and wide viewing angle The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing angle to produce H.264 IP video streaming with selectable bit rates.
- Up to 256 camera preset positions The SRG-360SHE support up to 256 camera preset positions using a plug-in free viewer and ActiveX viewer.
- The SRG-360SHE's new capabilities are built on the solid functionality common to the entire SRG line. Sony View-DR and XDNR technologies provide clear images

Surveillance Video Encoders

	Full Function				Basic Function	
	1CH Box		4CH Box	4CH Blade	4CH Box	4CH Blade
	SNT-EX101	SNT-EX101E	SNT-EX104	SNT-EX154	SNT-EP104	SNT-EP154
Codec image size (HxV)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)
Video compression format	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG
Codec streaming capability	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)
Maximum frame rate	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)
PTZ control	Yes	Yes	Yes	Yes	No	No
Visibility Enhancer	Yes	Yes	Yes	Yes	Yes	Yes
XDNR	Yes	Yes	Yes	Yes	Yes	Yes
Coaxitron® control	Yes	Yes	Yes	Yes	No	No
Serial Interface	RS-422/RS-485	RS-422/RS-485	RS-485	RS-485	-	-
USB Memory slots	x 1*1	x 1*1	x 4*1	-	-	-
Sensor input	x 2	x 2	x 4	x 4	-	-
Alarm output	x 2	x 2	x 4	x 4	-	-
Audio interface (IN/OUT)	IN x 1, OUT x 1	IN x 1, OUT x 1	IN x 4, OUT x 4	IN x 1, OUT x 1	-	-
Audio support	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	No	No
DEPA™ Advanced (Intelligence)	Yes DEPA Advanced	Yes DEPA Advanced	Yes DEPA Advanced	Yes DEPA Advanced	No	No
Dimensions (W x H x D)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)
Power requirements	AC 24V in, with loop through output Input: AC 24V, +/- 20%	PoE (IEEE802.3af)	DC12 V	From Rack Station	DC12 V	From Rack Station

25. Sony further has a SAS-HD1SET H.264 Satellite/Receiver Combo, as can be seen by this article on Engadget. *See* https://www.engadget.com/2008/09/02/sony-rolls-out-sas-hd1set-h-264-satellite-receiver-combo/:

Sony rolls out SAS-HD1SET h.264 satellite / receiver combo

Richard Lawler, @Rjcc
09.02.08

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Shares

Getting discerning Japanese viewers ready for the new SKY Perfect HDTV channels, Sony is launching an h.264 satellite dish / receiver combo, the SAS-HD1SET, due October 15. At ¥45,000 ($416 U.S.) or ¥37,000 ($342 U.S.) for the DST-HD1 tuner alone, it's a pretty expensive upgrade for 15 HDTV channels, with the promise of more than 70 by this time next year. Add-on the ¥3,500 monthly service charge and we're even more leery, but really, you'll need something to watch on that ultra thin LCD next month.

26. The Accused Instrumentalities determine a parameter of at least a portion of a video data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and resolution parameters. Different parameters correspond with different end applications. H.264 provides for multiple different ranges of such

parameters, each included in the "profiles" and "levels" as defined by the H.264 standard, from the below shown paragraphs from a white paper and Wikipedia. *See* http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

4. H.264 profiles and levels

The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting options and features to a minimum. An important aspect of the standard, as with other video standards, is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes) that optimally support popular productions and common formats.

H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what feature set the encoder may use and limits the decoder implementation complexity.

Network cameras and video encoders will most likely use a profile called the baseline profile, which is intended primarily for applications with limited computing resources. The baseline profile is the most suitable given the available performance in a real-time encoder that is embedded in a network video product. The profile also enables low latency, which is an important requirement of surveillance video and also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements. Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176×144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176×144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352×288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352×288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352×288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352×288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352×576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720×576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720×576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280×720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280×1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048×1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048×1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048×1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672×1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@56.3 (5)

27. A video data block is organized by the group of pictures (GOP) structure, which is a "collection of successive pictures within a coded video stream." *See* https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). *See* https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); https://en.wikipedia.org/wiki/MPEG-1#D-frames (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can

be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

28. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant system such as the Accused Instrumentalities would determine which profile (e.g., “baseline,” “extended,” “main”, or “high”) corresponds with that parameter, then select between at least two asymmetric compressors. If baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding (“CAVLC”) entropy encoder. If main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding (“CABAC”) entropy encoder. Both encoders are asymmetric compressors because it takes a longer period of time for them to compress data than to decompress data. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8x8 vs. 4x4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

The following table summarizes the two major types of entropy coding: Variable Length Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers superior coding efficiency over VLC by adapting to the changing probability distribution of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of CABAC.

H.264 Entropy Coding – Comparison of Approaches

Characteristics	Variable Length Coding (VLC)	Context Adaptive Binary Arithmetic Coding(CABAC)
• Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
• Probability distribution	**Static** - Probabilities never change	**Adaptive** - Adjusts probabilities based on actual data
• Leverages correlation between symbols	**No** - Conditional probabilities ignored	**Yes** - Exploits symbol correlations by using "contexts"
• Non-integer code words	**No** - Low coding efficiency forhigh probability symbols	**Yes** - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the encoder. *See* https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

entropy_coding_mode_flag selects the entropy decoding method to be applied for the syntax elements for which two descriptors appear in the syntax tables as follows:

– If entropy_coding_mode_flag is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).

– Otherwise (entropy_coding_mode_flag is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

29. The Accused Instrumentalities compress the at least the portion of the data

block with the selected one or more asymmetric compressors to provide one or more compressed data blocks, which can be organized in a GOP structure (see above). After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data to provide various compressed data blocks, which can also be organized in a GOP structure, as discussed previously above. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

Entropy Coding

For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf at 13:

Typical compression ratios to maintain excellent quality are:

- 10:1 for general images using JPEG
- 30:1 for general video using H.263 and MPEG-2
- 60:1 for general video using H.264 and WMV9

> Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.
>
> The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.
>
> The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.
>
> The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

30. Therefore, from at least the above, Sony has directly infringed and continues to infringe the ’046 Patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the system claimed by Claim 40 of the ’046 Patent, namely, a system, comprising: a data compression system for compressing and decompressing data input; a plurality of compression routines selectively utilized by the data compression system, wherein a first one of the plurality of compression routines includes a first compression algorithm and a second one of the

plurality of compression routines includes a second compression algorithm; and a controller for tracking throughput and generating a control signal to select a compression routine based on the throughput, wherein said tracking throughput comprises tracking a number of pending access requests to a storage device; and wherein when the controller determines that the throughput falls below a predetermined throughput threshold, the controller commands the data compression engine to use one of the plurality of compression routines to provide a faster rate of compression so as to increase the throughput. Upon information and belief, Sony uses the Accused Instrumentalities to practice infringing methods for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

31. On information and belief, the Accused Instrumentalities store at least a portion of the one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

32. On information and belief, Sony also directly infringes and continues to infringe other claims of the ’046 Patent, for similar reasons as explained above with respect to Claim 40 of the ’046 Patent.

33. On information and belief, all of the Accused Instrumentalities perform the claimed methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

34. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the systems and/or methods claimed by the ’046 Patent.

35. On information and belief, Sony has had knowledge of the ‘046 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Sony knew of the ’046 Patent and knew of its infringement, including by way of this lawsuit. By the time of trial, Sony will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of the claims of the ’046 Patent.

36. Upon information and belief, Sony’s affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’046 Patent by practicing a system, comprising: a data compression system for compressing and decompressing data input; a plurality of compression routines selectively utilized by the data compression system, wherein a first one of the plurality of compression routines includes a first compression algorithm and a second one of the plurality of compression routines includes a second compression algorithm; and a controller for tracking throughput and generating a control signal to select a compression routine based on the throughput, wherein said tracking throughput comprises tracking a number of pending access requests to a storage device; and wherein when the controller determines that the throughput falls below a predetermined throughput threshold, the controller commands the data compression engine to use one of the plurality of compression routines to provide a faster rate of compression so as to increase the throughput. For example, Sony adopted H.264 as its video codec in its

products/services, such as, e.g., Sony's cameras, Surveillance Video Encoders and Satellite/Receiver combos. For similar reasons, Sony also induces its customers to use the Accused Instrumentalities to infringe other claims of the '046 Patent. Sony specifically intended and was aware that these normal and customary activities would infringe the '046 Patent. Sony performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the '046 Patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Sony engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Sony has induced and continues to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the '046 Patent, knowing that such use constitutes infringement of the '046 Patent. Accordingly, Sony has been, and currently is, inducing infringement of the '046 Patent, in violation of 35 U.S.C. § 271(b).

37. Sony has also infringed, and continues to infringe, claims of the '046 Patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '046 Patent, and constitute a material part of the invention. Sony knows the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the '046 Patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Sony has been, and currently is, contributorily infringing the '046 Patent, in violation of 35 U.S.C. § 271(c).

38. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities' compression features, Sony has injured Realtime and is liable to Realtime for infringement of the '046 Patent pursuant to 35 U.S.C. § 271.

39. As a result of Sony's infringement of the '046 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Sony's infringement, but in no event less than a reasonable royalty for the use made of the invention by Sony, together with interest and costs as fixed by the Court.

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 8,634,462

40. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully set forth herein.

41. On information and belief, Sony has made, used, offered for sale, sold and/or imported into the United States products that infringe the '462 Patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Sony's video security camera series, including Minidomes series cameras SNC-VM772R, SNC-VM641, SNC-EM641, SNC-VM642R, SNC-EM642R, SNC-VM632R, SNC-VM602R, SNC-VM631, SNC-VM601, SNC-VM630, SNC-VM600, SNC-EM632RC, SNC-EM602RC, SNC-EM631, SNC-EM601, SNC-EM630, SNC-EM600, SNC-XM631, SNC-XM632, SNC-XM636, SNC-XM637, SNC-HM662, SNC-DH280, SNC-DH240T, SNC-DH140T, SNC-DH240, SNC-DH140, SNC-DH260, SNC-DH160, SNC-DH220T, SNC-DH120T, SNC-DH220, SNC-DH120, SNC-DH210T, SNC-DH110T, SNC-DH210, SNC-DH110, SNC-ZM551, SNC-ZM550; Fixed series cameras SNC-VB770, SNC-VB640, SNC-EB640, SNC-VB642D, SNC-EB642R, SNC-

VB635, SNC-VB630, SNC-VB600, SNC-VB632D, SNC-EB632R, SNC-EB602R, SNC-EB630, SNC-EB600, SNC-EB630B, SNC-EB600B, SNC-CX600W, SNC-CX600, SNC-CH280, SNC-CH180, SNC-CH240, SNC-CH140, SNC-CH260, SNC-CH160, SNC-CH220, SNC-CH120, SNC-CH110, SNC-ZB550; and Pan Tilt Zoom series cameras SNC-WR632C, SNC-WR602C, SNC-WR602, SNC-WR630, SNC-WR600, SNC-ER585, SNC-ER580, SNC-EP580, SNC-ER550, SNC-EP550, SNC-ER520, SNC-EP520, SNC-RS86N, SNC-RS46N; other Pan/Tilt/Zoom cameras (for Broadcast & Production) SRG360SHE, BRCH900/PAC2, and BRCH900; the cameras ILCE-7RM3, ILCE-7RM2; Sony's interchangeable-lens cameras, compact cameras; Sony camcorders, action cameras, motion cameras, film cameras, digital film cameras, music video recorders, professional camcorders; Sony Surveillance Video Encoders SNT-EX101, SNT-EX101E, SNT-EX104, SNT-EX154, SNT-EP104 and SNT-EP154; and the Sony SAS-HD1SET H.264 satellite and receiver combo, Sony PlayStation models including PS4 models, PS3 models, PS2 models, PS1 models, Sony Televisions such as the Z9D series, A1E series, XBR-X930E-X940E series, XBR-X900E series, XBR-X850E series, XBR-X800E series, X700E series, X690E series, XBR-X940D-X930D series, XBR-X750D-X700D series, XBR-X800D series, XBR-X850D series, W630B series, W650D series, W600D series; Sony Blu-Ray & DVD Players with playback capability of MPEG-4/AVC (.mov, .3gp, .3g2, .3gpp, .3gpp2, .flv) or MPEG-4 AVC (.mkv, .mp4, .m4v, .m2ts, .mts) such as the UBP-X800 and UBP-X1000ES series; Sony MP3 players; Sony in-car receivers and players, Sony 4K products including the Sony 4K BRAVIA TVs, Sony Video Unlimited 4K, Next generation 4K Media Player, Sony 4K Home Theater Projectors such as the VPL-VW500ES and VPL-VW1100ES, Sony consumer 4K

Handycams including the FDR-AX1, FDR-AX100, 4K products using the Sony IMX274 Chipset including the Urban Security Group (USG) Sony Chip Ultra 4K IP PoE Network Bullet Security Camera, the USG Sony Chip Ultra 4K IP PoE Network Dome Security Camera, the USG Sony DSP Ultra 4K IP PoE Network Bullet Security Camera, and all versions and variations thereof since the issuance of the ’462 Patent (“Accused Instrumentalities”).

42. For example, an official Sony press release in an entry about the Sony 4K BRAVIA TV products states that “2014 4K BRAVIA TVs incorporate a decoder compatible with the latest **H.265/HEVC (High Efficiency Video Coding) video compression format**, enabling them to display 4K/60p content from internet streams and other sources, without the need for additional devices” and “In addition to H.264/MPEG-4 AVC (Advanced Video Coding), this new 4K media player incorporates a decoder compatible with **the advanced HEVC compression format**. This decoder is designed to provide customers with the ability to enjoy 4K/60p content and anticipated new 4K streaming services” and “2014 4K BRAVIA TVs incorporate a decoder compatible with **the latest “HEVC” video compression format**, enabling them to display 4K/60p content from internet streams and other sources, without the need for additional devices”. *See* Sony News Release, Jan. 7 2014, Enhancing the World of 4K in the Home by Expanding 4K Product Lineup and Enriching 4K Content Environment, https://www.sony.net/SonyInfo/News/Press/201401/14-002E/index.html.

43. Furthermore, there are 4K products that utilize the Sony IMX274 chipset to perform H.265 video compression. *See* Urban Security Group (USG) Sony Chip Ultra 4K…H.265 Ultra HD IP PoE Network Bullet Security Camera,

https://www.amazon.com/3840x2160-Network-Bullet-Security-Camera/dp/B01N69Z3LN ("Top of The line SONY IMX274 Chipset * Professional Grade High Definition H.265/H.264 IP PoE Network Ultra 4K 8MP…Utilizes Newest Video Compression Format: H.265 H[EV]C…Sony IMX274 CMOS Sensor"); USG Sony Chip Ultra 4K…H.265 Ultra HD IP PoE Network Dome Security Camera, https://www.amazon.com/Ultra-3840x2160-Network-Security-Camera/dp/B01N0JYZYD/ref=cm_cr_arp_d_product_top?ie=UTF8 (same); Sony DSP Ultra 4K…H.265 Ultra HD IP PoE Network Bullet Security Camera, http://www.cctv.supplies/index.php/products/urban-security-group-usglslizm60s800-ip-network-8mp-bullet-security-camera-poe-h265-onvif-24-12mp-lens.html (same).

44. The Accused Instrumentalities performs a method for coding a video signal using hybrid coding. For example, the aim of the coding process is the production of a bitstream, as defined in definition 3.12 of the ITU-T H.265 Series H: Audiovisual and Multimedia Systems, "Infrastructure of audiovisual services – Coding of moving video" High efficiency video coding ("HEVC Spec"): "bitstream: A sequence of bits, in the form of a NAL unit stream or a byte stream, that forms the representation of coded pictures and associated data forming one or more coded video sequences (CVSs)." *See also, e.g.*, "Overview of the High Efficiency Video Coding (HEVC) Standard" by Gary J. Sullivan, Fellow, IEEE, Jens-Rainer Ohm, Member, IEEE, Woo-Jin Han, Member, IEEE, and Thomas Wiegand, Fellow, IEEE, published in IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12, DECEMBER 2012 ("IEEE HEVC) ("The video coding layer of HEVC employs the same hybrid approach (inter-/intrapicture prediction and 2-D transform coding) used in all

video compression standards since H.261"). *See also, e.g.*, HEVC Spec at 0.7 "Overview of the design characteristics."

45. The Accused Instrumentalities reduce temporal redundancy by block based motion compensated prediction in order to establish a prediction error signal. For example, clause 8.5.3 Decoding process for prediction units in inter prediction mode and the subclauses thereof of the HEVC Spec describe the block based motion compensation techniques used in the decoding process. *See also, e.g.*, IEEE HEVC at 1651-1652 6) Motion compensation: Quarter-sample precision is used for the MVs, and 7-tap or 8-tap filters are used for interpolation of fractional-sample positions (compared to six-tap filtering of half-sample positions followed by linear interpolation for quarter-sample positions in H.264/MPEG-4 AVC). Similar to H.264/MPEG-4 AVC, multiple reference pictures are used. For each PB, either one or two motion vectors can be transmitted, resulting either in unipredictive or bipredictive coding, respectively. As in H.264/MPEG-4 AVC, a scaling and offset operation may be applied to the prediction signal(s) in a manner known as weighted prediction.").

46. The Accused Instrumentalities perform quantization on samples of the prediction error signal or on coefficients resulting from a transformation of the prediction error signal into the frequency domain to obtain quantized values, representing quantized samples or quantized coefficients respectively. For example, the quantization parameter and the scaling (inverse quantization) are defined in definitions 3.112 (page 10) and 3.131 (page 11), respectively, the usage of the scaling process in the decoding being described in clause and 8.6 Scaling, transformation and array construction process prior to deblocking filter process of the HEVC Spec. *See also, e.g.*, IEEE HEVC at 1652 ("8)

Quantization control: As in H.264/MPEG-4 AVC, uniform reconstruction quantization (URQ) is used in HEVC, with quantization scaling matrices supported for the various transform block sizes.”).

47. The Accused Instrumentalities perform a method wherein the prediction error signal includes a plurality of subblocks each including a plurality of quantized values. For example, the quantized samples or transform coefficients from the subblock are scaled and transformed as described in above mentioned clause 8.6 of the HEVC Spec. *See also, e.g.*, IEEE HEVC at 1652 (“Prediction units and prediction blocks (PBs): The decision whether to code a picture area using interpicture or intrapicture prediction is made at the CU level. A PU partitioning structure has its root at the CU level. Depending on the basic prediction-type decision, the luma and chroma CBs can then be further split in size and predicted from luma and chroma prediction blocks (PBs). HEVC supports variable PB sizes from 64×64 down to 4×4 samples.”).

48. The Accused Instrumentalities perform a method of calculating a first quantization efficiency for the quantized values of at least one subblock of the plurality of subblocks; setting the quantized values of the at least one subblock to all zeroes; calculating a second quantization efficiency for the at least one subblock while all of the quantized values are zeroes; selecting which of the first and second quantization efficiencies is a higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized values prior to setting the quantized values of the at least one subblock to all zeroes if the first quantization efficiency is higher and selecting the at least one subblock with the quantized values set to zero, for further proceeding, if the second quantization efficiency is higher. For example, the bitstream resulting from the

encoding as described in this last item of the claim contains all the relevant information as needed by the decoder for proper decoding. If the coefficients of the subblock are set to zero as a consequence of the efficiency calculation, the coded_sub_block_flag, as described in clause 7.4.9.11 Residual coding semantics, HEVC Spec, is set to 0, indicating that all the 16 coefficients of the coded sub block have been set to 0: "coded_sub_block_flag[xS][yS] specifies the following for the sub-block at location (xS, yS) within the current transform block, where a sub-block is a (4x4) array of 16 transform coefficient levels: – If coded_sub_block_flag[xS][yS] is equal to 0, the 16 transform coefficient levels of the sub-block at location (xS, yS) are inferred to be equal to 0."

49. When coded_sub_block_flag[xS][yS] has not been set equal to 0, the position in the array of non 0 coefficients can be determined as follows:

– Otherwise (coded_sub_block_flag[xS][yS] is equal to 1), the following applies:

– If (xS, yS) is equal to (0, 0) and (LastSignificantCoeffX, LastSignificantCoeffY) is not equal to (0, 0), at least one of the 16 sig_coeff_flag syntax elements is present for the sub-block at location (xS, yS) .

– Otherwise, at least one of the 16 transform coefficient levels of the sub-block at location (xS, yS) has a non zero value.

When coded_sub_block_flag[xS][yS] is not present, it is inferred as follows:

– If one or more of the following conditions are true, coded_sub_block_flag[xS][yS] is inferred to be equal to 1:

– (xS, yS) is equal to (0, 0)

– (xS, yS) is equal to (LastSignificantCoeffX >> 2 , LastSignificantCoeffY >> 2)

– Otherwise, coded_sub_block_flag[xS][yS] is inferred to be equal to 0.

HEVC Spec at 7.4.9.11 Residual coding semantics. Therefore, even though the coding algorithms than can be used for reaching specific efficiency targets are not specified by the HEVC Spec (as stated in clause 0.7), this particular combination of choices produces a valid bitstream that has to be decoded by a conformant decoder.

50. The infringement of the Accused Instrumentalities is also shown by way of considering the reference software (*see, e.g.*, https://hevc.hhi.fraunhofer.de/). Setting the flag RDOQ=true in the encoder configuration file enables rate-distortion-optimized quantization for transformed TUs. This feature is implemented in the HM reference software as function xRateDistOptQuant in file TComTrQuant.cpp. In the function xRateDistOptQuant, the efficiency for setting all quantized values to zero is calculated and stored in the variable d64BestCost. In the variable iBestLastIdxP1, a 0 is stored indicating that all values starting from the 0th position are set to zero. Afterwards, the efficiency for keeping quantized values unequal to zero is calculated and stored in the variable totalCost. The variable iBestLastIdxP1 is adjusted correspondingly to values unequal to 0. The two efficiencies d64BestCost and totalCost are compared, and selecting for further proceeding either quantized values, which are all set to zero or quantized values, which are not all set to zero. All values starting from the position defined by the variable iBestLastIdxP1 are set to zero.

```
Double  d64BestCost         = 0;
Int     ui16CtxCbf          = 0;
Int     iBestLastIdxP1      = 0;
if( !pcCU->isIntra( uiAbsPartIdx ) && isLuma(compID) && pcCU->getTransformIdx( uiAbsPartIdx ) == 0 )
{
  ui16CtxCbf   = 0;
  d64BestCost  = d64BlockUncodedCost + xGetICost( m_pcEstBitsSbac->blockRootCbpBits[ ui16CtxCbf ][ 0 ] );
  d64BaseCost += xGetICost( m_pcEstBitsSbac->blockRootCbpBits[ ui16CtxCbf ][ 1 ] );
}
else
{
  ui16CtxCbf   = pcCU->getCtxQtCbf( rTu, channelType );
  ui16CtxCbf  += getCBFContextOffset(compID);
  d64BestCost  = d64BlockUncodedCost + xGetICost( m_pcEstBitsSbac->blockCbpBits[ ui16CtxCbf ][ 0 ] );
  d64BaseCost += xGetICost( m_pcEstBitsSbac->blockCbpBits[ ui16CtxCbf ][ 1 ] );
}
```

51. Calculation of the efficiency for setting all quantized values to zero and storing the result in the variable d64BestCost:

HEVC Reference Software (https://hevc.hhi.fraunhofer.de/).

52. Calculating the efficiency for keeping quantized values unequal to zero and storing the result in the variable totalCost:

```
Bool bFoundLast = false;
for (Int iCGScanPos = iCGLastScanPos; iCGScanPos >= 0; iCGScanPos--)
{
  UInt uiCGBlkPos = codingParameters.scanCG[ iCGScanPos ];

  d64BaseCost -= pdCostCoeffGroupSig [ iCGScanPos ];
  if (uiSigCoeffGroupFlag[ uiCGBlkPos ])
  {
    for (Int iScanPosinCG = uiCGSize-1; iScanPosinCG >= 0; iScanPosinCG--)
    {
      iScanPos = iCGScanPos*uiCGSize + iScanPosinCG;

      if (iScanPos > iLastScanPos) continue;
      UInt    uiBlkPos     = codingParameters.scan[iScanPos];

      if( piDstCoeff[ uiBlkPos ] )
      {
        UInt    uiPosY       = uiBlkPos >> uiLog2BlockWidth;
        UInt    uiPosX       = uiBlkPos - ( uiPosY << uiLog2BlockWidth );

        Double d64CostLast= codingParameters.scanType == SCAN_VER ? xGetRateLast( uiPosY, uiPosX, compID ) :
                                                                    xGetRateLast( uiPosX, uiPosY, compID );
        Double totalCost = d64BaseCost + d64CostLast - pdCostSig[ iScanPos ];
```

HEVC Reference Software (https://hevc.hhi.fraunhofer.de/).

53. Comparing the two efficiencies d64BestCost and totalCost:

```
if( totalCost < d64BestCost )
{
  iBestLastIdxP1  = iScanPos + 1;
  d64BestCost     = totalCost;
}
```

HEVC Reference Software (https://hevc.hhi.fraunhofer.de/).

54. Selecting for further proceeding either quantized values, which are all set

```
//===== clean uncoded coefficients =====
for ( Int scanPos = iBestLastIdxP1; scanPos <= iLastScanPos; scanPos++ )
{
  piDstCoeff[ codingParameters.scan[ scanPos ] ] = 0;
}
```

to zero or quantized values, which are not all set to zero:

HEVC Reference Software (https://hevc.hhi.fraunhofer.de/).

55. Therefore, from at least the above, Sony has directly infringed and continues to infringe the ’462 Patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the system claimed by Claim 1 of the ’462 Patent, namely, a method for coding a video signal using hybrid coding, comprising: reducing temporal redundancy by block based motion compensated prediction in order to establish a prediction error signal; performing quantization on samples of the prediction error signal or on coefficients resulting from a transformation of the prediction error signal into the frequency domain to obtain quantized values, representing quantized samples or quantized coefficients respectively, wherein the prediction error signal includes a plurality of subblocks each including a plurality of quantized values; calculating a first quantization efficiency for the quantized values of at least one subblock of the plurality of subblocks; setting the quantized values of the at least one subblock to all zeroes; calculating a second quantization efficiency for the at least one subblock while all of the quantized values are zeroes; selecting which of the first and second quantization efficiencies is a higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized values prior to setting the

quantized values of the at least one subblock to all zeroes if the first quantization efficiency is higher and selecting the at least one subblock with the quantized values set to zero, for further proceeding, if the second quantization efficiency is higher. Upon information and belief, Sony uses the Accused Instrumentalities to practice infringing methods for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

56. On information and belief, Sony also directly infringes and continues to infringe other claims of the ’462 Patent, for similar reasons as explained above with respect to Claim 1 of the ’462 Patent.

57. On information and belief, all of the Accused Instrumentalities perform the claimed methods in substantially the same way, e.g., in the manner specified in the HEVC (or H.265) standard.

58. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the methods and/or systems claimed by the ’462 Patent.

59. On information and belief, Sony has had knowledge of the ’462 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Sony knew of the ’462 Patent and knew of its infringement, including by way of this lawsuit. By the time of trial, Sony will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of the claims of the ’462 Patent.

60. Upon information and belief, Sony’s affirmative acts of making, using,

and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’462 Patent by practicing a method for coding a video signal using hybrid coding, comprising: reducing temporal redundancy by block based motion compensated prediction in order to establish a prediction error signal; performing quantization on samples of the prediction error signal or on coefficients resulting from a transformation of the prediction error signal into the frequency domain to obtain quantized values, representing quantized samples or quantized coefficients respectively, wherein the prediction error signal includes a plurality of subblocks each including a plurality of quantized values; calculating a first quantization efficiency for the quantized values of at least one subblock of the plurality of subblocks; setting the quantized values of the at least one subblock to all zeroes; calculating a second quantization efficiency for the at least one subblock while all of the quantized values are zeroes; selecting which of the first and second quantization efficiencies is a higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized values prior to setting the quantized values of the at least one subblock to all zeroes if the first quantization efficiency is higher and selecting the at least one subblock with the quantized values set to zero, for further proceeding, if the second quantization efficiency is higher. For example, Sony adopted HEVC (or H.265) as its video codec in its products/services, such as in its 4K TV, projector, home theater system, media player and camera products. For similar reasons, Sony also induces its customers to use the Accused Instrumentalities to infringe other claims of the ’462 Patent. Sony specifically intended and was aware that these normal and customary activities would infringe the ’462 Patent. Sony performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the ’462 Patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Sony engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Sony has induced and continue to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the ’462 Patent, knowing that such use constitutes infringement of the ’462 Patent. Accordingly, Sony has been, and currently is, inducing infringement of the ’462 Patent, in violation of 35 U.S.C. § 271(b).

61. Sony has also infringed, and continues to infringe, claims of the ’462 Patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the ’462 Patent, and constitute a material part of the invention. Sony knows the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the ’462 Patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Sony has been, and currently is, contributorily infringing the ’462 Patent, in violation of 35 U.S.C. § 271(c).

62. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’ compression features, Sony has injured Realtime and is liable

to Realtime for infringement of the ’462 Patent pursuant to 35 U.S.C. § 271.

63. As a result of Sony’s infringement of the ’462 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Sony’s infringement, but in no event less than a reasonable royalty for the use made of the invention by Sony, together with interest and costs as fixed by the Court.

COUNT III
INFRINGEMENT OF U.S. PATENT NO. 8,929,442

64. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully set forth herein.

65. On information and belief, Sony has made, used, offered for sale, sold and/or imported into the United States Sony products that infringe the ’442 Patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Sony’s video security camera series, including Minidomes series cameras SNC-VM772R, SNC-VM641, SNC-EM641, SNC-VM642R, SNC-EM642R, SNC-VM632R, SNC-VM602R, SNC-VM631, SNC-VM601, SNC-VM630, SNC-VM600, SNC-EM632RC, SNC-EM602RC, SNC-EM631, SNC-EM601, SNC-EM630, SNC-EM600, SNC-XM631, SNC-XM632, SNC-XM636, SNC-XM637, SNC-HM662, SNC-DH280, SNC-DH240T, SNC-DH140T, SNC-DH240, SNC-DH140, SNC-DH260, SNC-DH160, SNC-DH220T, SNC-DH120T, SNC-DH220, SNC-DH120, SNC-DH210T, SNC-DH110T, SNC-DH210, SNC-DH110, SNC-ZM551, SNC-ZM550; Fixed series cameras SNC-VB770, SNC-VB640, SNC-EB640, SNC-VB642D, SNC-EB642R, SNC-VB635, SNC-VB630, SNC-VB600, SNC-VB632D, SNC-EB632R, SNC-EB602R, SNC-EB630, SNC-EB600, SNC-EB630B, SNC-EB600B, SNC-CX600W, SNC-CX600, SNC-CH280, SNC-CH180, SNC-CH240, SNC-CH140, SNC-CH260, SNC-CH160, SNC-

CH220, SNC-CH120, SNC-CH110, SNC-ZB550; and Pan Tilt Zoom series cameras SNC-WR632C, SNC-WR602C, SNC-WR602, SNC-WR630, SNC-WR600, SNC-ER585, SNC-ER580, SNC-EP580, SNC-ER550, SNC-EP550, SNC-ER520, SNC-EP520, SNC-RS86N, SNC-RS46N; other Pan/Tilt/Zoom cameras (for Broadcast & Production) SRG360SHE, BRCH900/PAC2, and BRCH900; the cameras ILCE-7RM3, ILCE-7RM2; Sony's interchangeable-lens cameras, compact cameras; Sony camcorders, action cameras, motion cameras, film cameras, digital film cameras, music video recorders, professional camcorders; Sony Surveillance Video Encoders SNT-EX101, SNT-EX101E, SNT-EX104, SNT-EX154, SNT-EP104 and SNT-EP154; and the Sony SAS-HD1SET H.264 satellite and receiver combo, Sony PlayStation models including PS4 models, PS3 models, PS2 models, PS1 models, Sony Televisions such as the Z9D series, A1E series, XBR-X930E-X940E series, XBR-X900E series, XBR-X850E series, XBR-X800E series, X700E series, X690E series, XBR-X940D-X930D series, XBR-X750D-X700D series, XBR-X800D series, XBR-X850D series, W630B series, W650D series, W600D series; Sony Blu-Ray & DVD Players with playback capability of MPEG-4/AVC (.mov, .3gp, .3g2, .3gpp, .3gpp2, .flv) or MPEG-4 AVC (.mkv, .mp4, .m4v, .m2ts, .mts) such as the UBP-X800 and UBP-X1000ES series; Sony MP3 players; Sony in-car receivers and players, Sony 4K products including the Sony 4K BRAVIA TVs, Sony Video Unlimited 4K, Next generation 4K Media Player, Sony 4K Home Theater Projectors such as the VPL-VW500ES and VPL-VW1100ES, Sony consumer 4K Handycams including the FDR-AX1, FDR-AX100, 4K products using the Sony IMX274 Chipset including the Urban Security Group (USG) Sony Chip Ultra 4K IP PoE Network Bullet Security Camera, the USG Sony Chip Ultra 4K IP PoE Network Dome Security

Camera, the USG Sony DSP Ultra 4K IP PoE Network Bullet Security Camera, and all versions and variations thereof since the issuance of the ’442 Patent (“Accused Instrumentalities”).

66. For example, Sony notes that several of the Accused Instrumentalities possess H.264 capabilities on this web page on their United States of America website with the header “Did you know that Sony supports H.264?” The article lists several of the Accused Instrumentalities in the column on the right, which has a header of “Related Products.” In the first sentence underneath the main title, the article goes on to state that “Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.” So from the above, it is clear that all, most or many of Sony’s cameras utilize H.264 technology when processing, compressing or recording video. *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

Did you know that Sony supports H.264?

Video compression may seem really dull, but the real-world benefits of using the latest technology can radically increase the flexibility of your IP network. Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.

Put simply, better compression means greater flexibility – the more efficiently data is handled, the more choices you have with your existing resources. An existing network can support more cameras, better audio-video quality or both.

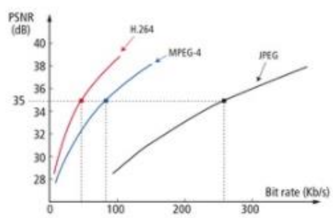
For surveillance applications, the 'industry-standard' image compression format is JPEG – which is perhaps best known for digital still photographs. In fact, using JPEG compression a network camera is acting rather like a digital camera – taking 25 (PAL) or 30 (NTSC) pictures per second. Each image is compressed individually (this is called intra-frame compression) which ensures each image is good quality and also provides a near constant data-size – making predicting network data traffic and data storage demands easy.

Often referred to as Motion JPEG or MJPEG, this form of compression has a relatively low processor demands and made possible the current generation of network cameras. It's also quite well suited to monitoring applications where it's not always essential to provide a TV-quality frame-rate. On the negative side, the MJPEG format dates back to the early 90s and since then the technology of compression has advanced considerably...

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

Related Products

SNC-DH220T
Vandal-resistant Minidome 1080p/30 fps Camera - E Series

SNC-CH120
Box-type 720p/30 fps Camera - E Series

SNC-CH280
Outdoor IR Bullet 1080p/30 fps Camera - V Series

SNC-CH140
Box-type 720p/30 fps Camera - V Series

SNC-DH160
Outdoor IR Ruggedized 720p/30 fps Camera - E Series

SNC-ZM550
Minidome 720p/30 fps camera capable of transmitting both analog video and H...

SNC-ER550
720p/30 fps Rapid Dome Camera - E Series

SNC-EB602R
Outdoor IR Bullet 720p/ 30 fps Camera Powered by IPELA ENGINE EX™ – E Series

SNC-EB632R
Outdoor IR Bullet 1080p/30 fps Camera Powered by IPELA ENGINE EX™ – E Series

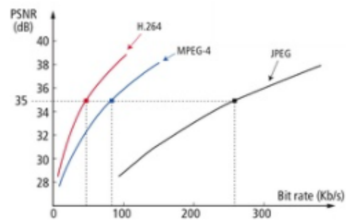
67. On that same website, Sony also mentions some background on the benefits of H.264, and also adds that "Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms." The website further states that: "Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading

role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!" *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit rate than MPEG-4, it uses a variety of different advanced techniques to achieve this aim – most notably block patterns used to predict movement across video frames.



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

The practical benefits of these varying compression formats can be illustrated quite simply. In the above diagram you can see JPEG compression operating at 260Kb/s, while MPEG-4 transmits at 85Kb/s and H.264 transmits at 50K/bs. To put this into perspective, MPEG-4 requires approximately one-third of the bandwidth used by JPEG and H.264 requires just one-fifth.

Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms.

Leadership & Compatibility

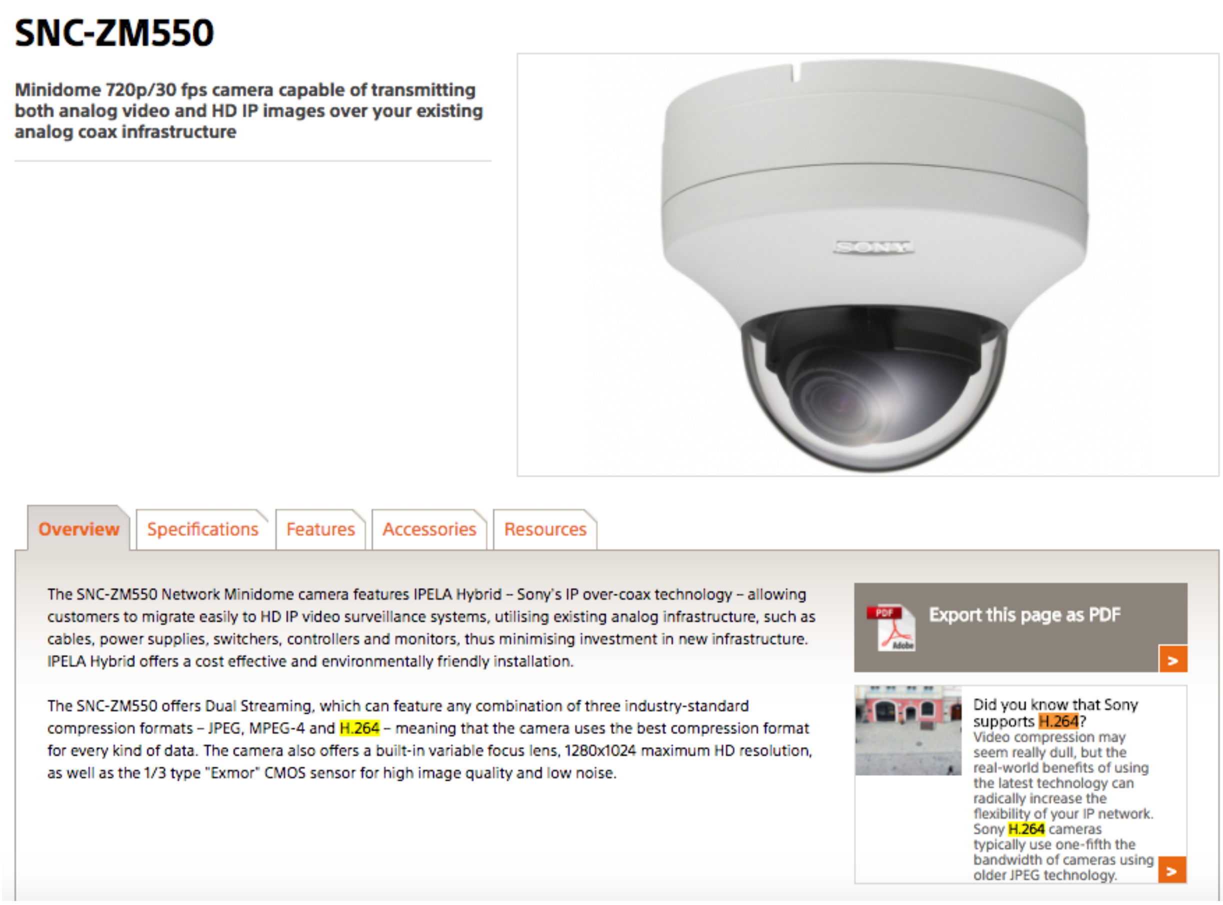
A five-fold increase in the capacity of an IP-based network might seem science fiction, but in a networked digital world it should come as no surprise that there's huge amount of investment in ensuring the highest possible video quality at the lowest possible bitrate. H.264 technology is currently used in Blu-ray discs, HDTV broadcasting (including BBC HD and Euro 1080), AVCHD (a HD recording format for HDD and Solid State camcorders) and a wide variety of mobile devices, including Apple's iPhone and Sony's PSP. The format is also commonly used online for high quality content, for example HD movie trailers, and it's also been adopted by YouTube for its new high quality mode. This also means most media players, such as QuickTime or VLC, support H.264 encoded content.

Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!

More information on Sony Video Security solutions

* The vertical axis shows Peak Signal-to-Noise Ratio (PSNR), a metric for the "quality" of compressed video images, while the horizontal axis shows the transmission bit rate. The graph shows just one example of comparing bit rates at which JPEG, MPEG-4, and H.264 images can be transmitted. Actual bit rates for transmitting data using these three compression formats differ with image quality and image size settings. In this example, the video parameters are; 10 frames per second, 176x144 (QCIF) resolution, 10 seconds of video (100 frames).

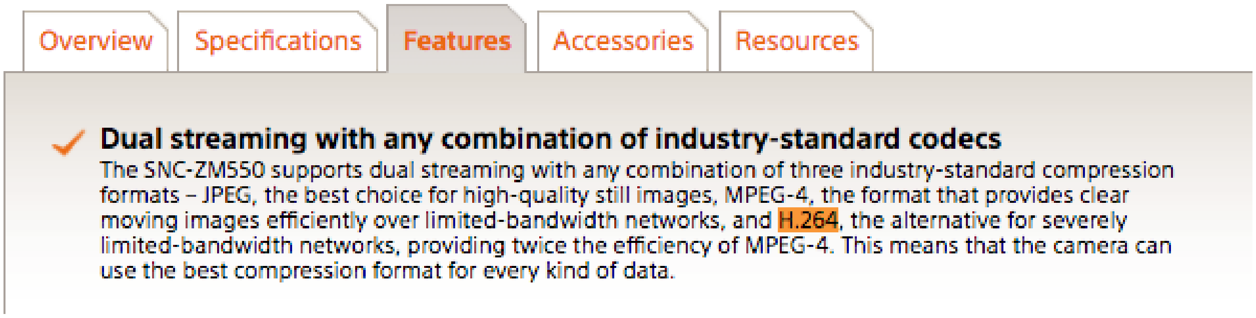
68. As an illustrative example, the website for Sony's SNC-ZM550 camera states in its "Overview" tab that "The SNC-ZM550 offers Dual Streaming, which can feature any combination of three industry-standard compression formats – JPEG, MPEG-4 and H.264 – meaning that the camera uses the best compression format for every kind of data." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-



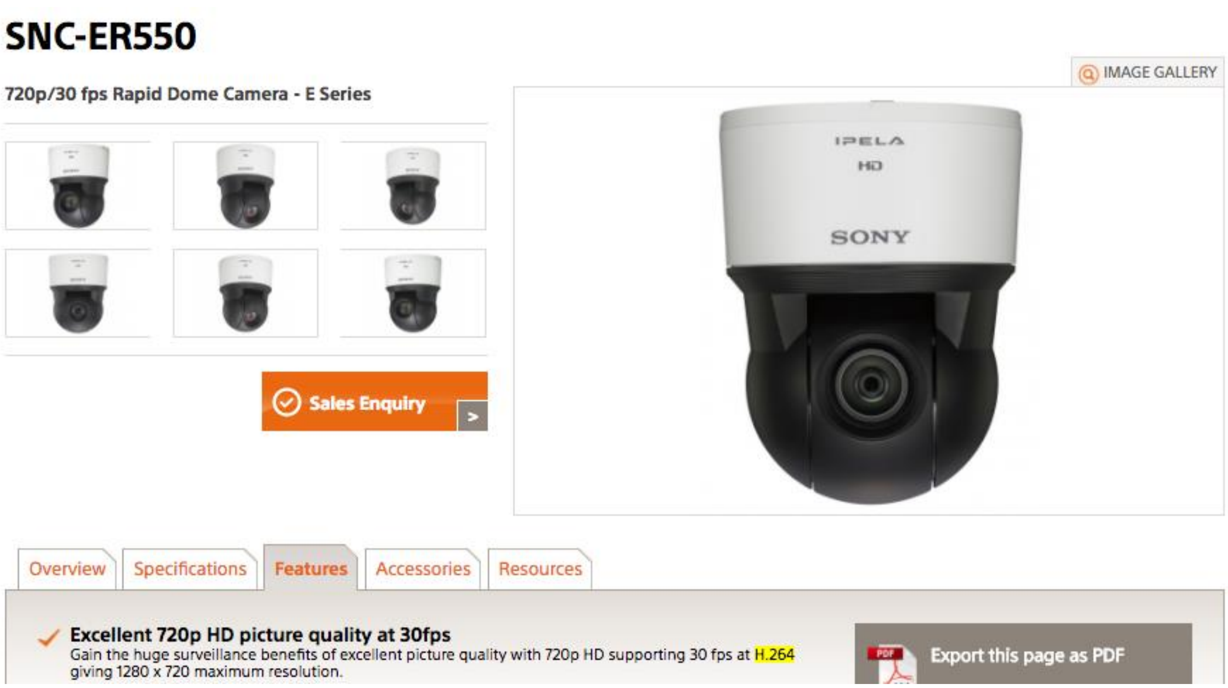
minidomes/snc-zm550/overview/#overview:

69. On the same web site, under the "Features" tab, it states that "The SNC-ZM550 supports dual streaming with…H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4." *See*

http://us.professional.sony.com/pro/product/video-security-ip-cameras-minidomes/snc-zm550/features/#features:



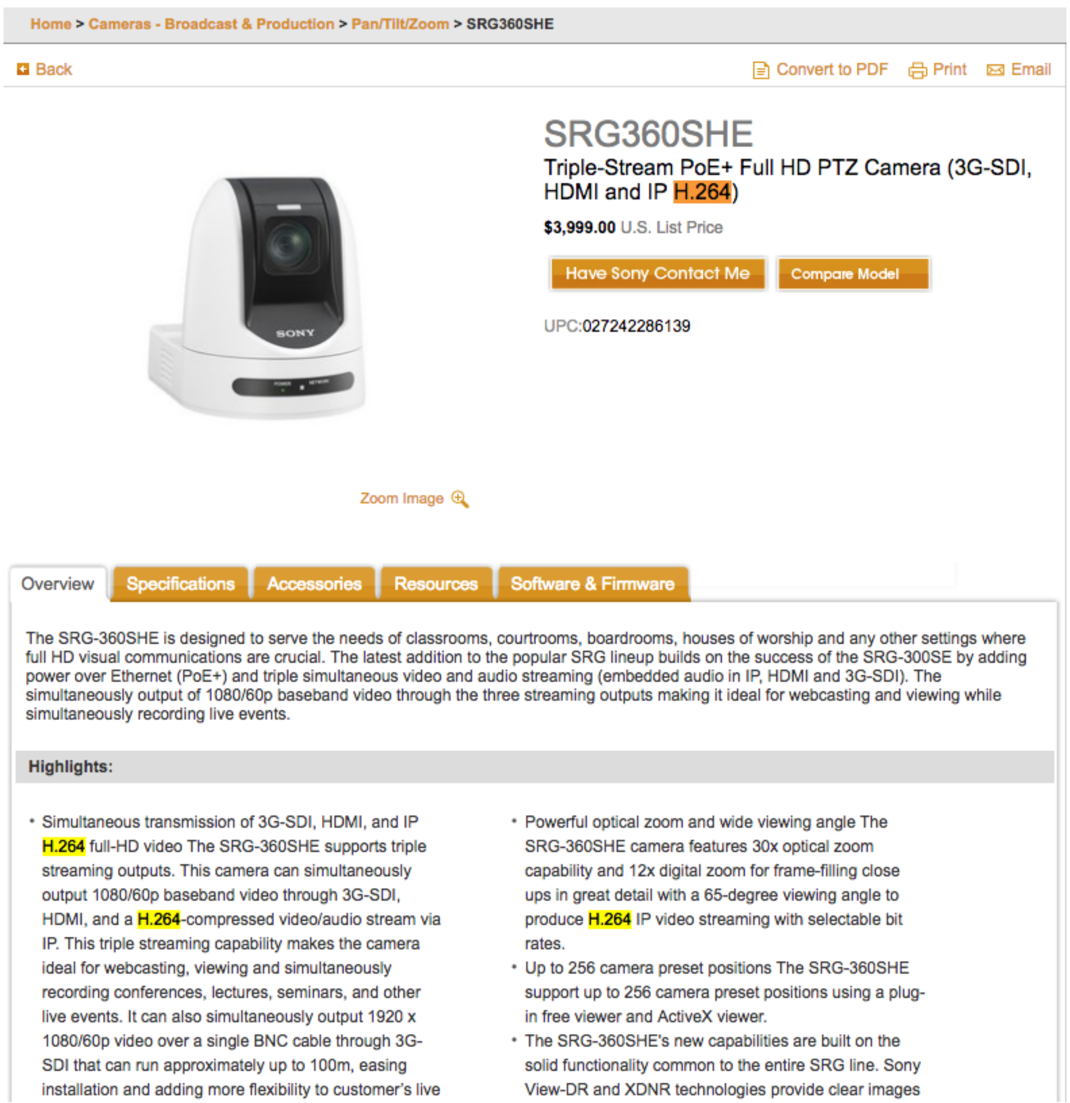
70. As another illustrative example, the website for Sony's SNC-ER550 camera has a "Features" tab which states: "Gain the huge surveillance benefits of excellent picture quality with 720p HD supporting 30 fps at H.264 giving 1280 x 720 maximum resolution." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-pan-tilt-zoom/snc-er550/features/#features:



71. As yet another illustrative example, the website for Sony's SRG360SHE camera (sub-header: "Triple-Stream PoE + Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)") mentions, under its "Overview" tab: "Simultaneous transmission of 3G-SDI, HDMI and IP H.264 full-HD video" and "This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264 compressed video/audio stream via IP" as well as "The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing

angle to produce H.264 IP video streaming with selectable bit rates." *See* https://pro.sony.com/bbsc/ssr/cat-broadcastcameras/cat-broadcastcamerapantiltzoom/product-SRG360SHE/:

72. Furthermore, Sony's Surveillance Video Encoders all use H.264 as a "Video compression format" as can be seen by the below datasheet. *See* https://pro.sony.com/bbsccms/assets/files/cat/camsec/brochures/quickref_sntexep.pdf:



Home > Cameras - Broadcast & Production > Pan/Tilt/Zoom > SRG360SHE

Back

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SRG360SHE

Triple-Stream PoE+ Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)

$3,999.00 U.S. List Price

Have Sony Contact Me Compare Model

UPC:027242286139

Zoom Image

Overview | Specifications | Accessories | Resources | Software & Firmware

The SRG-360SHE is designed to serve the needs of classrooms, courtrooms, boardrooms, houses of worship and any other settings where full HD visual communications are crucial. The latest addition to the popular SRG lineup builds on the success of the SRG-300SE by adding power over Ethernet (PoE+) and triple simultaneous video and audio streaming (embedded audio in IP, HDMI and 3G-SDI). The simultaneously output of 1080/60p baseband video through the three streaming outputs making it ideal for webcasting and viewing while simultaneously recording live events.

Highlights:

- Simultaneous transmission of 3G-SDI, HDMI, and IP H.264 full-HD video The SRG-360SHE supports triple streaming outputs. This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264-compressed video/audio stream via IP. This triple streaming capability makes the camera ideal for webcasting, viewing and simultaneously recording conferences, lectures, seminars, and other live events. It can also simultaneously output 1920 x 1080/60p video over a single BNC cable through 3G-SDI that can run approximately up to 100m, easing installation and adding more flexibility to customer's live
- Powerful optical zoom and wide viewing angle The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing angle to produce H.264 IP video streaming with selectable bit rates.
- Up to 256 camera preset positions The SRG-360SHE support up to 256 camera preset positions using a plug-in free viewer and ActiveX viewer.
- The SRG-360SHE's new capabilities are built on the solid functionality common to the entire SRG line. Sony View-DR and XDNR technologies provide clear images

Surveillance Video Encoders

	Full Function				Basic Function	
	1CH Box		4CH Box	4CH Blade	4CH Box	4CH Blade
	SNT-EX101	SNT-EX101E	SNT-EX104	SNT-EX154	SNT-EP104	SNT-EP154
						
Codec image size (HxV)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)
Video compression format	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG
Codec streaming capability	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)
Maximum frame rate	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)
PTZ control	Yes	Yes	Yes	Yes	No	No
Visibility Enhancer	Yes	Yes	Yes	Yes	Yes	Yes
XDNR	Yes	Yes	Yes	Yes	Yes	Yes
Coaxitron® control	Yes	Yes	Yes	Yes	No	No
Serial Interface	RS-422/RS-485	RS-422/RS-485	RS-485	RS-485	-	-
USB Memory slots	x 1*1	x 1*1	x 4*1	-	-	-
Sensor input	x 2	x 2	x 4	x 4	-	-
Alarm output	x 2	x 2	x 4	x 4	-	-
Audio interface (IN/OUT)	IN x 1, OUT x 1	IN x 1, OUT x 1	IN x 4, OUT x 4	IN x 1, OUT x 1	-	-
Audio support	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	No	No
DEPA™ Advanced (Intelligence)	Yes DEPA Advanced	Yes DEPA Advanced	Yes DEPA Advanced	Yes DEPA Advanced	No	No
Dimensions (W x H x D)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)
Power requirements	AC 24V in, with loop through output Input: AC 24V, +/- 20%	PoE (IEEE802.3af)	DC12 V	From Rack Station	DC12 V	From Rack Station

73. Sony further has a SAS-HD1SET H.264 Satellite/Receiver Combo, as can be seen by this article on Engadget. *See* https://www.engadget.com/2008/09/02/sony-rolls-out-sas-hd1set-h-264-satellite-receiver-combo/:

Sony rolls out SAS-HD1SET h.264 satellite / receiver combo

Richard Lawler, @Rjcc
09.02.08

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Shares

Getting discerning Japanese viewers ready for the new SKY Perfect HDTV channels, Sony is launching an h.264 satellite dish / receiver combo, the SAS-HD1SET, due October 15. At ¥45,000 ($416 U.S.) or ¥37,000 ($342 U.S.) for the DST-HD1 tuner alone, it's a pretty expensive upgrade for 15 HDTV channels, with the promise of more than 70 by this time next year. Add-on the ¥3,500 monthly service charge and we're even more leery, but really, you'll need something to watch on that ultra thin LCD next month.

74. The Accused Instrumentalities determine a parameter of at least a portion of a video data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and resolution parameters. Different parameters correspond with different end applications. H.264 provides for multiple different ranges of such

parameters, each included in the "profiles" and "levels" as defined by the H.264 standard, from the below shown paragraphs from a white paper and Wikipedia. *See* http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

4. H.264 profiles and levels

The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting options and features to a minimum. An important aspect of the standard, as with other video standards, is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes) that optimally support popular productions and common formats.

H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what feature set the encoder may use and limits the decoder implementation complexity.

Network cameras and video encoders will most likely use a profile called the baseline profile, which is intended primarily for applications with limited computing resources. The baseline profile is the most suitable given the available performance in a real-time encoder that is embedded in a network video product. The profile also enables low latency, which is an important requirement of surveillance video and also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements. Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176×144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176×144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352×288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352×288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352×288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352×288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352×576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720×576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720×576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280×720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280×1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048×1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048×1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048×1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672×1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@56.3 (5)

75. A video data block is organized by the group of pictures (GOP) structure, which is a "collection of successive pictures within a coded video stream." *See* https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). *See* https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); https://en.wikipedia.org/wiki/MPEG-1#D-frames (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can

be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

76. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant system such as the Accused Instrumentalities would determine which profile (e.g., "baseline," "extended," "main", or "high") corresponds with that parameter, then select between at least two asymmetric compressors. If baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding ("CAVLC") entropy encoder. If main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding ("CABAC") entropy encoder. Both encoders are asymmetric compressors because it takes a longer period of time for them to compress data than to decompress data. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8×8 vs. 4×4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf

at 7:

The following table summarizes the two major types of entropy coding: Variable Length Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers superior coding efficiency over VLC by adapting to the changing probability distribution of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of CABAC.

H.264 Entropy Coding – Comparison of Approaches

Characteristics	Variable Length Coding (VLC)	Context Adaptive Binary Arithmetic Coding(CABAC)
• Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
• Probability distribution	**Static** - Probabilities never change	**Adaptive** - Adjusts probabilities based on actual data
• Leverages correlation between symbols	**No** - Conditional probabilities ignored	**Yes** - Exploits symbol correlations by using "contexts"
• Non-integer code words	**No** - Low coding efficiency forhigh probability symbols	**Yes** - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the encoder. *See* https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

entropy_coding_mode_flag selects the entropy decoding method to be applied for the syntax elements for which two descriptors appear in the syntax tables as follows:

– If entropy_coding_mode_flag is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).

– Otherwise (entropy_coding_mode_flag is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

77. The Accused Instrumentalities compress the at least the portion of the data block with the selected one or more asymmetric compressors to provide one or more compressed data blocks, which can be organized in a GOP structure (see above). After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data to provide various compressed data blocks, which can also be organized in a GOP structure, as discussed previously above. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

> **Entropy Coding**
> For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf at 13:

> Typical compression ratios to maintain excellent quality are:
> - 10:1 for general images using JPEG
> - 30:1 for general video using H.263 and MPEG-2
> - 60:1 for general video using H.264 and WMV9

> Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.
>
> The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.
>
> The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.
>
> The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

78. Therefore, from at least the above, Sony has directly infringed and continues to infringe the ’442 Patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the system claimed by Claim 8 of the ’442 Patent, namely, an apparatus, comprising: a data decompression system configured to decompress a compressed data block; and a storage medium configured to store at least a portion of the decompressed data block, wherein at least a portion of a data block having video or audio data was compressed with one or more compression

algorithms selected from among a plurality of compression algorithms based upon a throughput of a communication channel and a parameter or an attribute of the at least the portion of the data block to create at least the compressed data block, and wherein at least one of the plurality of compression algorithms is asymmetric. Upon information and belief, Sony uses the Accused Instrumentalities to practice infringing methods for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

79. On information and belief, the Accused Instrumentalities store at least a portion of the one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

80. On information and belief, Sony also directly infringes and continues to infringe other claims of the ’442 Patent, for similar reasons as explained above with respect to Claim 8 of the ’442 Patent.

81. On information and belief, all of the Accused Instrumentalities perform the claimed methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

82. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the systems and/or methods claimed by the ’442 Patent.

83. On information and belief, Sony has had knowledge of the ’442 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Sony knew of the ’442 Patent and knew of its infringement, including by way of

this lawsuit. By the time of trial, Sony will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of the claims of the ’442 Patent.

84. Upon information and belief, Sony’s affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’442 Patent by practicing an apparatus, comprising: a data decompression system configured to decompress a compressed data block; and a storage medium configured to store at least a portion of the decompressed data block, wherein at least a portion of a data block having video or audio data was compressed with one or more compression algorithms selected from among a plurality of compression algorithms based upon a throughput of a communication channel and a parameter or an attribute of the at least the portion of the data block to create at least the compressed data block, and wherein at least one of the plurality of compression algorithms is asymmetric. For example, Sony adopted H.264 as its video codec in its products/services, such as, e.g., Sony’s cameras, Surveillance Video Encoders and Satellite/Receiver combos. For similar reasons, Sony also induces its customers to use the Accused Instrumentalities to infringe other claims of the ’442 Patent. Sony specifically intended and was aware that these normal and customary activities would infringe the ’442 Patent. Sony performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the ’442 Patent and with the knowledge, or willful blindness to the

probability, that the induced acts would constitute infringement. On information and belief, Sony engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Sony has induced and continues to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the ’442 Patent, knowing that such use constitutes infringement of the ’442 Patent. Accordingly, Sony has been, and currently is, inducing infringement of the ’442 Patent, in violation of 35 U.S.C. § 271(b).

85. Sony has also infringed, and continues to infringe, claims of the ’442 Patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the ’442 Patent, and constitute a material part of the invention. Sony knows the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the ’442 Patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Sony has been, and currently is, contributorily infringing the ’442 Patent, in violation of 35 U.S.C. § 271(c).

86. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’ compression features, Sony has injured Realtime and is liable to Realtime for infringement of the ’442 Patent pursuant to 35 U.S.C. § 271.

87. As a result of Sony’s infringement of the ’442 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Sony’s infringement, but in no event less than a reasonable royalty for the use made of the

invention by Sony, together with interest and costs as fixed by the Court.

COUNT IV
INFRINGEMENT OF U.S. PATENT NO. 8,934,535

88. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully set forth herein.

89. On information and belief, Sony has made, used, offered for sale, sold and/or imported into the United States Sony products that infringe the ’535 Patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Sony’s video security camera series, including Minidomes series cameras SNC-VM772R, SNC-VM641, SNC-EM641, SNC-VM642R, SNC-EM642R, SNC-VM632R, SNC-VM602R, SNC-VM631, SNC-VM601, SNC-VM630, SNC-VM600, SNC-EM632RC, SNC-EM602RC, SNC-EM631, SNC-EM601, SNC-EM630, SNC-EM600, SNC-XM631, SNC-XM632, SNC-XM636, SNC-XM637, SNC-HM662, SNC-DH280, SNC-DH240T, SNC-DH140T, SNC-DH240, SNC-DH140, SNC-DH260, SNC-DH160, SNC-DH220T, SNC-DH120T, SNC-DH220, SNC-DH120, SNC-DH210T, SNC-DH110T, SNC-DH210, SNC-DH110, SNC-ZM551, SNC-ZM550; Fixed series cameras SNC-VB770, SNC-VB640, SNC-EB640, SNC-VB642D, SNC-EB642R, SNC-VB635, SNC-VB630, SNC-VB600, SNC-VB632D, SNC-EB632R, SNC-EB602R, SNC-EB630, SNC-EB600, SNC-EB630B, SNC-EB600B, SNC-CX600W, SNC-CX600, SNC-CH280, SNC-CH180, SNC-CH240, SNC-CH140, SNC-CH260, SNC-CH160, SNC-CH220, SNC-CH120, SNC-CH110, SNC-ZB550; and Pan Tilt Zoom series cameras SNC-WR632C, SNC-WR602C, SNC-WR602, SNC-WR630, SNC-WR600, SNC-ER585, SNC-ER580, SNC-EP580, SNC-ER550, SNC-EP550, SNC-ER520, SNC-EP520, SNC-RS86N, SNC-RS46N; other Pan/Tilt/Zoom cameras (for Broadcast & Production)

SRG360SHE, BRCH900/PAC2, and BRCH900; the cameras ILCE-7RM3, ILCE-7RM2; Sony's interchangeable-lens cameras, compact cameras; Sony camcorders, action cameras, motion cameras, film cameras, digital film cameras, music video recorders, professional camcorders; Sony Surveillance Video Encoders SNT-EX101, SNT-EX101E, SNT-EX104, SNT-EX154, SNT-EP104 and SNT-EP154; and the Sony SAS-HD1SET H.264 satellite and receiver combo, Sony PlayStation models including PS4 models, PS3 models, PS2 models, PS1 models, Sony Televisions such as the Z9D series, A1E series, XBR-X930E-X940E series, XBR-X900E series, XBR-X850E series, XBR-X800E series, X700E series, X690E series, XBR-X940D-X930D series, XBR-X750D-X700D series, XBR-X800D series, XBR-X850D series, W630B series, W650D series, W600D series; Sony Blu-Ray & DVD Players with playback capability of MPEG-4/AVC (.mov, .3gp, .3g2, .3gpp, .3gpp2, .flv) or MPEG-4 AVC (.mkv, .mp4, .m4v, .m2ts, .mts) such as the UBP-X800 and UBP-X1000ES series; Sony MP3 players; Sony in-car receivers and players, Sony 4K products including the Sony 4K BRAVIA TVs, Sony Video Unlimited 4K, Next generation 4K Media Player, Sony 4K Home Theater Projectors such as the VPL-VW500ES and VPL-VW1100ES, Sony consumer 4K Handycams including the FDR-AX1, FDR-AX100, 4K products using the Sony IMX274 Chipset including the Urban Security Group (USG) Sony Chip Ultra 4K IP PoE Network Bullet Security Camera, the USG Sony Chip Ultra 4K IP PoE Network Dome Security Camera, the USG Sony DSP Ultra 4K IP PoE Network Bullet Security Camera, and all versions and variations thereof since the issuance of the '535 Patent ("Accused Instrumentalities").

90. For example, Sony notes that several of the Accused Instrumentalities

possess H.264 capabilities on this web page on their United States of America website with the header "Did you know that Sony supports H.264?" The article lists several of the Accused Instrumentalities in the column on the right, which has a header of "Related Products." In the first sentence underneath the main title, the article goes on to state that "Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology." So from the above, it is clear that all, most or many of Sony's cameras utilize H.264 technology when processing, compressing or recording video. *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

Did you know that Sony supports H.264?

Video compression may seem really dull, but the real-world benefits of using the latest technology can radically increase the flexibility of your IP network. Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.

Put simply, better compression means greater flexibility – the more efficiently data is handled, the more choices you have with your existing resources. An existing network can support more cameras, better audio-video quality or both.

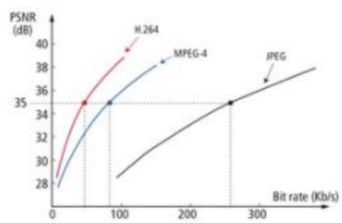
For surveillance applications, the 'industry-standard' image compression format is JPEG – which is perhaps best known for digital still photographs. In fact, using JPEG compression a network camera is acting rather like a digital camera – taking 25 (PAL) or 30 (NTSC) pictures per second. Each image is compressed individually (this is called intra-frame compression) which ensures each image is good quality and also provides a near constant data-size – making predicting network data traffic and data storage demands easy.

Often referred to as Motion JPEG or MJPEG, this form of compression has a relatively low processor demands and made possible the current generation of network cameras. It's also quite well suited to monitoring applications where it's not always essential to provide a TV-quality frame-rate. On the negative side, the MJPEG format dates back to the early 90s and since then the technology of compression has advanced considerably...

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

Related Products


SNC-DH220T
Vandal-resistant Minidome 1080p/30 fps Camera - E Series


SNC-CH120
Box-type 720p/30 fps Camera - E Series


SNC-CH280
Outdoor IR Bullet 1080p/30 fps Camera - V Series


SNC-CH140
Box-type 720p/30 fps Camera - V Series


SNC-DH160
Outdoor IR Ruggedized 720p/30 fps Camera - E Series


SNC-ZM550
Minidome 720p/30 fps camera capable of transmitting both analog video and H...


SNC-ER550
720p/30 fps Rapid Dome Camera - E Series


SNC-EB602R
Outdoor IR Bullet 720p/ 30 fps Camera Powered by IPELA ENGINE EX™ – E Series


SNC-EB632R
Outdoor IR Bullet 1080p/30 fps Camera Powered by IPELA ENGINE EX™ – E Series

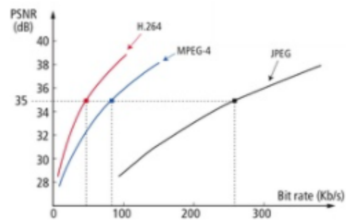
91. On that same website, Sony also mentions some background on the benefits of H.264, and also adds that "Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms." The website further states that: "Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading

role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!" *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit rate than MPEG-4, it uses a variety of different advanced techniques to achieve this aim – most notably block patterns used to predict movement across video frames.



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

The practical benefits of these varying compression formats can be illustrated quite simply. In the above diagram you can see JPEG compression operating at 260Kb/s, while MPEG-4 transmits at 85Kb/s and H.264 transmits at 50K/bs. To put this into perspective, MPEG-4 requires approximately one-third of the bandwidth used by JPEG and H.264 requires just one-fifth.

Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms.

Leadership & Compatibility

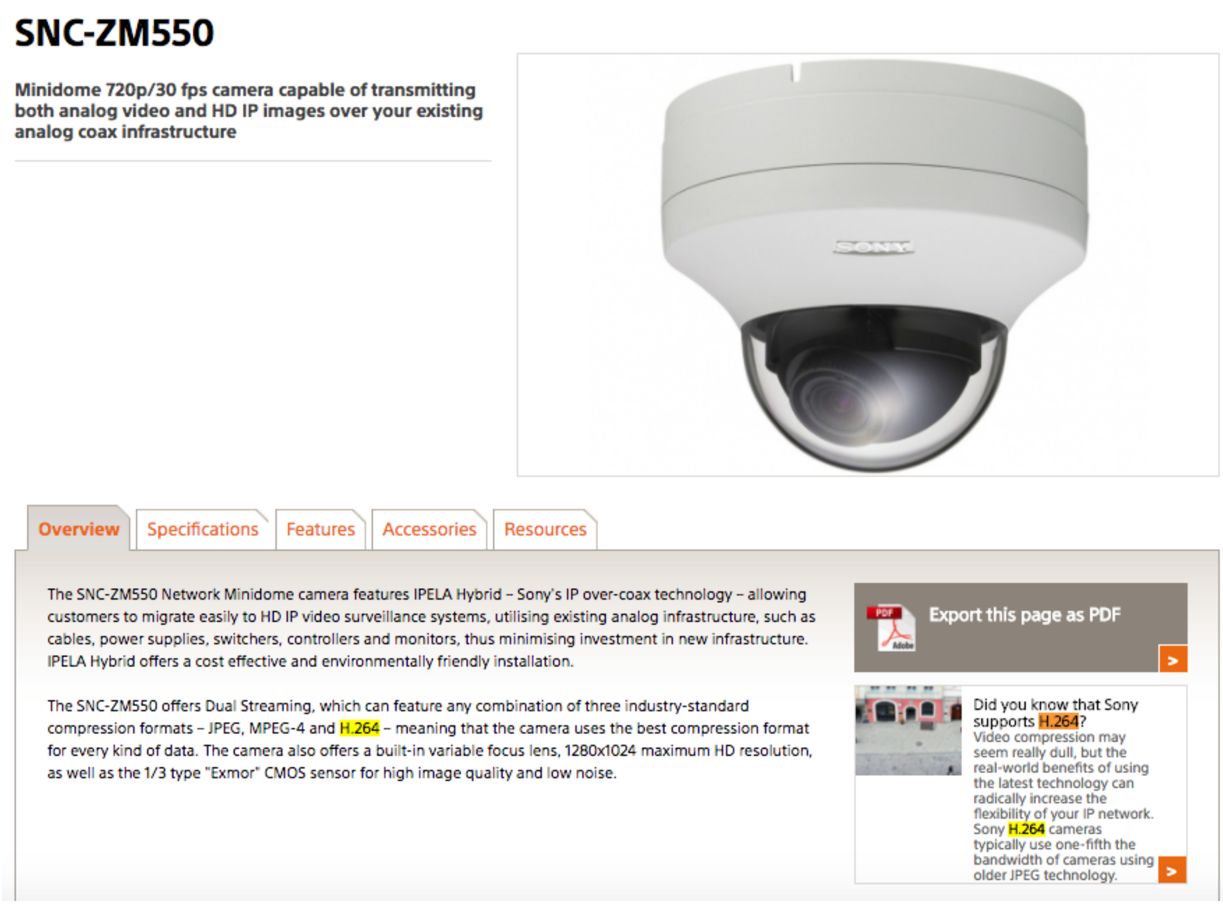
A five-fold increase in the capacity of an IP-based network might seem science fiction, but in a networked digital world it should come as no surprise that there's huge amount of investment in ensuring the highest possible video quality at the lowest possible bitrate. H.264 technology is currently used in Blu-ray discs, HDTV broadcasting (including BBC HD and Euro 1080), AVCHD (a HD recording format for HDD and Solid State camcorders) and a wide variety of mobile devices, including Apple's iPhone and Sony's PSP. The format is also commonly used online for high quality content, for example HD movie trailers, and it's also been adopted by YouTube for its new high quality mode. This also means most media players, such as QuickTime or VLC, support H.264 encoded content.

Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!

More information on Sony Video Security solutions

* The vertical axis shows Peak Signal-to-Noise Ratio (PSNR), a metric for the "quality" of compressed video images, while the horizontal axis shows the transmission bit rate. The graph shows just one example of comparing bit rates at which JPEG, MPEG-4, and H.264 images can be transmitted. Actual bit rates for transmitting data using these three compression formats differ with image quality and image size settings. In this example, the video parameters are; 10 frames per second, 176x144 (QCIF) resolution, 10 seconds of video (100 frames).

92. As an illustrative example, the website for Sony's SNC-ZM550 camera states in its "Overview" tab that "The SNC-ZM550 offers Dual Streaming, which can feature any combination of three industry-standard compression formats – JPEG, MPEG-4 and H.264 – meaning that the camera uses the best compression format for every kind of data." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-



minidomes/snc-zm550/overview/#overview:

93. On the same web site, under the "Features" tab, it states that "The SNC-ZM550 supports dual streaming with…H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4." *See*

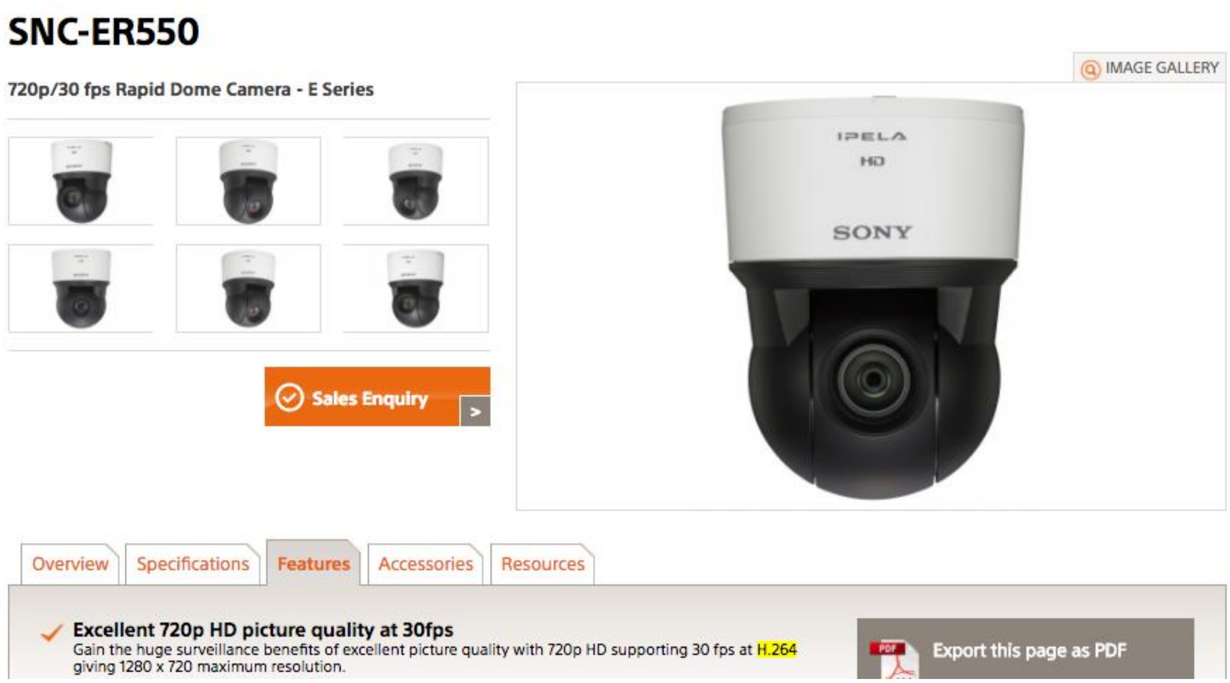
http://us.professional.sony.com/pro/product/video-security-ip-cameras-minidomes/snc-zm550/features/#features:

Overview | Specifications | **Features** | Accessories | Resources

Dual streaming with any combination of industry-standard codecs

The SNC-ZM550 supports dual streaming with any combination of three industry-standard compression formats – JPEG, the best choice for high-quality still images, MPEG-4, the format that provides clear moving images efficiently over limited-bandwidth networks, and H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4. This means that the camera can use the best compression format for every kind of data.

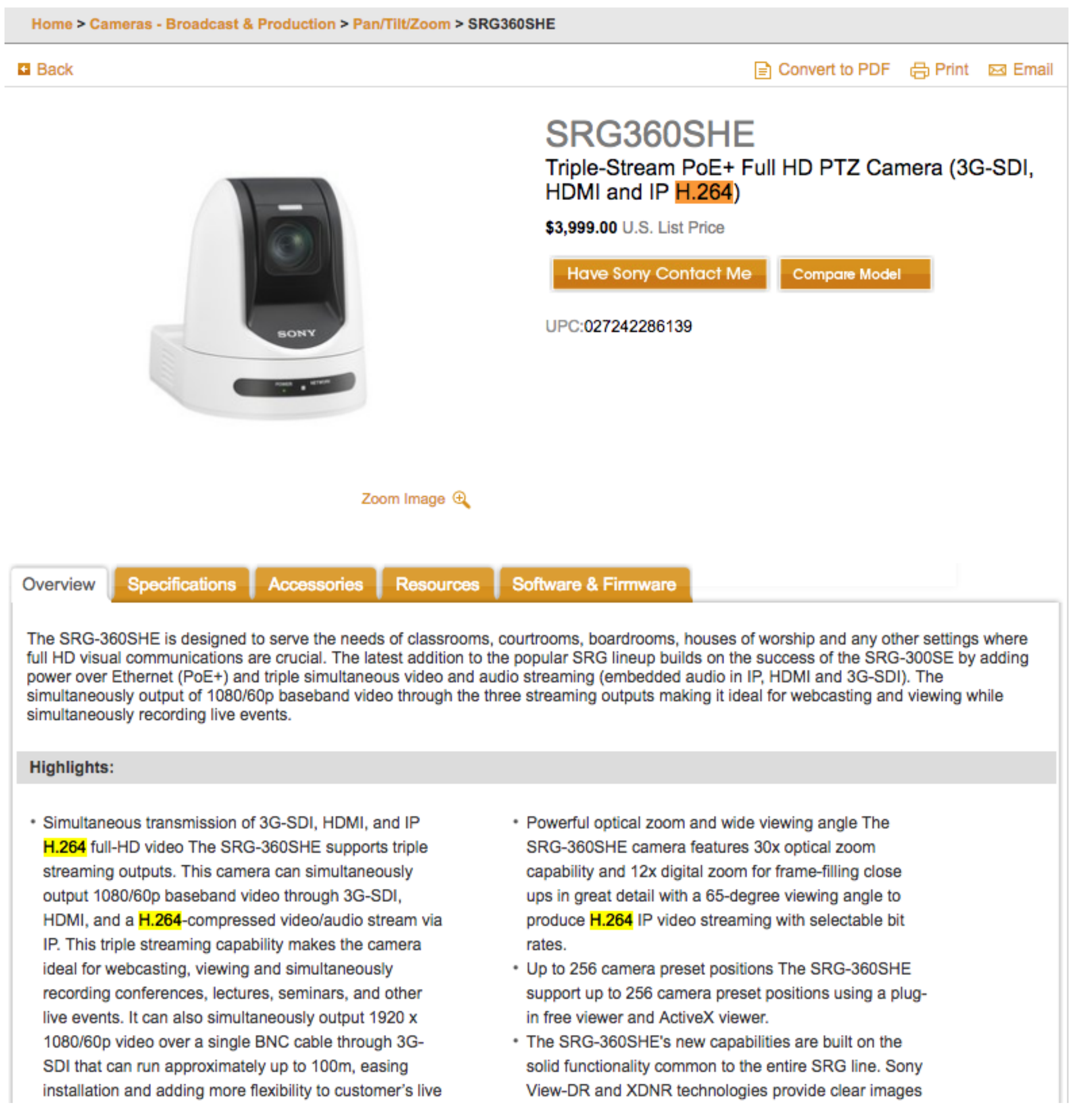
94. As another illustrative example, the website for Sony's SNC-ER550 camera has a "Features" tab which states: "Gain the huge surveillance benefits of excellent picture quality with 720p HD supporting 30 fps at H.264 giving 1280 x 720 maximum resolution." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-pan-tilt-zoom/snc-er550/features/#features:



95. As yet another illustrative example, the website for Sony's SRG360SHE camera (sub-header: "Triple-Stream PoE + Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)") mentions, under its "Overview" tab: "Simultaneous transmission of 3G-SDI, HDMI and IP H.264 full-HD video" and "This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264 compressed video/audio stream via IP" as well as "The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing

angle to produce H.264 IP video streaming with selectable bit rates.” *See* https://pro.sony.com/bbsc/ssr/cat-broadcastcameras/cat-broadcastcamerapantiltzoom/product-SRG360SHE/:

96. Furthermore, Sony’s Surveillance Video Encoders all use H.264 as a “Video compression format” as can be seen by the below datasheet. *See* https://pro.sony.com/bbsccms/assets/files/cat/camsec/brochures/quickref_sntexep.pdf:


Home > Cameras - Broadcast & Production > Pan/Tilt/Zoom > SRG360SHE

Back

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SRG360SHE

Triple-Stream PoE+ Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)

$3,999.00 U.S. List Price

Have Sony Contact Me Compare Model

UPC:027242286139

Zoom Image

Overview Specifications Accessories Resources Software & Firmware

The SRG-360SHE is designed to serve the needs of classrooms, courtrooms, boardrooms, houses of worship and any other settings where full HD visual communications are crucial. The latest addition to the popular SRG lineup builds on the success of the SRG-300SE by adding power over Ethernet (PoE+) and triple simultaneous video and audio streaming (embedded audio in IP, HDMI and 3G-SDI). The simultaneously output of 1080/60p baseband video through the three streaming outputs making it ideal for webcasting and viewing while simultaneously recording live events.

Highlights:

- Simultaneous transmission of 3G-SDI, HDMI, and IP H.264 full-HD video The SRG-360SHE supports triple streaming outputs. This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264-compressed video/audio stream via IP. This triple streaming capability makes the camera ideal for webcasting, viewing and simultaneously recording conferences, lectures, seminars, and other live events. It can also simultaneously output 1920 x 1080/60p video over a single BNC cable through 3G-SDI that can run approximately up to 100m, easing installation and adding more flexibility to customer’s live
- Powerful optical zoom and wide viewing angle The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing angle to produce H.264 IP video streaming with selectable bit rates.
- Up to 256 camera preset positions The SRG-360SHE support up to 256 camera preset positions using a plug-in free viewer and ActiveX viewer.
- The SRG-360SHE’s new capabilities are built on the solid functionality common to the entire SRG line. Sony View-DR and XDNR technologies provide clear images

Surveillance Video Encoders

	Full Function				Basic Function	
	1CH Box		4CH Box	4CH Blade	4CH Box	4CH Blade
	SNT-EX101	SNT-EX101E	SNT-EX104	SNT-EX154	SNT-EP104	SNT-EP154
						
Codec image size (HxV)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)
Video compression format	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG
Codec streaming capability	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)
Maximum frame rate	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)
PTZ control	Yes	Yes	Yes	Yes	No	No
Visibility Enhancer	Yes	Yes	Yes	Yes	Yes	Yes
XDNR	Yes	Yes	Yes	Yes	Yes	Yes
Coaxitron® control	Yes	Yes	Yes	Yes	No	No
Serial Interface	RS-422/RS-485	RS-422/RS-485	RS-485	RS-485	-	-
USB Memory slots	x 1*1	x 1*1	x 4*1	-	-	-
Sensor input	x 2	x 2	x 4	x 4	-	-
Alarm output	x 2	x 2	x 4	x 4	-	-
Audio interface (IN/OUT)	IN x 1, OUT x 1	IN x 1, OUT x 1	IN x 4, OUT x 4	IN x 1, OUT x 1	-	-
Audio support	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	No	No
DEPA™ Advanced (Intelligence)	Yes	Yes	Yes	Yes	No	No
Dimensions (W x H x D)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)
Power requirements	AC 24V in, with loop through output Input: AC 24V, +/- 20%	PoE (IEEE802.3af)	DC12 V	From Rack Station	DC12 V	From Rack Station

97. Sony further has a SAS-HD1SET H.264 Satellite/Receiver Combo, as can be seen by this article on Engadget. *See* https://www.engadget.com/2008/09/02/sony-rolls-out-sas-hd1set-h-264-satellite-receiver-combo/:

Sony rolls out SAS-HD1SET h.264 satellite / receiver combo

Richard Lawler, @Rjcc
09.02.08

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Shares

Getting discerning Japanese viewers ready for the new SKY Perfect HDTV channels, Sony is launching an h.264 satellite dish / receiver combo, the SAS-HD1SET, due October 15. At ¥45,000 ($416 U.S.) or ¥37,000 ($342 U.S.) for the DST-HD1 tuner alone, it's a pretty expensive upgrade for 15 HDTV channels, with the promise of more than 70 by this time next year. Add-on the ¥3,500 monthly service charge and we're even more leery, but really, you'll need something to watch on that ultra thin LCD next month.

98. The Accused Instrumentalities determine a parameter of at least a portion of a video data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and resolution parameters. Different parameters correspond with different end applications. H.264 provides for multiple different ranges of such

parameters, each included in the "profiles" and "levels" as defined by the H.264 standard, from the below shown paragraphs from a white paper and Wikipedia. *See* http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

4. H.264 profiles and levels

The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting options and features to a minimum. An important aspect of the standard, as with other video standards, is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes) that optimally support popular productions and common formats.

H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what feature set the encoder may use and limits the decoder implementation complexity.

Network cameras and video encoders will most likely use a profile called the baseline profile, which is intended primarily for applications with limited computing resources. The baseline profile is the most suitable given the available performance in a real-time encoder that is embedded in a network video product. The profile also enables low latency, which is an important requirement of surveillance video and also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements. Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176×144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176×144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352×288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352×288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352×288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352×288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352×576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720×576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720×576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280×720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280×1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048×1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048×1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048×1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672×1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@56.3 (5)

99. A video data block is organized by the group of pictures (GOP) structure, which is a "collection of successive pictures within a coded video stream." *See* https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). *See* https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); https://en.wikipedia.org/wiki/MPEG-1#D-frames (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can

be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

100. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant system such as the Accused Instrumentalities would determine which profile (e.g., "baseline," "extended," "main", or "high") corresponds with that parameter, then select between at least two asymmetric compressors. If baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding ("CAVLC") entropy encoder. If main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding ("CABAC") entropy encoder. Both encoders are asymmetric compressors because it takes a longer period of time for them to compress data than to decompress data. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8×8 vs. 4×4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

The following table summarizes the two major types of entropy coding: Variable Length Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers superior coding efficiency over VLC by adapting to the changing probability distribution of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of CABAC.

H.264 Entropy Coding – Comparison of Approaches

Characteristics	Variable Length Coding (VLC)	Context Adaptive Binary Arithmetic Coding(CABAC)
• Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
• Probability distribution	**Static** - Probabilities never change	**Adaptive** - Adjusts probabilities based on actual data
• Leverages correlation between symbols	**No** - Conditional probabilities ignored	**Yes** - Exploits symbol correlations by using "contexts"
• Non-integer code words	**No** - Low coding efficiency forhigh probability symbols	**Yes** - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the encoder. *See* https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

entropy_coding_mode_flag selects the entropy decoding method to be applied for the syntax elements for which two descriptors appear in the syntax tables as follows:

– If entropy_coding_mode_flag is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).

– Otherwise (entropy_coding_mode_flag is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

101. The Accused Instrumentalities compress the at least the portion of the data block with the selected one or more asymmetric compressors to provide one or more compressed data blocks, which can be organized in a GOP structure (see above). After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data to provide various compressed data blocks, which can also be organized in a GOP structure, as discussed previously above. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

> **Entropy Coding**
> For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf at 13:

> Typical compression ratios to maintain excellent quality are:
> - 10:1 for general images using JPEG
> - 30:1 for general video using H.263 and MPEG-2
> - 60:1 for general video using H.264 and WMV9

> Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.
>
> The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.
>
> The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.
>
> The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

102. Therefore, from at least the above, Sony has directly infringed and continues to infringe the ’535 Patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the system claimed by Claim 15 of the ’535 Patent, namely, a method, comprising: determining a parameter of at least a portion of a data block; selecting one or more asymmetric compressors from among a plurality of compressors based upon the determined parameter or attribute; compressing the at least the portion of the data block with the selected one or more asymmetric

compressors to provide one or more compressed data blocks; and storing at least a portion of the one or more compressed data blocks. Upon information and belief, Sony uses the Accused Instrumentalities to practice infringing methods for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

103. On information and belief, the Accused Instrumentalities store at least a portion of the one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

104. On information and belief, Sony also directly infringes and continues to infringe other claims of the ’535 Patent, for similar reasons as explained above with respect to Claim 15 of the ’535 Patent.

105. On information and belief, all of the Accused Instrumentalities perform the claimed methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

106. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the systems and/or methods claimed by the ’535 Patent.

107. On information and belief, Sony has had knowledge of the ’535 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Sony knew of the ’535 Patent and knew of its infringement, including by way of this lawsuit. By the time of trial, Sony will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the

infringement of the claims of the ’535 Patent.

108. Upon information and belief, Sony’s affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’535 Patent by practicing a method, comprising: determining a parameter of at least a portion of a data block; selecting one or more asymmetric compressors from among a plurality of compressors based upon the determined parameter or attribute; compressing the at least the portion of the data block with the selected one or more asymmetric compressors to provide one or more compressed data blocks; and storing at least a portion of the one or more compressed data blocks. For example, Sony adopted H.264 as its video codec in its products/services, such as, e.g., Sony’s cameras, Surveillance Video Encoders and Satellite/Receiver combos. For similar reasons, Sony also induces its customers to use the Accused Instrumentalities to infringe other claims of the ’535 Patent. Sony specifically intended and was aware that these normal and customary activities would infringe the ’535 Patent. Sony performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the ’535 Patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Sony engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Sony has induced and continues to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary

and customary way to infringe the ’535 Patent, knowing that such use constitutes infringement of the ’535 Patent. Accordingly, Sony has been, and currently is, inducing infringement of the ’535 Patent, in violation of 35 U.S.C. § 271(b).

109. Sony has also infringed, and continues to infringe, claims of the ’535 Patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the ’535 Patent, and constitute a material part of the invention. Sony knows the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the ’535 Patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Sony has been, and currently is, contributorily infringing the ’535 Patent, in violation of 35 U.S.C. § 271(c).

110. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’ compression features, Sony has injured Realtime and is liable to Realtime for infringement of the ’535 Patent pursuant to 35 U.S.C. § 271.

111. As a result of Sony’s infringement of the ’535 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Sony’s infringement, but in no event less than a reasonable royalty for the use made of the invention by Sony, together with interest and costs as fixed by the Court.

COUNT V
INFRINGEMENT OF U.S. PATENT NO. 9,578,298

112. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully set forth herein.

113. On information and belief, Sony has made, used, offered for sale, sold and/or imported into the United States products that infringe the '298 Patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Sony's video security camera series, including Minidomes series cameras SNC-VM772R, SNC-VM641, SNC-EM641, SNC-VM642R, SNC-EM642R, SNC-VM632R, SNC-VM602R, SNC-VM631, SNC-VM601, SNC-VM630, SNC-VM600, SNC-EM632RC, SNC-EM602RC, SNC-EM631, SNC-EM601, SNC-EM630, SNC-EM600, SNC-XM631, SNC-XM632, SNC-XM636, SNC-XM637, SNC-HM662, SNC-DH280, SNC-DH240T, SNC-DH140T, SNC-DH240, SNC-DH140, SNC-DH260, SNC-DH160, SNC-DH220T, SNC-DH120T, SNC-DH220, SNC-DH120, SNC-DH210T, SNC-DH110T, SNC-DH210, SNC-DH110, SNC-ZM551, SNC-ZM550; Fixed series cameras SNC-VB770, SNC-VB640, SNC-EB640, SNC-VB642D, SNC-EB642R, SNC-VB635, SNC-VB630, SNC-VB600, SNC-VB632D, SNC-EB632R, SNC-EB602R, SNC-EB630, SNC-EB600, SNC-EB630B, SNC-EB600B, SNC-CX600W, SNC-CX600, SNC-CH280, SNC-CH180, SNC-CH240, SNC-CH140, SNC-CH260, SNC-CH160, SNC-CH220, SNC-CH120, SNC-CH110, SNC-ZB550; and Pan Tilt Zoom series cameras SNC-WR632C, SNC-WR602C, SNC-WR602, SNC-WR630, SNC-WR600, SNC-ER585, SNC-ER580, SNC-EP580, SNC-ER550, SNC-EP550, SNC-ER520, SNC-EP520, SNC-RS86N, SNC-RS46N; other Pan/Tilt/Zoom cameras (for Broadcast & Production) SRG360SHE, BRCH900/PAC2, and BRCH900; the cameras ILCE-7RM3, ILCE-7RM2; Sony's interchangeable-lens cameras, compact cameras; Sony camcorders, action cameras, motion cameras, film cameras, digital film cameras, music video recorders, professional camcorders; Sony Surveillance Video Encoders SNT-EX101, SNT-EX101E,

SNT-EX104, SNT-EX154, SNT-EP104 and SNT-EP154; and the Sony SAS-HD1SET H.264 satellite and receiver combo, Sony PlayStation models including PS4 models, PS3 models, PS2 models, PS1 models, Sony Televisions such as the Z9D series, A1E series, XBR-X930E-X940E series, XBR-X900E series, XBR-X850E series, XBR-X800E series, X700E series, X690E series, XBR-X940D-X930D series, XBR-X750D-X700D series, XBR-X800D series, XBR-X850D series, W630B series, W650D series, W600D series; Sony Blu-Ray & DVD Players with playback capability of MPEG-4/AVC (.mov, .3gp, .3g2, .3gpp, .3gpp2, .flv) or MPEG-4 AVC (.mkv, .mp4, .m4v, .m2ts, .mts) such as the UBP-X800 and UBP-X1000ES series; Sony MP3 players; Sony in-car receivers and players, Sony 4K products including the Sony 4K BRAVIA TVs, Sony Video Unlimited 4K, Next generation 4K Media Player, Sony 4K Home Theater Projectors such as the VPL-VW500ES and VPL-VW1100ES, Sony consumer 4K Handycams including the FDR-AX1, FDR-AX100, 4K products using the Sony IMX274 Chipset including the Urban Security Group (USG) Sony Chip Ultra 4K IP PoE Network Bullet Security Camera, the USG Sony Chip Ultra 4K IP PoE Network Dome Security Camera, the USG Sony DSP Ultra 4K IP PoE Network Bullet Security Camera, and all versions and variations thereof since the issuance of the ’298 Patent (“Accused Instrumentalities”).

114. For example, an official Sony press release in an entry about the Sony 4K BRAVIA TV products states that “2014 4K BRAVIA TVs incorporate a decoder compatible with the latest **H.265/HEVC (High Efficiency Video Coding) video compression format**, enabling them to display 4K/60p content from internet streams and other sources, without the need for additional devices” and “In addition to H.264/MPEG-

4 AVC (Advanced Video Coding), this new 4K media player incorporates a decoder compatible with **the advanced HEVC compression format**. This decoder is designed to provide customers with the ability to enjoy 4K/60p content and anticipated new 4K streaming services" and "2014 4K BRAVIA TVs incorporate a decoder compatible with **the latest "HEVC" video compression format**, enabling them to display 4K/60p content from internet streams and other sources, without the need for additional devices". *See* Sony News Release, Jan. 7 2014, Enhancing the World of 4K in the Home by Expanding 4K Product Lineup and Enriching 4K Content Environment, https://www.sony.net/SonyInfo/News/Press/201401/14-002E/index.html.

115. Furthermore, there are 4K products that utilize the Sony IMX274 chipset to perform H.265 video compression. *See* Urban Security Group (USG) Sony Chip Ultra 4K…H.265 Ultra HD IP PoE Network Bullet Security Camera, https://www.amazon.com/3840x2160-Network-Bullet-Security-Camera/dp/B01N69Z3LN ("Top of The line SONY IMX274 Chipset * Professional Grade High Definition H.265/H.264 IP PoE Network Ultra 4K 8MP…Utilizes Newest Video Compression Format: H.265 H[EV]C…Sony IMX274 CMOS Sensor"); USG Sony Chip Ultra 4K…H.265 Ultra HD IP PoE Network Dome Security Camera, https://www.amazon.com/Ultra-3840x2160-Network-Security-Camera/dp/B01N0JYZYD/ref=cm_cr_arp_d_product_top?ie=UTF8 (same); Sony DSP Ultra 4K…H.265 Ultra HD IP PoE Network Bullet Security Camera, http://www.cctv.supplies/index.php/products/urban-security-group-usglslizm60s800-ip-network-8mp-bullet-security-camera-poe-h265-onvif-24-12mp-lens.html (same).

116. The Accused Instrumentalities receive the video stream which comprises

at least one composite frame (FC), each composite frame containing a pair of stereoscopic digital images (L,R) according to a predetermined frame packing format. For example, the coded bitstream when it contains a stereoscopic video in one of the frame packing arrangements such as side-by-side or top-and-bottom or segmented rectangular frame packing format as defined in the following sections of the ITU-T H.265 Series H: Audiovisual and Multimedia Systems, "Infrastructure of audiovisual services – Coding of moving video" High efficiency video coding ("HEVC Spec"): D.2.16 Frame packing arrangement SEI message syntax, D.3.16 Frame packing arrangement SEI message semantics, D.2.29 Segmented rectangular frame packing arrangement SEI message syntax, D.3.29 Segmented rectangular frame packing arrangement SEI message semantics.

117. The Accused Instrumentalities generate an output video stream which can be reproduced on a visualization apparatus. For example, the output of the decoding process as defined above is a sequence of decoded pictures. *See, e.g.*, HEVC Spec at 3.39 ("3.39 decoded picture: A decoded picture is derived by decoding a coded picture"). Decoded pictures are the input of the display process. *Id.* at 3.47 ("3.47 display process: A process not specified in this Specification having, as its input, the cropped decoded pictures that are the output of the decoding process.").

118. The Accused Instrumentalities receive metadata which determine an area occupied by one of the two images within said composite frame, said metadata indicating either a geometry of the frame packing format or a frame packing type of said composite frame. For example, the HEVC spec provides the default display window parameter to support 2D compatible decoding of stereo formats. *See, e.g.*, HEVC Spec ("NOTE 9 –

The default display window parameters in the VUI parameters of the SPS can be used by an encoder to indicate to a decoder that does not interpret the frame packing arrangement SEI message that the default display window is an area within only one of the two constituent frames.”).

119. The Accused Instrumentalities determine the area in the composite frame (FC) which is occupied by said one image of the stereoscopic pair within the composite frame based on said metadata. For example, the default display window parameter has been defined to support this application. The parameter syntax is defined in clause E.2.1 VUI parameters syntax, the semantics thereof being described in clause E.3.1 VUI parameters semantics. The usage of the Default Display Window for signaling the 2D single view in a stereoscopic frame packing format is illustrated in Note 9 of clause D.3.16 and Note 3 in Clause D.3.29 cited above.

120. The Accused Instrumentalities decode only that part of the composite frame which contains said one image to be displayed. For example, tiles are intended to support independent decoding of different picture regions. Clause 7.4.3.2.1 cited above illustrates the process to convert CTB picture scan in CTB tile scan to enable independent

row_height_minus1[i] plus 1 specifies the height of the i-th tile row in units of coding tree blocks.

The following variables are derived by invoking the coding tree block raster and tile scanning conversion process as specified in clause 6.5.1:

– The list CtbAddrRsToTs[ctbAddrRs] for ctbAddrRs ranging from 0 to PicSizeInCtbsY − 1, inclusive, specifying the conversion from a CTB address in the CTB raster scan of a picture to a CTB address in the tile scan,
– the list CtbAddrTsToRs[ctbAddrTs] for ctbAddrTs ranging from 0 to PicSizeInCtbsY − 1, inclusive, specifying the conversion from a CTB address in the tile scan to a CTB address in the CTB raster scan of a picture,
– the list TileId[ctbAddrTs] for ctbAddrTs ranging from 0 to PicSizeInCtbsY − 1, inclusive, specifying the conversion from a CTB address in tile scan to a tile ID,
– the list ColumnWidthInLumaSamples[i] for i ranging from 0 to num_tile_columns_minus1, inclusive, specifying the width of the i-th tile column in units of luma samples,
– the list RowHeightInLumaSamples[j] for j ranging from 0 to num_tile_rows_minus1, inclusive, specifying the height of the j-th tile row in units of luma samples.

The values of ColumnWidthInLumaSamples[i] for i ranging from 0 to num_tile_columns_minus1, inclusive, and RowHeightInLumaSamples[j] for j ranging from 0 to num_tile_rows_minus1, inclusive, shall all be greater than 0.

The array MinTbAddrZs with elements MinTbAddrZs[x][y] for x ranging from 0 to (PicWidthInCtbsY << (CtbLog2SizeY − MinTbLog2SizeY)) − 1, inclusive, and y ranging from 0 to (PicHeightInCtbsY << (CtbLog2SizeY − MinTbLog2SizeY)) − 1, inclusive, specifying the conversion from a location (x, y) in units of minimum transform blocks to a transform block address in z-scan order, is derived by invoking the z-scan order array initialization process as specified in clause 6.5.2.

decoding of the tile. *See also* HEVC Spec:

121. The Accused Instrumentalities generate an output frame containing said extracted image. For example, there is an output of the tile decoding process. *See, e.g.*, HEVC Spec at 8.1.1 ("8.1.1 General…Input to this process is a bitstream. Output of this process is a list of decoded pictures.").

122. Therefore, from at least the above, Sony has directly infringed and continues to infringe the '298 Patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the system claimed by Claim 1 of the '298 Patent, namely, a method for processing a video stream of digital images, the method comprising the steps of: receiving the video stream which comprises at least one composite frame (FC), each composite frame containing a pair of stereoscopic digital images (L,R) according to a predetermined frame packing format; generating an output video stream which can be reproduced on a visualization apparatus, receiving metadata which determine an area occupied by one of the two images within said composite frame (FC), said metadata indicating either a geometry of the frame packing format or a frame packing type of said composite frame (FC); determining the area in the composite frame (FC) which is occupied by said one image of the stereoscopic pair within the composite frame based on said metadata; decoding only that part of the composite frame (FC) which contains said one image to be displayed, and generating an output frame containing said decoded image. Upon information and belief, Sony uses the Accused Instrumentalities to practice infringing methods for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

123. On information and belief, Sony also directly infringes and continues to infringe other claims of the ’298 Patent, for similar reasons as explained above with respect to Claim 1 of the ’298 Patent.

124. On information and belief, all of the Accused Instrumentalities perform the claimed methods in substantially the same way, e.g., in the manner specified in the HEVC (or H.265) standard.

125. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the methods claimed by the ’298 Patent.

126. On information and belief, Sony has had knowledge of the ’298 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Sony knew of the ’298 Patent and knew of its infringement, including by way of this lawsuit. By the time of trial, Sony will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of the claims of the ’298 Patent.

127. Upon information and belief, Sony’s affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’298 by practicing a method for processing a video stream of digital images, the method comprising the steps of: receiving the video stream which comprises at least one composite frame (FC), each composite frame containing a pair of

stereoscopic digital images (L,R) according to a predetermined frame packing format; generating an output video stream which can be reproduced on a visualization apparatus, receiving metadata which determine an area occupied by one of the two images within said composite frame (FC), said metadata indicating either a geometry of the frame packing format or a frame packing type of said composite frame (FC); determining the area in the composite frame (FC) which is occupied by said one image of the stereoscopic pair within the composite frame based on said metadata; decoding only that part of the composite frame (FC) which contains said one image to be displayed, and generating an output frame containing said decoded image. For example, Sony adopted HEVC (or H.265) as its video codec in its products/services, such as in its 4K TV, projector, home theater system, media player and camera products. For similar reasons, Sony also induces its customers to use the Accused Instrumentalities to infringe other claims of the ’298 Patent. Sony specifically intended and was aware that these normal and customary activities would infringe the ’298 Patent. Sony performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the ’298 Patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Sony engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Sony has induced and continue to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the ’298 Patent, knowing that such use constitutes infringement of the ’298 Patent. Accordingly, Sony has been, and currently is, inducing infringement of the ’298 Patent, in violation of 35 U.S.C. § 271(b).

128. Sony has also infringed, and continues to infringe, claims of the ’298 Patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the ’298 Patent, and constitute a material part of the invention. Sony knows the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the ’298 Patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Sony has been, and currently is, contributorily infringing the ’298 Patent, in violation of 35 U.S.C. § 271(c).

129. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’ compression features, Sony has injured Realtime and is liable to Realtime for infringement of the ’298 Patent pursuant to 35 U.S.C. § 271.

130. As a result of Sony’s infringement of the ’298 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Sony’s infringement, but in no event less than a reasonable royalty for the use made of the invention by Sony, together with interest and costs as fixed by the Court.

COUNT VI
<u>INFRINGEMENT OF U.S. PATENT NO. 9,762,907</u>

131. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully set forth herein.

132. On information and belief, Sony has made, used, offered for sale, sold and/or imported into the United States Sony products that infringe the ’907 Patent, and continues to do so. By way of illustrative example, these infringing products include,

without limitation, Sony's video security camera series, including Minidomes series cameras SNC-VM772R, SNC-VM641, SNC-EM641, SNC-VM642R, SNC-EM642R, SNC-VM632R, SNC-VM602R, SNC-VM631, SNC-VM601, SNC-VM630, SNC-VM600, SNC-EM632RC, SNC-EM602RC, SNC-EM631, SNC-EM601, SNC-EM630, SNC-EM600, SNC-XM631, SNC-XM632, SNC-XM636, SNC-XM637, SNC-HM662, SNC-DH280, SNC-DH240T, SNC-DH140T, SNC-DH240, SNC-DH140, SNC-DH260, SNC-DH160, SNC-DH220T, SNC-DH120T, SNC-DH220, SNC-DH120, SNC-DH210T, SNC-DH110T, SNC-DH210, SNC-DH110, SNC-ZM551, SNC-ZM550; Fixed series cameras SNC-VB770, SNC-VB640, SNC-EB640, SNC-VB642D, SNC-EB642R, SNC-VB635, SNC-VB630, SNC-VB600, SNC-VB632D, SNC-EB632R, SNC-EB602R, SNC-EB630, SNC-EB600, SNC-EB630B, SNC-EB600B, SNC-CX600W, SNC-CX600, SNC-CH280, SNC-CH180, SNC-CH240, SNC-CH140, SNC-CH260, SNC-CH160, SNC-CH220, SNC-CH120, SNC-CH110, SNC-ZB550; and Pan Tilt Zoom series cameras SNC-WR632C, SNC-WR602C, SNC-WR602, SNC-WR630, SNC-WR600, SNC-ER585, SNC-ER580, SNC-EP580, SNC-ER550, SNC-EP550, SNC-ER520, SNC-EP520, SNC-RS86N, SNC-RS46N; other Pan/Tilt/Zoom cameras (for Broadcast & Production) SRG360SHE, BRCH900/PAC2, and BRCH900; the cameras ILCE-7RM3, ILCE-7RM2; Sony's interchangeable-lens cameras, compact cameras; Sony camcorders, action cameras, motion cameras, film cameras, digital film cameras, music video recorders, professional camcorders; Sony Surveillance Video Encoders SNT-EX101, SNT-EX101E, SNT-EX104, SNT-EX154, SNT-EP104 and SNT-EP154; and the Sony SAS-HD1SET H.264 satellite and receiver combo, Sony PlayStation models including PS4 models, PS3 models, PS2 models, PS1 models, Sony Televisions such as the Z9D series, A1E series, XBR-X930E-X940E series, XBR-X900E series, XBR-X850E series, XBR-X800E series, X700E series, X690E series, XBR-X940D-X930D series, XBR-X750D-X700D series, XBR-X800D series, XBR-X850D series, W630B series, W650D series, W600D series; Sony Blu-Ray & DVD Players with playback capability of MPEG-4/AVC (.mov, .3gp, .3g2, .3gpp, .3gpp2, .flv) or MPEG-4 AVC (.mkv, .mp4, .m4v, .m2ts, .mts) such as the UBP-X800 and UBP-X1000ES series; Sony MP3 players; Sony in-car receivers and players, Sony 4K products including the Sony 4K BRAVIA TVs, Sony Video Unlimited 4K, Next generation 4K Media Player, Sony 4K Home Theater Projectors such as the VPL-VW500ES and VPL-VW1100ES, Sony consumer 4K Handycams including the FDR-AX1, FDR-AX100, 4K products using the Sony IMX274 Chipset including the Urban Security Group (USG) Sony Chip Ultra 4K IP PoE Network Bullet Security Camera, the USG Sony Chip Ultra 4K IP PoE Network Dome Security Camera, the USG Sony DSP Ultra 4K IP PoE Network Bullet Security Camera, and all versions and variations thereof since the issuance of the ’907 Patent (“Accused Instrumentalities”).

133. For example, Sony notes that several of the Accused Instrumentalities possess H.264 capabilities on this web page on their United States of America website with the header “Did you know that Sony supports H.264?” The article lists several of the Accused Instrumentalities in the column on the right, which has a header of “Related Products.” In the first sentence underneath the main title, the article goes on to state that “Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.” So from the above, it is clear that all, most or many of Sony’s cameras utilize H.264 technology when processing, compressing or recording video. *See*

http://us.professional.sony.com/pro/article/video-security-h264-article:

Did you know that Sony supports H.264?

Video compression may seem really dull, but the real-world benefits of using the latest technology can radically increase the flexibility of your IP network. Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.

Put simply, better compression means greater flexibility – the more efficiently data is handled, the more choices you have with your existing resources. An existing network can support more cameras, better audio-video quality or both.

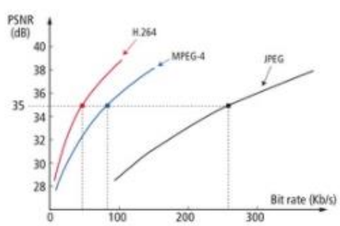
For surveillance applications, the 'industry-standard' image compression format is JPEG – which is perhaps best known for digital still photographs. In fact, using JPEG compression a network camera is acting rather like a digital camera – taking 25 (PAL) or 30 (NTSC) pictures per second. Each image is compressed individually (this is called intra-frame compression) which ensures each image is good quality and also provides a near constant data-size – making predicting network data traffic and data storage demands easy.

Often referred to as Motion JPEG or MJPEG, this form of compression has a relatively low processor demands and made possible the current generation of network cameras. It's also quite well suited to monitoring applications where it's not always essential to provide a TV-quality frame-rate. On the negative side, the MJPEG format dates back to the early 90s and since then the technology of compression has advanced considerably...

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

Related Products

SNC-DH220T
Vandal-resistant Minidome 1080p/30 fps Camera - E Series

SNC-CH120
Box-type 720p/30 fps Camera - E Series

SNC-CH280
Outdoor IR Bullet 1080p/30 fps Camera - V Series

SNC-CH140
Box-type 720p/30 fps Camera - V Series

SNC-DH160
Outdoor IR Ruggedized 720p/30 fps Camera - E Series

SNC-ZM550
Minidome 720p/30 fps camera capable of transmitting both analog video and H...

SNC-ER550
720p/30 fps Rapid Dome Camera - E Series

SNC-EB602R
Outdoor IR Bullet 720p/ 30 fps Camera Powered by IPELA ENGINE EX™ – E Series

SNC-EB632R
Outdoor IR Bullet 1080p/30 fps Camera Powered by IPELA ENGINE EX™ – E Series

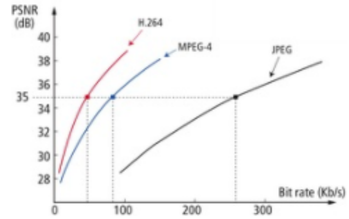
134. On that same website, Sony also mentions some background on the benefits of H.264, and also adds that "Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms."

The website further states that: “Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!” *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit rate than MPEG-4, it uses a variety of different advanced techniques to achieve this aim – most notably block patterns used to predict movement across video frames.



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

The practical benefits of these varying compression formats can be illustrated quite simply. In the above diagram you can see JPEG compression operating at 260Kb/s, while MPEG-4 transmits at 85Kb/s and H.264 transmits at 50K/bs. To put this into perspective, MPEG-4 requires approximately one-third of the bandwidth used by JPEG and H.264 requires just one-fifth.

Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms.

Leadership & Compatibility

A five-fold increase in the capacity of an IP-based network might seem science fiction, but in a networked digital world it should come as no surprise that there's huge amount of investment in ensuring the highest possible video quality at the lowest possible bitrate. H.264 technology is currently used in Blu-ray discs, HDTV broadcasting (including BBC HD and Euro 1080), AVCHD (a HD recording format for HDD and Solid State camcorders) and a wide variety of mobile devices, including Apple's iPhone and Sony's PSP. The format is also commonly used online for high quality content, for example HD movie trailers, and it's also been adopted by YouTube for its new high quality mode. This also means most media players, such as QuickTime or VLC, support H.264 encoded content.

Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!

More information on Sony Video Security solutions

* The vertical axis shows Peak Signal-to-Noise Ratio (PSNR), a metric for the "quality" of compressed video images, while the horizontal axis shows the transmission bit rate. The graph shows just one example of comparing bit rates at which JPEG, MPEG-4, and H.264 images can be transmitted. Actual bit rates for transmitting data using these three compression formats differ with image quality and image size settings. In this example, the video parameters are; 10 frames per second, 176x144 (QCIF) resolution, 10 seconds of video (100 frames).

135. As an illustrative example, the website for Sony's SNC-ZM550 camera states in its "Overview" tab that "The SNC-ZM550 offers Dual Streaming, which can feature any combination of three industry-standard compression formats – JPEG, MPEG-4 and H.264 – meaning that the camera uses the best compression format for every kind of data." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-minidomes/snc-zm550/overview/#overview:

SNC-ZM550

Minidome 720p/30 fps camera capable of transmitting both analog video and HD IP images over your existing analog coax infrastructure

Overview | Specifications | Features | Accessories | Resources

The SNC-ZM550 Network Minidome camera features IPELA Hybrid – Sony's IP over-coax technology – allowing customers to migrate easily to HD IP video surveillance systems, utilising existing analog infrastructure, such as cables, power supplies, switchers, controllers and monitors, thus minimising investment in new infrastructure. IPELA Hybrid offers a cost effective and environmentally friendly installation.

The SNC-ZM550 offers Dual Streaming, which can feature any combination of three industry-standard compression formats – JPEG, MPEG-4 and H.264 – meaning that the camera uses the best compression format for every kind of data. The camera also offers a built-in variable focus lens, 1280x1024 maximum HD resolution, as well as the 1/3 type "Exmor" CMOS sensor for high image quality and low noise.

Export this page as PDF

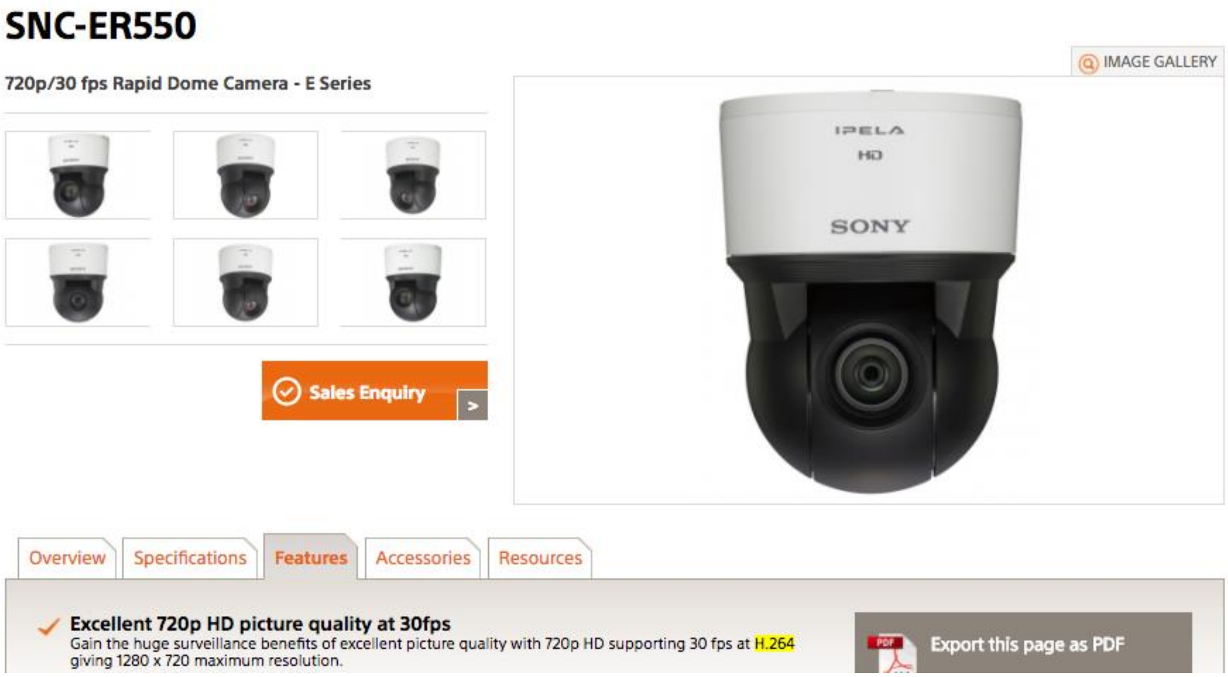
Did you know that Sony supports H.264? Video compression may seem really dull, but the real-world benefits of using the latest technology can radically increase the flexibility of your IP network. Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.

136. On the same web site, under the "Features" tab, it states that "The SNC-ZM550 supports dual streaming with…H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-minidomes/snc-zm550/features/#features:

Overview | Specifications | **Features** | Accessories | Resources

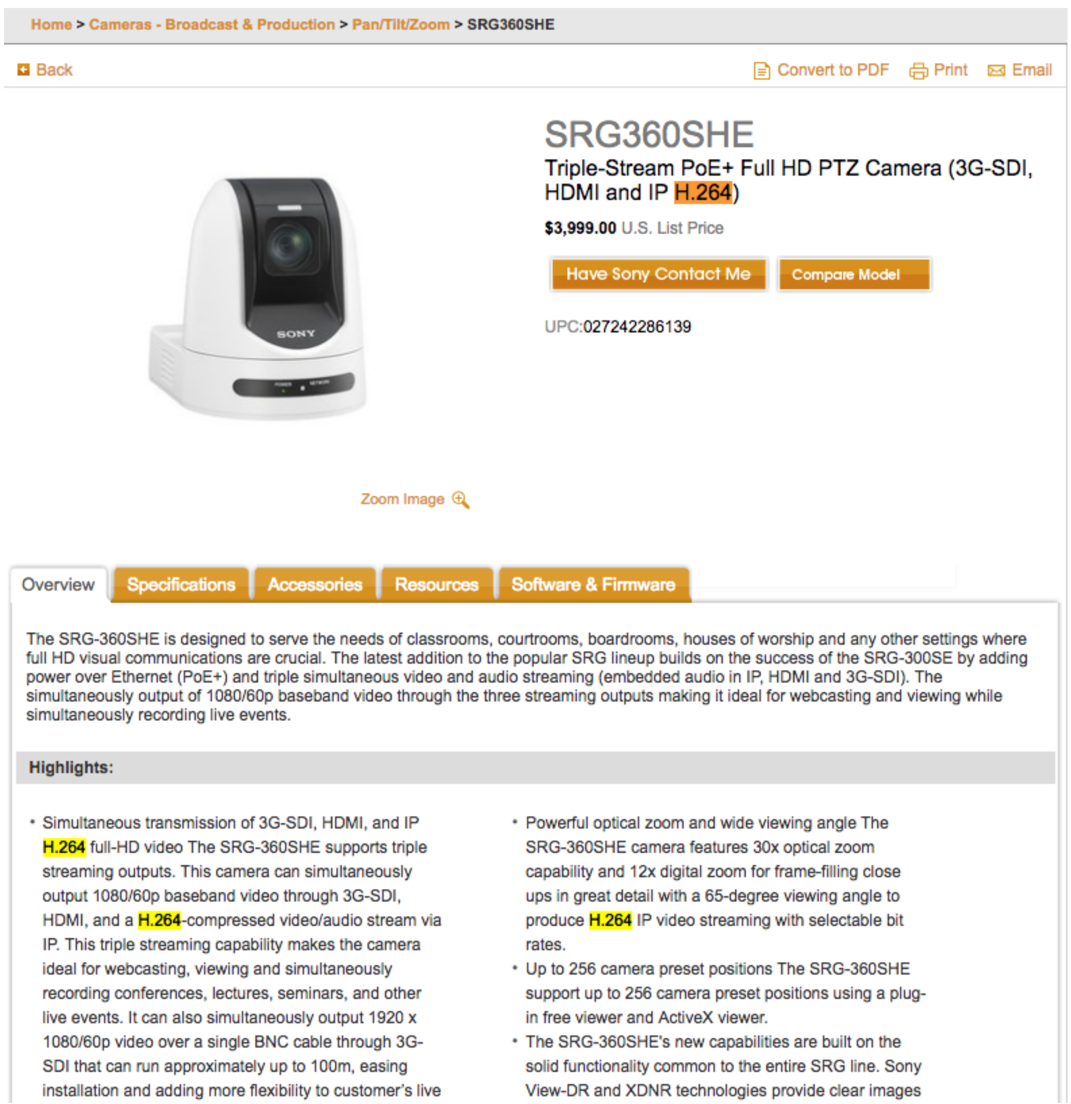
Dual streaming with any combination of industry-standard codecs
The SNC-ZM550 supports dual streaming with any combination of three industry-standard compression formats – JPEG, the best choice for high-quality still images, MPEG-4, the format that provides clear moving images efficiently over limited-bandwidth networks, and H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4. This means that the camera can use the best compression format for every kind of data.

137. As another illustrative example, the website for Sony's SNC-ER550 camera has a "Features" tab which states: "Gain the huge surveillance benefits of excellent picture quality with 720p HD supporting 30 fps at H.264 giving 1280 x 720 maximum resolution." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-pan-tilt-zoom/snc-er550/features/#features:



138. As yet another illustrative example, the website for Sony's SRG360SHE camera (sub-header: "Triple-Stream PoE + Full HD PTZ Camera (3G-SDI, HDMI and IP

H.264)") mentions, under its "Overview" tab: "Simultaneous transmission of 3G-SDI, HDMI and IP H.264 full-HD video" and "This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264 compressed video/audio stream via IP" as well as "The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing angle to produce H.264 IP video streaming with selectable bit rates." *See*



SRG360SHE

Triple-Stream PoE+ Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)

$3,999.00 U.S. List Price

Have Sony Contact Me | Compare Model

UPC:027242286139

Overview | Specifications | Accessories | Resources | Software & Firmware

The SRG-360SHE is designed to serve the needs of classrooms, courtrooms, boardrooms, houses of worship and any other settings where full HD visual communications are crucial. The latest addition to the popular SRG lineup builds on the success of the SRG-300SE by adding power over Ethernet (PoE+) and triple simultaneous video and audio streaming (embedded audio in IP, HDMI and 3G-SDI). The simultaneously output of 1080/60p baseband video through the three streaming outputs making it ideal for webcasting and viewing while simultaneously recording live events.

Highlights:

- Simultaneous transmission of 3G-SDI, HDMI, and IP H.264 full-HD video The SRG-360SHE supports triple streaming outputs. This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264-compressed video/audio stream via IP. This triple streaming capability makes the camera ideal for webcasting, viewing and simultaneously recording conferences, lectures, seminars, and other live events. It can also simultaneously output 1920 x 1080/60p video over a single BNC cable through 3G-SDI that can run approximately up to 100m, easing installation and adding more flexibility to customer's live
- Powerful optical zoom and wide viewing angle The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing angle to produce H.264 IP video streaming with selectable bit rates.
- Up to 256 camera preset positions The SRG-360SHE support up to 256 camera preset positions using a plug-in free viewer and ActiveX viewer.
- The SRG-360SHE's new capabilities are built on the solid functionality common to the entire SRG line. Sony View-DR and XDNR technologies provide clear images

https://pro.sony.com/bbsc/ssr/cat-broadcastcameras/cat-broadcastcamerapantiltzoom/product-SRG360SHE/:

139. Furthermore, Sony's Surveillance Video Encoders all use H.264 as a "Video compression format" as can be seen by the below datasheet. See

Surveillance Video Encoders

	Full Function				Basic Function	
	1CH Box		4CH Box	4CH Blade	4CH Box	4CH Blade
	SNT-EX101	SNT-EX101E	SNT-EX104	SNT-EX154	SNT-EP104	SNT-EP154
						
Codec image size (HxV)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)
Video compression format	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG
Codec streaming capability	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)
Maximum frame rate	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)
PTZ control	Yes	Yes	Yes	Yes	No	No
Visibility Enhancer	Yes	Yes	Yes	Yes	Yes	Yes
XDNR	Yes	Yes	Yes	Yes	Yes	Yes
Coaxitron® control	Yes	Yes	Yes	Yes	No	No
Serial Interface	RS-422/RS-485	RS-422/RS-485	RS-485	RS-485	-	-
USB Memory slots	x 1*1	x 1*1	x 4*1	-	-	-
Sensor input	x 2	x 2	x 4	x 4	-	-
Alarm output	x 2	x 2	x 4	x 4	-	-
Audio interface (IN/OUT)	IN x 1, OUT x 1	IN x 1, OUT x 1	IN x 4, OUT x 4	IN x 1, OUT x 1	-	-
Audio support	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	No	No
DEPA™ Advanced (Intelligence)	Yes	Yes	Yes	Yes	No	No
Dimensions (W x H x D)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)
Power requirements	AC 24V in, with loop through output Input: AC 24V, +/- 20%	PoE (IEEE802.3af)	DC12 V	From Rack Station	DC12 V	From Rack Station

https://pro.sony.com/bbsccms/assets/files/cat/camsec/brochures/quickref_sntexep.pdf:

140. Sony further has a SAS-HD1SET H.264 Satellite/Receiver Combo, as can be seen by this article on Engadget. *See* https://www.engadget.com/2008/09/02/sony-rolls-out-sas-hd1set-h-264-satellite-receiver-combo/:

Sony rolls out SAS-HD1SET h.264 satellite / receiver combo

Richard Lawler, @Rjcc
09.02.08

0
Shares

Getting discerning Japanese viewers ready for the new SKY Perfect HDTV channels, Sony is launching an h.264 satellite dish / receiver combo, the SAS-HD1SET, due October 15. At ¥45,000 ($416 U.S.) or ¥37,000 ($342 U.S.) for the DST-HD1 tuner alone, it's a pretty expensive upgrade for 15 HDTV channels, with the promise of more than 70 by this time next year. Add-on the ¥3,500 monthly service charge and we're even more leery, but really, you'll need something to watch on that ultra thin LCD next month.

141. The Accused Instrumentalities determine a parameter of at least a portion of a video data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and resolution parameters. Different parameters correspond with different end applications. H.264 provides for multiple different ranges of such

parameters, each included in the "profiles" and "levels" as defined by the H.264 standard, from the below shown paragraphs from a white paper and Wikipedia. *See* http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

4. H.264 profiles and levels

The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting options and features to a minimum. An important aspect of the standard, as with other video standards, is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes) that optimally support popular productions and common formats.

H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what feature set the encoder may use and limits the decoder implementation complexity.

Network cameras and video encoders will most likely use a profile called the baseline profile, which is intended primarily for applications with limited computing resources. The baseline profile is the most suitable given the available performance in a real-time encoder that is embedded in a network video product. The profile also enables low latency, which is an important requirement of surveillance video and also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements. Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176×144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176×144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352×288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352×288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352×288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352×288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352×576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720×576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720×576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280×720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280×1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048×1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048×1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048×1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672×1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@56.3 (5)

142. A video data block is organized by the group of pictures (GOP) structure, which is a "collection of successive pictures within a coded video stream." *See* https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). *See* https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); https://en.wikipedia.org/wiki/MPEG-1#D-frames (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can

be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

143. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant system such as the Accused Instrumentalities would determine which profile (e.g., “baseline,” “extended,” “main”, or “high”) corresponds with that parameter, then select between at least two asymmetric compressors. If baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding (“CAVLC”) entropy encoder. If main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding (“CABAC”) entropy encoder. Both encoders are asymmetric compressors because it takes a longer period of time for them to compress data than to decompress data. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8x8 vs. 4x4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

The following table summarizes the two major types of entropy coding: Variable Length Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers superior coding efficiency over VLC by adapting to the changing probability distribution of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of CABAC.

H.264 Entropy Coding – Comparison of Approaches

Characteristics	Variable Length Coding (VLC)	Context Adaptive Binary Arithmetic Coding(CABAC)
• Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
• Probability distribution	**Static** - Probabilities never change	**Adaptive** - Adjusts probabilities based on actual data
• Leverages correlation between symbols	**No** - Conditional probabilities ignored	**Yes** - Exploits symbol correlations by using "contexts"
• Non-integer code words	**No** - Low coding efficiency forhigh probability symbols	**Yes** - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the encoder. *See* https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

entropy_coding_mode_flag selects the entropy decoding method to be applied for the syntax elements for which two descriptors appear in the syntax tables as follows:

– If entropy_coding_mode_flag is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).

– Otherwise (entropy_coding_mode_flag is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

144. The Accused Instrumentalities compress the at least the portion of the data

block with the selected one or more asymmetric compressors to provide one or more compressed data blocks, which can be organized in a GOP structure (see above). After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data to provide various compressed data blocks, which can also be organized in a GOP structure, as discussed previously above. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

> **Entropy Coding**
> For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See

http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf

at 13:

> Typical compression ratios to maintain excellent quality are:
> - 10:1 for general images using JPEG
> - 30:1 for general video using H.263 and MPEG-2
> - 60:1 for general video using H.264 and WMV9

> Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.
>
> The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.
>
> The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.
>
> The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

145. Therefore, from at least the above, Sony has directly infringed and continues to infringe the ’907 Patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the system claimed by Claim 1 of the ’907 Patent, namely, a system comprising: one or more different asymmetric data compression algorithms, wherein each algorithm of the one or more different asymmetric data compression algorithms utilizes one or more asymmetric data compression routines of a plurality of different asymmetric data compression routines, wherein a first

asymmetric data compression routine of the plurality of different asymmetric data compression routines is configured to produce compressed data with a higher data rate for a given data throughput than a second asymmetric data compression routine of the plurality of different asymmetric data compression routines; and a processor configured: to analyze one or more data parameters from one or more data blocks containing video data, wherein at least one data parameter relates to an expected or anticipated throughput of a communications channel; and to select two or more different data compression routines from among a plurality of different data compression routines based upon, at least in part, the one or more data parameters relating to the expected or anticipated throughput of the communications channel. Upon information and belief, Sony uses the Accused Instrumentalities to practice infringing methods for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

146. On information and belief, the Accused Instrumentalities store at least a portion of the one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

147. On information and belief, Sony also directly infringes and continues to infringe other claims of the ’907 Patent, for similar reasons as explained above with respect to Claim 1 of the ’907 Patent.

148. On information and belief, all of the Accused Instrumentalities perform the claimed methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

149. On information and belief, use of the Accused Instrumentalities in their

ordinary and customary fashion results in infringement of the systems and/or methods claimed by the ’907 Patent.

150. On information and belief, Sony has had knowledge of the ’907 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Sony knew of the ’907 Patent and knew of its infringement, including by way of this lawsuit. By the time of trial, Sony will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of the claims of the ’907 Patent.

151. Upon information and belief, Sony’s affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’907 Patent by practicing a system comprising: one or more different asymmetric data compression algorithms, wherein each algorithm of the one or more different asymmetric data compression algorithms utilizes one or more asymmetric data compression routines of a plurality of different asymmetric data compression routines, wherein a first asymmetric data compression routine of the plurality of different asymmetric data compression routines is configured to produce compressed data with a higher data rate for a given data throughput than a second asymmetric data compression routine of the plurality of different asymmetric data compression routines; and a processor configured: to analyze one or more data parameters from one or more data blocks containing video data, wherein at least one data

parameter relates to an expected or anticipated throughput of a communications channel; and to select two or more different data compression routines from among a plurality of different data compression routines based upon, at least in part, the one or more data parameters relating to the expected or anticipated throughput of the communications channel. For example, Sony adopted H.264 as its video codec in its products/services, such as, e.g., Sony's cameras, Surveillance Video Encoders and Satellite/Receiver combos. For similar reasons, Sony also induces its customers to use the Accused Instrumentalities to infringe other claims of the '907 Patent. Sony specifically intended and was aware that these normal and customary activities would infringe the '907 Patent. Sony performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the '907 Patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Sony engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Sony has induced and continues to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the '907 Patent, knowing that such use constitutes infringement of the '907 Patent. Accordingly, Sony has been, and currently is, inducing infringement of the '907 Patent, in violation of 35 U.S.C. § 271(b).

152. Sony has also infringed, and continues to infringe, claims of the '907 Patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '907 Patent, and constitute a material part of the invention. Sony knows the components in the Accused Instrumentalities to be especially made or

especially adapted for use in infringement of the ’907 Patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Sony has been, and currently is, contributorily infringing the ’907 Patent, in violation of 35 U.S.C. § 271(c).

153. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’ compression features, Sony has injured Realtime and is liable to Realtime for infringement of the ’907 Patent pursuant to 35 U.S.C. § 271.

154. As a result of Sony’s infringement of the ’907 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Sony’s infringement, but in no event less than a reasonable royalty for the use made of the invention by Sony, together with interest and costs as fixed by the Court.

COUNT VII
INFRINGEMENT OF U.S. PATENT NO. 9,769,477

155. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully set forth herein.

156. On information and belief, Sony has made, used, offered for sale, sold and/or imported into the United States Sony products that infringe the ’477 Patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Sony’s video security camera series, including Minidomes series cameras SNC-VM772R, SNC-VM641, SNC-EM641, SNC-VM642R, SNC-EM642R, SNC-VM632R, SNC-VM602R, SNC-VM631, SNC-VM601, SNC-VM630, SNC-VM600, SNC-EM632RC, SNC-EM602RC, SNC-EM631, SNC-EM601, SNC-EM630, SNC-EM600, SNC-XM631, SNC-XM632, SNC-XM636, SNC-XM637, SNC-HM662,

SNC-DH280, SNC-DH240T, SNC-DH140T, SNC-DH240, SNC-DH140, SNC-DH260, SNC-DH160, SNC-DH220T, SNC-DH120T, SNC-DH220, SNC-DH120, SNC-DH210T, SNC-DH110T, SNC-DH210, SNC-DH110, SNC-ZM551, SNC-ZM550; Fixed series cameras SNC-VB770, SNC-VB640, SNC-EB640, SNC-VB642D, SNC-EB642R, SNC-VB635, SNC-VB630, SNC-VB600, SNC-VB632D, SNC-EB632R, SNC-EB602R, SNC-EB630, SNC-EB600, SNC-EB630B, SNC-EB600B, SNC-CX600W, SNC-CX600, SNC-CH280, SNC-CH180, SNC-CH240, SNC-CH140, SNC-CH260, SNC-CH160, SNC-CH220, SNC-CH120, SNC-CH110, SNC-ZB550; and Pan Tilt Zoom series cameras SNC-WR632C, SNC-WR602C, SNC-WR602, SNC-WR630, SNC-WR600, SNC-ER585, SNC-ER580, SNC-EP580, SNC-ER550, SNC-EP550, SNC-ER520, SNC-EP520, SNC-RS86N, SNC-RS46N; other Pan/Tilt/Zoom cameras (for Broadcast & Production) SRG360SHE, BRCH900/PAC2, and BRCH900; the cameras ILCE-7RM3, ILCE-7RM2; Sony's interchangeable-lens cameras, compact cameras; Sony camcorders, action cameras, motion cameras, film cameras, digital film cameras, music video recorders, professional camcorders; Sony Surveillance Video Encoders SNT-EX101, SNT-EX101E, SNT-EX104, SNT-EX154, SNT-EP104 and SNT-EP154; and the Sony SAS-HD1SET H.264 satellite and receiver combo, Sony PlayStation models including PS4 models, PS3 models, PS2 models, PS1 models, Sony Televisions such as the Z9D series, A1E series, XBR-X930E-X940E series, XBR-X900E series, XBR-X850E series, XBR-X800E series, X700E series, X690E series, XBR-X940D-X930D series, XBR-X750D-X700D series, XBR-X800D series, XBR-X850D series, W630B series, W650D series, W600D series; Sony Blu-Ray & DVD Players with playback capability of MPEG-4/AVC (.mov, .3gp, .3g2, .3gpp, .3gpp2, .flv) or MPEG-4 AVC (.mkv, .mp4, .m4v, .m2ts, .mts) such as the UBP-X800 and UBP-X1000ES series; Sony MP3 players; Sony in-car receivers and players, Sony 4K products including the Sony 4K BRAVIA TVs, Sony Video Unlimited 4K, Next generation 4K Media Player, Sony 4K Home Theater Projectors such as the VPL-VW500ES and VPL-VW1100ES, Sony consumer 4K Handycams including the FDR-AX1, FDR-AX100, 4K products using the Sony IMX274 Chipset including the Urban Security Group (USG) Sony Chip Ultra 4K IP PoE Network Bullet Security Camera, the USG Sony Chip Ultra 4K IP PoE Network Dome Security Camera, the USG Sony DSP Ultra 4K IP PoE Network Bullet Security Camera, and all versions and variations thereof since the issuance of the '477 Patent ("Accused Instrumentalities").

157. For example, Sony notes that several of the Accused Instrumentalities possess H.264 capabilities on this web page on their United States of America website with the header "Did you know that Sony supports H.264?" The article lists several of the Accused Instrumentalities in the column on the right, which has a header of "Related Products." In the first sentence underneath the main title, the article goes on to state that "Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology." So from the above, it is clear that all, most or many of Sony's cameras utilize H.264 technology when processing, compressing or recording video. *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

Did you know that Sony supports H.264?

Video compression may seem really dull, but the real-world benefits of using the latest technology can radically increase the flexibility of your IP network. Sony H.264 cameras typically use one-fifth the bandwidth of cameras using older JPEG technology.

Put simply, better compression means greater flexibility – the more efficiently data is handled, the more choices you have with your existing resources. An existing network can support more cameras, better audio-video quality or both.

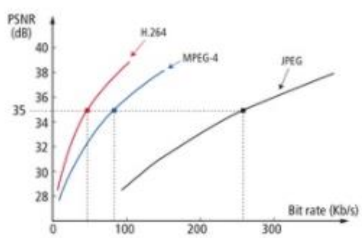
For surveillance applications, the 'industry-standard' image compression format is JPEG – which is perhaps best known for digital still photographs. In fact, using JPEG compression a network camera is acting rather like a digital camera – taking 25 (PAL) or 30 (NTSC) pictures per second. Each image is compressed individually (this is called intra-frame compression) which ensures each image is good quality and also provides a near constant data-size – making predicting network data traffic and data storage demands easy.

Often referred to as Motion JPEG or MJPEG, this form of compression has a relatively low processor demands and made possible the current generation of network cameras. It's also quite well suited to monitoring applications where it's not always essential to provide a TV-quality frame-rate. On the negative side, the MJPEG format dates back to the early 90s and since then the technology of compression has advanced considerably...

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

Related Products

SNC-DH220T
Vandal-resistant Minidome 1080p/30 fps Camera - E Series

SNC-CH120
Box-type 720p/30 fps Camera - E Series

SNC-CH280
Outdoor IR Bullet 1080p/30 fps Camera - V Series

SNC-CH140
Box-type 720p/30 fps Camera - V Series

SNC-DH160
Outdoor IR Ruggedized 720p/30 fps Camera - E Series

SNC-ZM550
Minidome 720p/30 fps camera capable of transmitting both analog video and H...

SNC-ER550
720p/30 fps Rapid Dome Camera - E Series

SNC-EB602R
Outdoor IR Bullet 720p/ 30 fps Camera Powered by IPELA ENGINE EX™ – E Series

SNC-EB632R
Outdoor IR Bullet 1080p/30 fps Camera Powered by IPELA ENGINE EX™ – E Series

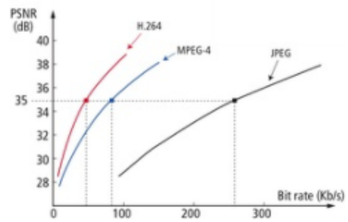
158. On that same website, Sony also mentions some background on the benefits of H.264, and also adds that "Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms." The website further states that: "Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High

Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!" *See* http://us.professional.sony.com/pro/article/video-security-h264-article:

H.264 & hardware support

MPEG-4 compression not only operates on each individual frame (intra-frame compression) but also across a series of frames (inter-frame compression). Since a large amount of data is frequently unchanged between frames, this enables a highly significant increase in compression.

MPEG-4 is actually a series of standards, developed by ISO/IEC Motion Pictures Expert Group (MPEG), and MPEG-4 Part 2 is supported by most Sony network cameras. In 2006, however, Sony began introducing a more advanced MPEG-4 format known as H.264 (or MPEG-4 Part 10). Specifically developed to provide high quality video at a much lower bit rate than MPEG-4, it uses a variety of different advanced techniques to achieve this aim – most notably block patterns used to predict movement across video frames.



*Comparison of H.264, MPEG-4, and JPEG (picture quality vs. bit rate)**

The practical benefits of these varying compression formats can be illustrated quite simply. In the above diagram you can see JPEG compression operating at 260Kb/s, while MPEG-4 transmits at 85Kb/s and H.264 transmits at 50K/bs. To put this into perspective, MPEG-4 requires approximately one-third of the bandwidth used by JPEG and H.264 requires just one-fifth.

Since H.264 compression is so advanced, it does demand more processing power than older formats, but as Sony network cameras natively support H.264 in hardware this doesn't make any difference in operational terms.

Leadership & Compatibility

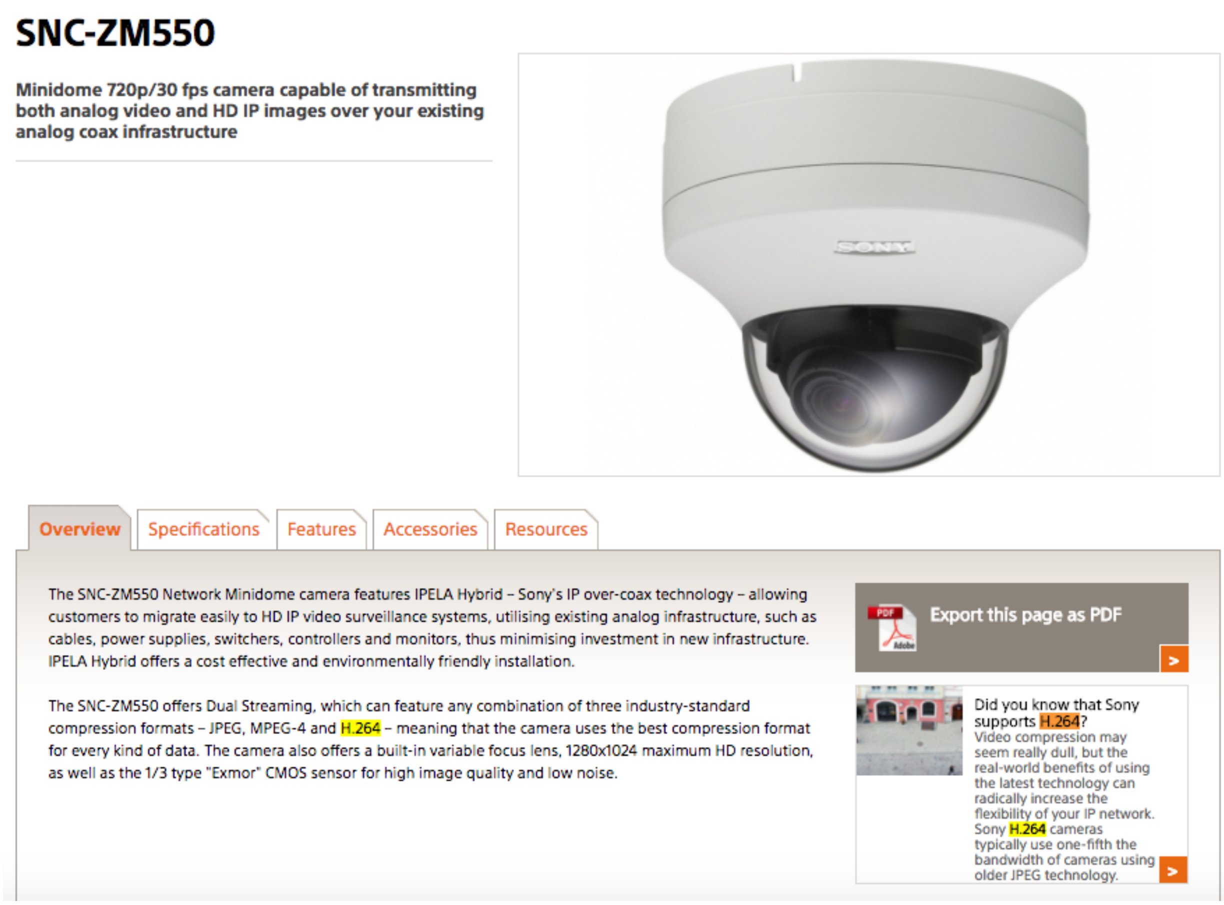
A five-fold increase in the capacity of an IP-based network might seem science fiction, but in a networked digital world it should come as no surprise that there's huge amount of investment in ensuring the highest possible video quality at the lowest possible bitrate. H.264 technology is currently used in Blu-ray discs, HDTV broadcasting (including BBC HD and Euro 1080), AVCHD (a HD recording format for HDD and Solid State camcorders) and a wide variety of mobile devices, including Apple's iPhone and Sony's PSP. The format is also commonly used online for high quality content, for example HD movie trailers, and it's also been adopted by YouTube for its new high quality mode. This also means most media players, such as QuickTime or VLC, support H.264 encoded content.

Sony is at the heart of this networked digital world, in fact the Joint Video Team (JVT) Committee of which Sony is a long-standing member recently received an Emmy Engineering Award for its work on H.264/MPEG-4's High Profile compression standard. So it should be no surprise that Sony has played a leading role in bringing the most advanced technology to video security. The first Sony security cameras using H.264 compression were introduced in 2006. Two years later, the Sony range now has no less than seven cameras supporting H.264 – the widest range of cameras in the industry!

More information on Sony Video Security solutions

* The vertical axis shows Peak Signal-to-Noise Ratio (PSNR), a metric for the "quality" of compressed video images, while the horizontal axis shows the transmission bit rate. The graph shows just one example of comparing bit rates at which JPEG, MPEG-4, and H.264 images can be transmitted. Actual bit rates for transmitting data using these three compression formats differ with image quality and image size settings. In this example, the video parameters are; 10 frames per second, 176x144 (QCIF) resolution, 10 seconds of video (100 frames).

159. As an illustrative example, the website for Sony's SNC-ZM550 camera states in its "Overview" tab that "The SNC-ZM550 offers Dual Streaming, which can feature any combination of three industry-standard compression formats – JPEG, MPEG-4 and H.264 – meaning that the camera uses the best compression format for every kind of data." *See* http://us.professional.sony.com/pro/product/video-security-ip-cameras-



minidomes/snc-zm550/overview/#overview:

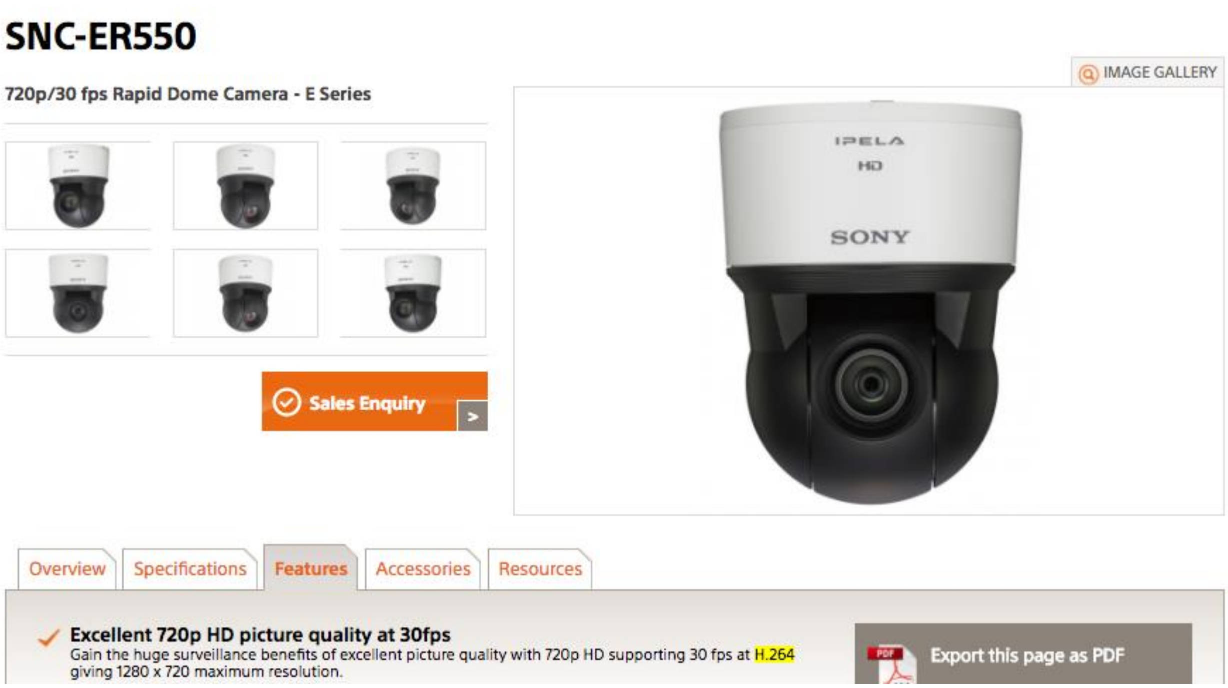
160. On the same web site, under the "Features" tab, it states that "The SNC-ZM550 supports dual streaming with…H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4." *See*

http://us.professional.sony.com/pro/product/video-security-ip-cameras-minidomes/snc-zm550/features/#features:

Overview | Specifications | **Features** | Accessories | Resources

Dual streaming with any combination of industry-standard codecs
The SNC-ZM550 supports dual streaming with any combination of three industry-standard compression formats – JPEG, the best choice for high-quality still images, MPEG-4, the format that provides clear moving images efficiently over limited-bandwidth networks, and H.264, the alternative for severely limited-bandwidth networks, providing twice the efficiency of MPEG-4. This means that the camera can use the best compression format for every kind of data.

161. As another illustrative example, the website for Sony's SNC-ER550 camera has a "Features" tab which states: "Gain the huge surveillance benefits of excellent picture quality with 720p HD supporting 30 fps at H.264 giving 1280 x 720 maximum resolution." *See* http://us.professional.sony.com/pro/product/video-security-ip-

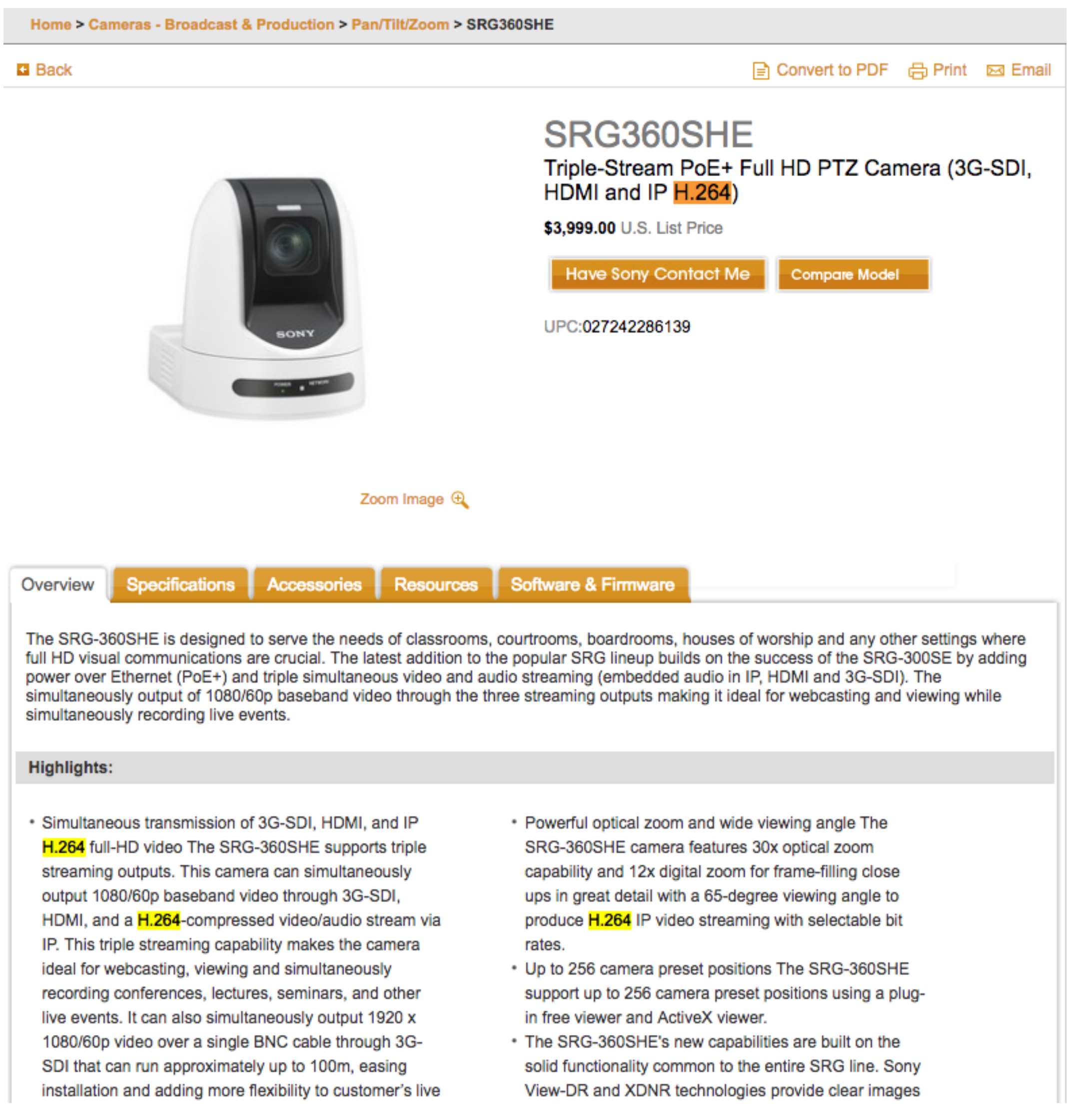


cameras-pan-tilt-zoom/snc-er550/features/#features:

162. As yet another illustrative example, the website for Sony's SRG360SHE camera (sub-header: "Triple-Stream PoE + Full HD PTZ Camera (3G-SDI, HDMI and IP H.264)") mentions, under its "Overview" tab: "Simultaneous transmission of 3G-SDI, HDMI and IP H.264 full-HD video" and "This camera can simultaneously output 1080/60p baseband video through 3G-SDI, HDMI, and a H.264 compressed video/audio stream via IP" as well as "The SRG-360SHE camera features 30x optical zoom capability and 12x digital zoom for frame-filling close ups in great detail with a 65-degree viewing angle to produce H.264 IP video streaming with selectable bit rates." *See*

https://pro.sony.com/bbsc/ssr/cat-broadcastcameras/cat-broadcastcamerapantiltzoom/product-SRG360SHE/:

163. Furthermore, Sony's Surveillance Video Encoders all use H.264 as a "Video compression format" as can be seen by the below datasheet. *See* https://pro.sony.com/bbsccms/assets/files/cat/camsec/brochures/quickref_sntexep.pdf:



Surveillance Video Encoders

	Full Function				Basic Function	
	1CH Box		4CH Box	4CH Blade	4CH Box	4CH Blade
	SNT-EX101	SNT-EX101E	SNT-EX104	SNT-EX154	SNT-EP104	SNT-EP154
						
Codec image size (HxV)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)	D1 (NTSC: 720 x 480, PAL: 720 x 576), VGA (640 x 480), CIF (384 x 288), QVGA (320 x 240)
Video compression format	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG	H.264, MPEG-4, JPEG
Codec streaming capability	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)	Dual streaming (Any combination with JPEG/MPEG-4/H.264, including multiple streams of the same format)
Maximum frame rate	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)	H.264/MPEG-4/JPEG: 30fps (NTSC: 720 x 480, PAL: 720 x 576)
PTZ control	Yes	Yes	Yes	Yes	No	No
Visibility Enhancer	Yes	Yes	Yes	Yes	Yes	Yes
XDNR	Yes	Yes	Yes	Yes	Yes	Yes
Coaxitron® control	Yes	Yes	Yes	Yes	No	No
Serial Interface	RS-422/RS-485	RS-422/RS-485	RS-485	RS-485	-	-
USB Memory slots	x 1*1	x 1*1	x 4*1	-	-	-
Sensor input	x 2	x 2	x 4	x 4	-	-
Alarm output	x 2	x 2	x 4	x 4	-	-
Audio interface (IN/OUT)	IN x 1, OUT x 1	IN x 1, OUT x 1	IN x 4, OUT x 4	IN x 1, OUT x 1	-	-
Audio support	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	Yes - Full Duplex	No	No
DEPA™ Advanced (Intelligence)	Yes	Yes	Yes	Yes	No	No
Dimensions (W x H x D)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	2 7/8 x1 3/8 x 6 1/8 inches (73 x 34 x 155 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)	8 3/8 x 1 3/4 x 9 7/8 inches (210 x 44 x 250 mm)	3 1/8 x 1 3/8 x 15 1/8 inches (78 x 34 x 382 mm)
Power requirements	AC 24V in, with loop through output Input: AC 24V, +/- 20%	PoE (IEEE802.3af)	DC12 V	From Rack Station	DC12 V	From Rack Station

164. Sony further has a SAS-HD1SET H.264 Satellite/Receiver Combo, as can be seen by this article on Engadget. *See* https://www.engadget.com/2008/09/02/sony-rolls-out-sas-hd1set-h-264-satellite-receiver-combo/:

Sony rolls out SAS-HD1SET h.264 satellite / receiver combo

Richard Lawler, @Rjcc
09.02.08

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Shares

Getting discerning Japanese viewers ready for the new SKY Perfect HDTV channels, Sony is launching an h.264 satellite dish / receiver combo, the SAS-HD1SET, due October 15. At ¥45,000 ($416 U.S.) or ¥37,000 ($342 U.S.) for the DST-HD1 tuner alone, it's a pretty expensive upgrade for 15 HDTV channels, with the promise of more than 70 by this time next year. Add-on the ¥3,500 monthly service charge and we're even more leery, but really, you'll need something to watch on that ultra thin LCD next month.

165. The Accused Instrumentalities determine a parameter of at least a portion of a video data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and resolution parameters. Different parameters correspond with different end applications. H.264 provides for multiple different ranges of such

parameters, each included in the "profiles" and "levels" as defined by the H.264 standard, from the below shown paragraphs from a white paper and Wikipedia. *See* http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

4. H.264 profiles and levels

The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting options and features to a minimum. An important aspect of the standard, as with other video standards, is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes) that optimally support popular productions and common formats.

H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what feature set the encoder may use and limits the decoder implementation complexity.

Network cameras and video encoders will most likely use a profile called the baseline profile, which is intended primarily for applications with limited computing resources. The baseline profile is the most suitable given the available performance in a real-time encoder that is embedded in a network video product. The profile also enables low latency, which is an important requirement of surveillance video and also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements. Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176×144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176×144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352×288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352×288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352×288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352×288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352×576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720×576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720×576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280×720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280×1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048×1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048×1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048×1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672×1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@56.3 (5)

166. A video data block is organized by the group of pictures (GOP) structure, which is a "collection of successive pictures within a coded video stream." *See* https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). *See* https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); https://en.wikipedia.org/wiki/MPEG-1#D-frames (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can

be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

167. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant system such as the Accused Instrumentalities would determine which profile (e.g., "baseline," "extended," "main", or "high") corresponds with that parameter, then select between at least two asymmetric compressors. If baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding ("CAVLC") entropy encoder. If main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding ("CABAC") entropy encoder. Both encoders are asymmetric compressors because it takes a longer period of time for them to compress data than to decompress data. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8×8 vs. 4×4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf

at 7:

The following table summarizes the two major types of entropy coding: Variable Length Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers superior coding efficiency over VLC by adapting to the changing probability distribution of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of CABAC.

H.264 Entropy Coding – Comparison of Approaches

Characteristics	Variable Length Coding (VLC)	Context Adaptive Binary Arithmetic Coding(CABAC)
• Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
• Probability distribution	**Static** - Probabilities never change	**Adaptive** - Adjusts probabilities based on actual data
• Leverages correlation between symbols	**No** - Conditional probabilities ignored	**Yes** - Exploits symbol correlations by using "contexts"
• Non-integer code words	**No** - Low coding efficiency forhigh probability symbols	**Yes** - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the encoder. *See* https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

entropy_coding_mode_flag selects the entropy decoding method to be applied for the syntax elements for which two descriptors appear in the syntax tables as follows:

– If entropy_coding_mode_flag is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).

– Otherwise (entropy_coding_mode_flag is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

168. The Accused Instrumentalities compress the at least the portion of the data block with the selected one or more asymmetric compressors to provide one or more compressed data blocks, which can be organized in a GOP structure (see above). After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data to provide various compressed data blocks, which can also be organized in a GOP structure, as discussed previously above. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

> **Entropy Coding**
> For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf at 13:

> Typical compression ratios to maintain excellent quality are:
> - 10:1 for general images using JPEG
> - 30:1 for general video using H.263 and MPEG-2
> - 60:1 for general video using H.264 and WMV9

Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.

The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.

The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.

The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

169. Therefore, from at least the above, Sony has directly infringed and continues to infringe the ’477 Patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the system claimed by Claim 1 of the ’477 Patent, namely, a system, comprising: a plurality of different asymmetric data compression encoders, wherein each asymmetric data compression encoder of the plurality of different asymmetric data compression encoders is configured to utilize one or more data compression algorithms, and wherein a first asymmetric data compression

encoder of the plurality of different asymmetric data compression encoders is configured to compress data blocks containing video or image data at a higher data compression rate than a second asymmetric data compression encoder of the plurality of different asymmetric data compression encoders; and one or more processors configured to: determine one or more data parameters, at least one of the determined one or more data parameters relating to a throughput of a communications channel measured in bits per second; and select one or more asymmetric data compression encoders from among the plurality of different asymmetric data compression encoders based upon, at least in part, the determined one or more data parameters. Upon information and belief, Sony uses the Accused Instrumentalities to practice infringing methods for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

170. On information and belief, the Accused Instrumentalities store at least a portion of the one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

171. On information and belief, Sony also directly infringes and continues to infringe other claims of the ’477 Patent, for similar reasons as explained above with respect to Claim 1 of the ’477 Patent.

172. On information and belief, all of the Accused Instrumentalities perform the claimed methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

173. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the systems and/or methods

claimed by the ’477 Patent.

174. On information and belief, Sony has had knowledge of the ’477 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Sony knew of the ’477 Patent and knew of its infringement, including by way of this lawsuit. By the time of trial, Sony will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of the claims of the ’477 Patent.

175. Upon information and belief, Sony’s affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’477 Patent by practicing a system, comprising: a plurality of different asymmetric data compression encoders, wherein each asymmetric data compression encoder of the plurality of different asymmetric data compression encoders is configured to utilize one or more data compression algorithms, and wherein a first asymmetric data compression encoder of the plurality of different asymmetric data compression encoders is configured to compress data blocks containing video or image data at a higher data compression rate than a second asymmetric data compression encoder of the plurality of different asymmetric data compression encoders; and one or more processors configured to: determine one or more data parameters, at least one of the determined one or more data parameters relating to a throughput of a communications channel measured in bits per second; and select one or more asymmetric data

compression encoders from among the plurality of different asymmetric data compression encoders based upon, at least in part, the determined one or more data parameters. For example, Sony adopted H.264 as its video codec in its products/services, such as, e.g., Sony's cameras, Surveillance Video Encoders and Satellite/Receiver combos. For similar reasons, Sony also induces its customers to use the Accused Instrumentalities to infringe other claims of the '477 Patent. Sony specifically intended and was aware that these normal and customary activities would infringe the '477 Patent. Sony performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the '477 Patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Sony engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Sony has induced and continues to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the '477 Patent, knowing that such use constitutes infringement of the '477 Patent. Accordingly, Sony has been, and currently is, inducing infringement of the '477 Patent, in violation of 35 U.S.C. § 271(b).

176. Sony has also infringed, and continues to infringe, claims of the '477 Patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '477 Patent, and constitute a material part of the invention. Sony knows the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the '477 Patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Sony

has been, and currently is, contributorily infringing the ’477 Patent, in violation of 35 U.S.C. § 271(c).

177. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’ compression features, Sony has injured Realtime and is liable to Realtime for infringement of the ’477 Patent pursuant to 35 U.S.C. § 271.

178. As a result of Sony’s infringement of the ’477 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Sony’s infringement, but in no event less than a reasonable royalty for the use made of the invention by Sony, together with interest and costs as fixed by the Court.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff Realtime respectfully requests that this Court enter:

a. A judgment in favor of Plaintiff that Sony has infringed, literally and/or under the doctrine of equivalents, the ’046, ’535, ’442, ’907, ’477, ’462, and ’298 Patents;

b. A judgment and order requiring Sony to pay Plaintiff its damages, costs, expenses, and prejudgment and post-judgment interest for its infringement of the Patents-in-Suit, as provided under 35 U.S.C. § 284;

c. A judgment and order requiring Sony to provide an accounting and to pay supplemental damages to Realtime, including without limitation, prejudgment and post-judgment interest;

d. A judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding to Plaintiff its reasonable attorneys’ fees against Sony; and

e. Any and all other relief as the Court may deem appropriate and just under the circumstances.

DEMAND FOR JURY TRIAL

Plaintiff, under Rule 38 of the Federal Rules of Civil Procedure, requests a trial by jury of any issues so triable by right.

November 21, 2017

BAYARD, P.A.

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