IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO

REALTIME ADAPTIVE STREAMING LLC,

              Plaintiff,

          v.

ARRIS SOLUTIONS, INC.,

              Defendant.

Case No. 1:19-CV-585

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 Defendant ARRIS Solutions, Inc. ("Defendant" or "ARRIS"):

PARTIES

1.   Realtime is a Texas limited liability company. 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.   On information and belief, Defendant ARRIS is a Delaware corporation with a principal place of business at 3871 Lakefield Drive, Suwanee, Georgia 30024. ARRIS can be served with process through its registered agent, the United Agent Group Inc, 3411 Silverside Road Tatnall Building, Suite 104, Wilmington, Delaware 19810.

3.   ARRIS has a regular and established place of business in this District, including, e.g., sales office, employees, and other business. For example, ARRIS's office is located at 9800 E. Geddes Ave., Suite A-100, Englewood, Colorado 80112, which is in this District. *See, e.g.,* https://www.arris.com/company/offices/

JURISDICTION AND VENUE

4.   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).

5.   This Court has personal jurisdiction over ARRIS in this action because ARRIS has committed acts within the District of Colorado giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over ARRIS would not offend traditional notions of fair play and substantial justice. ARRIS has committed and continues 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.

6.   Venue is proper in this district, e.g., under 28 U.S.C. § 1400(b). ARRIS is registered to do business in Colorado, and upon information and belief, ARRIS has transacted business in the District of Colorado as and has committed acts of direct and indirect infringement in the District of Colorado. ARRIS has regular and established place of business in this District, as set forth above.

COUNT I

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

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

8.   Plaintiff Realtime is the owner by assignment of United States Patent No. 8,929,442 ("the '442 patent") entitled "System and method for video and audio data distribution." The '442 patent was duly and legally issued by the United States Patent and Trademark Office on January 6, 2015. A true and correct copy of the '442 patent is included as Exhibit A.

9.   On information and belief, ARRIS has made, used, offered for sale, sold and/or imported into the United States ARRIS products that infringe the '442 patent, and continues to do so. By way of illustrative example, these infringing products include,

without limitation, ARRIS's Video Media Servers, MS4000 Media Streamer, ConvergeMedia XMS 1U AD Server, MC6505 UDH Cable Media Gateway, HMC4100 Cable Media Gateway, ME-7000 Converged Compression Platform, Video Device Portfolio for Android TV (e.g., VIP5402W), Video Device Portfolio for Mediaroom (e.g., VIP5662), VIP1113, ZC4210, KreaTV, and all versions and variations thereof since the issuance of the '442 patent ("Accused Instrumentalities").

10.   On information and belief, ARRIS has directly infringed and continues to infringe the '442 patent, for example, through its sale, offer for sale, importation, use and testing of the Accused Instrumentalities, which 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.

11.   The Accused Instrumentalities include a data decompression system configured to decompress a compressed data block. For example, the Accused Instrumentalities utilize H.264 video compression standard. *See, e.g.,* https://www.arris.com/products/vip5662/;   https://www.arris.com/products/media-streamer-ms4000/; https://www.arris.com/globalassets/resources/data-sheets/mc6505.pdf; https://www.arris.com/products/mediaroom-video-devices/.

12.   The Accused Instrumentalities include a storage medium configured to store at least a portion of the decompressed data block. For example, the Accused Instrumentalities include volatile and non-volatile memory (e.g., RAM, flash, etc.) configured to store at least a portion of the decompressed data block. *See* e.g.,

https://www.arris.com/globalassets/resources/data-sheets/vip5402w.pdf.

VIP5402W UHD IP Set-Top

ARRIS

GENERAL SPECIFICATIONS		GENERAL SPECIFICATIONS - CONTINUED	
Core Processor		**Wi-Fi**	
Processing	Quad-core, 15000 DMIPS	Radio	2x2 802.11ac dual-band selectable
Graphics		Bandwidth	20,40 and 80Mhz Support
Technology	3D OpenGL ES3.1	Beamforming	TX and RX
Memory		Modulation	BPSK,QPSK,16QAM,64QAM,256 QAM
RAM	2 GB DDR4	PHY rate	867 Mbps 5Ghz 300 Mbps 2.4GHz
Application Flash	8 GB eMMC		

13.   In the Accused Instrumentalities, 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, compressed video output formats "may be UltraHD 4k, HD, SD or multi-bitrate (MBR) transcoding for ABR multi-screen IP video delivery."   *See* e.g., https://www.arris.com/products/me-7000/. In particular, "HTTP Adaptive Bitrate (ABR) streaming uses small segments to compromise   HTTP   file   transfer   request."   *See*   e.g., https://www.arris.com/globalassets/resources/white-papers/arris_bandwidthefficientcontentdelivery_whitepaper_final.pdf. As such, the client selects a media segment with an adequate bitrate via HTTP get request. Subsequently, the client "continues the media segment request one after another either in the same bitrate or in a different bitrate based on network bandwidth condition."   *See* e.g., https://www.arris.com/globalassets/resources/white-papers/arris_bandwidthefficientcontentdelivery_whitepaper_final.pdf.

14.   As another example, the Accused Instrumentalities utilize H.264, which include, e.g., Context-Adaptive Variable Length Coding ("CAVLC") entropy encoder

and Context-Adaptive Binary Arithmetic Coding ("CABAC") entropy encoder. H.264 provides for multiple different ranges of parameters (e.g., bitrate, resolution parameters, etc.), each included in the "profiles" and "levels" defined by the H.264 standard. *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)

15.   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.

16.   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. *See* https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/:

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	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:

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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).

17.   After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data to provide various compressed data blocks, which can be organized   in   a   GOP   structure   (see   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

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

> 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.

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18.   On information and belief, ARRIS also directly infringes and continues to infringe other claims of the '442 patent.

19.   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.

20.   On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the methods claimed by the '442 patent.

21.   On information and belief, ARRIS has had knowledge of the '442 patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, ARRIS knew of the '442 patent and knew of its infringement, including by way of this lawsuit. By the time of trial, ARRIS 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.

22.   Upon information and belief, ARRIS'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. For example, ARRIS adopted H.264 as its video codec in the Accused Instrumentalities. For similar reasons, ARRIS also induces its customers to use the Accused Instrumentalities to infringe other claims of the '442 patent. ARRIS specifically intended and was aware that these normal and customary activities would infringe the '442 patent. ARRIS 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, ARRIS engaged in such

inducement to promote the sales of the Accused Instrumentalities. Accordingly, ARRIS

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 '442 patent,

knowing that such use constitutes infringement of the '442 patent. Accordingly, ARRIS

has been, and currently is, inducing infringement of the '442 patent, in violation of 35

U.S.C. § 271(b).

23.   ARRIS 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.

ARRIS 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,

ARRIS has been, and currently is, contributorily infringing the '442 patent, in violation

of 35 U.S.C. § 271(c).

24.   By making, using, offering for sale, selling , importing, and/or exporting

into the United States the Accused Instrumentalities, and touting the benefits of using the

Accused Instrumentalities' compression features, ARRIS has injured Realtime and is

liable to Realtime for infringement of the '442 patent pursuant to 35 U.S.C. § 271.

25.   As a result of ARRIS's infringement of the '442 patent, Plaintiff Realtime

is entitled to monetary damages in an amount adequate to compensate for ARRIS's

infringement, but in no event less than a reasonable royalty for the use made of the

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

COUNT II

INFRINGEMENT OF U.S. PATENT NO. RE46,777

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

as if fully set forth herein.

27.   Plaintiff Realtime is the owner by assignment of United States Patent No. RE46,777 ("the '777 patent") entitled "Quantization for Hybrid Video Coding." The '777 patent was duly and legally issued by the United States Patent and Trademark Office on April 3, 2018. The '777 patent is a reissue of U.S. Pat. No. 8,634,462, which was issued on January 21, 2014. A true and correct copy of the '777 patent is included as Exhibit B.

28.   On information and belief, ARRIS has made, used, offered for sale, sold and/or imported into the United States ARRIS products that infringe the '777 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, ARRIS's products and services that perform encoding using HEVC/H.265, including, e.g., MC6505 UDH Cable Media Gateway, ME-7000 Converged Compression Platform, Modular Uplink System, and all versions and variations thereof since the issuance of the '777 patent ("Accused Instrumentalities").

29.   On information and belief, ARRIS has directly infringed and continues to infringe the '777 patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the method claimed by Claim 1 of the '777 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, ARRIS 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 ARRIS's customers.

30.   For example, the Accused Instrumentalities utilize the H.265 (or HEVC) video compression standard. Specifically, in a data sheet entitled "ME-7000 Converged Compression Platform," it is stated that the ME-7000 platform provides "multi-codec support with SD, HD encoding and transcoding plus multi-screen delivery for IPTV, cable and satellite applications." *See* e.g., "ME-7000 Converged Compression Platform." Moreover, the same article states that ME-7000 supports "MPEG-4, MPEG-2, HEVC /4K and MBR." *See* e.g., "ME-7000 Converged Compression Platform."

Video Outputs
Eight 1GB/10GB optical/copper ports
Unicast or Multicast
Main Plus Picture-in-Picture (PIP)
MBR: Multi bit-rate groups with aligned GOP/IDR boundaries

MBR Video Formats
Multi bit-rate (GOP/IDR aligned): MPEG-4 AVC: MP/HP@3.1, 4.0, 4.1 HEVC: Main@4.1 (future upgrade)
Progressive and Interlaced video at 59.94, 50, 29.97 or 25 frames
Up to 1920 x 1080 resolutions

See e.g., "ME-7000 Converged Compression Platform."

31.   Furthermore, the official ARRIS product site for the Modular Uplink System states "[T]he Modular Uplink System consists of … various encoder and modulator products." *See* e.g., https://www.arris.com/products/modular-uplink-solution/. With this regard, the product site further specifies that "supported encoding elements can provide either MPEG-2, MPEG-4, or HEVC encoding, of either HD or SD source formats, multiplexed in either CBR or stat-mux format." *See* e.g., https://www.arris.com/products/modular-uplink-solution/.

32.   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."

33.   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.").

34.   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.").

35.   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

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in size and predicted from luma and chroma prediction blocks (PBs). HEVC supports variable PB sizes from 64×64 down to 4×4 samples.").

36.   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."

37.   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,

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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.

38.   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.

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

```
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 ] );
}
```

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

40.   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/).

41.   Comparing the two efficiencies d64BestCost and totalCost:

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

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

42.   Selecting for further proceeding either quantized values, which are all set to zero or quantized values, which are not all set to zero:

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

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

43.   On information and belief, ARRIS also directly infringes and continues to infringe other claims of the '777 patent.

44.   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.

45.   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 '777 patent.

46.   On information and belief, ARRIS has had knowledge of the '777 patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, ARRIS knew of the '777 patent and knew of its infringement, including by way of this lawsuit. By the time of trial, ARRIS 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 '777 patent.

47.   Upon information and belief, ARRIS'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 '777 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, ARRIS adopted HEVC (or H.265) as its video codec in its products/services,

such as in its television products and streaming video services. For similar reasons,

ARRIS also induces its customers to use the Accused Instrumentalities to infringe other

claims of the '777 patent. ARRIS specifically intended and was aware that these normal

and customary activities would infringe the '777 patent. ARRIS performed the acts that

constitute induced infringement, and would induce actual infringement, with the

knowledge of the '777 patent and with the knowledge, or willful blindness to the

probability, that the induced acts would constitute infringement. On information and

belief, ARRIS engaged in such inducement to promote the sales of the Accused

Instrumentalities. Accordingly, ARRIS 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 '777 patent, knowing that such use constitutes

infringement of the '777 patent. Accordingly, ARRIS has been, and currently is, inducing

infringement of the '777 patent, in violation of 35 U.S.C. § 271(b).

48.   ARRIS has also infringed, and continues to infringe, claims of the '777

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 '777 patent, and constitute a material part of the invention.

ARRIS knows the components in the Accused Instrumentalities to be especially made or

especially adapted for use in infringement of the '777 patent, not a staple article, and not

a commodity of commerce suitable for substantial noninfringing use. Accordingly,

ARRIS has been, and currently is, contributorily infringing the '777 patent, in violation

of 35 U.S.C. § 271(c).

49.   By making, using, offering for sale, selling , importing, and/or exporting

into the United States the Accused Instrumentalities, and touting the benefits of using the

Accused Instrumentalities' compression features, ARRIS has injured Realtime and is

liable to Realtime for infringement of the '777 patent pursuant to 35 U.S.C. § 271.

50.   As a result of ARRIS's infringement of the '777 patent, Plaintiff Realtime

is entitled to monetary damages in an amount adequate to compensate for ARRIS's

infringement, but in no event less than a reasonable royalty for the use made of the

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

<div align="center">

COUNT III

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

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51.   Plaintiff re-alleges and incorporates by reference the foregoing

paragraphs, as if fully set forth herein.

52.   Plaintiff Realtime is the owner by assignment of United States Patent No.

9,578,298 ("the '298 patent") entitled "Method for Decoding 2D-Compatible

Stereoscopic Video Flows." The '298 patent was duly and legally issued by the United

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States Patent and Trademark Office on February 21, 2017. A true and correct copy of the '777 patent is included as Exhibit C.

53.   On information and belief, ARRIS has made, used, offered for sale, sold and/or imported into the United States ARRIS products that infringe the '298 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, ARRIS's products and services that perform decoding using HEVC/H.265, including, e.g., MC6505 UDH Cable Media Gateway, DSR-4450 Commercial Integrated Receiver/Decoder, DSR-4470 Commercial Integrated Receiver/Decoder, HMC4100 Cable Media Gateway, ME-7000 Converged Compression Platform, Video Device Portfolio for Android TV (e.g., VIP5402W), VIP5305, VIP4205, VIP4302, Zx4430, VIP5202W, Video Device Portfolio for Mediaroom (e.g., VIP5662), ZC4210, and all versions and variations thereof since the issuance of the '298 patent ("Accused Instrumentalities").

54.   On information and belief, ARRIS 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 method 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, ARRIS 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 ARRIS's customers.

55.   For example, the Accused Instrumentalities utilize the H.265 (or HEVC) video compression standard. Specifically, the product data sheet for MC6505 UDH Cable Media Gateway discloses supports for HEVC H.265 video decoder.

GENERAL SPECIFICATIONS - CONTINUED	
Video Decode / Encode	
Decoders	Single 4Kp60 Quad up to 1080p60
Encoders	Dual up to 1080p30
Profiles	HEVC H.265 up to MP@L5.1; AVC H.264 up to MP@L4.2; MPEG-2 up to MP@HL VP9 Profile 0

See e.g., https://www.arris.com/globalassets/resources/data-sheets/mc6505.pdf.

56.   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.

57.   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.").

58.   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.").

59.   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.

60.   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

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

---

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.

---

61.   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.").

62.   On information and belief, ARRIS 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.

63.   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.

64.   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.

65.   On information and belief, ARRIS has had knowledge of the '298 Patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, ARRIS knew of the '298 Patent and knew of its infringement, including by way of this lawsuit. By the time of trial, ARRIS 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.

66.   Upon information and belief, ARRIS'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, ARRIS adopted HEVC (or H.265) as its video codec in its products/services, such as in its television products and streaming video services. For similar reasons, ARRIS also induces its customers to use the Accused Instrumentalities to infringe other claims of the '298 Patent. ARRIS

specifically intended and was aware that these normal and customary activities would infringe the '298 Patent. ARRIS 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, ARRIS engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, ARRIS 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, ARRIS has been, and currently is, inducing infringement of the '298 Patent, in violation of 35 U.S.C. § 271(b).

67.   ARRIS 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. ARRIS 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, ARRIS has been, and currently is, contributorily infringing the '298 Patent, in violation of 35 U.S.C. § 271(c).

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

69.   As a result of ARRIS's infringement of the '298 Patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for ARRIS's infringement, but in no event less than a reasonable royalty for the use made of the

invention by ARRIS, 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 ARRIS has directly infringed, literally and/or under the doctrine of equivalents, as well as indirectly infringed the '442, '777 and '298 patents;

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

c. A judgment and order requiring ARRIS 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 ARRIS; 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.

Dated: February 27, 2019   Respectfully submitted,

By: /s/ *Eric B. Fenster*
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RUSS AUGUST & KABAT

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