

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LENOVO (UNITED STATES) INC., DELL INC.,
DELL TECHNOLOGIES, INC., HP INC.,
Petitioner,

v.

UNIVERSAL CONNECTIVITY TECHNOLOGIES, INC.,
Patent Owner.

Case IPR2024-01481
U.S. Patent No. 7,746,798

DECLARATION OF PAUL S. MIN, PH.D.

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1003	Declaration of Paul S. Min, Ph.D.
1004	U.S. Patent No. 5,686,965 (Auld)
1005	ISO/IEC 13818-1, First edition, 1996-04-15 (MPEG-2, Part 1)
1006	U.S. Patent No. 5,974,464 (Shin)
1007	U.S. Patent No. 5,801,781 (Hiroshima)
1008	Infringement Contention Claim Chart for U.S. Patent No. 7,746,798, <i>Universal Connectivity Technologies Inc. v. Lenovo Group Limited</i> , No. 2:23-cv-00449
1009	USB 3.2 Specification
1010	Declaration of June Ann Munford
1011	U.S. Patent No. 4,308,557 (Dietrich)
1012	S. Dolinar & K. M. Cheung, <i>Frame Synchronization Methods Based on Channel Symbol Measurements</i> , Telecomm. Data Acquisition Rep. (1989).

I. INTRODUCTION

1. My name is Paul Min. I submit this declaration on behalf of Lenovo (United States) Inc., Dell Technologies, Inc., and HP Inc. (collectively, “Petitioners”), which I understand are challenging the validity of claims 1–9, 11–26, and 28 (“the Challenged Claims”) of U.S. Patent No. 7,746,798 (“the ’798 Patent”) in a petition for inter partes review.

2. I have been asked to provide an opinion on the validity of the Challenged Claims. In my opinion, for the reasons in the following sections, the Challenged Claims are invalid on the following grounds:

- Claims 1, 4, 5, 6, 7, 9, 11, 14, 15, 16, 18, 19, 22–25, and 28 are obvious based on Auld (Ex. 1004) and MPEG-2, Part 1 (Ex. 1005);
- Claims 2, 3, 12, 13, 20, and 21 are obvious based on Auld (Ex. 1004), MPEG-2, Part 1 (Ex. 1005), and Shin (Ex. 1006);
- Claims 8, 17, and 26 are obvious based on Auld (Ex. 1004), MPEG-2, Part 1 (Ex. 1005), and Hiroshima (Ex. 1007).

II. BACKGROUND/QUALIFICATIONS

3. Appendix A to this declaration is my curriculum vitae, which sets forth my qualifications.

4. I received a B.S. degree in Electrical Engineering in 1982, an M.S. degree in Electrical Engineering in 1984, and a Ph.D. degree in Electrical

Engineering in 1987 from the University of Michigan in Ann Arbor. I received several academic honors, including my B.S. degree with honors, a best graduate student award and a best teaching assistant award during my M.S. study, and a best paper award from a major international conference for reporting results from my Ph.D. thesis.

5. After receiving my Ph.D., I worked at Bellcore in New Jersey from August 1987 until August 1990. At Bellcore, I was responsible for evolving the public switched telephone network (POTS) into a multi-services voice and data network that incorporated packet switches, optical technologies, and wireless technologies.

6. In September 1990, I joined the faculty at Washington University in St. Louis. In July 1996, I was promoted to an Associate Professor of Electrical Engineering with tenure. I am currently a Senior Professor at Washington University of the Electrical and Systems Engineering. I have also served as the Chair of the Graduate Curriculum (2000-2002) and the Chair of the Undergraduate Curriculum (2011-2014) for the Electrical and Systems Engineering department.

7. At Washington University, I have conducted research in communication, computing, and related electronic hardware and software. My research group has pioneered a new paradigm for designing electronic circuits that can alleviate the speed and performance mismatch against optical technology. I

have received several grants from the U.S. Federal Agencies, including the National Science Foundation and the Defense Advanced Research Project Agency, and numerous contracts from companies and organizations around the world. Specifically related to the technology matters in this Investigation, I have researched a variety of wireless communication technologies, including CDMA, WCDMA, OFDM, FDD, SC-FDMA, and TDD. In addition, for nearly 40 years, I have designed and developed a number of switching and transmission devices that process various packet formats. I have an extensive background and experience in each of these technologies.

8. As a faculty member at Washington University, I have taught a number of courses in electronics, communication, and computing at both the undergraduate and graduate levels. For example, I have taught communication theory (Washington University ESE 471), transmission and multiplexing (Washington University ESE 571), and signaling and control of communication networks (Washington University ESE 572).

9. I have supervised numerous undergraduate and graduate students, many of whom received a doctoral degree under my guidance. A number of doctoral theses that I have supervised relate specifically to packet processing technology. In particular, my students and I have published a number of peer-reviewed articles on resource allocation, scheduling, modulation, mobility

management, and multiplexing. Several of these articles received accolades in the field. For example, in 2011, we received a best paper award at the Mobility 2011 international conference.

10. In addition to my responsibilities as a university faculty member, I have founded two companies. In May 1997, I founded MinMax Technologies, Inc., a fabless semiconductor company that developed switch fabric integrated circuit chips for the Internet. In March 1999, I founded Erlang Technology, Inc., a fabless semiconductor company that focused on the design and development of integrated circuit chips and software for the Internet. One of Erlang's products received a best product of the year award in 2004 from a major trade journal for the electronics industry.

11. Outside my own start-up companies, I have also served in various technology and business advisor roles for other companies and organizations around the world. I was the main technical author for one of two winning proposals to the Korean government for CDMA wireless service licenses (1996). I was responsible for designing a commercial scale IS-95 CDMA cellular network, which I understand to be one of the earliest such networks deployed in the world. I worked with numerous engineers and scientists around the world to implement this commercial-scale cellular network before IS-95 CDMA was widely accepted. This provided me with extensive insight into various components of CDMA technology,

which by and large are used in WCDMA network. I have also been involved in a semiconductor company that specializes in semiconductor memories such as flash EEPROMs as a board member and as a technical advisor (2007-2011).

12. I am a named inventor on eleven U.S. patents, many of which are directly related to resource allocation, packet processing, and network designing. I have extensively published technical papers in international conferences and journals, technical memoranda and reports, and given a number of seminars and invited talks. I have organized several international conferences and served as an international journal editor.

13. I am a member of and have been actively involved in a number of professional organizations. For example, I have served as the Chair of the Saint Louis Section of the IEEE with more than 3,000 members (2014), and a member of the Eta Kappa Nu Honor Society for electrical engineers. I have also been an Ambassador of the McDonnell International Scholars Academy (2007-2013).

14. In my nearly 40 years of experience with telecommunications technology, I have acquired significant knowledge about telecommunications systems industry standards, standard setting organizations, and the rules and document policies that those organizations have in place to develop industry standards.

III. LEGAL PRINCIPLES

15. I am not an attorney. I offer no opinions on the law. But counsel has informed me of legal standards that apply to the issue of patent validity. I have applied these standards in arriving at my conclusions.

16. I understand that in an *inter partes* review the petitioner has the burden of proving a proposition of unpatentability by a preponderance of the evidence. I understand this standard is different from the standard that applies in a district court, where I understand a challenger bears the burden of proving invalidity by clear and convincing evidence.

17. I understand that the claims of a patent are reviewed from the perspective of a hypothetical person of ordinary skill in the art (“POSITA”) at the time of the alleged invention. Here, the “art” in question is the field of technology to which a patent is related. I understand that the purpose of using the viewpoint of a POSITA is for objectivity.

18. I understand that a patent claim is invalid based on anticipation if a single prior art reference discloses all of the features of that claim, and does so in a way that enables one of ordinary skill in the art to make and use the invention. Each of the claim features may be expressly or inherently present in the prior art reference. I understand that if the prior art necessarily functions in accordance with, or includes a claim’s feature, then that prior art inherently discloses that

feature. I have relied on this understanding in expressing the opinions set forth below.

19. I further understand that a patent claim is invalid based on obviousness if the petitioner establishes by a preponderance of the evidence that, as of the priority date, the subject matter of the claim, considered as a whole, would have been obvious to a POSITA. I understand that the analysis of whether a claim is obvious depends upon a number of factual inquiries, for example, (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of non-obviousness.

20. For example, I understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand that an obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim because a court can take account of the inferences and/or creative steps that a person of ordinary skill in the art would employ.

IV. PERSON OF ORDINARY SKILL IN THE ART

21. In my opinion, a POSITA as of the time of the alleged invention of the '798 Patent would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or equivalent training, and three years of

experience with data communications systems or interfaces, including at least some experience with serial or display data communications systems or interfaces. Additional education can substitute for less work experience, and vice versa. My qualifications fall within this definition of level of skill in the art.

V. OVERVIEW OF THE '798 PATENT AND THE STATE OF THE ART

22. The '798 Patent is titled "Method and System for Integrating Packet Type Information With Synchronization Symbols." Ex. 1001. It is directed to a "serial communications architecture for communicating between hosts and data storage devices." Ex. 1001, Abstract. The patent discloses an embodiment wherein "the serial communications architecture defines multiple primitives to operate as synchronization signals," which are "typically used by the physical layer to help ensure correct alignment of symbols." *Id.*, 14:31–35. This refers to a process commonly known in the art at the time of the invention as "frame synchronization." Frame synchronization is an essential data processing operation performed in digital communication wherein a receiver identifies the beginning of a frame (i.e., grouping of data) in order to correctly interpret that data. These synchronization techniques have been employed for decades and in a variety of communication technologies, from Barker codes and radar in the 1950's to transmitting data from spacecraft. *See* Ex. 1011 (Dieterich), 3:25–40; Ex. 1012 (*Frame Synchronization Methods Based on Channel Symbol Measurements*), 122.

23. The '798 Patent teaches the use of “synchronization primitives” to achieve this frame synchronization process: “[a] transmitting communications node periodically transmits synchronization primitives so that the receiving communications node can properly align with that synchronization primitive.” Ex. 1001, 14:35–39. Thus, “[w]hen a communications node receives a synchronization primitive, it knows that the primitive is correctly aligned on a symbol boundary.” *Id.*, 14:39–41.

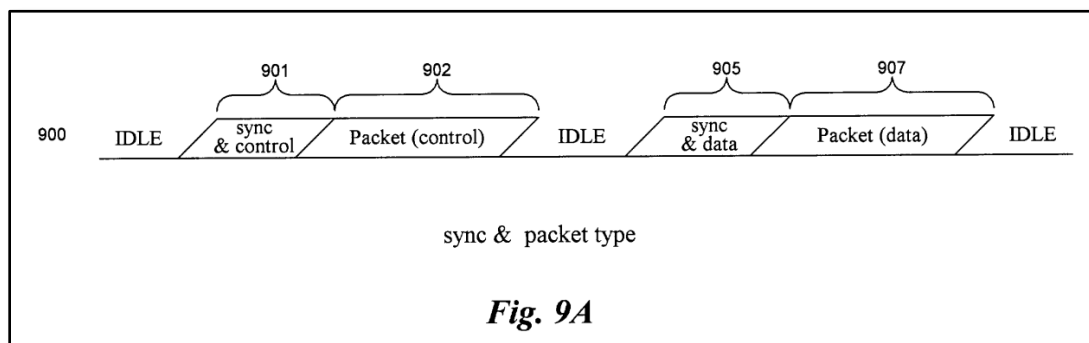
24. The '798 Patent teaches that synchronization primitives are comprised of “synchronization symbols,” i.e., discrete groupings of bits in the bitstream. *Id.*, 15:22–24, 17:60–64. Table 3 illustrates example synchronization primitives that are comprised of pairs of 9-bit synchronization symbols:

TABLE 3		
	Falling Edge	Rising Edge
0	100000001 - 100111111	011000000 - 011111110
1	100000011 - 100011111	011100000 - 011111100
2	100000111 - 100001111	011110000 - 011111000
3	100001111 - 100000111	011111000 - 011110000
4	100011111 - 100000011	011111100 - 011100000
5	100111111 - 100000001	011111110 - 011000000

Id., Table 3.

25. According to the disclosures of the '798 Patent, multiple potential primitives can be used at once as synchronization primitives. *Id.*, 14:32–34. In this way, one can encode the “type” of a packet (i.e., packetizations of data created by

the transport layer, *id.*, 8:27–29) into different synchronization primitives and thus later identify the packet type using the synchronization primitive. *Id.*, 14:43–46, 15:27–20. This is illustrated by an example embodiment in Figure 9A:



Id., Figure 9A. Figure 9A includes two example synchronization primitives 901 and 905 which indicate an associated packet type. Synchronization primitive 901 identifies a packet of type “control,” and synchronization primitive 905 identifies a packet of type “data.” *Id.*, 15:8–10, 15:14–16.

VI. CLAIM CONSTRUCTION

26. I have been informed that, in an IPR, the claims of the patent are construed in accordance with the ordinary and customary meaning as understood by a POSITA at the time of the invention. I understand that no specialized constructions have been identified for any of the terms appearing in the claims of the '798 patent. I have, therefore, applied the ordinary and customary meaning of the terms in the challenged claims unless otherwise noted.

VII. INVALIDITY ANALYSIS OF CHALLENGED CLAIMS 1–9, 11–26, AND 28

A. Ground 1: Claims 1, 4, 5, 6, 7, 9, 11, 14, 15, 16, 18, 19, 22–25, and 28 are obvious under 35 U.S.C. § 103 over Auld in view of MPEG-2, Part 1.

1. Summary of Auld (U.S. Patent No. 5,686,965)

27. As with the '798 Patent, Auld discloses a “synchronization scheme” that uses specific bit patterns to ensure it is synchronized and aligned. *See* Ex. 1004, 7:26–29. In Auld, this synchronization procedure is described as part of the process for decoding a bitstream—a video program which has been “converted into digital format, compressed and encoded in accordance with an established compression algorithm or methodology”—containing audio and video data. *Id.*, 1:38–43. As Auld explains, “[s]ynchronization generally involves finding a unique pattern of bits, often termed sync codes or start codes, in the multiplexed system bitstream, and aligning the bitstream data following the sync code.” *Id.*, 6:24–28.

28. “The various groupings of bits making up the bitstream are often referred to as variable length symbols. These variable length symbols typically represent specific signal information in accordance with the syntax of the encoding and decoding algorithm employed, such as the MPEG standard.” *Id.*, 6:28–33. In an embodiment of the invention, Auld discloses that “the multiplexed system bitstream is of a type conforming to the MPEG standard,” *id.*, 10:9–11—specifically, the MPEG “system stream” standard, *id.*, 10:16–20, which is set forth

in MPEG-2, Part 1. As Auld explains, the MPEG bitstream typically comprises a “sequence of one or more packets,” where the packets “may carry either audio or video data.” Auld, 10:29–33. “It should be noted that each packet ... may contain one or more synchronization codes, referred to in the art as sync code, which are necessary to properly synchronize and align the encoded bitstream.” *Id.*, 10:42–45.

2. Summary of MPEG-2, Part 1

29. MPEG-2, Part 1 is a standard specification promulgated by the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC). Ex. 1005, vii. It “addresses the combining of one or more elementary streams of video and audio, as well as other data, into single or multiple streams which are suitable for storage or transmission.” *Id.*, viii.

30. MPEG-2, Part 1 describes a “Program Stream” which “can be decoded with synchronization.” *Id.*, ix. The standard further includes a specification of the “Program Stream,” including its syntax and semantics. *Id.*, Section 2.5.3. Video and audio data compressed according to the specification of the “Program Stream” “are packetized to produce PES [packetized elementary stream] packets.” *Id.*, viii. The structure of these PES packets is set out in Table 2-17 of MPEG-2, Part 1:

Table 2-17 – PES packet		
Syntax	No. of bits	Mnemonic
<pre> PES_packet() { packet_start_code_prefix stream_id PES_packet_length if (stream_id != program_stream_map && stream_id != padding_stream && stream_id != private_stream_2 && stream_id != ECM && stream_id != EMM && stream_id != program_stream_directory && stream_id != DSMCC_stream && stream_id != ITU-T Rec. H.222.1 type E stream) { </pre>	24 8 16	bslbf uimsbf uimsbf

Id., Table 2-17 (excerpted). In the PES packet, a series of bits which comprise a “packet_start_code_prefix” are transmitted first, followed by a series of bits which comprise a “stream_id.” *Id.* “The stream_id specifies the type and number of the elementary stream” packet (i.e., the packet type)—e.g., audio or video bitstream packet. *Id.*, 29. Collectively, the “packet_start_code_prefix” and “stream_id” are referred to as the “start code.” *Id.*, 4 (“Start codes consist of a 24-bit prefix (0x000001) and an 8-bit stream_id.”).

31. Table 2-18 of the MPEG-2, Part 1 standard displays possible values for the “stream_id”:

stream_id	Note	Stream coding
1011 1100	1	program_stream_map
1011 1101	2	private_stream_1
1011 1110		padding_stream
1011 1111	3	private_stream_2
110x xxxx		ISO/IEC 13818-3 or ISO/IEC 11172-3 audio stream number x xxxx
1110 xxxx		ITU-T Rec. H.262 ISO/IEC 13818-2 or ISO/IEC 11172-2 video stream number xxxx
1111 0000	3	ECM_stream
1111 0001	3	EMM_stream
1111 0010	5	ITU-T Rec. H.222.0 ISO/IEC 13818-1 Annex B or ISO/IEC 13818-6 DSMCC_stream
1111 0011	2	ISO/IEC 13522_stream
1111 0100	6	ITU-T Rec. H.222.1 type A
1111 0101	6	ITU-T Rec. H.222.1 type B
1111 0110	6	ITU-T Rec. H.222.1 type C
1111 0111	6	ITU-T Rec. H.222.1 type D
1111 1000	6	ITU-T Rec. H.222.1 type E
1111 1001	7	ancillary_stream
1111 1010 ... 1111 1110		Reserved data stream
1111 1111	4	program_stream_directory

Id., Table 2-18 (excerpted). PES packets with a stream_id corresponding to the “110x xxxx” format convey audio data, and PES packets with a stream_id corresponding to the “1110 xxxx” format convey video data. *Id.*

3. Motivation to Combine Auld and MPEG-2, Part 1

32. A POSITA reviewing Auld at the time of the purported invention of the ’798 patent would understand that Auld on its face teaches its mutual operability with MPEG-2, Part 1. Auld discloses that its synchronization scheme may be used where the “multiplexed system bitstream is of a type conforming to the MPEG standard,” and specifically referencing the MPEG “ISO (International Standards Organization) system stream.” Ex. 1004, 10:9-20; *see also id.*, 6:29–33, 10:9–45, Figure 5, claims 1, 15. A POSITA would understand that MPEG-2, Part 1 is the ISO

standard for MPEG bitstreams. Thus, it is my opinion that Auld supplies an express teaching, suggestion, or motivation to use its synchronization scheme with the MPEG bitstreams set forth in MPEG-2, Part 1, including video and audio data compressed according to the specification of the “Program Stream” and packetized using PES packets. At a minimum, combining the teachings of Auld and MPEG-2, Part 1 in such a manner would constitute combining prior art elements according to known methods to yield predictable results, and with a reasonable expectation of success.

4. Claim 11

[11(pre)] A method for identifying packet types of packets of symbols, the method comprising:

33. To the extent the preamble is limiting, in my opinion, Auld discloses this element. Specifically, Auld discloses a “method for synchronizing a video decoder,” Ex. 1004, 1:12-14, in which *packet types of packets of symbols are identifi[ed]*.

34. As Auld explains, “[t]ypically, the video and audio signals comprising a video program are converted into a digital format, compressed and encoded in accordance with an established compression algorithm or methodology.” *Id.*, 1:35–38. This compressed format, which Auld also refers to as a “bitstream,” includes both audio and video data. *Id.*, 1:38–43. “The various groupings of bits making up the bitstream are often referred to as variable length symbols.” *Id.*, 6:28–29. “A

decoder is then typically employed to decompress and decode the received system signal in accordance with the same compression algorithm or methodology previously mentioned.” *Id.*, 1:43–46.

35. Auld discloses an approach for decompressing and decoding such a bitstream that was compressed and encoded, for example, “conforming to the MPEG standard.” *Id.*, 8:61–64, 10:9–11. Specifically, Auld describes an example wherein the bitstream conforms to the MPEG “system stream” standard. *Id.*, 10:16–20. This MPEG “system stream” refers specifically to ISO/IEC standard 13818-1, which was prepared by a joint technical committee of two leading internal standardization bodies, the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Ex. 1005, vii. Auld specifically references the “Program Stream” bitstream standard from MPEG-2, Part 1, the structure of which Auld sets forth at a high level in Figure 5. Ex. 1004, Figure 5. Section 2.5 sets forth the syntax and requirements for the MPEG “Program Stream” with greater specificity. Ex. 1005, Section 2.5.

36. In an MPEG bitstream, data is transmitted in a series of packets, *id.*, 10:20–24, which “typically contain[] either encoded audio or encoded video stream data,” *id.*, 10:29–31. Auld teaches “identify[ing] the type of packet analyzed”—i.e., audio or video—through information provided at the packet layer. *Id.*, 11:39–42

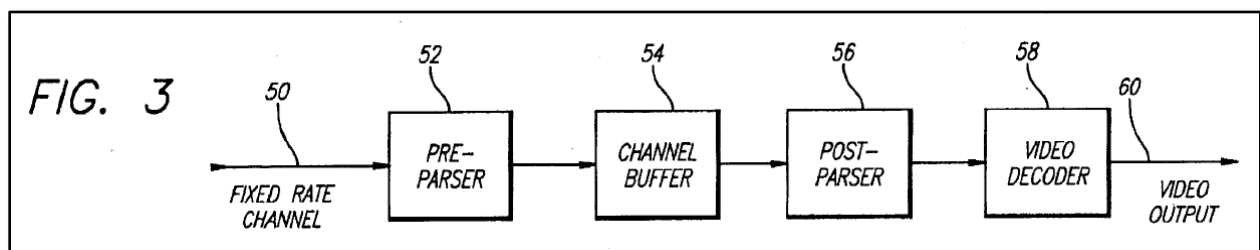
(“Essentially, the packet sync code, Stream ID, and packet length information at the packet layer are used to identify the type of packet being analyzed....”).

[11(a)] receiving a synchronization symbol¹ by a receiver indicating a packet type, each packet type having a different synchronization symbol;

37. In my opinion, Auld in view of MPEG-2, Part 1 discloses and/or renders obvious this element. Auld discloses *receiving* a synchronization code *by a receiver* and, in connection with MPEG-2, Part 1, teaches that this synchronization code comprises a *synchronization symbol ... indicating a packet type, each packet type having a different synchronization symbol*.

a) Auld discloses *receiving* a synchronization code *by a receiver*.

38. Auld describes utilizing a *receiver*, illustrated in Figure 3 below, which receives an “initial multiplexed bitstream” and provides “video output.” *Id.*, 8:61–64.



¹ For purposes of this declaration, I have been instructed by Petitioners to assume that this limitation allows for the claimed “synchronization symbol” to be provided within the packet.

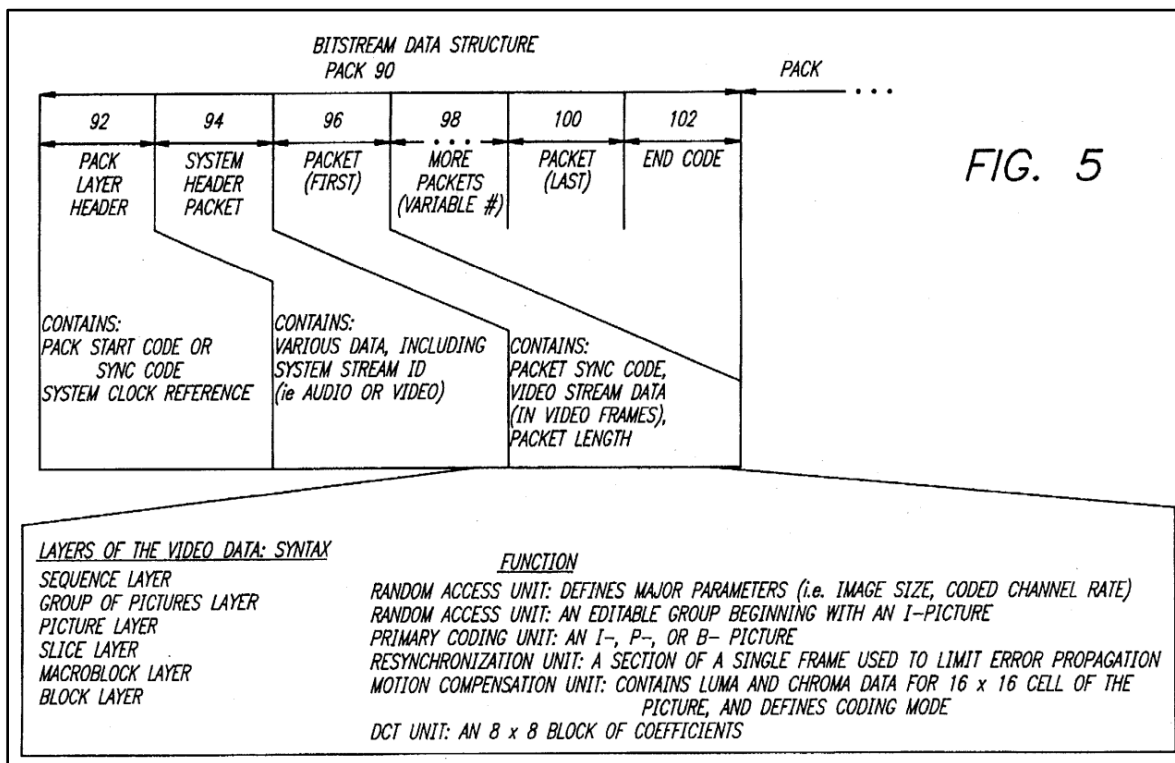
39. Auld further discloses that this receiver includes a pre-parser 52, and “[w]ithin the pre-parser 52, a system stream synchronizer 62, coupled to input channel 50, synchronizes to the multiplexed system bitstream.” *Id.*, 9:29–32. Auld’s synchronizer 62 “searches for a sync code, or start code,” in the bitstream. *Id.*, 10:49–50. “When the sync code is located, ... the bitstream is considered synchronized.” *Id.*, 10:67–11:01.

40. Auld teaches that “[s]ynchronization involves the alignment of data within a packet relative to the position of a sync word within the bitstream.” *Id.*, 11:12–14. A POSITA would understand that synchronization is necessary in order to properly interpret the bitstream. Information in such a bitstream is represented using “groupings of bits ... often referred to as variable length symbols.” *Id.*, 6:28–29. Thus, in before the symbols may be translated, it is necessary to “establish the alignment of the symbols.” *Id.*, 6:39–42. This synchronization process “involves finding a unique pattern of bits, often termed sync codes or start codes, in the multiplexed system bitstream, and aligning the bitstream data following the sync code.” Ex. 1004, 6:24–28.

- b) Auld in connection with MPEG-2, Part 1 teach that Auld’s synchronization code comprises a *synchronization symbol ... indicating a packet type, each packet type having a different synchronization symbol.*

41. The “sync codes” in Auld consist of sequences of symbols that are used for synchronization, and therefore qualify as *synchronization symbols*.

42. As discussed for element [11(pre)] above, Auld teaches that its approach may be used for decoding a bitstream conforming to the MPEG “system stream” standard of MPEG-2, Part 1. *See, e.g.*, 1004, 10:16–20. Auld illustrates the logical structure of such a bitstream (including the sync codes) in Figure 5:



Ex. 1004, Figure 5. Specifically, the bitstream of Auld comprises “a sequence of packets 96, 98, and 100,” where the packets “may carry either audio or video data.” *Id.*, 10:21–33. Each packet contains a “sync code,” *id.*, 10:42–45, as illustrated in Figure 5 for packet 96.

43. The MPEG-2, Part 1 standard provides further detail regarding the content of the “sync codes” that may be used in Auld, which Auld also refers to as

“start codes.” *See id.*, 6:29–33. The MPEG-2, Part 1 standard explains, “[t]he packet layer of the [MPEG] Program Stream is defined by the PES packet layer.” Ex. 1005, 55. A PES packet begins with a “start code” consisting of two symbols: a “packet_start_code_prefix” and a “stream_id.” *Id.*, 4 (“Start codes consist of a 24-bit prefix (0x000001) and an 8-bit stream_id.”). These are illustrated in Table 2-17:

Table 2-17 – PES packet		
Syntax	No. of bits	Mnemonic
PES_packet() {		
packet_start_code_prefix	24	bslbf
stream_id	8	uimsbf
PES_packet_length	16	uimsbf
if (stream_id != program_stream_map		
&& stream_id != padding_stream		
&& stream_id != private_stream_2		
&& stream_id != ECM		
&& stream_id != EMM		
&& stream_id != program_stream_directory		
&& stream_id != DSMCC_stream		
&& stream_id != TU-T_P_H.222_1_time_stream)		
}		

Id., Table 2-17. A person of ordinary skill would understand that Auld’s sync codes are the “start codes” discussed in the MPEG specification, as Auld uses the terms “sync code” and “start code” interchangeably. *See, e.g.*, Ex. 1004, 6:24–26 (“Synchronization generally involves finding a unique pattern of bits, often termed sync codes or start codes....”), 10:49–50 (“[T]he system synchronizer 62 searches for a sync code, or start code, comprising the packet layer 96....”).

44. Thus, a person of ordinary skill would understand MPEG 2, Part 1 to teach that these “packet_start_code_prefix” and “stream_id” symbols may be used to collectively form Auld’s “sync code.” These symbols qualify as *synchronization*

symbols under the '798 patent, as they are symbols used to form the sync code that Auld uses to “synchronize and align the encoded bitstream.” Ex. 1004, 10:42–45. *See generally* Ex. 1001, 17:2–64 (identifying “synchronization symbols” used to form “synchronization primitives”), 14:33–35 (explaining that these synchronization primitives “operate[s] as synchronization signals ... to help ensure correct alignment of symbols”).²

45. Further, the “stream_id” synchronization symbol constitutes a *synchronization symbol ... indicating a packet type*—e.g., a symbol indicating whether the associated packet is a type for audio or video data. As explained by the MPEG-2, Part 1 standard, “the stream_id specifies the type and number of the elementary stream.” *Id.*, 29. At least two different stream_id values are provided for video and audio packets, as shown in Table 2-18 of the MPEG-2, Part 1 standard:

² As I discuss in more detail below for element [11(d)], it is my opinion that Auld’s “sync codes” qualify as *synchronization primitives* under the '798 patent. The '798 patent identifies exemplary synchronization primitives consisting of pairs of 9-bit synchronization symbols. Ex. 1001, 16:52–17:64. Auld’s sync codes similarly consist of a sequence of synchronization symbols (i.e., the “packet_start_code_prefix” and “stream_id.”).

Table 2-18 – Stream_id assignments

stream_id	Note	stream coding
1011 1100	1	program_stream_map
1011 1101	2	private_stream_1
1011 1110		padding_stream
1011 1111	3	private_stream_2
110x xxxx		ISO/IEC 13818-3 or ISO/IEC 11172-3 or ISO/IEC 13818-7 or ISO/IEC 14496-3 audio stream number x xxxx
1110 xxxx		ITU-T Rec. H.262 ISO/IEC 13818-2 or ISO/IEC 11172-2 or ISO/IEC 14496-2 video stream number xxxx
1111 0000	3	ECM_stream
1111 0001	3	EMM_stream
1111 0010	5	ITU-T Rec. H.222.0 ISO/IEC 13818-1 Annex A or ISO/IEC 13818-6 DSMCC_stream
1111 0011	2	ISO/IEC_13522_stream
1111 0100	6	ITU-T Rec. H.222.1 type A
1111 0101	6	ITU-T Rec. H.222.1 type B
1111 0110	6	ITU-T Rec. H.222.1 type C
1111 0111	6	ITU-T Rec. H.222.1 type D
1111 1000	6	ITU-T Rec. H.222.1 type E
1111 1001	7	ancillary_stream
1111 1010		ISO/IEC14496-1_SL-packetized_stream
1111 1011		ISO/IEC14496-1_FlexMux_stream
1111 1100 ... 1111 1110		reserved data stream
1111 1111	4	program_stream_directory

Id., Table 2-18. For example, a stream_id of “110x xxxx” corresponds to an “audio stream,” and a stream_id of “1110 xxxx” corresponds to a “video stream.” Thus, the stream_id synchronization symbol *indicat[es] a packet type* (e.g., whether the associated packet contains audio or video data), with *each packet type having a different synchronization symbol*.

[11(b)] receiving a packet of symbols;

46. In my opinion, Auld discloses and/or renders obvious this element. As explained above for claim element [11(pre)], Auld discloses receiving a bitstream comprised of groupings of bits referred to as *symbols*. As further explained above with respect to claim element [11(pre)], Auld describes receiving

data from an MPEG bitstream, which comprises “a sequence of packets,” carrying audio or video data. Ex. 1004, 10:21–33, Fig. 5 (illustrating packets in MPEG bitstream). Thus, Auld discloses *receiving a packet of symbols*.

[11(c)] indicating that the received packet of symbols has the packet type of the received synchronization symbol; and

47. In my opinion, Auld in view of MPEG-2, Part 1 renders obvious this element. As explained above for claim element [11(a)], Auld discloses receiving a synchronization symbol (stream_id) indicating the packet type of the associated packet—e.g., whether the packet contains audio or video data. That is, the synchronization symbol specifies *that the received packet of symbols has the packet type of the received synchronization symbol*.

48. Further, Auld discloses that this synchronization symbol (stream_id) is used by a system stream pre-parser 63, which “separates the video signal component, commonly referred to as a video bitstream, from the multiplexed system bitstream.” Ex. 1004, 9:32–35, Fig. 4. “Any non-video information components, such as the audio portion of the system bitstream, are discarded by the system stream pre-parser.” *Id.*, 11:37–39. In order to accomplish this, Auld teaches that “the packet sync code, stream ID, and packet length information at the packet layer are used to identify the type of packet being analyzed, and to skip any non-video packets.” *Id.*, 11:39–42. Accordingly, a person of ordinary skill would understand that the synchronization symbol (stream_id) is used to *indicate*, for the

associated packet, *that the received packet of symbols has the packet type of the received synchronization symbol.*

[11(d)] the synchronization symbol permitting proper alignment upon receiving with a synchronization primitive to be correctly aligned on a symbol boundary.

49. In my opinion, Auld in view of MPEG-2, Part 1 renders obvious this element. *See* claim [11(a)]. As I explain above, Auld discloses that “[s]ynchronization generally involves finding a unique pattern of bits, often termed sync codes or start codes, in the multiplexed system bitstream, and aligning the bitstream data following the sync code.” Ex. 1004, 6:24–28. “[E]ach packet or layer may contain one or more” of these sync codes. *Id.*, 10:42–45. That is, a synchronizer “must establish the alignment of the symbols” before the symbols can be translated. *Id.*, 6:39–42.

50. In other words, Auld discloses that synchronization involves using a *synchronization symbol* to permit *properly aligning ... on a symbol boundary* so that the symbols may be properly parsed from the bitstream and interpreted. As Auld further explains:

Synchronization involves the alignment of data within a packet relative to the position of a sync word within the bitstream. . . . Alignment involves the recognition of word or byte boundaries within a system bitstream in accordance with the syntax of the selected compression algorithm. **The location of sync words distributed within the system bitstream delineates the boundaries between**

informational word groupings within the packet. These word groupings conform to the particular grammar and syntax rules dictated by the compression algorithm employed for data encoding. Once aligned, the organization of the data structure comprising a particular informational word grouping following a sync code is thus of an established format.

Ex. 1004, 11:12–26.

51. The synchronization process in Auld further constitutes alignment *with a synchronization primitive to be correctly aligned on a symbol boundary.* As explained for element [11(a)] above, Auld relies on “sync codes” to “synchronize and align the encoded bitstream.” Ex. 1004, 10:42–45. These sync codes which are (made up of the “packet_start_code_prefix” and “stream_id” symbols) qualify as *synchronization primitives* under the ’798 patent.

52. In the ’798 patent, synchronization primitives are sequences of symbols that “operate as synchronization signals ... to help ensure correct alignment of symbols.” Ex. 1001, 14:33–35. These primitives are transmitted periodically “so that the receiving communications node can properly align with that synchronization primitive.” *Id.*, 14:35–39. For example, the ’798 patent describes “primitives” comprising pairs of synchronization symbols, “where a symbol is assumed to have nine bits.” *Id.*, 15:23–25. Table 3 illustrates examples of synchronization primitives comprising pairs of nine-bit synchronization symbols:

TABLE 3		
	Falling Edge	Rising Edge
0	100000001 - 100111111	011000000 - 011111110
1	100000011 - 100011111	011100000 - 011111100
2	100000111 - 100001111	011110000 - 011111000
3	100001111 - 100000111	011111000 - 011110000
4	100011111 - 100000011	011111100 - 011100000
5	100111111 - 100000001	011111110 - 011000000

Ex. 1001, Table 3; *see also id.*, 17:60–64 (referring to “100000001” and “100111111” as “synchronization symbol[s]”). The “sync codes” in Auld similarly consist of sequences of symbols (the “packet_start_code_prefix” and “stream_id” symbols) that operate as synchronization signals, and therefore constitute *synchronization primitives*.

53. As the MPEG-2, Part 1 standard explains, “decoders must include a means to look for start codes . . . in order to begin decoding correctly, and to identify errors, erasures or insertions while decoding.” Ex. 1005, 8. Thus, Auld’s disclosure of alignment using a sync code (*synchronization primitive*) comprising the stream ID (*synchronization symbol*) constitutes a teaching of *the synchronization symbol permitting properly alignment upon receiving with a synchronization primitive to be correctly aligned on a symbol boundary*.

5. Claim 14

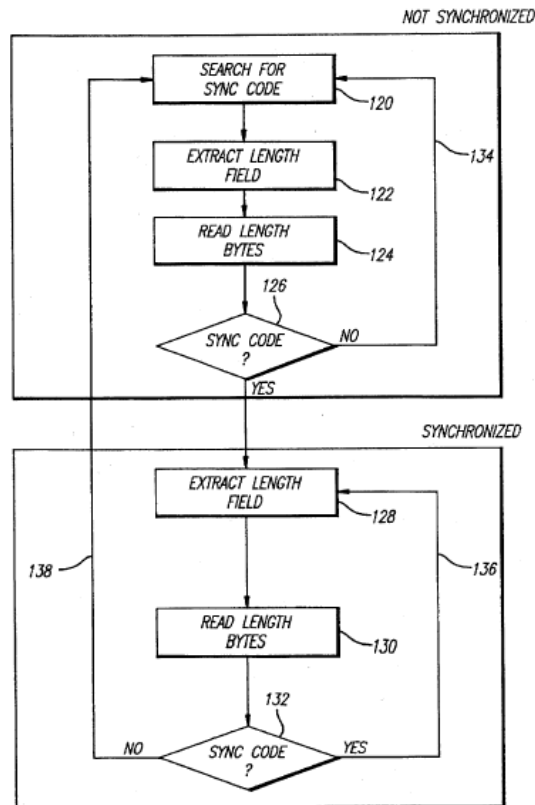
[14] The method of claim 11 wherein the synchronization symbol is received before the symbols of the packet³ are received.

54. In my opinion, Auld in view of MPEG-2, Part 1 discloses this claim and/or renders it obvious.

55. Auld discloses that “[s]ynchronization generally involves finding a unique pattern of bits, often termed **sync codes** or start codes, in the multiplexed system bitstream, and **aligning the bitstream data following the sync code.**” Ex. 1004, 6:24–28. Auld also discloses this process in detail in Fig. 6 (shown below), where a synchronization system first checks for a sync code and subsequently reads a packet. Ex. 1004, 10:46–65.

³ For purposes of this declaration, I have been instructed by Petitioners to assume that in this limitation “the symbols of the packet” corresponds to the packet payload.

FIG. 6



56. Therefore, a POSITA would have understood that the sync code—which comprises the stream_id that constitutes the *synchronization symbol*, as explained for claim 11—is transmitted first, and is used to align a subsequent bitstream, which includes the *symbols of the packet*.

57. Additionally, MPEG-2, Part 1 teaches that the *synchronization symbol* is transmitted before the *symbols of the packet*, as part of the packet “start code” which comprises the *synchronization symbol* (“stream_id”). See Ex. 2005, 4 (“Start codes consist of a 24-bit prefix (0x000001) and an 8-bit stream_id.”). As shown in

Table 2-17, the `packet_start_code_prefix` and `stream_id` appear at the beginning of the packet, before transmitting the packet's data (e.g., the “payload”).

Table 2-17 – PES packet		
Syntax	No. of bits	Mnemonic
<pre> PES_packet() { packet_start_code_prefix stream_id PES_packet_length if (stream_id != program_stream_map && stream_id != padding_stream && stream_id != private_stream_2 && stream_id != ECM && stream_id != EMM && stream_id != program_stream_directory && stream_id != DSMCC_stream && stream_id != ITU-T Rec. H.222.1 type E stream) { </pre>	24 8 16	bslbf uimbsf uimbsf

Id., Table 2-17 (excerpted). Similarly, Figure F.0.2 shows that the `stream_id` (*synchronization symbol*) is transmitted before the packet data bytes (i.e., the *symbols of the packet*).

F.0.2 PES packet

See Figure F.2.

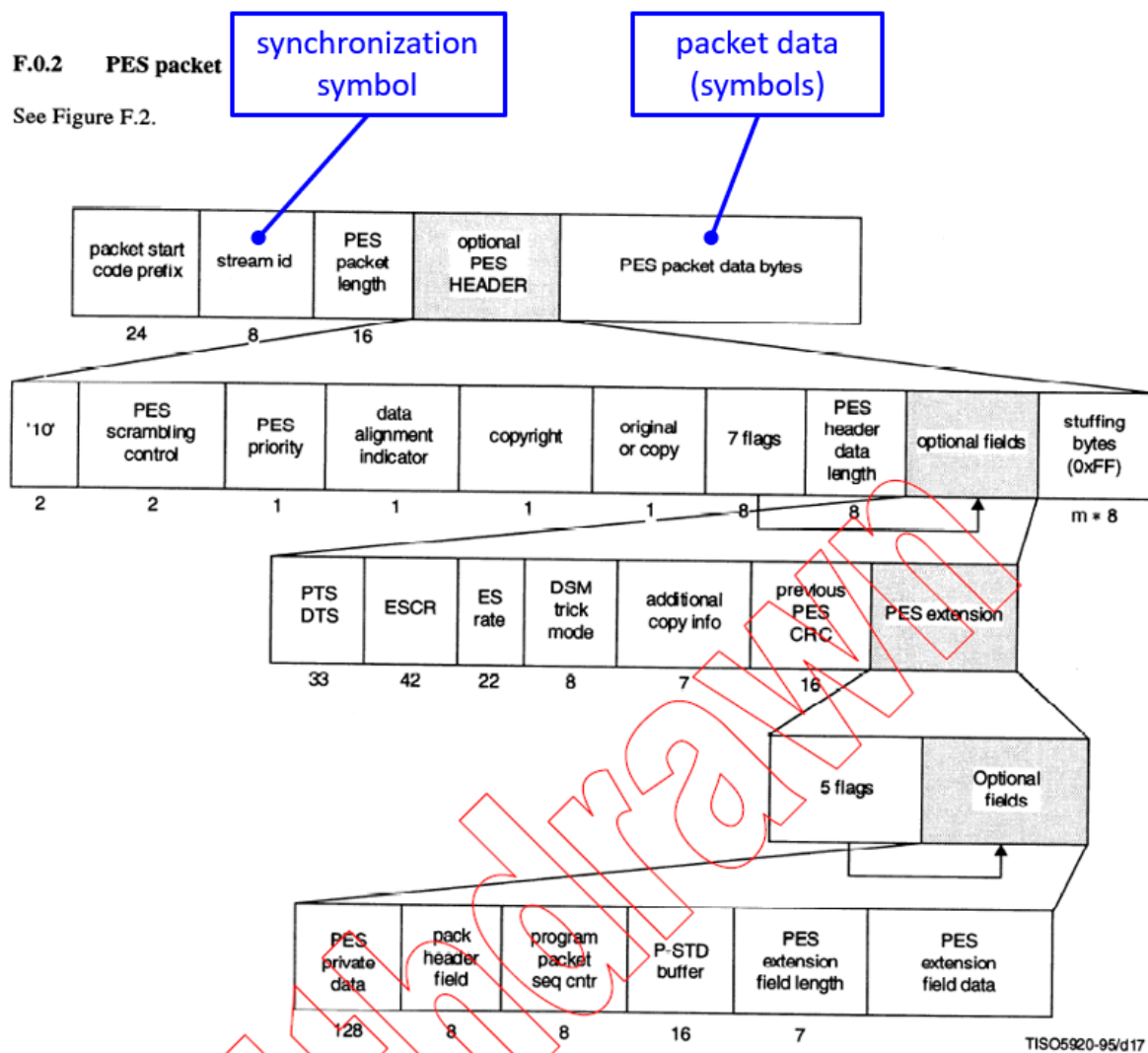


Figure F.2 – PES packet syntax diagram

Id., Figure F.0.2 (annotated).

6. Claim 15

[15] The method of claim 11 wherein the packet types include a data packet.

58. In my opinion, Auld in view of MPEG-2, Part 1 discloses this claim and/or renders it obvious.

59. Auld's bitstream includes video data packets ("data packet"). Ex. 1004, 5:23–26, 10:20–24.

7. Claim 16

[16] The method of claim 11 wherein the packet types include a control packet.

60. In my opinion, Auld in view of MPEG-2, Part 1 discloses this claim and/or renders it obvious.

61. As explained above with respect to claim element [11(a)], Auld discloses a decoding scheme involving synchronization and alignment of bitstream data that was encoding and compressed according to the MPEG-2, Part 1 standard. As further described above with respect to claim element [11(a)], the "stream_id" field identifies potential packet types that may correspond to each packet, including "audio stream" and "video stream" data:

stream_id	Note	Stream coding
1011 1100	1	program_stream_map
1011 1101	2	private_stream_1
1011 1110		padding_stream
1011 1111	3	private_stream_2
110x xxxx		ISO/IEC 13818-3 or ISO/IEC 11172-3 audio stream number xxxx
1110 xxxx		ITU-T Rec. H.262 ISO/IEC 13818-2 or ISO/IEC 11172-2 video stream number xxxx
1111 0000	3	ECM_stream
1111 0001	3	EMM_stream
1111 0010	5	ITU-T Rec. H.222.0 ISO/IEC 13818-1 Annex B or ISO/IEC 13818-6_DSMCC_stream
1111 0011	2	ISO/IEC_13522_stream
1111 0100	6	ITU-T Rec. H.222.1 type A
1111 0101	6	ITU-T Rec. H.222.1 type B
1111 0110	6	ITU-T Rec. H.222.1 type C
1111 0111	6	ITU-T Rec. H.222.1 type D
1111 1000	6	ITU-T Rec. H.222.1 type E
1111 1001	7	ancillary_stream
1111 1010 ... 1111 1110		Reserved data stream
1111 1111	4	program_stream_directory

The notation x means that the value '0' or '1' are both permitted and results in the same stream type. The stream number is given by the values taken by the x's.

NOTES

- 1 PES packets of type program_stream_map have unique syntax specified in 2.5.4.1.
- 2 PES packets of type private_stream_1 and ISO/IEC_13522_stream follow the same PES packet syntax as those for ITU-T Rec. H.262 | ISO/IEC 13818-2 video and ISO/IEC 13818-3 audio streams.
- 3 PES packets of type private_stream_2, ECM_stream and EMM_stream are similar to private_stream_1 except no syntax is specified after PES_packet_length field.
- 4 PES packets of type program_stream_directory have a unique syntax specified in 2.5.5.
- 5 PES packets of type DSM-CC_stream have a unique syntax specified in ISO/IEC 13818- 6.
- 6 This stream_id is associated with stream_type 0x09 in Table 2-29.
- 7 This stream_id is only used in PES packets, which carry data from a Program Stream or an ISO/IEC 11172-1 System Stream, in a Transport Stream (refer to 2.4.3.7).

Ex. 1005, Table 2-18.

62. The MPEG-2, Part 1 standard teaches sending *control packets* as well as data packets (i.e., audio and video data). A control packet, as opposed to a data packet, does not contain the data sought to be exchanged by the transmitter and receiver during the transaction, but rather control information such as to inform and manage how that transaction occurs. One such example of these control packets are program_stream_map packets (stream_id of “1011 1100”). *Id.* A program stream map packet, unlike an audio or video packet, does not include program data. As the MPEG-2, Part 1 standard explains, a “Program Stream Map

(PSM) provides a description of elementary streams in the Program Stream and their relationship to one another.” *Id.*, 55. That is, it provides instructions, or *control* information regarding how to read the different types of bitstream data. Therefore, Auld in view of MPEG-2, Part 1 renders obvious that the *packet types include a control packet*.

8. Claim 18

[18] The method of claim 11 wherein the synchronization primitive is made up of a sequence of bit-string synchronization symbols.

63. In my opinion, Auld in view of MPEG-2, Part 1 discloses this claim and/or renders it obvious.

64. As explained above for claim 11, Auld discloses a “sync code” that corresponds to the “start code” in MPEG-2, Part 1 and constitutes the claimed *synchronization primitive*. This synchronization primitive, in turn, is *made up of a sequence of bit string symbols* comprising the “packet_start_code_prefix” and “stream_id” symbols as set forth for example in Table 2-17 of MPEG-2, Part 1.

Table 2-17 – PES packet		
Syntax	No. of bits	Mnemonic
PES_packet() { packet_start_code_prefix stream_id PES_packet_length if (stream_id != program_stream_map && stream_id != padding_stream && stream_id != private_stream_2 && stream_id != ECM && stream_id != EMM && stream_id != program_stream_directory && stream_id != DSMCC_stream && stream_id != ITU-T Rec. H.222.1 type E stream) {	24 8 16	bslbf uimsbf uimsbf

Ex. 1005, Table 2-17 (excerpted); see also *id.*, 4 (“Start codes consist of a 24-bit

prefix (0x000001) and an 8-bit stream_id.”).

65. As a person of ordinary skill would recognize, the “packet_start_code_prefix” and “stream_id” comprise a *sequence of bit string symbols* as they are made up of symbols comprising strings of bits. For example, the “stream_id” is a string of 8 bits as shown in Table 2-17 above.

9. Claim 19

[19(pre)] A communications device for transmitting packet types of packets, comprising:

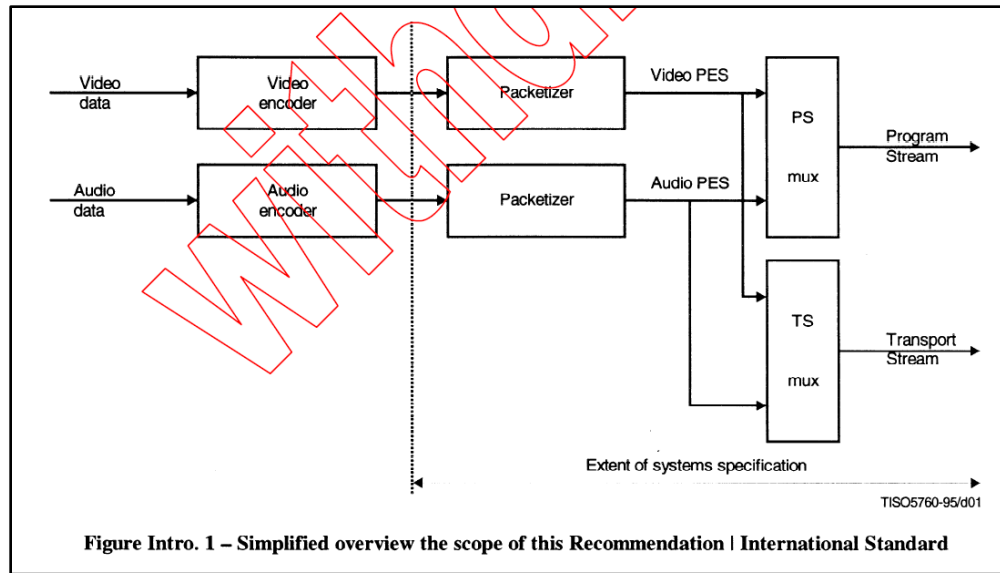
66. To the extent the preamble is limiting, in my opinion, Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious.

67. In my opinion, Auld discloses a *communications device for transmitting* comprising a “**transmitter** including an encoder for encoding data in accordance with an MPEG standard for producing and **transmitting a multiplexed bitstream.**” Ex. 1004, Claim 1.

68. Further, it is clear from Auld that its “novel video decoding architecture,” *id.*, 8:62–63, may be used to decode a bitstream that is transmitted from a communications device. In the “Background of the Invention,” for example, Auld explains that “[t]he compressed system signal or bitstream, ... may ... be transmitted over existing television channels, cable television channels, satellite communication channels, and the like,” where “[a] decoder is then typically employed to decompress and decode the received system signal in accordance with

the same compression algorithm or methodology previously mentioned.” *Id.*, 1:38–46; *see also id.*, 5:66–6:1 (explaining that the “multiplexed system bitstream may ... be stored in a digital storage media 24 or **transmitted** along an appropriate transmission channel 24”), Fig. 1. Thus, at a minimum it would have been obvious to use a *communications device for transmitting* in connection with Auld’s decoding architecture.

69. Additionally, as discussed above with respect to claim element [11(a)], Auld discloses a decoder which receives *packet types of packets* encoded according to the MPEG-2, Part 1 standard. It would be obvious to a person of ordinary skill in the art that in order to receive packet types of packets, the corresponding transmitter which compressed and encoded the bitstream data must transmit the packet types of packets. Moreover, the MPEG-2, Part 1 standard describes the requirements and specifications of a transmitter preparing a bitstream in accordance with said standard, as show in Figure Intro 1:



Ex. 1005, Figure Intro 1. As described above with respect to claim element [11(a)], the stream_id symbol included in the transmitted bitstream identifies the packet type of each packet. Thus, Auld in view of MPEG-2, Part 1 discloses and/or renders obvious *a communications device for transmitting packet types of packets*.

[19(a)] an identification component that identifies a packet type of a packet of symbols; and

70. In my opinion, Auld in view of MPEG-2, Part 1 discloses and/or renders obvious this element.⁴

71. As described above with respect to claim element [11(a)], Auld in view of MPEG-2, Part 1 discloses/renders obvious receiving a synchronization

⁴ For purposes of this declaration, I have been instructed by Petitioners to assume that this limitation is not a means-plus-function limitation and that it may encompass any form of component in regards to structure.

symbol (the stream_id) which indicates a packet type of a packet. Further, as described above with respect to claim [11(pre)], Auld discloses receiving packets which are comprised of symbols. The MPEG-2, Part 1 standard discloses a bitstream including a stream_id which identifies a packet type of a packet. *See* Ex. 1005, 29. It would be obvious to a person of ordinary skill in the art that in order to include the stream_id in the bitstream which identifies the packet type, that the transmitter must include an *identification component* that identifies the packet type of the packet.

[19(b)] a transmission component that transmits a synchronization symbol⁵ that corresponds to the identified packet type,

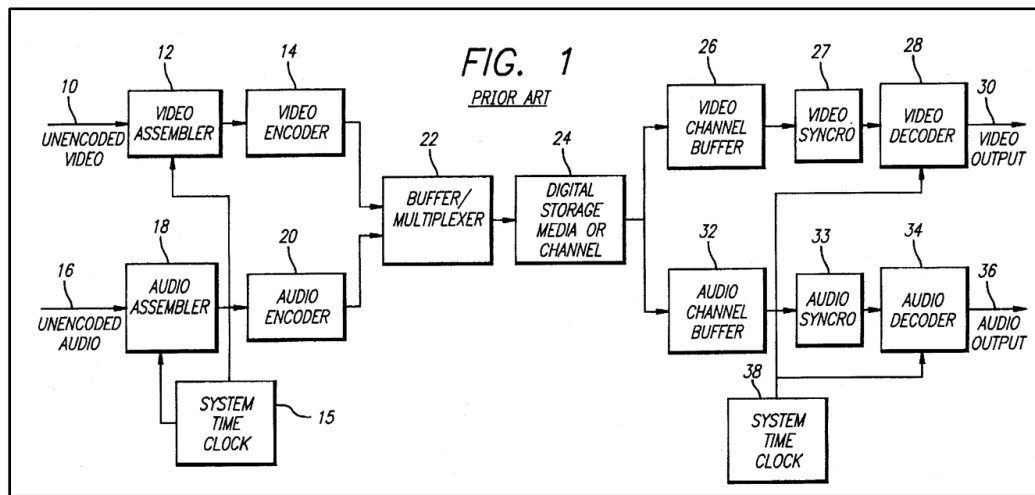
72. In my opinion, Auld in view of MPEG-2, Part 1 discloses and/or renders obvious this element.⁶

73. As described above with respect to claim element [19(pre)], Auld in view of MPEG-2, Part 1 discloses/renders obvious transmitting packet types of packets. Further, as described above with respect to claim elements [11(a)] and [19(a)], the it would be understood that the transmitter must *transmit[] a*

⁵ *See supra* note 1.

⁶ For purposes of this declaration, I have been instructed by Petitioners to assume that this limitation is not a means-plus-function limitation and that it may encompass any form of component in regards to structure.

synchronization symbol that indicates the packet type (i.e., *corresponds to the identified packet type*). A person of ordinary skill in the art would understand that in order to transmit a synchronization symbol that corresponds to the packet type, the transmitter must include a *transmission component* that transmits said synchronization symbol. Such a transmission component is disclosed in, for example, Figure 1 of Auld:



Ex. 1004, Figure 1. As Auld explains, after buffer/multiplexer 22 “produce[s] a multiplexed bitstream,” the bitstream “is transmitted along an appropriate transmission channel 24 for later reception, decoding, and display,” i.e., by a *transmission component*.

[19(c)] the transmitted synchronization symbol providing synchronization information and each packet type having a different synchronization symbol and

74. In my opinion, Auld in view of MPEG-2, Part 1 renders obvious this element.

75. As described above with respect to claim element [11(a)], Auld in view of MPEG-2, Part 1 discloses/renders obvious receiving a *synchronization symbol with each packet type having a different synchronization symbol*. As described above with respect to claim element [19(b)], it would have been obvious to a person of ordinary skill in the art that in order to receive a synchronization symbol, the transmitter must *transmit* that symbol.

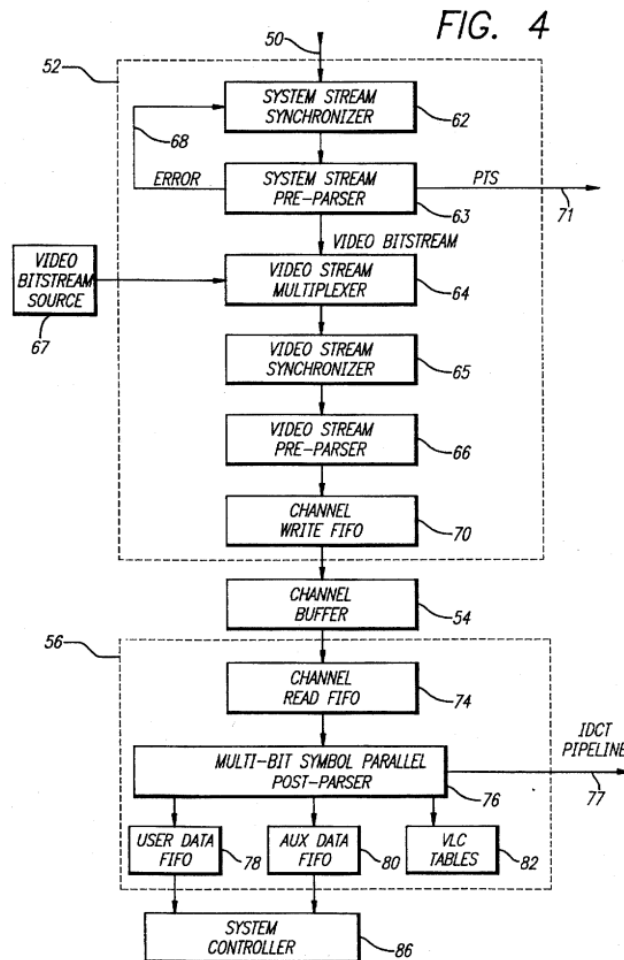
76. In my opinion, Auld in view of MPEG-2, Part 1 also discloses/renders obvious that the synchronization symbol (stream_id) provides *synchronization information*. As explained with respect to claim element [11(a)], the stream_id together with the packet_start_code_prefix collectively form the start code, or sync code. This sync code is used to provide *synchronization information* that allows the decoder to synchronize and align the bitstream data. *See* Ex. 1004, 6:24–28 (“Synchronization generally involves finding a unique pattern of bits, often termed sync codes or start codes, in the multiplexed system bitstream, and aligning the bitstream data following the sync code.”).

[19(d)] permitting an external receiving node to properly align with a synchronization primitive to be correctly aligned on a symbol boundary, and

77. In my opinion, Auld in view of MPEG-2, Part 1 discloses this claim and/or renders it obvious.

78. As further described above with respect to claim element [11(d)], Auld in view of MPEG-2, Part 1 discloses/renders obvious receiving a

“synchronization symbol [that permits] properly alignment [sic] upon receiving with a synchronization primitive to be correctly aligned on a symbol boundary.” Auld discloses that this synchronization and alignment process is performed by a pre-parser which receives the compressed and encoded bitstream (i.e., *external receiving node*). See Ex. 1004, 7:35–49. As shown in Figure 4 of Auld, “[t]he pre-parser 52 performs an initial channel synchronization to the multiplexed system bitstream received from the fixed rate channel 50,” *id.*, 9:7–9:



Id., Figure 4.

[19(e)] that transmits the symbols of the packet.

79. In my opinion, Auld in view of MPEG-2, Part 1 discloses this claim and/or renders it obvious.

80. As described above with respect to claim element [19(b)], Auld in view of MPEG-2, Part 1 discloses/renders obvious *transmitting symbols of a packet*.

10. Claim 22

[22] The communications device of claim 19 wherein the synchronization symbol is transmitted before transmitting the symbols of the packet.⁷

81. In my opinion, this claim is satisfied for the same reasons as explained above for claim [14].

11. Claim 23

[23] The communications device of claim 19 wherein the packet has a header with a field that indicates packet type and the identification component checks the field of the header that indicates packet type.

82. In my opinion, Auld in view of MPEG-2, Part 1 discloses this claim and/or renders it obvious.

83. As set forth in Table 2-17 of MPEG-2, Part 1, the “start code” (which Auld also describes as a “sync code”) comprising the packet_start_code_prefix and

⁷ See *supra* note 3.

stream_id (see Ex. 1005, 4) appears as fields at the beginning of the packet. That is, they appear as *fields* of the *header* of the packet.

Table 2-17 – PES packet		
Syntax	No. of bits	Mnemonic
<pre> PES_packet() { packet_start_code_prefix stream_id PES_packet_length if (stream_id != program_stream_map && stream_id != padding_stream && stream_id != private_stream_2 && stream_id != ECM && stream_id != EMM && stream_id != program_stream_directory && stream_id != DSMCC_stream && stream_id != ITU-T Rec. H.222.1 type E stream) { </pre>	24 8 16	bslbf uimsbf uimsbf

Id., Table 2-17 (excerpted). Indeed, MPEG-2, Part 1 explains that such “leading fields in a PES packet up to and not including the PES packet data byte fields” may be referred to as a “PES packet header” MPEG-2, Part 1, 4.

84. Accordingly, the packet *has a header with a field that indicates packet type*. That is, the packet has a header including a field (i.e., the stream ID) that indicates the type of the packet as discussed above for claims 11 and 19.

85. As discussed above with respect to claim element [19(a)], Auld in view of MPEG-2, Part 1 discloses/renderers obvious an “identification component that identifies a packet type of a packet of symbols.” It would be obvious to a person of ordinary skill in the art that in order for the identification component to identify the packet type of the packet of symbols, wherein—as described above—the packet type is identified by the stream_id field included in the PES packet

header—the identification component must *check the field of the header that indicates the packet type*.

12. Claim 24

[24] The communications device of claim 19 wherein the packet types include a data packet.

86. In my opinion, this claim is satisfied for the same reasons as explained above for claim [15].

13. Claim 25

[25] The communications device of claim 19 wherein the packet types include a control packet.

87. In my opinion, this claim is satisfied for the same reasons as explained above for claim [16].

14. Claim 28

[28] The communications device of claim 19 wherein the synchronization primitive is made up of a sequence of bit-string synchronization symbols.

88. In my opinion, this claim is satisfied for the same reasons as explained above for claim [18].

15. Claim 1

89. Claim 1 is a method claim that closely tracks claim 19 and in my opinion is satisfied for similar reasons as explained below.

[1(pre)] A method for transmitting packet types of packets, the method comprising:

90. To the extent the preamble is limiting, in my opinion, Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious for the same reasons as discussed above for element [19(pre)].

91. For example, Auld discloses a *method for transmitting* utilizing a “**transmitter** including an encoder for encoding data in accordance with an MPEG standard for producing and **transmitting a multiplexed bitstream.**” Ex. 1004, Claim 1. Additionally, Auld discloses a decoder which receives *packet types of packets* encoded according to the MPEG-2, Part 1 standard. It would be obvious to a person of ordinary skill in the art that in order to receive packet types of packets, the corresponding transmitter which compressed and encoded the bitstream data must transmit the packet types of packets. Thus, Auld in view of MPEG-2, Part 1 discloses and/or renders obvious a *method for transmitting packet types of packets. [1(a)] receiving a packet having symbols;*

92. In my opinion, Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious.

93. As explained above for element [19(a)] it would have been obvious that Auld’s transmitter must include an identification component for identifying the packet type of a packet comprised of symbols. In order to be able to perform such identification, a POSITA would appreciate that the identification component would need to *receiv[e] a packet having symbols.*

[1(b)] identifying a packet type of the packet;

94. In my opinion, Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious for the same reasons as explained above for element [19(a)]. As explained for that element, it would have been obvious that Auld's transmitter must include an identification component for *identifying a packet type of the packet*.

[1(c)] transmitting a synchronization symbol⁸ that corresponds to the identified packet type,

95. In my opinion, Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious for the same reasons as explained above for element [19(b)]—namely, that it would be understood that the transmitter must *transmit[] a synchronization symbol* that indicates the packet type (i.e., *corresponds to the identified packet type*).

[1(d)] wherein the transmitted synchronization symbol provides synchronization information and wherein each packet type has a different synchronization symbol, and

96. In my opinion, Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious for the same reasons as explained above for element [19(c)].

⁸ See *supra* note 1.

[1(e)] the synchronization symbol permitting an external receiving node to properly align with a synchronization primitive to be correctly aligned on a symbol boundary; and

97. Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious for the same reasons as explained above for element [19(d)].

[1(f)] transmitting the symbols of the received packet.

98. In my opinion, Auld in view of MPEG-2, Part 1 discloses this element and/or renders it obvious for the same reasons as explained above for element [19(e)].

16. Claim 4

[4] The method of claim 1 wherein the synchronization symbol is transmitted before transmitting the symbols of the packet.⁹

99. In my opinion, this claim is satisfied for the same reasons as explained above for claims [14] and [22].

17. Claim 5

[5] The method of claim 1 wherein the packet has a header with a field that indicates packet type and the identifying of the packet type includes checking the field of the header that indicates packet type.

100. In my opinion, this claim is satisfied for the same reasons as explained above for claim [23].

⁹ See *supra* note 3.

18. Claim 6

[6] The method of claim 1 wherein the packet types include a data packet.

101. In my opinion, this claim is satisfied for the same reasons as explained above for claims [15] and [24].

19. Claim 7

[7] The method of claim 1 wherein the packet types include a control packet.

102. In my opinion, this claim is satisfied for the same reasons as explained above for claims [16] and [25].

20. Claim 9

[9] The method of claim 1 wherein the synchronization primitive is made up of a sequence of bit-string synchronization symbols.

103. In my opinion, this claim is satisfied for the same reasons as explained above for claim [28].

B. Ground 2: Claims 2, 3, 12, 13, 20, and 21 are obvious under 35 U.S.C. § 103 over Auld in view of MPEG-2, Part 1 and Shin.

1. Claim 12

[12] The method of claim 11 wherein the symbols of the packets¹⁰ include in-band symbols and the synchronization symbols are out-of-band symbols.

104. In my opinion, Auld, MPEG-2, Part 1 and Shin render obvious this claim.

¹⁰ See *supra* note 3.

105. As described above with respect to claim element [19(a)], Auld discloses the use of sync codes or start codes in order to synchronize and align bitstream data, and MPEG-2, Part 1 provides further information about the syntax and composition of such bitstreams and such codes. Although Auld does not directly disclose that *the symbols of the packet include in-band symbols and the synchronization symbols are out-of-band symbols*, a POSITA would understand that this approach is expressly taught in the Shin reference.

106. According to the '798 patent, “[a] packet . . . typically comprises **in-band symbols with certain desirable characteristics, such as with its number of bit transitions optimized.**” Ex. 1001, 11:39–42. The '798 packet also describes an “out-of-band symbol” as “**a symbol that does not normally appear within a packet because it may not have the same desirable characteristic as an in-band symbol (e.g., bit transitions not optimized).**” *Id.*, 11:46–50. The '798 patent continues to describe the embodiment where an out-of-band symbol contains “**three or less transitions**” and an in-band symbol contains “**four or more transitions**”—wherein a transition is a bit value of 1 followed by a bit value of 0, or vice versa. *Id.*, 23:66–24:3.

107. Shin is an earlier patent sharing two of the same inventors of the '798 patent and also discloses a high-speed video data transmission system that uses “in-band characters” and “out-of-band characters” to optimize transmissions. A

POSITA would recognize that Shin discloses the same transition-controlled encoding scheme as the '798 patent, wherein out-of-band characters may serve as synchronization or control characters, so that they can be readily distinguished from in-band characters in the data stream:

In accordance with another aspect of the invention, various **synchronization and other special characters are defined using the high-transition and low-transition sets of out-of-band characters.** Each character corresponding to one of these “out-of-band” characters associated with the high-transition set includes less than four logical transitions, and each of the out-of-band characters associated with the low-transition set of code characters includes more than four logical transitions. **The difference in the number of transitions between in-band and out-of-band characters allows selected out-of-band characters to serve as control characters, and to be readily distinguished from in-band characters within the transmitted data stream.**

Ex. 1006, 9:63–10:8; *see also id.*, 14:46–49, 17:16–18. Shin also discloses a “high transition mode”—just like the '798 patent—in which in-band codes (or *symbols*) comprise “four or more logical transitions” and out-of-band codes comprise “less than four logical transitions.” Ex. 1006, 9:13–16, 9:66–10:2.

108. A POSITA would have been motivated to combine the teachings of Shin with those of Auld and MPEG-2, Part 1. Auld discloses sync codes, or “start codes,” that enable efficient transmission and reception of video data packets, *see*

Ex. 1004, 11:39–41, and MPEG-2, Part 1 provides further details on such codes, *see* Ex. 1005, 4, 31. A POSITA would recognize Shin as analogous art to Auld and MPEG-2, Part 1 because it is directed to high speed video signal transmission and also discloses using sync codes to properly align bitstreams and increase transmission efficiency between devices. Ex. 1006, 1:11–6, 2:60–65, 17:16–18; Ex. 1004, 10:43–45, 10:56–58.

109. A POSITA starting with the Auld video communication and synchronization system and the further details in MPEG-2, Part 1 would have looked to Shin because Shin discloses a high-speed video data transmission system that uses particular characters to optimize transmissions. *See* Ex. 1006, 9:63–10:8, 14:46–49, 17:16–18. Shin explains how the use of out-of-band synchronization or control characters allows for them to be readily distinguished from in-band characters within the transmitted data stream. *Id.*, 9:63–10:8, 14:46–49. In my opinion, this furthers the objectives of Auld and MPEG-2, Part 1, which entail using particular sync codes or start codes so that the codes can be readily distinguished from the rest of the bitstream and therefore used for purposes of synchronizing to the bitstream.

110. A POSITA would have also appreciated that Shin’s teachings can be readily incorporated into the approach of Auld and MPEG-2, Part 1, by using in-band codes (or *symbols*) with four or more logical transitions for the packet data,

while retaining the same sync code (or start code) as taught in Auld and MPEG-2, Part 1.

111. MPEG-2, Part 1 permits the use of packet data that is not “coded according to a standard specified by ITU-T | ISO/IEC.” Ex. 1005, 111. This is known as using “private data.” *Id.* MPEG-2, Part 1 discloses the use of such private data for the *data* of the packet while still using the “first three fields” of the PES header (i.e., including the start code). A POSITA would thus recognize that Shin’s “high transition mode” data encoding scheme may be combined with Auld and MPEG-2, Part 1 through use of these private data stream options disclosed by MPEG-2, Part 1. Therefore, in my opinion, the *symbols of the packet* would *include in-band symbols* (private data field symbols with four or more transitions, as disclosed by Shin).

112. In my opinion, a POSITA would have also recognized that the *synchronization symbols* in this system (the *stream_id* of the sync code) would constitute *out-of-band symbols*. As I explained above with respect to claim element [11(a)], the “*stream_id*” field corresponds to potential types of packets. Table 2-18 Note 3 (depicted below) indicates that packets of type *private_stream_2*, *ECM_stream*, and *EMM_stream* each may be chosen to convey private data for audio and video while still following the syntax for the PES header start code (“syntax . . . specified [before] *PES_packet_length* field”).

stream_id	Note	Stream coding
1011 1100	1	program_stream_map
1011 1101	2	private_stream_1
1011 1110		padding_stream
1011 1111	3	private_stream_2
110x xxxx		ISO/IEC 13818-3 or ISO/IEC 11172-3 audio stream number xxxxx
1110 xxxx		ITU-T Rec. H.262 ISO/IEC 13818-2 or ISO/IEC 11172-2 video stream number xxxxx
1111 0000	3	ECM_stream
1111 0001	3	EMM_stream
1111 0010	5	ITU-T Rec. H.222.0 ISO/IEC 13818-1 Annex B or ISO/IEC 13818-6_DSMCC_stream
1111 0011	2	ISO/IEC_13522_stream
1111 0100	6	ITU-T Rec. H.222.1 type A
1111 0101	6	ITU-T Rec. H.222.1 type B
1111 0110	6	ITU-T Rec. H.222.1 type C
1111 0111	6	ITU-T Rec. H.222.1 type D
1111 1000	6	ITU-T Rec. H.222.1 type E
1111 1001	7	ancillary_stream
1111 1010... 1111 1110		Reserved data stream
1111 1111	4	program_stream_directory

The notation x means that the value '0' or '1' are both permitted and results in the same stream type. The stream number is given by the values taken by the x's.

NOTES

- 1 PES packets of type program_stream_map have unique syntax specified in 2.5.4.1.
- 2 PES packets of type private_stream_1 and ISO/IEC_13522_stream follow the same PES packet syntax as those for ITU-T Rec. H.262 | ISO/IEC 13818-2 video and ISO/IEC 13818-3 audio streams.
- 3 PES packets of type private_stream_2, ECM_stream and EMM_stream are similar to private_stream_1 except no syntax is specified after PES_packet_length field.
- 4 PES packets of type program_stream_directory have a unique syntax specified in 2.5.5.
- 5 PES packets of type DSM-CC_stream have a unique syntax specified in ISO/IEC 13818- 6.
- 6 This stream_id is associated with stream_type 0x09 in Table 2-29.
- 7 This stream_id is only used in PES packets, which carry data from a Program Stream or an ISO/IEC 11172-1 System Stream, in a Transport Stream (refer to 2.4.3.7).

Ex. 1005, Table 2-18; *see also id.*, Table 2-17. Each potential stream_id corresponding to Note 3 includes less than four transitions: 1011 1111 (private_stream_2, 2 transitions); 1111 0000 (ECM_stream, 1 transition); and 1111 0001 (EMM_stream, 2 transitions). *Id.*, Table 2-18. That is, these *synchronization symbols are out-of-band symbols* under the '798 patent.

113. Accordingly, it is my opinion that the combination of Auld, MPEG-2, Part 1, and Shin renders obvious *wherein the symbols of the packet include in-band symbols and the synchronization symbols are out-of-band symbol*.

2. Claim 13

[13] The method of claim 12 wherein the in-band symbols are transition optimized and the out-of-band synchronization symbols are not transition optimized.

114. In my opinion, Auld, MPEG-2, Part 1 and Shin render obvious this claim.

115. For the same reasons described above with respect to claim 12, Auld, MPEG-2, Part 1, and Shin render obvious “wherein the in-band symbols have has three or fewer transitions and the out-of-band synchronization symbols have four or more transitions.”

116. As the '798 patent explains, “[t]ransition control may be optimized to either maximize or minimize the number of transitions in symbols that are to be transmitted.” Ex. 1001, 23:10–12. Further, the patent explains that the described coding technique uses the optimization approach of “maximiz[ing] the number of transitions in symbols to be transmitted.” *Id.*, 23:21–23. This optimization method corresponds to the '798 patent’s teaching—as described above with respect to claim 12—that in-band symbols have “at least four transitions” and out-of-band symbols have “three or less transitions.” *See id.*, 23:66–24:3; *see also* Ex. 1006, 9:13–16, 9:66–10:2 (describing “high-transition mode” transition encoding, i.e., *transition optimiz[ation]* using a maximizing scheme). Thus, for the same reasons described above with respect to claim 12, the combination of Auld, MPEG-2, Part

1, and Shin render obvious *wherein the in-band symbols are transition optimized and the out-of-band synchronization symbols are not transition optimized.*

3. Claim 20

[20] The communications device of claim 19 wherein the symbols of the packet¹¹ include in-band symbols and the synchronization symbols are out-of-band symbols.

117. In my opinion, this claim is satisfied for the same reasons as explained above for claim [12].

4. Claim 21

[21] The communications device of claim 20 wherein the in-band symbols are transition optimized and the out-of-band synchronization symbols are not transition optimized.

118. In my opinion, this claim is satisfied for the same reasons as explained above for claim [13].

5. Claim 2

[2] The method of claim 1 wherein the symbols of the packet¹² include in-band symbols and the synchronization symbols are out-of-band symbols.

119. In my opinion, this claim is satisfied for the same reasons as explained above for claim [20].

¹¹ See *supra* note 3.

¹² See *supra* note 3.

6. Claim 3

[3] The method of claim 2 wherein the in-band symbols are transition optimized and the out-of-band synchronization symbols are not transition optimized.

120. In my opinion, this claim is satisfied for the same reasons as explained above for claim [21].

C. Ground 3: Claims 8, 17, and 26 are obvious under 35 U.S.C. § 103 over Auld in view of MPEG-2 Part 1 and Hiroshima

1. Claim 17

[17] The method of claim 11 wherein the symbols are received from a switch.

121. In my opinion, Auld, MPEG-2, Part 1, and Hiroshima render obvious this claim.

122. The Auld system discloses video transmission between interconnected components (Ex. 1004, 1:31–47, 14:53–55) but does not expressly disclose a network type for the interconnected components.

123. Hiroshima discloses a video-on-demand system that includes an asynchronous transfer mode (ATM) network. Ex. 1007 (Hiroshima), 5:44–48. Hiroshima further discloses that the ATM network “operates in an asynchronous transfer mode [] in which a transmission rate is equal to 156Mbps.” *Id.*, 5:44–46. In my opinion, a POSITA would have understood that Auld’s components may be readily connected through a well-known network such as Hiroshima’s ATM network, which allows data transfer at high speeds. Implementing the prior art

teachings in this manner would entail having *the symbols ... transmitted over a switch network* (i.e., Hiroshima's ATM network).

124. In my opinion, a POSITA would have been motivated to combine the teachings of Hiroshima with those of Auld and MPEG-2, Part 1. Hiroshima, which is directed to an “apparatus for converting moving picture stream[s],” in which MPEG data is converted for transmission on a transport stream (Ex. 1007, 2:10–25), is analogous art to Auld and MPEG-2, Part 1, which discloses pertain to video encoding/decoding for storage and transmission (Ex. 1004, 3:5–20). Hiroshima discloses that a multiplexer “divides the video and audio packetized elementary streams into transport packets each having a fixed length (188 bytes) and, thereafter, multiplexes the transport packets, thereby converting to a transport stream.” *Id.*, 2:25–30. Hiroshima further discloses a straightforward networked approach that a POSITA would have recognized as providing a natural and ready way to implement the data transmission taught in Auld.

2. Claim 26

[26] The communications device of claim 19 wherein the symbols are transmitted to a switch network.

125. In my opinion, this claim is satisfied for the same reasons as explained above for claim [17].

3. Claim 8

[8] The method of claim 1 wherein the symbols are transmitted to a switch network.

126. In my opinion, this claim is satisfied for the same reasons as explained above for claims [17] and [26].

VIII. CONCLUSION

127. For the reasons discussed above, in my opinion the foregoing claims of the '798 patent would have been obvious to a POSITA.

* * *

128. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on October 2, 2024



Paul S. Min

APPENDIX A

Paul S. Min, Ph.D.
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Education

<u>Year</u>	<u>College or University</u>	<u>Degree</u>
1987	The University of Michigan	Ph.D. in Electrical Engineering
1984	The University of Michigan	M.S. in Electrical Engineering
1982	The University of Michigan	B.S. in Electrical Engineering

Professional Experience

From: 1990
To: Present
Organization: Washington University, St. Louis

Summary:

2015 - Senior Professor - Department of Electrical Systems Engineering

2011 – 2014 Chair – Undergraduate Curriculum, Department of Electrical and Systems Engineering

2000 – 2002 Chair – Graduate Curriculum, Department of Electrical and Systems Engineering

2002 - 2014 Associate Professor - Department of Electrical and Systems Engineering

1997 - 2008 On leave from full-time duty at Washington University – as Presidents of MinMax Technologies and Erlang Technology.)

1996 - 2002 Associate Professor - Department of Electrical Engineering

1996 Promoted with Tenure

1990 - 1996 Assistant Professor - Department of Electrical Engineering

- Teaching Experience
- “Transmission System and Multiplexing,” Washington University, ESE 571
 - “Electrical Laboratory I,” Washington University, EE 250.
 - “Communication Theory,” Washington University, ESE 471.
 - “Reliability and Quality Control,” Washington University, ESE 405/505
 - “Signaling and Control of Communications Networks,” Washington University, ESE 572.
 - “Introduction to Electronic Circuits,” Washington University, ESE232
 - “Queueing Systems and Discrete Stochastic Processes,” Washington University, EE 536 / CS 567.
 - “Digital Computer,” Washington University, EE 260M / CS 260.
 - “Data Networks,” Washington University, EE 530.
 - “Electrical Circuit Analysis,” Washington University, ESE 230.
 - “Computer/Communications System Analysis I,” Washington University, EE 557/ CS 557.
 - “Computer/Communications System Analysis II,” Washington University, EE558 / CS 558.
 - “Digital Systems Laboratory,” Washington University, EE 455 / CS 455.

From: 1999
To: 2008
Organization: Erlang Technology, Inc., St. Louis, Missouri
Title: Founder and President
Summary: Up to 70 employees, \$40M in total capital raised from 5 VCs and 3 Corporations
Received “Product of Year” Award from Analog Zone Magazine in 2004

From: 1997
To: 1999
Organization: MinMax Technologies, Inc., St. Louis, Missouri
Title: Founder and President
Summary: Fabless semiconductor company, designing high performance switching ASICs

From: September 1987
To: August 1990
Organization: Bellcore, New Jersey
Title: Member of Technical Staff
Summary: Member of New Network Architecture Development Group

From: 1983
To: 1987

Organization: Department of Electrical Engineering, The University of Michigan
Title: Graduate Instructor
Summary: Instructor for senior level Electrical Engineering Laboratory Class. Received a Best "Best Graduate Instructor Award" from the Department of Electrical Engineering

Professional Affiliations, Achievements & Awards

- Technical Program Committee, COMCAS 2021, Tel Aviv, November 2021.
- Technical Program Committee, COMCAS 2019, Tel Aviv, November 2019.
- Technical Program Committee, COMCAS 2017, Tel Aviv, November 2017.
- Technical Program Committee, COMCAS 2015, Tel Aviv, October 2015.
- Past-Chair, Saint Louis Section of the Institute of Electrical and Electronics Engineers (IEEE), 2015.
- Member of Executive Committee, Saint Louis Section of the IEEE, 2010-2015.
- Chair, Saint Louis Section of the IEEE, 2014.
- Technical Program Committee, COMCAS 2013, Tel Aviv, October 2013.
- Vice Chair, Saint Louis Section of the IEEE, 2013
- Treasurer, Saint Louis Section of the IEEE, 2012.
- The Best Paper Award at MOBILITY 2011, October 2011, Barcelona, Spain.
- Counselor, Student Chapter of the Year, the Institute of Electrical and Electronics Engineers, 2011.
- Award of Appreciation, Saint Louis Section of the Institute of Electrical and Electronics Engineers, 2011, for contribution to various activities of the Saint Louis Section the Institute of Electrical and Electronics Engineers.
- Secretary, Saint Louis Section of the IEEE, 2010.
- Counselor, Student Chapter of the Year, the Institute of Electrical and Electronics Engineers, 2010.
- Wall Street Journal Businessmen of Year, 2003.
- American Men and Women of Science, listed in 1997.
- Member, Eta Kappa Nu (Honor Society for Electrical Engineers), inducted in 1992
- Outstanding Achievement Award, Bellcore, 1990.
- 18th ISATA Award of Technical Excellence, the best paper award at ISATA 1988.
- Rockwell Fellow, Rockwell International, 1985, 1986.
- Outstanding Graduate Student Award, the University of Michigan, 1985.
- Outstanding Teaching Award, the University of Michigan, 1984, 1986.
- Member of Honor's College, the University of Michigan, 1979, 1980.

- Honor's Convocation, the University of Michigan, 1979.
- Outstanding Freshman Award, the University of Michigan, 1979.
- Woodhaven Rotary Club Scholarship, Woodhaven Rotary Club, 1978.
- Second Place Winner, the State of Michigan Mathematics Prize Competition, 1977.
- International Program Committee, *IASTED International Conference on Communications, Internet and Information Technology (CIIT 2005)*, Cambridge, Massachusetts from October 31-November 2, 2005.
- International Program Committee, *IASTED International Conference on Communications 2003*, Scottsdale, Arizona, 2003.
- International Program Committee, *Wireless and Optical Communications 2003*, Banff, Canada, 2003.
- International Program Committee, Session Chair, *Wireless and Optical Communications 2002*, Banff, Canada, 2002.
- Invited participant, *NSF Workshop on Enhancing International Cooperation in CS/CE Research and Education*, Portland, 1997.
- Session Chair, *the 1993 Conference on Information Sciences and Systems*, Baltimore, March 1997.
- Member, Board of Editors, *Journal of Network and Systems Management*, 1996-1998.
- Program Committee, *International Symposium on Integrated Network Management*, San Diego, 1997.
- Guest Editor, *Journal of Network and Systems Management, Special Issue on Routing in Broadband Networks*, December 1995 and June 1996.
- Invited participant, *ARPA Workshop on Survivability of Large Scale Systems*, Washington D.C., 1996.
- Special Event Organizer, *International Symposium on Integrated Network Management*, Santa Barbara, 1995.
- Organizing Committee, *International Symposium on Integrated Network Management*, Santa Barbara, 1995.
- Local Arrangements Chair, *IEEE Information Theory Workshop on Information Theory Multiple Access and Queueing*, St. Louis, 1995.
- Chair, *Communications Chapter, St. Louis Section of the IEEE*, 1995.
- Participant, *IEEE Information Theory Workshop on Information Theory, Multiple Access and Queueing*, St. Louis, 1995.
- Participant, *ARPA/AFOSR Non-Linear Optics and Communication Workshop*, Denver, 1994.
- Participant, *CNRI Giga Bit Network Workshop*, Washington D.C., 1993.
- Participant, *IFIP/IEEE International Workshop on Distributed Systems*, New Jersey, 1993.
- Program Committee, *International Conference on Computer Communications and Networks*, San Diego, 1992.
- Session Chair, *ISMM International Conference*, New Orleans, 1990.
- Senior Member, *IEEE*.

- Member, *IEEE Committee on Network Operations and Management*.
- Member, *IEEE Committee on Computer Communications*.
- Registered Specialist, *Hong Kong Research Grant Council*.
- Reviewer, *IEEE Transactions on Communications*.
- Reviewer, *IEEE Transactions on Networking*.
- Reviewer, *IEEE Journal on Selected Areas in Communications*.
- Reviewer, *Journal of Network and Systems Management*.
- Reviewer, *Telecommunication Systems*.
- Reviewer, *Computers and Electrical Engineering*.
- Reviewer, *ETRI Journal*.
- Reviewer, *IEEE Transactions on Automatic Control*.
- Reviewer, *IEEE Communications*.
- Book Reviewer, *Prentice Hall*.
- Book Reviewer, *Morgan Kaufmann Publishers, Inc.*
- Book Reviewer, *Irwin Publishing Co.*

University Activities:

- Undergraduate Studies Committee, School of Engineering and Applied Science (2012 – Present)
- Faculty Advisor for IEEE Student Chapter (2009 – Present)
- Ambassador for McDonnell International Scholar Academy (2007 – 2013)
- Web Development Committee (2006 – 2008)
- University Judicial Board (1998 - 2000)
- Resource Generation Committee (1994 - 1995)
- Top 20 Committee (1992 - 1995)
- Telecommunications Committee, Chair (1991 - 1997)
- Library Planning Committee (1991 - 1992)
- Computer Engineering Committee (1990 - 1996)
- Communications Curriculum Committee (1990 - 1992)
- Resources Committee (1990 - 1992)

Patents

<u>Patent No.</u>	<u>Date</u>	<u>Title</u>
10,623,323	04/14/20	Network Devices and a Method for Signature Pattern Detection
10,284,476	05/07/19	Hierarchical Pattern Matching Devices and Methods

7,110,411	09/19/06	Method of and Apparatus for WFQ Scheduling Using a Plurality of Scheduling Queues to Provide Fairness, High Scalability, and Low Computational Complexity
7,106,738	09/12/06	Method of and Apparatus for High Speed Packet Switching Using Train Packet Queuing and Providing High Scalability
6,859,455	02/22/05	Method of and Apparatus for Building and Using Multi-Dimensional Index Trees for Multi-Dimensional Data Objects
6,614,789	09/02/03	Method of and Apparatus for Matching Strings of Different Lengths
6,359,885	3/19/02	Multi-Channel Packet Switching Apparatus Having Traffic Flow Controlling and Checking Functions
6,128,292	10/03/00	Packet Switching Apparatus with Multi-Channel and Multi-Cast Switching Functions and Packet Switching System Using the Same
5,788,161	12/13/98	Network Designer for Communication Networks
5,526,352	06/11/95	Integrable Low Complexity Multi-Channel Switch
5,440,549	08/08/95	Nonblocking Multi-Channel Switching with Multicasting Capability

Publications

- Yu, Qixiang, Luo, Z., and Min, P.S., “Intrusion Detection in Wireless Sensor Networks for Destructive Intruders.” Proceedings of the APSIPA 2015 conference. December 16-19, 2015.
- Hung, C.P., and Min, P.S., “Simple Web Application Framework.” Submitted for publication in the IEEE Transactions on Cloud Computing.
- Luo, Z., and Min, P.S., “Parallel Implementation of Energy-Based Target Localization Methods in Wireless Sensor Networks.” Proceeding of the 2014 IEEE SOUTHEASTCON.
- Yu, Q., Luo, Z., and Min, P.S., “Intrusion Detection in Wireless Sensor Networks for Destructive Intruder.” Proceeding of 2014 International Conference on Smart Computing (SMARTCOMP 2014).
- Luo, Z., and Min, P.S., “Survey of Target Localization Methods in Wireless Sensor Networks,” 19th IEEE International Conference on Networks (ICON 2013), Singapore, December 11-13, 2013.
- Hung, C.P., and Min, P.S., “Deriving and Visualizing the Lower Bounds of Information Gain for Prefetch Systems,” 19th IEEE International Conference On Networks (ICON 2013), Singapore, December 11-13, 2013.
- Hung, C.P., and Min, P.S., “Access LUT without CAM - Improved Pearson Hashing for Collision Reduction,” 19th IEEE International Conference On Networks (ICON 2013), Singapore, December 11-13, 2013.
- Luo, Z and Min, P.S., “Target Localization in Wireless Sensor Networks for Industrial Control with Selected Sensors.” International Journal of Distributed Sensor Networks, Volume 2013 (2013), Article ID 304631.
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- Hung, C.P. and Min, P.S., "Infrastructure Arrangement for Application Virtualization Service," the 9th International Information and Telecommunication Technologies Symposium, Vol.1, pp. 78-85, Rio de Janeiro, December 2010.
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Testimony Provided or Expected to Provide as Expert Witness

Matter: Patent Infringement for Wireless Local Area Networks
Law Firm: Quinn Emanuel Urquhard & Sullivan LLP

Case Name: Certain Audio Players and Components thereof (II). U.S.I.T.C. Inv. No. 337-TA-1330.

Testifying Expert for Google Inc.

Completed in June 2023.

(Expert reports submitted and deposed.)

Matter: Patent Infringement for Wireless Communications

Law Firm: Alston & Bird

Case Name: Atlas Global Technologies LLC v. ASUSTek Computers Inc. USDC WD TX

Civil Action No. 6:21-cv-820

Testifying Expert for ASUSTek

Completed in November 2023

(Expert report submitted.)

Matter: Patent Infringement for Wireless Communications

Law Firm: Perkins Coie

Case Name: Bell Northern Research, LLC v. HMD AMERICA, INC. et al., Case No.: 1:22-cv-22706-SCOLA/GOODMAN (S.D. Fla.)

Testifying Expert for HMD

Completed in December 2023

(Expert report submitted. Deposed.)

Matter: Patent Infringement for Wireless Communications

Law Firm: LAW OFFICES S. J. CHRISTINE YANG

Case Name: Atlas Global Technologies LLC v. ZyXEL Communications Corp. et al., U.S.D.C., W.D.T.X., Waco Div., Case No. 6:22-cv-00355 Atlas Global Technologies LLC v. D-Link Corp. U.S.D.C., W.D.T.X., Waco Div., Case No. 6:22-cv-00520

Testifying Expert for ZyXel

Retained in March 2023.

(Expert report submitted.)

Matter: Patent Infringement for Wireless Communications

Law Firm: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP

Case Name: Bell Northern Research v. MeidaTek Inc.

Testifying Expert for MediaTek Inc.

Retained in August 2023.

Matter: Patent Infringement for Home Security System

Law Firm: Foley and Lardner LLP

Case Name: Alarm.com v. Vivint, Inc., AAA Arbitration Case. No. 01-22-0004-5525 and U.S.D.C. Case No. 2:23-cv-00004-JRG-RSP (E.D. Tex.),

Testifying Expert for Vivint, Inc.

Completed in 2023.

Matter: Patent Infringement for Wireless Communications and Electronics

Law Firm: Perkins Coie
Case Name: Bell Northern Research, LLC v. HMD AMERICA, INC. et al., Case No.: 1:22-cv-22706-SCOLA/GOODMAN (S.D. Fla.)
Testifying Expert for HMD
Completed in December 2023.

Matter: Patent Infringement for Network Switches
Law Firm: Charhon Callahan Robson & Garza, PLLC
Case Name: Sable Networks, Inc. and Sable IP, LLC v. CouldFlare, Inc. U.S.D.C. WD Tx
Case No. 6:21-cv-261
Testifying Expert for CloudFlare, Inc.
Completed in January 2024.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Network Security
Law Firm: Fish and Richardson
Case Name: Finjan LLC v. Palo Alto Networks, Inc. – Case No. 4:14-cv-04908-PJH. USDC
ND CA, Oakland Division.
Testifying Expert for Finjan LLC.
Retained in September 2022.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Network Management
Law Firm: Irell & Manella LLP
Case Name: SNMP Research, Inc. & SNMP Research International, Inc. v. Broadcom Inc.,
Brocade Communications Systems LLC, & Extreme Networks, Inc. U.S.D.C.
E.D. Tennessee at Knoxville Case No. 3:20-CV-451
Testifying Expert for SNMP Research.
Retained in May 2022.

Matter: Inter Parte Reexamination for Wireless Communications
Law Firm: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP
Case Name: Patent reexamination in front of the U.S.P.T.O.
Testifying Expert for MediaTek
Retained in March 2023.

Matter: Patent Infringement for Network Switching
Law Firm: Baker Botts
Case Name: Corrigent Corp. v. Arista Networks, Inc., Case No. 1:22-cv-00497-UNA. USDC
Delaware
Testifying Expert for Arista
Retained in October 2022.

Matter: Patent Infringement for Mobile Devices
Law Firm: Fish and Richardson
Case Name: GComm v. Samsung, U.S.D.C. ED. TX. Case No.: 2:22-cv-0078-JRG

Testifying Expert for Samsung
Completed in January 2024.

Matter: Patent Infringement for Wireless Networks
Law Firm: McKool Smith
Case Name: Certain Mobile Telephones, Tablet Computers with Cellular Connectivity, and Smart Watches with Cellular Connectivity, Components Thereof, and Products Containing Same. U.S.I.T.C. Inv. No. 337-TA-1299
Testifying Expert for Ericsson
Completed in July 2022.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Semiconductor Manufacturing
Law Firm: Kramer Levin
Case Name: Oasis Tooling, Inc. v. Siemens Indus. Software, Inc., 1:22-cv-151 (D. Del.), Oasis Tooling, Inc. v. GlobalFoundries U.S. Inc., 1:22-cv-312 (D. Del.)
Testifying Expert for Oasis Tooling
Retained in June 2022.
(Expert reports submitted.)

Matter: Patent Infringement for Optical Networks
Law Firm: Duane Morris
Case Name: NextGen Innovations, LLC v. Infinera Corporation. U.S.D.C. ED. TX (Marshall)
Case No. 2:22-cv-00306-JRG-RSP / IPR
Testifying Expert for Infinera
Retained in April 2023.

Matter: Patent Infringement for Wireless Devices
Law Firm: King and Spalding LLP
Case Name: Intellectual Ventures, et. al. v. General Motors Company and General Company Motors, LLC, Case No. 6:21-CV-1088 pending in the Western District of Texas, Waco Division
Testifying Expert for General Motors
Completed in January 2023.
(Expert report submitted.)

Matter: Patent Infringement for Wireless Devices
Law Firm: Sterne Kessler
Case Name: Neo Wireless LLC v. Volkswagen Group of America, Inc. and Volkswagen Group of America Chattanooga Operations, LLC and related matters
Testifying Expert for Volkswagen
Completed in September 2023.
(Expert report submitted and deposed. IPR declarations submitted)

Matter: Patent Infringement for Wireless Networks
Law Firm: Covington & Burling LLP

Case Name: XR Communications, LLC v. D-Link Systems, Inc., No. 8:17-cv-00596
(Consolidated) (C.D. Cal.)
Testifying Expert for Hewlett Packard Enterprise
Completed
(Expert report submitted and deposed.)

Matter: Patent Infringement for USB Charging System
Law Firm: Orrick, Herrington & Sutcliffe LLP
Case Name: Fundamental Innovation Systems International LLC v. TCT Mobile (US), TCT
Mobile (US) Holdings, Inc., et al. U.S.D.C. Delaware No. 20-552-RGA-CJB
Testifying Expert for TCL
Completed in June 2022.
(Expert report submitted and deposed.)

Matter: Inter Parte Reexamination for Wireless Communications
Law Firm: Alston & Bird
Case Name: Patent reexamination in front of the U.S.P.T.O.
Testifying Expert for Nokia
Retained in May 2022.
(Expert report submitted.)

Matter: Patent Infringement for Network Management System
Law Firm: Morgan, Lewis & Bockius, LLP
Case Name: Certain Routers, Access Points, Controllers, Network Management Devices,
Other Networking Products, and Hardware and Software Components Thereof,
U.S.I.T.C. Inv. No. 337-TA-1227
Testifying Expert for Hewlett Packard, Netgear, and CommScope
Completed in August 2021.
(Expert report submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Security Systems
Law Firm: Forley and Lardner LLP
Case Name: Certain Residential Premises Security Monitoring and Automation Control
Panels, and Components Thereof (ITC Inv. No. 337-TA-1273) and ADT LLC et
al v. Vivint, Inc., Case No. 6:21-cv-00687 (W.D. Tex.)
Testifying Expert for Vivint, Inc.
Completed in April 2022.
(Expert report submitted, deposed, and testified during trial.)

Matter: Inter Parte Reexamination for Internet Communications
Law Firm: Perkins Coie
Case Name: Patent reexamination in front of the U.S.P.T.O.
Testifying Expert for Twitter
Retained in June 2020.
(Expert report submitted.)

Law Firm: Fisher Broyles
Case Name: Vaxcel International Co., Ltd. v. Heathco LLC, U.S.D.C. Delaware No. 20-224-LPS
Testifying Expert for Vaxcel
Retained in February 2021.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Network Communication System
Law Firm: Charhon Callahan Robson & Garza, PLLC
Case Name: Sable Networks, Inc. and Sable IP, LLC, v. ClouFlare, Inc. U.S.D.C. WDTX, Civil Action No. 6:21-cv-261
Testifying Expert for CloudFlare, Inc.,
Completed in January 2024.

Matter: Patent Infringement for Mobile Wireless Device
Law Firm: Pearl Cohen
Case Name: In the Matter Of Certain UMTS And LTE Cellular Communications Modules And Products Containing The Same, U.S.I.T.C. Inv. No. 337-TA-1240
Testifying Expert for Telit Wireless Communication, Quectel, and Thales
Completed in March 2023.
(Expert reports submitted and deposed.)

Matter: Transactional Taxes for Internet Application
Law Firm: Ryan Rapp & Underwood, PLC
Case Name: ADP, LLC v. Arizona Department of Revenue (TX2018-000246),
Testifying Expert for ADP, LLC.
Completed in June 2020.
(Expert report submitted.)

Matter: Trade Secret Misappropriation in Digital Electronics
Law Firm: Goodwin Proctor LLP
Case Name: Guzik Technical Enterprises versus Keysight Technologies, Inc. Superior Court of the State of California for the County of Santa Clara, Case No.: 19CV355879
Testifying Expert for Keysight Technologies, Inc.
Retained in August 2020.

Matter: Patent Infringement for Fiber Optic Devices
Law Firm: Cooley
Case Name: Certain High-Density Fiber Optic Equipment and Components Thereof, U.S.I.T.C. Inv. No. 337-TA-1194
Testifying Expert for AFL Communications, Panduit, FS.Com, Wirewerk, and Siemon
Completed in October 2020.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Optical Transport Networks

Law Firm: Venerble
Case Name: Huawei Technologies Co. Ltd v Verizon Communications, Inc., et. al., 2:20-cv-0030
Testifying Expert for Verizon.
Retained in March 2020.
(IPR declarations submitted.)

Matter: Patent Infringement for Lighting System
Law Firm: Fisher Broyles
Case Name: Vaxcel International Co., Ltd., v. Jasco Products Company, LLC., (Case No. USDC Western District of Oklahoma, 5:19-CV-00154-JD)
Testifying Expert for Vaxcel.
Retained in August 2020.

Matter: Patent Infringement for Wireless Communication
Law Firm: McDermott Will & Emery
Case Name: Bell Northern Research LLC v. ZTE. (Case No. 3:18-cv-01786 - S.D. Cal)
Testifying Expert for ZTE.
Retained in July 2019.
(IPR declarations submitted.)

Matter: Patent Infringement for Wireless Communication
Law Firm: Jones Day
Case Name: Bell Northern Research LLC v. Kyocera Corp. (Case No. 3:18-cv-1785 - S.D. Cal)
Testifying Expert for Kyocera.
Completed in May 2019.
(Claim construction declaration submitted, and deposed.)

Matter: Patent Infringement for Electronic Payment Systems
Law Firm: Paul Hastings
Case Name: ID Tech Corp. v. Samsung Electronics Co., Ltd., et al. (Case No. No. 8:17-cv-1748-DOC-JDE (C.D. Cal))
Testifying Expert for Samsung.
Retained in January 2019.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Internet Switching
Law Firm: Maynard Cooper
Case Name: Parity Networks, LLC v. Juniper Networks, Inc., Case No. 6:17-CV-00495-RWS-KNM (U.S.D.C.E.D. Tx.)
Testifying Expert for Juniper.
Retained in April 2018.
(IPR declarations submitted.)

Matter: Patent Infringement for Internet Switching

Law Firm: Morgan Lewis
Case Name: Parity Networks, LLC v. Hewlett Packard Enterprise Company, Case No. 6:17-CV-00682 (U.S.D.C.E.D. Tx.)
Testifying Expert for Hewlett Packard Enterprise Company.
Retained in September 2018.
(IPR declarations submitted.)

Matter: Inter Parte Rexamination for Covered Business Method
Law Firm: Reed Smith LLP
Case Name: NASDAQ v. Miami International
Expert for Miami International.
Retained in February 2018.
(Expert declarations submitted, and deposited.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Quinn Emanuel
Case Name: Qualcomm v. Apple, Case No. 3:17-cv-00108-GPC-MDD (U.S.D.C.S.D. Cal.)
Testifying Expert for Qualcomm.
Completed in April 2019.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Communication Devices
Law Firm: Venable
Case Name: Sycamore IP Holdings LLC v. Verizon Communications Inc, Case No. 2:16-cv-591-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for Verizon and Level 3.
Completed in September 2017.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Alston Bird
Case Name: Huawei Technologies Co. Ltd. V. Nokia Solutions and Networks, Case No. 2:16-cv-0056-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for Nokia.
Completed in December 2017.
(Expert reports submitted.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Quinn Emanuel
Case Name: Huawei Technologies Co. Ltd. V. Samsung Electronics C. Ltd, Case No. 3:16-cv-02787 (U.S.D.C. N.D. Cal)
Testifying Expert for Samsung.
Completed in March 2019.
(Expert reports submitted, and deposited.)

Matter: Arbitration for Licensing
Law Firm: Alston Bird
Case Name: Nokia v. LG Electronics, International Chamber of Commerce Arb. No. 21326
Testifying Expert for Nokia.
Completed in October 2016.
(Expert reports submitted.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Ropes and Gray
Case Name: Godo Kaisha IP Bridge 1 v. TCL Communication Technology Holdings, Case No. 15-634-SLR-SRF (U.S.D.C.S.D. Delaware.)
Testifying Expert for IP Bridge.
Completed in October 2018.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Paul Hastings
Case Name: Odyssey Wireless, Inc., v. Samsung Electronics Co., Ltd., et al, Case No. 3:15-cv-1738-H-RBB (U.S.D.C.S.D. Cal.)
Testifying Expert for Samsung.
Completed in October 2016.
(Expert reports submitted.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Greenberg Traurig
Case Name: Mobile Telecommunications Technologies LLC v. Amazon.com, Inc., 2:13-cv-883-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for Amazon.
Completed in April 2015.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Mayer Brown
Case Name: Mobile Telecommunications Technologies LLC v. LG Electronics Mobilecomm U.S.A., Inc., 2:13-cv-947-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for LG Electronics Mobilecomm.
Completed in February 2016.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Semiconductor Devices
Law Firm: Mayer Brown
Case Name: Inter Parte Reexamination for U.S. Patent Nos. 6,895,520 and 6,899,332
Expert for LG Electronics.
Completed in February 2016.
(Expert declaration submitted, and deposed.)

Matter: Patent Infringement in Vehicular Electronics
Law Firm: Gardner, Linn, Burkhardt & Flory, L.L.P
Case Name: *Magna Electronics Inc. v. TRW Automotive Holdings Corp. et al.*, Civil Action No. 1:12-cv-00654 (Western District of Michigan), and relating to the action styled *Magna Electronics Inc. v. TRW Automotive Holdings Corp. et al.*, Civil Action No. 1:13-cv-00324 (Western District of Michigan).
Testifying Expert for Magna Electronics
Completed in February 2016.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement in Electronic Circuits
Law Firm: Ropes and Gray
Case Name: Certain Devices Containing Non-Volatile Memory and Products Containing the Same (USITC Inv. Nos. 337-TA-922)
Testifying Expert for Spansion Inc.
Completed in February 2015.
(Expert reports submitted.)

Matter: Trade Secret Misappropriation in Software Method for Cable Television Advertisement
Law Firm: Brownstein Hyatt Farber Schreck
Case Name: Cross MediaWorks v. EMT Holdings, USDC Southern District of New York, Case No. 1:14-cv-00561-VSB
Testifying Expert for Cross MediaWorks.
Completed in April 2015.
(Testified during injunction hearing.)

Matter: Patent Infringement in Vehicular Electronics
Law Firm: Steptoe and Johnson
Case Name: Certain Vision-Based river Assistance System Cameras and Components Thereof (USITC Inv. Nos. 337-TA-899 and 907)
Testifying Expert for Magna Electronics
Completed in February 2015.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Vehicular System
Law Firm: Susman Godfrey
Case Name: Eagle Harbor Holdings, LLC, and Mediustech, LLC, v. Ford Motor Company, 3:11-cv-05503-BHS (U.S.D.C. Western District of Washington at Tacoma)
Testifying Expert for Mediustech.
Completed in March 2015.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Communication Networks
Law Firm: Davis Polk & Wardwell LLP

Case Name: Sprint Communications Company L.P., v. Comcast Cable Communications, LLC, Comcast IP Phone, LLC, and Comcast Phone of Kansas, LLC. 2:11-cv-02684-KHV-DJW (U.S.D.C. Kansas)
Testifying Expert for Comcast.
Retained in March 2012.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Communication Networks
Law Firm: Quinn Emanuel
Case Name: France Telecom S.A. v. Marvell Semiconductor, Inc., 12-Civ-4986 (S.D.N.Y.)
Testifying Expert for Marvell.
Completed in September 2014.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Wireless Image Distribution
Law Firm: Jones Day
Case Name: *Inter Partes* Review of U.S. Patent No. 8,437,797
Expert for Google Inc.
Completed in November 2014.
(Expert declaration submitted.)

Matter: Nonvolatile Semiconductor Memories
Law Firm: Jones Day
Case Name: *Inter Partes* Review of U.S. Patent Nos. 8,301,833 and 8,516,187
Expert for SanDisk.
Completed in May 2014.
(Expert declaration submitted.)

Matter: Communication Protocols for Wireless Device
Law Firm: Dorsey & Whitney, LLP
Case Name: Certain Point-To-Point Network Communication Devices and Products Containing Same (USITC Inv. No. 337-TA-892)
Testifying Expert for Toshiba
Completed in May 2014.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Wireless Networks
Law Firm: Ropes and Gray
Case Name: In the Matter of Certain Wireless Devices With 3G and/or 4G Capabilities and Components Thereof (USITC Inv. No. 337-TA-868) InterDigital Comms., Inc. v. Huawei Techs. Co., Ltd., No. 13-00008 (D. Del., filed January 2, 2013), InterDigital Comms., Inc. v. ZTE Corp., No. 13-00009 (D. Del., filed January 2, 2013), InterDigital Comms., Inc. v. Nokia Corp., No. 1:13-cv-00010 (D. Del., filed January 2, 2013), InterDigital Comms., Inc. v. Samsung Elec. Co., Ltd., No. 13-00011 (D. Del., filed January 2, 2013)
Testifying Expert for Joint Defense Group.

Completed in February 2014.
(Expert reports submitted, deposed, and testified during trials.)

Matter: Patent Infringement for Mobile Communication
Law Firm: Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.
Case Name: Certain Digital Media Devices, Including Televisions, Blu-Ray Disc Players, Home Theater Systems, Tablets and Mobile Phones, Components Thereof and Associated Software (USITC Inv. No. 337-TA-882)
Testifying Expert for LG Electronics, Inc.
Completed in February 2014.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Wireless Networks
Law Firm: Vinson & Elkins LLP
Case Name: Wi-LAN USA, Inc. and Wi-LAN, Inc. v. Telefonaktiebolaget LM Ericsson and Ericsson, Inc. (USDC: Southern District of FL - Case #1: 12-cv-23569), Wi-LAN USA, Inc. and Wi-LAN, Inc. v. Alcatel-Lucent USA, Inc. (USDC: Southern District of FL - Case #1: 12-cv-23568-Altonaga/Simonton)
Testifying Expert for Wi-LAN.
Completed in May 2015.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Data Storage
Law Firm: Ropes and Gray, Weil Gotshal
Case Name: Summit Data Systems, LLC v. EMC Corporation., et al. 1:10-cv-00749-GMS (U.S.D.C. Delaware)
Testifying Expert for EMC Corporation and Netapp, Inc.
Completed in December 2012.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Wireless Mobile Device
Law Firm: Ashurst Australia
Case Name: Samsung v. Apple, Australian Federal Court Proceeding No. NSD 1243 of 2011
Testifying Expert for Samsung Electronics.
Completed in December 2012.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Wireless Mobile Devices
Law Firm: Quinn Emanuel
Case Name: Apple Inc. v. Samsung Electronics Co., Ltd., et al., 4:11-cv-01846-LHK (N.D. Cal.) and Samsung Electronics Co., Ltd., et al. v. Apple Inc., 4:11-cv-02079 (N.D. Cal.)
Testifying Expert for Samsung Electronics.
Completed in July 2012.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Wireless Mobile Device
Law Firm: Quinn Emanuel
Case Name: Certain Electronic Devices, Including Wireless Communication Devices, Portable Music And Data Processing Devices, And Tablet Computer, U.S.I.T.C. Inv. No. 337-TA-794
Testifying Expert for Samsung Electronics.
Completed in June 2012.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Portable Storage Device
Law Firm: White and Case
Case Name: CERTAIN UNIVERSAL SERIAL BUS (“USB”) PORTABLE STORAGE DEVICES, INCLUDING USB FLASH DRIVES AND COMPONENTS THEREOF, US International Trade Commission Investigation No. 337-TA-788
Testifying Expert Witness for Trek
Completed in May 2012.
(Expert reports submitted, and deposed.)

Matter: Copyright Infringement for Petroleum Processing Software
Law Firm: Osha Liang LLP
Case Name: Aspen Technology, Inc. v. Tekin A. Kunt and M3 Technology, Inc., Case Number: H-10-1127, US District Court, Texas, Houston Division.
Testifying Expert for M3 Technology, Inc.
Completed in May 2012.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Trade Secret Misappropriation for DC-DC converter
Law Firm: Covington & Burling, Haynes Boone
Case Name: Certain DC—DC Controllers and Products Containing Same, US International Trade Commission Investigation No. 337-TA-698
Testifying Expert for UPI.
Completed in March 2012.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Parallel Processor
Law Firm: Orrick, Herrington, & Sutcliffe. Kirkland and Ellis.
Case Name: BIAx Corporation v. Nvidia and Sony Civil Action No. 09-cv-01257-PAB-MEH
Testifying Expert for Nvidia and Sony
Completed in March 2012.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Call Center Technology
Law Firms: Duffy, Sweeney, and Scott. Foley Lardner.
Case Name: Ronald Katz Technology Licensing v. Citizens Financial Group 7-ML-1816-C RGK (FFM)
Testifying Expert Witness for Citizens Financial Group.

Completed in 2011.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Storage Area Network
Law Firm: DLA Piper
Case Name: Network Appliance, Inc., v. Sun Microsystems, Inc., Case Number: C-07-06053
EDL, US District Court, Northern District of California, San Francisco Division.
Testifying Expert for Sun Microsystems, Inc.
Completed in 2010.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Flat Panel Display Controller
Law Firm: Jones Day
Case Name: Certain Video Displays, Components Thereof, and Products Containing Same, US
International Trade Commission Investigation No. 337-TA-687
Testifying Expert for Vizio, Inc.
Completed in 2010.
(Expert reports submitted, deposited, and testified during trial.)

Matter: Patent Infringement for Call Center Technology
Law Firms: Foley Lardner
Case Name: Ronald Katz Technology Licensing v. US Bank 7-ML-1816-C RGK (FFM)
Testifying Expert Witness for US Bank
Completed in May 2009.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for USB to VGA Converter
Law Firm: Wang Hartmann, Gibbs, & Cauley, P.C.
Case Name: Displaylink Corporation v. Magic Control Technology Corporation, Case No.
5:07-CV-01998-RMW, US District Court, Northern District of California, San
Francisco Division.
Testifying Expert for Magic Control Technology Corporation
Completed in 2009.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Flash Memory
Law Firm: Jones Day and Wilson Sansini
Case Name: Certain Flash Memory Controllers, Drives, Memory Card, and Media Players and
Products Containing Same. US International Trade Commission Investigation
No. 337-TA-619
Testifying Expert for SanDisk Corporation.
Completed in 2008.
(Expert reports submitted, deposited, and testified during trial.)

Matter: Patent Infringement for Semiconductor Packaging
Law Firm: Jones Day

Case Name: Certain Semiconductor Chips with Minimized Chip Package Size and Products Containing the Same. US International Trade Commission Investigation No. 337-TA-605
Testifying Expert for Freescale Semiconductor
Completed in 2008.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Automatic Switching System
Law Firms: Jones Day, and Heller Ehrman, LLP.
Case Name: ATEN International Co., Ltd and ATEN Technology, Inc. v. Belkin Corporation, Belkin Logistics, Inc. and Emine Technology Co., Ltd. US International Trade Commission Investigation No. Ltd 337-TA-589
Testifying Expert for Belkin Corporation, Belkin Logistics, Inc., and Emine Technology Co., Ltd.
Completed in 2007.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Dual Mode Communication
Law Firm: Wilmer Cutler Pickering Hale and Dorr, LLP
Case Name: Broadcom Corporation v. Qualcomm Incorporated SACV05-467-JVS (RNBx)
Testifying Expert Witness for Broadcom Corporation
Completed in 2007.
(Expert reports submitted, deposed, and testified during trial.)