

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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AT&T SERVICES INC., AND NOKIA OF AMERICA CORP.;

Petitioners

v.

ADAPTIVE SPECTRUM AND SIGNAL ALIGNMENT, INC.,

Patent Owner.

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IPR2025-00451

U.S. PATENT NO. 9,954,631

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**DECLARATION OF DR. RICHARD GITLIN**

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### List of Exhibits

| Exhibit | Short Name                         | Description                                                                                                                                                                                |
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| Ex-1001 | '631 patent                        | U.S. Patent No. 9,954,631                                                                                                                                                                  |
| Ex-1002 | '631 File History                  | File History of U.S. Patent No. 9,954,631                                                                                                                                                  |
| Ex-1003 | Gitlin Declaration                 | Declaration of Dr. Richard D. Gitlin                                                                                                                                                       |
| Ex-1004 | Bingham                            | U.S. Patent No. 5,680,394 to Bingham                                                                                                                                                       |
| Ex-1005 | Strobel                            | U.S. Patent No. 9,531,491 to Strobel                                                                                                                                                       |
| Ex-1006 | Strobel '943 Provisional           | U.S. Provisional Patent Application No.61/601,943                                                                                                                                          |
| Ex-1007 | Strobel '270 Provisional           | U.S. Provisional Patent Application No. 61/598,270                                                                                                                                         |
| Ex-1008 | Kuipers                            | ITU Temporary Document 2012-06-4A-061 by ADTRAN, titled "G.fast: A flexible framing structure"                                                                                             |
| Ex-1009 | Wei                                | ITU Temporary Document 2012-06-4A-040 by Wei                                                                                                                                               |
| Ex-1010 | Cioffi                             | U.S. Patent No. 5,887,032 patent to Cioffi                                                                                                                                                 |
| Ex-1011 | Liu                                | U.S. Patent No. 6,754,261                                                                                                                                                                  |
| Ex-1012 | Joint Claim Construction Statement | Joint Claim Construction Statement, Exhibit A, <i>Adaptive Spectrum and Signal Alignment, Inc. v. AT&amp;T Inc. et al.</i> , No. 24-cv-00029-JRG-RSP, Dkt. 105-1 (E.D. Tex. July 22, 2024) |
| Ex-1013 | Lantiq Contribution                | ITU Temporary Document 2012-02-4A-054 by Oksman                                                                                                                                            |
| Ex-1014 | CV                                 | <i>Curriculum Vitae</i> of Richard Gitlin                                                                                                                                                  |
| Ex-1015 | Grami                              | Grami, Introduction to Digital Communications, Academic Press, 2016. Chapter 11                                                                                                            |
| Ex-1016 | G.9701                             | Fast access to subscriber terminals (G.fast) – Physical layer specification                                                                                                                |
| Ex-1017 | Docket Control Order               | Docket Control Order, <i>Adaptive Spectrum and Signal Alignment, Inc. v. AT&amp;T Inc. et al.</i> , No. 24-cv-00029-JRG-RSP, Dkt. 84 (E.D. Tex. July 22, 2024)                             |

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| Ex-1018 | Order Focusing Claims         | Order Focusing Patent Claims and Prior Art to Reduce Costs, <i>Adaptive Spectrum and Signal Alignment, Inc. v. AT&amp;T Inc., et al.</i> , Case No. 2:24-cv-00029-JRG-RSP (E.D. Tex. Oct. 23, 2024), ECF No. 104.                                                                                                                   |
| Ex-1019 | Motion to Transfer            | Defendants' Motion to Transfer Venue Based on the Parties' Contractual Forum-Selection Clause, and Alternatively, Motion to Stay Case Pending Arbitration, <i>Adaptive Spectrum and Signal Alignment, Inc. v. AT&amp;T Inc., et al.</i> , Case No. 2:24-cv-00029-JRG-RSP (E.D. Tex. Oct. 23, 2024), ECF No. 92 ( <i>Redacted</i> ). |
| Ex-1020 | Gagnaire                      | Maurice Gagnaire, <i>Broadband Local Loops for High-Speed Internet Access</i> (Artech House, 2003).                                                                                                                                                                                                                                 |
| Ex-1021 | DSL Advances                  | Thomas Starr, et al., <i>DSL Advances</i> , (Prentice Hall, 2002).                                                                                                                                                                                                                                                                  |
| Ex-1022 | ISDN Architecture             | Richard T. Roca, <i>ISDN architecture</i> (AT&T Technical Journal, 1986).                                                                                                                                                                                                                                                           |
| Ex-1023 | Gitlin                        | U.S. Patent No. 4,924,492 to Gitlin                                                                                                                                                                                                                                                                                                 |
| Ex-1024 | Data Communication Principles | Richard D. Gitlin, Jeremiah F. Hayes and Stephen B. Weinstein, <i>Data Communication Principles</i> (Plenum Press, 1992).                                                                                                                                                                                                           |
| Ex-1025 | A Review of HDSL Progress     | Joseph W. Lechleider, <i>High Bit Rate Digital Subscriber Lines: A Review of HDSL Progress</i> , Vol. 9, No. 6, IEEE Journal on Selected Areas in Comm. 769 (1991).                                                                                                                                                                 |
| Ex-1026 | Strobel (Book)                | Strobel, <i>Channel Modeling and Physical Layer Optimization in Copper Line Networks</i> , (Springer, 2019).                                                                                                                                                                                                                        |
| Ex-1027 | ITU Work Program              | ITU Temporary Document 2012-06-4A-A20 titled "G.fast: Work programme for G.fast"                                                                                                                                                                                                                                                    |
| Ex-1028 | Broadband Access Networks     | Leif Aarhun Ims, <i>Broadband Access Networks</i> (Springer, 1998)                                                                                                                                                                                                                                                                  |
| Ex-1029 | Issues List                   | ITU Temporary Document 2012-06-4A-U20R1                                                                                                                                                                                                                                                                                             |
| Ex-1030 | NF-085                        | ITU Temporary Document NF-085                                                                                                                                                                                                                                                                                                       |
| Ex-1031 | CI-075                        | ITU Temporary Document CI-075                                                                                                                                                                                                                                                                                                       |
| Ex-1032 | ITU Global Directory          | ITU Global Directory from Wayback Machine, dated December 6, 2000                                                                                                                                                                                                                                                                   |

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| Ex-1033 | ITU-T Guide | ITU-T Guide for Beginners, March 2005,<br>International Telecommunication Union |
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## **I. INTRODUCTION**

1. My name is Richard D. Gitlin, and I have been retained as a technical expert by counsel for Petitioners AT&T Services Inc. (“AT&T”) and Nokia of America Corp. (“Nokia”) to address certain issues regarding U.S. Patent No. 9,954,631 (the “’631 Patent”). My CV is Ex-1014.

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, development, and management experiences, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owner’s expert(s) in this matter.

7. I am being compensated at my usual consulting rate of \$750 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

## **II. QUALIFICATIONS**

8. In 1964, I graduated from the City College of New York with a Bachelor's Degree in electrical engineering, with honors, and a Master of Science in electrical engineering in 1965 and a Doctor of Engineering Science from Columbia University in 1969.

9. After graduating from Columbia University with my doctorate, I joined Bell Laboratories. At that time, Bell Laboratories was the research and development arm of the Bell System.

10. Through various acquisitions, Bell Laboratories became AT&T Bell Labs, then Lucent Technologies-Bell Labs before my retirement. Subsequent to my employment, Lucent Technologies-Bell Labs became Alcatel-Lucent Bell Labs, and is now Nokia Bell Labs.

11. Altogether, I was with Bell Laboratories, AT&T Bell Labs, and Lucent Technologies Bell Labs for thirty-two years.

12. Upon starting at Bell Labs, I worked with data communications (i.e., modems) technologies, where I contributed to the invention of many voice-band modem technologies.

13. In the early 1980s, I contributed to the technical development of the V.32 and V.34 (voice-band) modems and I was also the leader of the development teams for those projects.

14. In addition to inventing and developing modem technologies, I was a co-inventor of foundational technology for Digital Subscriber Line (“DSL”), with work starting in 1986. This fundamental advancement demonstrated that megabits per second could be transported over conventional telephone twisted-pair wiring between the home and telephone networks and was instrumental in the development of broadband communications technologies used today.

15. The successes in creating and realizing this foundational technology was a major reason that I was elected as a member of the National Academy of Engineering (“NAE”) in 2005 and recently awarded the 2025 IEEE Alexander Graham Bell Medal.

16. In 1987, I moved to Bell Labs Research to lead research on wireless systems, high-speed packet switching, optical networking, and related areas. I held several senior executive positions in Bell Labs Research, including Senior Vice President for Communications and Networking Research.

17. As the Senior Vice President for Communications and Networking Research, I was responsible for all wireless and wireline communications research projects at Bell Labs, including time division multiple access (“TDMA”), code

division multiple access (“CDMA”), and OFDM research for both cellular and wireless local area network (“WLAN” or WiFi) systems, packet networking, and optical research in coherent detection and Wavelength Division Multiplexing (“WDM”) optical systems.

18. As part of my responsibilities in this role, I oversaw and managed more than 500 professionals, many of whom were involved in wireless and communications and networking research, and were responsible for significant innovations in wireless and wireline (including optical) technologies.

19. Additionally, as Senior Vice President for Communications and Networking Research with Bell Labs, I established and oversaw the first Bell Labs research group located outside the United States in Utrecht, Netherlands, which was focused on creating a wireless LAN (“WLA”), which later became standardized and known as WiFi technology.

20. I further oversaw a cellular wireless research group located in Swindon, United Kingdom and United States based Bell Labs research groups working on wireless research, many of whom worked on OFDM and MIMO technologies.

21. I was also personally involved in advancing CDMA (e.g., multi-code CDMA) and pioneering MIMO (smart antenna) wireless technologies, packet networking, and technology for enabling coherent optical communications.

22. In addition to my responsibilities at Bell Laboratories and Lucent Technologies, from 1999 to 2001, I was a Visiting Professor of Electrical Engineering at Columbia University where I taught courses, conducted research, and supervised doctoral students in the area of communications and wireless networking. In 2001 I became an Adjunct Professor at Columbia, and maintained that role until 2003.

23. In 2001, I became Vice President, Technology and Chief Technical Officer of NEC Laboratories America, Inc., where I had responsibility for wireless networking, broadband and IP systems, systems LSI, quantum communications, and bio-informatics. I served in this role until 2004.

24. From 2002 to 2005, I served on the Board of Directors of PCTEL, a NASDAQ listed company focused on wireless technologies.

25. From 2005 to 2008, I served as Chief Technical Officer of Hammerhead Systems, a Silicon Valley venture-funded start-up providing innovative data networking solutions for wireline, wireless, and cable service providers that uniquely combined existing Layer 2 and 3 technologies to efficiently manage streaming data. At Hammerhead Systems, I was responsible for product line vision and system architecture, creating and developing novel technologies, representing product technology and directions with customers, partners, and standard bodies.

26. From August 2008 to August 2019, I was a State of Florida 21st Century Scholar, Distinguished University Professor, and the Agere Systems Endowed Chaired Professor in Electrical Engineering at the University of South Florida.

27. As part of my research at USF, I worked on technology for 4G/5G wireless systems and the Internet of Things (“IoT”), and also at the intersection of wireless communications and networking with medicine to advance minimally invasive surgery and other cyber-physical health care systems. Some of the courses I taught at USF including graduate-level courses in Random Processes, Digital Communications, and Wireless Networking.

28. In total, I have more than fifty years of experience in the field of telecommunication technologies through roles with companies and universities, including managing and leading research in wireline and wireless systems, broadband data, and optical networking.

29. As a part of my career, I have led pioneering research in the development in digital communications, wired and wireless systems, and broadband networking resulting in many innovative products.

30. I am the named inventor on 75 issued United States patents, the author, or co-author, of over 170 journals, conference articles, and a graduate level communications textbook, *Data Communications Principles*. I have presented multiple keynote presentations, including at some of the most premier and well-

renown conferences such as COMCAS 2019, WAMICON 2016, Wireless Communications and Networking Conference 2015 (WCNC 2015), Wireless Telecommunications Symposium 2015), Mobicom 2004, Wireless Communications and Networking Conference 2003 (WCNC 2003), and the Wireless Telecommunications Symposium 2010 (WTS 2010).

31. For more than 15 years, I presented two intensive five-day short courses on wireless systems and broadband networking to industrial, government, and academic participants from wireless organizations around the world.

32. In 1986 I was named a Fellow of the IEEE. I also served as the Chair of the Communication Theory Committee of the IEEE Communications Society (“COMSOC”), the Editor for Communications Theory of the IEEE Transactions on Communications, as a member for the Board of Governors of the IEEE Communications Society, and as a member of the Nominations and Elections Board of the IEEE Communications Society.

33. In 1987, I was named an AT&T Bell Laboratories Fellow.

34. Also, I am the co-recipient of three prize paper awards including the 1995 IEEE Communications Society’s Steven O. Rice Award, the 1993 IEEE Communications Society’s Frederick Ellersick Award, and the 1982 Bell System Technical Journal Award.

35. As mentioned above, in 2005 I was elected to the National Academy of Engineering. In 2012 I was named a Charter Fellow of the National Academy of Inventors (NAI). In 2017, I was inducted into the Florida Inventors Hall of Fame, in 2020 I was named a Fellow of American Association for the Advancement of Science, and recently I was awarded the 2025 IEEE Alexander Graham Bell Medal.

### **III. SCOPE OF ENGAGEMENT**

36. I have been retained by Alston & Bird LLP on behalf of AT&T to provide various analyses and opinions. Among other tasks, I have been asked to address the technology claimed in the '631 Patent and to evaluate whether a POSITA would find certain claims of the '631 Patent either anticipated by, or obvious in view of, certain prior art references.

37. All of the opinions I express in this Declaration have been made from the standpoint of a person of ordinary skill in the relevant art ("POSITA") at the time of the invention of the '631 Patent, which I am informed is the earliest claimed priority date of July 27, 2012 for purposes of this matter. I explain what level of skill a person of ordinary skill in the art as of July 27, 2012 would have had below in Section IV.E.

### **IV. LEGAL STANDARDS**

38. For purposes of this Declaration, counsel for AT&T have instructed me to make the following assumptions:

39. Claims are construed from the perspective of a POSITA as of the effective filing date of the patent application. Persons of ordinary skill in the art are deemed to read the claims in the context of the entire patent, including the specification and prosecution history. In other words, the terms are not considered in a vacuum.

40. It is my understanding that information that satisfies one of the categories of prior art set forth in 35 U.S.C. § 102 may be used in an invalidity analysis under §§ 102 or 103. If information is not properly classified as prior art under one of the subsections of § 102 of the Patent Act, then it may not form the basis of an anticipation or obviousness determination. It is also my understanding that, for *inter partes* review, applicable prior art is limited to patents and printed publications.

#### **A. Presumption of Validity**

41. I understand that in deciding whether to issue a patent, the U.S. Patent and Trademark Office (“USPTO”) examines the patent specification, its claims, and relevant prior art references to determine whether the patent application and its claims meet the requirements for patentability. I understand that if the USPTO then issues the patent, it has determined that the claims are valid. I understand that the law recognizes that the USPTO possesses special expertise to conduct such determinations, and that, as a result, each claim of a patent issued by the USPTO is

presumed valid by law. This presumption of validity can be overcome only if the party seeking to invalidate a claim proves invalidity by clear and convincing evidence, which I understand to mean evidence that convinces you that it is highly probable that the particular proposition is true. I understand that clear and convincing evidence is more than a preponderance of the evidence but less than beyond a reasonable doubt. I understand that the clear and convincing evidence standard applies to all aspects of an allegation of anticipation or obviousness, including the prior art status of the relevant reference(s).

42. I understand the first step in determining whether or not a patent claim is valid is to properly construe the claims. I also understand that the claims must be construed the same way in determining validity/invalidity and infringement/non-infringement. I also understand that, as a general matter, a claim should not be limited to a preferred embodiment, but that in certain cases, the scope of the right to exclude may be limited by a narrow disclosure or by positions taken, such as by statements made during patent prosecution. I also understand the claims must be supported by the specification. Also, to the extent that a patent claims priority to an earlier filed application, the claims must be supported by the disclosure in that application. For terms that have not been construed I understand that they should be afforded their plain and ordinary meaning to one of ordinary skill in the art.

## **B. Anticipation**

43. I have been informed by counsel and understand that a patent is invalid on the basis of anticipation (under 35 U.S.C. § 102) if a single prior art reference discloses, either expressly or inherently, each and every limitation of the claimed invention. If the single prior art reference fails to disclose even one claim limitation, it does not anticipate the claim.

44. I understand that a single prior art reference may anticipate without disclosing a feature of the claimed invention if such feature is necessarily present, or inherent, in that reference.

45. I have been informed that under the principles of inherency, if the prior art necessarily functions in accordance with or includes the claimed limitations, it anticipates. However, the prior art reference must necessarily include the non-disclosed limitation. Mere probabilistic inherency, nor the presence of an unrecognized *de minimis* quantity of a claimed substance in the prior art, cannot anticipate a later patent or patent application.

### **C. Obviousness**

46. I have been informed that a claim is invalid as obvious under 35 U.S.C. § 103 (pre-AIA) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a person of ordinary skill in the art. I have been informed that the following matters are relevant to determining whether the claimed invention would

have been obvious: (1) the scope and content of the prior art, (2) the difference or differences between the patent claim and the prior art, (3) the level of ordinary skill in the art at the time the invention of the patent, and (4) any secondary considerations or objective indicia of non-obviousness.

47. I have been informed that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. When a claim simply arranges prior art elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, then such a combination is obvious. When a patent claims a structure already known in the prior art altered by the mere substitution of one element for another known in the field, the combination is likely to be obvious unless the combination yields an unpredictable result.

48. I have been informed that when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill in the art can implement a predictable variation, such a variation is likely unpatentable. For the same reason, if a technique has been used to improve one device, and one of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her

skill. One question to consider is whether the improvement is more than predictably using prior art elements according to their established functions.

49. I have been informed that it may often be necessary, in a validity analysis, to consider whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. This can be accomplished by looking to interrelated teachings of multiple patents or other publications or pieces of prior art; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by one of ordinary skill in the art.

50. I have been informed that a validity analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim; it is appropriate to take account of the inferences and creative steps that a person of ordinary skill in the art would employ. I have been informed that a person of ordinary skill in the art is a person of ordinary creativity, not an automaton.

51. I have been informed that a claim composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art. I have been informed that it can be important to identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does. I am told that one way that subject matter can be proved obvious is by noting there existed at

the time of the invention a known problem for which there was an obvious solution encompassed by the patent's claims. I have been informed that any need or problem known in the field of endeavor at the time of the claimed invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

52. I have been informed that one should not assume that a person of ordinary skill in the art attempting to solve a problem will be led only to those elements of prior art designed to solve the same problem. Instead, I have been informed that since familiar items may have obvious uses beyond their primary purposes, in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple prior art references together like pieces of a puzzle.

53. I have been informed that, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, persons of ordinary skill in the art have good reason to pursue the known options within their technical grasp. If this leads to the anticipated success, the product was likely not accomplished by innovation but by using ordinary skill and common sense. I have been informed that, in such an instance, the fact that the combination was obvious to try may show that the combination was obvious.

54. I have been informed that, when determining whether a claimed combination would have been obvious, the correct analysis is not whether a person of ordinary skill in the art, writing on a blank slate, would have chosen the particular

combination of elements described in the claim. Instead, I have been informed that the correct analysis considers whether one of ordinary skill, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to selecting the combination claimed.

55. I have been informed that, when determining whether a claimed invention is obvious, any “secondary considerations” of non-obviousness identified by the patentee should also be considered. These secondary considerations can include:

- commercial success of the invention, causally related to the invention itself rather than to companion factors, such as advertising or attractive packaging;
- the invention taught away from the technical direction followed by those skilled in the art;
- a long-felt but unsatisfied need for the invention while the needed implementing arts and elements had long been available;
- the invention achieves results unexpected to those skilled in the art;
- copying of the invention by competitors as distinguished from their independent development

- unsuccessful attempts by those skilled in the art to make the invention;
- acquiescence by the industry to the patent's validity by honoring the patent through taking licenses or not infringing the patent, or both; and
- skepticism, disbelief in or incredulity by those skilled in the art that the patentee's approach worked.

56. I have been informed that, for the above information to impact the obviousness of a patent claim, there must be a nexus between the alleged secondary considerations and the claims. In addition, I have been informed that the burden of introducing evidence of secondary considerations generally is on the Patent Owner. If the Patent Owner or its expert should assert secondary considerations of non-obviousness, I reserve the right to provide a Declaration addressing assertions of non-obviousness due to secondary considerations.

#### **D. Claim Construction**

57. I have been informed that claim terms are typically given their plain and ordinary meanings, as would have been understood by a person of ordinary skill in the art at the time of the earliest alleged priority date. I have further been informed that when considering the meaning of any terms in the challenged claims of the '631 Patent, I should apply the plain and ordinary meaning of those terms (though I do

discuss certain terms below). I have further been informed that in considering the meaning of the claims, one must consider the language of the claims, the specification, and the prosecution history of record.

58. I have been informed that, in general, a preamble limits the invention if it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim. I have further been informed that a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. I have further been informed that dependence on a particular disputed preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the preamble and claim body to define the claimed invention. I have further been informed that clear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention.

59. I have also been informed that claim terms reciting a “means” are considered “means-plus-function” terms that should be construed to include the structure described in the specification that performs the recited function. To show that a means-plus-function claim limitation is taught by prior art, the prior art must include a discussion of the same function as recited in the challenged claim, using

substantially the same structure, materials, or acts, or their equivalents as discussed in the specification of the challenged patent, to achieve the claimed function; essentially, proving that the prior art discloses or teaches that the claimed function is performed in a substantially similar way with a substantially similar result as the disclosed structure in the challenged patent.

#### **E. Person of Ordinary Skill in the Art**

60. I have been asked to identify the level of skill in the art pertinent to the '631 Patent. It is my opinion that a person of ordinary skill in the art pertinent to the '631 Patent would have had at least a Bachelor's Degree in electrical engineering, computer engineering, or similar discipline and had approximately two years of experience with electronic communication systems and familiarity with standards governing DSL systems. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background.

61. I consider myself a person of ordinary skill in the art as of at least the earliest claimed priority date (July 27, 2012).

62. My opinions regarding the level of ordinary skill in the art are based on, among other things, my more than 50 years of experience with optical, wireless, and wireline (e.g., DSL) networks and the components used in those communication systems, my understanding of the basic qualifications that would be relevant to an

engineer or scientist tasked with investigating DSL networks and components therefor, my knowledge and experience with the capabilities of such systems by 2012, and my familiarity with the backgrounds of colleagues, both past and present. Although my qualifications and experience exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '631 Patent have been based on the perspective of a person of ordinary skill in the art as of July 2012. I am able to take on that perspective based on my experience as I have worked with individuals who had this level of experience in the 2012-time frame and I am familiar with their level of knowledge.

63. My opinions are also based on the information I have reviewed as of the date of this Declaration. In connection with my analysis, I have reviewed the exhibits listed in the above list of exhibits, as well as each of the items referenced herein. I attest that the foregoing exhibits are true and accurate copies that I downloaded. My opinions directed to the invalidity of the challenged claims are based, at least in part, on the following patents and publications:

- “Bingham” (Ex-1004), which is U.S. Patent No. 5,680,394 to Bingham *et al.*, filed on July 11, 1995 and issued on October 21, 1997.
- “Strobel” (Ex-1005), which is U.S. Patent No. 9,531,491 to Strobel *et al.*, filed on February 13, 2013 and granted on December 27, 2016;

- “Strobel ’943 Provisional” (Ex-1006), which is U.S. Provisional Application No. 61/601,943 to Strobel et al. that Strobel claims priority to, which was filed on February 22, 2012;
- “Strobel ’270 Provisional” (Ex-1007), which is U.S. Provisional Application No. 61/598,270 to Strobel et al. that Strobel claims priority to, which was filed on February 13, 2012;
- “Wei” (Ex-1009), which is ITU contribution submitted by Huawei titled “G.fast: Discontinuous Mode Power Saving” that was distributed and made available prior to the June 2012 meeting of the ITU.
- “Kuipers” (Ex-1008), which is ITU contribution submitted by ADTRAN titled “G.fast: A flexible framing structure” that was distributed and made available prior to the June 2012 meeting of the ITU.

## **V. SUMMARY OF OPINIONS**

64. I have been asked to consider whether the claims of the ’631 Patent are obvious over certain prior art references. As explained in detail in the following sections, it is my opinion that:

- Ground 1: Claims 1, 3-6, 34, and 37 are unpatentable under 35 U.S.C. §§ 102 and 103 over U.S. Patent No. 5,680,394 (“Bingham”).

- Ground 2A: Claims 1, 3-6, 8-9, 11-16, 22-25, and 33-37 are unpatentable under 35 U.S.C. § 103 over U.S. Patent No. 9,531,491 (“Strobel”).
- Ground 2B: Claims 3, 15, and 16 Are Unpatentable Under 35 U.S.C. § 103 Over Strobel in View of Wei.
- Ground 2C: Claims 5, 6, 9–14, 35, and 36 Are Unpatentable Under 35 U.S.C. § 103 Over Strobel in View of Kuipers.
- Ground 2D: Claim 33 Is Unpatentable Under 35 U.S.C. § 103 Over Strobel in View of Kuipers and Wei.

65. The following table is a summary of the above grounds:

| Ground | Prior Art                 | Claims                               | Type       |
|--------|---------------------------|--------------------------------------|------------|
| 1      | Bingham                   | 1, 3-6, 34, and 37                   | §§102, 103 |
| 2A     | Strobel                   | 1-4, 11, 14-17, 19-20, 23, and 26-29 | §103       |
| 2B     | Strobel and Wei           | 3, 5, and 16                         | §103       |
| 2C     | Strobel and Kuipers       | 5, 6, 9-14, 35, 36                   | §103       |
| 2D     | Strobel, Wei, and Kuipers | 33                                   | §103       |

## VI. TECHNICAL BACKGROUND

66. The ’631 patent purports to describe an invention that mitigates errors in systems that use Time Division Duplex (TDD) transmission over copper physical

channels. The most common example of copper physical channels are the twisted pair telephone loops from the premises to the telephone exchange (or a remote exchange) and are the transmission media for Digital Subscriber Line (DSL) systems. However, the processes described in the '631 Patent to mitigate errors in TDD systems that are deployed over such copper physical channels were well established before the priority date of the patent and appeared in communication textbooks and literature. The patent is principally directed to a DSL system called 'G.fast,' which is based on TDD and was in the process of standardization by the ITU-T (International Telecommunication Union—Telecommunication Standardization Sector) at the time of the patent was filed. G.fast is designed to transmit over relatively short (<250 m) copper telephone loops and premises wiring using TDD. *See* Ex. 1001; Ex-1016.

67. As I illustrate later in this Declaration, TDD has been extensively used in digital communication systems and TDD use-case examples include digital cordless phones, such as DECT, wireless Bluetooth devices, IEEE802.11 WLAN (Wi-Fi) and cellular UMTS (3G)-TDD. In many of the above TDD systems, such as DECT, multiple users share the uplink and downlink time slots using TDD management techniques presented in the '631. Given that these techniques for management of TDD systems has been proven effective for the above wireless

systems, a POSITA would have recognized that these techniques are applicable to DSL communication networks.

68. This section describes how the telephone network evolved from a voice-band (~4KHz) network to a broadband (Megabit) network by incorporating DSL (Digital Subscriber Line) loop technology, then briefly describes the various generations of DSL technology and standards, and finally gives an overview of the G.fast standardized DSL technology that is relevant for discussion of the '631 Patent.

69. The overview I provide below discusses technical features and concepts that would have been known to a person of ordinary skill in the art prior to, and at the time of, the earliest alleged priority date of the '631 Patent. The technical concepts and features that I describe in this Technical Background section reflect the state of the art that a person of ordinary skill in the art would have had knowledge of and would have understood prior to and at the time of the alleged invention of the '631 Patent. I rely on, and incorporate as applicable (even if not expressly mentioned below in Sections X.A and X.B), the following disclosures to support my opinions in this Declaration, including those opinions relating to how the prior art discloses and/or suggests the challenged claims of the '631 Patent and how (and why) a person of ordinary skill in the art would have been motivated to consider and combine the disclosures and suggestions from one or more prior art references.

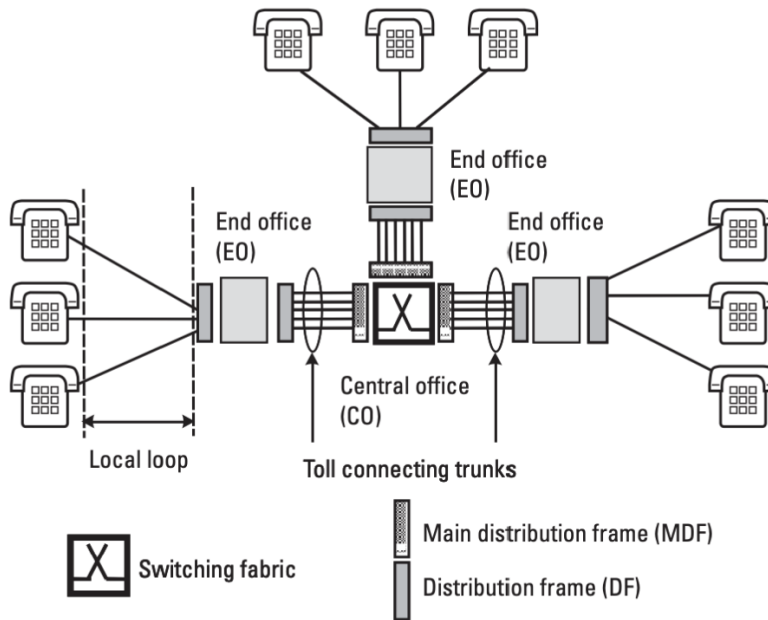
#### **A. Telephony System Architecture**

70. After the invention of the telephone in 1876, the telephone network was transformed from being a short distance point-to-point service to today's ubiquitous broadband network that enables almost instant high-speed, low-latency, and reliable communication over large distances. The beginning of this transformation was the development of local exchanges (central offices), physical "hubs" that terminate multiple subscriber lines. These are "nodes" of the public switched telephone network (PSTN), sometimes also called POTS (Plain Old Telephone Service). As well as enabling interconnection between all users of a particular exchange, the development of backbone trunk systems that linked various exchanges enabled first inter-urban, then international, connection.

71. The original backbone (toll connecting) trunks between central offices were made up of traditional telephony cables, but by the 1980's many of the trunks were replaced with optical fibers using high-speed digital transmission. However, the connections from end offices to customers *i.e.*, the subscriber lines leading to each end customer, remained traditional pairs of twisted copper wires. This section, often referred to as the "local loop" or the "last mile" of the telephony network is where DSL technology was been introduced to enable multi-megabits per second networking.

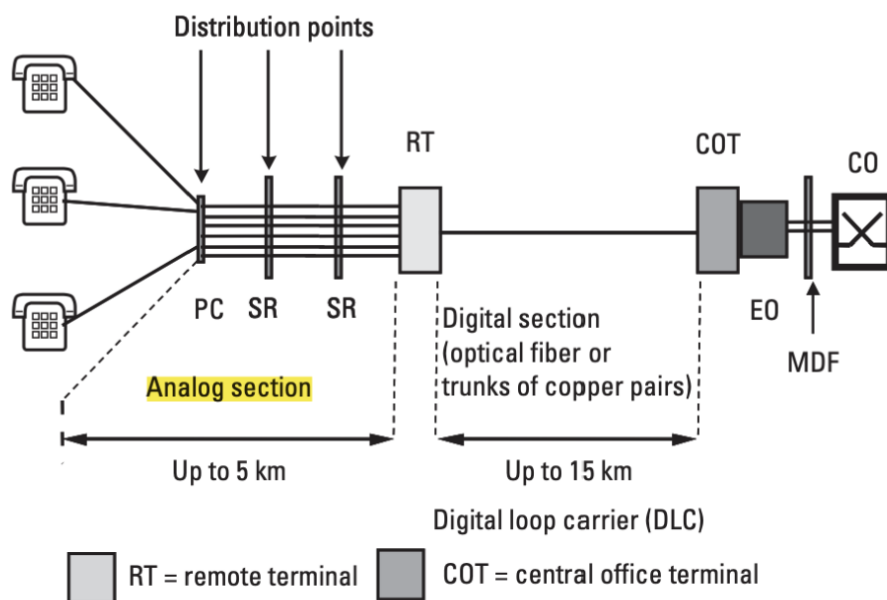
72. In general, the local loop could extend from the telephone company central office to the customer premises and the figure below shows the telephone

network architecture prior to DSL, where data service was provided via voice-band modems that operated within the same spectrum as voice calls.



Ex. 1020, Figure 2.7.

73. To improve the quality of connections, it was of interest to minimize the effective length of the local loop, i.e., decreasing the distance between the subscribers and an extension of the local exchange. For this reason, “remote terminals” (RTs) were introduced in the 1970’s, as shown in the figure below, where the local end office (EO) is connected to a RT via a high-speed link known as a digital loop carrier (DLC) that uses similar technology to the toll-connecting trunks described above. The “Analog section” highlighted in the figure refers the individual local loops from the premises to the RT.



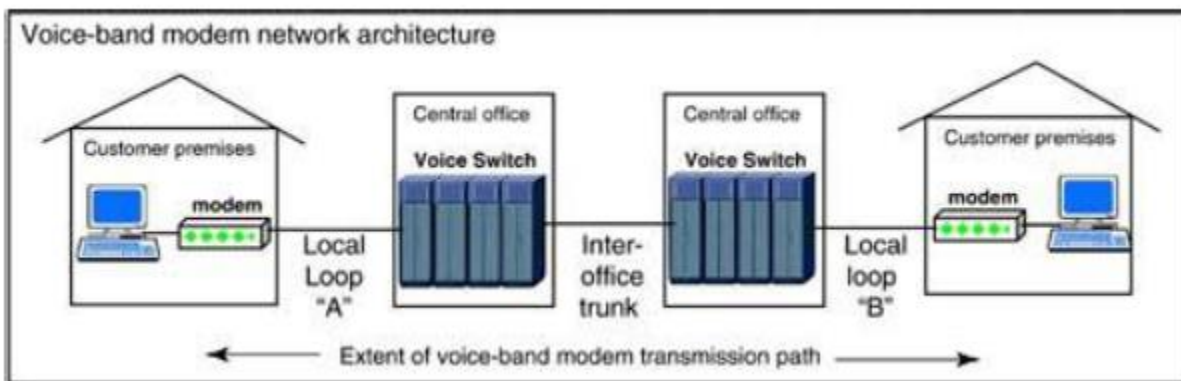
Ex. 1020 Figure 2.13 (emphasis added).

## B. Telecomm Network Evolution to DSL

74. The public switched telephone network (PSTN) was originally designed to carry voice signals, and the bandwidth of these signals was limited to the voice-band frequency range from approximately 200 Hz to 3.4 kHz. By the early 1980's, in the PSTN a voice, or data modem, signal was transmitted as an analog signal from the originating user to the local CO across a copper twisted pair (the local loop), where it is digitized by a codec ("coder/decoder"), following which it is transmitted as a digital signal over the trunk network to the CO serving the user at the other end. Here, it was converted from digital form back to analog by another codec, before being transmitted across the recipient's local loop to the recipient's telephone.

75. Voiceband data modems were introduced for the purpose of transmitting data across the PSTN using a spectrum that was designed to roughly resembled speech signals. Modem technology quickly developed in the 1970's and 1980's to provide higher bit rates up to 33.6 kbit/s, with various fallback options. In the late 1990s, pulse coded modulation (PCM) modems operating at 56 kbits/s were developed and standardized as ITU-T Recommendation V.90.

76. The figure below shows a block diagram of a typical voiceband end-to-end (non-PCM) modem communication link as it existed in the mid 1980's prior to the introduction of DSL.



Ex. 1021, Figure 1.3

### C. Integrated Services Digital Network (ISDN)

77. In 1986 AT&T developed technology to digitize the telephone network, including the local loop. *See* Ex. 1022. This effort included the development of the digital network known as the Integrated Services Digital Network (ISDN), which some consider the first digital subscriber line (DSL). Ex. 1021, Chapter 1. ISDN

provided voice, data, and video services over the telephone network. ISDN digitized the local loop and used a baseband transmission format capable of transmission speeds up to 160 kb/s of symmetric digital information.

#### **D. Digital Subscriber Line (DSL)**

78. As users (both residential and commercial) continued to demand ever-increasing bit rates, the local loop remained a bottleneck even with ISDN. However, network traffic was found to be asymmetric for many users. For example, web browsing (typical of home users) requires higher bit rates in the downstream direction (from the network to customer premises) than in the upstream direction (from the customer premises to the network). Business users often require more symmetric networking speeds for remote office connectivity, LAN-extension, file sharing, video-conferencing, etc.

79. Beginning in the late 1980s, user requirements for higher-speed service focused attention on the local-loop bottleneck, namely the need for local loop access transmission systems capable of providing transmission speeds on the order of megabits per second. DSL, which refers to a group of digital technologies that met this need, provides high-speed (i.e., megabit/sec) digital signal transmission over the existing twisted-wire pair analog local loop between each customer premises and its local central/end office. Through the central office, the user is connected directly to the existing broadband digital backbone network.

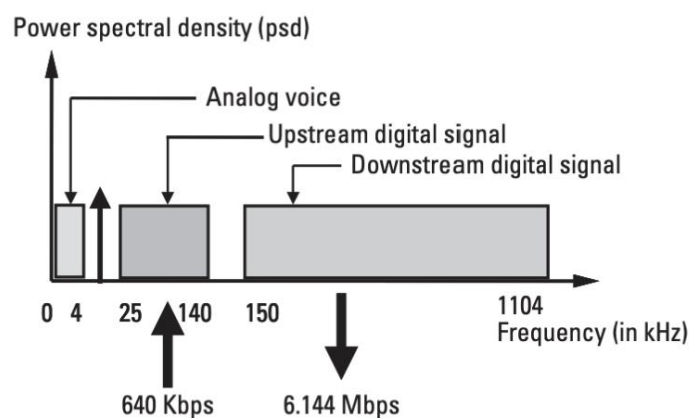
80. The twisted-wire pair used in the local loop was originally designed for voice analog signals and was loaded with inductive coils spaced regularly along the local loop to make the frequency response flat across the effective 4kHz voice band. This improved voice quality, but limited the bandwidth to 4 kHz. Loops shorter than 18Kft did not require loading coils and subsequent research demonstrated that these shorter loops supported high-speed megabit/sec data transmission.

81. To provide megabit per second data over twisted pair, AT&T Bell Labs and Bellcore research developed several foundational technologies that evolved into the DSL we recognize today. In 1986, I led an AT&T Bell Labs research team that created and developed the foundational technology of DSL and demonstrated megabit per second, full-duplex transmission over twisted pairs (Ex. 1023; Ex. 1024, Sections 1.6.2 and 2.7.2) was achievable. This breakthrough technology demonstrated reliable upstream and downstream transmission between an end user and a CO at the DS-1 rate of 1.544 Mb/s over a twisted pair on loops up to 18 kft in length, even in the presence of near-end and far-end (NEXT and FEXT respectively) crosstalk.

82. The underlying technology of DSL uses modulation of higher-frequency carrier waves above the 4KHz voiceband and corresponding technology at the receiver (generally, receiver processing is in reverse functional order from that of the transmitter). A DSL system has a transmitting modem at the premises and at

the end/central office (or equivalent network distribution point, such as a DSL Access Multiplexer-DSLAM) that modulates patterns of bits into signals for transmission to the receiving modem. Signals received at the far-end modem are demodulated to form a corresponding bit pattern that the modem passes on, in digital form, to its interfaced equipment, such as a computer, router, switch, etc.

83. When products were developed to support DSL, those products used frequency division multiplexing (FDM) to separate DSL data signals from standard POTS (voice or modem) services by using a different frequency band to provide a data-over-voice (in frequency) capability. As an example data was transmitted in a frequency band above the voiceband on ordinary telephone lines, as shown in the frequency plan in the figure below.



Ex. 1020 Figure 6.2.

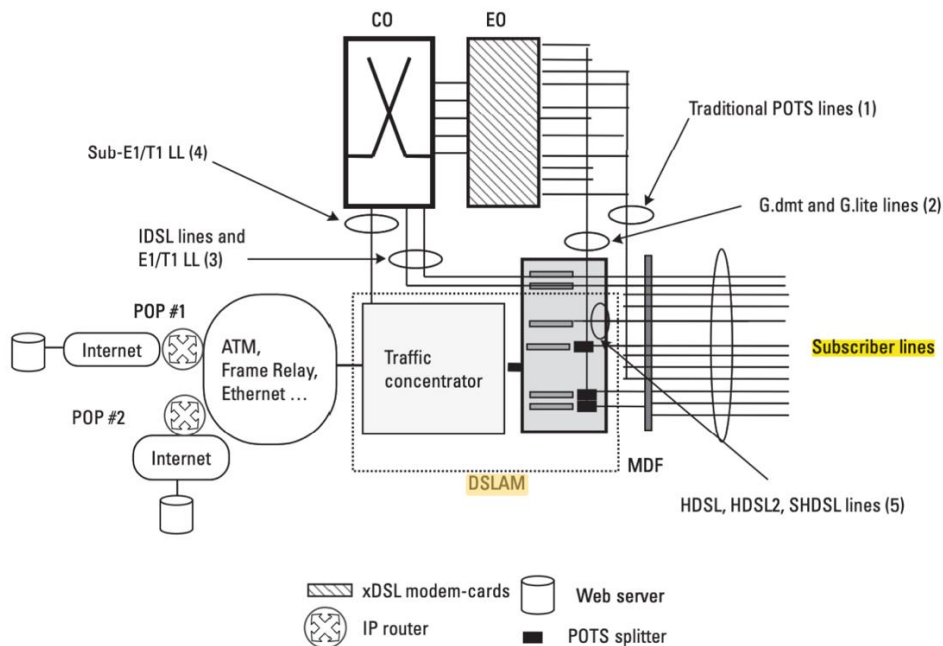
84. In the above figure the upstream and downstream data channels use FDM, and the downstream bandwidth is larger to accommodate the more typical

download use case. This model is called Asymmetric DSL (ADSL), developed by Joseph W. Lechleider of Bellcore. Ex. 1025, 779. This allowed Internet service providers to offer efficient service to consumers, who benefited from the ability to download large amounts of data but rarely needed to upload comparable amounts. ADSL was standardized in part by the T1E1.4 working group, a technical subcommittee of T1 – an ANSI accredited standards committee that developed telecommunications. Later in the 1990’s, John Cioffi proposed a highly adaptive modulation approach known as Discrete Multitone (DMT) that became widely used in many DSL systems. *See* Ex.1021.

#### **E. DSL Network Architecture**

85. A block diagram of a typical DSL system is shown below. A DSL modem is required at each end of the local loop (typically the customer premises and the telephone company CO or a DSL Access Multiplexer (DSLAM)). DSL service is provided by an “overlay” network that is not part of the normal switched telephone network. Consequently, the service provider Central/End Office (CO/EO) separates the DSL service from the voice (POTS) service and sends the voice service over the ordinary trunk network and the data carried by the DSL is sent over a separate data network (e.g., in the figure below ATM, Frame Relay, Ethernet). The CO/EO will generally provide DSL service to the user premises using a DSLAM, shown in the

figure below (highlights added), where the DSLAM contains many DSL modems serving multiple data customers.



Ex. 1020, Figure 8.1 (annotated).

## F. DSL Channel Impairments

86. Digital Subscriber Line (DSL) signals travel over twisted pairs of copper telephone lines, which are subject to various impairments that degrade signal quality and reduce achievable data rates. Ex. 1024. These impairments in DSL channels include:

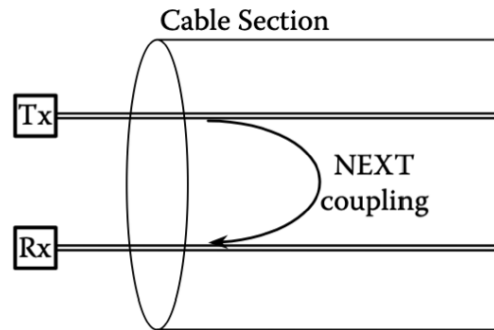
87. Linear Distortion: Attenuation (Signal Loss) and Phase Distortion: Attenuation is the gradual weakening of the signal as it travels over a distance. The longer the copper line, the more the signal is weakened. Phase distortion spreads a transmitted signal out over time and can create inter-symbol interference between

signals transmitted at different times. Higher frequencies attenuate more than lower frequencies, limiting data rates, especially over long distances. Attenuation generally increases linearly as a function of transmission length, and is mitigated by use of adaptive equalizers (either in the time or frequency domain, or in combination).

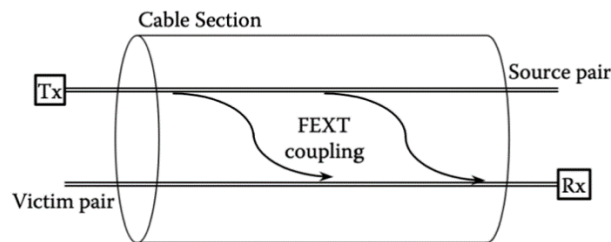
88. Thermal Noise: Thermal noise, often just referred to as noise, is caused by random motion of electrons along a copper pair or within the end-point modems. When the signal-to-noise ratio (SNR) is evaluated between the receiver modem and the data receiver, generally thermal noise has a much lower power compared to the power of the received signal. Noise is also characterized by very low-speed fluctuations and is often modeled as additive Gaussian noise with a variable power across the frequency band.

89. Crosstalk: Crosstalk from other DSL pairs has a substantial influence on the maximum data rate achievable for a DSL communication channel. Crosstalk refers to the leakage of a detectable signal from one communication channel (denoted as a “pair” in the figure below) into another channel. For DSL, crosstalk often occurs between twisted pairs in the same cable. Crosstalk becomes more prevalent for longer cables and for higher frequency signals. As shown in the figures below, there are two forms of crosstalk that affect the capacity of DSL systems, near-end crosstalk (NEXT) and far-end crosstalk (FEXT). NEXT is the coupling between

transmitters and receivers at the same end of a cable, and frequency separation between upstream and downstream bands reduces NEXT in ADSL systems.



90. While FEXT, or far-end crosstalk is crosstalk at the far end (i.e., receiver) of the cable pair arising from other transmitters (only one is shown in the figure below) than the one on the channel of interest and is illustrated below:



91. In many DSL systems, uplink and downlink transmission is over separate bandwidths (Frequency Division Duplexing—FDD) or over distinct timeslots for downstream and upstream (Time Division Duplexing—TDD). As we will see below, TDD is used in G.fast systems, which is discussed in the '631 patent, and which use a common frequency for upstream and downstream transmission. As

we show later in this Declaration, TDD-based DSL systems may be strongly adversely affected by NEXT.

### **G. DSL Standardization**

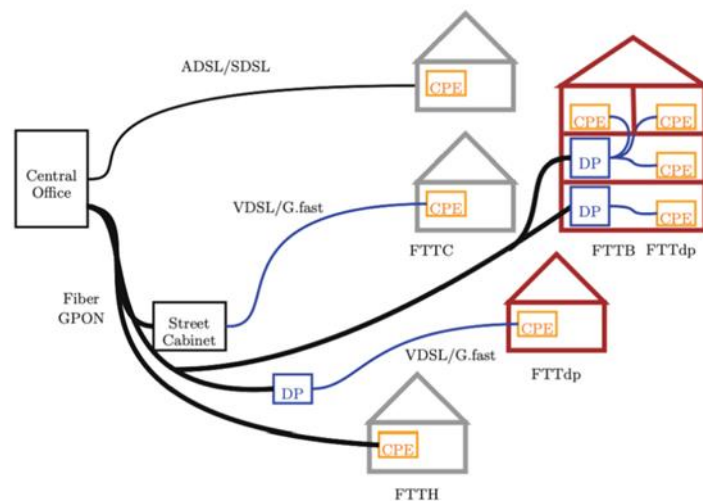
92. As DSL standards advanced, Discrete Multitone (DMT), became the dominant modulation method. Today, DSL includes the family of broad family of standards, often referred to as xDSL. The first generation of digital subscriber line technologies was based on ADSL (asynchronous digital subscriber line) and SDSL (synchronous digital subscriber line (i.e., the same capacity in uplink and downlink)) transmission technologies. They achieved data rates in the range of 10s of Mbits/s and support a twisted pair line length of several kilometers. ADSL and SDSL are served from a central office or a DSLAM (i.e., a network node that supplies several thousand subscribers).

### **H. VDSL2**

93. To further improve data rates and service quality, new network nodes, the street cabinets, and a new transmission technology, VDSL2 (very high speed digital subscriber line 2), were introduced. VDSL2 service achieves 100 Mbit/s data rate and works on loops shorter than 1000 m. A fiber connection is used to connect the street cabinets, referred to as DP [Distribution Points that replace the DSLAMs], with the central office. The street cabinets serve several hundred subscribers and this network topology is often called fiber to the curb (FTTC). With the introduction of

FEXT crosstalk cancelation for VDSL2, 100 Mbit/s services achieve much longer reach.

94. The successive generations of xDSL are shown in the figure below which also depicts a future generation network topology with fiber to the home (FTTH). The different access technologies coexist with each other. This is mainly implemented by a spectral separation of the services. As discussed below, G.fast uses a wider spectrum than VDSL and uses TDD, described below, to separate upstream and downstream data.



Ex. 1026, Fig 1.1.

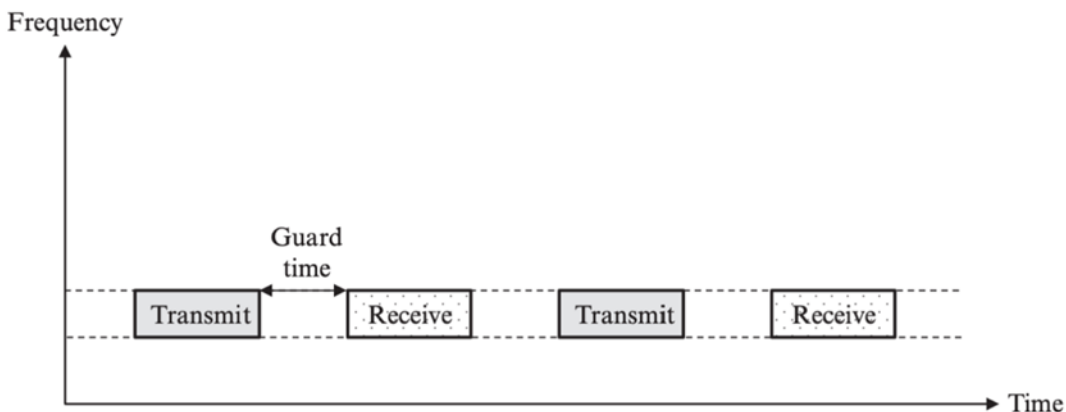
### **I. Time Division Duplexing (TDD)**

95. In time-division duplexing (TDD), time rather than frequency is used to separate the transmission and reception of the signals, and thus a single frequency is assigned to a user for both uplink and downlink. Time-Division Duplexing (TDD) has been extensively used in wireless digital communication systems and TDD

examples include digital cordless phones, such as DECT, wireless Bluetooth devices, IEEE802.11 WLAN (Wi-Fi) and cellular UMTS (3G)-TDD. Some 4G mobile systems, such as IEEE802.16 WiMAX and LTE, can employ both FDD and TDD. In many of the above TDD systems, such as DECT, multiple users share the uplink and downlink time slots using a variety of multiple access methods including TDMA (Time-Division Multiple Access). Ex. 1015, section 11.2.

96. As shown in the figure below, in each TDD frame each user is generally assigned at least two time slots, one for upstream (transmission) and one for downstream (reception), with a short data burst in each direction, as shown in the figure below, where a guard time between transmit and receive streams is sometimes required. The guard time is intended for a time allowance for the round-trip propagation delay (i.e., the time that it takes the signal to travel the geographical distance between the transmitter and receiver and back). This time interval must be sufficiently long so the transmit and receive signals do not clash. TDD is generally employed where the distance between the transmitter and receiver is small; otherwise, the channel efficiency drops as the time guard then needs to be rather long. TDD can adaptively increase the number of time slots in favor of one direction over the other and easily adapts to match asymmetric downlink and uplink traffic, by dividing up the time frame slots in proportion to the respective downlink and uplink traffic. These properties of TDD makes G.fast very attractive for use in DSL

systems that require high bits, short distances, and have varying uplink and downlink bit rate requirements.



Ex. 1015, Fig. 11.3b.

97. These properties of TDD makes G.fast very attractive in systems that require high bits, short distances, and have varying uplink and downlink bit rate requirements.

#### **J. G.fast**

98. G.fast, also known as G.9701, is a DSL specification standardized and is used in this document to discuss the validity of the '631 Patent's claims. Note that *fast* is a recursive acronym for *fast access to subscriber terminals*. G.fast targets speeds ranging between 100 Mbit/s and 1 Gbit/s, depending on loop length, with real-world speeds of up to 300 Mb/s. Although G.fast is similar in physical layer functionality to prior DSL standards, such as VDSL2, as noted above, G.fast is a fundamentally very different technology from VDSL2 and most other DSL systems, since it uses Time Division Duplex (TDD) to support upstream and downstream data

transfer, rather than Frequency Division Duplex (FDD). Each time slot in a frame carries either uplink or downlink data. G.fast must synchronize and maintain the times in which they transfer data, generally requiring the frames and time slots in each line be synchronized, referred to in the standard as STTD (Synchronized TDD), which means that TDD frames are synchronized, so that no time overlap occurs between downstream transmission on any line and upstream transmission on any other line. Ex. 1016, p.28.

## **VII. OVERVIEW OF THE '631 PATENT**

### **A. Prosecution History**

99. The '631 Patent stems from an International PCT Application (PCT/US2012/060115) filed on October 12, 2012. That PCT application claims priority to July 27, 2012, the date U.S. Provisional Application No. 61/767,862 was filed. *See* Ex-1001 at 1.

100. The Examiner issued an office action on January 26, 2016, requiring applicant to make an election to proceed with the prosecution of initially drafted claims 1-39 or claim 40. *See* Ex-1002 at 258. In its office action, the Examiner noted that claims 1-39 have “separate utility such as *different time slot different channels*” while claim 40 has “a separate utility such as *same time slots same channels*.” *Id.* at 258 (italics in original). In response, applicant elected to prosecute claims 1-39. *See id.* at 272.

101. On November 23, 2016, the Examiner issued a non-final office action rejecting all of claims as unpatentable under 35 U.S.C. § 103(a) in view of Williams et al. (U.S. Appl. Publ. No. 20140003307) in further view of Cioffi (U.S. Patent No. 5,887,032). *Id.* at 357-58.

2. Claims 1-39 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Williams et al. (Pub. No. US 20140003307) further in view of Cioffi (Patent No. 5,887,032).

Regarding claims 1, 34, and 37, Williams teaches a method in a data communications system for managing multiple time division physical channels, the method comprising scheduling upstream time slots for upstream transmission in a physical channel [Para. 17, 18, Claim 1, 2, 11]; and scheduling downstream time slots for downstream transmission in a physical channel, wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots [Para. 17, 18, Claim 1, 2, and 11].

However, Williams doesn't explicitly teach about a first and second physical channels that are subjected to crosstalk.

Cioffi teaches first physical channel (line) for downstream and second physical channel for upstream that are subjected to crosstalk [fig. 6 and related description].

It would have been obvious to one of ordinary skill in the art, at the time of this invention was made, to modify Williams to schedule transmission for first and second physical channel subjected to crosstalk, feature as taught by Cioffi; because the modification enable system removes crosstalk interference from received signals on a given line by adaptively estimating the crosstalk interference induced by certain other of the lines having interfering transmissions.

102. In rendering its rejection, the Examiner noted that Williams “teaches a method in a data communications system for managing multiple time division channels, the method comprising scheduling upstream time slots for upstream transmission in a physical channel . . . and scheduling downstream time slots for downstream transmission in a physical channel,” where the two transmissions are substantially not simultaneous with one another. *Id.* at 358.

103. The Examiner further stated that although “Williams doesn’t explicitly teach about a first and second physical channels that are subjected to crosstalk,” but Cioffi teaches a “first physical channel . . . for downstream and [a] second physical channel for upstream that are subjected to crosstalk.” *Id.*

104. The Examiner found that combining Williams with Cioffi would have been obvious to a POSITA, at the time of the invention, because the “modification enable (*sic*) system removes crosstalk interference form received signals on a given

line by adaptively estimating the crosstalk interference induced by certain other of the lines having interfering transmissions.” *Id.* at 358-59.

105. In response, applicant amended claims 1, 3, 6, 9, 11, 14, 20, and 30. *See id.* at 382-85.

## LISTING OF CLAIMS

1. **(Currently Amended)** A method in a data communications system for managing multiple time division physical channels that are subject to crosstalk, the method comprising:  
scheduling upstream time slots for upstream transmission in a first physical channel; and  
scheduling downstream time slots for downstream transmission in a second physical channel, wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.
2. (Previously Presented) The method of Claim 1, wherein scheduling downstream time slots comprises allowing some simultaneous transmission in the upstream and downstream time slots, the method further comprising cancelling near-end crosstalk (NEXT) from downstream into upstream transmission at a network end of the channels.
3. **(Currently Amended)** The method of Claim 1, wherein the upstream and downstream time slots have an active portion during which signals are transmitted and an off portion during which no signals are transmitted, and wherein the active portions of the upstream time slots are substantially not simultaneous with the active portions of the downstream time slots.
4. (Previously Presented) The method of Claim 1, wherein scheduling upstream and downstream time slots comprises scheduling upstream and downstream time slot boundaries.
5. (Previously Presented) The method of Claim 4, wherein the time slot boundaries are flexible.
6. **(Currently Amended)** The method of Claim 5, wherein the time slot boundaries have one or more of: variable-length frames; variable upstream time slot lengths; ~~[[and]]~~or variable downstream time slot- lengths.
7. (Previously Presented) The method of Claim 1, further comprising assigning time slots to a network element based on the scheduling and transmitting the assignments from a management system to a network element.

106. In addition to amended specified claims, applicant argued that the Examiner failed to provide any reasonable rationale, or a clear articulation, as to why the claimed features would have been obvious. *See id.* at 389. Applicant asserted that Williams over Cioffi did not render obvious the proposed claim because, in Williams, “there are no separate physical channels for downstream and upstream; instead “both upstream and downstream transmission is on the same channel which is time multiplexed by [switches].” *Id.*, 390.

While the above list is not an exclusive list, the MPEP requires that some rationale be provided in order to support a conclusion of obviousness.

Here, not only has the Office Action failed to present one or more of the above-listed rationales, the Office Action has failed to present **any** type of reasonable rationale. Specifically, the Office Action lacks a **clear articulation** of the reasons why these features would allegedly have been obvious. As such, the rejection cannot be supported per the requirements set forth by the United States Supreme Court in the *KSR* decision.

The Office Action merely appends a citation to the end of each paragraph of the claims with no reasoning or association with the claimed features. As such, Applicants cannot reasonably determine which “element” of the claim is believed to correspond with which section, figure or feature cited in the rejection. In other words, Applicants are not put on any reasonable notice as to the rationale behind the rejection and cannot adequately determine whether such basis is proper.

Further, failure to specifically identify which features of Williams and Cioffi are believed to disclose each element of the claims likely renders the Office Action “arbitrary and capricious”, and therefore invalid, under the Administrative Procedure Act (5 U.S.C. § 706), a standard to which all Actions by the USPTO must adhere (see *Dickenson v. Zurko*, 527 U.S. 150 (1999)). Without proper guidance as to which “element” of the claim is believed to correspond with which section cited in the rejection, Applicants are forced to guess which features in the cited art the Examiner believed to disclose each of the claimed features.

Thus, it is respectfully submitted that the rejection is improper and must be withdrawn. Further, because the Office Action failed to establish a *prima facie* case of obviousness, any rejection in a subsequent Office Action providing adequate reasoning(s) would be presented for the first time on the record, and, as such, a subsequent Office Action cannot be made final.

Despite the above deficiencies in the Office Action, Applicants also contend that Williams teaches away from having a first physical channel for downstream and a second physical channel for upstream that are subjected to crosstalk. For example, Williams states in

paragraph [0008] that “SW1, SW2, SW3 to prevent or ameliorate interference ingresses, i.e., one or more of the switches SW0, SW1, SW2, SW3 may be controllably closed to prevent interference from a corresponding portion of the system 10, and oscillation in the case of amplifiers” which strongly suggests that the channel used in Williams is not subject to crosstalk.

Further, there are no separate physical channels for downstream and upstream in Williams. Instead, both upstream and downstream transmission is on the same channel which is time multiplexed by the switches SW0, SW1, SW2, SW3. This deficiency is not cured by Cioffi.

107. Next addressing Cioffi, the Applicant asserted that “Cioffi does not disclose having separate channels for upstream and downstream.” *Id.* Rather, the Applicant explained that the lines in Cioffi “appear to be bi-directional” and thus there was no “need for having separate channels for upstream and downstream.” *Id.*

108. Applicant reasoned that the combination of the two would not render the claims obvious in view of the fact that the purpose of the disclosed switches in Williams would be rendered “meaningless” and alter Williams’ principle of operation. *See id.* at 389-91.

Cioffi allegedly discloses a data transmission system that mitigates crosstalk interference by adaptively estimating the crosstalk from received signals on a given line by adaptively estimating the crosstalk interference induced by certain other of the lines having interfering transmission and by cancelling the crosstalk interference using the estimated crosstalk interference from the certain other of the lines. Cioffi “Summary of the Invention.” However, Cioffi does not disclose having separate channels for upstream and downstream. Instead, the alleged lines Cioffi appear to be bi-directional. Therefore, Cioffi does not have the need for having separate channels for upstream and downstream. As such, Cioffi and Williams together or alone do not disclose a method in a data communications system for managing multiple time division physical channels that are subject to crosstalk, the method comprising: scheduling upstream time slots for upstream transmission in a first physical channel; and scheduling downstream time slots for downstream transmission in a second physical channel, wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.

Additionally, since both upstream and downstream transmission in Williams are on the same channel which is time multiplexed by the switches SW0, SW1, SW2, SW3, it means any combination of a reference that teaches separate physical channels for downstream and upstream will change the principle of operation of Williams because the purpose of the switches will be meaningless.

109. On May 30, 2017, the Examiner withdrew the previous rejection that relied on the combination of Williams and Cioffi, and issued a new non-final office action rejecting all claims as unpatentable under 35 U.S.C. § 103(a) in view of Williams and further in view of Liu et al (U.S. Pat. No. 6,754,261). *See id.* at 410. Examiner’s grounds for rejection echoed those originally made in the first non-final office action, except the Examiner relied upon Liu’s teaching of a using a first and second physical channel for downstream and upstream where the downstream and

upstream occupy different physical communication links, respectively, to modify Williams to schedule transmission on the separate channels. *See id.* at 412.

3. Claims 1-39 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Williams et al. (Pub. No. US 20140003307) further in view of Liu et al. (Patent No. US 6754261).

Regarding claims 1, 34, and 37, Williams teaches a method in a data communications system for managing multiple time division physical channels, the method comprising scheduling upstream time slots for upstream transmission in a physical channel [Claim 1, 2, 11, Para. 17, 18]; and scheduling downstream time slots for downstream transmission in a physical channel, wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots [Claim 1, 2, and 11, Para. 17, 18].

Williams teaches that the present invention could be configured for use with any coaxial line, however, Williams doesn't explicitly teach having a first physical channel for upstream and second physical channel for downstream transmission.

Liu teaches having first physical channel for downstream and second physical channel for upstream that are subjected to crosstalk [Col. 1 line 51-61, Col. 2 lines 45-50, fig. 1].

It would have been obvious to one of ordinary skill in the art, at the time of this invention was made, to modify Williams to schedule transmission for first and second physical channel, feature as taught by Liu; because the modification enable system equalize time-domain in communication channel to reduce signal distortion.

110. Specifically, Liu discloses that “[t]he upstream channel and the downstream channel may share the same physical communication link or occupy different physical communication links.” Ex. 1011, 1:52-55.

111. In response, applicant distinguished the modification of Williams and Liu, again noting that Williams discloses that the upstream and downstream transmissions occur on the same channel, and accordingly, combining Williams with a reference teaching separate physical channels for downstream and upstream transmissions (e.g., Liu), would render the discloses switches in Williams “meaningless.” *Id.* at 452-53.

112. Applicant made three arguments. First, the Applicant asserted that because Williams disclosed multiplexing done by switches “any combination of a

reference that teaches separate physical channels for downstream and upstream will change the principle of operation of Williams.” Ex-1002 at 452. Second, the Applicant acknowledged that although Liu does mention that “[t]he upstream channel and the downstream channel may share the same physical communication link or occupy different physical communication links,” this was inapplicable because Liu was in a different field of endeavor. *Id.*, 453. And third, the Applicant reasoned that “there is no place in Liu to explicitly disclose or suggest scheduling upstream transmission for first and downstream transmission for second physical channel to reduce signal distortion.” *Id.*

113. Additionally, applicant argued that Liu is not in the same field of endeavor as the claimed invention concerning managing time division duplex transmissions over copper physical channels because Liu “is focused on determining sampling time for a time-domain equalizer divides an over-sampled sequence into a plurality of individual Nyquist rate sequences.” *Id.* at 453.

The Examiner rejected claims 1-39 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Publication No. 2014/0003307 to Williams *et al.* (hereinafter, “Williams”) in view of U.S. Patent No. 6,574,261 to Liu *et al.* (hereinafter, “Liu”). Applicant respectfully disagrees.

Claim 1 states (*emphasis added*):

“A method in a data communications system for managing multiple time division physical channels that are subject to crosstalk, the method comprising:

**scheduling upstream time slots for upstream transmission in a first physical channel;** and

**scheduling downstream time slots for downstream transmission in a second physical channel,** wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.”

In the Office Action, the Examiner notes on page 3 that

*“Williams teaches that the present invention could be configured for use with any coaxial line, however, Williams doesn't explicitly teach having a first physical channel for upstream and second physical channel for downstream transmission.*

*Liu teaches having first physical channel for downstream and second physical channel for upstream that are subjected to crosstalk [Col. 1 line 51-61, Col. 2 lines 45-50, fig. 1].*

*It would have been obvious to one of ordinary skill in the art, at the time of this invention was made, to modify Williams to schedule transmission for first and second physical channel, feature as taught by Liu; because the modification enable system equalize time-domain in communication channel to reduce signal distortion.”*

Applicant respectfully asserts that there is no rational to modify Williams with teaching of Liu.

First, Applicant respectfully points out that in Williams' disclosure, the upstream transmission and downstream transmission are on the same channel which is time multiplexed by the switches SW0, SW1, SW2, SW3. Therefore, any combination of a reference that teaches separate physical channels for downstream and upstream will change the principle of operation of Williams because the purpose of the switches will be meaningless. MPEP § 2143.01(V) states “If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is **no suggestion or motivation** to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)” (*emphasis added*).

Second, Liu's disclosure is focused on determining sampling time for a time-domain equalizer divides an over-sampled sequence into a plurality of individual Nyquist rate sequences (abstract, and summary of invention). While on the other hand, the current patent application is related to managing time division duplex transmission over copper physical channels. Although Liu only mentioned briefly and once in background section that "*The upstream channel and the downstream channel may share the same physical communication link or occupy different physical communication links*", Liu is not at the same field of endeavor as the claimed invention, nor reasonably pertinent to the problem faced by the inventor. MEPE § 2141.01 states that "*In order for a reference to be proper for use in an obviousness rejection under 35 U.S.C. 103 , the reference must be analogous art to the claimed invention..... a reference is analogous art to the claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention).*" (emphasis added)

Third, the Examiner states that "*It would have been obvious to one of ordinary skill in the art, at the time of this invention was made, to modify Williams to schedule transmission for first and second physical channel, feature as taught by Liu; because the modification enable system equalize time-domain in communication channel to reduce signal distortion*". However, there is no place in Liu to explicitly disclose or suggest scheduling upstream transmission for first and downstream transmission for second physical channel to reduce signal distortion. Therefore, the combining reason stated by the Examiner is not supported or suggested.

Therefore, based on at least the above remarks, Applicant respectfully asserts that claim 1 is patentable over Williams in view of Liu.

114. On December 15, 2017, the Examiner issued a notice of allowance, withdrawing his rejections of claims 1-39. *See id.* at 471.

115. The Examiner stated that the rejections were withdrawn because "Applicant's arguments filed 8/29/2017 have been fully considered and are persuasive." *See id.* at 471. Therefore, as I explain further below, it is my opinion

that the only reason the claims were allowed was because the Applicant disclaimed claim scope as to the meaning of “physical channel.” Specifically, Applicant disclaimed that the physical channel of the ’631 patent can ever be bidirectional by overcoming Cioffi (which disclosed bidirectional lines in a TDD system) and then confirming that even though Liu disclosed using unidirectional physical channels for upstream and downstream, modifying Williams as such would not work.

#### DETAILED ACTION

##### *Response to Arguments*

1. Applicant’s arguments filed on 8/29/2017 have been fully considered and are persuasive. The rejection of claim 1-20 has been withdrawn.

#### EXAMINER’S AMENDMENT

2. An examiner’s amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner’s amendment was given in a telephone interview with Dai Xin on 12/6/2017.

The application has been amended as follows:

- Claim 40 is cancelled.

#### **B. Priority Date**

116. U.S. Patent No. 9,954,631 to Kerpez et al. (the “’631 Patent) (Ex-1001) issued on April 24, 2018 and claims priority to a PCT application filed on October

12, 2012. Ex-1001 at 1. The '631 Patent further claims priority to U.S. Provisional Application No. 61/676,832 filed on July 27, 2012. *Id.*

### **C. The '631 Patent's Specification**

117. The '631 patent explains that known communication systems includes “TDD (Time Division Duplex) systems [that] transmit downstream (network to subscriber) data and upstream (subscriber to network) data in distinct time slots of the same physical channel” and that “there is often a small guard-time between distinct time slots to ensure that data does not overlap.” Ex-1001, 1:24-29. It then explains that one “new TDD system is called ‘G.fast,’ which is currently in the process of standardization.” *Id.*, 1:29-30.

118. The '631 patent continues by explaining that “[i]n many TDD systems, there are multiple physical channels,” and “[i]f these channels are close together in location and overlap in frequency, then they may interfere with each other.” *Id.*, 2:1-4. The '631 patent refers to Figure 3 to demonstrate this interference caused by two physical channels:

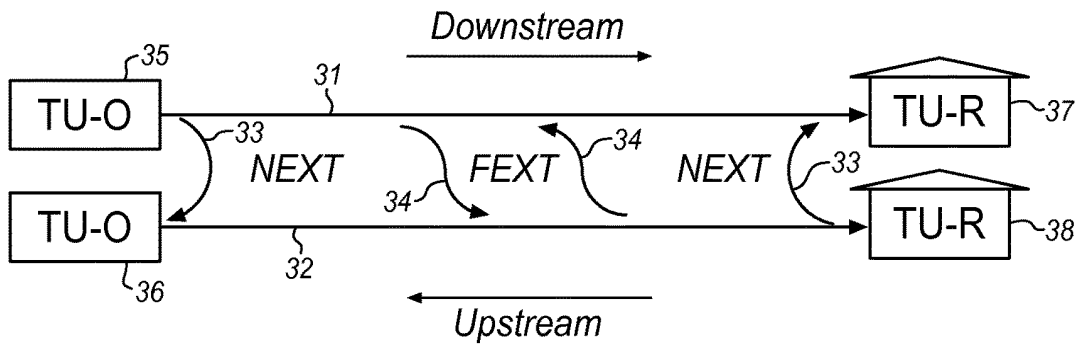


**FIG. 3**

*Id.*, Fig. 3.

119. The '631 Patent discusses a method for managing multiple physical channels in a data communication system that are subject to crosstalk, where the disclosed method includes scheduling time slot allocations for the physical channels. Ex-1001 at 2:30-35.

120. The '631 Patent's process determines time slot allocations for the physical channels connected to a data communications system to assign upstream and downstream time slots along the channel to ensure upstream and downstream transmissions are not simultaneous. *Id.* at 2:40-44.

121. The '631 Patent states that the data communications system invokes a management system for systems utilizing multiple physical channels, where time-division duplexing (TDD) is invoked, allowing for the assessment of service levels, traffic, power and additional requirements, to then determine how and when to

assign time slots and inactive time slots to reach optimal performance while minimizing traffic delays and power usage. *See id.* at 3:22-30.

122. Figure 5 (reproduced below) is an exemplary depiction of the arrangement of active and inactive time slots, as well as scheduled upstream and downstream time slots across related channels:

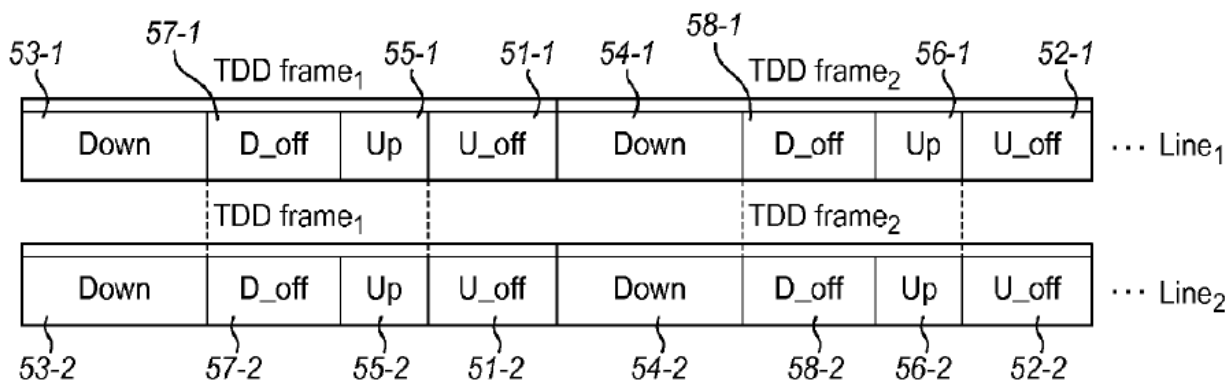


**FIG. 5**

*See* Ex-1001 at Fig. 5. The time slots shown in Figure 5 need not be aligned, although doing so avoids transmitting upstream and downstream at the same time on any single line. *See id.* at 4:4-7. The '631 patent explains that [i]deally, no two lines that have significant crosstalk coupling into each other can transmit upstream and downstream at the same time,” but it does contemplate a certain amount of flexibility that would be required when dealing with a significant number of lines. *Id.*, 5:64-66.

123. The '631 Patent further states that the time slots and frame times can vary in length and time for optimization and decreased strain on the system. *See id.* at 4:10-11, 9:57-61, and 17:3-6.

## VIII. CLAIM CONSTRUCTION

124. Generally, based on my review of the '631 Patent and its file history, a POSITA would have understood the claim terms in light of the specification, and interpreted them by using their plain and ordinary meaning in accordance with the then current state of the art. I address two limitations below.

### A. “Means for” Limitations

125. Notwithstanding the above, Claim 37 of the '631 patent recites several “means” limitations, and I understand that these claim terms are to be interpreted to include the corresponding structure described in the specification. I have listed these limitations in the table below with citations to the relevant description of the structure in the specification of the '631 patent.

| Claim Term                                                                                       | Citation to Specification                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| “means for scheduling upstream time slots for upstream transmission in a first physical channel” | Structure includes a TDD management system, which “includes a memory 1295 coupled directly or through a bus to a processor or processors 1296. The memory may be a hard drive, non-volatile memory, solid state memory, |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>or a combination of different memory types for different purposes. The processor may also include its own internal memory. The memory may, for example, store instructions to be executed and the processor may execute the stored instructions. The processor may also implement or execute implementing logic 1260 having logic to implement the methodologies discussed herein. System 1200 includes one or more communications buses 1215 to connect the various illustrated components and to transfer transactions, instructions, requests, and data within the system among the components and other peripheral devices. The system further includes a management interface 1225 coupled to the bus and to external management devices, for example, to receive requests, return responses, and otherwise interface with network elements located separately from the system. This information may include Operations</p> |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>Support System (OSS) data and Management Information Database (MIB) parameters. These network elements may include access nodes, a central office, vectoring units, crossboxes, TU-Rs, and TU-Os. The system further includes a LAN (Local Area Network) interface 1230 coupled to the bus and externally to communicate information via a LAN based connection, including collecting network information, reporting information and diagnostics to other entities within the network, and for initiating instructions and commands over the network. The system further includes a WAN (Wide Area Network) interface 1235 coupled to the bus and to an external WAN, to communicate information via a WAN based connection for similar purposes and to reach other more remote devices.” ’631 patent at 14:47-15:13.</p> |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>Structure includes a scheduling or analysis module of a management device, which “is coupled to the bus [and] includes a collection module 1270, analysis module 1275, diagnostics module 1280, and implementation module 1285. Management Device 1201 may be installed and configured in a compatible system 1200 as is depicted by FIG. 12A, or provided separately so as to operate in conjunction with appropriate implementing logic 1260 or other software.” Id. at 15:45-51. “The modules of the management device 1201 may be provided as separate components coupled to the bus 1215 as shown or may be incorporated into the processor or memory or another component. The management device may include its own processing and memory resources that interact with the processor and the external interfaces. The management device may include more or fewer modules than those shown. The TDD</p> |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                | <p>management system of FIG. 12 is provided only as an example and may be modified to suit different implementations. It may also be incorporated into another component such as an access node, or a TU-O. In one embodiment, the management system is provided as a card in a system rack with a backplane interface to communicate with local and remote network elements.” Id. at 16:6-19.</p>                                                                                                     |
| <p>“means for scheduling downstream time slots for downstream transmission in a second physical channel subject to crosstalk from the upstream time slots”</p> | <p>Structure includes a TDD management system, which “includes a memory 1295 coupled directly or through a bus to a processor or processors 1296. The memory may be a hard drive, non-volatile memory, solid state memory, or a combination of different memory types for different purposes. The processor may also include its own internal memory. The memory may, for example, store instructions to be executed and the processor may execute the stored instructions. The processor may also</p> |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>implement or execute implementing logic 1260 having logic to implement the methodologies discussed herein. System 1200 includes one or more communications buses 1215 to connect the various illustrated components and to transfer transactions, instructions, requests, and data within the system among the components and other peripheral devices. The system further includes a management interface 1225 coupled to the bus and to external management devices, for example, to receive requests, return responses, and otherwise interface with network elements located separately from the system. This information may include Operations Support System (OSS) data and Management Information Database (MIB) parameters. These network elements may include access nodes, a central office, vectoring units, crossboxes, TU-Rs, and TU-Os. The system further includes a LAN (Local Area Network) interface 1230</p> |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>coupled to the bus and externally to communicate information via a LAN based connection, including collecting network information, reporting information and diagnostics to other entities within the network, and for initiating instructions and commands over the network. The system further includes a WAN (Wide Area Network) interface 1235 coupled to the bus and to an external WAN, to communicate information via a WAN based connection for similar purposes and to reach other more remote devices.” ’631 patent at 14:47-15:13.</p> <p>Structure includes a scheduling or analysis module of a management device, which “is coupled to the bus [and] includes a collection module 1270, analysis module 1275, diagnostics module 1280, and implementation module 1285. Management Device 1201 may be</p> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

installed and configured in a compatible system 1200 as is depicted by FIG. 12A, or provided separately so as to operate in conjunction with appropriate implementing logic 1260 or other software.” Id. at 15:45-51. “The modules of the management device 1201 may be provided as separate components coupled to the bus 1215 as shown or may be incorporated into the processor or memory or another component. The management device may include its own processing and memory resources that interact with the processor and the external interfaces. The management device may include more or fewer modules than those shown. The TDD management system of FIG. 12 is provided only as an example and may be modified to suit different implementations. It may also be incorporated into another component such as an access node, or a TU-O. In one embodiment, the management system is provided as a card in a

|  |                                                                                                                |
|--|----------------------------------------------------------------------------------------------------------------|
|  | system rack with a backplane interface to communicate with local and remote network elements.” Id. at 16:6-19. |
|--|----------------------------------------------------------------------------------------------------------------|

126. The ’631 patent specification includes a limited description of the structure performing the functionality of the recited “means” limitations as noted above, but the detailed discussion in the Opinions section of this Declaration (*infra*, Section X), demonstrates that the prior art discloses at least the same structure and level of detail as the ’631 patent specification for performing the functions recited in independent claim 1.

### **B. Physical channel**

127. With respect to the term “physical channel,” for the reasons I explained with respect to the prosecution history, a POSITA would have understood that the scope of the term was disclaimed to exclude physical channels that are bidirectional.

128. I have been informed that Prosecution disclaimer “preclud[es] patentees from recapturing through claim interpretation specific meanings disclaimed during prosecution.” *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1323 (Fed. Cir. 2003). “Thus, when the patentee unequivocally and unambiguously disavows a certain meaning to obtain a patent, the doctrine of prosecution history disclaimer narrows the meaning of the claim consistent with the scope of the claim

surrendered.” *Biogen Idec, Inc. v. GlaxoSmithKline LLC*, 713 F.3d 1090, 1095 (Fed. Cir. 2013).

129. The Applicant first overcame the Cioffi reference by asserting that “Cioffi does not disclose having separate channels for upstream and downstream” and that the lines “appear to be bi-directional.” Ex-1002 at 390.

130. Reviewing Cioffi, Cioffi discloses synchronizing “wires that share a binder” using time division duplexing “such that downstream communications are not transmitted at times that overlap with the transmission of upstream communications.” Ex-1010 at 2:28-35.

131. Cioffi also discloses the below:

Another promising proposed VDSL/FTTC modulation scheme uses periodic synchronized upstream and downstream communication periods are provided that do not overlap with one another. That is, the upstream and downstream communication periods for all of the wires that share a binder are synchronized. With this arrangement, all the very high speed transmissions within the same binder are synchronized and time division duplexed such that downstream communications are not transmitted at times that overlap with the transmission of upstream communications. This is also referred to as a "ping pong" based data transmission scheme. Quiet periods, during which no data is transmitted in either direction, separate the upstream and downstream communication periods....When the synchronized time division duplexed approach is used with DMT it is referred to as synchronized DMT (SDMT).

Ex. 1010 at 2:25-52.

132. Applicant's statements in view of Cioffi therefore means that the twisted pair wires of Cioffi did not meet the limitation because they allowed both upstream and downstream communications on a single wire.

133. In response to this argument, the Examiner provided an additional reference (Liu) that filled this gap, disclosing that the "upstream channel and the downstream channel may . . . occupy different physical communication links." Ex-1002, 411-412; Ex-1011, 1:52-55. The fact that the Examiner reached for this reference would have informed a POSITA of the scope of the disclaimer, namely that bidirectional physical channels was disclaimed.

134. The Applicants overcame this reference by acknowledging that Liu did indeed teach upstream and downstream on different channels (not on the same channel) but that a "combination of a reference that teaches separate physical channels for downstream and upstream will change the principle of operation of Williams." Id., 452. The fact that the Applicant acknowledged this teaching of Liu and that this did in fact address Applicant's prior argument (but merely that the combination would not work) further would have informed a POSITA's understanding of this disclaimer.

135. Therefore, it is my opinion that the correct construction of this term is "a physical channel that transmits in only the upstream or the downstream, not both."

136. Even though I believe that the Applicant narrowed the scope of the term “physical channel” during prosecution by disclaiming bi-directional physical channels, I understand that ASSIA disagrees with that construction. Regardless of the construction that is ultimately adopted, in my opinion both Grounds 1 (Bingham) and 2 (Strobel, Wei, Kuipers) disclose the Challenged Claims of the ’631 patent. I explain how each construction affects Grounds 1 and 2 with each ground.

## **IX. SUMMARY OF THE PRIOR ART**

### **A. U.S. Patent No. 5,680,394 to Bingham et al (“Bingham”) (Ex-1004)**

137. Bingham is a granted patent that describes a “method of coordinating very high speed bi-directional data transmissions between a central unit and a plurality of remote units over distinct twisted pair transmission lines that share a binder is described.” Ex-1004 at Abstract. Bingham explains that “periodic synchronized upstream and downstream communication periods are provided that do not overlap with one another.” *Id.* “The upstream and downstream communication periods for all of the wires that share a binder are synchronized.” *Id.* It continues that “[w]ith this arrangement, all of the very high speed transmissions within the same binder are synchronized and time division duplexed such that downstream communications are not transmitted at times that overlap with the transmission of upstream communications.” *Id.* Bingham adds that “quiet periods are provided to separate the upstream and downstream communication periods.” *Id.*

138. More specifically, Bingham discloses “a time division, duplexed data transmission scheme that is well adapted for transmissions over bundled transmission wires such as subscriber lines.” Ex-1004, 1:8-10. Bingham explains that, at the time of its invention, one of the standards bodies (ANSI) was “just beginning work on the next generation subscriber line based transmission system, which is referred to as the VDSL (Very High Digital Subscriber Line) standard.” *Id.*, 1:62-65. This VDSL standard was viewed as a substantial improvement in bit rate over the then-in-use ADSL Standard. The problem was that there was a dispute over the duplexing scheme. One proposal was using frequency division duplexing (as used in ADSL) and the other was using time division duplexing. *Id.*, 2:9-26, 44-58. Bingham proposed a time division duplexing approach for VDSL. That is shown in Figure 5 of Bingham, below.



139. Bingham’s proposals for a time division duplexing system, though for VDSL, are very similar to the ’631 patent’s proposal for a time division duplexing approach for G.fast. TDD was a well-known concept before the ’631 patent, including in the DSL community., see Bingham (Ex. 1004) and Cioffi (Ex. 1010). It is thus not surprising that the disclosures of Bingham, though a decade before the disclosures of the ’631 patent, are so similar to the disclosures of the ’631 patent. I have been informed that Bingham qualifies as prior art under at least pre-AIA 35 U.S.C. §102(b), based on its issuance date.

**B. U.S. Patent No. 9,531,491 to Strobel et al. (“Strobel”) (Ex-1005)**

140. Strobel is a granted patent that is assigned to Lantiq Deutschland GmbH and titled “Communication Method, Apparatus and System” and as filed on February 13, 2013. Ex-1005 at 1. Strobel discloses a transceiver architecture that is able to switch among different configuration to enhance communication rates and overall system performance to result in increased optimization, higher throughput rates, or higher quality transmissions. *Id.* at 3:64-4:3. Strobel further discloses a system that serves multiple electronic communication lines, multiple line interfaces, and crosstalk channels. *Id.* at 4:8-30.

141. Strobel discloses two solutions to minimize distribution point systems’ power consumption, while optimizing the system’s transmission capabilities to end users: (1) using time division duplexing between upstream and downstream; and (2)

using synchronized time division multiple access (STDMA). Ex-1005 at 2:43-47. Strobel provides that transmission methods must be capable of operating in a distribution point “using either the first approach, the second approach, or a combination of both.” *Id.* at 2:58-62.

142. My opinions related to Strobel are limited to the time division duplexing approach, which is what was ultimately adopted into the G.fast standard and what the '631 patent discloses.

143. Strobel discloses that “recent trends in the access communications market” requires faster speeds, which can only be “achieved if copper pairs connected the CPE to the fiber backbone are as short as 100 m – 200 m.” Ex-1005, 2:17-21; Ex-1007 at 1 (same). “This requires installation of small street/MDU cabinets, called Distribution Points (DP) that intend to serve a very small number of potential users; the number of potential users shown by recent analysis internationally is 8-16.” *Id.*, 2:21-25. This configuration contemplated by Strobel is the exact configuration considered in G.fast, which was the emerging DSL standard that the '631 patent was directed towards. *See* Ex-1001 at 1:29-34 (“One new TDD system is called ‘G.fast,’ which is currently in the process of standardization by the ITU-T (International Telecommunication Union—Telecommunication Standardization Sector). G.fast is to transmit over relatively short (<250 m) copper telephone loops and premises wiring.”).

144. Strobel discloses a communication system operative to serve multiple electronic communication lines to transmit electronic data related to channel characteristics via an electronic receiver or transceiver. Ex-1005 at 6:35-42. The channels connecting to the communication system may be provided as a physical channel. *Id.* at 5:42-43.

145. Strobel discloses a TDD system comprising time slots that are allocated for uplink and downlink transmission. *See* Ex-1005 at 22:3-10, Fig. 11. Strobel discloses that there are time slots where the lines transmit or receive, and a switching time, where the lines switch between the two as needed depending on the system's requirements at a given time. *See id.* at 22:11-23.

146. Strobel also discloses transmission time slots used to assign the particular transmission time for a specific line in upstream and/or downstream direction, where the duration of those time slots have a duration that is an integer of symbols. *See id.* at 31:40-46. These time slots are programmable and their assignment and duration may depend on traffic requests from connected users or another system received information. *Id.* at 31:45-63.

**a. Strobel Qualifies as Prior Art**

147. Strobel claims priority to U.S. Provisional Patent Application Nos. 61/598,270 (the "Strobel '270 Provisional" Exhibit 1007) and 61/601,943 (the "Strobel '943 Provisional" Exhibit 1006) (collectively, the "Strobel Provisionals"),

and should be afforded the priority date of at least the later of the two, the Strobel '943 Provisional's, filing date of February 22, 2012.

148. I understand that under *Dynamic Drinkware, LLC v. National Graphics, Inc.*, in order to claim that a prior art reference is entitled to an earlier priority date based on its provisional application, the provisional application's written description must provide "support for the claims of the [later] patent" and further, the "subject matter relied upon for prior art was effectively filed in the provisional application." 800 F.3d 1375, 1380–81 (Fed. Cir 2015).

149. Here, Strobel is entitled to the priority date of the Strobel '943 Provisional (i.e., February 22, 2012) for the reasons set forth below. Because it satisfies the *Dynamic Drinkware* analysis by both providing adequate written description for at least Strobel's Claim 4 and further discloses the subject matter of Strobel.

- i. The Strobel Provisionals provide adequate written disclosure under § 112, ¶ 1 for at least Claim 4 of Strobel.*

150. In my opinion, the Strobel Provisionals (Ex-1006 and Ex-1007) provide written description for Strobel's Claim 4, as shown at least by the table below, which shows exemplary disclosures from the Strobel Provisionals providing the written description for Strobel Claim 4.

|                          |                                                                                  |
|--------------------------|----------------------------------------------------------------------------------|
| <b>Claim 4 (Ex-1005)</b> | <b>Strobel '943 Provisional (Ex-1006) and Strobel '270 Provisional (Ex-1007)</b> |
|--------------------------|----------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A system operative to serve multiple electronic communication lines, comprising:</p>                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• “Solutions related to dynamic rate adaptation may operate on any system, including, without limitation, any cable, wireline telephony, other wireline, wireless system, or hybrids of any of the aforementioned kinds of systems.” Ex-1006, 24:9-11.</li> <li>• “One solution is a transceiver system that services multiple electronic communication lines.” Ex-1006, 24:21-22.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                          |
| <p>a distribution point, comprising a central unit and a plurality of transceivers;</p>                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• “This solution includes a distribution point, which itself may include a central unit and multiple transceivers.” Ex-1006, 24:22-23.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <p>a crosstalk channel;</p>                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>• “This solution also may include . . . a crosstalk channel, and multiple remote terminals.” Ex-1006, 24:23-24.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p>wherein the system is configured to compute a plurality of power level configurations, wherein the plurality of power level configurations corresponds to a non-zero data rate on the multiple electronic communication lines, store in memory data about said configurations, process said data into time sharing</p> | <ul style="list-style-type: none"> <li>• “[T]he system may be configured to compute locally optimal communication configurations, store in memory data about said configurations, process said data into time sharing information, convey such time sharing information to the transceivers and the remote terminals.” Ex-1006, 24:24-25.</li> <li>• “‘Local optimization’ is the process of finding transmission power levels for two communication units, and the corresponding data rate for each such unit.” Ex-1006, 6:1-6.</li> <li>• “One solution is a transceiver system that services multiple electronic communication lines.” Ex-1006, 24:30-31.</li> <li>• “A media access plan message contains the information about what configuration is to be used at which particular time.” Ex-1006, 15:10-11.</li> </ul> |

|                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| information comprised in a medium access plan,                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| the time sharing information specifying, for each one of the multiple electronic communication lines, when to switch between the respective plurality of power level configurations, | <ul style="list-style-type: none"> <li>• “The time sharing information allows the communication units to transmit at times and power levels,” Ex-1006, Abstract.</li> <li>• “The time sharing information is later used by the transceivers and remote terminals to transmit in accordance with such time sharing information.” Ex-1006, 24:28-29.</li> <li>• “One solution is the central unit that may be part of a communication system operative to serve multiple electronic communication lines, wherein the media access plan includes information about time slots, about when transceivers should transmit, and about the power levels at which transceivers should transmit.” Ex-1006, 29:23-26.</li> </ul> |
| and to convey the medium access plan to the transceivers,                                                                                                                            | <ul style="list-style-type: none"> <li>• “The central unit may include ... a unit that conveys the media access plan to transceivers that will transmit in accordance with the plan.” Ex-1006, 29:8-15.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| wherein the medium access plan includes all downstream and upstream transmissions over all active transmission media.                                                                | <ul style="list-style-type: none"> <li>• “A media access plan message contains the information about what configuration is to be used at which particular time.” Ex-1006, 15:10-11.</li> <li>• “The dynamic assignment of TS is by broadcasting a special control message called Medium Access Plan (MAP). This message includes the list of TS assigned to both the DP and all CPEs for transmitting and receiving data symbols, respectively.” Ex-1007, 7.</li> <li>• “providing a medium access plan that includes all downstream and upstream transmissions over all active lines;” Ex-1007, 17.</li> </ul>                                                                                                       |

151. In addition to the above, claim 1 as disclosed in the Strobel '943 Provisional nearly discloses this claim word for word.

1. A system operative to serve multiple electronic communication lines, comprising:
  - a distribution point, comprising a central unit and a plurality of transceivers;
  - a plurality of line interfaces;
  - a crosstalk channel; and
  - a plurality of remote terminals;wherein the system is configured to compute locally optimal communication configurations, store in memory data about said configurations, process said data into time sharing information, convey such time sharing information to the transceivers and the remote terminals, wherein such transceivers and remote terminals later transmit in accordance with such time sharing information.

152. As the above chart shows, the Strobel '943 Provisional (Ex-1006) discloses that a system comprising a distribution point, comprising a central unit and a plurality of transceivers, and a crosstalk channel, is configured to determine optimal transmission power levels and data rate points to calculate optimization configurations to improve the performance of the communication system. Ex-1006 at 6:1-25, 24:9-29. The Strobel '943 Provisional further discloses that these optimization configurations, which include power level configurations, are stored in memory, and are used to help process data. *Id.* at 24:24-29. Lastly, the Strobel Provisional discloses the computation of a media access plan to achieve optimal system communication, which is conveyed to the transceivers.

153. Further, a POSITA would have understood that the Strobel '943 Provisional's disclosure concerning the "transmit ('Tx') and "receive ('Rx') modes (Ex-1006 at 21:5-8), are synonymous to downstream and upstream, uplink and downlink, transmissions. This is further supported by the Strobel Provisional's Figures 11 and 12, which illustrate the allocation of time slots in a TDD system.

154. Specifically in Figure 12, the Strobel Provisional discloses an allocation of time slots for uplink and downlink transmissions in missed access systems. Ex-1006 at 21:12-27. There, the Strobel '943 Provisional depicts transmission lines that are capable of switching from transmit to receive modes, as claimed.

155. A POSITA would have understood that the disclosed BUS system is integral to the switching mechanisms and conveyance of the medium access plan to transceivers, so to ensure all transmissions are occurring with the claimed media access plan. Ex-1006 at 20:1-4. Indeed, the disclosed BUS system is the driver that enhances the switching capabilities between the transceivers while facilitating the optimization of power and data levels of communication systems subject to crosstalk. *See* Ex-1006 at 19:20-30.

156. As such, the Strobel '943 Provisional alone provides written description for Claim 4 of Strobel.

157. The same is true for the Strobel '270 Provisional. A POSITA would have understood that in order for the disclosed system to "perform crosstalk channel

estimation by using SS,” the system must necessarily comprise a crosstalk channel. Ex-1007 at 7.

158. Additionally, a POSITA would understand that the assignment of time slots for specific lines in the upstream or downstream direction supports Claim 4’s limitation requiring the computation of a plurality of power level configurations corresponding to a non-zero data rate because the Strobel ’270 Provisional discloses that the time slots and superframe arrangements are designed to limit power consumption. *See* Ex-1007 at 4, 8-10. A POSITA would further understand that the “time sharing information” is akin to the time slots, that are aligned on the multiple electronic communication lines in the upstream and downstream directions. Ex-1007 at 9-10.

159. The Strobel ’270 Provisional further discloses that the disclosed medium access plan may be fixed in a superframe, or may be “modified every superframe,” and that this decision will ultimately impact the transmission overhead (i.e., power consumption of the system). Ex-1007 at 10-11. A POSITA would understand this disclosure to mean that the time slots contained within the medium access plans impact the overall power levels, and where those medium access plans are modified in various superframes and communication lines, those power consumption levels change accordingly.

160. Lastly, a POSITA would understand that the Strobel '270 Provisional further discloses that the medium access plan includes all downstream and upstream transmissions over all active transmission media, given the Strobel '270 Provisional's disclosure of both "providing a medium access plan that includes all downstream and upstream transmissions over all active lines," and quiet periods, or inactive lines, where there is no transmission occurring. Ex-1007 at 8, 20.

161. As such, the Strobel '270 Patent also provides the necessary written description support for at least Claim 4 of Strobel.

162. To the extent that the Strobel Provisionals do not provide support for claim 4 separately, there is no doubt that together they provide support. As such, Strobel properly claims priority to at least by the latest date of the Strobel Provisionals (February 22, 2012).

*ii. The Strobel Provisionals disclose and describe the subject matter of Strobel relied upon as prior art in the Petition.*

163. The Strobel Provisionals (Ex-1006 and Ex-1007) adequately disclose and provide support for the subject matter relied upon as prior art in Strobel.

164. As described above, the two Strobel Provisionals were both incorporated into the Strobel Application and Strobel.

165. Also, I have cited to both Strobel and the relevant provisional where required below.

166. Based on my assessment of Strobel as being supported by its Provisionals, I have been informed that Strobel qualifies as prior art under at least pre-AIA 35 U.S.C. §102(e).

**C. ITU-T Temporary Document 2012-06-4A-040 (“Wei”)**

167. Wei is an ITU contribution that was submitted within just four months of the provisional applications submitted for Strobel and just one month before the provisional application for the '631 patent. Ex 1009.

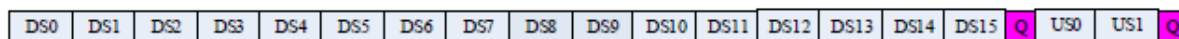
168. Wei is directed to a particular issued contemplated in G.fast called “discontinuous mode power saving (DMPS) method for G.fast.” Ex-1009 at 1. Specifically, “[i]t describes how DMPS can significantly reduce the power consumption of a G.fast transceiver when traffic is in a low level” by turning “the entire transmission and reception path” off “during some DMT symbols within a TDD frame to save power on DFE, aFE, and LD.” *Id.*, 2. Wei proposes possible methods for turning off these transmission paths, including turning off portions of the downstream and upstream paths.

169. Wei explains that “Time-Division Duplexing (TDD) has been adopted as the duplexing method for G.fast.” *Id.*, 2. It states that the “discontinuity inherent in TDD makes the implementation of discontinuous mode power saving (DMPS) more practically feasible in G.fast.” *Id.* “In the DMPS method, when user traffic is lower than channel capacity, the entire transmission and reception path can be turned

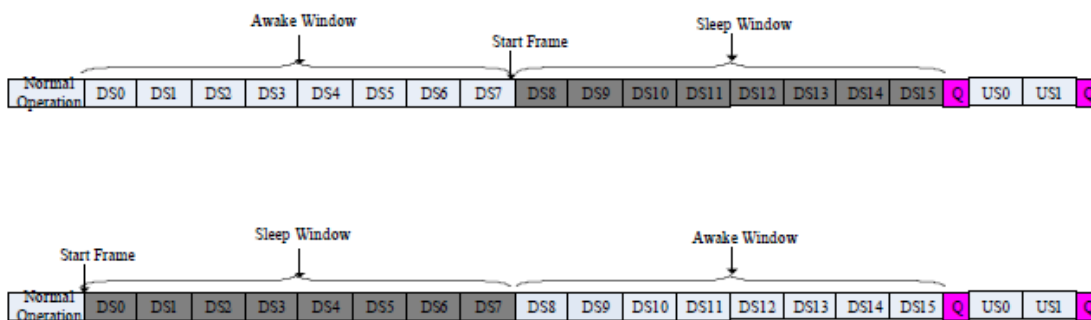
off during some DMT symbols within a TDD frame to save power on DFE, AFE, and LD.” *Id.*

170. Wei then goes on to explain how discontinuous mode power saving method would work in G.fast. It explains that “[w]hen When user traffic in showtime on a line becomes lower than its achievable data rate, the number of transmitted DMT/OFDM symbols within a TDD frame can be reduced. This allows the entire transmission and reception path to be turned off during some DMT/OFDM symbol periods to save power in DFE, AFE, and LD.” *Id.*, 3.

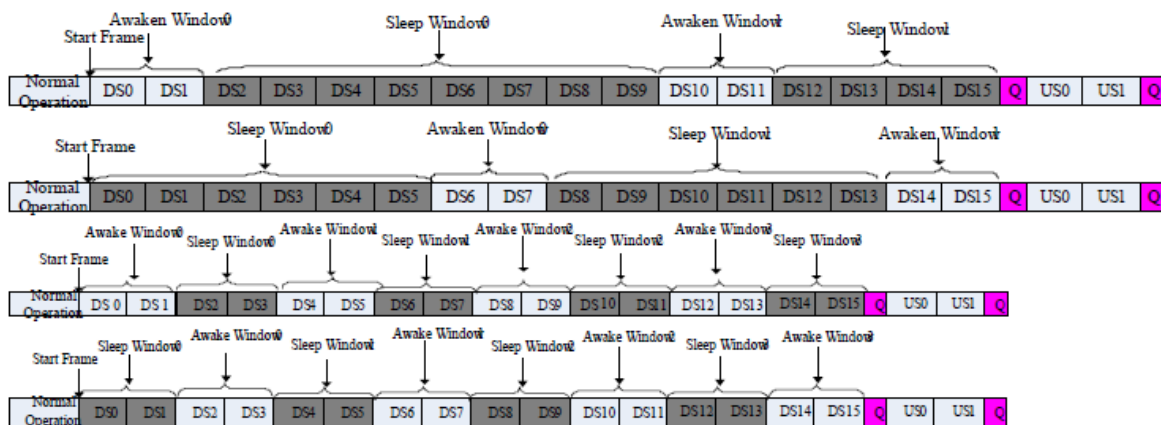
171. Wei explains that a TDD frame with quiet intervals (denoted by “Q”) or guard time periods looks like in the figure below:



172. Wei then explains that different methods may be used to implement DMPS in TDD G.fast, such as, for example, using Awake and Sleep windows, which is shown in the below figure:



173. Wei further explains that lines within a DP group can have different Awake Window lengths, such as those shown in the figure below:



174. Generally, Wei explains that “[d]ifferent levels of DMPS can be defined depending on tolerable latency levels.” *Id.*, 5. By having sleep windows using DMPS Wei reasons that power can be saved.

175. I have been informed that Wei is therefore prior art under at least pre-AIA 35 U.S.C. §102(a), based on its publication date, discussed below.

#### **D. ITU-T Temporary Document 2012-06-4A-061 (“Kuipers”)**

176. Kuipers is an ITU contribution also submitted within four months of the provisional applications submitted for Strobel and just one month before the provisional application for the ’631 patent.

177. I have been informed that Kuipers is therefore prior art under at least pre-AIA 35 U.S.C. §102(a), based on its publication date, discussed below.

178. Kuipers is directed to a particular issue contemplated in G.fast related to a “flexible frame structure for G.fast that will enable dynamic adaptation to the actual needs and offered traffic load.” Ex-1008 at 1. Kuipers explains that a “regular framing structure is of the utmost importance for a communication system” because it “provides synchronization, schedules time intervals for US and DS transmission, and gives implementers guidance in their design.” *Id.* As an example, it is imperative to “the provision of the required data rates, US/DS asymmetry ratio, latency, and the ability to save power.” *Id.* Kuipers therefore proposes a flexible frame format that allows for dynamically altering time slots of upstream and downstream transmissions, as shown in the figure below:

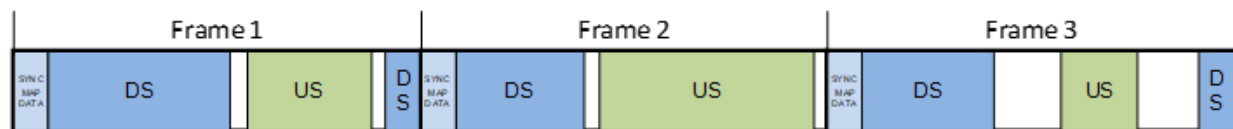


**Figure 2: Frame format examples**

179. Kuipers specifically explains that, at least for purposes of the contribution, a ‘symbol’ corresponds to an OFDM/DMT symbol, and a ‘timeslot’ corresponds to one or more consecutive symbols in a given upstream or downstream direction.” *Id.*, 2. It states that the “[t]he first symbol will additionally contain a MAP (Media Access Plan),” which “will provide the indication of which symbols in the present frame are US and which are DS.” *Id.* “It will therefore instruct the FTU-R<sup>1</sup>

<sup>1</sup> G.fast FTU stands for G.fast Fast Transceiver Unit, a device that establishes a high-speed transmission path between reference points. The FTU-O is the FTU at

at what time to listen to DS transmission and the interval to be used for US transmission.” *Id.* Importantly, Kuipers explains that this “MAP may change from frame to frame according to the needs.” *Id.*

180. Kuipers additionally discloses power savings capabilities of this flexible frame format. It explains that the “flexible framer can also be used to reduce power consumption.” *Id.*, 5. That is shown in the below figure.

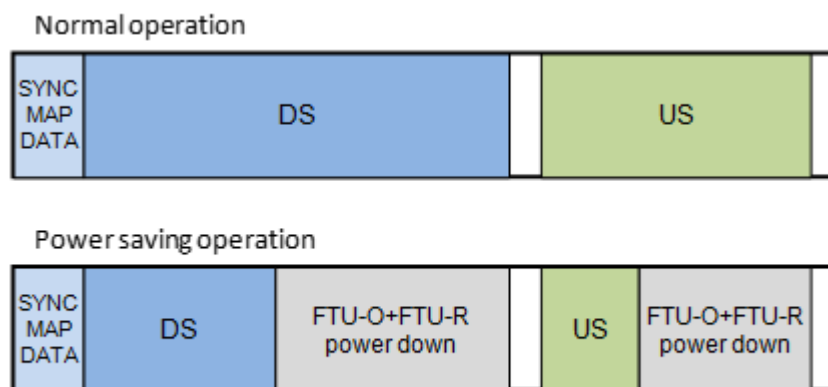


**Figure 6: Power saving example**

## **E. Publication of Wei and Kuipers**

181. It is my opinion that Wei and Kuipers were published documents available to the interested public before the earliest possible priority date of the '631 patent, as discussed further below.

### **a. Standards Bodies**

182. Wei and Kuipers are contributions that were submitted to the ITU. The ITU is an agency of the United Nations that specializes in information and

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the Optical network unit and the FTU-R is an FTU at the Remote site (i.e., subscriber end of the loop). Ex-1016 p. 8.

communication technologies, and the ITU-T is the Telecommunications Sector of the ITU. The ITU-T publishes documents related to the development of its Recommendations. Wei and Kuipers were specifically submitted to Study Group 15 (“SG15”), focused on Question 4 (“Q4”) (hereinafter “SG15/Q4”).

183. I have personal experience with standards bodies. I previously participated in the CCITT (pre-cursor to the ITU) study group for voice-band modem standards as a representative of AT&T. I also previously attended meetings of the ITU, including meetings for Study Group 15, Question 4. In my role at my organization, even when I did not personally attend standards meetings, I always had individuals within my organizations actively involved in standards pertinent R&D (both wireline and wireless) who could have and would have provided any relevant standards and contributions. For example, Bell Labs had many individuals involved in DSL standardization (we had a whole Standards lab) and each individual had access to all of the contributions submitted to the ITU Study Group 15, addressing Question 4.

184. Given that I was in a management role at Bell Labs, I worked closely with the individuals attending the ITU meetings. There was a very close relationship between our engineers in R&D (who would be reviewing and making contributions) and the ITU representative for Bell Labs who attended every meeting. I was closely intertwined with this process as well. For example, if an engineer made a

contribution, that engineer would likely defend the contribution at an ITU meeting. Management would be very involved in those defenses.

#### **i. How the ITU Generally Works**

185. Relevant here, Wei and Kuipers are published documents that are each considered to be a “contribution” to these meetings. Specifically, contributions like Wei and Kuipers are known as “temporary documents” or “TDs.”

186. During the standardization process, contributions are tracked as something called issues. These issues are tracked by something called Issues lists. *See, e.g.*, For ITU-T SG15/Q4 contribution NF-085 (May 1998) (Ex. 1030) (“NF-085”). For example, NF-085 specifically states that “New items for the Issues List are generally identified in committee contributions. Only those issues that have been delineated in the ‘summary’ section of said contributions shall be added to the list. These issues are automatically added to the list as ‘Open’ issues (questions) without prior committee review. Upon review by the committee, these issues may become agreed goals, requirements, or specific actions.” Thus if something is on an issue list, the issue would have been identified in a contribution first (and thus it can be determined that a contribution had been published to the ITU members).

187. In my experience, contributions are uploaded to the ITU Server before the beginning of the ITU meeting listed on the face of the document. I confirmed this by reviewing the rules of the ITU, which expressly required this. *See* CI-075

(Ex. 1031). CI-075 requires that the “Documents should be uploaded to the ftp site at least seven (7) days prior to the meeting for presentation.” Relevant excerpts with these requirements are shown below.

1. ALL Documents shall be posted to the ITU informal ftp site provided for this work. The format of the document shall be in accordance with the TD template, provided by the Rapporteur, without changes in the format, fonts etc. Document numbers shall be provided by the Rapporteur when the Source has provided the expected Title and an Abstract electronically (Email in plain text is fine for this stage.) to the Rapporteur. The preferred document electronic format shall be RTF. The second choice is PDF. Zipping of very large files is allowed provided the Zipping S/W is identified in the reflector “document announcement” Emailing.
5. Documents should be uploaded to the ftp site at least seven (7) days prior to the meeting for presentation. This is being done to allow review prior to the meeting. Additionally, all participants are expected to download and bring their own copies of documents so uploaded. The Source shall bring sufficient

copies for ALL expected attendees if they do not comply with this 7 day restriction. If the Source has complied with the 7 day restriction they will need to bring sufficient copies for new ITU members and new attendees to the meetings whose companies HAVE NOT attended previous meetings. This is estimated at about 12 copies. If the 7 day restriction is not achieved then the source/author must bring sufficient copies for ALL expected attendees.

If the document has NOT been uploaded, a VIRUS FREE ELECTRONIC COPY must FIRST be provided to the Rapporteur (for uploading), before the document can be presented. This includes, of course, any document generated at the meeting as well.

188. CI-075 also states that the contribution number was accompanied by an “Email ‘document announcement’ on the Question 4/15 Reflector.” Ex-1031. That confirms for me that there was also an email reflector where the relevant document number was circulated to all those members involved in Study Group 15, Question 4. Specifically, CI-075 lists the email reflector as [tsg15q4@ITU.INT](mailto:tsg15q4@ITU.INT). Ex-1031 at 4. That means that not only were members of the SG15/Q4 able to access these documents, but that they were specifically told about these documents through the reflector. Although the documents themselves were not necessarily circulated,

because the document number was circulated, and because it was known how to access those documents through an FTP, it is my opinion that circulating the document number was as though the documents themselves were circulated.

2. The uploading of all documents shall be accompanied by an Email "document announcement" on the Question 4/15 Reflector. The announcement shall provide the document number, the title, the source, and the abstract for the document and shall be as Email text, NOT an attachment.. The Email SUBJECT shall be as follows: SUBJECT: Q4/15upload There shall be a space before the "Q" and after the "d". NO spaces or other variations shall be made in the string. This string is to allow EMAIL parsing and therefore shall not be changed. After the space that must be after the "d" you may add an appropriate additional description of the emailing.

189. Everyone who had access to the ITU Server could then download all contributions for the meeting from the ITU Server. Although the ITU Server required a user to have a login credential, these credentials were freely available to people who worked for ITU-T member companies, even those they rarely or never attended meetings of SG15. CI-075 confirms this as well. Ex-1031. Not only was the login structure permissive, but the contributions themselves were not subject to any expectation of secrecy as these documents were freely shared amongst interested people in the industry.

**STEP1:** The first step is to get a TIES account. If you already have a TIES account then you can skip this step. Here is a sample message to use to first get a TIES account, noting the following criteria for eligibility:

ITU TIES service is available without any charge only to persons or companies meeting one or other of the following conditions:

1. Your company is a sector member of ITU. To find out, please check this URL address: <http://www.itu.int/aboutitu/smallm.html>.
2. You are working in a permanent mission of a country that is one of the ITU Member States.
3. You are working in a government Administration in one of the ITU Member States (to find out whether your country is Member or not, check the URL address: <http://www.itu.int/aboutitu/bigm.html>) .

If you are working in a permanent mission of a country that is one of the ITU Member States or in a government Administration in one of the ITU Member States, please send us an email query ([helpdesk@itu.int](mailto:helpdesk@itu.int)) noting the area of your involvement in ITU activities, asking for a TIES registration form.

TIES membership allows you access on the Internet (Telnet, ftp, gopher, WWW, email) to some ITU documents. If you have access to the WWW, these documents are the ones marked with a black padlock. Access to other documents marked with a red padlock is reserved to paid subscribers to the ITU online subscription service in effect since July 1995. For further information on this paying service, please contact the Electronic Bookshop directly ([sales.online@itu.int](mailto:sales.online@itu.int)).

Please note that there are currently NO EXCEPTIONS to the criteria clearly noted above.

## **ii. Public Accessibility**

190. Contributions, such as those of Wei and Kuipers, are electronically available to ITU members worldwide. Although the ITU website requires a username and password, in my experience there are hundreds of people from governmental agencies, and member companies from around the world who participate in and have access to the work and documents of SG15/Q4 .

191. For example, according to the Internet Archive, as of December 6, 2000 the ITU-T members included, among others: 3Com, ADTRAN, Alcatel, Analog Devices, AT&T, Aware, Bell Atlantic, Bell Canada, Bell South, Broadcom, British Telecom, Burr-Brown Corporation, Catena Networks, Centillium Communications,

Cisco Systems, Conexant Systems, Copper Mountain Networks, Covad Communications, Element 14, Ericsson, Excess Bandwidth Corporation, France Telecom, Fujitsu, Globespan, Infineon, Italtel, Legerity, Level One, LG Electronics, Lucent, Marconi Communications, Matsushita, Metalink, Mitel Corporation, Mitsubishi, Motorola, NEC, Next Level Communications, Nokia, Nortel Networks, NTT, PairGain, Paradyne Corporation, Philips, PMC-Sierra, Qwest, Sagem, Sasken, SBC Communications, Siemens, Sprint, STMicroelectronics, Sumitomo, Swisscom, Telcordia, Telecom Italia, Telenor, Telesis Technologies Laboratory, Telia, Tellabs, Texas Instruments, VDSL Systems, Verizon, Velocity Communication (later renamed Ikanos), and Virata. *See*

[https://web.archive.org/web/20001206175700/http://www.itu.int:80/cgi-bin/htsh/mm/scripts/mm.list?\\_search=SEC%26\\_languageid=1](https://web.archive.org/web/20001206175700/http://www.itu.int:80/cgi-bin/htsh/mm/scripts/mm.list?_search=SEC%26_languageid=1) (last visited January 15, 2024) (Ex. 1032). Many of these companies would send more than one participant to meetings. Similarly, many companies would have more than one corporate participant, such as different divisions or regional entities. In my opinion, these member companies represented the industry and, likewise, employed the majority, if not all, of the interested persons working in this space at the time.

192. As I explained above, the members would have had access to contributions that were uploaded to the ITU Server before the beginning of the ITU meeting listed on the face of the document. *See* CI-075 (Ex. 1031). Additionally, an

email reflector ([tsg15q4@ITU.INT](mailto:tsg15q4@ITU.INT)) was used to circulate a list of the contributions prior to that meeting, and the members of that email reflector would have been persons of ordinary skill in the art that were involved in SG15/Q4. Ex-1031 at 4. Also, all documents, including Wei and Kuipers, “are available via the ITU website.” Ex-1033, 34. The documents are indexed by meeting and can be tracked as described below:

For electronic access, all documents can be found via the SG web page, but you will need to have a **TIES account** with username and password. TIES accounts are granted to representatives of ITU Member States, ITU-T Sector Members and Associates. Details of how to register for TIES access are given in "Additional details".

All documents for SG or WP meetings are available via the ITU website. Go to the home page of the SG of interest and you will find a section entitled "Documents by meeting". Here you should find everything you need. Further information can be found in the "Electronic working methods" section.

193. As I explained above, in my ordinary course of business practice while at Bell Labs, I regularly accessed documents from the ITU server, or had other employees I worked with access documents from the ITU server. Based on my experience with the ITU-T and with standardization generally, I would expect any person implementing a standardized telecommunications system to consult the corresponding standards-setting organization specifications, contributions, and other

documents associated with those systems. Such a person would be the same person reviewing the disclosures of the '631 patent.

194. Specifically, I would expect anyone implementing G.fast DSL systems or transceivers to consult the contributions and other documents of SG15/Q4 during the time that G.fast was being standardized, including the Wei and Kuipers contributions. The whole purpose of the ITU-T creating Recommendations and making participants' SG15/Q4 contributions available was so that engineers and other individuals would have ready access to them when developing and implementing DSL networks and devices. Thus, there was an incentive to make sure the contributions were available to all those POSITAs relevant to the industry.

195. Also, it was my understanding that there was no expectation of confidentiality regarding contributions to SG15/Q4 meetings. The purpose of the meetings was to share contributions and evaluate proposals. Members sharing and presenting contributions had no reasonable expectation that their publications would not be copied and shared, such as to those who were not ITU-T members. Many of the members, and the companies they represented, were developing technology in parallel with the emerging standards, and therefore it was important to be able to consider and share proposals that were being made in the standards-setting organizations to assess whether a proposal would have an impact on a product being developed. Those making contributions to SG15/Q4 understood that their

contributions could be widely disseminated. For example, even though I did not attend all of the ITU meetings, members of my organization did. Those members would share contributions with me where relevant, even if I was not the individual that had attended the ITU meetings. I understood such dissemination to be widespread amongst POSITAs in the industry.

196. By 1998, SG15 was well-known to persons in the telecommunications industry as a source of information and contributions, proposals, meeting announcements and agendas, meeting reports, technical discussions, and other key documents regarding DSL industry standards and technological advances. By 2000, SG15 was known worldwide as the primary DSL standardization body that was responsible for the majority of DSL standard development. The same remained true in 2012. As such, I would expect that POSITAs at member companies, which represented the majority, if not all, of the companies interested in the development of DSL, would have regularly accessed the ITU's website and the ITU Server to obtain documentation of the work of SG15/Q4, and to download documents from the ITU Server.

### **iii. Wei**

197. Based on my personal knowledge, I recognize Ex-1009 as a true and correct copy of ITU-T Temporary Document 2012-06-4A-040 ("Wei"). I understand that the actual ITU contributions are not edited after submission without providing

an indication of such edits, and thus Wei would not have changed since its publication.

198. On the face of Wei, it indicates that it was submitted prior to the June 2012 meeting of the ITU. I have no reason to believe that this is incorrect and I confirmed this by consulting the additional ITU documents referenced below.

199. First, I reviewed the issues list submitted for the June 18-22 ITU meeting. Wei was added to the issues list for the June 18-22 Antwerp meeting and is listed with a descriptive title indicating its topic to any interesting person. Ex-1029 at 27 (shown below). That means that it had been submitted to the ITU servers and disseminated via Email (therefore publicly accessible) before the June 18-22 meeting.

|         |                    |                                                                                                                                               |                                                  |
|---------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 6.4.1.5 | Open<br>7-May-12   | Should G.fast define different levels of low power modes based on discontinuous operation as a function of maximum latency and recovery time? | 2012-05-4A-030<br><a href="#">2012-06-4A-040</a> |
| 6.4.1.7 | Open<br>18-June-12 | Should discontinuous operations be defined on a per-TDD frame basis or on a per-Superframe basis?                                             | <a href="#">2012-06-4A-040</a>                   |

200. Next, I reviewed the work program for the June 18-22, 2012 meeting. Ex-1027. That document states that it “outlines the proposed work program for the discussion of contributions and resolution of G.fast issues at the Q4a meeting, 18-22 June, 2012.” Id., 1.

Antwerpen, Belgium, 18 – 22 June 2012  
Question: 4a/15

SOURCE<sup>1</sup>: Associate Rapporteur for G.fast

TITLE: G.fast: Work programme for G.fast

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This document outlines the proposed work program for the discussion of contributions and resolution of G.fast issues at the Q4a meeting, 18 – 22 June, 2012. It should be viewed in conjunction with the issues list 2012-06-4A-U20.

201. The work program then goes on to list the contributions up for discussion. Wei is listed under the “Low power modes” section under its document number 2012-06-4A-040, which indicates that it had been circulated within the ITU prior to that June 2012 meeting. Id., 2.

|                                                                   |         |                                                                                                                      |                                                                |
|-------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Low power modes</li></ul> | 6.4.1.x | <div>2012-06-4A-007</div> 2012-05-4A-030,<br>2012-05-4A-038,<br>2012-05-4A-042,<br>2012-06-4A-040,<br>2012-06-4A-070 | Contributions for discussion<br>carried over from last meeting |
|-------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|

202. Persons interested and of ordinary skill in the art at the time would have located Wei using such an agenda. While there are approximately 50 contributions that were to be considered at the meeting, Wei was specifically directed to “Low power modes” within G.fast. Ex-1027, 2. Within that category of “low power modes,” there are only five documents. As such, a POSITA reading the ’631 patent that discloses using low power modes in Time Division Duplexing as it relates to G.fast would have looked to ITU contributions that relate to G.fast and that relate to low power modes. In doing so, and reviewing bracketed lists as is shown in Exhibit

1027, the POSITA would have been left with only five options of documents to review, one of which included Wei.

203. What's more, this agenda and document list would have been available to all members of the ITU Study Group 15, Question 4, and would have been disseminated to the listserv [tsg15q4@ITU.INT](mailto:tsg15q4@ITU.INT) in compliance with the rules set forth by the ITU.

204. Wei was therefore made available to the ITU server electronically before June 18, 2012. Per the ITU operating rules, it should have been uploaded one week prior to the meeting. Because Wei was distributed and made available to the ITU prior to the June 2012 meeting of the ITU, it is my opinion that Wei was publicly available prior to the July 27, 2012 priority date of the '631 patent to any POSITA at the time. Specifically, relevant POSITAs at the time, including individuals doing work focused on DSL, likely would have been members of the ITU or would have worked for a company or institution that was a member of the ITU. Therefore, any POSITA interested in relevant DSL technology related to G.fast would have had either direct access to Wei or indirect access to Wei through a relevant company or organization.

#### **iv. Kuipers**

205. Based on my personal knowledge, I recognize Ex-1008 as a true and correct copy of ITU-T Temporary Document 2012-06-4A-061 ("Kuipers"). I

understand that the actual ITU contributions are not edited after submission without providing an indication of such edits, and thus Kuipers would not have changed since its publication.

206. On the face of Kuipers, it indicates that it was submitted prior to the June 2012 meeting of the ITU. I have no reason to believe that this is incorrect and I confirmed this by consulting additional ITU documents.

207. First, I reviewed the issues list submitted for the June 18-22 ITU meeting. Kuipers was added to the issues list for the June 18-22 Antwerp meeting and is listed with a descriptive title indicating its topic to any interested person. Ex-1029 at 27 (shown below). That means that it had been submitted to the ITU servers and disseminated via Email (therefore publicly accessible) before the June 18-22 meeting.

|                         |                                                    |                                                                                           |                                |
|-------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------|
| <a href="#">6.1.5.9</a> | <a href="#">Open</a><br><a href="#">18-June-12</a> | <a href="#">Should G.fast utilize a type II HARQ retransmission scheme with soft-ACK?</a> | <a href="#">2012-06-4A-061</a> |
|-------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------|

208. Next, I reviewed the work program for the June 18-22, 2012 meeting. Ex-1027. That document states that it “outlines the proposed work program for the discussion of contributions and resolution of G.fast issues at the Q4a meeting, 18-22 June, 2012.” Id., 1.

Antwerpen, Belgium, 18 – 22 June 2012  
Question: 4a/15

SOURCE<sup>1</sup>: Associate Rapporteur for G.fast

TITLE: G.fast: Work programme for G.fast

---

This document outlines the proposed work program for the discussion of contributions and resolution of G.fast issues at the Q4a meeting, 18 – 22 June, 2012. It should be viewed in conjunction with the issues list 2012-06-4A-U20.

209. It then goes on to list the contributions up for discussion. Kuipers is listed under the “Frame Structure” section under its document number 2012-06-4A-061, which indicates that it had been circulated within the ITU prior to that June 2012 meeting. Id., 2.

|                   |       |                                                                                                                                                         |  |
|-------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| • Frame structure | 6.3.x | 2012-06-4A-030,<br>2012-06-4A-032R1,<br>2012-06-4A-035,<br>2012-06-4A-045,<br>2012-06-4A-061,<br>(2012-06-4A-063),<br>2012-06-4A-064,<br>2012-06-4A-069 |  |
|-------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--|

210. Persons interested and of ordinary skill in the art at the time would have located Kuipers using such an agenda. While there are approximately 50 contributions that were to be considered at the meeting, Kuipers was specifically directed to “frame structure” within G.fast. Ex-1027, 2. Within that category of “frame structure,” there are only eight documents. As such, a POSITA reading the ’631 patent that discloses a flexible frame format in Time Division Duplexing as it relates to G.fast would have looked to ITU contributions that relate to G.fast and that

relate to the actual frame format to be used. In doing so, and reviewing bracketed lists as is shown in Exhibit 1027, the POSITA would have been left with only eight options of documents to review, one of which was Kuipers.

211. What's more, this agenda and document list would have been available to all members of the ITU Study Group 15, Question 4, and would have been disseminated to the listserv [tsg15q4@ITU.INT](mailto:tsg15q4@ITU.INT) in compliance with the rules set forth by the ITU.

212. Kuipers was therefore made available to the ITU server electronically before June 18, 2012. Per the ITU operating rules, it should have been uploaded one week prior to the meeting. Because Kuipers was distributed and made available to the ITU prior to the June 2012 meeting of the ITU, it is my opinion that Kuipers was publicly available prior to the July 27, 2012 priority date of the '631 patent to any POSITA at the time. Specifically, relevant POSITAs at the time, including individuals doing work focused on DSL, likely would have been members of the ITU or would have worked for a company or institution that was a member of the ITU. Therefore, any POSITA interested in relevant DSL technology related to G.fast would have had either direct access to Wei or indirect access to Wei through a relevant company or organization.

## **X. OPINIONS**

213. It is my opinion that claims 1, 3-6, 34, and 37 are unpatentable under 35 U.S.C. §§ 102 and 103 over U.S. Patent No. 5,680,394 (“Bingham”); claims 1, 3-6, 8-9, 11-16, 22-25, and 33-37 are unpatentable under 35 U.S.C. § 103 over U.S. Patent No. 9,531,491 (“Strobel”); claims 3, 15, and 16 are unpatentable under 35 U.S.C. § 103 over Strobel in view of ITU Temporary Document 2012-06-4A-040 (“Wei”); claims 5, 6, 9, 11-14, 35, 36 are unpatentable under 35 U.S.C. § 103 over Strobel in view of ITU Temporary Document 2012-06-4A-061 (“Kuipers”); and claim 33 is unpatentable under 35 U.S.C. § 103 over Strobel in view of Wei and Kuipers.

214. As I discuss below, Strobel discloses every limitation of the challenged claims, but Wei and Kuipers provide additional disclosures that make those grounds more explicit.

### **A. Ground 1: Claims 1, 3-6, 34, and 37 are unpatentable under 35 U.S.C. §§ 102 and 103 over U.S. Patent No. 5,680,394 (“Bingham”).**

215. Bingham teaches all of the limitations of claims 1, 3-6, 34, and 37. Specifically, Bingham anticipates the challenged claims. To the extent it is determined that there is no anticipation, Bingham combined with the knowledge of a POSITA at the time of the ’631 patent renders the challenged claims obvious.

216. Much like the '631 patent, Bingham discloses “a time division, duplexed data transmission scheme that is well adapted for transmissions over bundled transmission wires such as subscriber lines.” Ex-1004, 1:8-10. Bingham explains that, at the time of its invention, one of the standards bodies (ANSI) was “just beginning work on the next generation subscriber line based transmission system, which is referred to as the VDSL (Very High Digital Subscriber Line) standard.” *Id.*, 1:62-65. This VDSL standard was viewed as a substantial improvement in bit rate over the then-in-use ADSL Standard. The problem was that there was a dispute over the duplexing scheme—one proposal was using frequency division duplexing (as used in ADSL) and the other was using time division duplexing. *Id.*, 2:9-26, 44-58. Bingham proposed a time division duplexing approach for VDSL, much like the '631 patent proposes a time division duplexing approach for G.fast.

**a. Independent Claim 1**

217. Even a cursory comparison of the Abstract of Bingham to claim 1 of the '631 patent demonstrates the lack of inventiveness of the '631 patent:

### Claim 1, '631 Patent

1. A method in a data communications system for managing multiple time division physical channels that are subject to crosstalk, the method comprising:

scheduling upstream time slots for upstream transmission in a first physical channel; and

scheduling downstream time slots for downstream transmission in a second physical channel, wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.

### Bingham

A method of coordinating very high speed bi-directional data transmissions between a central unit and a plurality of remote units over distinct twisted pair transmission lines that share a binder is described. Specifically, periodic synchronized upstream and downstream communication periods are provided that do not overlap with one another. The upstream and downstream communication periods for all of the wires that share a binder are synchronized. With this arrangement, all of the very high speed transmissions within the same binder are synchronized and time division duplexed such that downstream communications are not transmitted at times that overlap with the transmission of upstream communications. In some embodiments, quiet periods are provided to separate the upstream and downstream communication periods. The described invention may be used in conjunction with a wide variety of modulation schemes, including both multi-carrier and single carrier transmission schemes. It is backwards compatible with existing systems and has particular advantages in very high performance systems.

218. My below analysis related to Bingham applies under either construction of the term “physical channel.” I understand that ASSIA proposes that the term should be construed under its plain and ordinary meaning. Under that construction, Bingham anticipates the challenged claims. If disclaimer is applied (as I believe it should be), in my opinion Bingham still renders obvious the challenged claims because a POSITA would have understood that Bingham could be used with unidirectional channels. *See* Ex-1028 (disclosing that “HDSL requires two or three pairs for symmetric 2 Mbit/s transmission over 2.5km” and a POSITA would have understood that each pair could be unidirectional).

219. Although a unidirectional system (where data is sent either in just the upstream or the downstream on a single physical channel) would be less efficient than a bidirectional system because significant bandwidth may be lost, the system

would be less complex from a management perspective. For example, one of the considerations in a bidirectional channel is having to switchover between receiving and transmitting signals, something commonly referred to as a turnaround time. Turnaround time generally refers to the time it takes for a transceiver to switch from transmitting mode to receiving mode, and vice versa, within a single frequency channel. A faster turnaround time correlates to more efficient data transfer in TDD systems where the same frequency is used for both sending and receiving data at different time slots. Having a longer turnaround time because of this switchover time reduces rate efficiency. Ex-1005, 21:6-9.

220. A POSITA would have been motivated to use Bingham with unidirectional channels to eliminate this turnaround time. More specifically, although a unidirectional system (where data is sent either in just the upstream or the downstream on a single physical channel) is less efficient in that some bandwidth may be wasted, a POSITA would have been motivated to use unidirectional channels to eliminate the turnaround time that is required to transition between transmit and receive states in bidirectional channels. Strobel confirms that a POSITA would have been motivated as such, explaining that bidirectional channels “has a disadvantage in that turnaround time is required to switch between uplink and downlink, and vice versa,” and this “[t]urnaround time reduces the rate efficiency.” Ex-1005, 21:6-9. A POSITA thus could have been motivated to use unidirectional channels to increase

rate efficiency in either Bingham or Strobel and, given that this was a known solution to reduce turnaround time, would have had a reasonable expectation of success in doing so.

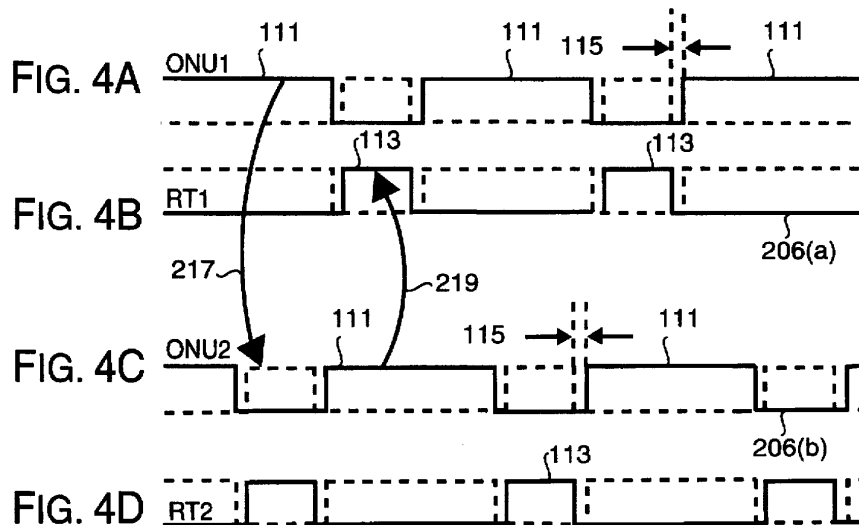
**1[pre]: A method in a data communications system for managing multiple time division physical channels that are subject to crosstalk, the method comprising:**

221. Bingham teaches the preamble of claim 1, to the extent it is determined to be limiting. For purposes of this proceeding I treat it as limiting.

222. Bingham discloses “A method of coordinating very high speed bi-directional data transmissions between a central unit and a plurality of remote units over distinct twisted pair transmission lines that share a binder.” Ex-1004, Abstract. Bingham teaches a method that uses “a time division duplexed (i.e. “ping pong”) based data transmission scheme.” *Id.*, 4:18-20. Bingham confirms that this method is for managing crosstalk across multiple time division physical channels by explaining that “[t]he present invention overcomes the near end crosstalk problem by synchronizing time division duplexed transmissions for very high speed data transmissions that share a binder,” where a binder is a group of multiple physical channels or lines. *Id.*, 4:34-37, 8:65-66 (“lines that share the same binder”).

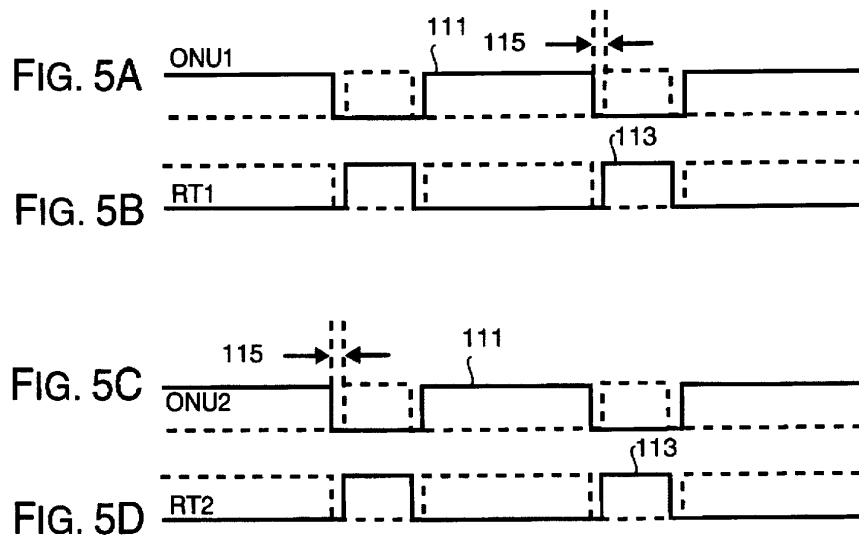
223. Bingham explains that in unsynchronized systems (as shown in Figures 4a-4d below), two separate transmission lines 206(a) and 206(b) both transmit time division duplexed discrete multi tone signals.” *Id.*, 6:64-7:1. Here, each “line

provides a sixteen symbol downstream communication period 111 a two symbol upstream communication period 113 with single symbol quiet periods 115 arranged therebetween.” *Id.*, 7:1-4. “In this embodiment, the communications are not synchronized” and so “downstream communication transmission on lines 206(a) and 206(b) occurs at the same time as upstream transmission on lines 206(b) and 206(a) respectively and will result in near end crosstalk into both of the distribution unit's associated receivers.” *Id.* 7:4-9.



224. Bingham discloses a data communications system for managing multiple time division physical channels that are subject to crosstalk as shown in Figures 5A-5D. Here, “all of the very high speed transmissions that share a binder are synchronized.” *Id.*, 7:16-18. Bingham explains that “[i]n the synchronized system, the downstream communication periods 111 all begin and end at the same

times, and the upstream communication periods 113 all begin and end at the same time. Such synchronization of the upstream and downstream communication periods effectively eliminates the problems caused by near end crosstalk.” *Id.*, 7:18-24.



225. Bingham discloses that a “modem timing and synchronization arrangement” can be used to implement this. *Id.*, 7:25-27.

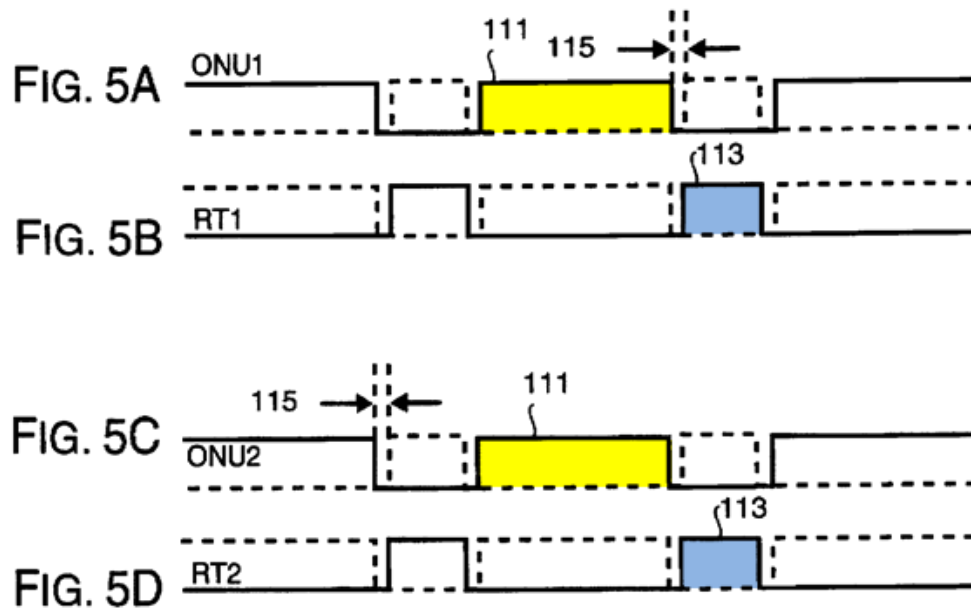
**1[a] scheduling upstream time slots for upstream transmission in a first physical channel; and**

226. Bingham teaches limitation 1[a].

227. As I explained with reference to the preamble, Bingham discloses a scheduling scheme with respect to Figure 5, which solves the problems disclosed in Figure 4.

228. Referring to Figures 5A-5D (which is annotated below), Bingham explains that in a “synchronized system, the downstream communication periods

111 [(shown in yellow)] all begin and end at the same times, and the upstream communication periods 113 [(shown in blue)] all begin and end at the same time.” Ex-1004 at 7:16-21. As will be discussed later, those communication periods do not overlap.



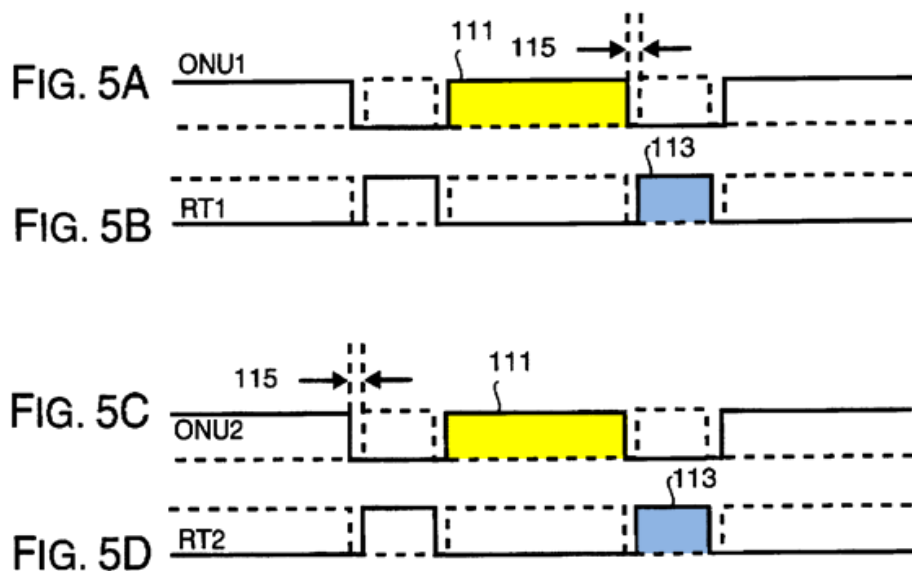
229. Still referring to Figures 5A-5D, Bingham discloses scheduling upstream time slot (113 in blue) in a first physical channel (shown in Figure 5B). As depicted in Figure 5B, the transmission comes from RT1, which Bingham explains is a first “upstream transmitter” or “receiver.” *Id.*, 7:8-13. A POSITA would have understood that Figure 5B (along with Figure 5A) depicts a first physical channel and Figure 5C (along with Figure 5D) depicts a second physical channel made up of twisted pair copper wires.

230. This can be confirmed when looking to Figure 4. Bingham discloses, with respect to Figure 4 (annotated below), that “*twisted pair transmission lines* 206(a) [(in orange)] and 206(b) [(in purple)] both transmit time division duplexed discrete multi tone signals.” Ex-1004 at 6:65-7:1. This means that when comparing Figures 4B and 4C, those are two separate twisted pair transmission lines. A POSITA would have understood those same physical channels carry over to Figures 5A-5D.

**1[b] scheduling downstream time slots for downstream transmission in a second physical channel,**

232. As explained with respect to limitation 1[a], Bingham teaches that in a “synchronized system, the downstream communication periods 111 [(yellow)] all begin and end at the same times, and the upstream communication periods 113

[(blue)] all begin and end at the same time.” Ex-1004 at 7:16-21. As will be discussed later, those communication periods do not overlap.

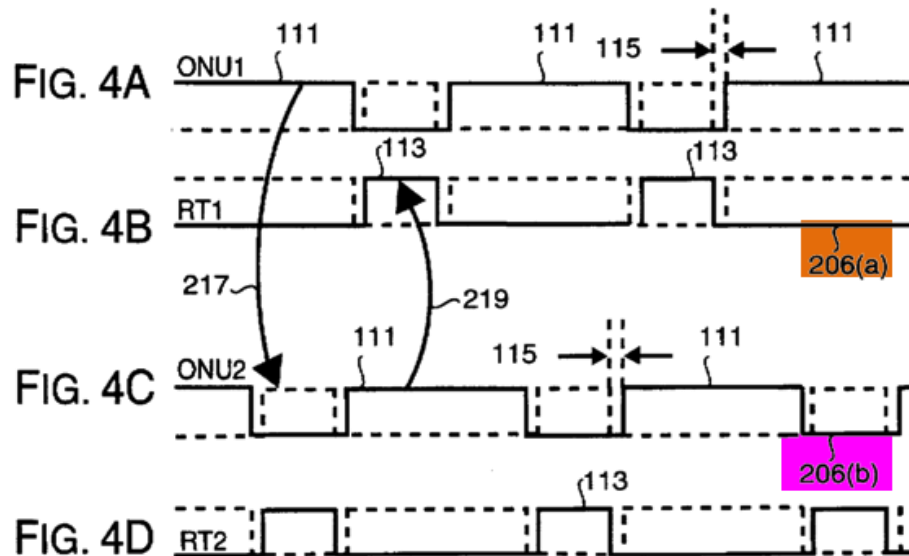


233. Here, Bingham discloses scheduling downstream time slots (111 in yellow) in a second physical channel (shown in Figure 5C). As depicted in Figure 5C, the transmission comes from ONU2, which Bingham explains is the “central unit.” *Id.*, 7:28.

234. As I already explained with respect to limitation 1[a], a POSITA would have understood that Figure 5C shows downstream transmission from the “central unit” on the second physical channel, while Figure 5B shows upstream transmission on the first physical channel.

235. This can be confirmed when looking to Figure 4. Bingham discloses, with respect to Figure 4 (annotated below), that “*twisted pair transmission lines*

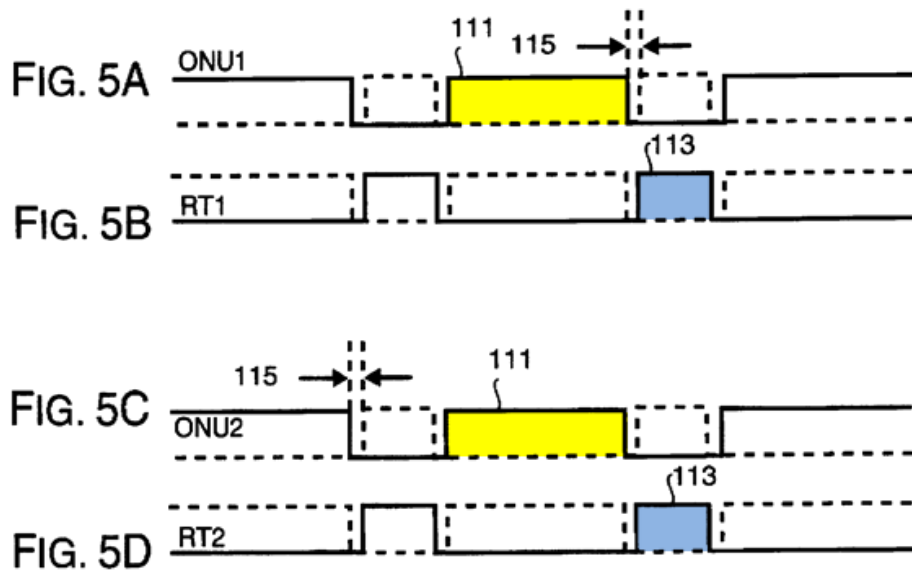
206(a) [(in orange)] and 206(b) [(in purple)] both transmit time division duplexed discrete multi tone signals.” Ex-1004 at 6:65-7:1. This means that when comparing Figures 4B and 4C, those are two separate twisted pair transmission lines. A POSITA would have understood those same physical channels carry over to Figures 5A-5D.



**1[c] wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.**

236. Bingham teaches limitation 1[c].

237. As shown in Figure 5, Bingham discloses that transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots. When comparing 111 (downstream in yellow) to 113 (upstream in blue), it is apparent that the transmissions are not simultaneous.



238. But there is no need to guess here. Bingham tells us so. Bingham explains that “[w]ith this arrangement, all of the very high speed transmissions within the same binder are synchronized and time division duplexed such that *downstream communications are not transmitted at times that overlap with the transmission of upstream communications.*” Ex-1004 at Abstract (emphasis added).

239. Bingham thus discloses that transmission in the upstream time slots is not substantially simultaneous with transmission in the downstream time slots of this embodiment.

240. Though the claim language does specify “substantially not simultaneous,” rather than just “not simultaneous,” if the times are entirely not simultaneous that falls within the claim scope of “substantially not simultaneous.”

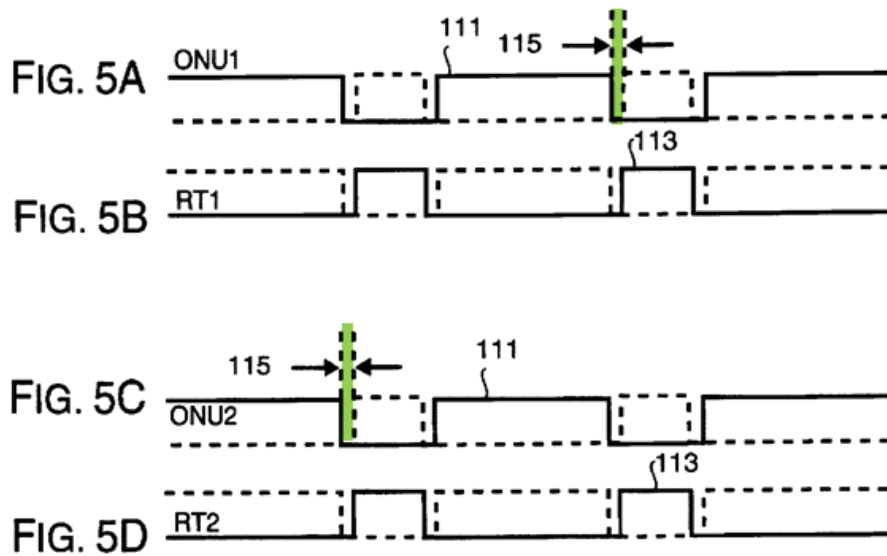
In fact, it is not entirely clear what “substantially” means in this context in that it is not clear what the bounds of the term mean. What a POSITA would understand, however, is that not being simultaneous at all falls within the scope of this claim term, and thus Bingham discloses this limitation.

**b. Dependent Claim 3: The method of claim 1, wherein the upstream and downstream time slots have an active portion during which signals are transmitted and an off portion during which no signals are transmitted, and wherein the active portions of the upstream time slots are substantially not simultaneous with the active portions of the downstream time slots.**

241. Bingham discloses claim 3.

242. As I explained with respect to Figure 5A-5D, Bingham discloses both active and downstream portions. Within those portions, however, Bingham additionally discloses active portions and off portions.

243. As depicted in annotated Figure 5 below, both the upstream time slots 113 and downstream time slots 111 have “quiet periods 115 [(in green)] arranged therebetween.” Ex-1004 at 7:3-4. Bingham explains that these “quiet periods are provided to separate the upstream and downstream communication periods” and, during these quiet periods, “neither upstream nor downstream communications may be transmitted.” *Id.*, 2:59-62.



244. These quiet periods 115 disclosed by Bingham constitute the off portions of the downstream and upstream time slots. To be sure, the downstream and upstream time slots need to be assigned such that they do not overlap. Adding in additional quiet periods constitutes time that the upstream and downstream transmissions are off. Those quiet periods can be applied to both the upstream and the downstream time periods.

245. Because I already explained that the upstream and downstream time slots are not simultaneous at all, and because the quiet periods disclosed by Bingham only further narrow the length of those periods (as opposed to broadening them), the active portions of the upstream and downstream time slots must be substantially not simultaneous.

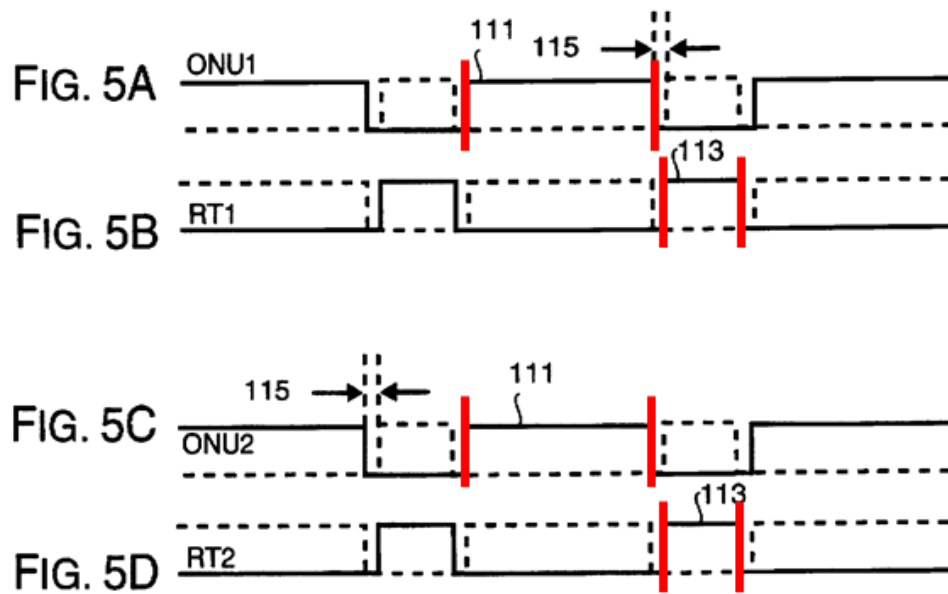
**c. Dependent Claim 4: The method of claim 1, wherein scheduling upstream and downstream time slots comprises scheduling upstream and downstream time slot boundaries.**

246. Bingham discloses claim 4.

247. When the upstream and downstream time slot time slots are set such that they are substantially not simultaneous, a POSITA would have known that inherently means that there are time slot boundaries in place to prevent transmission when one or the other is transmitting.

248. Figure 5 of Bingham (annotated below) confirms this. It shows scheduling upstream time slot boundaries for period 113 (in red) and downstream time slot boundaries for period 115 (also in red).

249. As explained by Bingham, “the downstream communication periods 111 all begin and end at the same times, and the upstream communication periods 113 all begin and end at the same time,” where the beginning of the period is one boundary and where the period ends is another boundary. Ex-1004 at 7:19-21. If there were no time slot boundaries in place, then transmissions in the upstream or downstream could potentially overlap, causing damaging crosstalk. A POSITA thus would have known that the below lines showing the time slots of the upstream and downstream are boundaries for those upstream and downstream transmissions.



**d. Dependent Claim 5: The method of claim 4, wherein the time slot boundaries are flexible.**

250. Bingham discloses claim 5.

251. With reference to Figure 3 (annotated below), Bingham explains that “downstream communication periods 111” (in yellow), “upstream communication periods 113” (in blue), and “quiet periods 115” (in green) may all be scheduled. Ex. 1004 at 5:45-55. A POSITA would have understood that if the periods can be scheduled, then they could be changed (at least at some point), meaning that they are not fixed to any particular length.

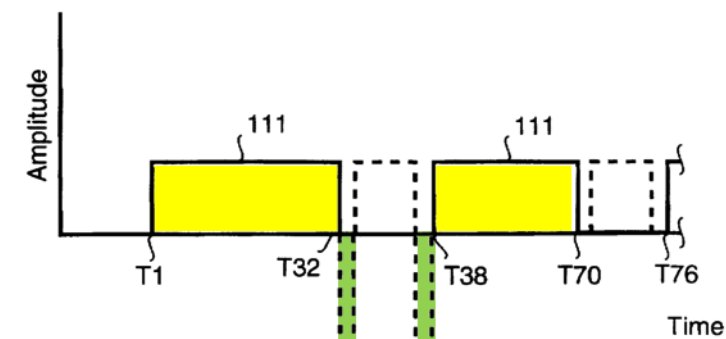


FIG. 3A

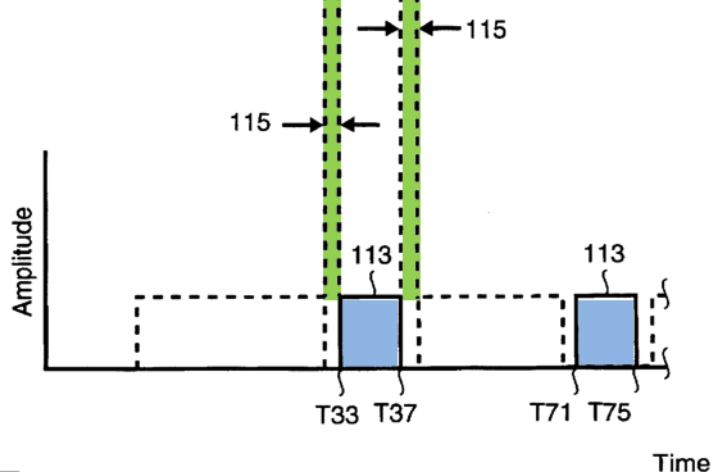


FIG. 3B

252. Bingham confirms this understanding, explaining that the “actual duration of the upstream, downstream and quiet periods as well as the superframe may all be varied extensively within the scope of the present invention.” *Id.* at 5:57-61. A POSITA would have understood this to mean that the time slot boundaries of the upstream and downstream periods are flexible. If the time slot boundaries were in fact fixed, then Bingham would not have expressly stated that the actual periods may be varied extensively.

- e. Dependent Claim 6: The method of claim 5, wherein the time slot boundaries have one or more of: variable-length frames;**

**variable upstream time slot lengths; or variable downstream time slot-lengths.**

253. Bingham discloses claim 6.

254. As I just explained, Bingham states that the “actual duration of the upstream, downstream and quiet periods as well as the superframe may all be varied extensively within the scope of the present invention.” *Id.* at 5:57-61. Thus, because the duration of the upstream, downstream, and quiet periods can be varied, a POSITA would have understood that the actual time slot lengths for both the upstream and downstream would be variable.

255. Looking to annotated Figure 3 below, where the downstream transmission in yellow, upstream transmission in blue, and quiet periods in green, Bingham’s disclosure that these periods may be varied means that the time slot lengths of at least the upstream time slot and the downstream time slot may be varied. A POSITA thus would have understood Bingham to disclose at least variable upstream time slot lengths or variable downstream time slot lengths.

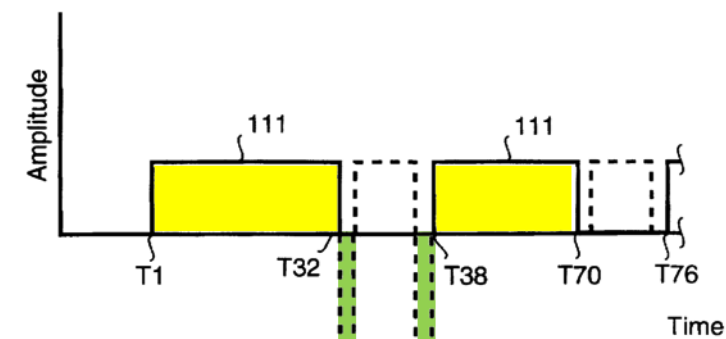


FIG. 3A

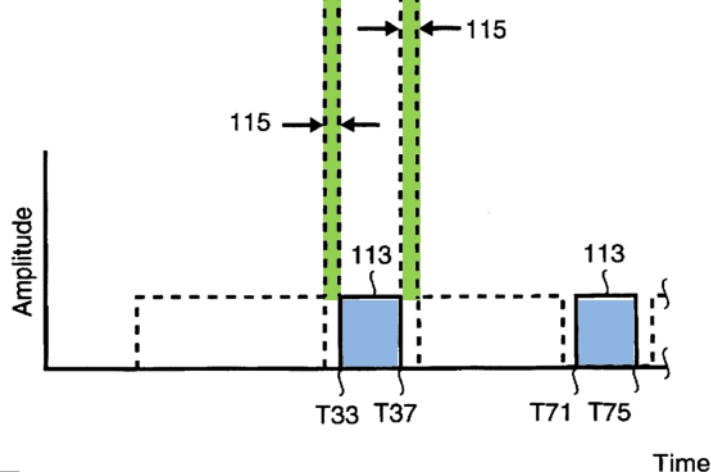


FIG. 3B

**f. Independent Claim 34**

**34[pre]: A machine-readable medium having instructions that when operated on by the machine cause the machine to perform operations comprising:**

256. To the extent the preamble is limiting, Bingham discloses limitation 34[pre]. For purposes of this proceeding, I treat this preamble as limiting.

257. With reference to Figure 6 (below), Bingham discloses that Figure 6 “is a block diagram illustrating a central office and remote modem timing architecture suitable for implementing the synchronization of the present invention.” Ex-1004,

4:11-13. Note that 206 is a twisted-pair copper link connecting the central unit, 201, and the remote unit, 204. Bingham further explains that “the invention can be implemented using a wide variety of modem constructions at both the central and remote station locations.” *Id.*, 9:12-14. A POSITA would have understood that the central office and remote location modems and equipment disclosed by Bingham would have included a memory with software for implementing the usual processes for communications and processing equipment and software at each end of the link 206. Thus, a POSITA would have recognized that Bingham discloses a machine-readable medium that includes instructions to perform certain operations, including time-division duplexing operations.

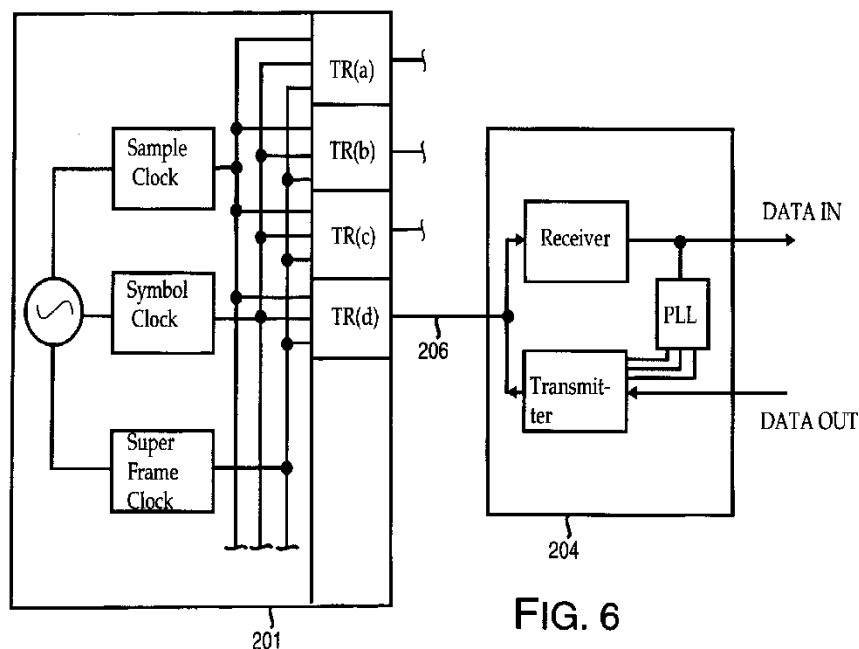
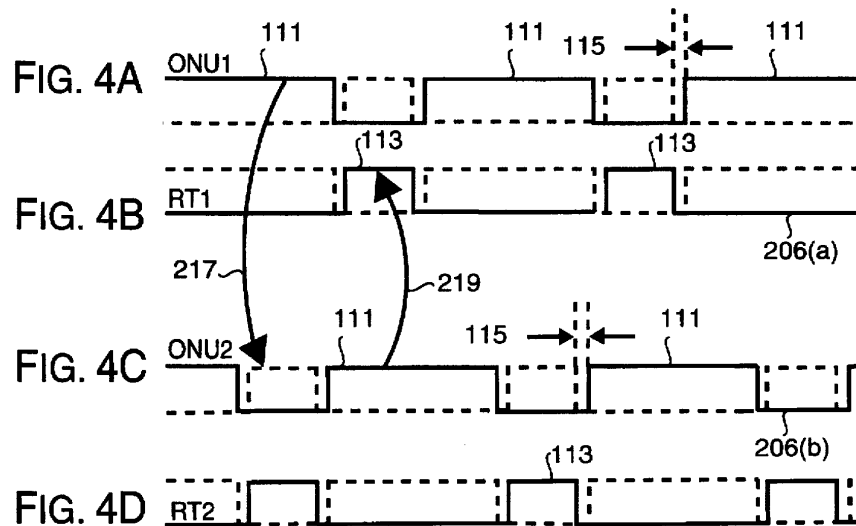


FIG. 6

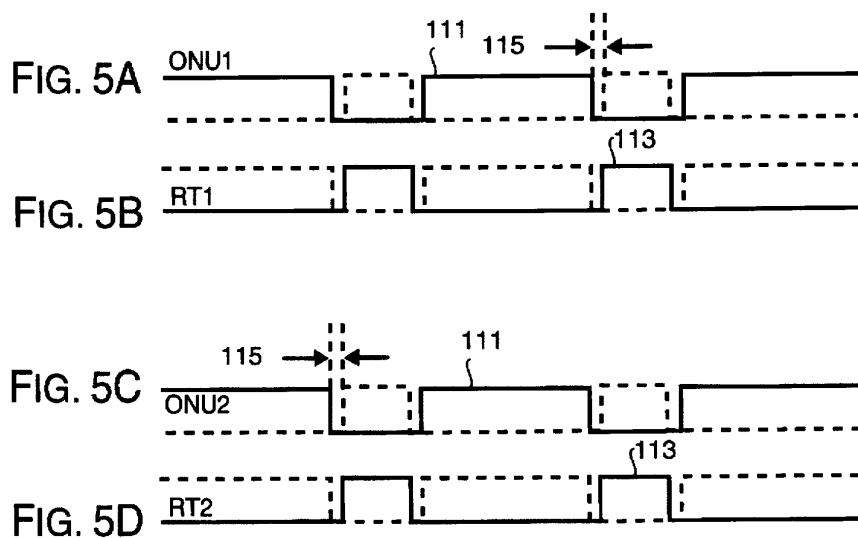
258. Additionally, Bingham discloses “A method of coordinating very high speed bi-directional data transmissions between a central unit and a plurality of remote units over distinct twisted pair transmission lines that share a binder.” Ex-1004, Abstract. Bingham teaches a method that uses “a time division duplexed (i.e. “ping pong”) based data transmission scheme.” *Id.*, 4:18-20. Bingham confirms that this method is for managing crosstalk across multiple time division physical channels by explaining that “[t]he present invention overcomes the near end crosstalk problem by synchronizing time division duplexed transmissions for very high speed data transmissions that share a binder,” where a binder is a group of multiple physical channels or lines. *Id.*, 4:34-37, 8:65-66 (“lines that share the same binder”).

259. Bingham explains that in unsynchronized systems (as shown in Figures 4a-4d below), two separate transmission lines 206(a) and 206(b) both transmit time division duplexed discrete multi tone signals.” *Id.*, 6:64-7:1. Here, each “line provides a sixteen symbol downstream communication period 111 a two symbol upstream communication period 113 with single symbol quiet periods 115 arranged therebetween.” *Id.*, 7:1-4. “In this embodiment, the communications are not synchronized” and so “downstream communication transmission on lines 206(a) and 206(b) occurs at the same time as upstream transmission on lines 206(b) and 206(a)

respectively and will result in near end crosstalk into both of the distribution unit's associated receivers.” *Id.* 7:4-9.



260. Bingham discloses a data communications system for managing multiple time division physical channels that are subject to crosstalk as shown in Figures 5A-5D. Here, “all of the very high speed transmissions that share a binder are synchronized.” *Id.*, 7:16-18. Bingham explains that “[i]n the synchronized system, the downstream communication periods 111 all begin and end at the same times, and the upstream communication periods 113 all begin and end at the same time. Such synchronization of the upstream and downstream communication periods effectively eliminates the problems caused by near end crosstalk.” *Id.*, 7:18-24.



261. Bingham discloses that a “modem timing and synchronization arrangement” can be used to implement the above system. *Id.*, 7:25-27.

**34[a] scheduling upstream time slots for upstream transmission in a first physical channel of multiple time division physical channels in a data communication system in which the physical channels are subject to crosstalk; and**

262. Bingham discloses limitation 34[a] for at least the same reasons I discussed in limitations 1[pre] and 1[a], which I incorporate here. I will note that although the combination of both limitations 1[pre] and 1[a] are required to disclose limitation 34[a], the claimed scope is otherwise identical, except that claim 34 claims a “machine readable medium” while claim 1 claims a “method,” which I explained above.

**34[b]: scheduling downstream time slots for downstream transmission in a second physical channel subject to crosstalk from the upstream time slots,**

263. Bingham discloses limitation 34[b] for the same reasons I discussed in limitation 1[b], which I incorporate here. Limitation 34[b] recites “subject to crosstalk from the upstream time slots,” which is not recited in limitation 1[b]. But a POSITA would have understood that downstream transmissions are almost always subject to crosstalk from simultaneous upstream transmissions, which are on the same frequency. For example, the ’631 patent discloses that “system transmitting in multi-pair copper cables can generate crosstalk into each other,” Ex-1001 at 2:7-9, and Bingham discloses that “downstream communication transmission [that] occurs at the same time as upstream transmission . . . will result in near end crosstalk,” Ex-1004 at 7:5-7. Therefore, the downstream time slots that are scheduled in Bingham would be subject to crosstalk from upstream time slots if they overlapped, and thus Bingham’s disclosure satisfies this limitation.

**34[c]: wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.**

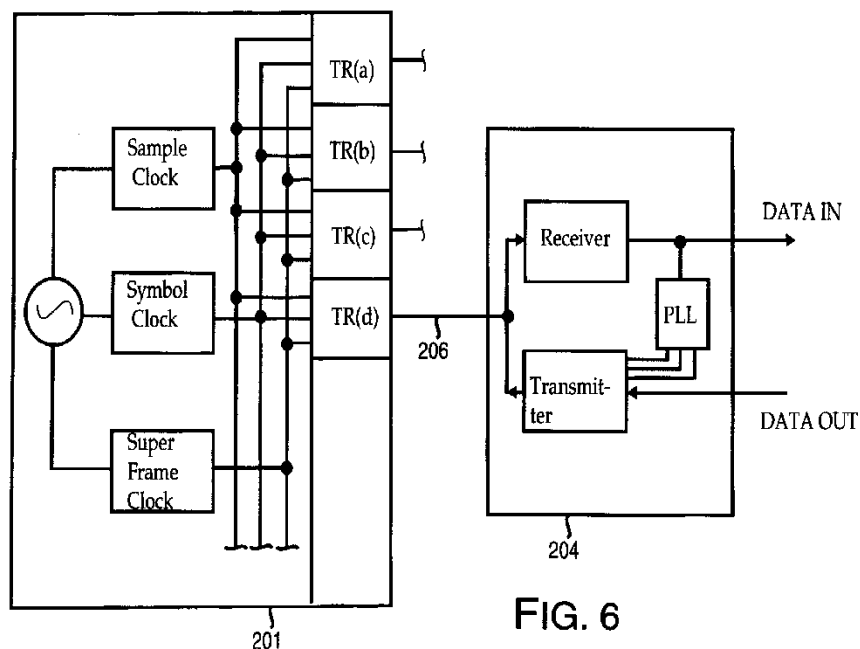
264. Limitation 34[c] is identical to limitation 1[c]. Bingham therefore discloses limitation 34[c] for the same reasons I discussed in limitation 1[c], which I incorporate here.

**g. Independent Claim 37**

**37[pre]: An apparatus for managing multiple time division physical channels in a data communications system that are subject to crosstalk, the apparatus comprising:**

265. Bingham discloses 37[pre] for the same reasons explained with respect to limitation 1[pre], which recites the same language (except as a method rather than apparatus). I incorporate 1[pre] here.

266. As to the apparatus portion, Bingham discloses an apparatus in Figure 6, which shows “a central office and remote modem timing architecture” that are “suitable for implementing the synchronization of the present invention.” Ex-1004, 4:11-13. Using this apparatus and the synchronization manager discussed in limitation 1[pre], Bingham discloses this limitation.



**37[a]: means for scheduling upstream time slots for upstream transmission in a first physical channel; and**

267. Bingham discloses limitation 37[a] for the same reasons explained with respect to limitation 1[a], which I incorporate here.

268. This claim language is a little different than it is in the claim 1 in that it claims a “means” for scheduling these upstream time slots.

269. As I explain in my section on claim construction, there are two alternative structures contemplated by the '631 patent specification related to this “means” term, including a “system 1200 [that] includes a memory 1295 coupled directly or through a bus to a processor or processors 1296,” where the “processor may also include its own internal memory,” and where processor may also implement or execute implementing logic 1260 having logic to implement the methodologies discussed herein.” Ex-1001 at 14:47-58. It also includes “one or more communications buses 1215 to connect the various illustrated components and to transfer transactions, instructions, requests, and data within the system among the components and other peripheral devices. The system further includes a management interface 1225 coupled to the bus and to external management devices, for example, to receive requests, return responses, and otherwise interface with network elements located separately from the system. . . . The system further includes a LAN (Local Area Network) interface 1230 coupled to the bus and externally to communicate information via a LAN based connection, including

collecting network information, reporting information and diagnostics to other entities within the network, and for initiating instructions and commands over the network. The system further includes a WAN (Wide Area Network) interface 1235 coupled to the bus and to an external WAN, to communicate information via a WAN based connection for similar purposes and to reach other more remote devices. . . . The system further includes stored historical information 1250 which may be stored within the memory 1295 or as a separate component coupled to the memory or to the bus.” *Id.* 14:47-15:44.

270. Alternatively, another structure includes a scheduling or analysis module of a management device, which “is coupled to the bus [and] includes a collection module 1270, analysis module 1275, diagnostics module 1280, and implementation module 1285. Management Device 1201 may be installed and configured in a compatible system 1200 as is depicted by FIG. 12A, or provided separately so as to operate in conjunction with appropriate implementing logic 1260 or other software.” *Id.* at 15:45-51. “The modules of the management device 1201 may be provided as separate components coupled to the bus 1215 as shown or may be incorporated into the processor or memory or another component. The management device may include its own processing and memory resources that interact with the processor and the external interfaces. The management device may include more or fewer modules than those shown. The TDD management system of

FIG. 12 is provided only as an example and may be modified to suit different implementations. It may also be incorporated into another component such as an access node, or a TU-O. In one embodiment, the management system is provided as a card in a system rack with a backplane interface to communicate with local and remote network elements.” *Id.* at 16:6-19.

271. Bingham discloses at least the first structure contemplated. Specifically, Bingham discloses that the invention may be implemented by “a central office and remote modem timing architecture.” Ex-1004, 4:11-13. Bingham explains that the “central unit . . . may include a transceiver . . . that is functionally broken into a transmitter 209 and a receiver 210.” *Id.*, 4:49-51. A POSITA would have understood that transceivers at the time of Bingham would have included both processors and memory connected in such a way as to implement logic. Without a memory and processor the transmitter and receiver of the transceiver would likely be of little use.

272. A POSITA also would have recognized that the transceiver would include communication buses to connect the various components. Indeed, it was well understood at the time of Bingham that things like the processor and memory within a transceiver would be connected, and that the connection could be done via a communication bus. The transceiver shown in Bingham in Figure 6 illustrates this structure, where there are connections between the receiver, the transmitter, and the PLL (which is a circuit).

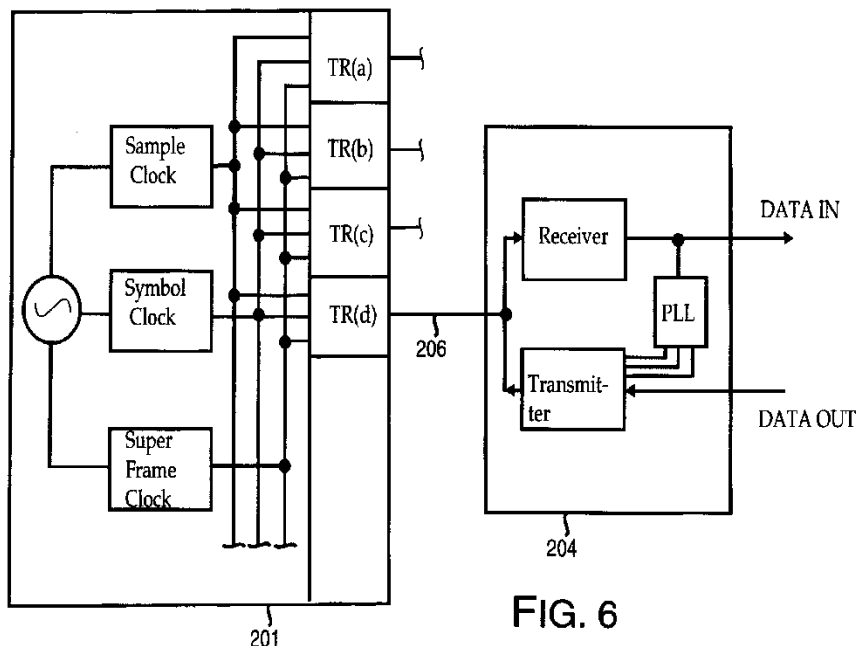


FIG. 6

273. A POSITA would have recognized that there would be a management interface to interface with the varying network elements as it relates to the transceivers. For example, the management interface would have interfaced with both the receiver and transmitter. As shown in Figure 6 of Bingham above, there is a master clock unit in the central unit that supplies a super-frame clock to all of the central unit transmitters. Ex-1004 at 7:25-36. This may constitute the management interface.

274. A POSITA further would have recognized that the transceivers (which are for DSL) would operate in some way with both a LAN and WAN. This makes sense as the purpose of the DSL modem disclosed by Bingham was to provide connection to the internet. A POSITA also would have known that the transceivers

of Bingham could have stored historical information on its memory, such as connections and connection points. A POSITA also would have recognized that Bingham discloses an analysis module or scheduling module of a management device (which might be part of the modem or transceiver).

**37[b]: means for scheduling downstream time slots for downstream transmission in a second physical channel subject to crosstalk from the upstream time slots,**

275. Bingham discloses limitation 37[b] for the same reasons explained with respect to limitation 1[b].

276. I incorporate here my discussion of the “means” from limitation 37[a]. Bingham discloses the structure with respect to upstream and downstream.

**37[c]: wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.**

277. Bingham discloses limitation 37[c] for the same reasons explained with respect to limitation 1[c], which shares the same language. I therefore incorporate limitation 1[c] here.

**B. Ground 2A: Claims 1, 3-6, 8-9, 11-16, 22-25, and 33-37 Are Unpatentable Under 35 U.S.C. § 103 Over Strobel.**

**Ground 2B: Claims 3, 15, and 16 Are Unpatentable Under 35 U.S.C. § 103 Over Strobel in View of Wei.**

**Ground 2C: Claims 5, 6, 9, 11-14, 35, and 36 Are Unpatentable Under 35 U.S.C. § 103 Over Strobel in View of Kuipers.**

**Ground 2D: Claim 33 Is Unpatentable Under 35 U.S.C. § 103 Over Strobel in View of Kuipers and Wei.**

278. Strobel alone teaches all of the limitations of claims 1, 3-6, 8-9, 11-16, 22-25, and 33-37, Strobel in view of Wei teaches all of the limitations of claims 3, 15, and 16, Strobel in view of Kuipers teaches all of the limitations of claims 6, 9, 11-14, 35, and 36, and Strobel in view of Kuipers and Wei teaches all of the limitations of claim 33.

279. My below analysis related to Strobel, Wei, and Kuipers applies under either construction of the term “physical channel.” I understand that ASSIA proposes that the term should be construed under its plain and ordinary meaning. Under that construction, Strobel, Wei, and Kuipers discloses the challenged claims. If disclaimer is applied (as I believe it should be), in my opinion Strobel, Wei, and Kuipers still renders obvious the challenged claims because a POSITA would have understood that Strobel could be used with unidirectional channels. *See* Ex-1028 (disclosing that “HDSL requires two or three pairs for symmetric 2 Mbit/s transmission over 2.5km” a POSITA would have understood that each pair could be unidirectional).

280. Although a unidirectional system (where data is sent either in just the upstream or the downstream on a single physical channel) would be less efficient than a bidirectional system because significant bandwidth may be lost, the system would be less complex from a management perspective. For example, one of the

considerations in a bidirectional channel is having to switchover between receiving and transmitting signals, something commonly referred to as a turnaround time. Turnaround time generally refers to the time it takes for a transceiver to switch from transmitting mode to receiving mode, and vice versa, within a single frequency channel. A faster turnaround time correlates to more efficient data transfer in TDD systems where the same frequency is used for both sending and receiving data at different time slots. Having a longer turnaround time because of this switchover time reduces rate efficiency. Ex-1005, 21:6-9.

281. A POSITA would have been motivated to use Strobel with unidirectional channels to eliminate this turnaround time. More specifically, although a unidirectional system (where data is sent either in just the upstream or the downstream on a single physical channel) is less efficient in that some bandwidth may be wasted, a POSITA would have been motivated to use unidirectional channels to eliminate the turnaround time that is required to transition between transmit and receive states in bidirectional channels. Strobel confirms that a POSITA would have been motivated as such, explaining that bidirectional channels “has a disadvantage in that turnaround time is required to switch between uplink and downlink, and vice versa,” and this “[t]urnaround time reduces the rate efficiency.” Ex-1005, 21:6-9. A POSITA thus could have been motivated to use unidirectional channels to increase rate efficiency in either Bingham or Strobel and, given that this was a known solution

to reduce turnaround time, would have had a reasonable expectation of success in doing so.

**a. Motivation to Combine Strobel and Wei, Strobel and Kuipers, and Strobel, Wei, and Kuipers**

282. In my opinion, Strobel discloses all of the limitations of the asserted claims. Nonetheless, because Wei and Kuipers provide context that informs how a POSITA would have understood Strobel, as well as alternative embodiments that separately disclose the limitations of the asserted claims, I combine the references.

283. For example, while Strobel discloses guard times (as it relates to claim 3), it does not expressly disclose that those guard times are off times of a downstream or upstream time slot (as it relates to claim 3). Wei, however, does make this explicit disclosure, disclosing both guard times and an alternative “discontinuous mode power save (DMPS) method” that includes “Awake Windows” and “Sleep Windows.” Ex-1009 at 2. Similarly, with respect to Kuipers, while Strobel discloses “programmable” time slots, it does not expressly provide that those time slots are “flexible” (as it relates to claim 5). Kuipers, however, specifically “presents a flexible frame structure for G.fast that will enable dynamic adaptation to the actual needs and offered traffic load.” Ex-1008 at 1.

284. Each of Strobel, Wei, and Kuipers are analogous art at least because all three references are directed to solving problems related to G.fast. Ex-1005, 2:17-21; Ex-1008, 1; Ex-1009, 1. Strobel explains that one approach for distribution

points (DPs) “uses time division duplexing between the upstream and downstream,” but that approach “requires higher power consumption and is more complex.” Ex-1005, 2:43-52. Strobel continues by explaining that “[t]he task of finding transceiver settings in a communication system that lead to a desired rate configuration, typically requires very complex optimization.” *Id.*, 2:63-65. Wei and Kuipers contemplate varying transceiver settings such a flexible frame format and discontinuous mode power save that could be incorporated in a time division duplexed system. Ex-1008; Ex-1009.

285. Importantly, Wei and Kuipers are ITU contributions submitted to the ITU Study Group related to “G.fast.” Ex-1008; Ex-1009. Both references were submitted in advance of the June 2012 ITU meeting for Study Group 15, Question 4 that was held in Antwerp, Belgium. *Id.* While Strobel is a patent, much of its disclosure derives from an ITU contribution by Lantiq that was similarly submitted to the topic related to G.fast. *See* Ex-1013. That Lantiq contribution, which was submitted in advance of the February 2012 meeting for Study Group 15, Question 4 that was held in Paris, France, proposes a frame format that could be used for “both synchronous TDD . . . and for synchronous TDMA.” *Id.*, 1. Given that the ITU ultimately agreed that the duplexing method for G.fast would be TDD, a POSITA would have known to review the TDD embodiments disclosed in Strobel, along with the more detailed parameters disclosed by Wei and Kuipers. Ex-1005 (and 1006 and

1007), 1008, and 1009 (“Time-division duplexing (TDD) has been adopted as the duplexing method for G.fast.”). Ex-1009.

286. From my personal experience with standards organizations, a POSITA would have looked to all the contributions directed to a specific standard, especially where those topics were being discussed at the same meeting. In fact, the way the ITU works is that contributions are submitted to the members of the ITU Study Group 15 (which includes individuals that would have need for information relevant to DSL at the time and there are typically several hundred participants in the meetings and a wider group would receive the contributions). After considering the merits and feasibility of the proposals the members agree or do not agree to include elements of those contributions into a draft standard. The draft standard is discussed, edited, and finally voted upon. Thus, even where recommendations are not agreed, a POSITA would have been motivated to look to it to understand what might have been an option at the time.

287. As such, a POSITA would have been motivated to combine the TDD embodiments of Strobel with the power-saving proposal of Wei because Strobel admits that the TDD approach “requires higher power consumption” (Ex-1005 at 2:48) and Wei contemplates an alternative solution to reduce power within the same TDD system. *Compare* Ex-1005, 2:43-52, *with* Ex-1009 at 1. Here, the Wei reference was submitted and considered at an ITU meeting just one month before the ’631

patent and just four months after the ITU contribution related to Strobel. A POSITA therefore would have looked for possible solutions to the high power consumption problem mentioned by Strobel.

288. For example, Strobel explains that in one embodiment its system may include “information about time slots, about when transceivers should transmit, and/or about the power levels at which transceivers should transmit.” Ex-1005 at 6:53-63. Wei proposes an alternative approach to reducing power wherein, “when user traffic is lower than channel capacity, the entire transmission and reception path can be turned off during some DMT symbols within a TDD frame to save power.” Ex-1009 at 2.

289. A POSITA would have had a reasonable expectation of success in combining Strobel and Wei because Strobel discusses a time-division duplexing system conscious of reducing power and Wei discloses a power reduction technique for a time-division duplexed system. Ex-1005, 2:43-52; Ex-1009 at 1.

290. A POSITA also would have been motivated to combine the TDD embodiments of Strobel with the flexible frame proposal of Kuipers because Strobel admits that the TDD approach “is more complex” and Kuipers contemplates a proposed flexible frame format that addresses this complexity. *Compare* Ex-1005, 2:43-52, *with* Ex-1008 at 1. Like Wei, Kuipers reference was submitted and considered at an ITU meeting just one month before the ’631 patent and just four

months after the ITU contribution related to Strobel. A POSITA therefore would have looked for possible solutions to the complexity problem posed by Strobel.

291. For example, Strobel contemplates something called “[d]ynamic rate adaptation,” where “local optimizations” of a system are reprogrammed in response to “an event [that] happens to change the local optimizations.” Ex-1005, 12:44-50. Kuipers offers “a flexible frame structure for G.fast” that “enable[s] [this] dynamic adaptation.” Ex-1008, 1.

292. A POSITA would have had a reasonable expectation of success in combining Strobel and Wei because Strobel discusses a time-division duplexing system for G.fast that uses dynamic rate adaptation and Kuipers discloses a flexible frame format that enables dynamic rate adaptation in G.fast. Ex-1005, 12:44-50; Ex-1008, 1.

293. A POSITA further would have been motivated to combine each of Strobel, Wei, and Kuipers together to address an entire G.fast system. Wei and Kuipers were proposed at the exact same ITU meeting and each provided separate parameters for optimizing a G.fast system that complement each other. For example, while Wei is directed to power reduction, Kuipers explains that its “flexible framer can also be used to reduce power consumption.” Ex-1008, 5. A POSITA would have therefore been motivated to combine Wei with Kuipers into the implementation of

Strobel, and had a reasonable expectation of success in doing so, because the power saving framework of Wei could function within the flexible frame format of Kuipers.

**b. Independent Claim 1**

**1[pre] A method in a data communications system for managing multiple time division physical channels that are subject to crosstalk, the method comprising:**

294. In my opinion, to the extent the preamble is limiting, a POSITA would have understood Strobel to disclose 1[pre].

295. Strobel is clear in that it discloses methods for configuring and operating elements of a time sharing electronic communication system comprising a crosstalk channel and communication and central units. Ex-1005 at Abstract.

296. Strobel discloses “various methods for configuring and operating the elements of [a communication] system to enhance communication between communication units within the system.” Ex-1005 at Abstract. One of the issues Strobel sought to address through its invention is “crosstalk between the lines” that occurs when you have “multiple parallel transmissions bound together.” *Id.*, 1:17-19; Ex-1006 at 1 (provisional disclosure the same as the patent, hereinafter “same”). As one example, Strobel discloses that crosstalk may occur in “[t]ransmissions in a cable binder,” such as that of DSL where multiple physical channels are in a single binder. Ex-1005 at 1:17-23; Ex-1006 at 1 (same).

297. Strobel discloses a transmission method between a first approach DP (distribution point), a second approach DP, and/or a combination of a first and second approach DP, to CPEs wherein the combination solution uses TDD and/or STDMA. Ex-1005 at 10:53-63. Strobel asserts that “a transmission method from a DP shall be capable to operate in a DP using *either* the first approach, the second approach, or a combination of both.” Ex-1005 at 2:59-62.

298. By way of another example, Strobel discloses sending sync-symbols to corresponding transmission media across all active lines in both TDD and STDMA cases. Ex-1005 at 11:34-44.

299. The embodiment of Strobel that I will focus on is the method of reducing crosstalk that “uses time division duplexing between upstream and downstream.” Ex-1005 at 2:44-45; Ex-1007 at 1 (same).

300. As an example, one of the proposed methods of reducing crosstalk is depicted by the time division duplexed method of Figure 16 of Strobel, which discloses a method of managing two separate physical channels (US1 in green depicts upstream transmission on a first physical channel and DS2 (in peach) depicts downstream transmission on a second physical channel) that would be subject to crosstalk. Ex-1005, Fig. 16; Ex-1007 at 4 (same).

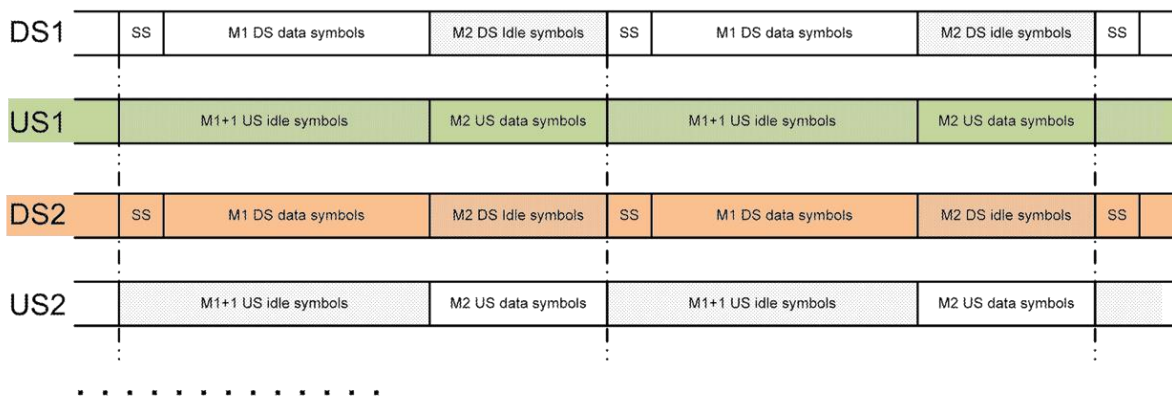


FIG. 16

301. In disclosing a time division duplexed system with multiple physical channels, Strobel therefore discloses a method of managing two separate physical channels that would be subject to crosstalk.

**1[a] scheduling upstream time slots for upstream transmission in a first physical channel; and**

302. In my opinion, Strobel discloses limitation 1[a].

303. As seen in Figure 16, Strobel discloses scheduling upstream time slots for upstream transmission in a first physical channel where, as an example, the M2 US transmitted upstream data symbols depicted in blue are scheduled in the time slots on the first physical channel is US1. Ex-1005, Fig. 16; Ex-1007 at 4 (same).

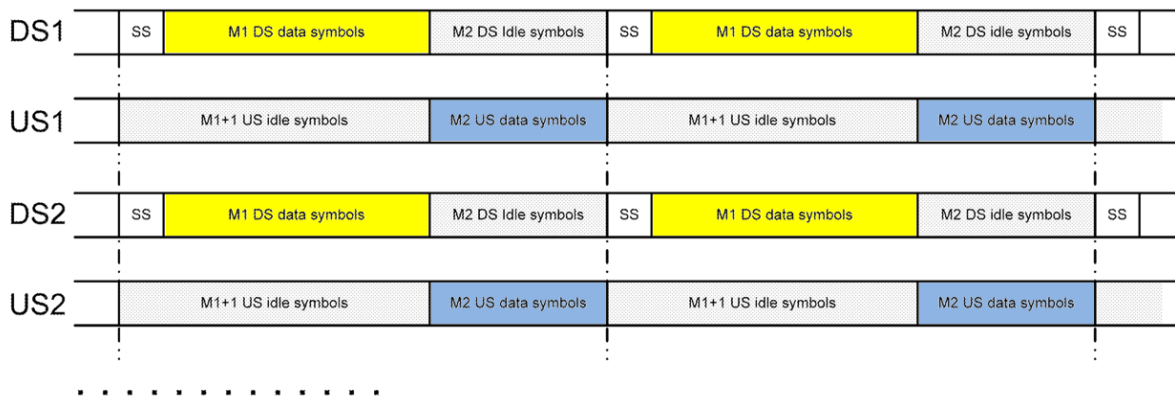


FIG. 16

304. I will note that while Figure 16 depicts slot allocations based on data symbols as opposed to slot allocations based on time (i.e., time slots), the allocation of symbols represents time slots. Strobel confirms this. Strobel explains that “all TS [(i.e., transmission time slots)] shall have duration that is an integer number of symbols.” Ex-1005 at 31:45-46; Ex-1007 at 7. This means that those data symbols disclosed by Strobel represent the same time slots claimed by the ’631 patent.

305. I therefore use Figure 16 throughout this declaration to aid in understanding the disclosure of Strobel and, even though it states data symbols, based on this disclosure of Strobel a POSITA would have understood that to directly correspond to time slots.

306. To be sure, Strobel continues by explaining that “the symbols allocated for upstream transmission have an associated time position for actual upstream transmission” and the “the symbols allocated for downstream transmission have an associated time position for actual downstream transmission,” wherein “the two

associated time positions are different.” Ex-1005 at 8:43-49; Ex-1007 at 6. In other words, the symbols are assigned actual time positions within time slots. Strobel confirms that it does disclose the same time slots as in the ’631 patent, stating that “transmission time slots (TS) are used to assign the particular transmission time (or transmission opportunity time) for a specific line in upstream and/or downstream direction.” Ex-1005 at 31:40-43; Ex-1007 at 6.

307. To further confirm this understanding, Strobel discloses Figure 11, which it describes as “an illustration of a possible allocation of time slots 1110 for uplink and downlink transmission in a TDD system.” Ex-1007 at 22:5-7. Here it is apparent that Strobel is contemplating time slots, and that those allocated symbols are associated with actual time slots.

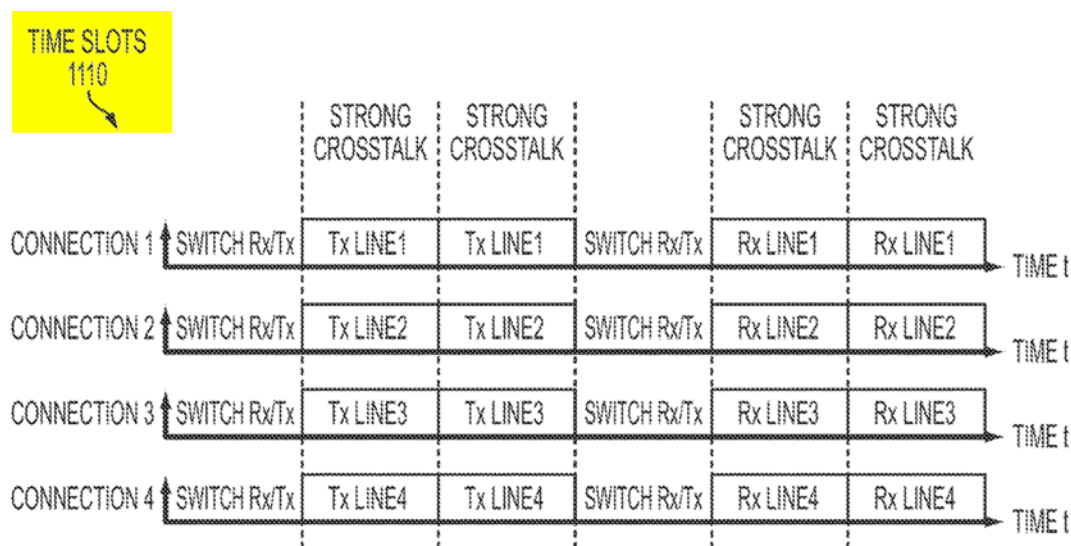


FIG. 11

308. Strobel’s disclosure of M2 US data symbols therefore discloses this limitation.

**1[b] scheduling downstream time slots for downstream transmission in a second physical channel,**

309. In my opinion, Strobel discloses limitation 1[b].

310. As seen in Figure 16, Strobel discloses scheduling downstream time slots for downstream transmission in a second physical channel where, as an example, the M1 DS2 downstream data symbols depicted in yellow are scheduled in time slots in the second physical channel. Ex-1005, Fig. 16; Ex-1007 at 4 (same). As explained with respect to limitation 1[a], the data symbols of Figure 16 represent actual time slots.

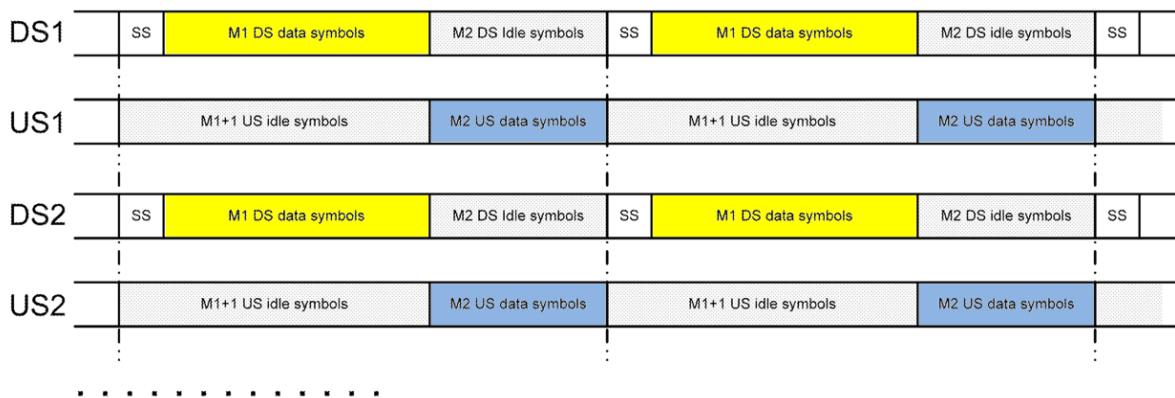


FIG. 16

311. As I also explained in limitation 1[a], Strobel discloses Figure 11, which it describes as “an illustration of a possible allocation of time slots 1110 for uplink and downlink transmission in a TDD system.” Ex-1007 at 22:5-7. This confirms that the data symbols are time slots.

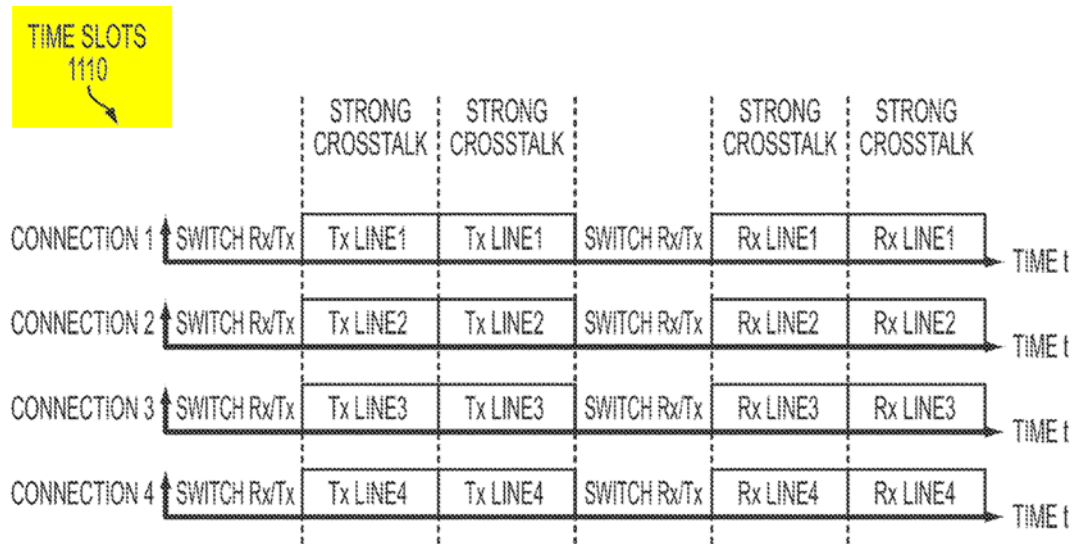


FIG. 11

312. Strobel's disclosure of M1 DS data symbols therefore discloses this limitation.

**1[c] wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.**

313. In my opinion, Strobel discloses limitation 1[c].

314. Focusing once again on Figure 16, Strobel discloses scheduling upstream time slots (as depicted in blue) at times that are substantially not simultaneous with transmission in the downstream time slots (depicted in yellow).

Ex-1005, Fig. 16; Ex-1007 at 4 (same).

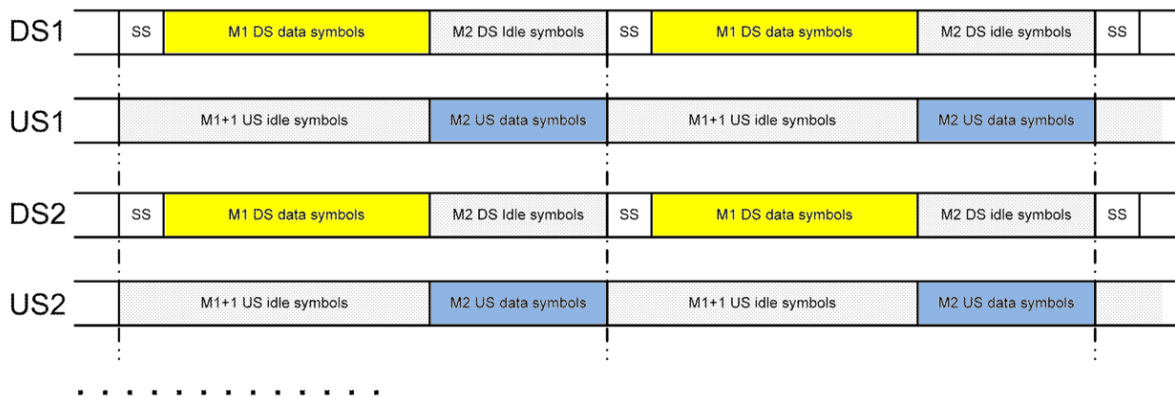


FIG. 16

315. While Figure 16 discloses data symbols, because Strobel explains that the symbols have an “associated time position,” a POSITA would have understood that the time slots of the upstream (in blue) and downstream (in yellow) are substantially not simultaneous. To be sure, it is apparent just from reviewing Figure 16 that the upstream is not substantially simultaneous with the downstream.

316. But Strobel also confirms this. Strobel explains that “the symbols allocated for upstream transmission have an associated time position for actual upstream transmission” while the “the symbols allocated for downstream transmission have an associated time position for actual downstream transmission,” wherein “the two associated time positions are different.” Ex-1005 at 8:43-49; Ex-1007 at 6 (emphasis added). A POSITA would have known that meant that they are substantially not simultaneous.

317. Additionally, although Strobel discloses upstream and downstream “idle symbols” that do overlap with the upstream and downstream time slot

boundaries, Strobel explains that these idle symbols could be replaced with “quiet periods” where “symbols may not be transmitted at all.” *Id.*, 30:41-46; Ex-1007 at 5. Thus, replacing the “idle symbols” shown in Figure 16 according to this alternative embodiment with quiet periods, transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.

318. Though the claim language does specify “substantially not simultaneous,” rather than just “not simultaneous,” if the times are entirely not simultaneous that falls within the claim scope of “substantially not simultaneous.” In fact, it is not entirely clear what “substantially” means in this context in that it is not clear what the bounds of the term mean. What a POSITA would understand, however, is that not being simultaneous at all falls within the scope of this claim term, and thus Bingham discloses this limitation.

**c. Claim 3: The method of claim 1, wherein the upstream and downstream time slots have an active portion during which signals are transmitted and an off portion during which no signals are transmitted, and wherein the active portions of the upstream time slots are substantially not simultaneous with the active portions of the downstream time slots.**

319. In my opinion, Strobel alone or in view of Wei discloses claim 3.

320. Focusing again on Figure 16, Strobel discloses both the upstream and downstream having an active portion when it discloses time slots with “M2 US data symbols” (in blue) and “M1 DS data symbols” (in yellow). Strobel explains that in Figure 16, “one upstream (US) and one downstream (DS) transmission are

established during a superframe.” Ex-1005 at 30:12-14. Reviewing this disclosure, and what is shown in Figure 16, a POSITA would have understood that at least the M1 DS data symbols and M2 US data symbols are transmitted during an active portion.

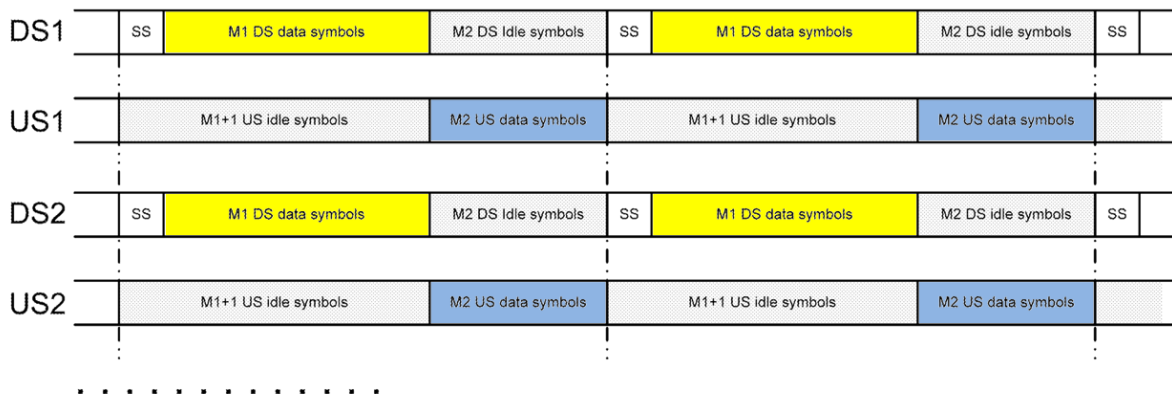


FIG. 16

321. Moreover, because the M1 DS and M2 US symbols are already not transmitted at the same time, for the same reasons that I discussed with respect to limitation 1[c], the active portions of the upstream time slots are substantially not simultaneous with the active portions of the downstream time slots.

322. Strobel also discloses an off portion during which no signals are transmitted. Specifically, in annotated Figure 20 (below), there exists guard times ( $T_{g1}$  and  $T_{g2}$ ) shown in green:

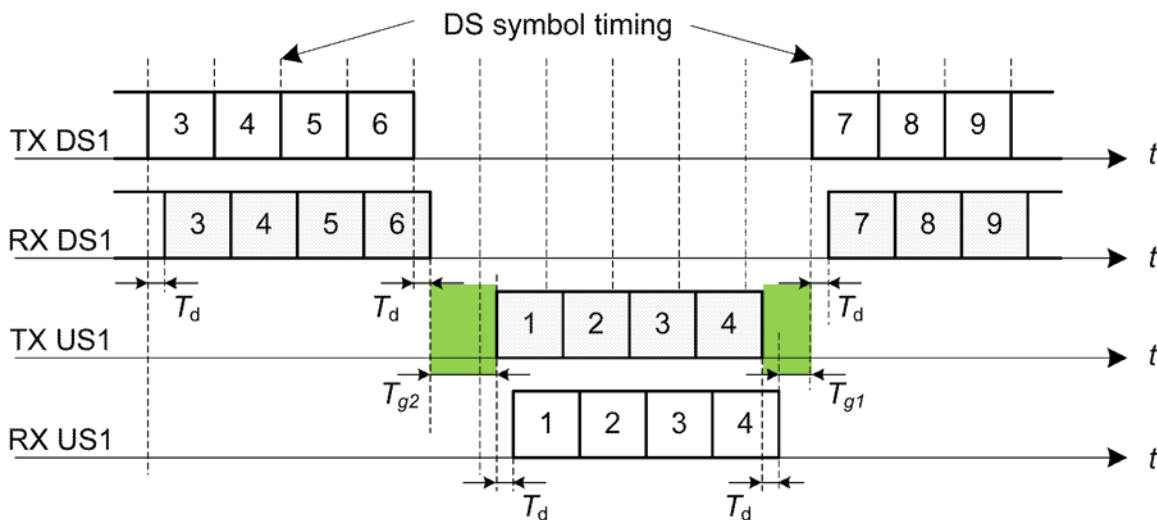


Fig. 20

323. These disclosed guard times constitute off periods during which no signals are transmitted. Strobel explains that in “an exemplary case of TDD, the guard time may be used, for example, to convert transmission circuitry from transmission mode to reception mode, and vice versa.” *Id.*, 33:23-26. It explains that “switching between transmission and reception . . . takes a turnaround time, wherein turnaround time may depend on the particular circuit and/or portions of circuit involved and/or subject to the switch, and/or depend on the direction of switching from transmission to reception or reception to transmission.” *Id.*, 33:27-33. Thus, during this guard time, no transmissions are sent.

324. A POSITA would have understood that these guard times apply to both the upstream and the downstream time slots. As an example, applying those guard times to Figure 16 would look like the below, where the guard time falls between

both the upstream data symbols of the first physical channel and the downstream data symbols of the second physical channels. Thus, both the upstream and downstream time slots would have an active portion and an off portion.

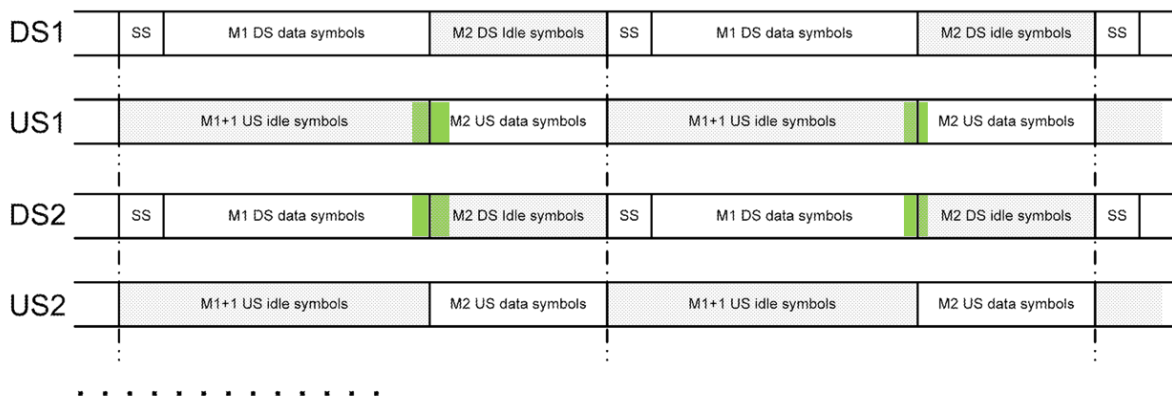


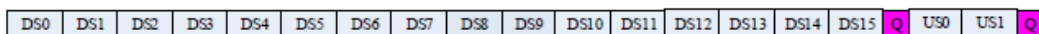
FIG. 16

325. Additionally, Strobel expressly asserts that an advantage of the claimed system is that “not all the transmitters are active in every time slot,” so that the time slots may be arranged so that transmissions are not necessarily required in any given time slot. Ex-1005 at 21:23-30. In other words, Strobel discloses utilizing active and inactive time slots, where signals are transmitted during active time slots (i.e., on portion) and no signals are transmitted during an inactive time slot (i.e., off portion).

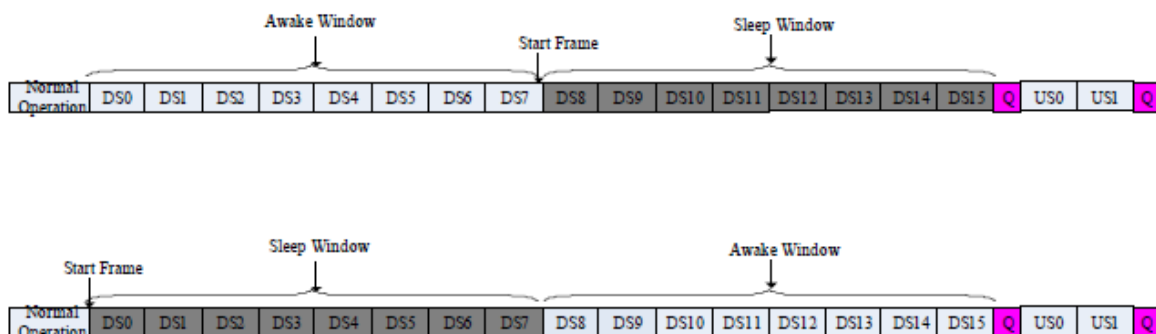
326. Although I believe this disclosure of Strobel expressly teaches the limitation of claim 3[a], Wei expressly discloses “(Quiet) intervals (i.e., guard time periods)” that are inserted during discontinuous operations and where no signals are transmitted. Ex-1009 at 4. These quiet intervals (shown in pink in the disclosure

below) constitute off portions during which no data is transmitted, much like the quiet periods of Strobel.

The following figure shows a typical TDD frame with 16 DS and 2 US DMT symbol positions with 2 Q (Quiet) intervals (i.e., guard time periods) inserted in between:



327. Wei, however, goes a step further, and additionally discloses a “discontinuous mode power save (DMPS) method” whereby “the entire transmission and reception path can be turned off during some DMT symbols within a TDD frame.” Ex-1009 at 2. An example of this discontinuous mode power save method is shown below, whereby Awake Windows and Sleep Windows are defined and where DMT symbols in the sleep window are off (meaning that no signals are transmitted). Ex-1009 at 4-5.



328. Thus, either the guard times or quiet intervals disclosed by Strobel and Wei disclose these off times, or the combination of Wei’s discontinuous mode power save method with the frame format of Strobel renders obvious this claim.

**d. Claim 4: The method of claim 1, wherein scheduling upstream and downstream time slot comprises scheduling upstream and downstream time slot boundaries.**

329. In my opinion, Strobel discloses claim 4.

330. Strobel discloses that “transmission time slots (TS) are used to assign the particular transmission time (or transmission opportunity time) for a specific line in upstream and/or downstream direction.” Ex-1005 at 31:40-43; Ex-1007 at 6. Strobel continues that “all TS [(i.e., transmission time slots)] shall have duration that is an integer number of symbols” and that “when a particular transceiver is granted a transmission opportunity, it may use the granted TS starting from any symbol of the TS.” Ex-1005 at 31:46-49; Ex-1007 at 7.

331. In discussing downstream and upstream transmission, Strobel adds “aligning downstream transmissions over all transmission media by *boundaries*” and “aligning upstream transmissions over all lines by *boundaries*.” Ex-1005, 10:5-12.

332. Reviewing these disclosures of Strobel, a POSITA would have understood that the start and end of the transmission time slot (TS) constitutes these time slot boundaries. As an example, annotated Figure 16 below with red lines shows the break points between the various data symbols in Figure 16 (annotated in red).

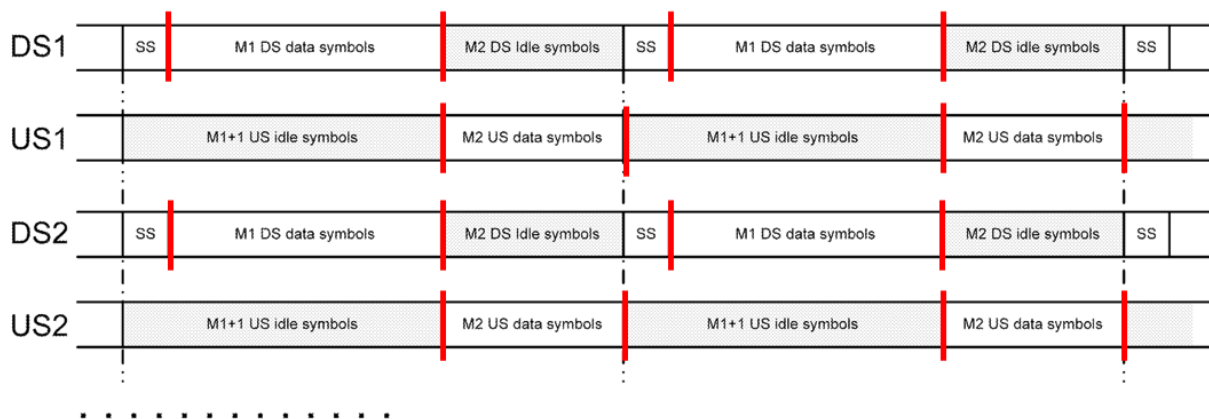


FIG. 16

333. In my opinion, a POSITA would have therefore understood Strobel to disclose this claim.

**e. Claim 5: The method of claim 4, wherein the time slot boundaries are flexible.**

334. In my opinion, Strobel alone or in view of Kuipers discloses claim 5.

335. Strobel discloses time slots that are used to assign particular transmission times for specific lines in upstream and/or downstream direction. More specifically, Strobel discloses that “[i]n an embodiment transmission time slots (TS) are used to assign the particular transmission time (or transmission opportunity time) for a specific line in upstream and/or downstream direction.” *Id.* at 31:40-44. Strobel further specifies that all time slots “shall have duration that is an integer number of symbols.” *Id.* at 31:45-46.

336. Strobel discloses that in one embodiment, “other TS may be programmable,” meaning that “their assignment and duration may depend, for

example, on traffic requests from connected users.” Ex-1005 at 31:55-58; Ex-1007 at 7.

337. Strobel also discloses that “dynamic rate adaption”—which allows for dynamically changing “optimizations”—“may be implemented in various embodiments, which may improve performance of the communication system.” Ex-1005, 12:44-54; Ex-1006 at 6. A POSITA reviewing Strobel would have understood such programmable time slots with flexible assignments and duration to mean that the boundaries of the time slots are flexible.

338. To the extent Strobel’s disclosure of “programmable” time slots is not explicit that the time slots are, in fact, flexible, Kuipers provides more detail regarding flexible time slots.

339. Kuipers is a contribution that “presents a flexible frame structure for G.fast that will enable dynamic adaptation to the actual needs and offered traffic load.” Ex-1008 at 1. Discussing the flexible frame format, Kuipers explains that “a ‘symbol’ corresponds to an OFDM/DMT symbol, and a ‘timeslot’ corresponds to one or more consecutive symbols in a given upstream or downstream direction.” *Id.*, 2.

340. Kuipers then goes on to explain that the flexible frame format utilizes a Media Access Plan (MAP) to “instruct the FTU-R at what time to listen to DS

transmission and the interval to be used for US transmission.” *Id.* Kuipers continues that this “MAP may change from frame to frame according to the needs.” *Id.*

341. As an example, Kuipers provides Figure 2 (below), which shows flexible time slot boundaries (in that at least the time slot boundaries differ from frame to frame).



342. In my opinion, a POSITA would have understood that the “programmable” time slots of Strobel could have such a flexible frame format as is disclosed by Kuipers.

343. Accordingly, it is my opinion that Strobel alone or in view of Kuipers discloses Claim 5.

**f. Claim 6: The method of claim 5, wherein the time slot boundaries have one or more of: variable-length frames; variable upstream time slot lengths; or variable downstream time slot-lengths.**

344. In my opinion, Strobel alone or in view of Kuipers discloses claim 6.

345. Strobel discloses that “transmission time slots (TS) are used to assign the particular transmission time (or transmission opportunity time) for a specific line in upstream and/or downstream direction.” Ex-1005 at 31:40-44; Ex-1007 at 6. Strobel continues by explaining that “all TS [(time slots)] shall have a duration that

is an integer number of symbols,” but that the “TS may be programmable” in that “their assignment and duration” can be changed. Ex-1005 at 31:45-58; Ex-1007 at 7. A POSITA would have understood the ability to program time slot lengths to mean that the time slot boundaries may at least have variable upstream time slot lengths or variable downstream time slot lengths.

346. Strobel discloses superframes containing time slots that assign transmission times and have durations that are an integer number of symbols (e.g.,  $M_1$ ,  $M_2$ ,  $M+1$ , etc.). Ex-1005 at 31:40-60. Strobel also shows that “[a]ll symbols in a superframe may have the same duration that, for example, depends on the selected value of a cyclic prefix.” Ex-1005 at 29:46-48. These refer to OFDM/DMT symbols, which have a cyclic prefix. Accordingly, if the frame has a variable number of symbols of the same duration, then the frame will be of variable length.

347. Furthermore, Strobel discloses that these superframe  $M$  symbols are data symbols, which may identify “user data, control, management commands or data, or symbols with special content.” Ex-1005 at 29:39-45. These data symbols ultimately determine the duration of the time slots because they are variable in number. *See* Ex-1005 at 29:46-48.

348. Additionally, Strobel discloses that the transmission time slots are used to assign the particular transmission time for upstream and/or downstream transmissions. Ex-1004 at 31:40-44.

349. Looking to Figure 15 (below), which shows an embodiment of a superframe that may be used in TDD, the superframe is made up of “M data symbols.” Ex-1005 at 29:39-45; Ex-1007, 3-4. Because the time slots are defined by these “M data symbols,” *id.*, 31:45-46, if the time slots are altered (by increasing or decreasing the number of M data symbols) the superframe itself will be altered. Strobel thus separately discloses time slot boundaries with variable length frames.

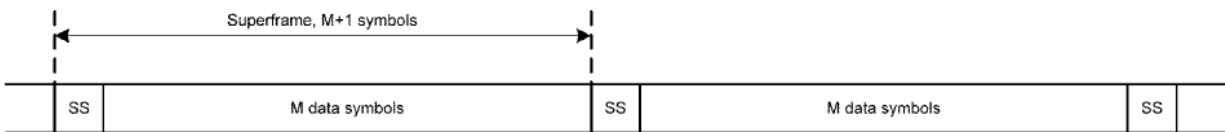


FIG. 15

350. To the extent Strobel’s disclosure of “programmable” time slots is unclear, Kuipers expressly discloses at least variable upstream time slot lengths and variable downstream time slot-lengths.

351. Kuipers is directed to “a flexible frame structure for G.fast.” Ex-1008 at 1. Kuipers explains that the flexible frame format utilizes a Media Access Plan (MAP) to “instruct the FTU-R at what time to listen to DS transmission and the interval to be used for US transmission.” *Id.* Kuipers continues that this “MAP may change from frame to frame according to the needs.” *Id.* This is shown in Figure 2 (below), where the time slot lengths for both the downstream and upstream varies between each frame.

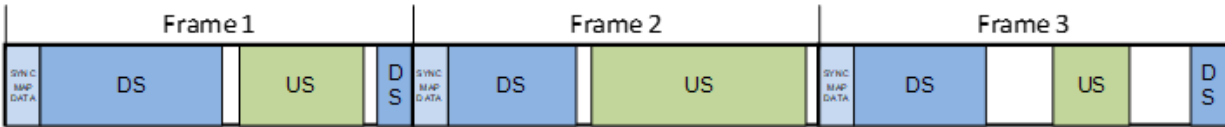


**Figure 2: Frame format examples**

352. Kuipers additionally discloses that “the allocation of symbols to DS or US can change from frame to frame.” *Id.*, 3. A POSITA would have understood this to mean that the upstream and downstream time slots may be variable. As with claim 5, a POSITA would have recognized that the programmable time slots of Strobel could use the variable upstream and downstream time slot format of Kuipers.

353. Accordingly, it is my opinion that Strobel alone or in view of Kuipers discloses Claim 6.

**g. Claim 8: The method of claim 1, further comprising adapting scheduling at least one of upstream and downstream time slots to accommodate delay requirements for the other of a downstream and upstream traffic source.**

354. In my opinion, Strobel discloses claim 8.

355. Strobel discloses an embodiment where time slot “assignment and duration may depend, for example, on traffic requests from connected users.” Ex-1005 at 31:55-58. Strobel additionally discloses a “guard time,” as shown in annotated Figure 20 below. A POSITA would have understood that this guard time could be used to accommodate delay requirements, such as low latency for certain traffic and propagation delay for downstream and upstream traffic sources. A POSITA would also have understood that the traffic request could include low

latency and the media access plan would accommodate this requirement in assigning low-latency data to the “soonest” available time slot. The communication unit also includes a media access plan to achieve optimal system communication according to a criterion, such as delay. The communication unit also includes means for conveying the media access plan to transceivers that will transmit in accordance with the plan. Ex-1005, 4:41-46.

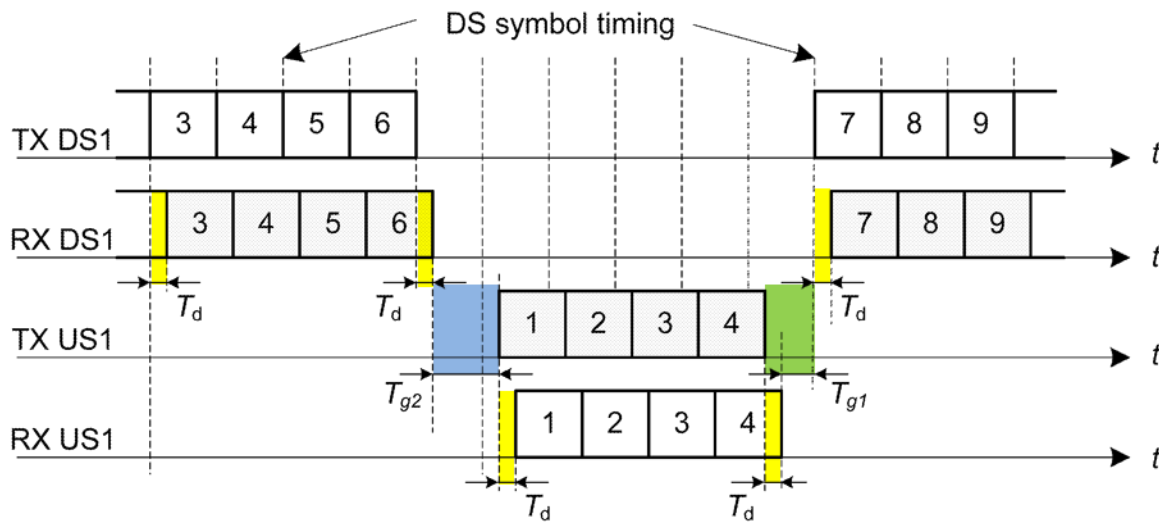


Fig. 20

356. Strobel explains that the guard time in the case of TDD, can convert from “transmission mode to reception mode, and vice versa,” (i.e., upstream and downstream) via the use of a “turnaround time” that depends on the specific circuits involved, what circuits are subject to switching, and the direction of the switch. Ex-1005 at 33:24-28; Ex-1007 at 8.

357. Addressing propagation delay, in the annotated Figure 20, the propagation delay,  $T_d$ , is shown in yellow, the guard time at the CPE ( $T_{g1}$ ) is shown in green, and the guard time at the CO ( $T_{g2}$ ) is shown in blue:

358. Furthermore, Strobel discloses that the downstream transmission timing must be aligned with the symbol timing and the upstream timing, thus, where delays are encountered in transmission in upstream or downstream, the delay must be accounted for in the other. Ex-1005 at 33:36-53. Thus, in order to maintain the required timing alignment between the two, Strobel asserts that the guard times must respect the following equation:

$$T_d + T_{g2} + T_d + T_{g1} = n \times T_{OFDM}, \text{ and } T_{g2} + T_{g1} = n \times T_{OFDM} - 2T_d$$

Ex-1005 at 33:36-53; Ex-1007 at 9.  $T_{g1}$  and  $T_{g2}$  denote the guard times at the user equipment and at the central unit (i.e., central office (CO)), and  $T_{OFDM}$  is the symbol period. *Id.* at 33:36-47; Ex-1007 at 9.

359. As such, the scheduling of the upstream and downstream time slots is dependent on scheduling this guard time, and Strobel therefore discloses claim 8.

**h. Claim 9: The method of claim 1, further comprising receiving input on desired traffic levels for the first and second physical channels, and wherein scheduling upstream and downstream time slots is performed based on the received input.**

360. In my opinion, Strobel alone or in view of Kuipers discloses claim 9.

361. Strobel discloses that in one embodiment, “other TS [(time slots)] may be programmable,” meaning that “their assignment and duration may depend, for

example, on traffic requests from connected users.” Ex-1005 at 31:55-58; Ex-1007 at 7. Looking to annotated Figure 16 (below) as an example, a POSITA would have understood this disclosure of Strobel to mean that connected users may request access to either of the first or second physical channels (i.e., receiving input on desired traffic levels for the first and second physical channels), and then the upstream and downstream time slots (which are programmable) would have been scheduled based on these received traffic requests.

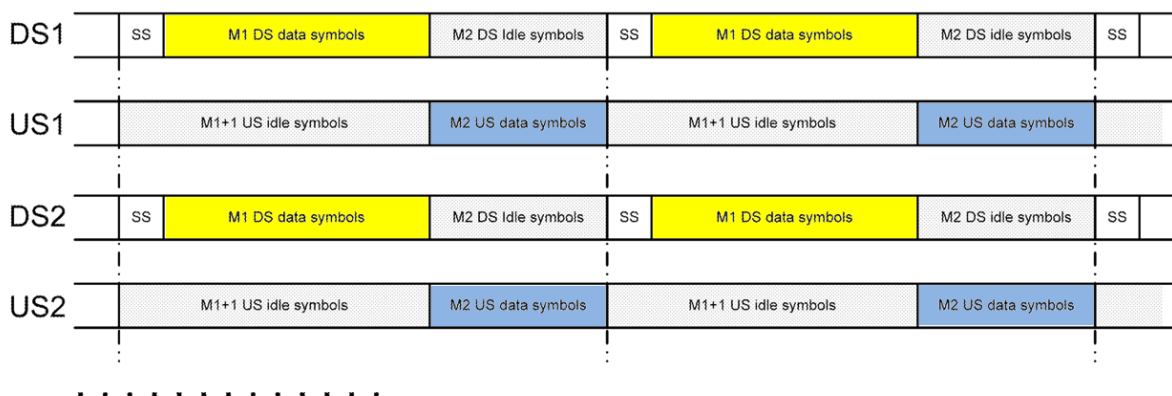


FIG. 16

362. In my opinion, Strobel explicitly discloses this limitation by disclosing “traffic requests.” Nonetheless, a POSITA looking to Kuipers would have understood that Kuipers separately discloses this limitation. Kuipers discloses that the “flexible frame structure” it proposes “will enable dynamic adaptation to the actual needs and offered traffic load.” Ex-1008 at 1. Kuipers explains that “[t]he portion of the frame required for US and DS transmission to fulfill these requirements depends on the offered traffic load and the loop conditions.” *Id.*, 2.

Continuing, Kuipers discloses that “the allocation of symbols to DS or US can change from frame to frame,” which “will require some knowledge about the actual offered traffic load in DS and US direction.” *Id.*, 3. Thus, a POSITA would have understood that scheduling the flexible frames of Kuipers would be based, in part, on receiving input on desired traffic levels.

363. A POSITA would have understood that the implementation used in Strobel (which relies on traffic requests) would have benefitted from using additional parameters such as disclosed in Kuipers (which relies on actual offered traffic load), and thus would have modified the implementation of Strobel to include the actual traffic load disclosed in Kuipers.

364. It is therefore my opinion that Strobel alone or Strobel in view of Kuipers discloses claim 9.

- i. Claim 11: The method of claim 9, wherein the received input comprises at least one of static subscription data, service layer information from a policy manager, behavior data for traffic types and users of the physical channels, long term traffic types and users of the physical channels, long term traffic behavior data as a function of time, current traffic demands, queue lengths, traffic requests, upstream/downstream asymmetry, or traffic descriptors.**

365. In my opinion, Strobel alone or in view of Kuipers discloses claim 11.

366. As explained with respect to claim 9, Strobel discloses that in one embodiment, “other TS [(time slots)] may be programmable,” meaning that “their

assignment and duration may depend, for example, on traffic requests from connected users.” Ex-1005 at 31:55-58; Ex-1007 at 7 (emphasis added). This alone discloses claim 11.

367. Similarly, Kuipers discloses the received input including “offered traffic load,” i.e., current traffic demands. Ex-1008 at 1. Kuipers thus separately discloses 11.

368. Claim 11 requires that the received input comprises at least one of “traffic requests” or “current traffic demands” and thus this claim is disclosed separately by Strobel and Kuipers (and this supports that both likewise discloses claim 9). For the reasons explained in claim 9, a POSITA would have implemented the current traffic demands disclosed by Kuipers into Strobel.

**j. Claim 12: The method of claim 9, wherein scheduling upstream and downstream time slots comprises assigning time slots to achieve a target upstream/downstream asymmetry ratio of data throughput.**

369. In my opinion, Strobel alone or in view of Kuipers discloses claim 12.

370. Strobel discloses an embodiment where each assigned time slot “is for all lines” and the size of the time slots “determines the ratio between upstream and downstream and the duration of the upstream-downstream exchange cycle.” Ex-1005 at 31:64-67; Ex-1007 at 7. It continues by explaining that this “TS assignment may usually be permanent” or “may be changed” when, as an example under control by a “service provider.” Ex-1005 at 32:1-5; Ex-1007 at 7.

371. A POSITA would have understood that selecting these time slots would therefore impact the upstream/downstream asymmetry ratio of data throughput, and so would have scheduled the upstream and downstream time slots to achieve a target ratio between upstream and downstream.

372. Though it is my opinion that Strobel discloses this limitation, if there is any doubt that Strobel does not disclose a “target” asymmetry ratio (though it expressly discloses that the “size of the [time slot] determines [that] ratio”), a POSITA would have looked to Kuipers to understand the benefits of setting a target asymmetry ratio.

373. Kuipers explains that “one of the objectives” of its flexible framing structures “is to ensure that the desired data rates and US/DS asymmetry ratio are provided to the subscribers.” Ex-1008 at 2. Kuipers adds that “the operator will be able to provision a set of parameters that might include the min and max values of US/DS asymmetry ratio and defined data rates instead of just fixed values.” *Id.* This assignment of maximum and minimum values to the upstream and downstream asymmetry ratio represents the target upstream/downstream asymmetry ratio. A POSITA would have applied this target upstream/downstream asymmetry ratio as a parameter in the embodiment of Strobel, and picked a “size of the [time slot]” to achieve that target ratio.

374. It is therefore my opinion that Strobel alone or in view of Kuipers discloses claim 12.

**k. Claim 13: The method of claim 12, wherein the upstream/downstream asymmetry ratio is defined in numbers of discrete multi-tone symbol positions.**

375. In my opinion, Strobel alone or in view of Kuipers discloses claim 13.

376. Strobel discloses a ratio between upstream and downstream transmissions, which is determined by the size of the time slots on the channel communication. Ex-1005 at 31:64-32:6. Specifically, Strobel discloses that “the size of the TS determines the ratio between upstream and downstream” Ex-1005 at 31:64-67; Ex-1007 at 7. Prior to that, Strobel explains that “all TS [(i.e., transmission time slots)] shall have duration that is an integer number of symbols” (which Strobel contemplates is “M” symbols) and that “when a particular transceiver is granted a transmission opportunity, it may use the granted TS starting from any symbol of the TS.” Ex-1005 at 31:46-49; Ex-1007 at 7.

377. Each time slot existing on the physical channel is comprised of a fixed number of multi-tone symbols, and depending on that number of symbols, the size of the time slot changes—this refers to a commonly practiced modulation method known as discrete multi-tone modulation (DMT). Because Strobel’s “M” symbols dictate the duration and assignment of the time slots, the “M” symbols ultimately determine the asymmetry ratio for upstream and downstream transmissions.

378. Although it is my opinion that Strobel discloses this asymmetry ratio defined by symbols<sup>2</sup>, a POSITA also could have and would have looked to Kuipers to confirm its understanding. Just like Strobel, Kuipers expressly discloses that the “‘timeslot’ corresponds to one or more consecutive symbols in a given upstream or downstream direction.” Ex-1008 at 2. Having confirmed its understanding with Kuipers, a POSITA would have known that the upstream/downstream asymmetry ratio defined by Strobel could be defined particularly in numbers of discrete multi-tone symbol positions.

**I. Claim 14: The method of claim 12, wherein the measure of throughput is at least one of an average throughput across all lines, a traffic demand match, a minimum throughput for each physical channel, a perceived quality of experience, an average delay, or a minimum delay.**

379. In my opinion, Strobel alone or in view of Kuipers discloses claim 14.

380. Strobel discloses that its proposed embodiments with “enhanced communication rates may result in higher throughput rates.” Ex-1005, 4:1-2. Strobel discloses that in one embodiment, “other TS [(time slots)] may be programmable,” meaning that “their assignment and duration may depend, for example, on traffic requests from connected users.” Ex-1005 at 31:55-58; Ex-1007 at 7 (emphasis

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<sup>2</sup> The asymmetry ratio can be defined in terms of time for each slot or in terms of the number of DMT (Discrete Multi-Tone) symbol positions used by a particular user in upstream or downstream. Ex. 1001 10:16-20.

added). A POSITA would have understood that once time slots are assigned for a certain duration, that data would be transmitted, and so that would correlate to the data throughput. As the assignment and duration directly correlates to throughput, in my opinion claim 14 at least discloses that the throughput is dependent on matching a traffic demand.

381. Kuipers separately discloses that the measure of throughput is of an average throughput. Kuipers first explains that its proposal will provide “high throughput.” Ex-1008, 1. Kuipers explains that “there is usually no need to fulfill the provisioned requirements on a frame level with a granularity of e.g. 1ms. It should be sufficient to ensure that the US/DS asymmetry ratio and the data rate objectives are fulfilled on average.” Ex-1008 at 2. A POSITA would have understood that ensuring the asymmetry ratio and data rates “on average” constitutes measuring an average throughput across all lines. A POSITA also would have understood that measuring throughput as an average as disclosed by Kuipers could be used in the method disclosed by Strobel.

382. Thus, in my opinion, either Strobel alone or in view of Kuipers discloses claim 14.

**m. Claim 15: The method of claim 1, wherein scheduling upstream and downstream time slots comprises assigning time slots based at least in part on power usage.**

383. In my opinion, Strobel alone or in view of Wei discloses claim 15.

384. A key aspect of Strobel is contemplating the adjustment of both “transmission times and power levels to enhance the communication within the system.” Ex-1005 at Abstract. Strobel thus contemplates that in one embodiment, there exists a central unit that has “an optimizer adapted to operate an optimization routine to compute multiple locally optimal configurations. Ex-1005 at 6:43-46; Ex-1006 at 3. Strobel explains that that central unit may comprise “a media access plan,” which in turn “comprises information about time slots, about when transceivers should transmit, and/or about the power levels at which transceivers should transmit.” Ex-1005 at 6:53-63; Ex-1006 at 29; *see also* Ex-1005 at 27:56-61. Relying on this information (including time slots and power levels) Strobel explains that this allows the system “to achieve optimal system communication.” Ex-1005 at 63-67.

385. A POSITA would have understood that, in balancing the time slots and power levels, this “optimizer” would have scheduled the upstream and downstream time slots based at least in part of those power levels. Strobel elsewhere confirms this by explaining that “[t]here is a mapping between the possible power allocation [] for each transmission line[] . . . and the reachable data rate,” wherein that data rate is directly correlated to the time slots of the upstream and downstream physical channels. Ex-1005 at 13:53-67.

386. Strobel discloses that assigning time slots based, at least in part on power usage, is a sophisticated endeavor. Strobel discloses that:

An operation of an alternative system is shown in Figure 2, which illustrates a region of reachable data rates and powers for two lines that have strong crosstalk . . . Every transceiver [] or remote terminal [] is able to adjust some parameter of the physical link, such as a transmit power between 0 and  $p_{max}$ , continuously or in discrete steps. There is a mapping between the possible power allocation [] for each transmission lines, described by a power vector  $p$  for power levels  $P1$  and  $P2$  in Fig. 2, and the reachable data rate [] for each of the of the (sic) links  $R$ , shown as  $R1$  and  $R2$  in Fig. 2. The shape of the area of reachable data rates, which is ‘the rate region’, is defined by the capabilities of the transmission system and the transmission channel as shown in the concave curve in the data rate 210.

Ex-1005 at 13:53-67.

387. A POSITA would have understood this disclosure to mean that the system’s upstream and downstream transmissions are linked to the system’s power levels.

388. Although Strobel is clear in its disclosure, Wei confirms that time slots can be assigned based on power usage. Wei explains that when the traffic on a line becomes too low, “the number of transmitted DMT/OFDM symbols within a TDD frame can be reduced,” which “allows the entire transmission and reception path to be turned off during some DMT/OFDM symbol periods to save power in DFE, AFE, and LD.” Ex-1009 at 3. When the transmission/reception path is turned off for certain symbol periods (based on preferred power savings), it defines the time slots of the upstream and downstream transmissions.

389. Thus, it is my opinion that Strobel alone or in view of Wei discloses Claim 15.

**n. Claim 16: The method of claim 15, wherein assigning time slots based on power usage comprises assigning by scheduling entries, exits, and transitions between low-power link states and off states.**

390. In my opinion, Strobel alone or in view of Kuipers discloses claim 15.

391. As I explain in claim 15, Strobel explains that the central unit may comprise “a media access plan,” which in turn “comprises information about time slots, about when transceivers should transmit, and/or about the power levels at which transceivers should transmit.” Ex-1005 at 6:53-63; Ex-1006 at 29; *see also* Ex-1005 at 27:56-61.

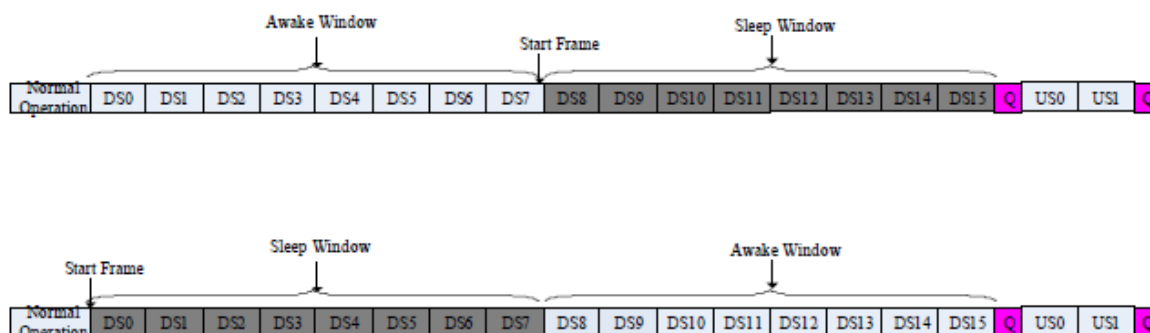
392. Strobel also describes a transmission concept comprising a superframe that contains  $M+1$  symbols, where the superframe starts from a sync-symbol (e.g., SS) and is followed by the  $M$  data symbols. Ex-1004 at 29:38-45. The “data” of the  $M$  data symbols may be data identifying user data, control or management commands or data, or symbols with special content like probe symbols or quiet symbols, if necessary for transmission purposes.” Ex-1004 at 29:38-45. Since the  $M$  data symbol blocks are used within the given time slots of the superframe, and those  $M$  data symbols can be data consisting of user data, quiet symbols, and/or control or management data, a POSITA would have understood that Strobel discloses assigning the time slots by scheduling entries, exits, and transitions between low-power link states and off states.

393. Also, reviewing Wei in view of Strobel, a POSITA would have understood assigning time slots by scheduling entries, exits, and transitions between low-power link states and off states would be one way of controlling the power levels at which transceivers should transmit.

394. Wei discloses “(Quiet) intervals (i.e., guard time periods)” that are inserted during discontinuous operations and where no signals are transmitted as well as “Sleep Window[s]” where that entire transmission and reception path can be turned off. Ex-1009 at 2. Specifically, Wei explains that “when user traffic is lower than channel capacity, the entire transmission and reception path can be turned off during some DMT symbols within a TDD frame to save power on DFE, AFE, and LD.” *Id.* This is depicted by that sleep window. This is confirmed when Wei explains that if the “Sleep window is too long,” the “FTU-R may lose sync.” *Id.*, 4.

395. As depicted below, Wei discloses an Awake Window with a downstream time period (DS). That Awake Window is followed by an off state (which Wei depicts as a Sleep Window). That Sleep Window (or off state) is then followed by a low-power link state (the quiet period). A POSITA would have known that the quiet period constitutes a low-power link state (and not an off state) because during a quiet period there could still be information being transmitted, such as synchronization information. Following the quiet period is an upstream time period

(US), which is again followed by an a low-power link state (the quiet period). *Id.* and another low-power link state (blank space).



396. A POSITA would have recognized this as one way of optimizing power levels as disclosed by Strobel. For example, Strobel discloses that scheduling transmissions “at such times and such power levels as to achieve enhanced communication within the system according to some criterion.” Ex-1005 at 5:63-6:7. One way of enhancing communication within this system would be to do it by scheduling entries, exits, and transitions between low-power link states and off states as disclosed by Wei. Strobel’s claimed invention intends to maintain desired throughput levels via its time slot assignments, to minimize potential interference that would reduce throughput, and/or increase power levels (which effects throughput). Ex-1005, 39:5-16.

397. Thus, a POSITA would have understood that Strobel’s time slot scheduling techniques that aim to minimize crosstalk and increase, or maintain,

system throughput levels, would necessarily require assigning time slots based on scheduling transitions between low-power link states and off states. *Id.*

398. Accordingly, in my opinion, Strobel alone or in view of Wei discloses claim 16.

**o. Claim 22: The method of claim 1, further comprising receiving requests for upstream and downstream transmission and wherein scheduling upstream time slots is based on the received upstream transmission requests.**

399. In my opinion, Strobel discloses claim 22.

400. Strobel discloses that in one embodiment, “other TS [(time slots)] may be programmable,” meaning that “their assignment and duration may depend, for example, on traffic requests from connected users.” Ex-1005 at 31:55-58; Ex-1007 at 7.

401. In the context of Figure 16 (annotated below), a POSITA would have understood that the request could be for upstream (in blue) and/or downstream (in yellow) transmissions.

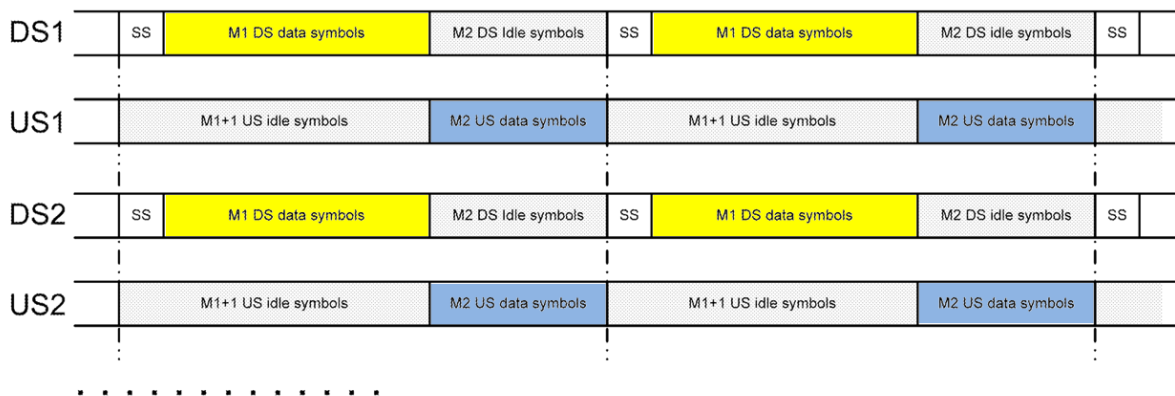


FIG. 16

402. In addition, Strobel discloses receiving requests from connected users, which are used to assign the time slots within the superframe. Ex-1005 at 31:45-63. Indeed, Strobel expressly discusses that time slots are dynamically assigned per transmission medium and/or per direction “based on the particular service request form each terminal.” Ex-1005 at 32:7-12.

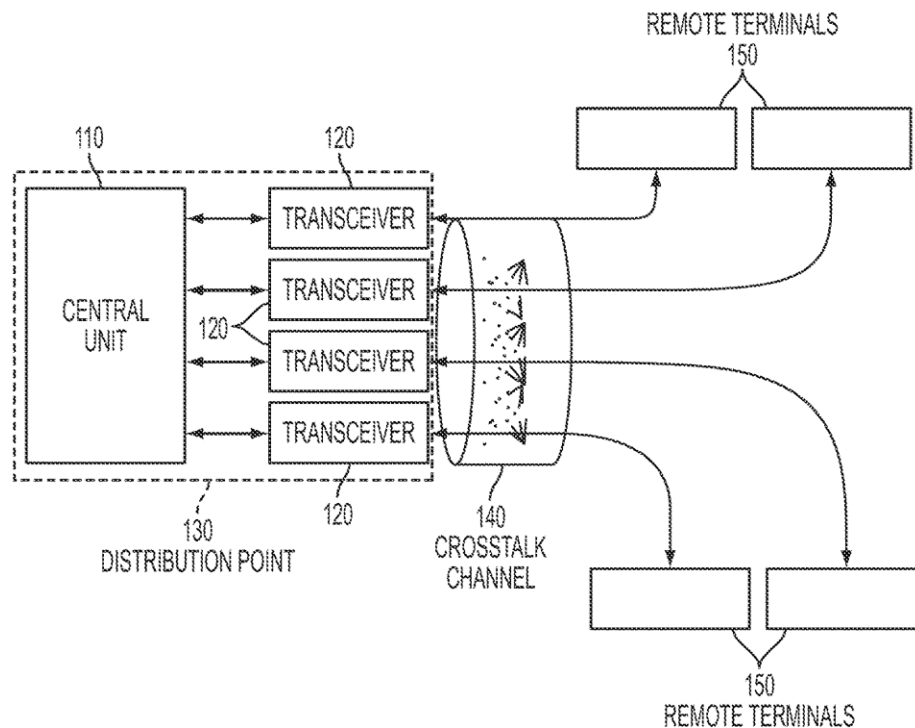
403. Because Strobel also explains that the time slots are “programmable” based on “traffic requests,” a POSITA would have understood that the upstream time slots may be scheduled based on those traffic requests.

404. Given that the assignment of time slots can depend on requests, a Strobel discloses claim 22.

**p. Claim 23: The method of claim 1, wherein the transmission in the upstream time slots is from a plurality of different network-end transmission sources.**

405. In my opinion, Strobel discloses claim 23.

406. With reference to Figure 1 (below), Strobel discloses that there may be multiple “remote terminals” 150 that transmit data in the upstream time slots. Strobel explains that a “remote terminal” is “a radio unit outside the distribution point” that “may be a transmitter, a receiver, or a transceiver.” Ex-1005 at 13:8-12; Ex-1006 at 7. Strobel adds that “[t]he remote terminals 150 may transmit through the crosstalk channel 140 to the transceiver 120, in which case the remote terminals 150 are acting as transmitters.” Ex-1005 at 13:46-52; Ex-1006 at 8.



407. A POSITA would have understood that transmissions from the remote terminals 150 to the transceivers 120 constitutes an upstream transmission.

408. Strobel thus discloses claim 23.

**q. Claim 24: The method of claim 23, further comprising synchronizing upstream transmission and downstream transmission among a plurality of different network-end transmission sources.**

409. In my opinion, Strobel discloses claim 24.

410. As shown in annotated Figure 16 (below), the upstream time slots across a first physical channel (which goes to a first remote terminal) is synchronized with the upstream time slots in a second physical channel (which goes to a second remote terminal).

411. Specifically, the downstream time slots (in yellow) are synchronized between DS1 and DS2, and the upstream time slots (in blue) are synchronized between US1 and US2 (in blue). Ex-1005, Fig. 16.

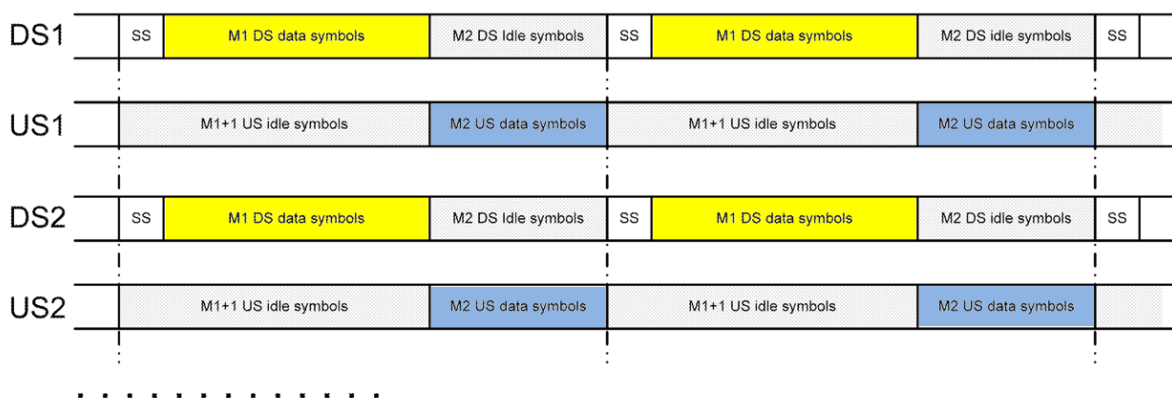


FIG. 16

412. Strobel confirms the lines for US1 and DS1 and US2 and DS2 may go to different lines by explaining that with respect to Figure 16 “all DS and all US transmissions shall be synchronized in all lines.” Ex-1006 at 30:14-18; Ex-1007 at

4. This thus indicates that there are multiple lines. Given Figure 1, and Strobel's disclosure of multiple remote terminals, a POSITA would have understood that synchronization would occur among a plurality of different network-end transmission sources.

**r. Claim 25: The method of claim 24, wherein synchronizing comprises sending synch symbols to a source of upstream transmissions.**

413. In my opinion, Strobel discloses claim 25.

414. As shown in Figure 16 (annotated below), Strobel contemplates sending synch symbols (denoted by SS in green) in the downstream (i.e., to the source of upstream). Ex-1005, Fig. 16.

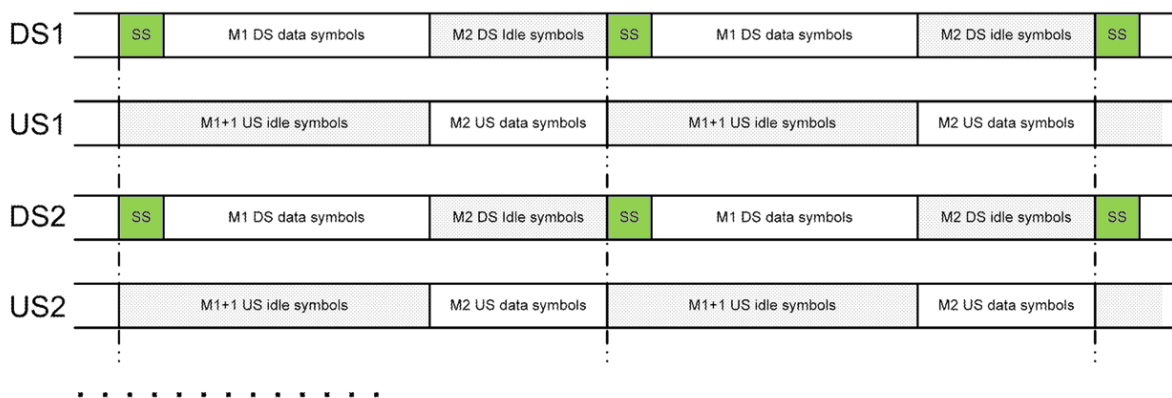


FIG. 16

415. Specifically, the synch symbols shown in Figure 16 are sent in the downstream towards a remote unit, which a POSITA would have understood is the source of the upstream transmissions.

416. Strobel discloses that in an embodiment, “the sync symbols (SS) are also sent only in the downstream direction, but in [another] embodiment SS may be also used in the upstream direction.” Ex-1005 at 30:55-58. Strobel explains that “the position of SS is synchronized over all lines,” which may be used for vectoring purposes. Ex-1005 at 30:1-4; Ex-1007 at 4.

417. Strobel therefore discloses the sync symbols contemplated by claim 25.

**s. Claim 33: The method of claim 1, further comprising receiving input on desired traffic levels for the first and second physical channels and wherein scheduling upstream and downstream time slots is performed based on the received input and at least in part on power usage.**

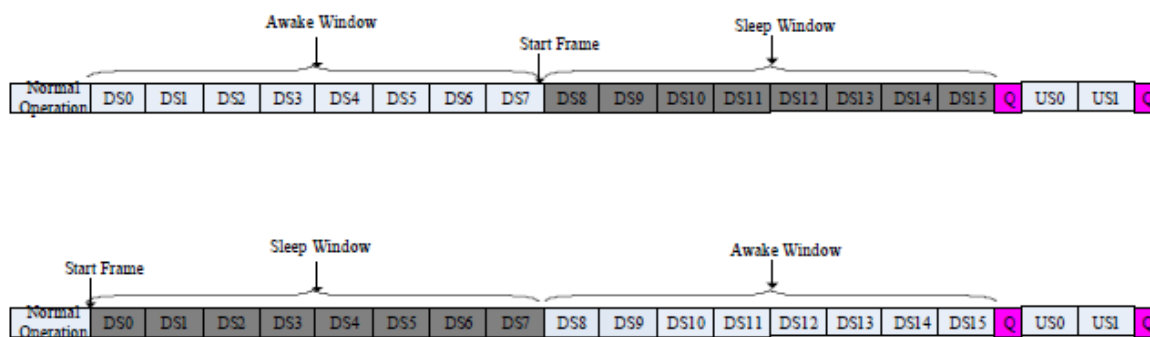
418. In my opinion, Strobel alone or in view of Kuipers and Wei discloses claim 33 for the same reasons explained with respect to claims 9 and 15.

419. Regarding scheduling time slots based on input on desired traffic levels (which is the language of claim 9), Strobel discloses that in one embodiment, “other TS [(time slots)] may be programmable,” meaning that “their assignment and duration may depend, for example, on traffic requests from connected users.” Ex-1005 at 31:55-58; Ex-1007 at 7.

420. Kuipers separately discloses that the “flexible frame structure” it proposes “will enable dynamic adaptation to the actual needs and offered traffic load.” Ex-1008 at 1. As explained in claim 9 (and which I incorporate herein), either

Strobel or Kuipers discloses receiving input on desired traffic levels for a first and second physical channel.

421. As explained with respect to claim 15 (incorporated herein), in addition to adjusting time slots based on traffic level inputs, Strobel explains that adjustment of “power levels” can be used to “enhance the communication within the system.” Ex-1005 at Abstract. To balance time slot allocation with power usage, Strobel contemplates a central unit that has “an optimizer adapted to operate an optimization routine to compute multiple locally optimal configurations. Ex-1005 at 6:43-46; Ex-1006 at 3. Strobel explains that that central unit may comprise “a media access plan,” which in turn “comprises information about time slots, about when transceivers should transmit, and/or about the power levels at which transceivers should transmit.” Ex-1005 at 6:53-63; Ex-1006 at 29; *see also* Ex-1005 at 27:56-61. Wei reinforces this concept, expressly disclosing adjusting upstream and downstream time slots to reduce power (shown in the Figure below).



422. As such, in my opinion, Strobel alone, or Strobel in view of Wei and Kuipers discloses claim 33.

**t. Claim 34:**

**34[pre] A machine-readable medium having instructions that when operated on by the machine cause the machine to perform operations comprising:**

423. To the extent it is limiting, in my opinion, Strobel discloses limitation 34[pre]. I treat it as limiting for purposes of this proceeding.

424. Strobel discloses that the invention contemplates a “transceiver architecture.” Ex-1005, 3:64. Strobel continues by explaining that a “system is provided that is operative to serve multiple electronic communication lines. The system includes a distribution point, which includes a central unit and multiple transceivers. The system also includes multiple line interfaces, a crosstalk channel, and multiple remote terminals. The system is configured to compute locally optimal communication configurations, store in memory data about said configurations, process said data into time sharing information, and convey such time sharing information to the transceivers and the remote terminals. The receivers and remote terminals later transmit in accordance with such time sharing information.” *Id.* 4:8-19.

425. Strobel also discloses that the embodiments in the specification “may be implemented in a software module, a software and/or hardware testing module, a telecommunications test device, a DSL modem, an ADSL modem, an xDSL modem,

a VDSL modem, a linecard, a G.hn transceiver, a MOCA transceiver, a Homeplug transceiver, a powerline modem, a wired or wireless modem, test equipment, a multicarrier transceiver, a wired and/or wireless wide/local area network system, a satellite communication system, network-based communication systems, such as an IP, Ethernet or ATM system, a modem equipped with diagnostic capabilities, or the like, or on a separate programmed general purpose computer having a communications device.” Ex-1007 at 38:7-19. Accordingly, a POSITA would find Strobel discloses 34[pre].

426. In my opinion, a POSITA would have recognized that a device able to execute the described arrangements, communication systems, and methods comprising the same would constitute the claimed “machine-readable medium.” Specifically, Strobel makes clear that the system includes a memory that stores configurations. That memory would include instructions that when operated on by the system would cause the system to perform certain operations, including “convey[ing] such time sharing information to the transceivers and the remote terminals.”

427. Thus, in my opinion, Strobel discloses limitation 34[pre].

**34[a] scheduling upstream time slots for upstream transmission in a first physical channel of multiple time division physical channels in a data communication system in which the physical channels are subject to crosstalk; and**

428. In my opinion, Strobel discloses limitation 34[a] for at least the same reasons discussed in limitations 1[pre] and 1[a]. I incorporate that section here.

429. Although the combination of both limitations 1[pre] and 1[a] are required to disclose limitation 34[a], the claimed scope is otherwise identical (except that claim 34 claims a “machine readable medium” while claim 1 claims a “method”).

430. To be sure, Strobel discloses scheduling and arranging upstream time slots in the upstream channel of a first physical channel. Ex-1004 at 31:40-63, Fig. 16.

431. Thus, in my opinion, Strobel discloses limitation 34[a].

**34[b] scheduling downstream time slots for downstream transmission in a second physical channel subject to crosstalk from the upstream time slots,**

432. In my opinion, Strobel discloses limitation 34[b] for the same reasons discussed in limitation 1[b]. I incorporate that section here.

433. Limitation 34[b] recites “subject to crosstalk from the upstream time slots,” which is not recited in limitation 1[b]. But a POSITA would have understood that downstream transmissions are almost always subject to crosstalk from upstream transmissions, since both upstream and downstream are transmitted on the same frequency. For example, the ’631 patent discloses that “system transmitting in multi-pair copper cables can generate crosstalk into each other,” Ex-1001 at 2:7-9, and

Strobel discloses that “[i]n many communication transmission systems, there are multiple parallel transmissions bound together which can cause crosstalk between the lines,” Ex-1005 at 1:16-18.

434. Thus, in my opinion, Strobel discloses limitation 34[b].

**34[c] wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.**

435. Strobel discloses limitation 34[c] for the same reasons discussed in limitation 1[c], which has identical language. I incorporate that section here.

**u. Claim 35: The medium of claim 34, the operations further comprising receiving input on desired traffic levels for the first and second physical channels and wherein scheduling upstream and downstream time slots is performed based on the received input.**

436. In my opinion, Strobel alone or in view of Kuipers discloses Claim 35 for the same reasons explained with respect to claim 9, which recites identical language. I incorporate that section here.

**v. Claim 36: The medium of claim 34, wherein scheduling upstream and downstream time slots comprises assigning time slots to achieve a target upstream/downstream asymmetry ratio of data throughput.**

437. In my opinion, Strobel alone or in view of Kuipers discloses Claim 36 for the same reasons explained with respect to claim 12, which recites identical language. I incorporate that section here.

**w. Claim 37:**

**37[pre] An apparatus for managing multiple time division physical channels in a data communications system that are subject to crosstalk, the apparatus comprising:**

438. In my opinion, Strobel discloses 37[pre] for the same reasons explained with respect to limitation 1[pre], which recites the same language (except as a method rather than apparatus). I incorporate by reference my opinions discussed in those sections above for 37[a].

439. Strobel also discloses an apparatus. *See, e.g.,* Fig. 1.

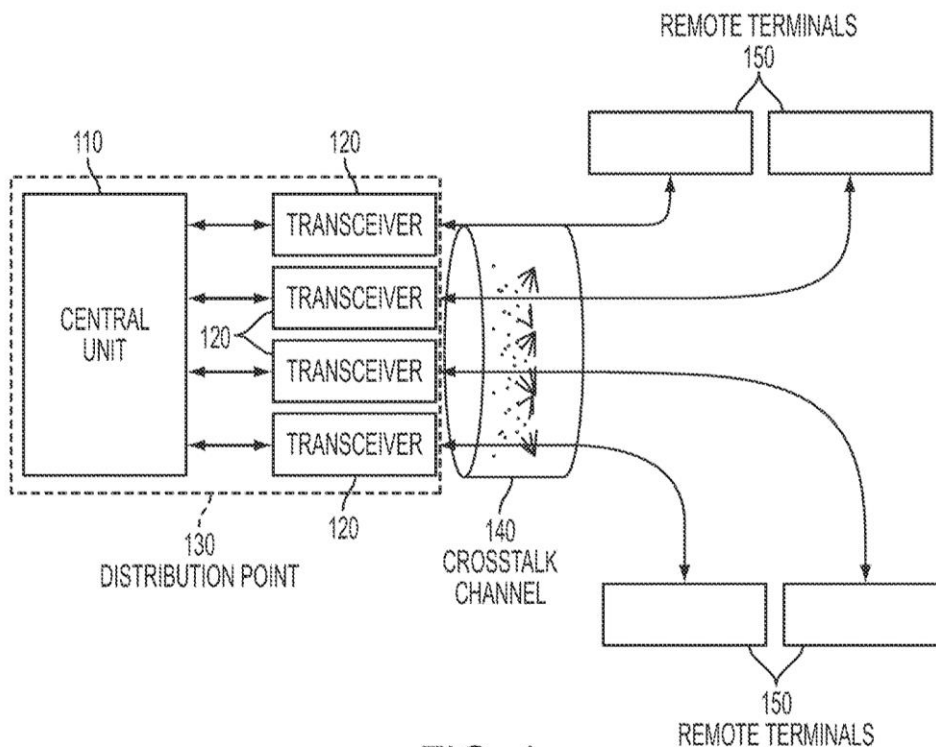


**FIG. 1**

**37[a] means for scheduling upstream time slots for upstream transmission in a first physical channel; and**

440. In my opinion, Strobel discloses limitation 37[a] for the same reasons explained with respect to limitation 1[a]. I incorporate by reference my opinions discussed in those sections above for 37[a].

441. As I explain in my section on claim construction, there are two alternative structures contemplated by the '631 patent specification related to this “means” term, including a “system 1200 [that] includes a memory 1295 coupled directly or through a bus to a processor or processors 1296,” where the “processor may also include its own internal memory,” and where processor may also implement or execute implementing logic 1260 having logic to implement the methodologies discussed herein.” Ex-1001 at 14:47-58. It also includes “one or more communications buses 1215 to connect the various illustrated components and to transfer transactions, instructions, requests, and data within the system among the components and other peripheral devices. The system further includes a management interface 1225 coupled to the bus and to external management devices, for example, to receive requests, return responses, and otherwise interface with network elements located separately from the system. . . . The system further includes a LAN (Local Area Network) interface 1230 coupled to the bus and externally to communicate information via a LAN based connection, including collecting network information, reporting information and diagnostics to other entities within the network, and for initiating instructions and commands over the

network. The system further includes a WAN (Wide Area Network) interface 1235 coupled to the bus and to an external WAN, to communicate information via a WAN based connection for similar purposes and to reach other more remote devices. . . . The system further includes stored historical information 1250 which may be stored within the memory 1295 or as a separate component coupled to the memory or to the bus.” *Id.* 14:47-15:44.

442. Alternatively, another structure includes a scheduling or analysis module of a management device, which “is coupled to the bus [and] includes a collection module 1270, analysis module 1275, diagnostics module 1280, and implementation module 1285. Management Device 1201 may be installed and configured in a compatible system 1200 as is depicted by FIG. 12A, or provided separately so as to operate in conjunction with appropriate implementing logic 1260 or other software.” *Id.* at 15:45-51. “The modules of the management device 1201 may be provided as separate components coupled to the bus 1215 as shown or may be incorporated into the processor or memory or another component. The management device may include its own processing and memory resources that interact with the processor and the external interfaces. The management device may include more or fewer modules than those shown. The TDD management system of FIG. 12 is provided only as an example and may be modified to suit different implementations. It may also be incorporated into another component such as an

access node, or a TU-O. In one embodiment, the management system is provided as a card in a system rack with a backplane interface to communicate with local and remote network elements.” *Id.* at 16:6-19.

443. Strobel discloses at least the first structure contemplated. Specifically, Strobel discloses a “system is provided that is operative to serve multiple electronic communication lines. The system includes a distribution point, which includes a central unit and multiple transceivers. The system also includes multiple line interfaces, a crosstalk channel, and multiple remote terminals. The system is configured to compute locally optimal communication configurations, store in memory data about said configurations, process said data into time sharing information, and convey such time sharing information to the transceivers and the remote terminals. The receivers and remote terminals later transmit in accordance with such time sharing information.” *Id.*, 4:8-19.

444. Strobel also discloses a system as disclosed in Figure 1:

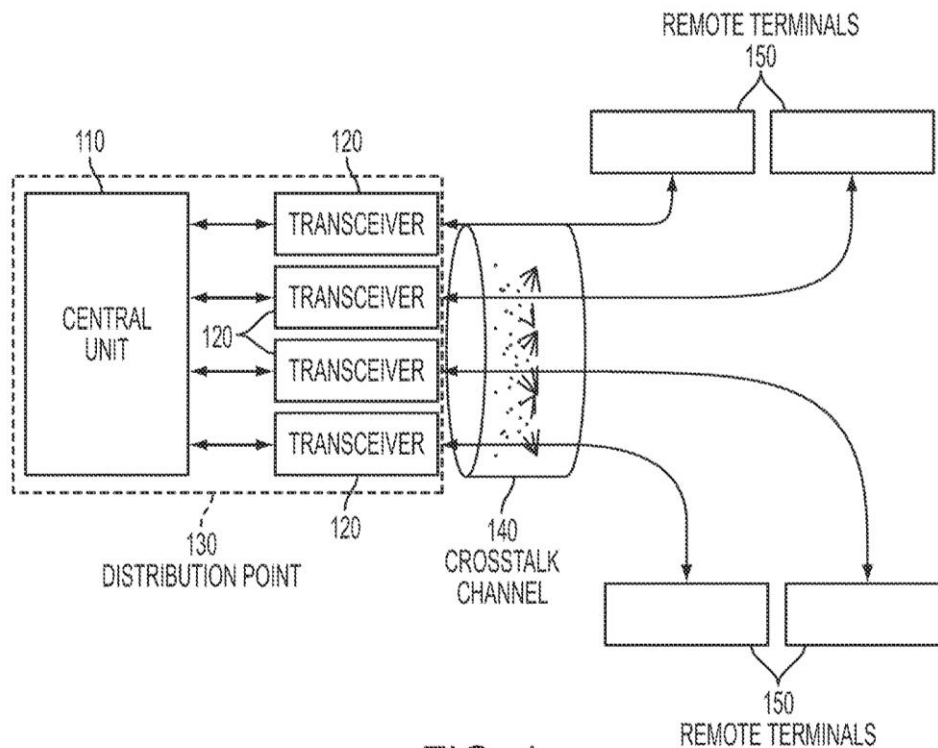


FIG. 1

445. Strobel thus expressly discloses a system that includes both a processor and a memory. A POSITA would have understood that the processor and memory are used to compute locally optimal configurations, store in memory data about the configurations, and process the data into time sharing information. A POSITA would have understood this distribution point (shown as 130 in Figure 1) controls this functionality, and that the distribution point includes a management interface. Looking to Figure 1, a POSITA also would have understood the Figure to disclose communication buses between the transceivers and the central unit within a distribution point. A POSITA would have understood that the distribution point

includes buses for LAN and WAN as well for general transmission purposes. Strobel also expressly discloses that the memory stores information about configurations, that is, about historical data.

446. Strobel provides a number of alternative structures as well, including the below. Strobel discloses that “the arrangements, procedures and protocols of the described implementations may be implemented on a special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit element(s), an ASIC or other integrated circuit, a digital signal processor, a flashable device, a hard-wired electronic or logic circuit such as discrete element circuit, a programmable logic device such as PLD, PLA, FPGA, PAL, a modem, a transmitter/receiver, any comparable device, or the like.” Ex-1005 at 38:25-33.

447. For the reasons explained with respect to limitation 1[a], and because Strobel discloses the same structure as the '631 patent, Strobel discloses limitation 37[a].

**37[b] means for scheduling downstream time slots for downstream transmission in a second physical channel subject to crosstalk from the upstream time slots,**

448. Strobel discloses limitation 37[b] for the same reasons explained with respect to limitation 1[b]. As to the “means,” Strobel discloses the same “means” embodied in the '631 patent for the same reasons explained with respect to limitation

37[a], which shares the same structure here. I incorporate by reference my opinions discussed in those sections above for 37[b].

**37[c] wherein transmission in the upstream time slots is substantially not simultaneous with transmission in the downstream time slots.**

449. In my opinion, Strobel discloses limitation 37[c] for the same reasons explained with respect to limitation 1[c], which shares the same language. I incorporate by reference my opinions discussed in those sections above for 37[c].

## **XI. REVISION OR SUPPLEMENTATION**

450. In this report, I have presented my opinions regarding the invalidity of the challenged claims of the '631 Patent based on the information available to me. My opinions are subject to change in view of opinions provided by the Patent Owner or its expert, or any additional information that I receive. I reserve the right to supplement my opinions accordingly.

I hereby declare that all statements made herein are true and of my own knowledge 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 this 17th day of January, 2025.

A handwritten signature in cursive script, reading "Richard D. Gitlin".

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Richard D. Gitlin